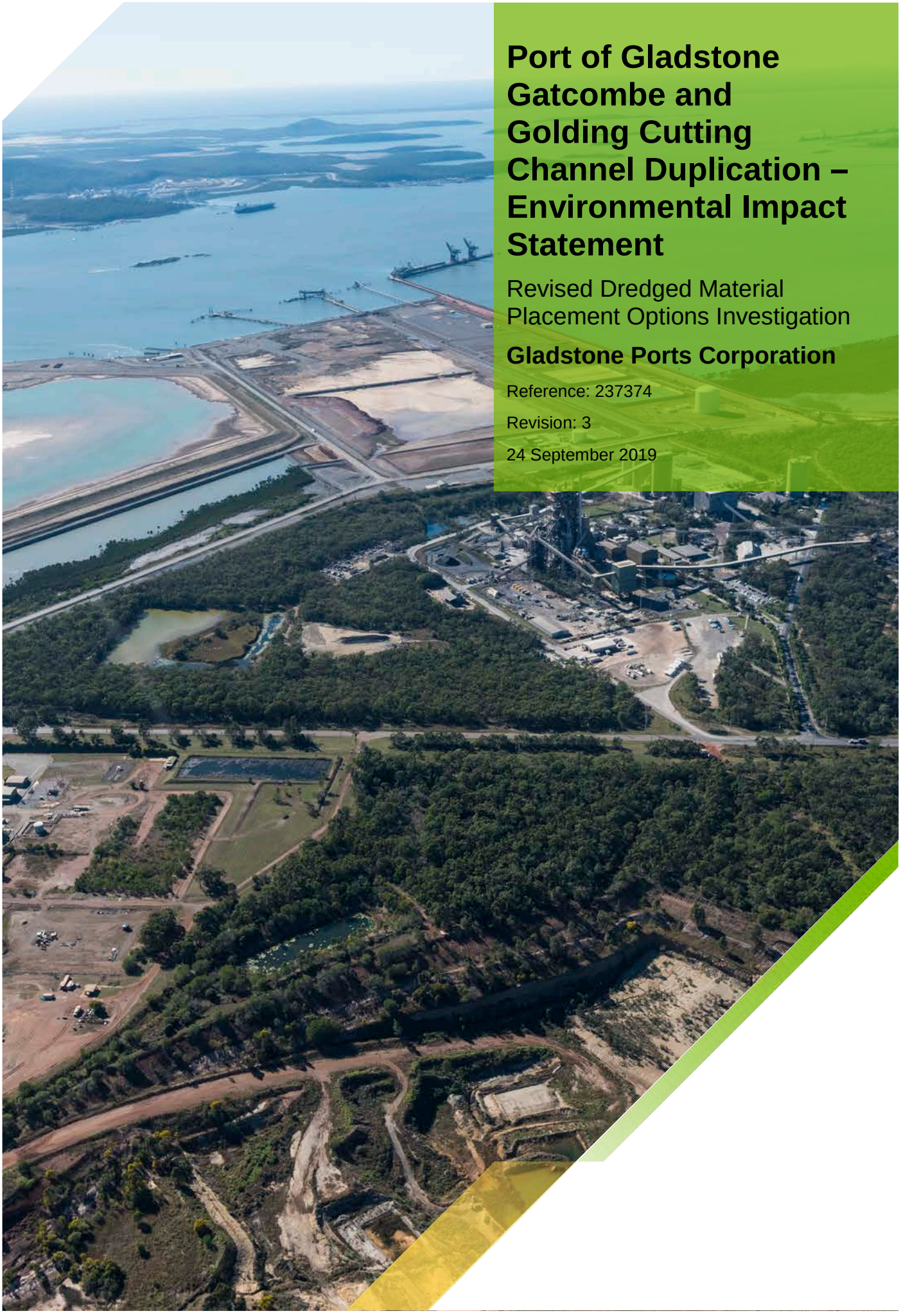

Port of Gladstone Gatcombe and Golding Cutting Channel Duplication – Environmental Impact Statement

Revised Dredged Material Placement Options Investigation

Gladstone Ports Corporation

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Document prepared by:

Aurecon Australasia Pty Ltd
ABN 54 005 139 873
Ground Floor, 25 King Street
Bowen Hills QLD 4006
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	Bruce Penman	Name	Stephen Cole
Title	Managing Principal	Title	Principal

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Acronyms and abbreviations

Abbreviation	Explanation
AEIS	Additional Information on the Project EIS
BUF	barge unloading facility
CG	Coordinator-General
CSD	cutter suction dredger
Cth	Commonwealth
CVIP	Clinton Vessel Interaction Project
DAF	Department of Agriculture and Fisheries
DMPA	dredged material placement area
DMPOI	Dredged Material Placement Options Investigation (completed in 2013-2015)
DoEE	Department of Environment and Energy
DES	Department of Environment and Science
DTMR	Department of Transport and Main Roads
EA	Environmental Authority
EIS	Environmental Impact Statement
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
GBR Coast MP	Great Barrier Reef Coast Marine Park (Queensland)
GBRMP	Great Barrier Reef Marine Park (Commonwealth)
GBRMPA	Great Barrier Reef Marine Park Authority
GBRMP Regs	*Great Barrier Reef Marine Park Regulations 1983* (Cth)
GBRWHA	Great Barrier Reef World Heritage Area
GPC	Gladstone Ports Corporation Limited
GRC	Gladstone Regional Council
GSDA	Gladstone State Development Area
ILUA	Indigenous Land Use Agreement
km	kilometres
LAT	lowest astronomical tide
LNG	Liquified natural gas
LTSDP	Long Term Sediment Disposal Plan
m	metres
m^3	cubic metres
MCA	multi-criteria analysis
mm	millimetres
Mm^3	million cubic metres
MNES	matters of national environmental significance
MSES	matters of state environmental significance
Mtpa	million tonnes per annum
NC Act	*Nature Conservation Act 1992* (Qld)
OUV	outstanding universal value
PASS	potential acid sulphate soil

Abbreviation	Explanation
Ports Act	*Sustainable Ports Development Act 2015* (Qld)
Project	Gatcombe and Golding Cutting Channel Duplication Project
Project EIS	Gatcombe and Golding Cutting Channel Duplication Project EIS (public display version)
Qld	Queensland
Reef 2050	Reef 2050 Long-Term Sustainability Plan
RGTCT	RG Tanna Coal Terminal
SDPWO Act	*State Development and Public Works Act 1971* (Qld)
SID	Supplementary Information Document
SSMP	Sustainable Sediment Management Project
Supplementary DMPOI	Supplementary DMPOI (completed in 2017-2018)
TECs	threatened ecological communities
ToR	Terms of Reference
TSHD	trailing suction hopper dredger
USL	unallocated state land
WBDDP	Western Basin Dredging and Disposal Project
WBE	Western Basin Expansion
WICT	Wiggins Island Coal Terminal
WICET Pty Ltd	Wiggins Island Coal Export Terminal Pty Ltd

Glossary

Term	Definition
area to be dredged	The defined area where capital dredging operations are proposed to occur as part of the Gatcombe and Golding Cutting Channel Duplication Project
beneficial reuse of dredged material	Means dredged material that has been used for a purpose that provides social, economic or environmental benefits (or a combination of these)
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
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

1 Introduction

1.1 Project background

1.1.1 Overview

Gladstone Ports Corporation Limited (GPC) proposes to undertake the Gatcombe and Golding Cutting Channel Duplication Project (the Project), which involves duplicating the existing Gatcombe and Golding Cutting shipping channels, and the construction and operation of associated port infrastructure within the Port of Gladstone. The Project is required to improve Port of Gladstone operation and economical efficiencies, and improve the existing and future safe passage of vessels within the Port as throughput and associated vessel numbers increase, and the portion of predicted Capesize vessels (export and import) also increases.

The key components of the Project relevant to this report are summarised below.

- Dredging approximately 12.6 million cubic metres (Mm^3) of seabed material (including dredging tolerance) to duplicate the already existing Gatcombe and Golding Cutting shipping channels. The duplication involves the deepening and widening of the existing Gatcombe and Golding Cutting bypass shipping channels, resulting in two shipping channels of the same depth to allow vessel passing. The preferred dredging methodology involves utilising a trailing suction hopper dredger (TSHD) which loads the dredged material from the Gatcombe and Golding Cutting bypass shipping channels into barges (four barges will be working in cycles for the entire dredging operation) which will transport the material to a barge unloading facility (BUF) adjacent to an existing or new wharf line to be unloaded using large excavators into trucks for placement within a beneficial reuse area. It is important to note that the Project capital dredging volume excludes the initial dredging for barge access to the BUF.
- Dredged material placement for beneficial reuse within a beneficial reuse area
- Provision of supporting services to the Project activities
- Demobilisation of dredging operation
- Project maintenance phase activities, including:
  - Reclaimed land surface stabilisation and maintenance activities
  - Final land uses on reclaimed land
  - Maritime operation within duplicated channels
  - Maintenance dredging within duplicated channels.

The purpose of this investigation is to confirm that the existing Western Basin reclamation area and the proposed Western Basin Expansion (WBE) reclamation area are the preferred beneficial reuse areas for the Project.

1.1.2 Location of shipping channels to be dredged and material volume

The major dredging component of the Project involves the duplication of the existing Gatcombe and Golding Cutting bypass shipping channels to provide a duplicated channel parallel to the main shipping channel with a sufficient depth and width to allow an improved two-way passage into the Port under all weather and tidal conditions. The location of the existing maintained channel and the area to be dredged as part of the Project are shown in Figure 1.1.

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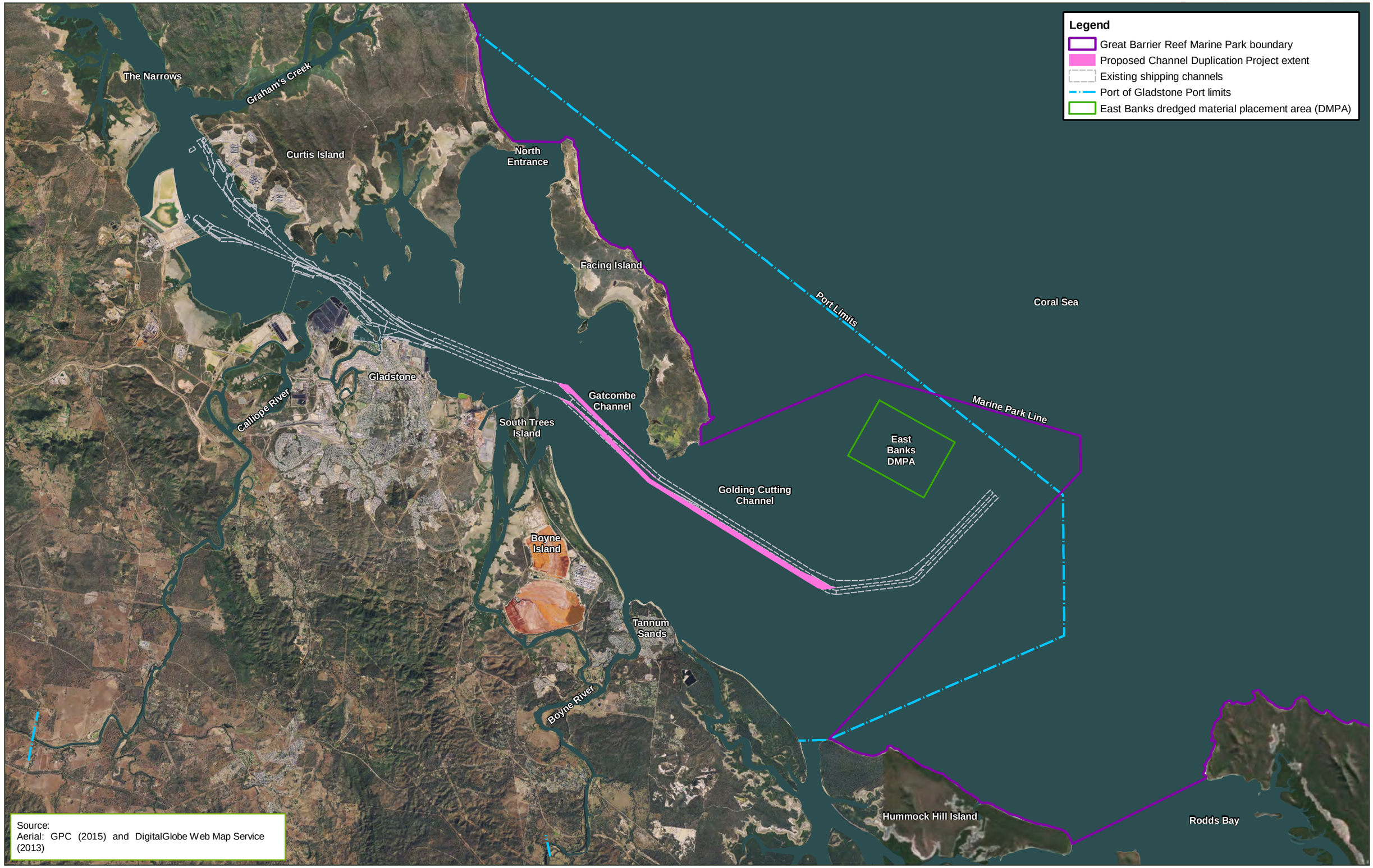

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Gatcombe and Golding Cutting Channel Duplication Project

Figure 1.1: Gatcombe and Golding Cutting Channels areas to be dredged

The proposed duplicate channel will be approximately 15 kilometre (km) long and dredging is proposed to be undertaken to an ultimate depth of -16.1 metres (m) lowest astronomical tide (LAT), with a channel width (toe to toe) of 200m. This equates to the removal of approximately 12.6Mm^3 of seabed material (including dredging tolerance) from the Gatcombe and Golding Cutting duplicate channels.

Two dredging campaign options are proposed and will be selected upon predicted throughput and associated vessel movements. At this stage it is envisaged that the Project will be undertaken over two stages. However, should the need and/or growth for Port trade justify the need for the final design channel depth, the two stages will be combined into a singular campaign. The likely volumes and timing of each dredging campaign option are outlined in Table 1.1.

Table 1.1 Dredging campaign and staging options, location and volumes

Stage	Location	Timeframe – likely start date or later (duration)	Design depth (m LAT)	Volume (Mm^3) [1]
1	Gatcombe and Golding Cutting Channels	2023 or later (33 weeks)	-13.5	7.25
2	Gatcombe and Golding Cutting Channels	2026 or later (25 weeks)	-16.1	5.35[2]
Singular campaign	Initial dredging works and Gatcombe and Golding Cutting Channels	2023 or later (64.5 weeks)	-16.1	12.60

Table notes:

1 Includes 0.3m (depth) allowance for average dredging tolerance
2 The Stage 2 dredged material volume assumes that the barge access channel is maintained at the Project design depth as part of the Port-wide maintenance dredging

There is potential for dredging to commence after 2023 subject to actual and predicted Port throughput and associated vessel movements over the next 5 to 10 years.

1.1.3 Dredging equipment and dredged material placement scenarios

Based on the nature and volume of the material to be dredged, availability and limitations of dredging equipment, the Project dredging methodology adopted for the EIS includes:

- A large sized TSHD (i.e. 20,000m^3) hopper capacity with production in the order of approximately 0.2Mm^3 per week) dredging the Gatcombe and Golding Cutting channel duplication areas
- The dredged material from the TSHD will be placed into a series of large barges (i.e. four barges with a capacity of approximately 7,000m^3 to 10,000 m^3) which will transport the material to a BUF, adjacent to an existing or new wharf line, to be unloaded by large excavators into trucks (e.g. Moxy 40t) for placement within the beneficial reuse area. The dredged material placed within the beneficial reuse area will be managed for dewatering purposes with licenced discharge of excess water into Port Curtis.

1.1.4 Project status

The Project was declared a 'coordinated project' by the Queensland Coordinator-General (CG) under the *State Development and Public Works Organisation Act 1971* (Qld) (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* (Cth) (EPBC Act) on 23 October 2012.

GPC is currently proceeding with the EIS phase of the Project. The draft Gatcombe and Golding Cutting Channel Duplication Project EIS (Project EIS) has been submitted for parallel assessment to both the CG under the SDPWO Act and the Commonwealth Environment Minister (Department of Environment and Energy (DoEE)) under the EBPC Act. The statutory public notice/display period for the Project EIS has been completed.

The Revised DMPOI forms part of the Additional Information on the Project EIS (AEIS) that addresses the submissions received during the statutory public notice/display period (refer Section 1.5).

1.1.5 Project objectives

The high level framework objectives of the Project are:

- 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
- To identify dredged material placement option(s) for capital 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 maintenance phases of the Project, including:
    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 that apply to the Project.

1.2 Dredged material placement options investigation

As part of the CG's EIS Terms of Reference (ToR) and Commonwealth Environment Minister's EIS Guidelines issued for the Project, there is a requirement to document the alternatives and site selection processes for any offshore (at sea), land based and/or reclamation dredged material placement options identified for the Project.

Section 5.3.3 of the ToR specifies that the EIS must describe placement options for both capital and maintenance dredged materials, including:

- Justification for the choice of the preferred dredged material placement 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.

Section 5.7 of the EIS Guidelines specifies that the EIS must describe, to the extent reasonably practicable, any prudent and feasible alternatives to the proposal. For each alternative listed the proponent should provide the project details, impacts (positive and negative), location, scale, configuration and staging options. Sufficient detail must be provided to make clear why an alternative is preferred to another.

In response to the ToR and EIS Guidelines requirements, a Dredged Material Placement Options Investigation (DMPOI) was undertaken between 2013 and 2015 to support the Project's objectives associated with the identification of potential dredged material placement site option(s) for the 12.6Mm^3 of dredged material from the Project that:

- Complied with regulatory requirements and supported current policy objectives
- Maximised the beneficial ecological environmental, social, cultural heritage and economic outcomes
- Could be considered feasible option(s) to be taken forward into the detailed assessment phase of the EIS to undergo further analysis and impact assessment.

However, in seeking to achieve this primary objective, the following secondary objectives were 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.

At the commencement of the DMPOI, a total of 16 potential dredged material placement sites were identified for investigation. At the completion of the DMPOI, three potential dredged material placement sites (being two onshore and one offshore (at sea) dredged material placement areas) remained to undergo detailed impact assessment as part of the Project EIS. In 2014, EIS baseline data collection commenced for the Project study area that incorporated the wider Port Curtis area and the three potential dredged material placement sites.

The methodology and findings of the DMPOI were presented in a DMPOI report, which was finalised in February 2015 and issued to the stakeholders and regulatory agencies involved in the DMPOI process. A copy of the full DMPOI report is contained in Appendix B2 to the Project EIS.

1.3 Supplementary dredged material options investigation

1.3.1 Purpose and need

During 2015 and 2016, after the DMPOI had been completed, significant legislative changes occurred in Commonwealth and State Government policy and environmental regulation which directly impacted the 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 (OUV) of the Great Barrier Reef World Heritage Area (GBRWHA)
- Enactment of the *Sustainable Ports Development Act 2015* (Qld) (Ports Act) which introduced prohibitions on capital dredging and capital dredged material placement, restrictions on port development and the mandating of master planning for the priority ports of Gladstone, Abbot Point, Townsville, Hay Point and Mackay to 2050
- Amendments to the *Great Barrier Reef Marine Park Regulations 1983* (Cth) (GBRMP Regs) which introduced prohibitions and limitations on the sea-based placement of capital dredged material within the Great Barrier Reef Marine Park (GBRMP).

A detailed summary of these legislative changes and their implications to the Project is provided in Section 3.2. These policy and legislative changes triggered a review of the findings of the DMPOI and required the completion of a Supplementary DMPOI in 2017 and 2018.

1.3.2 Objectives

Whilst the primary objectives of the Supplementary DMPOI reflect those of the DMPOI, the legislative changes that occurred in 2015 and 2016 (and more specifically, the mandating of the beneficial reuse of port-related capital dredged material) prompted the broadening of the original secondary objective (refer Section 1.2) associated with considering the longer term dredging needs of the Port of Gladstone.

For the Revised DMPOI (this document) the primary objective is to consider the dredged material placement needs of future approved capital dredging projects within the Port of Gladstone and the needs of the Gatcombe and Golding Cutting Channel Duplication Project.

The opportunities for dredged material placement to accommodate dredged material from other (yet to be approved) future Port of Gladstone dredging projects to 2050 (to align with priority port master planning, introduced under the Ports Act) are considered in the Long Term Sediment Disposal Plan (LTSDP) (refer Section 4.2).

1.4 Report purpose

This report has been prepared to address the following matters:

- Queensland Government comments received on the Project EIS (in particular the supplementary DMPOI included in Appendix B1 of the Project EIS) during the statutory public notice/display period between 8 April 2019 and 23 May 2019 (refer Section 1.5)
- Consider and assess the potential of all dredged material placement areas to identify the preferred dredged material placement area(s) for the Project.

Whilst it is intended that the Revised DMPOI (this report) be referred to as the most current assessment of alternative beneficial reuse dredged material placement options for the Project EIS process, this report should also be read in conjunction with the original DMPOI (Appendix B2 of the Project EIS) and the Supplementary DMPOI (Appendix B1 of the Project EIS) given that both reports operate together to capture the full history of the DMPOI process and address the requirements of the EIS ToR and EIS Guidelines in relation to the assessment of alternative placement options for both capital and maintenance dredged materials.

1.5 Queensland Government comments on the Supplementary Dredged Material Placement Options Investigation

During the statutory public notice period for the Project EIS the Department of Agriculture and Fisheries (DAF) and Department of Environment and Science (DES) provided comments on the Supplementary DMPOI and the proposed WBE reclamation area. Table 1.2 summarises the relevant Government agency comments that have been addressed in this report.

Table 1.2 **Queensland Government agency comments on draft Project Environmental Impact Statement relevant to the Supplementary Dredge Material Placement Options Investigation**

Government agency	Agency comment	Agency recommendation	Section addressed in this report
DAF	The proposed Western Basin Expansion area is twice the size needed to accommodate the Gatcombe and Golding Cutting spoil. In assessing the impacts, an impact area that is twice the actual size needed for the project does not address requirements of an, avoid, minimise and mitigate impacts hierarchy of assessment. Allowing for additional reclamation using spoil from possible future capital dredging projects that are not yet formally planned or approved, or clearly outlined in this EIS is not appropriate justification of the very significant impact that it will have upon marine plants.	-	Section 4
DES	The draft EIS has adequately considered all feasible alternatives, as required by Section 3.5 of the proposed Project's TOR. The supplementary options investigation completed in 2019 (Appendix B1 of the EIS) and used to inform the proponent's choice of the preferred dredged material placement site, has considered the eight sites short-listed in the original investigation completed in 2015 (reported in Appendix B2 of the EIS). The original options investigation considered potential offshore dredged material placement sites, no longer permitted under the *Sustainable Ports Act 2015*, and onshore placement sites within 3km of the dredging activity, given the logistical constraints and costs of transporting dredged material onshore via pipeline. Offshore placement of dredged material is no longer an option and the current project no longer proposes to transport the majority of the dredged material via pipes, but proposes to unload the dredged material from barges directly into trucks for distribution within the reclamation area. Only a small portion of dredged material is still proposed to be piped directly into the reclamation area by a dredge (approximately 150,000m^3 of dredged material from the proposed barge access channel). In light of these significant changes to the project methodology, particularly the potential to now transport the dredged material via trucks to sites more than 3km from the dredging activity.	The department recommends the options investigation be revised in light of the significant environmental values identified and located at, or adjacent to, the proposed WBE reclamation area that would be impacted by the proposed Project. Any revised options investigation should consider additional onshore placement sites with less significant environmental values that may have become available and would be feasible to be used since the completion of the original options investigations.	Section 1.1.3 Section 3 Table 3.7 (potential applicability of beneficial reuse option for material to be dredged) Section 5

Government agency	Agency comment	Agency recommendation	Section addressed in this report
DES	The draft EIS does not clearly quantify how much additional capacity would remain in the WBE reclamation area on completion of this project. The draft EIS has not demonstrated that the location and design of the dredged material placement site has been selected to avoid and minimise potential environmental impacts. Given the potential impacts of the proposed reclamation area on seagrass, HES wetlands and other matters of state environmental significance (MSES) and national environmental significance (MNES), including turtles, dugongs and migratory shorebirds, the department requires specific detailed information, supported by evidence and a reasoned discussion, to determine the acceptability of the size and location of the dredge material placement site, including: ■ Planned dredging campaigns that are proposed to be accommodated in the proposed WBE reclamation area ■ Volumes of material from future dredging projects that are planned to be placed in the WBE reclamation area ■ Planned timing of these projects ■ Additional capacity within the WBE reclamation area available on completion of each of these projects	-	Section 4 (planned dredging campaigns to be accommodated in the WBE reclamation area) Section 6 and Appendices A and B (assessment of impacts) Section 6.3.5 (additional capacity within WBE reclamation area)
DES	The draft EIS should include a detailed explanation of why the volume of dredged material to be disposed of in the existing western basin reclamation area has been significantly reduced since the completion of the EIS for that project. The draft EIS should also explain why there is a reduced capacity in the existing western basin reclamation area to accommodate dredge material from approved dredging campaigns (e.g. Clinton Vessel Interaction Project) as well as this proposed project. In the absence of this detailed information, the department is of the view that a potential impact area larger than is required for this project is unacceptable.	-	Section 4.3.3

2 Methodology and structure

2.1 Overview

This section summarises the methodology and structure of the Revised DMPOI.

2.2 Methodology

A four phase process has been adopted to undertake the Revised DMPOI. The four phases are:

- **Phase one – Port dredging and dredged material beneficial reuse considerations**
  - Review of the legislative requirements and the undertaking of 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 reuse options for dredged material that could be feasible within the Gladstone region (refer Section 3).
- **Phase two – dredged material volume considerations**
  - Defining the dredged material volumes to be accommodated within a beneficial reuse area for the Project dredged material, and considerations for accommodating other future approved Port dredging projects (e.g. Western Basin Dredging and Disposal Project (WBDDP)) (refer Section 4)
- **Phase three – dredged material beneficial reuse options for the Project**
  - Definition of the spatial extent of the Project study area and the development of a set of decision criteria for identifying dredged material beneficial and placement opportunities for the Project. This included incorporating the results of preliminary desktop site investigations to determine the feasibility of the potential beneficial reuse options (refer Section 5).
- **Phase four – MCA on short listed options for the Project**
  - Undertaking a MCA of the potential dredged beneficial reuse and material placement locations to score and rank each option/site to support identification of a preferred beneficial reuse site (s) for the Project (refer Section 6).

Further detail regarding the methodology used in each phase is provided in the relevant section of this report.

3 Phase one – Port dredging and dredged material beneficial reuse considerations

3.1 Overview and phase one methodology

Beneficial reuse is the practice of using dredged material for another purpose that provides social, economic or environmental benefits (Lukens 2000). Phase one identifies and discusses a range of factors that are required to be considered when determining the suitability of beneficial reuse options for dredged material within the Port. These considerations include:

- Legislative considerations (refer Section 3.2)
- Nature of material (refer Section 3.3)
- Environmental values (refer Section 3.4)
- Economic factors (refer Section 3.5)
- Availability of land (refer Section 3.6)
- Other considerations (e.g. timing of dredging) (refer Section 3.8)
- The different beneficial use options (types) (refer Section 3.9).

The key findings from this phase have been used in phase three to support the identification of potential dredged material placement areas within Gladstone and the dredged material placement and beneficial reuse capacity requirements for the Project and remaining future stages of the WBDDP.

3.2 Legislative considerations

3.2.1 Environment Protection and Biodiversity Conservation Act 1999

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

If a project is likely to significantly impact on any MNES, a referral under the EPBC Act must be made to the Minister. Subsequent to the receipt of a referral, the Minister will determine whether or not the proposed action is a ‘controlled action’. If the action is considered a ‘controlled action’, then an environmental assessment must be submitted to the Minister for approval.

The environmental assessment can proceed through a bilateral agreement that accredits a State or Territory assessment process (i.e. EIS process under the EPBC Act), or a ministerial declaration that accredits another Commonwealth agency or through an assessment determined by the Minister.

In 2012, GPC referred the Project to the Commonwealth Environment Minister under the EPBC Act, seeking a determination as to whether the Project would constitute a ‘controlled action’. On 23 October 2012, following assessment of the referral, the Project was determined to be a ‘controlled action’ for which an EIS would be required.

The Project EIS has been submitted for assessment to the Commonwealth Environment Minister (DoEE) under the EBPC Act. The statutory public notification period for the Project EIS has been completed.

3.2.2 Great Barrier Reef Marine Park Act 1975

The *Great Barrier Reef Marine Park Act 1975* (Cth) (GBRMP Act) establishes a legislative framework for ensuring the long term protection and management of the GBRWHA. The GBRMP Act is administered by the Great Barrier Reef Marine Park Authority (GBRMPA) and holds provisions for:

- The establishment of the GBRWHA, which extends from the low water mark of the mainland and includes all islands, internal waters of Queensland and its seas, and exclusion under the *Submerged Lands Act 1973* (Cth), as detailed in Schedule 1 of the GBRMP Act
- The designation of the GBRMP as a protected area
- The establishment of the GBRMPA, the Commonwealth authority responsible for administering the GBRMP Act and managing the GBRMP
- A planning and management framework for the GBRMP, incorporating zoning plans, plans of management and a system of permissions.

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

The GBRMP Regs prescribe limitations on the granting of permission for 'prohibited dumping', prohibiting the sea-based placement of an amount of capital dredged material that prior to its excavation was, in situ, greater than 15,000m^3 in volume anywhere within the GBRMP but which does not include burying a pipe, cable or tube with capital dredged material if the material had been excavated to create the trench in which the pipe, cable or tube was laid.

As part of the original EPBC Act referral of the Project, there was the potential that the dredged material placement site could be located within the GBRMP. The Project has since changed as the placement of capital dredged material is prohibited within the GBRMP. Therefore, given that the Project involves the undertaking of dredging and dredged material placement works within the GBRWHA, but outside of the GBRMP, a Marine Park Permit under the GBRMP Act will not be required. The GBRMP Regs, and the superseded version of the Regulations Section 88R(j) (considerations of applications under the GBRMP Act) is not relevant to the Project.

Notwithstanding this, as part of water quality monitoring for the Project, monitoring buoys were installed at four locations within the GBRMP as part of the EIS baseline water quality monitoring. The buoys were installed and operated for a period of 13 months and were removed in July 2015 in accordance with a Marine Park Permit (Research) granted to GPC. The installation of any future monitoring buoys within the GBRMPA during the dredging phase of the Project will again be carried out under a Marine Park Permit (Research).

3.2.3 State Development and Public Works Organisation Act 1971

The SDPWO Act provides for state development and planning through the provision of a system to coordinate and regulate public works and manage major land and infrastructure assets. In addition, the SDPWO Act establishes the framework for the assessment of major projects in Queensland. In accordance with Section 26 of the SDPWO Act, the CG may declare a project to a be a 'coordinated project' (previously a 'significant project') for which an EIS is required.

The CG declared the Project to be a 'coordinated project for which an EIS is required' under the SDPWO Act. The Project EIS was placed on public display from 8 April 2019 to 23 May 2019. During this period Queensland Government agencies, non-government groups and private submitters provided comments on the Project EIS to the CG.

This report forms part of the AEIS as part of the SDPWO Act EIS assessment process.

3.2.4 Reef 2050 Long-Term Sustainability Plan

Released by the Australian and Queensland Governments in March 2015, Reef 2050 presents a plan to action protecting the OUV of the GBRWHA, whilst supporting ecologically sustainable development. The Reef 2050 included the following dredging, dredged material placement and port-related development actions:

- Undertake port master planning for the priority ports of Gladstone, Abbot Point, Townsville and Hay Point/Mackay
- A commitment to restrict port-related capital dredging in the GBRWHA to the four priority ports
- Support for the prohibition of sea-based placement of capital dredged material in the restricted area
- A commitment to establishing a maintenance dredging framework which identifies future dredging and examines opportunities for the beneficial reuse of dredged material or on-land placement where it is environmentally safe to do so.

In December 2016, the Australian and Queensland Governments released an update to the Reef 2050 Plan, capturing progress made within the first 18 months of the Reef 2050 Plan's 35 year horizon.

Whilst Reef 2050 does not have any direct legislative implications for the Project, any recommendations from Reef 2050 that are implemented through legislative or policy mechanisms relevant to dredging (capital and maintenance), dredged material placement and/or port development have the potential to be relevant to the Project. Key legislative changes that have occurred to date that are relevant to the Project are detailed in the sections below.

3.2.5 Sustainable Ports Development Act 2015

The Ports Act introduced a legislative framework for the protection of the GBRWHA through managing port-related development in and adjacent to the area. The Ports Act gives legislative effect to the Queensland Government's key port-related commitments in Reef 2050.

There are a number of ways the Ports Act facilities sustainable development, including:

- Restricting new port development in and adjoining the GBRWHA to within current port limits and outside both the Commonwealth and State marine parks
- Prohibiting capital dredging for the development of new, or the expansion of, existing port facilities within the GBRWHA outside the identified priority ports of Gladstone, Hay Point/Mackay, Abbot Point and Townsville
- Prohibiting the sea-based placement of port-related capital dredged material within the restricted area, unless the material is beneficially reused. A restricted area includes any area within the GBRWHA but outside the GBRMP.

In addition to the above, the Ports Act also mandates the requirement to prepare master plans and port overlays for the declared four priority ports of Gladstone, Abbot Point, Hay Point and Mackay and Townsville.

3.2.5.1 Master plan for the priority Port of Gladstone 2018

The Master Plan for the priority Port of Gladstone 2018 is the first master plan prepared under the Ports Act. The Master Plan for the priority Port of Gladstone 2018, whilst a statutory requirement, is not a regulatory planning instrument, however it outlines the strategic vision, objectives and desired outcomes for the port and the land and marine areas vital for its sustainable development to 2050. Furthermore, the Master Plan for the priority Port of Gladstone 2018 supports capital dredging as an essential part of port operations to create new, or improve existing navigation channels, berth pockets and swing basins, and to continue the economic development of the Port of Gladstone.

The port overlay, the regulatory instrument that implements the Master Plan for the priority Port of Gladstone 2018 over the master planned area, is currently being prepared. Whilst a preliminary draft port overlay was released in 2017, a formal draft port overlay is yet to be released for public consultation in accordance with the Ports Act.

3.3 Nature of material, ease of dredging and suitability for reuse

3.3.1 Background

The opportunities for beneficial reuse 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 (e.g. composition, pH, salinity and nutrients) (Permanent International Association of Navigation Congresses (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 recognised potential constraints on beneficial reuse of dredged material as including difficulties in separating 'useful' materials (e.g. sand) from other elements (e.g. silts and clays), as well as managing treatment requirements for materials with certain characteristics (e.g. potential acid sulphate soils (PASS), contamination).

A complex material matrix (e.g. mix of silt, clay and sand) may limit the ability to achieve sufficient separation of material types where required for certain beneficial reuses, for example, beneficial reuses 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 reuse options assessed for dredged material within the Port of Gladstone need to consider the nature of the material and compatibility with the potential use options.

3.3.2 Sediment sampling and analysis

Sediment sampling and analysis reports for projects undertaken in the Port of Gladstone (e.g. the Project, WBDDP, Wiggins Island Coal Terminal (WICT) Project) indicate that approximately 0.3m of the upper layer of sediment within Port Curtis is likely to have been deposited after the 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, sediment sample laboratory testing has demonstrated the presence of only minor concentrations of naturally occurring and potential anthropogenic contaminants in individual samples across various areas. In the case of the Project, all sediments have been found to be clean as per the *National Assessment Guidelines for Dredging 2009* (NAGD) (Commonwealth of Australia 2009) with low concentrations of metals and the sediment is suitable for both offshore placement and onshore beneficial reuse.

Contaminant status of sediments

Geochemical investigations demonstrated that the Project dredged material is assessed as clean in accordance with NAGD (2009) and are chemically suitable for placement within a reclamation area. Sediment results from the dredged material indicate that the material is suitable for a future land use of port-related industrial.

There is potential for minor impacts related to the resuspension of sediment and mobilisation of contaminants during dredging and placement activities which can be adequately managed through Project mitigation measures.

Sediment physical characteristics

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 expected particularly at shallow depths, with cobbles and boulders (diameter greater than 150 millimetres (mm)) also being present.

The upper sediments within the Port of Gladstone are characterised as typically finer in composition (i.e. sand, silt, clay with minor gravel components), while higher concentrations of coarse material (i.e. 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, which present 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 (e.g. 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, the extent of separation and suitability of the components of the separated material has been limited. Photograph 3.1 and Photograph 3.2 illustrate the variability of dredged material within the Port of Gladstone, with both showing material dredged within the same dredging footprint, on the same day of the WBDDP Stage 1A dredging works.

Photograph 3.1 Dredged material from the Western Basin Dredging and Disposal Project

Photograph 3.2 Dredged material forming clay balls from the Western Basin Dredging and Disposal Project

A detailed geotechnical investigation of the Gatcombe and Golding Cutting Channels was undertaken between February and May 2015 as part of the Project EIS investigations. A total of 23 boreholes were drilled over water from a jack-up barge. A summary of the grading and composition characteristics of the material to be dredged within the Gatcombe and Golding Cutting Channels is provided below.

- The sedimentary deposits observed during the geotechnical investigation were comparative to materials encountered in previous investigations undertaken in the Port, being composed primarily of clays, sands and significant gravel deposits
- Whilst the submarine soils would have likely been deposited in horizontal layers over time, the complex natural depositional and erosional environment of the Port of Gladstone has resulted in a complex and convoluted soil profile. Generally three layers were observed from the borehole section, including clay/silt (layer 1), sand (layer 2) and gravel (layer 3) (refer Figure 3.1).
- In general, sands overlying gravels were encountered within the Gatcombe Channel
- A significant deposit of gravel, likely containing cobbles and boulders, was identified between the Gatcombe and Golding Cutting Channels in the area of borehole GG12 (refer Figure 3.1). The geotechnical data suggests that Boyne River discharges into the Port have formed these cobble and boulder deposits.
- Cohesive material was recorded within the Golding Cutting Channel beneath the seafloor. This layer is medium to high plasticity and stiff to very stiff in consistency. Sand and gravel layers underlie this cohesive layer.
- Bedrock was not encountered during the geotechnical investigation within the Gatcombe and Golding Cutting Channels
- There is a 5m change in seabed level in the vicinity of borehole GG15 (refer Figure 3.1) which is likely to be due to the complex underlying geological structures of the area, which is known to comprise a series of horst and graben structures and later sedimentary deposits.

The geotechnical investigation findings of the material to be dredged have direct implications on the type, scale and nature of dredging equipment that can be utilised for the Project, and the dredging methodology.

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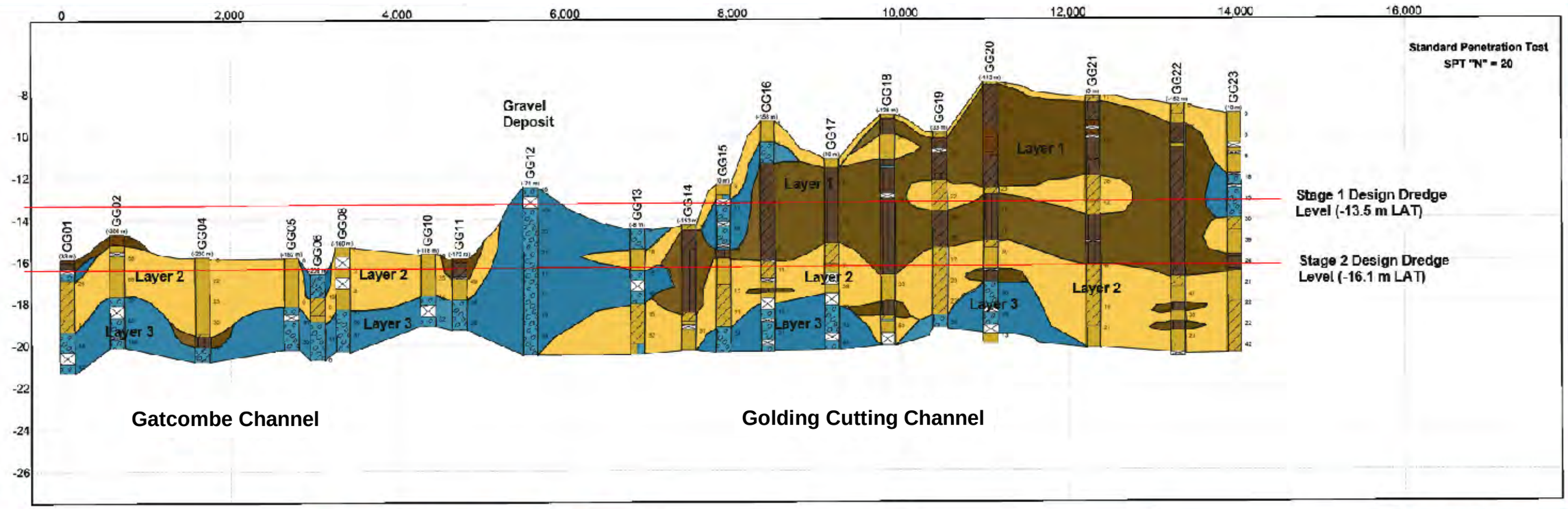
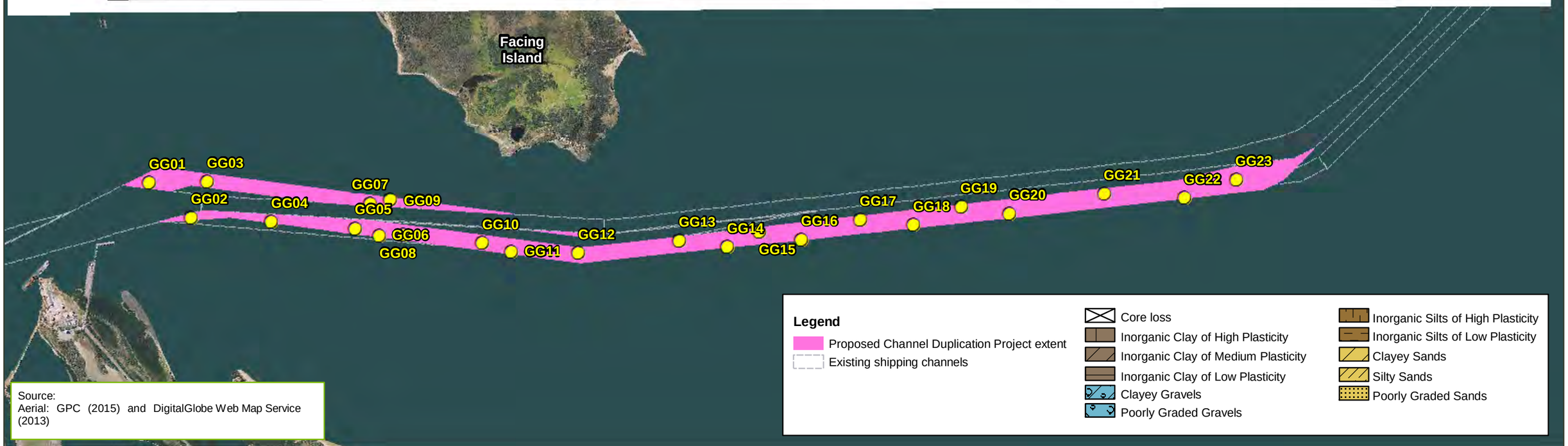
Distance (m)

ELEVATION (m LAT)





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Date: 13/11/2017 Version: 2 Job No: 237374

Coordinate system: GDA_1994_MGA_Zone_56

Gatcombe and Golding Cutting Channel Duplication Project

Figure 3.1: Interpreted geological section for the combined Gatcombe and Golding Cutting Channels

3.3.3 Material type implications for dredging methodology

Summary of material types

The geotechnical data collected for the channel duplication area to be dredged has been incorporated into a database which allows interrogation of the key material properties in 0.5m dredging sediment layers and this has influenced the development of the dredging methodology.

Table 3.1 provides a summary of material types in Stage 1 of the channel duplication dredging works, with sand and clay in relatively equal portions.

Table 3.1 Summary of Stage 1 material types (channel duplication)

Material type	Percentage for each material type	Percentage for general material group
Sand	17%	52%
Silty **sand**	8%	
Clayey **sand**	5%	
Gravelly clayey **sand**	6%	
Gravelly **sand**	15%	
Gravelly silty **sand**	1%	
Gravel	1%	6%
Sandy **gravel**	5%	
Clay	1%	37%
Silty **clay**	25%	
Sandy **clay**	11%	
Gravelly sandy **clay**	0%	
Gravelly silty **clay**	0%	
Clayey **silt**	3%	5%
Silt	2%	

Table 3.2 provides a summary of material types in Stage 2 of the dredging works, with sand being dominant, however clay material types occur in high portions. Gravel is found throughout the material to be dredged, which is typical of the seabed material found within Port Curtis.

Table 3.2 Summary of Stage 2 material types (channel duplication)

Material type	Percentage for each material type	Percentage for general material group
Sand	18%	61%
Silty **sand**	12%	
Clayey **sand**	4%	
Gravelly clayey **sand**	8%	
Gravelly **sand**	18%	
Gravelly silty **sand**	1%	
Gravel	1%	5%
Sandy **gravel**	4%	

Material type	Percentage for each material type	Percentage for general material group
Silty **clay**	21%	32%
Sandy **clay**	9%	
Gravelly sandy **clay**	1%	
Gravelly silty **clay**	1%	
Clayey **silt**	1%	2%
Silt	1%	

While different sediment type layers have been shown to occur from the results of the Project geotechnical investigation, the sediment to be dredged forms a complex and convoluted soil profile, with lenses of different sediment types, which is difficult to predict, thereby making it infeasible for a dredger to work and target the stratigraphy of different sediment types.

The sand and stiff to very stiff clay form a significant quantity of the sandy clay in the form of sandy clay lumps and clay balls. This characteristic of the dredged material for the Project is a major determining factor in selecting the most appropriate dredging equipment.

The impact of the material types to be dredged on the cutter suction dredger (CSD) and TSHD dredging methodologies were assessed as part of the Project EIS and resulted in the preferred Project dredging methodology (refer Section 1.1.3).

3.3.4 Summary of dredged material properties and suitability for reuse

The material to be dredged for the Project is utilises a dredging methodology that involves the use of a TSHD loading dredged material into barges to transport the material to an unloading facility (BUF), to be transferred to trucks for transport to a placement area. On arrival at the unloading facility, the material is saturated and saline and requires dewatering prior to being available for reuse. It is not immediately available for land improvement and requires placement in a secure area to control fines, to manage the water content and to manage any lenses of PASS within the areas to be dredged.

Based on the known sediment characteristics, the dredged material is highly variable and not readily classified in terms of a standard category of engineering earthworks material. The material is not suitable as a structural engineering fill (piling is still required for structures associated with future land uses on the placement area), and after final dredged material placement, the area requires capping material, prior to developing general industrial, port purposes and/or other land uses on top of the dredged material.

The variability of the material to be dredged and the placement of material within internal ponds to settle creates pockets that are high in fines and very soft, which makes it difficult to access with vehicles and machines to manage the dewatering process. Therefore great care needs to be taken when working with the dredged material sediment within the placement area as it very easy to bog machinery. To stabilise the internal placement area and allow machinery access within the placement area, material is mixed at a ratio of 2 to 1, and the dredged material is replaced and supplemented with capping material on top.

Table 3.3 provides a summary of the Project dredged material volume, properties and dewatering management requirements, and their influence in considering dredged material placement within a terrestrial placement area or marine/intertidal placement area.

Table 3.3 **Project dredged material volume, properties and dewatering management requirements and their influence in considering dredged material placement within a terrestrial land-based dredged material placement area or marine/intertidal dredged material placement area**

Project dredged material issue	Terrestrial land-based dredged material placement	Marine/intertidal dredged material placement
Dredged material volume and area required to place and manage the saline water and sediment mix		
The Project involves capital dredging of 12.85Mm^3 (in situ) of dredged material within the Gatcombe and Golding Cutting bypassing shipping channels (including 0.25Mm^3 for the barge access channel). The Project dredging will either be undertaken in stages, including Stage 1 dredging of 7.5Mm^3 and Stage 2 dredging of 5.35Mm^3, or undertaken as a singular campaign. The placement area required to manage the Project dredged material volume and dewatering process during dredging is in the order of 275ha. If a number of placement areas are used for the Project, the combined placement area required would be greater than 275ha due to the area needed for multiple outer bund walls for each placement area.	The same area is required for the Project dewatering and management process for both terrestrial land-based dredged material placement and marine/intertidal dredged material placement.	
Transfer of saturated material from barges to the placement area		
The Project dredging methodology results in truck movements from the BUF to the placement area to transport the marine water and sediment mix as follows: ■ Stage 1 dredging will involve approximately 625,000 Moxy 40t or B-double two-way vehicle movements over a 40 week dredging program ■ Stage 2 dredging will involve approximately 446,000 Moxy 40t or B-double two-way vehicle movements over a 25 week dredging program ■ Singular dredging campaign will involve approximately 1.07 million Moxy 40t or B-double two-way vehicle movements over a 65 week dredging program.	In both the terrestrial land-based dredged material placement and marine/intertidal dredged material placement, dredged material directly loaded from the barges to the trucks will stick to the walls of the excavator loading buckets and to trucks. Due to the potential for trucks to leak water and sediment as they are loaded and travelling to the unloading point, the surface of the roads will become saturated, resulting in the preference of using off road trucks (e.g. Moxy) for the transport of dredged material between the BUF and placement area.	
	A BUF will need to be located at an existing reclamation area or wharf, or new BUF constructed. The distance to transport dredged material from the BUF and the terrestrial placement area will result in the potential for increased transport and environmental impacts when compared to a marine/intertidal placement area that can minimise the distance between the BUF and placement area. Potential additional impacts for terrestrial placement areas include: ■ Potential increased noise and dust levels for sensitive receptors from the transport of dredged material along a haul route or existing road network ■ Increase in GHG emissions due the increase in truck travel distances between the BUF and placement area	A BUF can be located adjacent or in close proximity to the marine/intertidal placement area resulting in lower transport and environmental impacts compared to using a terrestrial placement area.

Project dredged material issue	Terrestrial land-based dredged material placement	Marine/intertidal dredged material placement
	■ Environmental and cultural heritage impacts associated with clearing and disturbing land for the construction of a dedicated haul route for Moxy 40t vehicles or widening the existing road network, including upgrading bridges over watercourses ■ Additional tenure and Native Title requirements associated with the construction of a dedicated haul route for Moxy 40t vehicles or widening the existing road network, including upgrading bridges over watercourses ■ The extra time involved in handling and transporting dredged material increases safety risks to workers ■ Where a dedicated haul road is not possible, highway loaded vehicles will be required reducing life of existing State and local roads, and increasing safety issues with other users of these roads.	
Managing saline water and licenced discharges into the marine environment		
Due to the Project volume of saline water and dredged material sediment mix to be placed and dewatered within a placement area, there is a need to regularly discharge saline water into the marine environment. Water quality licenced discharge limits will be included in the Project environmental approvals.	Terrestrial placement area will need significant dewatering infrastructure to manage the dewatering process which could include: ■ Impermeable ponds to contain saline runoff and prevent water quality impacts to freshwater and groundwater environments ■ Pipework and corridor to transfer this collected saline water to a marine licenced discharge point ■ Pumps to transfer the water along the tailwater pipelines, unless gravity can be used. If gravity can be used the pipeline or storage pond will need to be sized to meet the volume of the dredged material, dewater process to achieve the licenced water quality discharge limits and the time required to regain pond capacity. ■ The discharge outlet will need to be constructed to match either a subsurface or surface discharge ■ Dewatering for future land use will be difficult as the containment will have to remain sealed, therefore lengthening the dewatering process to enable some degree of compaction	Marine/intertidal placement area will need less dewatering infrastructure (i.e. shorter pipeline and less pumps) than a terrestrial placement area, as this area can be designed to drain by gravity via surface flow to an associated nearby licenced discharge point into the marine environment, resulting in less maintenance and environmental risk compared to a terrestrial placement area.

Project dredged material issue	Terrestrial land-based dredged material placement	Marine/intertidal dredged material placement
	■ Possible use of wick drains connected to a specifically designed containment pond will be required to dewater the area and to remove excess stormwater. This would have to be in place for the entire life of the placement area (i.e. 20 to 30 years) and then continually monitored until the salinity levels are acceptable in relation to runoff and leaching.	
Outer bund wall construction and seepage control through the bund walls		
	Outer bunds in the terrestrial environment need to be constructed in the similar manner to a marine landfill cell with a clay lining design. In addition, the base of the bunded area would require clay lining. The specification would be similar to what is required for a refuse site (to prevent the migration of saline waters into groundwater and freshwater environments).	Outer bunds in the marine environment can be constructed to be more permeable due to the proximity to marine waters (i.e. saline water seepage through the outer bund walls would not impact on upstream freshwater watercourses and terrestrial groundwater). Outer bund walls include a geotextile liner to minimise sediment migration resulting in elevated turbidity in nearby marine waters. Post construction and dredging the exchange of waters from tidal influences and rain has negligible ability to impact the marine environment.
Management of Project potential acid sulfate soils (PASS)		
	Within a terrestrial placement area there is a higher potential for PASS to result in actual acid sulfate soils (AASS) given PASS cannot be placed below the water table to avoid being exposed to oxygen. PASS can be managed within the terrestrial placement area by implementing an acid sulfate soil management plan, including in situ treatment.	Lenses of PASS within the areas to be dredged can be placed within the marine/intertidal placement area below the marine water level (i.e. permanent submergence), therefore resulting in the PASS material not being exposed to oxygen which minimises the potential for AASS being generated by the dredging and dredged material placement process. PASS can be managed within the marine/intertidal placement area by implementing an acid sulfate soil management plan. PASS will be identified and preferentially dredged (allowing segregation and placement below the marine water level). The PASS identification will be based on the existing Project EIS sampling and analysis data (refer Project EIS Chapter 5 and Appendices E4 to E6), supplemented with the geotechnical sampling and geotechnical cross sections identifying the geological layers where PASS is present.

3.4 Environmental values

Land-based and marine areas within and surrounding the Port include environmental values of national and state importance, and are recognised and protected through Commonwealth and State legislation. The Port contains a range of marine habitats, including seagrass meadows (coastal and deep water meadows), coral reef habitats and extensive intertidal habitats (including mangroves, coastal saltmarshes and tidal estuaries). These marine and intertidal habitats support a range of fauna species, including dugong, inshore dolphins, marine turtles, migratory and resident shorebirds, and a diverse range of fish species.

A variety of terrestrial habitats are located within and surrounding the Port of Gladstone, including inshore continental islands such as Curtis and Facing Islands, rivers and wetlands, remnant terrestrial vegetation communities, and Mount Larcom which is a prominent landform in the area.

A summary of the attributes that contribute to the local expression of the OUV of the GBRWHA, and their relative contribution to the overall value of the GBRWHA, as defined under the Master plan for the priority Port of Gladstone 2018 (TMR 2018) is provided in Table 3.4. The mapping of these key environmental values is provided in Appendix A.

Table 3.4 Key local attributes and environmental values that contribute to the OUV of the GBRWHA

Local attribute	Key environmental values
Coral reefs	**Minor contribution to the OUV of the GBRWHA** Fringing and inshore turbid reefs are present within the area, including on the seaward side of Curtis Island and Facing Island, coral reefs associated with Seal Rocks, Turtle Island Reef, Bushy Reef and Manning Reef. Several reef communities within the Port of Gladstone exist within naturally (and anthropogenically affected) high ambient turbidity conditions and light-limited environments. Coral species diversity in the area are generally limited to those coral taxa that are tolerant or semi-tolerant to turbid conditions such as faviids, Turbinaria, poritids, Acropora and soft corals. These species are typical of fringing and turbid coral reefs of the southern inshore Great Barrier Reef.
Fish	**Minor contribution to the OUV of the GBRWHA** The Port and surrounding areas provide a diverse range of important fish habitat (e.g. reefs, mangroves, seagrass meadows). There are two declared fish habitat areas within the area: Dē-răl-lĭ (Calliope River) and Colosseum Inlet. Estuarine and coastal fish species are known from the Port of Gladstone, including potential habitat for conservation significant fish species. However, the Port is not currently recognised as critical habitat for any threatened fish species.
Marine megafauna	**Minor to significant contribution to the OUV of the GBRWHA** Dugong, Australian humpback dolphin, and Humpback whales have all been recorded within the Port. The Port of Gladstone supports a resident population of dugong (estimated in the low hundreds). Seagrass meadows within the Port and surrounds provide important connectivity habitat between larger dugong habitat areas at Shoalwater Bay to the north and Hervey Bay to the south. The area between Rodds Bay and The Narrows is a declared dugong protection area, in recognition of the importance of the seagrass meadows to dugong populations. The Australian humpback dolphin is known to utilise the Port, and the Port is considered to be one of the important locations for this species within the context of the GBRWHA. Humpback whales and calves are known to utilise the Port and surrounding offshore waters during seasonal migrations. The area is not recognised as critical or protected habitat for this species.
Marine turtles	**Minor to moderate contribution to the OUV of the GBRWHA** Several marine turtle species have been recorded in the area. Of these, Flatback and Green turtles are the most commonly recorded. Nesting beaches are present on Facing, Curtis and Wild Cattle Islands, Boyne Island Beach and Tannum Sands. Curtis Island provides an important nesting beach for the Flatback turtle, which is endemic to the east Australian continental shelf. South End Beach is listed as one of four key rookeries for this species.

Local attribute	Key environmental values
Seagrass and macroalgae	**Minor to moderate contribution to the OUV of the GBRWHA** Coastal and deep water seagrass meadows are present within the Port and surrounds, representing seven different species of seagrass. Seagrass meadows in the region are ephemeral and changes in seagrass abundance, species composition and biomass occur over different seasons. Key seagrass meadows are located at Pelican Banks North, Pelican Banks South, Facing Island and Quoin Island. Seagrass and macroalgae provide important habitat for a range of marine fauna in the area, including dugong, inshore dolphins, marine turtles and fish species.
Shorebirds and migratory birds	**Minor to significant contribution to the OUV of the GBRWHA** The Port and surrounds contains large areas of potential habitat for both resident and migratory shorebirds, including foraging and roosting habitat in intertidal and subtidal areas along the coastline. There are several important roost sites within the area, including the Kangaroo Island wetland and important shorebird roosting habitat at Friend Point, North Passage and South Passage Islands, Boyne Island Beach, shorebird habitat associated Curtis Island, Facing Island and the other inshore islands. Several threatened migratory shorebirds are known to frequent the area. Marine waters provide potential foraging habitat for a range of migratory seabirds, however the area is not recognised as critical habitat for seabirds. No breeding habitat for migratory shorebirds or seabirds is present within the area or surrounds.
Flora, fauna and ecological communities	**Minor to moderate contribution to the OUV of the GBRWHA** Several conservation significant flora and fauna species are known or highly likely to occur within the Port and surrounds. These species area known from terrestrial, intertidal and marine habitats. Key conservation significant species occurring or potentially occurring in the Port and surrounds include: Water mouse (*Xeromys myoides*), Yellow chat (*Epthianura crocea macgregori*) and Quassia (*Samadera bidwillii*). All of these species are listed under the provisions of the EPBC Act and/or the NC Act. Three threatened ecological communities (TECs) are present within the Port and are associated with intertidal areas, coastal dunes and watercourses. The Subtropical and Temperate Coastal Saltmarsh TEC covers the largest area within adjoining areas of the Port, and is associated with intertidal areas, often in areas adjacent to mangrove communities. This community is listed as vulnerable under the provisions of the EPBC Act. Intact, remnant mangrove forests are important habitats and ecosystems within the area, with key forests located in The Narrows, along the coastline between Fisherman's Landing and Wiggins Island, South Trees Inlet, Boyne Island Beach, and along the coastline of the continental islands. The area supports a diverse range of mangrove species, with 13 species recorded within the Port.
Geomorphology	**Minor contribution to the OUV of the GBRWHA** Features such as beaches, dune systems, and river deltas are important geological features within the area. The Narrows is a key example of cross-shelf connectivity. It is one of only four tidal passages in Australia, and separates Curtis Island from the mainland. The only other tidal passage in the GBRWHA is the Hinchinbrook Channel (approximately 800km north of Gladstone). The parabolic dunes near Cape Capricorn on Curtis Island are viewed as regionally significant examples of landscape formation and evolution, and include a natural sand blow at Yellow Patch (north eastern Curtis Island). Marine tidal sand deltas at the mouth of the Boyne River and Colosseum Inlet are local examples of the fine sediments transported along the coast by longshore drift, and deposited at the mouth of estuaries.
Marine fauna	**Minor to moderate contribution to the OUV of the GBRWHA** A diverse range of marine fauna species occur in the area, including marine mammals, marine turtles, and estuarine and reef fish communities. A range of habitats support the diversity of marine species present, including seagrass meadows, reefs, soft sediment habitats, mangrove communities, estuaries, deep water habitats and intertidal areas.

Local attribute	Key environmental values
Marine water quality	**Moderate contribution to the OUV of the GBRWHA** The marine and estuarine waters of the Port and surrounds are predominantly described as 'moderately disturbed' (in terms of management intent/level of protection), with the exception of the coastal waters which are described as 'slightly to moderately disturbed', and The Narrows which are 'high ecological value'. Although marine water quality is slightly to moderately disturbed, it is critical to supporting and sustaining the local expression of several attributes that contribute to the OUV of the GBRWHA, including reef communities, seagrass meadows, fish species diversity and habitat, marine mammals, marine turtles, migratory shorebird habitat, and the total diversity of marine life.
Continental islands	**Moderate to significant contribution to the OUV of the GBRWHA** There are a number of continental islands within the Port and surrounds, including Curtis and Facing Islands, and several smaller inshore islands such as Quoin, Compigne, Turtle, Diamantina, Witt, Tide, Picnic, She Oak, Rat and Garden Islands, and Bushy Islet. Curtis Island is the largest continental island in the GBRWHA (by land area) and is recognised as having high terrestrial flora species diversity with more than 500 species. Curtis Island is important as it contains a high level of flora species diversity, and represents a key example of the unique island vegetation communities on islands in the GBRWHA. Other islands in the Port and surrounds are likely to support the similar floristically diverse communities, however there is limited available and relevant information for these islands. The continental islands also provide unique habitats within the area, such as beaches, cliff and shoreline platforms, beach ridges, swale systems, parabolic dunes and coral reef platforms.
Cultural heritage	**Moderate contribution to the OUV of the GBRWHA** The Port and surrounds contain a number of culturally significant sites, and provide access to areas enabling traditional Aboriginal use of land and sea. The Port Curtis Coral Coast Indigenous group has formalised their aspirations for sea and country through entering into a Traditional Use of Marine Resource Agreement which encompasses the Port, as well as the Capricorn-Bunker Group of reefs, cays and islands.
Total species diversity	**Moderate contribution to the OUV of the GBRWHA** Diversity of available habitat types contribute to the diversity of marine species within the Port and surrounds. Marine habitat areas include coral reefs, seagrass meadows, mangrove communities, hard and soft benthic substrates and beach habitats. Although the marine habitats within the area are not considered to be unique, they do support fauna species that are considered to significantly contribute to the OUV of the GBRWHA (i.e. dolphins and migratory shorebird species).

Source: TMR (2018)

Separate to the OUV of the GBRWHA, there are a number of other environmental values within the Port.

Table 3.5 summarises the other environmental values within and surrounding the Port that do not contribute to the OUV of the GBRWHA.

Table 3.5 Other environmental values within and surrounding the Port

Environmental value	Description
Water quality	Sources of fresh water and groundwater, their quality and the ecosystem services they support (e.g. watercourses providing habitat for flora and fauna species).
Terrestrial flora and fauna Intertidal flora and fauna Marine flora and fauna	Flora and fauna species and ecological communities not contained within the GBRWHA or not considered to contribute to the OUV of the GBRWHA (e.g. vegetation communities or fauna habitat located outside of the Great Barrier Reef coastal zone, such as flora and fauna habitat within the Aldoga area).
Protected areas	A range of protected areas (e.g. National Parks and Conservation Parks) are present within the area as listed under the provisions of Commonwealth and state legislation.
Heritage properties	World, Commonwealth and National Heritage Places. State and local heritage places.

Environmental value	Description
Social	Community infrastructure and facilities, local workforce, housing and accommodation.
Recreational opportunities and natural scenic amenity	Areas utilised for conservation, environmental management, tourism, open space, and sport and recreational uses. Also includes areas that provide natural scenic amenity.
Cultural heritage	Areas, interactions or sites that are culturally important and are considered not to contribute to the OUV of the GBRWHA (e.g. Indigenous cultural heritage sites that are located outside of the GBRWHA and associated Great Barrier Reef coastal zone, Indigenous Land Use Agreements and Native Title determination areas).

Source: TMR (2018)

The environmental considerations for the purposes of this Revised DMPOI are assessed further in phases three and four.

3.5 Economic factors

The viability of beneficial reuse options is also 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. The requirement for any double handling of the material rather than direct placement can also affect the cost of the dredging campaign.

The timeframes associated with the dewatering and settlement of reclaimed land before it is useable and the cost associated with this delay is a major consideration for beneficial reuse options. The consideration as to whether the reclaimed land can generate an income stream once complete is also an important factor. A new reclaimed area within the Port of Gladstone can generate an income stream for GPC by establishing new Port industrial land and additional berths for commercial shipping. The income is obtained by GPC from leasing the reclaimed land to industry proponents and Port charges associated with vessel movements within the Port for the import and/or export of products.

The size of each potential dredged material placement site will have an economic impact. For example, the establishment costs of a large area of reclaimed land and the management of this land is more cost efficient than the establishment and management of multiple smaller sites. If more than one site is required for all the long term Port dredged material placement needs, then this increases the overall costs for dredging projects. The capacity of every site needs to be maximised to ensure establishment costs are capitalised.

The dredging methodology also has an economic impact on each dredging campaign. The nature of the dredged material (refer Section 3.3) directly determines the feasibility of different dredging methodologies for the Project and for future approved capital dredging campaigns (refer Section 4). For the future stages of the WBDDP pumping distance is a critical economic factor, the feasibility of which is impacted by the nature of the dredged material. In the Port of Gladstone, feasible pumping distances for capital dredging at a distance from a suitable placement area are limited due to the mixed nature of the sediments in the dredged material. This pumping distance issue for the future stages of the WBDDP has been discussed in the LTSDP.

Demand for Port expansion is driven by the needs of the industries that currently utilise or would like to utilise Port facilities. Therefore, the industry demand for future Port capital dredging to widen and/or deepen shipping channels, swing basins and berths will be the driving factor in the nature, scope and timing for further Port expansion and additional dredging requirements. Industries that currently utilise the Port, or future proponents, will need to cover the costs of capital dredging directly for each dredging campaign and/or costs will need to be covered indirectly with charges such as port fees. Financial contributions from proponents to future dredging campaigns will make dredged material placement options such as reclamation more feasible. If future Port capital dredging is too costly and cannot be recovered, then the deepening and widening of Port of Gladstone shipping channels, swing basins and berth pockets may not occur which has the potential to limit the Port throughput capacity.

Economic costs and demand for products will be considered in the assessment of potential beneficial reuse options for the material to be dredged in phase three.

3.6 Availability of land

A key factor in consideration of the beneficial uses for dredged material is also the availability of land to establish primary dredged material placement area(s), either as the final placement location (e.g. terrestrial land-based placement, reclamation) or for the management or treatment of dredged material prior to its relocation for other beneficial reuse (e.g. for construction materials).

The Commonwealth Government dredged material management study (SKM 2013) has also identified that 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 a key common constraint to dredged material management.

Table 3.6 provides a summary of the availability of land considerations for terrestrial land-based placement and marine/intertidal placement of Project dredged material.

Table 3.6 Availability of land considerations for terrestrial land-based and marine/intertidal placement

Availability of land issues	Terrestrial land-based dredged material placement	Marine/intertidal dredged material placement
Securing sufficient area to place the Project dredged material volume and manage the dewatering process		
As stated in Table 3.3, the placement area required to place the dredged material volume and manage the Project dewatering process during dredging is in the order of 275ha. If a number of placement areas are used for the Project, the combined placement area required would be greater than 275ha due to the area needed for multiple outer bund walls for each placement area.	■ Long term lease or the purchase of freehold land parcels for dredged material placement and dewatering would be required ■ For long term leases multiple land owners may not be willing to accept the long timeframe (i.e. 10 to 15 years, or longer) that the land parcels cannot be used for other land uses which could generate a higher income than the long term tenure for dredged material placement ■ Native Title issues will need to resolved for the land parcels within the placement area ■ Purchase of multiple land parcels is likely to increase the capital cost of the Project	■ In order to use unallocated state water, GPC would make an 'application to lease state land' to the Department of Natural Resources, Mines and Energy (DNRME) in accordance with the *Land Act 1994* and would seek a term lease for the purpose of 'marine works' with a condition allowing sufficient time for completion of the reclamation. GPC would have a survey plan of the proposed lease area prepared as part of the application. ■ GPC has a current Indigenous Land Use Agreement (ILUA) in place with Traditional Owners. The ILUA allows the granting of a reclamation area lease (an 'applicable authorisation'). The 'agreed Acts' consented to under the ILUA includes reclamation within Port of Gladstone marine waters and intertidal areas. Therefore a new lease over the reclamation area can be carried out under the terms of the ILUA without any further Native Title actions being required.

Availability of land issues	Terrestrial land-based dredged material placement	Marine/intertidal dredged material placement
The approximate timeframe to construct a terrestrial placement area or marine/intertidal placement area (to accommodate the total Project dredging volume) is likely to be 3 years (this timeframe has been included in the Project EIS for the proposed WBE reclamation area). Any terrestrial placement area or marine/intertidal placement area would require 10 to 15 years (or longer) of secure tenure over the area to receive the Project dredged material and undertake the dewatering process.		■ DNRME would undertake its lease assessment in accordance with the *Land Act 1994* and relevant agency policies and if all requirements were met, an Agreement to Offer a Term Lease would be issued to GPC, including a lease permit fee and annual rent and proposed lease conditions ■ GPC would be obligated to comply with all lease conditions, including reclamation deadlines within the term, until the term lease expires or it was surrendered prior to purchasing the land ■ Upon completion of the reclamation GPC would submit to DNRME an 'application to purchase state land' in accordance with the *Land Act 1994*. If all DNRME requirements for freeholding are met, an Agreement to Offer a Deed of Grant over Unallocated State Land (USL), including a sale price for the property would be issued to GPC. ■ Issues that would make USL marine/intertidal areas not available, include if there was any legislation prohibiting development like reclamation in the subject area, for example: – It was designated a Fish Habitat Area where development is restricted, or – It was located within the marine precinct of the priority Port of Gladstone Master Plan where development should be limited, or – If all DNRME term lease assessment requirements could not be met.
Dedicated Moxy 40t haul route between BUF and placement area		
If the existing road network could not be utilised to transport dredged material from the BUF to the placement area, a dedicated Moxy 40t haul route would need to be constructed	■ The haul route will require tenure to be obtained between the BUF and the placement area. This could result in the need to obtain temporary medium to long tenure over multiple properties, depending on the distance between the BUF and the placement area. Depending on the location of the placement area and land uses between the BUF and placement area, it may not be possible to construct a dedicated haul route.	■ Marine/intertidal dredged material placement area is unlikely to require a dedicated Moxy haul route as the BUF can be constructed adjacent to the placement area

Availability of land issues	Terrestrial land-based dredged material placement	Marine/intertidal dredged material placement
Securing a dewatering pipeline corridor		
As part of the dewatering process within the dredged material placement area a licenced discharge into the marine environment is required	■ Will require a number of pipelines between the placement area and a marine discharge point due to the saline nature of the marine water and sediment mix being managed within the placement area ■ The tailwater pipelines could be installed adjacent to the dedicated Moxy 40t haul route (if constructed)	■ Marine/intertidal placement area is unlikely to require a dedicated dewatering pipeline corridor due to the area being adjacent to the marine environment

3.7 Port of Gladstone Sustainable Sediment Management Project

The Port of Gladstone Sustainable Sediment Management Project (SSMP) for maintenance dredging involves the following studies and option assessments:

- Avoiding maintenance dredging assessment
- Reducing maintenance dredging assessment
- Beneficial reuse assessment.

The SSMP beneficial reuse assessment involved undertaking an initial high level review of over 30 potential recycling or reuse options for Port of Gladstone maintenance dredged material.

The majority of these options were discounted following a preliminary feasibility review. However, it is noted that technology or Gladstone region land uses may alter in the medium to long term resulting in other options potentially coming to the forefront. As GPC's Long Term Maintenance Dredging Management Plan is reviewed regularly, the options list may then be altered, or as part of future Port of Gladstone maintenance dredging projects.

Nine recycling or reuse options were identified for stakeholder evaluation/assessment, which aligned with six broad categories, namely:

1. Land reclamation – Either at the existing Fisherman's Landing facility or at a new reclamation site. The availability of coarse sediments suggests that a long term reclamation area (similar to that adopted by the Port of Brisbane) would be feasible. Nevertheless, a key issue will be the availability of suitably low lying portside land. While investigations have revealed that some of the potentially suitable areas have been designated for environmental protection or future development, the priority Port of Gladstone master plan identifies potential future dredged material placement areas.
2. Shoreline protection (coastal erosion mitigation) – The availability of coarse sands and some gravels allows direct placement of dredged materials on eroding foreshores comprised of finer, less stable sediments. Alternatively, dredged materials could be used to fill geotextile bags or tubes for use as a variety of shoreline protection structures. The high additional costs associated with such works mean that feasibility will be determined by the need for shoreline protection measures and the availability of lower cost, alternative, non-dredging related solutions.
3. Beach nourishment (onshore or offshore placement) – Unlike many ports within Queensland, maintenance dredging within the Port of Gladstone requires relocation of significant quantities of sand, which could be potentially suitable for beach nourishment. Beach nourishment is the preferred policy approach to dealing with coastal erosion in Queensland and there are a number of local sites which would benefit from placement of maintenance dredged material.

4. Coastal habitat restoration/creation (direct and indirect placement options) – This option would provide significant benefits such as supporting migratory and resident birds, land fauna such as reptiles, insects and small mammals (e.g. the vulnerable Water mouse), promotion of the growth of seagrass and indirect benefits such as improved long term water quality and green and blue carbon benefits. The primary drawbacks with such options relate to the potential impact on existing habitat and additional cost of delivering the works.
5. Lining/bunding material – The physical properties of the maintenance dredged material sediments are such that a suitable lining/bunding material could be produced. A number of industries within the Gladstone region use environmental bunds, however, it is recognised that there is relatively little demand for such material locally. The primary challenges associated with this option relate to the high cost of establishing an onshore area for dewatering and the extensive works required to produce a suitable product.
6. Land rehabilitation/land improvement/fill – The variety of material types requiring dredging means that a viable land rehabilitation improvement material could be produced. Similarly to bund material, the challenges associated with this option relate to the low demand and high resource use and costs associated with producing such a material. Once dewatered, a complex process of mixing, treatment, extraction, processing by screening, stockpiling, and then potential blending and batching with imported material, would be required which may render this option uncompetitive when compared to other potential sources of material.

The SSMP beneficial reuse options for Port of Gladstone maintenance dredged material were evaluated in stakeholder forums and online to short list the preferred options for more detailed feasibility studies.

In addition to the current GPC approved approach of relocation of maintenance dredged material at sea to East Banks DMPA, four alternative options performed well, indicating that they could warrant further investigation. Two options were using sustainable relocation to reduce dredging near the LNG terminals and in the Gladstone Marina. The other two options were from the beneficial reuse assessment namely, beach nourishment and habitat restoration/creation.

The sustainable relocation options scored well as there was a reduction in dredging and/or placement of material at East Banks DMPA. These reductions and the potential 'no change' in impact on the environment, requires detailed validated modelling to ensure the material disperses into the sediment system. If the modelling and any verification monitoring shows that the relocated material increases the risk to a sensitive receptor or future maintenance dredging it is unlikely to progress further.

Beach nourishment scored well, but would also need to show, via modelling, that the material would improve the protection of the dunes and turtle nesting habitat when compared to any impacts to the initial placement area.

Habitat restoration was the best scoring environmental option, providing a positive environmental outcome, although it was associated with increased costs and emissions.

The next steps of the Port of Gladstone SSMP involve narrowing the top performing options into one or two tangible approaches for progressing into a feasibility stage and potential trial.

Where relevant the findings of the Port of Gladstone SSMP have been incorporated into the Revised DMPOI phase one considerations to identify the preferred beneficial reuse options for the Project dredged material.

3.8 Other considerations

In addition to the considerations already outlined, identifying options for the beneficial reuse 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 reuse also needs to be considered in the assessment of beneficial reuse options. The dewatering and/or treatment of material (where required) can take a number of years and is dependent on local weather (i.e. 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.

3.8.1 Consideration of other available options for dredged material placement

As part of the DMPOI process, consideration has been given to a number of alternative options for use and placement of the dredged material. The alternatives considered are included in the Project EIS Appendices B1 and B2, and the Revised DMPOI, including meeting records of workshops with government agencies where a wide range of alternative options were raised and considered (refer Project EIS Appendix B2).

In response to the Queensland Government's review of the Revised DMPOI, the following further information is provided to supplement the previous consideration of alternative options:

- **Purchasing land for long term management of dredged material:** In the consideration of alternative beneficial use options, the tenure and cost of land has not acted as a constraint on the selection of options for consideration. It has been assumed that where a preferred site was identified, that land tenure arrangements (purchase or leasing) would be able to be resolved at reasonable cost, if that site were to be selected as the preferred option for dredged material placement. Of the beneficial reuse options, the terrestrial land-based placement and land improvement options identified in the process are outlined in Section 5 of the Revised DMPOI.
- **Shipping material offshore to the Coral Sea outside the GBRWHA:** Offshore (at sea) options were investigated in the DMPOI process (refer Project EIS Appendices B1 and B2) prior to the gazettal of the Ports Act, and were then not considered any further. Whilst these options were within Port limits and outside the GBRMP boundary, the option of transporting material to the open sea, beyond the eastern and southern GBRMP and GBRWHA boundary would be considered unfeasible based on the travelling significant distances to placement locations (including longer dredging cycle time) along with the associated increases in operational and fuel costs, greenhouse gas emissions, and risks of collisions and/or spills due to greater vessel steaming time. This option would also involve environmental risk from the placement of dredged material at sea, and it therefore not considered to be a feasible placement option.
- **Back loading the material via the existing coal rail infrastructure to spent coal pits:** The option of transporting dredged material to spent coal pits remote from the Port is not a feasible option due to the:
  - Fleet of coal wagons not being suitable for securely transporting saturated dredged material as coal wagons are not designed for this purpose. If coal train wagons were to carry the sand, silt and clay, there would be a high potential for these wagons to leak in transit as the wagons are designed for transporting bulky solid material, not seawater-infused dredged material as well as potential risks from cross contamination of the coal wagons and impacts to rail congestion.
  - Capacity of the coal trains and their wagons would not be sufficient to efficiently deal with the rate of dredged material generated by the dredger
  - Existing coal terminal and transport facilities have been designed for the export of coal to port. A dedicated reclaiming facility and machinery would be required to load train wagons, similarly unloading pits at the coal mine would be required.

- Due to the above constraints the dredged material would still need to be dewatered within a dredged material placement area. As discussed in Section 3.9.6, secondary beneficial reuse options for dredged material after dewatering and settlement within a primary placement area have been considered in this Revised DMPOI.

- **Using the existing Western Basin reclamation area as a staging area to dewater/treat and/or hydraulically separate material to create usable building material:** Section 4 sets out the existing Western Basin reclamation area approvals, works to date and remaining capacity. Table 4.3 identifies that the remaining capacity is allocated to the approved Clinton Vessel Interaction Project (1Mm^3), future approved WBDDP Stage 1B dredging (3Mm^3), imported capping material to allow port land to be developed (3Mm^3), and the polishing pond to be retained for WBDDP dredging and the Project dredging dewatering process (1.2Mm^3). Therefore the remaining capacity within the Western Basin reclamation area is minimal, and represents an insufficient area to accommodate the rate of dredging proposed over the two Project stages, to enable dewatering to satisfactorily meet the licenced discharge limit and to accommodate construction compounds and dredged material placement equipment. The existing Western Basin reclamation area can be used for part of the Project dewatering process (final polishing pond), and potentially a small dredged material volume (in the order of 0.31Mm^3), but would need to be supplemented by a significantly larger area, to meet the dredged material placement and dewatering management needs of the Project. Further using the existing Western Basin reclamation area would prevent the opportunity of using the area for future port development.

3.8.2 Background and applicability to material to be dredged

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

- Engineered uses
  - Land creation/reclamation
  - Land improvement (combined with a primary land creation/reclamation site)
  - Terrestrial land-based placement and 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 3.7 provides a summary of each of these beneficial reuse options, together with an assessment of their potential for successful implementation for the material to be dredged as part of the Project.

Table 3.7 Beneficial reuse options and their applicability to the Project

Background information	Potential applicability to material to be dredged
Land creation/reclamation	
Land creation, also referred to as reclamation, involves the beneficial reuse 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 (e.g. 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 (RGTCT) 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 ■ WBDDP Stage 1A and WICT Project in the early 2010s. GPC would be required to obtain tenure over the marine/intertidal placement area (refer Table 3.6 for further details). A dedicated Moxy 40t haul route and dewatering pipeline corridor are unlikely to be required for this option given the placement area would be located adjacent to the BUF and marine waters. Obtaining land tenure over marine/intertidal placement area involves a statutory process that GPC has previously followed for other reclamation areas within the Port of Gladstone (refer Table 3.6 for details of the tenure process). Reclamation provides a viable option for the beneficial reuse of dredged material from the Project and has been explored further as part of this Revised DMPOI. Although some of the material to be dredged may not be the most suitable material for reclamation, the material is suitable for long term development sites where a long timeframe is required for consolidation. The Ports Act declares the Port of Gladstone as one of the Queensland Government's four priority ports. A reclamation option that achieves an end land use of port industrial development would be consistent with the Ports Act. Opportunities for land creation/reclamation within the Port of Gladstone include: ■ Areas adjoining the Port of Gladstone coastline (above and below LAT) ■ Creation of a new reclamation island within the Port of Gladstone. For the purposes of this assessment, land creation/reclamation options outside Port limits (e.g. within the GBRMP) have not been investigated.

Background information	Potential applicability to material to be dredged
Land improvement (combined with land creation/reclamation)	
Dredged material can be used to improve land considered inadequate for the intended future use (e.g. due to ground level or soil structure). This beneficial reuse 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 requires 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 reuse 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 coastline being identified for future development that would require fill material to achieve developable levels. This beneficial reuse option may also be achievable for locations set back from the coastline within the Gladstone region. However, these location options would require a primary dredged material placement area within close proximity to the coastline to allow dewatering of the dredged material before transferring to a secondary location. Depending on the size of the primary placement site, the availability of dewatered dredged material for a land improvement option would be dependent on the volumes dredged as a part of each dredging campaign, and the timing of dewatering and consolidation of material.
Terrestrial land-based placement and improvement	
Dredged material can be used to improve land considered inadequate for the intended use (e.g. due to ground level or soil structure) and this option assumes that the dredged material is initially placed, dewatered and consolidated at the intended improvement location (i.e. not associated with land creation/reclamation). Terrestrial land-based placement and improvement requires 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 terrestrial land-based placement, depending on the timing of projects (both dredging and the future land based development) and the characteristics of the material. Without an associated land creation/reclamation area, the dredged material will need to be transported, contained, dewatered, dried and consolidated over several years, and shaped into the final surface levels for the intended use.	Land-based placement projects in Gladstone to date have generally been associated with land creation/reclamation (discussed above). Opportunities for terrestrial land-based placement and improvement may exist in areas set back from the coastline which have been identified for future development that would require fill material to achieve developable levels. However, as discussed in Table 3.3 and Table 3.6, there are a number of limitations with this option, including: ■ The placement area is likely to involve multiple land parcels due to the volume of Project dredged material to be placed and dewater process. Long term land tenure over the placement area land parcels would need to be secured during the EIS process (i.e. purchase or lease for 10 to 15 years (or longer)). Also the placement area would need to be prepared ahead of the commencement of the dredging program and be available to accept and manage the dredged material at a rate and volume equivalent to the material being dredged under each stage of the dredging program and any future dredging programs. ■ The dredged material (in a saturated state) would need to be barged to an unloading facility, mechanically unloaded and transported in a contained state (to avoid seawater and fines spillage into the terrestrial environment) to the placement area. The transport of seawater and dredged material would require the use of large trucks, including either: – Moxy 40t trucks which would utilise a dedicated haul route between the unloading facility and the placement area – B-double trucks which would utilise the existing road network (refer Table 3.6 for further details). ■ A dedicated pipeline corridor would be required to transport tailwater from the placement area to a licenced discharge point within the marine environment

Background information	Potential applicability to material to be dredged
	■ The land owner(s) for the leased land parcels would need to be willing to accept the timeframes and limitations associated with the use of the land as a dredged material placement area, including the potential to accept dredged material from multiple dredging program/campaigns, part of the land would not be available for other uses, until the final dredging program/campaign is complete and the material is dewatered and stabilised for the end use. Terrestrial land-based placement and improvement has been considered further as a Project beneficial reuse option, noting the issues of this option discussed above and in Table 3.3 and Table 3.6.
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).	While the GPC Coastal Erosion Risk Plan identifies the Tannum, Boyne and Wild Cattle areas with erosion, due to the reasonably high clay and silt content of the future capital material to be dredged within the Port it is not considered suitable for the nourishment of the sandy beaches within the Gladstone region. For the purposes of this assessment, beach nourishment has not been considered further as a beneficial reuse option. However, beach nourishment may be reassessed as part of other future Port dredging campaign alternative dredged material placement and beneficial reuse options assessments.
Offshore berms	
PIANC (1992) identifies the creation of offshore berms for the protection of coastal areas/improvement of coastal stability as a potential beneficial reuse 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 (i.e. Facing and Curtis Islands) to the east. The eastern coastlines 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 for the Project would be suitable for this purpose due to the reasonably high proportion of fine sediments within the matrix and the high level of bed-shear stress (i.e. 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 marine water sediment plume impacts to nearby areas. For the purposes of this assessment, offshore berms has not been considered further as a beneficial reuse option.
Capping	
The capping of in situ material with dredged material offers a beneficial reuse 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 Revised DMPOI 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 coastline) using material to be dredged by the Project. As discussed above, for placement locations set back from the coastline within the Gladstone region, these location options would require a primary dredged material placement area within close proximity to the coastline to allow dewatering of the dredged material before transferring to a secondary location.

Background information	Potential applicability to material to be dredged
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 coastline within the Gladstone region, these location options would require a primary dredged material placement area within close proximity to the coastline to allow dewatering of the dredged material before transferring to a secondary location.
Parks and recreation	
The beneficial reuse 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 (e.g. sporting fields) having minimal load bearing requirements. This usually involves relatively small volumes of material (SKM 2013).	Consultation with the Gladstone Regional Council (GRC) in July 2019 indicated that there are no existing or planned future parks or recreational areas within Gladstone that would require dredged material as fill material within the Project dredging timeframe. For the purposes of this assessment, fill material for parks and recreation as a subset of land improvement has not been considered further as a beneficial reuse option. However, the use of dredged material as fill for parks and recreation will be reassessed as part of other future Port dredging campaign alternative dredged material placement and beneficial reuse options assessment.
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 reuse discussed above, a primary dredged material placement site(s) may be required to dewater and/or treat the dredged material (e.g. for PASS, salinity) before it can be transferred to the beneficial reuse site.	Material from the future areas to be dredged for the Project will be highly saline due to its origins from the marine environment which will impact on the viability of this beneficial reuse option. In addition, no opportunities for this beneficial reuse option have been identified within the region as part of the Revised DMPOI. For the purposes of this assessment, fill material for top soil use has not been considered further as a beneficial reuse option. However, the use of dredged material as top soil fill will be reassessed as part of other future Port dredging campaign alternative dredged material placement and beneficial reuse 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 coastline within the Gladstone region and no future aquaculture facilities have been identified through consultation with State and Local Government officers during the assessment that would benefit from or require material from the future areas to be dredged by the Project. For the purposes of this Revised DMPOI, fill material for aquaculture purposes has not been considered further as a beneficial reuse option. However, the use of dredged material for aquaculture purposes will be reassessed as part of other future Port dredging campaign alternative dredged material placement and beneficial reuse options assessment.

Background information	Potential applicability to material to be dredged
Construction materials	
The use of dredged material in the production of construction materials (e.g. fill material, bricks, ceramics, etc.) can be considered an important beneficial reuse option, due to issues with the availability of land based construction materials/resources (PIANC 1992). This type of beneficial reuse 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 construction material 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 (i.e. the mixing of components in the material matrix) and therefore affect its suitability for use.	Dredged material from the future areas to be dredged for the Project has the potential to contain components that could be suitable for construction materials (e.g. sand, gravel, clay), however these are in low abundance, and are heterogeneously mixed with the dominant silt and clay components. The hydraulic separation of Project dredged material types and sizes is achievable to an extent (e.g. through 'soil washing'), and would require a primary dredged material placement location close to the Port of Gladstone coastline to undertake the separation, treatment (if required) and storage of materials. Consultation with local stakeholders (e.g. State and Local Government officers, GPC) in June and July 2019 that have strong ties to the construction industry in the Gladstone region during the assessment have indicated that there is currently no market identified for the beneficial reuse of dredged material in the production of construction materials. However in the future a market need may exist for small quantities of dredged material in the production of construction materials. For the purpose of this assessment, the use of small quantities of dredged material for construction materials is possible as a secondary beneficial reuse option after dewatering and settlement within a reclamation area.
Habitat creation or restoration	
The creation or restoration of degraded habitats provides opportunity for the beneficial reuse of dredged material with an ecologically beneficial outcome. This type of beneficial reuse 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 reuse 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 in June and July 2019 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 (e.g. 'working with nature'). For the purposes of this Revised DMPOI, the use of dredged material for standalone creation or restoration of degraded habitat projects has not been considered further as a beneficial reuse option. However, the use of dredged material for habitat creation or restoration purposes will be reassessed as part of other future Port dredging campaign alternative dredged material placement and beneficial reuse options assessments.

3.8.3 Potential beneficial reuse options for material to be dredged

In summary, the potential beneficial reuse options for material to be dredged for the Project, and other future approved Port capital dredging projects, that are appropriate and feasible for the Revised DMPOI study are:

- Land creation/reclamation
- Land improvement (combined with a primary land creation/reclamation site)
- Terrestrial land-based placement and improvement
- Capping of in situ material

- Replacement fill
- Construction materials
- Habitat creation as part of land creation/reclamation.

A number of the potential beneficial reuse options (i.e. land improvement, capping of in situ material, replacement fill) for material to be dredged will require a land creation/reclamation area close to the coastline or terrestrial land-based placement area to enable primary placement of large volumes of material and dewatering prior to the potential use for other secondary purposes.

The terrestrial land-based placement and improvement options will require a facility for barge unloading, a secure method of transport (to avoid spillage of saturated material fines and saltwater into the terrestrial environment) and a means of returning treated water (i.e. pipeline) to the marine environment.

The availability of sites for the beneficial reuse options for dredged material (i.e. timing of dredging and the dewatering process compared to the timing of the beneficial reuse requirement) will influence their viability.

3.8.4 Preferred beneficial reuse option for material to be dredged

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 (e.g. industrial land) and available technology and associated costs. The high silt and clay content of the Project material to be dredged indicates that the preferred method of dredged material placement of land based and/or reclamation would be an engineered enclosure to contain the dredged material and manage the dewatering process.

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 approximately 1.25 is assumed for the purpose of this Project (refer Section 4.3). These dredged material placement areas then need to be managed for a number of years (depending on the dredged material and underlying material) to achieve the required settlement for the area’s intended final use.

3.9 Outcomes of phase one

The outcomes of phase one of the Revised DMPOI are summarised below. Phase three will utilise the findings of phase one to determine the site selection criteria for determining the potential dredged material beneficial reuse placement location options.

3.9.1 Legislative requirements

Although there are many legislative requirements that will need to be considered in determining the most suitable beneficial reuse and/or placement option/location, the enactment of the Ports Act has significantly limited the options for dredged material placement within the Port, compared to the options available historically for dredged material placement. With sea-based (offshore) placement of port-related capital dredging prohibited as an option, alternate land-based beneficial reuse and placement options need to be identified.

3.9.2 Nature of material and preferred dredging methodologies

The sediments within the Port of Gladstone are dominated by clays and silts. The blend of materials has implications for the effectiveness of separating material for certain reuses (e.g. sand from silts). Although in previous dredging campaigns within the Port, a degree of separation of heavier dredged material components from silts and fines has been achieved, the extent of separation and suitability of the components of the separated material has been limited. The nature of the material to be dredged within the Port therefore limits the options available for reuse.

The nature of the sediments in the Port also has implications for the dredging methods (e.g pumping) that can economically be applied to transfer dredged material from the areas to be dredged to the beneficial reuse placement location.

The preferred Project dredging methodology involves utilising a TSHD which loads the dredged material from the Gatcombe and Golding Cutting bypass shipping channels into barges (four barges will be working in cycles for the entire dredging operation) which will transport the material to a BUF adjacent to an existing or new wharf to be unloaded using large excavators into trucks (e.g. Moxy 40t) for placement within a beneficial reuse area.

3.9.3 Environmental values

The environmental values surrounding the Port include those of national and state importance, recognised and protected through Commonwealth and State legislation. The Port contains a range of marine, intertidal and terrestrial habitats. Key local attributes and environmental values that contribute to the OUV of the GBRWHA include (but are not limited to) several important roost sites for shorebirds and migratory birds, key seagrass meadows, habitat for turtles, dugongs and dolphins and continental islands within the area.

The environmental considerations for the purposes of this Revised DMPOI are assessed further in phases three and four. Further, Appendix C provides a summary of the justification for the phase four MCA scoring of potential options in relation to environmental values process.

3.9.4 Economic drivers

The viability of beneficial reuse options is also influenced by economic factors. Costs associated with dredging may result in a product that is significantly more expensive to access than alternatives. Further, timeframes associated with primary dredged material placement land being useable can be delayed and therefore cost is a major consideration for beneficial reuse options. The size of the potential dredged material placement site will also have an economic cost. From the findings of phase one, there is a general preference to consider one larger reclamation site rather than multiple smaller sites when determining potential beneficial reuse options. This will extend the timeframe for the full site being available for long term end uses.

3.9.5 Availability of land

The availability of land is a key consideration in determining the location for the primary dredged material placement site(s) for the beneficial reuse of dredged material, including the ability to secure long term tenure over the area from the EIS process to final land use timeframe (in the order of +10 years for the Project).

3.9.6 Preferred beneficial reuse option

Based on the phase one information reviewed, the most appropriate and feasible (technical and economical) beneficial reuse options for dredged material from the Port to take forward into phase three are land creation/reclamation and terrestrial land-based placement and improvement.

Secondary beneficial reuse options for dredged material after dewatering and settlement within a primary placement area, may include:

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

A land creation/reclamation area close to the coastline or terrestrial land-based placement area will be required to enable primary placement of large volumes of material and dewatering prior to the potential use of small volumes of material for other secondary purposes.

Following input from State government agencies in response to the Project EIS, the option of *terrestrial land-based placement and improvement* has been included in the options to take forward into phase three. This option is carried forward to test the assumption that once dredged material is mechanically unloaded from a barge into a truck, it may be possible to transport the material a distance from the coast with the material placed, dewatered and consolidated on a terrestrial site, outside the coastal zone and above the intertidal area.

4 Phase two – future dredged material placement needs

4.1 Phase two overview

Phase two identifies the future dredged material placement needs taking into account the volumes of dredged material approved under existing Port of Gladstone capital dredging project approvals, the material placed to date, the remaining capacity of existing dredged material placement areas and the need for future dredged material placement areas for approved capital dredging projects and the needs of the Gatcombe and Golding Cutting Channel Duplication Project.

As a major approved dredging project in the Port, this section describes the WBDDP dredging and dredged material beneficial reuse and placement activities undertaken to date, together with the WBDDP future dredging requirements and remaining dredged material capacity within the existing Western Basin reclamation area.

4.2 Western Basin Dredging and Disposal Project

This section describes the dredging and dredged material beneficial reuse and placement activities undertaken to date for the WBDDP, together with the WBDDP future dredging requirements and remaining dredged material capacity within the Western Basin reclamation area.

4.2.1 EPBC Act approvals

On 22 October 2010, the WBDDP EPBC Act controlled action was approved by the Commonwealth Environment Minister subject to conditions (refer Appendix A).

The WBDDP as approved by the Commonwealth Environment Minister is subject to the following dredging volume and dredged material placement conditions:

- Approval of Stages 1A and 1B dredging works with a total volume of no more than 25Mm^3 (in situ) (EPBC Act controlled action condition 1)
- Approval of Stages 2, 3 and 4 dredging works with a total volume of no more than 21Mm^3 (in situ) (EPBC Act controlled action condition 3)
- Approval of no more than 11Mm^3 offshore dredged material placement at the East Banks Dredged Material Placement Area (DMPA) (EPBC Act controlled action condition 2)
- The Western Basin land reclamation area must be not greater than 300ha in total and constructed generally in accordance with the design as shown in Annexure 2 of the EPBC Act controlled action approval and will not exceed 27 metres (m) height above the lowest astronomical tide (LAT) (EPBC Act controlled action condition 7) (refer Figure 4.1). This approved land reclamation area is to accommodate the dredged material volume (i.e. 25Mm^3 (in situ)) from Stages 1A and 1B (controlled action condition 1).

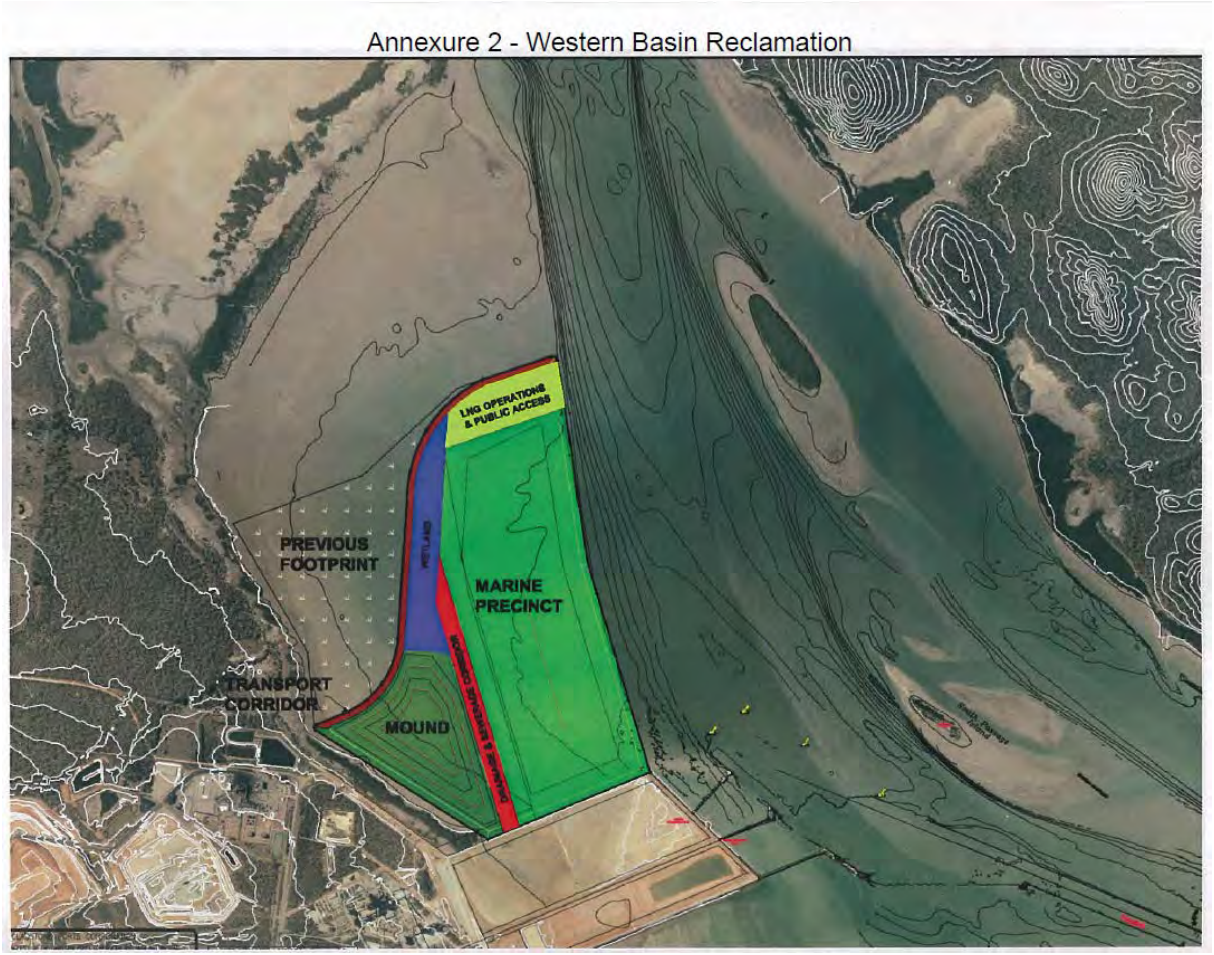

Figure 4.1 Western Basin reclamation area EPBC Act controlled action approval Annexure 2

- Approval of dredging works associated with Stages 2, 3 and 4 must be phased in accordance with a LTSDP approved by the Commonwealth Environment Minister (EPBC Act controlled action condition 4). The LTSDP must:

  (a) be developed in consultation with the Department (and Great Barrier Reef Marine Park (GBRMP) should offshore disposal in the GBRMP be proposed);
  (b) be submitted to the Department (and Great Barrier Reef Marine Park Authority (GBRMPA) should offshore disposal in the GBRMP be proposed) no less than two years prior to the expected date of commencement of Stage 2, 3 or 4 of dredging;
  (c) be approved in writing by the Minister prior to the commencement of dredging of Stages 2, 3 and 4;
  (d) include a comprehensive assessment of all dredge material disposal alternatives; and
  (e) include an indicative timetable of future dredging required for Stages 2, 3 and 4.

Figure 4.2 provides the location of the WBDDP stages as outlined in the EPBC Act controlled action approval.

Stage 1A of the WBDDP was completed in 2013. There has been no additional WBDDP dredging and dredged material placement as part of Stages 1B, 2, 3 or 4 undertaken since this time.

In preparation for future dredging for the remaining WBDDP stages and having regard to the two year lead time required by condition 4(b) for submission of the LTSDP, GPC has prepared a LTSDP to satisfy condition 4(a) of the EPBC Act controlled action approval and submitted to the DoEE in accordance with condition 4(b) of the EPBC Act controlled action approval.

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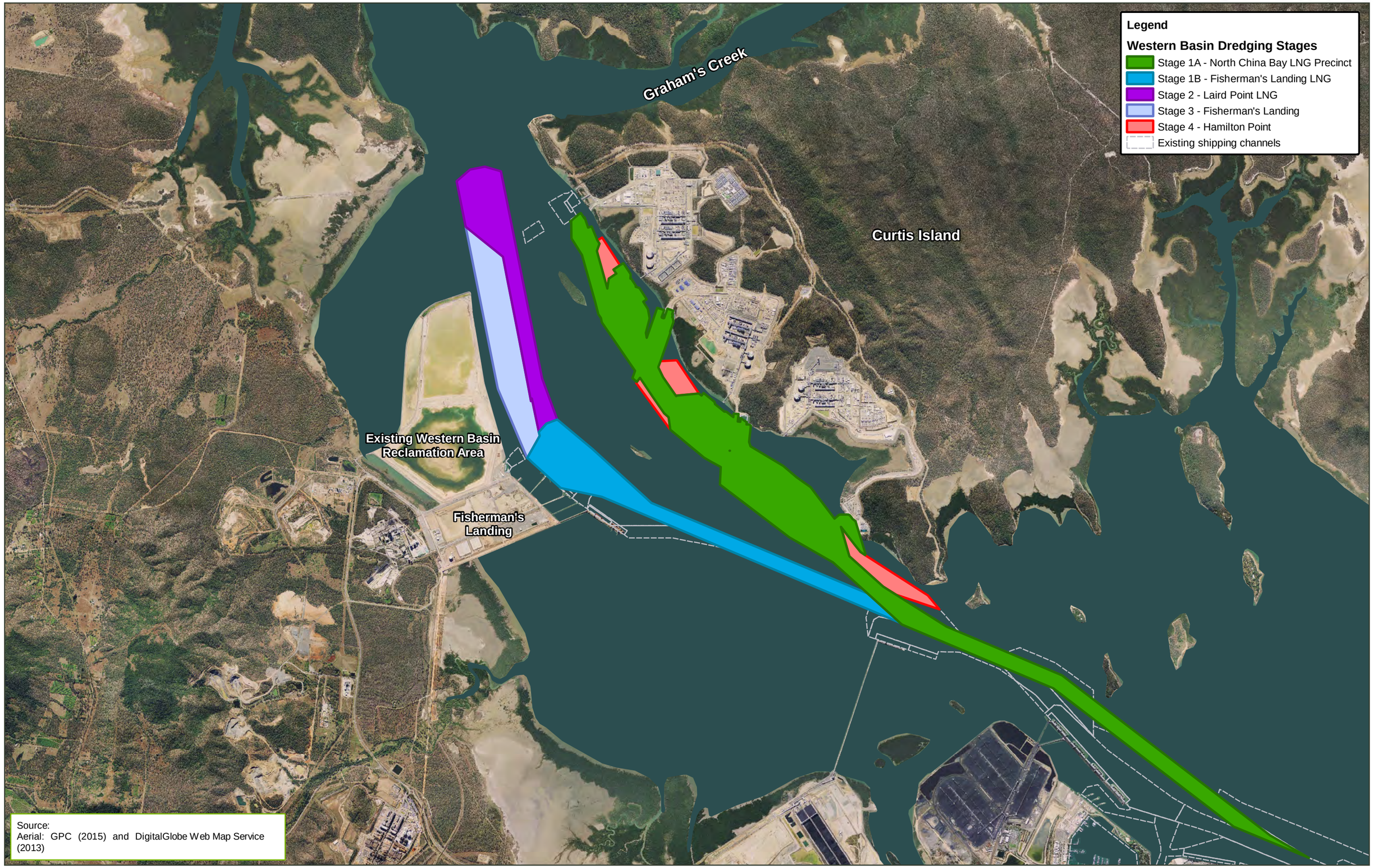

Source:
Aerial: GPC (2015) and DigitalGlobe Web Map Service (2013)

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Gatcombe and Golding Cutting Channel Duplication Project

Figure 4.2: Location of the Western Basin Dredging and Disposal Project Dredging Stages (EPBC Act controlled action approval)

4.2.2 SDPWO Act EIS approval

The Coordinator-General declared the WBDDP to be a 'significant project for which an EIS is required' under the SDPWO Act. The WBDDP EIS followed the assessment and consultation process under the Act, including the preparation of an EIS Supplementary Information Document (SID) and was approved by the Coordinator-General on 23 July 2010.

The Coordinator-General's WBDDP Evaluation Report dated July 2010, recommended that the WBDDP, as described in detail in the EIS and SID, and summarised in Section 2 of the Evaluation Report, can proceed subject to the conditions and recommendations contained Appendix 1 of the Evaluation Report.

Section 2 of the Evaluation Report contained the Western Basin reclamation area footprint shown in Figure 4.3.

Figure 4.3 **Western Basin reclamation area footprint approved by the Coordinator-General in July 2010**

4.2.3 Western Basin dredging works completed to date

Dredging for the WBDDP Stage 1A commenced on 20 May 2011 and concluded on 18 September 2013, involving the dredging of approximately 22.56Mm^3 of material (in situ) with placement within the:

- Western Basin reclamation area constructed as part of the WBDDP (approximately 17.45Mm^3 (in situ))
- East Banks DMPA (approximately 5.11Mm^3 (in situ)).

Dredging equipment utilised for the WBDDP Stage 1A involved a combination of TSHD, CSDs and backhoe dredgers operating with barges.

4.2.4 Western Basin future dredging works

The EPBC Act controlled action approval authorises the dredging of 46Mm^3, including 25Mm^3 for Stages 1A and 1B (condition 1) and 21Mm^3 for Stages 2, 3 and 4 (condition 3). The location of the WBDDP dredging stages are shown on Figure 4.2. The WBDDP dredging stages and volumes as stated in the WBDDP EIS SID and EPBC Act controlled action approval are summarised in Table 4.1.

Table 4.1 illustrates that there is an administrative error in the EPBC Act controlled action conditions 1 and 3, as the volumes do not align with the dredging stages and volumes proposed within the WBDDP EIS SID. Given these inconsistencies, GPC intends to seek an amendment to the WBDDP EPBC Act controlled action conditions 1 and 3 to reflect the Stage 1A dredged material volume removed to date and the Stage 1B dredging volume included in the WBDDP EIS SID.

Table 4.1 Dredging stages and volumes for the Western Basin Dredging and Disposal Project

Dredging stage	Description	WBDDP EIS SID volumes by stage (Mm^3) (in situ)	EPBC Act controlled action approval volumes (Mm^3) (in situ)	Material dredged to date by stage (Mm^3) (in situ)	Remaining approved capacity by stage (Mm^3) (in situ)
Stage 1A	LNG industry precinct	24.2		22.56	
Stage 1B	Targinie Channel	5.6			
Stages 1A and 1B sub total		29.8	25[2]		7.24[1]
Stage 2	Laird Point	4.5			
Stage 3	Fisherman's Landing development	5.5			
Stage 4	LNG final stages and Hamilton Point	5.5			
Stages 2, 3 and 4 sub total		15.5	21[2]		16.20[1,3]
Total		**45.3**	**46**	**22.56**	**23.44**

Table note:

1 TBC = Dredged material volumes per stage are to be confirmed via bathymetric survey prior to dredging
2 Administrative error in approved volumes breakdown by stage in EPBC Act approval
3 Stage 2,3 and 4 remaining approved capacity adjusted for total EPBC Approval volume of 46Mm^3

The full dredging campaign volumes for Stages 2 and 3 will not be undertaken in the staged spatial extent shown in Annexure 1 of the EPBC Act controlled action approval (refer Figure 4.2). Given the proposed progressive south to north development of the wharves on the existing Western Basin reclamation area and possible future Western Basin Extension reclamation area, an alternative south to north staging of dredging is likely to occur in the future.

Table 4.2 shows the indicative timeframes for proposed future dredging campaigns proposed under the LTSDP. The location of the WBDDP dredging stages as proposed under the LTSDP are shown on Figure 4.4.

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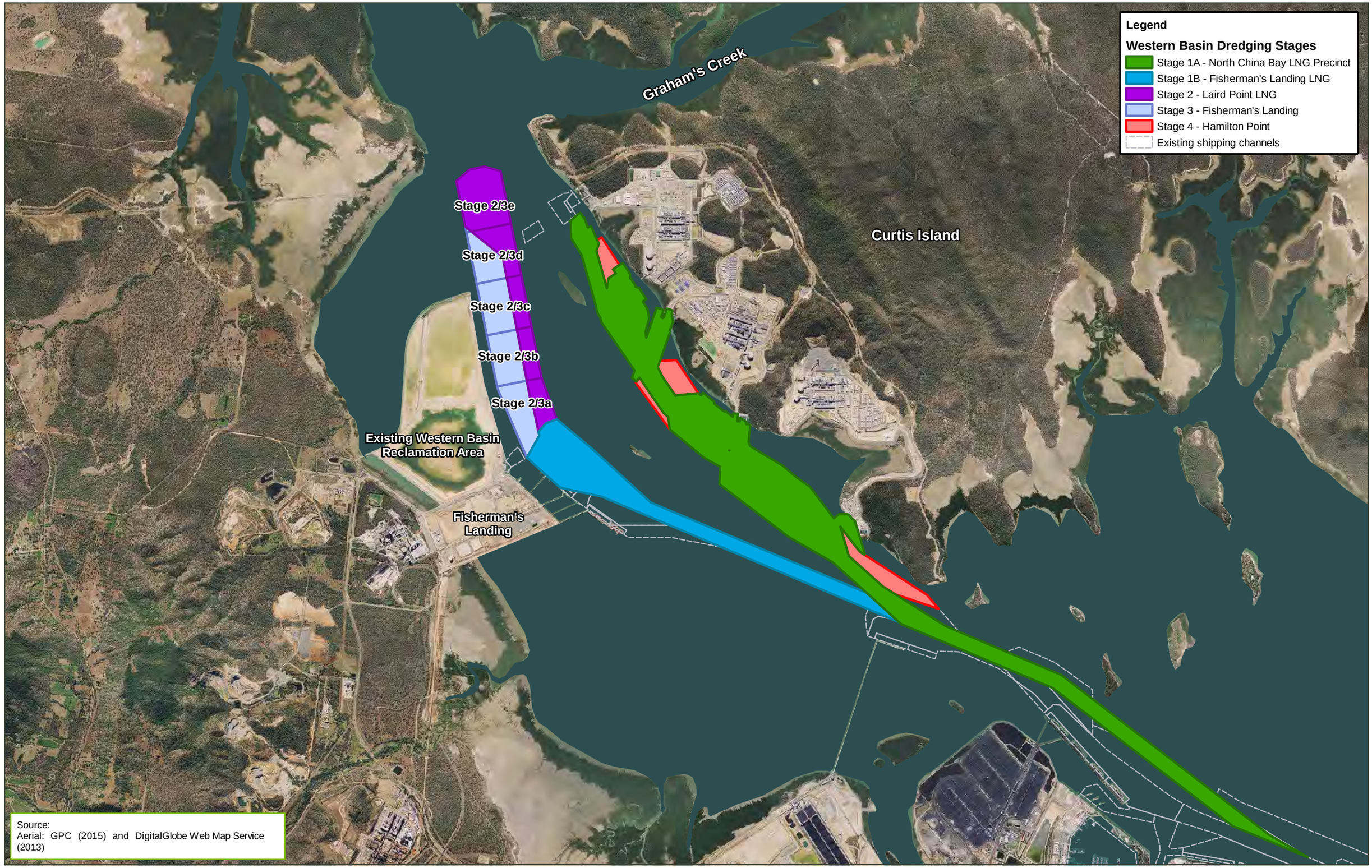

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Port of Gladstone Long Term Sediment Disposal Plan

Figure 4.4: Location of the Western Basin Dredging and Disposal Project dredging stages (proposed under the LTSDP)

Table 4.2 Timing of proposed future dredging campaigns

Dredging stage	In situ volume (Mm^3)[1]	Timing
Stage 1B	Dredged material volumes per stage are to be confirmed via bathymetric survey prior to dredging	2020 or later
Stage 2/3a		2024*
Stage 2/3b		2027*
Stage 2/3c		2030 *
Stage 2/3d		2034*
Stage 2/3e		2037*
Stage 4		2030*
Total	**23.44**	

Table notes:

1 The in situ volume of dredged material is based on a channel, swing basin and berth pocket depth of -13m LAT
* Could be undertaken earlier or later depending on future proponents' requirements

It is important to note that the timing for the future WBDDP dredging stages is driven by the timing of existing industries being expanded and/or establishment of future industries within the Gladstone region, in particular within the Fisherman's Landing, Western Basin and Curtis Island areas.

4.3 Material beneficial reuse and placement

4.3.1 Dredged material beneficial reuse and placement completed to date

The Western Basin reclamation area was constructed with an 8.8km long outer bund wall with a height of approximately 7m to 8m LAT and consists of approximately $2Mm^3$ of rock material sourced from GPC's Ticor Quarry. The reclamation area is approximately 287ha, including the inner bund walls and tailwater management areas.

Dredged material was hydraulically placed within the reclamation area using a CSD with a maximum of 7km of pipeline from the CSD cutter head via a combination of floating, sinker and shore pipelines 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, and an increased pumping distance, 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 the WBDDP 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 Photograph 4.1. When these blockages occurred, the location of the blockage needed to be identified, cut in situ on the seabed and raised by support craft fitted with cranes and replaced with a new pipeline section.

Photograph 4.1 Sinker pipeline blockage during the Western Basin Dredging and Disposal Project dredging works

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

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

Figure 4.5 illustrates a general arrangement of dredging and reclamation operations for one of the dredging locations in Stage 1A of the WBDDP.

Figure 4.5 **Western Basin Dredging and Disposal Project dredging and intertidal reclamation arrangement**

4.3.2 Stormwater management within the reclamation area

Stormwater management processes within the Western Basin reclamation area involve stormwater runoff being directed and stored within the northern pond, southern pond and polishing pond. There is currently sufficient capacity within these ponded areas to capture and store the annual rainfall runoff, including extreme rainfall events associated with ex-tropical cyclones, within the reclamation area.

As the northern and southern ponds are progressively filled with dredged material from future dredging projects, mounding of material will occur to ensure rainfall events can be managed within the reclamation area.

4.3.3 Remaining dredged material capacity within the Western Basin reclamation area

As stated in Section 4.2.3, the WBDDP Stage 1A dredging has resulted in approximately 17.45Mm^3 of (in situ) dredged material being placed within the Western Basin reclamation area.

GPC surveys and estimates have found that due to the bulking factor of dredged material and water within the Western Basin reclamation area, the volume of material currently within the reclamation area equates to approximately 23.7Mm^3 of material which represents a bulking factor of approximately 1.36. It has been found that the Port of Gladstone average bulking factor for capital dredged material is 1.25.

Table 4.3 shows the existing dredged material volumes, estimated remaining capacity and key assumptions to achieve the maximum dredged material capacity within the Western Basin reclamation area (as approved under the EPBC Act controlled action). Figure 4.6 illustrates the current material levels within the Western Basin reclamation area.

Table 4.3 Estimated remaining dredged material capacity within the Western Basin reclamation area

Western Basin reclamation area location	Dredged material placed within the Western Basin reclamation area (Mm^3)	Estimated remaining capacity[1] (Mm^3) (with bulking factor applied)
Northern pond	6	1 from Clinton Vessel Interaction Project[3] 3 for WBDDP (Stage 1B) and/or future projects 3 for capping material to be imported from a local quarry to allow Port land to be developed
Southern pond, including the mound[2]	16.5	
Polishing pond	1.2	To be utilised as final polishing pond for WBDDP future stages and future dredging campaigns[4]
Total	**23.7 (17.5 in situ)**	**7 (5.6 in situ)**

Table notes:

1 Estimated capacity assumes material is filled to an average of 4.75m Australian Height Datum (AHD), port land area in the eastern portion of the southern pond is filled to an average of 4.75m AHD and the mound in the western portion of the southern pond is filled to a maximum height of 24.6 m AHD (or 27m LAT)
2 Long term total capacity for the southern pond area, including the mound approved under the WBDDP EPBC Act controlled action, is approximately 22Mm^3
3 The Clinton Vessel Interaction Project is not a WBDDP stage, refer Section 4.4.1.2 for details of this capital dredging project.
4 The existing Western Basin polishing pond forms part of the Western Basin Expansion reclamation area dewatering management process (as proposed in the GGCC Duplication Project EIS).

It is important to note that the ability of the Western Basin reclamation area to achieve the estimated dredged material volume design capacities is highly dependent upon:

- The final bulking factor of the material to be dredged (given that the undertaking of dredged material dewatering and consolidation occupies a greater reclamation area size and capacity than what the same volume of dredged material occupies once dewatering and consolidation has occurred over a number of years)
- Timeframe of the dredging works, including timing between dredging campaigns which ultimately influences the length of time available for the dredged material within the Western Basin reclamation area to undergo dewatering and consolidation before new dredged material is introduced
- Carrying out of bulk earthworks to move and shape the dredged material (once dewatering and consolidation has occurred) so as to facilitate:
  - The creation of the final landform with the dredged material that has been dewatered and consolidated
  - The creation of, where required, additional working capacity (area and volume) to enable the Western Basin reclamation area to receive more dredged material and to efficiently dewater and consolidate the additional material.

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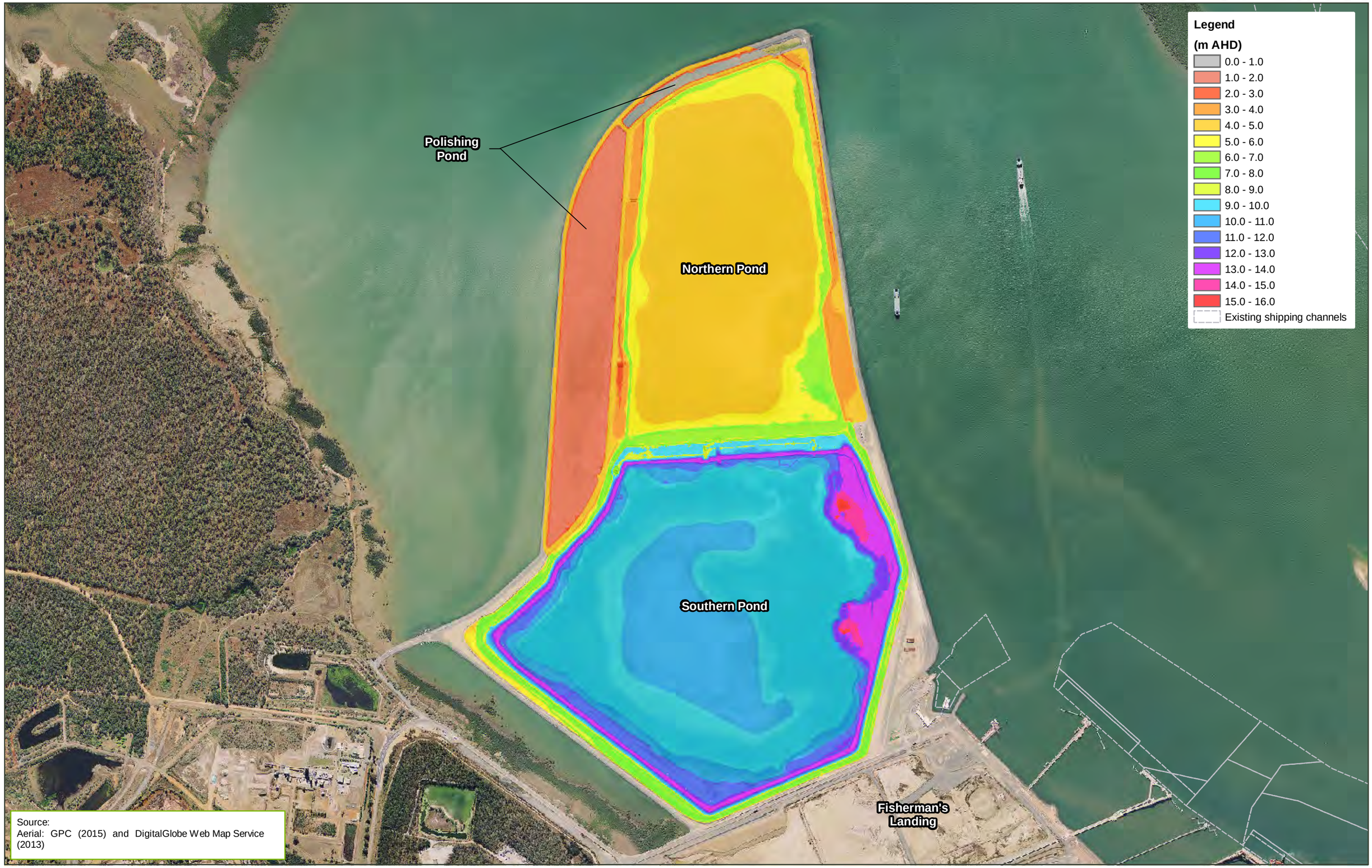

Source:
Aerial: GPC (2015) and DigitalGlobe Web Map Service (2013)

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Port of Gladstone Long Term Sediment Disposal Plan

Figure 4.6: Current material levels within the Western Basin reclamation area

4.4 Other approved dredging projects within the Port of Gladstone

4.4.1 Overview

Section 2 of the DMPOI (Appendix B2 of the Project EIS) covered in detail the history of past dredging in the Port of Gladstone, together with details of future planned capital and maintenance dredging works that were known in 2013-2015.

In the time since these original future planned capital and maintenance dredging works were identified in the DMPOI (Appendix B2 of the Project EIS), other future dredging projects have been approved. The Clinton Vessel Interaction Project (CVIP) has been approved by the Commonwealth and Queensland Governments which includes capital dredging of 0.8Mm^3 (in situ).

Other future dredging projects relevant to this Revised DMPOI include:

- WICT Project (future dredging stages) (3.4Mm^3)
- Annual port maintenance dredging (approximately 260,000m^3 annually).

4.4.1.1 Wiggins Island Coal Terminal Project

Future WICT Project stages will involve the dredging of approximately 3.4Mm^3 of material to establish the remaining berth pockets and swing basin. These stages will be developed in response to market demand and there is currently no timeframe proposed. The remaining dredged material is proposed to be placed in the WICT Project reclamation area B (north of Gladstone-Mt Larcom Road) and WICT Project reclamation area C (south of Gladstone-Mt Larcom Road) (refer Figure 4.7) which only has capacity to receive the future WICT Project dredging requirements.

Future WICT Project dredging and dredged material placement have received EPBC Act and SDPWO Act EIS approvals.

Accordingly, no allowance needs to be made for the approved future WICT Project stages dredged material placement requirements in the Revised DMPOI.

Figure 4.7 Wiggins Island Coal Terminal Project reclamation areas B and C

4.4.1.2 Clinton Vessel Interaction Project

GPC is currently proposing to undertake the CVIP which involves capital dredging of approximately 0.8Mm^3 of material to facilitate the widening of the existing Clinton Channel by around 100m. Due to the current configuration of the Clinton Channel, Capesize vessels are required to pass within 80m of vessels berthed at the RGTCT. When this occurs, displaced water from the passing vessel has the potential to result in significant forces on the berthed vessels, resulting in the risk that these vessels may break mooring lines and move off the RGTCT wharf.

Material to be dredged as part of CVIP is now required to be placed within the existing Western Basin reclamation area. An EPBC Act referral was lodged in July 2017 and the CVIP was determined by the Commonwealth Environment Minister to be a 'controlled action' for which assessment by preliminary documentation was required. Preliminary documentation was published for public comment in December 2018. Finalise preliminary documentation was submitted in January 2019 with public display of the finalise preliminary documentation in February 2019. The EPBC Act approval was issued in July 2019. With the required State approvals now secured, dredging for CVIP is planned to commence in 2020.

As an approved project, allowance needs to be made for CVIP in the Revised DMPOI (i.e reduces capacity of the Western Basin reclamation area to receive dredged material from the WBDDP future stages and the Channel Duplication Project).

4.4.1.3 Additional future Port capital dredging projects

GPC does not hold any existing approvals or permits associated with other future capital dredging. In addition, no background studies or assessments have been commenced at this time. Other possible future Port capital dredging requirements are addressed in the LTSDP.

4.4.1.4 Annual port maintenance dredging

As part of maintaining the Port and its associated maritime access and safety, GPC has an ongoing requirement to undertake maintenance dredging within the Port of Gladstone to provide safe passage and navigable channels for vessels under the *Transport Infrastructure Act 1995* (Qld). In 2016, the Queensland Government developed the 'Maintenance Dredging Strategy for Great Barrier Reef World Heritage Area Ports' (TMR 2016) to provide a framework for the sustainable, leading practice management of maintenance dredging at ports in the GBRWHA. Included within the framework is the requirement for all GBRWHA ports to develop, publish and implement Long-term Maintenance Dredging Management Plans that:

- Contribute to maintaining and enhancing the OUV of the GBRWHA
- Are based on the best available science
- Utilise the principles of ecologically sustainable development
- Ensure continued efficient operation of the port
- Are developed in consultation with key stakeholders.

GPC's 'Long-term Maintenance Dredging Management Plan for the Port of Gladstone' was finalised in December 2018.

Normally, GPC has an annual maintenance dredging campaign for its main Port channels and associated infrastructure. Any additional campaigns are carried out only if required. GPC's future maintenance dredging campaigns in the main channels will be on average approximately 0.26Mm^3 per annum (equalling an estimated 2.6Mm^3 over the next 10 years).

As the East Banks DMPA is currently used by GPC for placement of dredged material associated with the annual maintenance dredging of the channels, berth pockets and swing basins, no allowance needs to be made for maintenance dredging in the Revised DMPOI.

Future long term Port maintenance dredging requirements are addressed in the LTSDP.

4.5 Summary of future dredged material placement needs

Table 4.4 presents a summary of the other future Port dredging projects and their current identified capacity requirements relevant to this Revised DMPOI. Capacity requirements for the WICT Project have not been included owing to the WICT Project reclamation areas B and C already being identified as the preferred beneficial reuse location.

Table 4.4 Estimated dredged material volumes for other future Port dredging projects

Other future Port dredging projects	Timeframe	Volume to be dredged (Mm^3)	
		In situ volume	Bulking factor (Port average 1.25)
Capital dredging			
WBDDP Stage 1B	2020 or later	7.24	9.05
WBDDP Stages 2, 3 and 4	2024 to 2030 or later	16.20	20.25
CVIP	2020	0.80	1.00
Channel Duplication Project	2023 (or later, subject to actual and predicted Port throughput and associated vessel movements over the next 5 to 10 years)	12.60	15.75
Total		**36.84**	**46.05**

5 Phase three – definition and preliminary investigation of the potential dredged material placement areas

5.1 Phase three methodology

Drawing upon the findings of phase one, phase three identifies the potential dredged material placement areas, and then undertakes preliminary investigations of each potential dredged material placement area to identify a short list of feasible sites to take forward into the phase four MCA process. During phase three the following tasks were undertaken:

- Definition of the spatial extent of the study area based on the findings of phase one, including the preferred dredging methodology
- Development of a suite of site selection criteria based on the findings of phase one to inform identification of potential dredged material placement areas within the study area
- Identification of potential locations for dredged material placement within the defined study area
- Completion of targeted preliminary desktop investigations for each of the identified potential sites to assess potential site availability and feasibility, and to support identification of a short list of feasible sites to take forward into phase three. The preliminary investigations included an assessment of:
  - Dredged material placement capacity of the site
  - Implications of the timing of initial dredging and the time gap between dredging campaigns
  - Future use of the site
  - Potential environmental and other site constraints
  - Any known commercial restrictions of the site.

5.2 Preferred dredging methodology and spatial extent of the study area

As identified in phase one (refer Section 3.9.2), the preferred dredging methodology for the Project involves utilising a TSHD which loads the dredged material from the Gatcombe and Golding Cutting bypass shipping channels into barges (four barges will be working in cycles for the entire dredging operation) which will transport the material to a BUF to be unloaded using large excavators into trucks for placement within a beneficial reuse area.

Where a BUF is able to be constructed within or adjacent to a primary beneficial reuse area, the containment of saturated dredged material will be managed within the reuse area. Where the BUF is located remote from the primary beneficial reuse area, management of unloading and transporting the saturated material will need to be carried out in a contained manner, to avoid discharges of water or fines onto public roads or into the terrestrial environment. This may require the use of dedicated off-road haulage routes, depending on the distance that the material has to be transported.

Based on this preferred Project dredging methodology, phase three has adopted a study area that includes the full extent of the Port of Gladstone port limits, Gladstone State Development Area (GSDA) and the Gladstone Regional Council area.

5.3 Site selection criteria

Based on the findings from phase one, site selection criteria were developed to guide the identification of potential dredged material placement areas. The criteria included that the site exhibits one or more of the following opportunities:

- The site was identified as a result of consultation undertaken in June and July 2019 with Economic Development Queensland (EDQ) (land manager of GSDA land), GPC, GRC and existing large-scale industries within the Gladstone region
- It 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
- It is located within or directly joining an area that is:
  - Zoned or designated as industrial land under GRC's planning scheme, or
  - Within an industrial precinct of the GSDA, or
  - GPC Strategic Port Land, or
  - Identified as a future potential dredged material placement area in the priority Port of Gladstone master planning evidence base and/or port overlay
- The site includes all or part of an area that is subject to existing regulatory approval to carry out the beneficial reuse of dredged material and placement works
- The site is located within shallow harbour areas within Port limits with potential for reclamation for use as future Port land
- The site is situated within an existing industrial area and/or is subject to an existing industrial operation with a limited lifespan.

5.4 Identification of potential dredged material placement sites

Through a review of the study area and in applying the site selection criteria, 14 potential dredged material placement sites were identified. These were:

- Targinnie Valley Investigation Area
- Landing Road Investigation Area
- Queensland Alumina Limited (QAL) Red Mud Dams
- Tannum Sands North
- Tannum Sands South
- Ash Ponds
- West Banks Island Reclamation
- Port Central Expansion
- Western Basin Expansion
- Boat Creek (South)
- Gladstone Mt Larcom Rd South
- Fisherman's Landing Expansion (South)
- Kangaroo Island
- Callemondah West.

Each of the 14 potential dredged material placement sites is illustrated in Figure 5.1, with site descriptions and opportunities and constraints provided in Table 5.1.

Note that discussions were held with EDQ regarding the availability of sites within the Waste Management Precinct of the Gladstone State Development Area (GSDA). Due to commitments made to existing industries within the GSDA, there are no sites available for dredged material placement within the Waste Management Precinct.

Table 5.1 Potential dredged material placement sites

Dredged material placement area locality	Site description, key issues and constraints	
1. Targinnie Valley Investigation Area		
	**Placement type**	■ Land improvement (combined with a primary land creation/reclamation site) ■ Terrestrial land-based placement and land improvement
	Estimated capacity	5 to 7Mm^3
	Change in area boundary – increase in capacity consideration	There is potential to change the placement area boundaries to the south and west to increase the dredged material capacity of the area by approximately 2 to 3Mm^3
	Change in area boundary – reduced environmental impacts	There is potential to change the placement area boundaries to reduce environmental impacts, however this would reduce the dredged material capacity of the area
	Beneficial reuse/end land use	■ Land improvement/future industrial end land use
	Dredging equipment	■ TSHD for the area to be dredged, barge to BUF, material trucked to site
	Placement method	■ Material would be trucked to the site, placed and shaped for final land use ■ For the terrestrial land-based placement option, material would be securely trucked to the site, placed, dewatered, consolidated and shaped for final land use
	Establishment of placement area	■ Vegetation clearing ■ Bund wall construction – require import of bund wall material from a local quarry ■ Establishment of BUF ■ Establishment of dewatering ponds, water management system and return water discharge system
	Management of placement area	■ Dewatering of dredged material and decant water (for terrestrial land-based placement) ■ Settlement of material over 3 to 5 years, per dredging campaign (for terrestrial land-based placement) ■ Shaping of consolidated material for final land use

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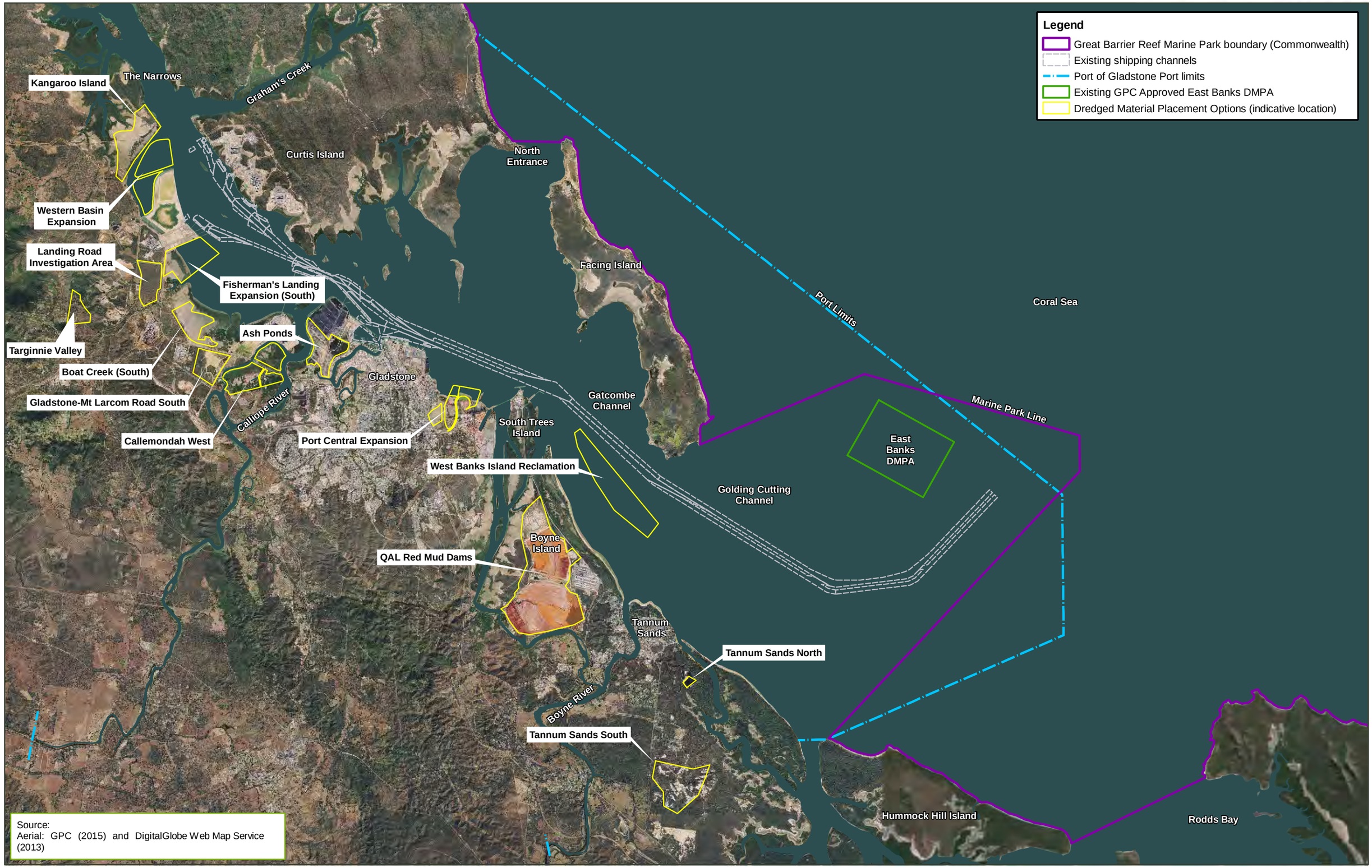

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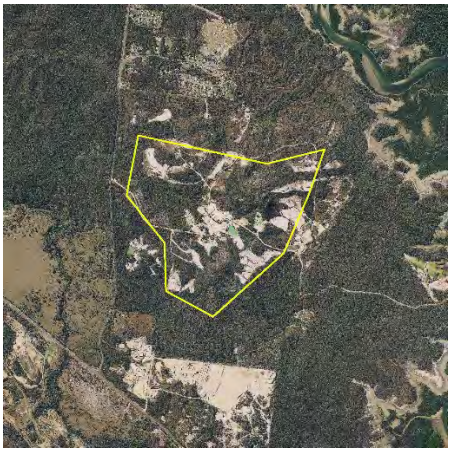
Gatcombe and Golding Cutting Channel Duplication Project

Figure 5.1: Indicative dredged material placement options for revised DMPOI

Dredged material placement area locality	Site description, key issues and constraints	
	Key issues	■ Loss of native vegetation and fauna ■ Potential impact to drainage patterns in the area ■ Saline dewatering process may impact on groundwater resource ■ Conflicts with future industrial use and Queensland Energy Resources Pty Ltd (QER) shale oil mining tenement within the area ■ Land sterilised for future use until dredging, dewatering and consolidation is completed ■ Capacity of site less than Project dredged material volume
2. Landing Road Investigation Area		
	**Placement type**	■ Land improvement (combined with a primary land creation/reclamation site) ■ Terrestrial land-based placement and land improvement
	Estimated capacity	5 to 7Mm^3
	Change in area boundary – increase in capacity consideration	There is limited opportunity to change the placement area boundaries due to existing infrastructure adjoining this area
	Change in area boundary – reduced environmental impacts	There is potential to change the placement area boundaries to reduce environmental impacts (e.g. setback from Boat Creek), however this would reduce the dredged material capacity of the area
	Dredging equipment	■ TSHD for the area to be dredged, barge to BUF, material trucked to site
	Placement method	■ Material would be trucked to the site, placed and shaped for final land use ■ For the terrestrial land-based placement option, material would be securely trucked to the site, placed, dewatered, consolidated and shaped for final land use
	Establishment of placement area	■ Vegetation clearing ■ Bund wall construction -– require import of bund wall material from a local quarry ■ Establishment of a barge unloading facility ■ Establishment of dewatering ponds, water management system and return water discharge system
	Management of placement area	■ Dewatering of dredged material and decant water (for terrestrial land-based placement) ■ Settlement of material over 3 to 5 years, per dredging campaign (for terrestrial land-based placement) ■ Shaping of consolidated material for final land use

Dredged material placement area locality	Site description, key issues and constraints	
	Key issues	■ Loss of native vegetation and fauna ■ Potential impact to drainage patterns in the area ■ Saline dewatering process may impact on groundwater resource ■ May conflict with QER shale oil mining tenements within the area ■ Land sterilised for future use until dredging, dewatering and consolidation is completed ■ Capacity of site less than Project dredged material volume
3. QAL Red Mud Dams		
	**Placement type**	■ Land based capping (combined with a primary land creation/reclamation site) ■ Terrestrial land-based placement and land improvement
	Estimated capacity	23 to 25Mm^3
	Change in area boundary – increase in capacity consideration	There is limited opportunity to change the placement area boundaries due to the existing red mud dam extent
	Change in area boundary – reduced environmental impacts	Not applicable due to the industrial nature of the placement area
	Dredging equipment	■ TSHD for the area to be dredged, barge to BUF, material trucked to site ■ BUF to be located near site ■ Potential for some material to be pumped directly to site by CSD
	Placement method	■ Consolidated material would be trucked to the site, placed and shaped for future use ■ For the terrestrial land-based placement option, saturated material would be securely trucked to the site, placed, dewatered, consolidated and shaped for final land use ■ Potential for some direct placement by CSD
	Establishment of placement area	■ Bund wall construction or existing bund wall raising ■ Material to be sourced from a mainland quarry ■ Establishment of BUF near site
	Management of placement area	■ Dewatering of dredged material and decant water (for terrestrial land-based placement) ■ Material settlement over 3 to 5 years per dredging campaign (for terrestrial land-based placement) ■ Shaping of consolidated material for final land use

Dredged material placement area locality	Site description, key issues and constraints	
	Key issues	■ Availability of site within the Project dredging works timeframe ■ Loss of future storage capacity for red mud disposal and management ■ Ability to accommodate Project dredged material volume ■ Construction of a BUF near the site would result in loss of coastal vegetation and marine planets, and additional marine infrastructure (e.g. jetty) and dredging for barge access to the BUF ■ Land sterilised for future use until dredging, dewatering and consolidation is completed
4. Tannum Sands North		
	**Placement type**	■ Land improvement (combined with a primary land creation/reclamation site) ■ Terrestrial land-based placement and land improvement
	Estimated capacity	2 to 4Mm^3
	Change in area boundary – increase in capacity consideration	There is potential to change the placement area boundaries to increase the dredged material capacity of the area by approximately 1 to 2Mm^3
	Change in area boundary – reduced environmental impacts	There is potential to change the placement area boundaries to reduce environmental impacts, however this would reduce the dredged material capacity of the area
	Dredging equipment	■ TSHD for the area to be dredged, barge to BUF, material trucked to site ■ BUF to be located near site
	Placement method	■ Consolidated material would be trucked to the site, placed and shaped for future use ■ For the terrestrial land-based placement option, saturated material would be securely trucked to the site, placed, dewatered, consolidated and shaped for final land use
	Establishment of placement area	■ Bund wall construction ■ Material to be sourced from a mainland quarry ■ Establishment of a BUF near site ■ Establishment of dewatering ponds, water management system and return water discharge system
	Management of placement area	■ Dewatering of dredged material and decant water (for terrestrial land-based placement) ■ Material settlement 3 to 5 years per dredging campaign (for terrestrial land-based placement) ■ Shaping of consolidated material for final land use

Dredged material placement area locality	Site description, key issues and constraints	
	Key issues	■ Availability of site ■ Potential impact to drainage patterns in the area ■ Saline dewatering process may impact on groundwater resource ■ Capacity of site less than Project dredged material volume ■ Distance from primary dewatering sites and potential BUF sites ■ Construction of a BUF near the site would result in loss of coastal vegetation and marine planets, and additional marine infrastructure (e.g. jetty) and dredging for barge access to the BUF ■ Conflicts with silica sand extraction operation ■ Land sterilised for future use until dredging, dewatering and consolidation is completed ■ Capacity of site less than Project dredged material volume
5. Tannum Sands South		
	**Placement type**	■ Land improvement (combined with a primary land creation/reclamation site) ■ Terrestrial land-based placement and land improvement
	Estimated capacity	2 to 4Mm^3
	Change in area boundary – increase in capacity consideration	There is limited opportunity to change the placement area boundary due to the Boral land tenure issues
	Change in area boundary – reduced environmental impacts	There is potential to amend the placement area boundaries to reduce environmental impacts, however this would reduce the dredged material capacity of the area
	Dredging equipment	■ TSHD for the area to be dredged, barge to BUF, material trucked to site ■ BUF to be located near site
	Placement method	■ Consolidated material would be trucked to the site, placed and shaped for future use ■ For the terrestrial land-based placement option, saturated material would be securely trucked to the site, placed, dewatered, consolidated and shaped for final land use
	Establishment of placement area	■ Vegetation clearing ■ Bund wall construction ■ Bund material to be sourced from a mainland quarry ■ Establishment of a BUF near site ■ Establishment of dewatering ponds, water management system and return water discharge system

Dredged material placement area locality	Site description, key issues and constraints	
	Management of placement area	■ Dewatering of dredged material and decant water (for terrestrial land-based placement) ■ Material settlement 3 to 5 years per dredging campaign (for terrestrial land-based placement) ■ Shaping of consolidated material for final land use
	Key issues	■ Availability of site ■ Proximity to residential dwellings ■ Potential impact to drainage patterns in the area ■ Saline dewatering process may impact on groundwater resource ■ Capacity of site less than Project dredged material volume ■ Distance from primary dewatering sites and potential BUF sites ■ Construction of a BUF near the site would result in loss of coastal vegetation and marine planets, and additional marine infrastructure (e.g. jetty) and dredging for barge access to the BUF ■ Conflicts with silica sand extraction operation ■ Land sterilised for future use until dredging, dewatering and consolidation is completed ■ Capacity of site less than Project dredged material volume
6. Ash Ponds (adjacent to RGTCT)		
	**Placement type**	■ Land improvement (combined with a primary land creation/reclamation site)
	Estimated capacity	2 to 4Mm^3
	Change in area boundary – increase in capacity consideration	There is limited opportunity to change the placement area boundaries due to the Calliope River and existing land uses and infrastructure
	Change in area boundary – reduced environmental impacts	Not applicable due to the industrial nature of the placement area 7
	Dredging equipment	■ Consolidated material would be trucked to the site, placed and shaped for final land use
	Placement method	■ TSHD for the area to be dredged, barge to BUF, material trucked to site
	Establishment of placement area	■ Bund wall construction ■ Material to be sourced from a mainland quarry ■ Establishment of dewatering ponds, water management system and return water discharge system

Dredged material placement area locality	Site description, key issues and constraints	
	Management of placement area	■ Dewatering of dredged material and decant water ■ Settlement of material over 3 to 5 years, per dredging campaign ■ Shaping of consolidated material for final land use
	Key issues	■ Part of the area is proposed for future Port land uses ■ Area forms part of the Ash Management Agreement for use by the Gladstone Power Station ■ Conflicts with future ash storage ■ Conflicts with existing rail infrastructure and services (e.g. water and sewage infrastructure to Curtis Island LNG plants) ■ Land sterilised for future use until dredging, dewatering and consolidation is completed ■ Construction of a BUF within the Calliope River would result in potential impacts on flooding and riverine ecology and would require additional dredging for a barge access channel to the BUF ■ Capacity of site less than Project dredged material volume
7. Western Basin Expansion		
	**Placement type**	Land creation/reclamation
	Estimated capacity	40 to 50Mm^3 with mounding
	Change in area boundary – increase in capacity consideration	There is potential to change the placement area boundaries to the north and west to increase the dredged material capacity of the area by approximately 5Mm^3. However the change in boundary would result in additional environmental impacts.
	Change in area boundary – reduced environmental impacts	Placement area boundary has been changed during the Revised DMPOI and Project EIS to avoid direct impacts on mangroves and terrestrial flora and fauna habitat along mainland foreshore
	Dredging equipment	■ TSHD for the area to be dredged, barge to BUF, material trucked to site ■ Direct placement by CSD for barge access channel.
	Placement method	■ Material would be trucked to the site from BUF, placed, dewatered, consolidated and shaped for final land use ■ Direct placement by CSD for barge access channel

Dredged material placement area locality	Site description, key issues and constraints	
	Establishment of placement area	■ Marine vegetation clearing and loss of seagrass ■ Bund wall construction within intertidal and sub-tidal area to varying depths ■ Greater bund wall material volumes required compared to intertidal or land based areas ■ Bund material to be imported to site from local quarry ■ Establishment of BUF ■ Establishment of dewatering ponds, water management system and return water discharge system
	Management of placement area	■ Dewatering of dredged material and decant water ■ Material settlement 3 to 5 years ■ Shaping of consolidated material for final land use ■ Reclamation area for industrial and/or port related land uses
	Key issues	■ Loss of intertidal habitat and seagrass ■ Minimal hydrodynamic and coastal process impacts on The Narrows ■ Limited dredged material trucking impacts ■ Ability to accommodate Project dredged material volume ■ Ability to accommodate the WBDDP future dredging stages dredged material placement needs ■ Ability to utilise existing Western Basin reclamation area for BUF and part of dredged material dewatering ■ Expansion area forms part of the Western Basin reclamation area included in the Coordinator-General's Evaluation Report ■ Preferred site for WBDDP future dredged material placement under the LTSDP
8. Fisherman's Landing Expansion (South)		
	**Placement type**	Land creation/reclamation
	Estimated capacity	12 to 20Mm^3 with mounding
	Change in area boundary – increase in capacity consideration	There is potential to change the placement area boundaries to the south to increase the dredged material capacity of the area by approximately 5 to 10Mm^3. However this would increase seagrass loss and impact on Boat Creek.
	Change in area boundary – reduced environmental impacts	There is potential to change the placement area boundaries to reduce environmental impacts, however this would reduce the dredged material capacity of the area

Dredged material placement area locality	Site description, key issues and constraints	
	Dredging equipment	■ TSHD for the area to be dredged, barge to BUF, material trucked to site ■ Direct placement by CSD for barge access channel.
	Placement method	■ Material would be trucked to the site from BUF, placed, dewatered, consolidated and shaped for final land use ■ Direct placement by CSD for barge access channel
	Establishment of placement area	■ Mangrove clearing and loss of seagrass ■ Bund wall construction within intertidal and sub-tidal area to varying depths ■ Greater bund wall material volumes required compared to land based areas ■ Bund material to be imported to site from local quarry ■ Establishment of a BUF or use nearby facility ■ Establishment of dewatering ponds, water management system and return water discharge system
	Management of placement area	■ Dewatering of dredged material and decant water ■ Material settlement 3 to 5 years per dredging campaign ■ Shaping of consolidated material for final land use
	Key issues	■ Loss of intertidal habitat and seagrass ■ Hydrodynamic and coastal process impacts likely to be minimal ■ Ability to accommodate the Project dredged material when mounding on the western portion of the site ■ Capacity of site cannot accommodate WBDDP future dredged material placement needs
9. Boat Creek (South)		
	**Placement type**	Land creation/reclamation
	Estimated capacity	5 to 6Mm^3
	Change in area boundary – increase in capacity consideration	There is limited opportunity to change the placement area boundary due to EDQ tenure and additional environmental impacts (e.g. loss of mangroves and/or seagrass meadow)
	Change in area boundary – reduced environmental impacts	The placement area boundary has been amended as part of the Revised DMPOI to avoid Boat Creek, and direct impact loss of seagrass meadows and mangroves
	Dredging equipment	■ TSHD for the area to be dredged, barge to BUF, material trucked to site ■ Direct placement by CSD for barge access channel.

Dredged material placement area locality	Site description, key issues and constraints	
	Placement method	■ Material would be trucked to the site from BUF, placed, dewatered, consolidated and shaped for final land use ■ Direct placement by CSD for barge access channel
	Establishment of placement area	■ Vegetation clearing ■ Bund wall construction ■ Bund material to be imported to site from local quarry ■ Establishment of a BUF or use nearby facility ■ Establishment of dewatering ponds, water management system and return water discharge system
	Management of placement area	■ Dewatering of dredged material and decant water ■ Material settlement 3 to 5 years per dredging campaign ■ Shaping of consolidated material for final land use
	Key issues	■ Loss of intertidal habitat ■ Site is within the GSDA and has had expressions of interest from various proponents for development. ■ EDQ has identified the site as a strategic opportunity for industry and supports the option of the site as primary/secondary beneficial reuse site, subject to the Project dredged material placement/dewatering/consolidation timing aligning with the development timing of the site ■ Land sterilised for future use until dredging, dewatering and consolidation is completed ■ Capacity of site less than Project dredged material volume (would need to be combined with other site(s)) ■ Capacity of site cannot accommodate WBDDP future dredged material placement needs

Dredged material placement area locality	Site description, key issues and constraints	
10. Gladstone-Mt Larcom Road (South)		
	**Placement type**	■ Land improvement (combined with a primary land creation/reclamation site) ■ Terrestrial land-based placement and land improvement
	Estimated capacity	1 to 2 Mm^3
	Change in area boundary – increase in capacity consideration	There is limited opportunity to change the placement area boundaries due to existing and future industry and infrastructure adjoining the area
	Change in area boundary – reduced environmental impacts	There is potential to change the placement area boundaries to reduce environmental impacts, however this would reduce the dredged material capacity of the area. Further area is already partly disturbed area due to the existing WICT dredged material dewatering ponds.
	Dredging equipment	■ TSHD for the area to be dredged, barge to BUF, material trucked to site
	Placement method	■ Material would be trucked to the site, placed and shaped for final land use ■ For the terrestrial land-based placement option, material would be trucked to the site from BUF, placed, dewatered, consolidated and shaped for final land use
	Establishment of placement area	■ 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 ■ Establishment of a BUF near site ■ Establishment of dewatering ponds, water management system and return water discharge system
	Management of placement area	■ Dewatering of dredged material and decant water (for terrestrial land-based placement) ■ Material settlement 3 to 5 years per dredging campaign (for terrestrial land-based placement) ■ Shaping of consolidated material for final land use ■ Reclamation area for GSDA

Dredged material placement area locality	Site description, key issues and constraints	
	Key issues	■ Timing of the Project dredging works may not align with the future industrial use timeframe ■ Site capacity has been allocated for the future dredging stages of the WICT Project ■ Land sterilised for future use until dredging, dewatering and consolidation is completed ■ Capacity of site less than Project dredged material volume
11. Port Central Expansion		
	**Placement type**	■ Land creation/reclamation ■ Capping for QAL activities.
	Estimated capacity	18Mm^3
	Change in area boundary – increase in capacity consideration	There is potential to change the placement area boundaries to the north to increase the dredged material capacity of the area by approximately 3 to 5Mm^3. However a change in the area boundary to the north will result in additional environmental impacts (e.g. loss of seagrass meadow).
	Change in area boundary – reduced environmental impacts	The boundary has been amended as part of the Revised DMPOI to reduce flooding impacts and minimise direct impact loss in seagrass meadows
	Dredging equipment	■ TSHD for the area to be dredged, barge to BUF, material trucked for placement
	Placement method	■ Material would be trucked to the site from BUF, placed, dewatered, consolidated and shaped for final land use
	Establishment of placement area	■ 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 from local quarry ■ Establishment of a BUF near site ■ Establishment of dewatering ponds, water management system and return water discharge system
	Management of placement area	■ Dewatering of dredged material and decant water ■ Material settlement 3 to 5 years per dredging campaign ■ Shaping of consolidated material for final land use

Dredged material placement area locality	Site description, key issues and constraints	
	Key issues	■ Construction and operational impacts on adjoining residential areas over many years ■ Loss of intertidal habitat and seagrass ■ Land sterilised for future use until dredging, dewatering and consolidation is completed ■ Ability to accommodate Project dredged material volume ■ Capacity of site cannot accommodate WBDDP future dredged material placement needs
12. West Banks Island Reclamation		
	**Placement type**	Island - land creation/reclamation
	Estimated capacity	27 to 30Mm^3
	Change in area boundary – increase in capacity consideration	There is potential to change the placement area boundaries to increase the dredged material capacity of the area by 5 to 10Mm^3. However the increase in area would result in increasing environmental impacts (e.g. loss of seagrass meadows, potential changes to coastal processes within adjoining areas).
	Change in area boundary – reduced environmental impacts	There is potential to change the placement area boundaries to reduce environmental impacts, however this would reduce the dredged material capacity of the area
	Dredging equipment	■ TSHD for the area to be dredged, barge to BUF, material trucked within site
	Placement method	■ Material would be trucked within the site from BUF, placed, dewatered, consolidated and shaped for final land use ■ Possible direct placement from CSD or TSHD
	Establishment of placement area	■ Bund material would be required to be sourced from a mainland quarry, trucked and/or barged or causeway/bridge constructed to the site ■ Bund wall construction on marine and sub-tidal area of varying depths ■ Establishment of a BUF on island ■ Establishment of dewatering ponds, water management system and return water discharge system
	Management of placement area	■ Dewatering of dredged material and decant water ■ Material settlement 3 to 5 years

Dredged material placement area locality	Site description, key issues and constraints	
	Key issues	■ Bridge and access road would need to be developed to realise beneficial reuse potential ■ Bridge and access siting issues, including environmental impact on foreshore ■ Ability to accommodate Project dredged material volume ■ Construction of bund walls would be over a long time period due to the need to barge rock material to the site, and would result in significant increased costs for construction ■ Ability to accommodate part of WBDDP future dredged material placement needs
13. Kangaroo Island		
	**Placement type**	Land creation/reclamation
	Estimated capacity	5 to 7Mm^3
	Change in area boundary – increase in capacity consideration	There is potential to change the placement area boundaries to the north, south and west to increase the dredged material capacity of the area by approximately 3 to 5Mm^3. However the increase in area would result in an increase in environmental impacts (e.g. direct impact loss of mangroves, intertidal areas and migratory shorebird habitat).
	Change in area boundary – reduced environmental impacts	There is potential to change the placement area boundaries to reduce environmental impacts, however this would reduce the dredged material capacity of the area
	Dredging equipment	■ TSHD for the area to be dredged, barge to BUF, material trucked within site ■ Direct placement by CSD for barge access channel.
	Placement method	■ Material would be trucked within the site from BUF, placed, dewatered, consolidated and shaped for final land use ■ Possible direct placement by CSD for barge access channel.
	Establishment of placement area	■ Loss of intertidal habitat and migratory shorebird habitat ■ Bund material to be imported to site from local quarry ■ Bund wall construction within intertidal and sub-tidal to varying depths ■ Establishment of BUF near site ■ Establishment of dewatering ponds, water management system and return water discharge system

Dredged material placement area locality	Site description, key issues and constraints	
	Management of placement area	■ Dewatering of dredged material and decant water ■ Material settlement 3 to 5 years per dredging campaign ■ Shaping of consolidated material for final land use
	Key issues	■ Loss of intertidal and significant shorebird habitat ■ Potential infrastructure conflicts (LNG pipelines) ■ Hydrodynamic and coastal process impacts on The Narrows is likely ■ Capacity of site less than Project dredged material volume
14. Callemondah West		
	**Placement type**	Land creation/reclamation
	Estimated capacity	9 to 10Mm^3
	Change in area boundary – increase in capacity consideration	There is potential to change the placement area boundaries to the south to increase the dredged material capacity of the area by approximately 2 to 3Mm^3. However the opportunity to change the placement area boundary is limited due to the Calliope River and Anabranch.
	Change in area boundary – reduced environmental impacts	There is potential to change the placement area boundaries to reduce environmental impacts, however this would reduce the dredged material capacity of the area
	Dredging equipment	■ TSHD for the area to be dredged, barge to BUF, material trucked to site ■ Possible placement by CSD for barge access channel.
	Placement method	■ Material would be trucked to the site from BUF, placed, dewatered, consolidated and shaped for final land use ■ Possible placement by CSD for barge access channel
	Establishment of placement area	■ Loss of intertidal habitat ■ Bund material to be imported to site from local quarry ■ Bund wall construction within intertidal and sub-tidal to varying depths ■ Establishment of BUF near site in Calliope River or Annabranch and dredging for barge access to the BUF ■ Establishment of dewatering ponds, water management system and return water discharge system
	Management of placement area	■ Dewatering of dredged material and decant water ■ Material settlement 3 to 5 years per dredging campaign ■ Shaping of consolidated material for final land use

Dredged material placement area locality	Site description, key issues and constraints	
	Key issues	■ Loss of significant area of intertidal habitat at mouth of Calliope River ■ Proximity to upstream fish habitat area ■ Siting of BUF in Calliope River/Anabranch and additional dredging to provide barge access to the BUF ■ Impacts on Calliope River flooding would need to be modelled and floodplain capacity loss compensated ■ Tenure issues including Native Title ■ Capacity of site less than Project dredged material volume

5.5 Preliminary desktop investigations

Targeted preliminary desktop investigations of each of the potential dredged material placement sites were undertaken to assess potential site availability, feasibility and potential impact to support the identification of a short list of feasible sites to take forward into the phase four MCA. The preliminary investigations included an assessment of:

- The future intended use of privately owned sites, including commercial restrictions and dredging campaign timing
- Dredging equipment and placement methods
- Dredged material placement capacity
- Potential environmental and other constraints.

5.5.1 Future site use, commercial restrictions and dredging campaign timing – private sites

Six of the potential dredged material placement sites were identified as being privately owned or managed. Each of these sites was investigated to confirm the future site use/intent, including whether any commercial operations or restrictions exist. These sites were:

- Targinnie Valley Investigation Area
- Landing Road Investigation Area
- QAL Red Mud Dams
- Tannum Sands North
- Tannum Sands South
- Ash Dams (adjacent to RGTCT).

5.5.1.1 Targinnie Valley Investigation Area and Landing Road Investigation Area

Both the Targinnie Valley and Landing Road Investigation Areas overlay parts of the QER shale oil mining tenement in the northern portion of the beneficial reuse study area. These areas were identified during the Channel Duplication Project DMPOI Workshop 2 as worthy of further investigation for the potential beneficial reuse 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 and whether current or future opportunities could exist for dredged material placement. Further consultation occurred with QER in June and July 2019.

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-placement of dredged material.

QER confirmed that the development of the resource is still being pursued and that it would not be in the interests of the State or QER to dispose of any significant thickness of dredged material over the QER tenements or QER freehold land.

It was therefore confirmed that these two sites would not be available for dredged material placement for the Project or other approved dredging projects.

5.5.1.2 Queensland Alumina Limited – Red Mud Dams

QAL produces approximately 3.95Mtpa 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 1,000ha residual disposal area (RDA).

This RDA was identified during GGCC Duplication Project DMPOI 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 44m Australian Height Datum (AHD), would be required to support these operations through the raising. Further consultation with QAL was undertaken in July 2019.

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

5.5.1.3 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 the GGCC Duplication Project DMPOI Workshop 2 as a potential beneficial reuse 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 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 (i.e. sand and clay).

Cement Australia also advised in 2013 and June 2019 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 or other approved dredging projects.

5.5.1.4 Tannum Sands South

Similar to Tannum Sands North site, the Tannum Sands South site is operated as a silica sand extraction area by Boral and was identified during the GGCC Duplication Project DMPOI Workshop 2 as a potential beneficial reuse 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.

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

5.5.1.5 Ash Dams

The Ash Dams site predominately comprises of freehold land owned by GPC that forms Strategic Port Land, as well as land located within the GSDA. The site is located south of GPC's existing RGTCT on land that has been historically used for dredged material placement as well as the storage of flyash by NRG associated with operation of the Gladstone Power Station (Clinton Ash Ponds). The site was identified during public consultation for the GGCC Duplication Project as a potential beneficial reuse site for dredged material as replacement filling following decommissioning of the ash dams.

Whilst the site is owned by GPC, an existing licencing arrangement remains in effect between GPC and NRG to facilitate flyash storage, with any development on Lot 211 SP174655 must address the *Gladstone Power Station Agreement Act 1993*. Therefore given the ongoing operation of the power station this site will not be available within the Project dredging timeframe. Also the site includes existing rail infrastructure and services (e.g. water and sewage infrastructure to Curtis Island LNG plants).

Therefore, it was determined that the Ash Dams site would not be available for dredged material placement for the Project or other approved dredging projects.

5.5.1.6 Summary

As a result of these preliminary investigations, all six of the privately owned or managed sites were identified as unlikely to be feasible for dredged material placement for the Project or other approved dredging projects due to either owner/operator requirements, inconsistency between timing of dredging and planned future development of the sites and/or dredging operational constraints.

5.5.2 Future site use, commercial restrictions and dredging campaign timing – Economic Development Queensland sites

A review was conducted of sites managed by the State, including sites held under the ownership of EDQ.

5.5.2.1 Gladstone Mount Larcom Road (South)

The Gladstone Mount Larcom Road (South) site is situated within the GSDA and includes the majority of an area which is subject to an approval held by GPC to undertake reclamation works. The area is referred to as 'Reclamation Area C' and covers approximately 140 hectares, with a portion of the area used for reclamation and dewatering from the Stage 1 dredging works to support the WICT Project.

Dredging for Stage 1 of the WICT Project was undertaken from May 2012 to February 2013 and included dredging of 2.9Mm^3 of material using a CSD to establish one berth pocket, departure channel and swing basin.

The WICT Project is the Port's second coal terminal to supplement the existing RGTCT export capacity. Situated at Golding Point, west of the RGTCT, the WICT Project has an ultimate export capacity of 84Mtpa, with the completed Stage 1 comprising 27Mtpa.

Existing approvals obtained for the WICT support development beyond Stage 1, including authorising dredging works beyond Stage 1 and a continued level of commitment to utilise the Reclamation Area C for future onshore dredged material placement. These existing approvals include:

- CG's Report on the WICT Project EIS (no currency end date)
- Commonwealth EPBC Act controlled action approval (valid to February 2021)
- Environmental Authority (EA) for Environmentally Relevant Activity 16 - Extractive Activities authorising dredging of up to 4Mm^3 with placement of dredged material within Reclamation Area B and C or at sea (EPPR00825113). It is noted however that in 2016, the EA was suspended by the Wiggins Island Coal Export Terminal Pty Ltd (WICET Pty Ltd) for the period between 5 December 2016 and 5 December 2019, unless the suspension is terminated earlier by WICET Pty Ltd.

Future WICT Project stages will involve the dredging of approximately 3.4Mm^3 of material to establish the remaining berth pockets and swing basin. These stages will be developed in response to market demand and there is currently no timeframe proposed.

Based on this information, it has been determined that the site would not be available for dredged material placement for the Project as it has been set aside for future dredged material placement associated with the WICT Project.

5.5.2.2 Boat Creek (South)

The Boat Creek (South) site is located in the intertidal area between Fisherman's Landing and the current WICT Project reclamation area C. The area is situated within the GSDA and is owned by the State.

The site has been subject to a number of expressions of interest from proponents for development of the site, however none of the proposals has progressed. Consultation with EDQ in June and July 2019, advised that the most recent proponent cited geotechnical issues as a factor limiting the development potential of the site and that significant earthworks would be required to stabilise the land.

EDQ has advised that the site could be made available as a primary or secondary dredged material placement site, subject to understanding the timing impacts of having to take the site "off market" until dredged material placement is completed, and the land is available for development purposes.

Subject to acceptable timing of dredged material placement for EDQ, the Boat Creek South site is considered likely to be feasible for further consideration in the Revised DMPOI on the basis of site availability.

5.5.2.3 Summary

Following consultations with EDQ and consideration of site capacity, Boat Creek (South) site was identified for further consideration in the Revised DMPOI.

Gladstone Mount Larcom Road (South) is not available due to commitments to future WICT stages and Callemondah West is discussed further in Section 5.5.3.

5.5.3 Dredged material placement capacity

One of the main considerations in selecting a preferred dredged material beneficial reuse and placement location is the capacity of the site or sites to receive and manage the dewatering process within the dredging timeframe. After concluding that the privately owned placement areas were not a practical option for Project dredged material the remaining placement areas were assessed for suitability based on capacity.

The Project dredged material placement needs to consider the beneficial reuse of 15.75Mm^3 of dredged material (including bulking factor) (refer Section 4.5). A preferred placement area would have the capacity for at least this volume.

The following placement areas have capacity less than the required 15.75Mm^3 for Project dredged material placement and management:

- Fisherman's Landing Expansion (South)
- Boat Creek (South)
- Callemondah West.

However, after further consideration of the above placement areas, it was decided to combine placement areas for inclusion into the phase four MCA process, including:

- Fisherman's Landing Expansion (South) and Boat Creek (South) (i.e. combined capacity of 17 to 21Mm^3)
- Fisherman's Landing Expansion (South) and Callemondah West (i.e. combined capacity of 21 to 30Mm^3).

5.5.4 Potential environmental impacts associated with Kangaroo Island sites

The Kangaroo Island site will not be considered any further in the Revised DMPOI due to the significant environmental values of the site. Kangaroo Island is located north of the Western Basin reclamation area. It is an intertidal zone forming part of The Narrows and has the following attributes:

- Least concern Regional Ecosystem
- Migratory bird habitat and important roosting sites
- Coastal saltmarsh threatened ecological communities
- Mangroves
- Area of State biodiversity significance
- Essential habitat
- Potential habitat for protected fauna species.

Whilst a number of the other sites also have environmental constraints and potential environmental impacts, it was considered that development of the Kangaroo Island site would result in unacceptable potential environmental risks.

5.6 Outcome of phase three

At the conclusion of phase three additional investigations (refer Sections 5.1 to 5.5) the following sites were identified as no longer being feasible to progress in the Revised DMPOI:

- Targinnie Valley Investigation Area (conflict with future QER development)
- Landing Road Investigation Area (conflict with future QER development)

- QAL Red Mud Dams (conflict with future red mud storage)
- Tannum Sands North (conflict with future silica sand extraction)
- Tannum Sands South (conflict with future silica sand extraction)
- Ash Ponds (conflict with future flyash storage)
- Gladstone Mount Larcom Rd (South) (conflict with future WICT dredged material placement)
- Kangaroo Island (significant environmental constraints).

As a result, the following four sites remained to progress to the Revised DMPOI phase four MCA process:

- Western Basin Expansion
- Fisherman's Landing (South) and Boat Creek (South) as a combined option
- Fisherman's Landing (South) and Callemondah West as a combined option
- Port Central Expansion
- West Banks Island Reclamation.

Figure 5.2 illustrates the locations of each of these potential dredged material placement options.

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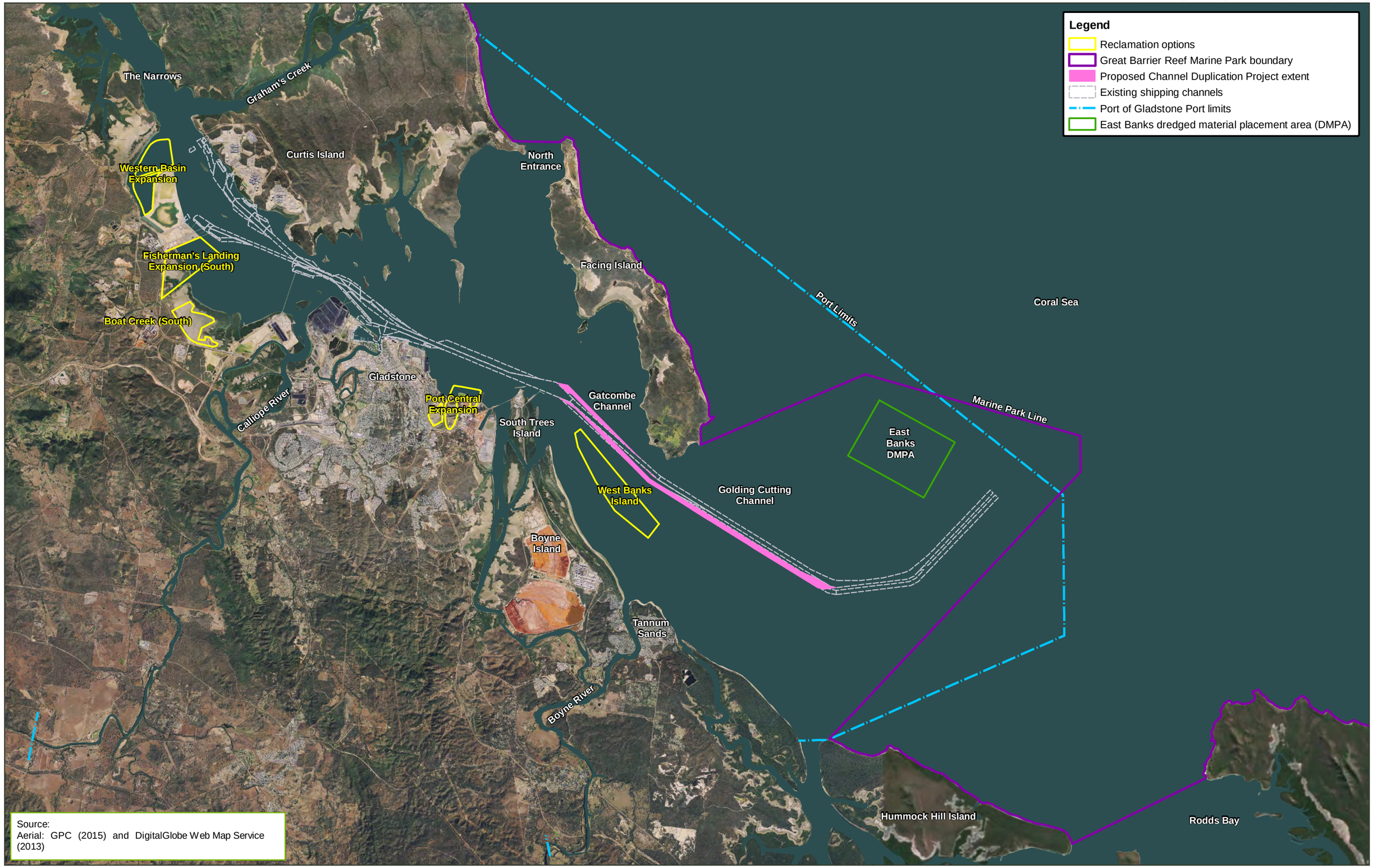

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Coordinate system: GDA_1994_MGA_Zone_56

Gatcombe and Golding Cutting Channel Duplication Project

Figure 5.2: Short-listed potential dredged material placement options

6 Phase four – Multi-criteria analysis on short listed dredged material placement options for the Project

6.1 Phase four methodology

Phase four of the Revised DMPOI involved undertaking a MCA process to identify the preferred dredged material beneficial reuse and placement location for the Project.

Specifically, the MCA process included:

- Identification of a suite of objectives and associated aspects/impacts for each objective to support more detailed ranking and greater transparency in the MCA process
- Scoring for each issue and applying weightings
- Sensitivity testing of outcomes.

A suite of issues and aspects for each objective were developed to support more detailed ranking and greater transparency in the MCA process. In addition, weightings were assigned to each of the objectives and aspect/issues.

The following four sites were assessed during the phase four MCA:

- Western Basin Expansion
- Port Central Expansion
- Fisherman's Landing Expansion (South) and Boat Creek (South) (as a combined option)
- Fisherman's Landing (South) and Callemondah West (as a combined option)
- West Banks Island.

6.2 Key assumptions

Prior to undertaking the MCA, the following key assumptions were required to be made:

- Rock armour for the construction of reclamation area bund walls will be sourced from an existing Gladstone quarry and will be transferred to the site primarily via trucks. Where the beneficial reuse area is located at a distance from the quarry or is situated offshore, transferring of rock armour will occur using a combination of trucks and barges.
- Reclamation area design for the Boat Creek (South) site will ensure that direct impacts to mangroves is minimised as far as is reasonably practical
- Reclamation area design for the Fisherman's Landing Expansion (South) site will ensure that the creek in the south-west corner will not be impacted
- Reclamation area design for Callemondah West site will ensure that the creek on the southern boundary will not be directly impacted
- Estimated capacities for each beneficial reuse are subject to the completion of detailed design for both bund wall construction and earthworks.

6.3 Objectives, issues/aspects and weightings

The objectives, issues/aspects and weightings used in the MCA process remain unchanged from the Supplementary DMPOI with the exception of Objective 5 which has been changed to address the dredged material placement needs from approved capital dredging projects only.

Table 6.1 presents the MCA objectives, issues/aspects and weightings used in the Revised DMPOI.

Table 6.1 Revised Dredged Material Placement Options Investigation multi-criteria assessment process objectives, issues/aspects and weightings

Objectives and issues/aspects	Weightings (%)
1. Aquatic environmental objectives	**27**
1.1 Avoid or minimise irrevocable adverse impact on aquatic and/or coastal ecosystem sensitive receptors (i.e. permanent loss of the OUV of the GBRWHA, including but not limited to seagrass meadows, mangroves, saltmarsh intertidal area)	
Intertidal vegetation	11
Seagrass (direct impacts)	12
1.2 Avoid or minimise short term water quality and adverse ecological impacts (e.g. occurrence of sediment plume) on aquatic and/or coastal ecosystem sensitive receptors (i.e. minimise short term impact on the OUV of the GBRWHA, including but not limited to seagrass meadows, coral/rocky reef, declared Fish Habitat Areas, turtle nesting beaches, GBRMP)	
Water quality and ecological impacts (indirect impacts)	11
Macroinvertebrate habitat	11
Acid sulfate soils	11
1.3 Avoid or minimise adverse impact on listed threatened, migratory and other protected marine fauna species (including the OUV of the GBRWHA biodiversity conservation attributes, and species listed under the EPBC Act, GBRMP Act and Nature Conservation Act 1992 (NC Act)) and their habitat	
Marine fauna	11
Migratory birds	11
Wetland values	11
OUV of the GBRWHA (biodiversity conservation values)	11
Total	**100**
2. Terrestrial environmental objectives	**20**
2.1 Avoid or minimise impacts on significant terrestrial vegetation communities (i.e. Matters of National Environmental Significance (MNES) (threatened ecological communities (TECs) and threatened species) and Matters of State Environmental Significance (MSES) (endangered or of concern regional ecosystems, habitat for threatened species))	
Terrestrial vegetation	33
Terrestrial fauna	33
2.2 Avoid or minimise adverse impacts on natural aesthetic values and geological processes/heritage attributes as defined under the OUV of the GBRWHA (e.g. Port Curtis islands, beaches, dune systems, fringing reefs)	
Amenity (World Heritage Values – aesthetics)	34
Total	**100**
3. Social and cultural heritage objectives	**18**
3.1 Maximise level of compatibility of the final placement location with existing and approved land uses and future land use planning documents	
Strategic land use intent	12

Objectives and issues/aspects	Weightings (%)
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)	
Community and recreational activities	12
Amenity (air, noise, vibration)	12
Amenity (visual)	12
Traffic	12
3.3 *Avoid or minimise adverse impacts on opportunities for reasonable use, appreciation, enjoyment and understanding of the Great Barrier Reef region and adjacent coastline*	
Amenity (World Heritage Values – human appreciation/enjoyment of the Great Barrier Reef)	12
3.4 *Avoid or minimise adverse impacts on cultural heritage values, including Traditional Owner/use values and heritage values*	
Indigenous cultural heritage	16
Non-indigenous cultural heritage	12
Total	**100**
4. Economic objectives	**20**
4.1 Avoid or minimise adverse impacts on ecosystem reliant commercial activities	
Commercial and recreational fishing	40
4.2 Maximise cost efficiency of dredged material placement	
Dredging method costs	30
Reclamation area establishment and dredged material placement costs	30
Total	**100**
5. Long term dredged material placement (beneficial reuse) objective	**15**
5.1 Maximise the potential capacity of the placement area to accommodate the beneficial reuse of dredged material volumes from the Project and other approved capital dredging projects	
Capacity of placement area	**100**
Total	**100**
Total (Objectives 1 to 5)	**100**

6.3.1 Scoring values and considerations

For consistency, the Revised DMPOI MCA process adopted the same set of scoring values as the Supplementary DMPOI MCA process and applied these to the set of 12 objectives and associated issues/aspects to be considered in the options scoring process. These are summarised in Table 6.2.

Table 6.2 Revised Dredged Material Placement Options Investigation multi-criteria assessment process scoring values

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

Scoring considerations developed for the Revised DMPOI MCA process in relation to aquatic environment, terrestrial environment, and social and cultural heritage were again applied, with amended/new scoring considerations developed to reflect the potential outcome/scale of potential impact associated with the economic and long term dredged material placement objectives.

The scoring considerations adopted from the Revised DMPOI MCA process are provided in Table 6.3.

Table 6.3 Revised Dredged Material Placement Options Investigation multi-criteria assessment process scoring objectives

Objective	Scoring		Scoring considerations
1.	**Aquatic environment objectives**		
1.1	***Avoid or minimise irrevocable adverse impact on aquatic and/or coastal ecosystem sensitive receptors (i.e. permanent loss of the OUV of the GBRWHA, including but not limited to seagrass meadows, mangroves, saltmarsh intertidal area)***		
	1	Prevents objective	Unacceptable impact on the OUV of the GBRWHA aquatic and coastal ecosystem sensitive receptors (e.g. seagrass meadows identified as having a comparatively high or medium potential value to the ecology of Port Curtis)
	2	Against objective	Impact on OUV of the GBRWHA aquatic and/or coastal ecosystem sensitive receptors (e.g. seagrass meadows identified as having a comparatively high or medium potential value to the ecology of Port Curtis)
	3	Partially fails objective	Impact on OUV of the GBRWHA aquatic and/or coastal ecosystem sensitive receptors (e.g. seagrass meadows identified as having a comparatively low potential value to the ecology of Port Curtis)
	4	Partially satisfies objective	Manageable impact on OUV of the GBRWHA aquatic and coastal ecosystem sensitive receptors (e.g. seagrass meadows)
	5	Meets objective	No impact on OUV of the GBRWHA aquatic and coastal ecosystem sensitive receptors (e.g. seagrass meadows, mangroves, intertidal areas)
	6	Exceeds objective	Creates additional potential OUV of the GBRWHA aquatic and coastal ecosystem habitat
1.2	***Avoid or minimise short term water quality and adverse ecological impacts (e.g. occurrence of sediment plume) on aquatic and/or coastal ecosystem sensitive receptors (i.e. minimise short term impact on the OUV of the GBRWHA, including but not limited to seagrass meadows, coral/rocky reef, declared Fish Habitat Areas, turtle nesting beaches, GBRMP)***		
	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
1.3	***Avoid or minimise adverse impact on listed threatened, migratory and other protected marine fauna species (including the OUV of the GBRWHA biodiversity conservation attributes, and species listed under the EPBC Act, GBRMP Act and NC Act) and their habitat***		
	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	***Avoid or minimise impacts on significant terrestrial vegetation communities (i.e. MNES (TECs and threatened species) and Matters of State Environmental Significance (MSES) (endangered or of concern regional ecosystems, habitat for threatened species))***		
	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	***Avoid or minimise adverse impacts on natural aesthetic values and geological processes/heritage attributes as defined under the OUV of the GBRWHA (e.g. Port Curtis islands, beaches, dune systems, fringing reefs)***		
	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
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 Great Barrier Reef 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
	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

Objective	Scoring		Scoring considerations
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
4.2	***Maximise cost efficiency of dredged material placement***		
	1	Prevents objective	Unacceptable costs for dredged material management and placement
	2	Against objective	Double (or more) handling of dredged material required, or placement area location requires high containment bund costs, high vehicular, services and infrastructure access costs and/or results in high dredged material placement costs
	3	Partially fails objective	Placement area location requires high containment bund costs or results in high dredged material placement costs Duplication of placement area and handling/management
	4	Partially satisfies objective	Placement area location requires high containment bund costs, however costs can be shared with other dredging project(s) or results in moderate dredged material placement costs
	5	Meets objective	Placement area location minimises containment bund costs and/or achieves a reasonable level of dredged material placement cost
	6	Exceeds objective	Lowest costs per m^3 for dredging and dredged material placement

Objective	Scoring		Scoring considerations
5.	**Long term dredged material placement (beneficial reuse) objectives**		
5.1	***Maximise the potential capacity of the placement area to accommodate the beneficial reuse of dredged material volumes from the Project and other approved capital dredging projects***		
	1	Prevents objective	Placement area cannot accommodate all of the dredged material volume for the Project and requires two or more additional sites
	2	Against objective	Placement area cannot accommodate all of the dredged material volume for the Project and relies on the use of a second placement site in parallel
	3	Partially fails objective	Placement area accommodates all of the dredged material volume for the Project (16Mm^3)
	4	Partially satisfies objective	Placement area: ■ Accommodates all of the dredged material volume for the Project ■ Provides additional capacity of up to 20Mm^3 which could be utilised by future capital and/or maintenance dredging projects within the Port of Gladstone
	5	Meets objective	Placement area: ■ Accommodates all of the dredged material volume for the Project ■ Provides additional capacity of more than 20Mm^3 but less than 30Mm^3 which could be utilised by future capital and/or maintenance dredging projects within the Port of Gladstone
	6	Exceeds objective	Placement area: ■ Accommodates all of the dredged material volume for the Project ■ Provides additional capacity of more than 30Mm^3 which could be utilised by future capital and/or maintenance dredging projects within the Port of Gladstone

6.3.2 Ranking of options

Consistent with the approach taken for the DMPOI and Supplementary DMPOI MCA process, each objective and associated issues/aspects were assessed for each option to allow comparison between each of the options and the application of comparative scores.

Allocated scores were recorded in a Microsoft Excel spreadsheet to facilitate calculation of the final scores with consideration to the weightings applied. Table 6.4 provides a summary of the justification for each of the scores applied, and the objective category and final overall rankings, with a ranking of '1' representing the most preferred and '5' presenting the least preferred. A copy of the final spreadsheet output from the Revised DMPOI MCA process is provided in Appendix B.

The key advantages for the WBE reclamation area being the preferred dredged material placement area, as demonstrated and justified by the Revised DMPOI MCA process include:

- Been identified as the preferred dredged material placement area to receive dredged material from future stages of the WBDDP (as detailed in the LTSDP)
- Avoids the need to have additional impacts on intertidal and marine habitats associated with constructing multiple reclamation areas to accommodate dredged material from the Project and future stages of the WBDDP
- Potential impacts to terrestrial vegetation and fauna (refer Table 6.4 objectives 2.1 and 2.2) that are lower when compared to all other short-listed options
- Potential impacts to aquatic environmental values are lower than that of Fisherman's Landing Expansion (South) and Boat Creek (South) option and Fisherman's Landing Expansion (South) and Callemondah West option (refer Table 6.4 objectives 1.1 to 1.3)
- The lowest potential impact to intertidal vegetation (i.e. mangroves) (refer Table 6.4 objective 1.1 (intertidal vegetation)) when compared to all other short-listed options

- Potential impacts to social and cultural heritage values (land use intent, community and recreational activities, amenity and traffic) are lower than the West Banks Island option, and Fisherman's Landing Expansion (South) and Callemondah West option and comparable to those of Fisherman's Landing Expansion (South) and Boat Creek (South) option (refer Table 6.4 objectives 3.1 to 3.4)
- Potential impacts to economic values and objectives are lower when compared to all other short-listed options (refer Table 6.4 objective 5.1).

It is important to note that the WBE reclamation area option scoring against the aquatic environment and terrestrial environment objectives and associated issues/aspects will achieve improved scores and/or rankings (i.e. higher level of compliance against the objectives) due to the WBE reclamation area option also being preferred (as identified in the LTSDP) and required to receive dredged material from future stages of the WBDDP. This further supports the '1' ranking for the WBE reclamation area as the disturbance from one proposed new reclamation area, that can accommodate both the Project and future stages of the WBDDP dredged material, is preferred over the disturbance of two or three new reclamation areas.

Table 6.4 Revised Dredged Material Placement Options Investigation multi-criteria assessment process rankings for preferred dredged material placement site

Objective	Issue/aspect	Western Basin Expansion		Fisherman's Landing Expansion (South) and Boat Creek (South)		Fisherman's Landing Expansion (South) and Callemondah West		Port Central Expansion		West Banks Island	
		Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification
Aquatic environment objectives											
1.1	Intertidal vegetation	5	This reclamation area has been designed to have minimal or no direct impact to mangroves and mainland intertidal vegetation. A channel will remain between the new reclamation area and the coastline to ensure that impacts to mangroves are minimised.	2	These reclamation areas will require the removal of a large area of mangroves and other marine plants (excluding seagrass) (approximately 299ha). The tidal flow into Boat Creek will remain to ensure that these tidal areas are not directly impacted.	2	These reclamation areas will require the removal of a large amount of mangroves and other marine plants (excluding seagrass) (approximately 294ha). There is a creek that flows through the southern area of the reclamation area which may cause indirect impacts to adjacent areas.	4	This reclamation area will require the removal of an area of mangroves, salt flats and saltmarsh (approximately 60ha).	4	This reclamation area will require the removal of mangroves (approximately 20ha) for the purposes of constructing a two way road and bridge, and corridor for services and products to the proposed island.
1.1	Seagrass (direct impacts)	2	This reclamation area will require the removal of known seagrass meadows (approximately 275ha) which are known to have a high ecological value within Port Curtis.	2	The Fisherman's Landing Expansion (South) reclamation area will require the removal of historical seagrass meadows (approximately 153ha) which are known to have a high ecological value within Port Curtis.	2	The Fisherman's Landing Expansion (South) reclamation area will require the removal of historical seagrass meadows (approximately 153ha) which are known to have a high ecological value within Port Curtis.	4	This reclamation area will require the removal of historical seagrass meadows (approximately 43ha).	4	This reclamation area is likely to require the removal of historical seagrass meadows (approximately 6ha) as well as macroalgae (approximately 7ha) for the construction of the access bridge to the proposed island.

Objective	Issue/aspect	Western Basin Expansion		Fisherman's Landing Expansion (South) and Boat Creek (South)		Fisherman's Landing Expansion (South) and Callemondah West		Port Central Expansion		West Banks Island	
		Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification
1.2	Water quality and ecological impacts (indirect impacts)	4	This reclamation area has the potential to impact on the nearby marine water quality and associated ecological values. This area is also closer to high environmental value waters based on EPP (Water) zones. The proposed Project management of dredging and construction in this area and the ongoing monitoring and adaptive management will ensure that any potential impacts are minimised.	4	These reclamation areas have the potential to impact on the nearby marine water quality and associated ecological values. The proposed Project management of dredging and construction in this area and the ongoing monitoring and adaptive management will ensure that any potential impacts are minimised.	4	These reclamation areas have the potential to impact on the nearby marine water quality and associated ecological values. The proposed Project management of dredging and construction in this area and the ongoing monitoring and adaptive management will ensure that any potential impacts are minimised.	4	This reclamation area has the potential to impact on the nearby marine water quality and associated ecological values. The proposed Project management of dredging and construction in this area and the ongoing monitoring and adaptive management will ensure that any potential impacts are minimised.	3	This reclamation area has the potential to impact on coastal processes and change the water velocities within this area of the Port (e.g. increasing erosion between the proposed island and the mainland). This reclamation areas also has the potential to impact the nearby marine water quality and associated ecological values. The proposed Project management of dredging and construction in this area and the ongoing monitoring and adaptive management will assist in minimising potential impacts, however the island nature of this option results in the impacts being less manageable than the other options.

Objective	Issue/aspect	Western Basin Expansion		Fisherman's Landing Expansion (South) and Boat Creek (South)		Fisherman's Landing Expansion (South) and Callemondah West		Port Central Expansion		West Banks Island	
		Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification
1.2	Macro-invertebrate habitat	4	There is limited macroinvertebrate information available for this reclamation area so it has been assumed that the same density will apply across all areas from the information that is available in the area. As a result this reclamation area will have a manageable impact on macroinvertebrates on a local scale.	4	There is limited macroinvertebrate information available for these reclamation areas so it has been assumed that the same density will apply across all areas from the information that is available in the area. As a result these reclamation areas will have a manageable impact on macroinvertebrates on a local scale.	4	There is limited macroinvertebrate information available for these reclamation areas so it has been assumed that the same density will apply across all areas from the information that is available in the area. As a result these reclamation areas will have a manageable impact on macroinvertebrates on a local scale.	4	There is limited macroinvertebrate information available for this reclamation area so it has been assumed that the same density will apply across all areas from the information that is available in the area. As a result this reclamation area will have a manageable impact on macroinvertebrates on a local scale.	4	There is limited macroinvertebrate information available for this reclamation area so it has been assumed that the same density will apply across all areas from the information that is available in the area. As a result this reclamation area will have a manageable impact on macroinvertebrates on a local scale.
1.2	Acid sulfate soils	4	Based on PASS and ASS information available in the area it is likely that any potential impacts will be on a local scale and manageable.	4	Based on PASS and ASS information available in the area it is likely that any potential impacts will be on a local scale and manageable.	4	Based on PASS and ASS information available in the area it is likely that any potential impacts will be on a local scale and manageable.	4	Based on PASS and ASS information available in the area it is likely that any potential impacts will be on a local scale and manageable.	3	Based on PASS and ASS information available in the area it is likely that any potential impacts will be on a local scale and manageable, however the island nature of this option results in the impacts being less manageable than the other options.

Objective	Issue/aspect	Western Basin Expansion		Fisherman's Landing Expansion (South) and Boat Creek (South)		Fisherman's Landing Expansion (South) and Callemondah West		Port Central Expansion		West Banks Island	
		Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification
1.3	Marine fauna	3	This reclamation area will have an impact on marine fauna habitat due to the loss of seagrass within this area. The potential impacts will be on a local scale and can be managed and offset as part of the Project.	3	The Fisherman's Landing (South) reclamation areas will have an impact on marine fauna habitat due to the loss of seagrass within this area. The potential impacts will be on a local scale and can be managed and offset as part of the Project.	3	The Fisherman's Landing (South) reclamation areas will have an impact on marine fauna habitat due to the loss of seagrass within this area. The potential impacts will be on a local scale and can be managed and offset as part of the Project.	4	This reclamation area will have an impact on marine fauna habitat due to the loss of seagrass within this area. The potential impacts will be on a local scale (however less area loss than other options) and can be managed and offset as part of the Project.	2	This reclamation area will have an impact on marine fauna habitat due to the loss of seagrass and other habitat within this area. The construction of the bridge and access road to the island has the potential to impact on the Boyne Island Beach, which is a known turtle nesting location (i.e. regional scale impact). Further this reclamation area has the potential to result in an increase in artificial lighting, which has the potential to affect the number of female adult turtles attempting to nest.

Objective	Issue/aspect	Western Basin Expansion		Fisherman's Landing Expansion (South) and Boat Creek (South)		Fisherman's Landing Expansion (South) and Callemondah West		Port Central Expansion		West Banks Island	
		Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification
1.3	Migratory birds	2	This reclamation area will impact on migratory bird foraging habitat (approximately 275ha) on a local and regional scale due to proximity to the Friend Point migratory bird roost site. The majority of indirect impacts are manageable. Significant residual adverse impact on migratory shorebird foraging habitat will be offset.	3	These reclamation areas will impact on migratory bird foraging habitat (approximately 332ha) on a local scale. Indirect impacts are manageable.	3	These reclamation areas will impact on migratory bird foraging habitat (approximately 154ha) on local scale. The Callemondah West reclamation area is within close proximity to a roost site.	3	This reclamation area will impact on migratory bird foraging habitat (approximately 138ha) on a local scale. Indirect impacts are manageable.	3	This reclamation area has the potential to have an indirect impact on the Boyne Island migratory bird roost site and foraging habitat on a local scale. Other indirect impacts are manageable.
1.3	Wetland values	4	This reclamation area will impact on high ecological significance (HES) wetland (approximately 49ha) and wetland management area (approximately 49ha). The potential impacts will be on a local scale and can be managed and offset as part of the Project.	3	These reclamation areas will impact on HES wetland (approximately 121ha) and wetland management area (approximately 414ha). The potential impacts will be on a local scale (however larger area of disturbance than three other options) and can be managed and offset as part of the Project.	3	These reclamation areas will impact on HES wetland (approximately 121ha) and wetland management area (approximately 566ha). The potential impacts will be on a local scale (however larger area of disturbance than other options) and can be managed and offset as part of the Project.	4	This reclamation area will impact on wetland management area (approximately 60ha). The potential impacts will be on a local scale and can be managed and offset as part of the Project.	5	This reclamation area will not directly impact on HES wetland or a wetland management area.

Objective	Issue/aspect	Western Basin Expansion		Fisherman's Landing Expansion (South) and Boat Creek (South)		Fisherman's Landing Expansion (South) and Callemondah West		Port Central Expansion		West Banks Island	
		Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification
1.3	OUV of GBRWHA (biodiversity conservation values)	3	This reclamation area has the potential to impact on the local expression of the OUV of the GBRWHA at the local scale.	3	These reclamation areas have the potential to impact on the local expression of the OUV of the GBRWHA at the local scale.	3	These reclamation areas have the potential to impact on the local expression of the OUV of the GBRWHA at the local scale.	4	This reclamation area has the potential to impact on the local expression of the OUV of the GBRWHA at the local scale. However the impact is considered to lower than other options due to the location of the area being adjacent to the QAL facility.	3	This reclamation area has the potential to impact on the local expression of the OUV of the GBRWHA at the local scale.
Total weighted score		**343**		**310**		**310**		**389**		**345**	
Rank		**3**		**4**		**4**		**1**		**2**	
Terrestrial and visual environment objectives											
2.1	Terrestrial vegetation	5	This reclamation area does not directly impact upon terrestrial vegetation (refer Appendix B)	3	These reclamation areas are mapped as essential habitat having biodiversity significance. However, the impact upon terrestrial vegetation in this area is potentially small and is manageable on a local scale (refer Appendix B).	3	These reclamation areas are mapped as essential habitat having biodiversity significance. However, the impact upon terrestrial vegetation in this area is potentially small and is manageable on a local scale (refer Appendix B).	3	This reclamation area is mapped as essential habitat having biodiversity significance. However, the impact upon terrestrial vegetation in this area is potentially small and is manageable on a local scale (refer Appendix B).	2	Coastal semi evergreen vine thicket is located on Boyne Island and other terrestrial vegetation will be impacted by the construction of a two way road and bridge, and corridor for services and products (i.e. approximately 20ha).

Objective	Issue/aspect	Western Basin Expansion		Fisherman's Landing Expansion (South) and Boat Creek (South)		Fisherman's Landing Expansion (South) and Callemondah West		Port Central Expansion		West Banks Island	
		Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification
2.1	Terrestrial fauna	4	This reclamation area does not directly impact on terrestrial fauna habitat areas. This reclamation area has the potential to have an indirect impact on terrestrial fauna habitat (e.g. Water mouse), however the impact is at a local scale and manageable.	3	These reclamation areas will have a direct impact on terrestrial fauna habitat (e.g. Water mouse) (approximately 300ha) and direct impact on a coastal fauna corridor (approximately 160ha).	3	These reclamation areas will have a direct impact on terrestrial fauna habitat (e.g. Water mouse) (approximately 294ha)	4	This reclamation area will have a direct impact on terrestrial fauna habitat (e.g. Water mouse) (approximately 5ha), however the impact is at a local scale and manageable.	3	This reclamation area will have a direct impact on terrestrial fauna habitat (e.g. Water mouse) from the construction of a two way road and bridge, and corridor for services and products (i.e. approximately 20ha), however the impact is at a local scale and manageable.
2.2	Amenity (World Heritage values – aesthetics)	4	This reclamation area will only partially impact on the aesthetics in the area. As an area that was previously unimpacted will now be reclaimed the site specific impacts will detract from the aesthetic, however as the reclamation area is located directly adjacent to port facilities and existing reclamation, the aesthetic impact will only partially detract from the local values.	4	These reclamation areas will only partially impact on the aesthetics in the area. As an area that was previously unimpacted will now be reclaimed the site specific impacts will detract from the aesthetic, however as the reclamation area is located directly adjacent to port facilities and existing reclamation, the aesthetic impact will only partially detract from the local values.	4	These reclamation areas will only partially impact on the aesthetics in the area. As an area that was previously unimpacted will now be reclaimed the site specific impacts will detract from the aesthetic, however as the reclamation area is located directly adjacent to port facilities and existing reclamation, the aesthetic impact will only partially detract from the local values.	4	This reclamation area will only partially impact on the aesthetics in the area. As an area that was previously unimpacted will now be reclaimed the site specific impacts will detract from the aesthetic, however as the reclamation area is located directly adjacent to port facilities and existing reclamation, the aesthetic impact will only partially detract from the local values.	3	This reclamation area will impact on the aesthetics of the local area. An island will be created in an area that it does not currently exist. The viewshed from a recreational beach and recreational boating in the Port will have an island permanently placed here with port-related activity occurring.

Objective	Issue/aspect	Western Basin Expansion		Fisherman's Landing Expansion (South) and Boat Creek (South)		Fisherman's Landing Expansion (South) and Callemondah West		Port Central Expansion		West Banks Island	
		Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification
Total weighted score		**433**		**334**		**334**		**367**		**267**	
Rank		**1**		**3**		**3**		**2**		**5**	
Social and cultural heritage objectives											
3.1	Strategic land use intent	6	This reclamation area is currently shown in the priority Port of Gladstone master plan preliminary draft port overlay as a future reclamation area option to receive dredged material. The area is adjacent to port land uses and industrial land uses.	6	The Fisherman's Landing (South) reclamation area is currently shown in the priority Port of Gladstone master plan preliminary draft port overlay as a future reclamation area option to receive dredged material. The area is adjacent to port land uses and industrial land uses. The Boat Creek (South) reclamation area is located within the GSDA and will be developed for industrial purposes in the future.	3	The Fisherman's Landing (South) reclamation area is currently shown in the priority Port of Gladstone master plan preliminary draft port overlay as a future reclamation area option to receive dredged material. The area is adjacent to port land uses and industrial land uses. Callemondah West reclamation area is located within the Gladstone Regional Council Planning Scheme zoned as open space. The area is outside the GSDA and LUP. Callemondah West reclamation area is within the floodplain of the Calliope River, in a flood hazard zone and the Calliope River Q100.	6	This reclamation area is currently shown in the priority Port of Gladstone master plan preliminary draft port overlay as a future reclamation area option to receive dredged material. The area is adjacent to port land uses and industrial land uses.	3	This reclamation area is located in Port marine waters and is not designated in the priority Port of Gladstone master plan preliminary draft port overlay as a future reclamation area option to receive dredged material.

Objective	Issue/aspect	Western Basin Expansion		Fisherman's Landing Expansion (South) and Boat Creek (South)		Fisherman's Landing Expansion (South) and Callemondah West		Port Central Expansion		West Banks Island	
		Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification
3.2	Community and recreational activities	3	This reclamation area has the potential to impact on recreational fishing and crabbing, however the impacts will be short term and manageable.	3	The Fisherman's Landing (South) reclamation area has the potential to impact on recreational fishing and crabbing, however the impacts will be short term and manageable.	3	The Callamonda West reclamation area is located 1.8km north of the Dē-răl-lĭ (Calliope River) fish habitat area and close to recreational boat ramps. These reclamation areas has the potential to impact on recreational fishing and crabbing, however the impacts will be short term and manageable	4	This reclamation area has the potential to impact on recreational fishing and crabbing, however the impacts will be manageable, and will be less than other options.	2	This reclamation area has the potential to impact on recreational fishing and crabbing. The construction of the bridge and access road to the island also has the potential to impact on beach fishing and 4WD activities on the beach.
3.2	Amenity (air, noise, vibration)	4	This reclamation area has the potential to have an impact on air, noise and vibration levels. However no residential receptors are located nearby, and the potential impacts are manageable.	4	These reclamation areas have the potential to have an impact on air, noise and vibration levels. However no residential receptors are located nearby, and the potential impacts are manageable.	4	These reclamation areas have the potential to have an impact on air, noise and vibration levels. However no residential receptors are located nearby, and the potential impacts are manageable.	3	This reclamation area has the potential to have an impact on air, noise and vibration levels. Residential receptors are located nearby, and the potential impacts are short term and manageable.	3	This reclamation area has the potential to have an impact on air, noise and vibration levels. Residential and recreational receptors are located nearby, and the potential impacts are short term and manageable.

Objective	Issue/aspect	Western Basin Expansion		Fisherman's Landing Expansion (South) and Boat Creek (South)		Fisherman's Landing Expansion (South) and Callemondah West		Port Central Expansion		West Banks Island	
		Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification
3.2	Amenity (visual)	5	This reclamation area will only partially impact on the visual amenity of the area. As an area that was previously unimpacted will now be reclaimed the site specific impacts will detract from the aesthetics, however as the reclamation area is located directly adjacent to port facilities and existing reclamation, the aesthetic impact will be minor.	5	These reclamation areas will only partially impact on the visual amenity of the area. As an area that was previously unimpacted will now be reclaimed the site specific impacts will detract from the aesthetics, however as the reclamation areas are located directly adjacent to port facilities and existing reclamation, the aesthetic impact will be minor.	4	These reclamation areas will only partially impact on the visual amenity of the area. As an area that was previously unimpacted will now be reclaimed the site specific impacts will detract from the aesthetics, however as the Fisherman's Landing (South) reclamation area is located directly adjacent to port facilities and existing reclamation, the aesthetic impact will be minor. The Callemondah West reclamation area is located outside of the GSDA adjacent to the Calliope River resulting in a higher visual impact than the Boat Creek (South) reclamation area	6	This reclamation area will only partially impact on the visual amenity of the area. Also this reclamation area has the potential to provide a long term benefit post dredging and dredged material management to the nearby community by providing a mounded buffer/screen between the residential area and the QAL facility.	2	This reclamation area will have a visual impact on the area. An island will be created in an area that it does not currently exist. The viewshed from a marine area and recreational beach will have an island permanently placed here with port-related development occurring.

Objective	Issue/aspect	Western Basin Expansion		Fisherman's Landing Expansion (South) and Boat Creek (South)		Fisherman's Landing Expansion (South) and Callemondah West		Port Central Expansion		West Banks Island	
		Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification
3.2	Traffic	4	The construction of this reclamation area will result in a short term increase in traffic for the local area. This impact is manageable.	4	The construction of these reclamation areas will result in a short term increase in traffic for the local area. This impact is manageable.	4	The construction of these reclamation areas will result in a short term increase in traffic for the local area. This impact is manageable.	4	The construction of this reclamation area will result in a short term increase in traffic for the local area. This impact is manageable.	3	The construction of this reclamation area will result in a short term increase in traffic for the local area. This impact is manageable. Construction and operational phases have the potential to impact on commercial vessel movements within the Port.
3.3	Amenity (World heritage values-human appreciate/enjoyment)	4	This reclamation area will have a minimal impact on the human enjoyment and appreciation of the area. Construction in this area will impact upon people fishing and crabbing temporarily until the bund wall is constructed, and this disruption can be managed with the community.	4	These reclamation areas will have a minimal impact on the human enjoyment and appreciation of the area. Construction in this area will impact upon people fishing and crabbing temporarily until the bund wall is constructed, and this disruption can be managed with the community.	4	These reclamation areas will have a minimal impact on the human enjoyment and appreciation of the area. Construction in this area will impact upon people fishing and crabbing temporarily until the bund wall is constructed, and this disruption can be managed with the community.	4	This reclamation area will have a minimal impact on the human enjoyment and appreciation of the area. Construction in this area will impact upon people fishing and crabbing temporarily until the bund wall is constructed, and this disruption can be managed with the community.	2	This reclamation area will impact on the human enjoyment and appreciation of the area. An island will be created in an area that it does not currently exist. The viewshed from the marine area and recreational beach will have an island permanently placed here with port-related development occurring. There will be a bridge structure permanently constructed at this location for access to the island.

Objective	Issue/aspect	Western Basin Expansion		Fisherman's Landing Expansion (South) and Boat Creek (South)		Fisherman's Landing Expansion (South) and Callemondah West		Port Central Expansion		West Banks Island	
		Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification
3.4	Indigenous cultural heritage	3	This reclamation area impacts upon the intertidal area and has the potential to impact on Indigenous cultural heritage values at the local scale.	3	These reclamation areas impact upon the intertidal area and has the potential to impact on Indigenous cultural heritage values at the local scale.	3	These reclamation areas impact upon the intertidal area and has the potential to impact on Indigenous cultural heritage values at the local scale.	3	This reclamation area impacts upon the intertidal area and has the potential to impact on Indigenous cultural heritage values at the local scale.	3	This reclamation area impacts upon the intertidal area and has the potential to impact on Indigenous cultural heritage values at the local scale.
3.4	Non-Indigenous cultural heritage	5	This reclamation area is likely to have no impact to non-Indigenous heritage values.	5	These reclamation areas are likely to have no impact to non-Indigenous heritage values.	5	These reclamation areas are likely to have no impact to non-Indigenous heritage values.	5	This reclamation area is likely to have no impact to non-Indigenous heritage values.	5	This reclamation area is likely to have no impact to non-Indigenous heritage values.
Total weighted score		**420**		**420**		**372**		**432**		**288**	
Rank		**2**		**2**		**4**		**1**		**5**	
Economic objectives											
4.1	Commercial and recreational fishing	2	This reclamation area has the potential to result in a loss in fisheries habitat, however the impact is considered to be minimal given the other commercial fishing resources in the region.	2	These reclamation areas have the potential to result in a loss in fisheries habitat, however the impact is considered to be minimal given the other commercial fishing resources in the region.	2	These reclamation areas have the potential to result in a loss in fisheries habitat, however the impact is considered to be minimal given the other commercial fishing resources in the region.	2	This reclamation area has the potential to result in a loss in fisheries habitat, however the impact is considered to be minimal given the other commercial fishing resources in the region.	2	This reclamation area has the potential to result in a loss in fisheries habitat, however the impact is considered to be minimal given the other commercial fishing resources in the region.

Objective	Issue/aspect	Western Basin Expansion		Fisherman's Landing Expansion (South) and Boat Creek (South)		Fisherman's Landing Expansion (South) and Callemondah West		Port Central Expansion		West Banks Island	
		Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification
4.2	Reclamation area establishment and dredged material placement costs	4	Cost of the reclamation area bund wall establishment and internal dewatering ponds is shared between the Project and the future stages of the WBDDP. The high level capital cost for establishing the reclamation area bund walls and BUF (including ASS treatment and management if required) is approximately $180 million. The approximate cost for offsets for this reclamation area using the financial settlement offset calculator is $18 million (this is an approximate estimate and only includes known values and areas that require offsetting at this stage, field investigations would be required to validate this).	3	Reclamation area bund wall establishment costs will be higher than the WBE option due to the need to construct two additional reclamation areas to accommodate the Project dredged material. The high level capital cost for establishing the reclamation area bund walls and BUF(including ASS treatment and management if required) is approximately $205 million. The approximate costs for offsets for these reclamation areas using the financial settlement offset calculator is $29 million (this is an approximate estimate and only includes known values and areas that require offsetting at this stage, field investigations would be required to validate this).	3	Reclamation area bund wall establishment costs will be higher than the WBE option due to the need to construct two additional reclamation areas to accommodate the Project dredged material. The high level capital cost for establishing the reclamation area bund walls and BUF and dredging for barge access to Callamondah West BUF or dedicated haul route for Moxy 40t transport of dredged material from Fisherman's Landing (South), BUF and placement area (including ASS treatment and management, if required) is approximately $510 million. The approximate costs for offsets for these reclamation areas using the financial settlement offset calculator is	4	Reclamation area bund wall establishment costs will be higher than the WBE option due to the need to construct an additional reclamation area to accommodate the Project dredged material. The high level capital cost for establishing the reclamation area bund walls and BUF (including ASS treatment and management, if required) is approximately $205 million. The approximate costs for offsets for this reclamation area using the financial settlement offset calculator is $14 million (this is an approximate estimate and only includes known values and areas that require offsetting at this stage, field investigations would be required to validate this).	2	Reclamation area bund wall establishment costs will be significantly higher than the other placement area options due to constructing an island and the need to provide a bridge, road, services and infrastructure to the island. The high level capital cost for establishing the reclamation area bund walls and BUF (including ASS treatment and management, if required) is approximately $870 million. The approximate costs for offsets for this reclamation area using the financial settlement offset calculator is $6 million (this is an approximate estimate and only includes known values and areas that require offsetting at this stage, field investigations would

Objective	Issue/aspect	Western Basin Expansion		Fisherman's Landing Expansion (South) and Boat Creek (South)		Fisherman's Landing Expansion (South) and Callemondah West		Port Central Expansion		West Banks Island	
		Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification
							$15 million (this is an approximate estimate and only includes known values and areas that require offsetting at this stage, field investigations would be required to validate this).				be required to validate this).
Total weighted score		**300**		**250**		**250**		**300**		**200**	
Rank		**1**		**3**		**3**		**4**		**5**	
Long term dredged material placement (beneficial reuse) objective											
5.1	Capacity of placement area	6	This reclamation area is the only site that is large enough to accommodate an additional 23.44Mm^3 of dredged material from other future Port approved dredging projects (i.e. future stages of the WBDDP). The WBE boundary has provided a separation from the shoreline to minimise impacts on mangroves, salt marshes and other potential terrestrial flora values as well as terrestrial fauna and cultural heritage values. Reducing	3	These reclamation areas cannot accommodate the additional 23.44Mm^3 of dredged material from other future Port approved dredging projects (i.e. future stages of the WBDDP). Boat Creek (south) reclamation area has already been designed to avoid disturbance to mangroves and other marine plants. Narrowing of the landward boundary of both reclamation areas could reduce impacts on mangroves and	3	These reclamation areas cannot accommodate the additional 23.44Mm^3 of dredged material from other future Port approved dredging projects (i.e. future stages of the WBDDP). Narrowing of the landward boundary of both reclamation areas could reduce impacts on mangroves and other marine plants, however, this would result in a reduction in potential dredged material placement capacity.	3	This reclamation area cannot accommodate the additional 23.44Mm^3 of dredged material from other future Port approved dredging projects (i.e. future stages of the WBDDP). Port Central expansion boundary has been reassessed as part of this DMPOI to avoid seagrass and reduce potential flooding impacts. Narrowing of the landward boundary could reduce impacts on terrestrial vegetation and migratory shorebird	4	This reclamation area can accommodate an additional 11.25Mm^3 of dredged material from other future Port approved dredging projects (i.e. future stages of the WBDDP). Minimal opportunity to alter boundaries to minimise impacts on mangroves and other marine plants as well as turtle nesting. Siting of bridge to minimise impacts would be considered in detailed design.

Objective	Issue/aspect	Western Basin Expansion		Fisherman's Landing Expansion (South) and Boat Creek (South)		Fisherman's Landing Expansion (South) and Callemondah West		Port Central Expansion		West Banks Island	
		Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification
			the boundary would result in a reduction in potential dredged material placement capacity.		other marine plants, however this would result in a reduction in potential dredged material placement capacity.				habitat, however this would result in a reduction in potential dredged material placement capacity.		
Total weighted score		**90**		**45**		**45**		**45**		**60**	
Rank		**1**		**3**		**3**		**3**		**2**	

6.3.3 Sensitivity analysis

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

6.3.4 Preferred dredged material placement option

At the conclusion of the Revised DMPOI MCA process, the WBE reclamation area was confirmed as the preferred dredged material placement area which was included in the Project EIS impact assessment process and further assessed in the AEIS.

A summary of the findings of the Revised DMPOI MCA process is provided in Table 6.5.

Table 6.5 Summary of Revised Dredged Material Placement Options Investigation multi-criteria assessment process rankings for preferred dredged material placement site

Objective	Western Basin Expansion	Fisherman's Landing Expansion (South) and Boat Creek (South)	Fisherman's Landing Expansion (South) and Callemondah West	Port Central Expansion	West Banks Island Reclamation
1. Aquatic environmental objectives	3	4	4	1	2
2. Terrestrial environmental objectives	1	3	3	2	5
3. Social and cultural heritage objectives	2	2	4	1	5
4. Economic objectives	1	3	3	1	5
5. Long term dredged material placement (beneficial reuse) objectives	1	3	3	3	2
TOTAL	**1**	**2**	**4**	**3**	**5**

Table note:

The 'total rank' is calculated using the total scores of each weighted aspect and applying the overall weightings to each objective

6.3.5 Western Basin Expansion reclamation area remaining capacity

Once the dredged material from the Project and future stages of the WBDDP, and capping material is included to allow port-related industries to occur on the reclamation area, the WBE reclamation area will have no remaining capacity to receive dredged material from other future Port dredging projects. However if dredged material is relocated from the WBE reclamation area for a secondary beneficial reuse (refer Section 6.3.6), there may be a corresponding available capacity within the WBE reclamation area to receive dredged material from other future Port dredging projects.

6.3.6 Secondary beneficial reuse of dredged material

Once dredged material is dewatered and consolidated (3 to 5 years) the material is able to be shaped into a final land form suitable for the end use of the reclamation area. The material can also be mounded, to increase the capacity of the primary storage area, which will be required within the WBE reclamation area to accommodate dredged material from both the Project and future stages of the WBDDP.

It is also possible to extract and export the material for placement at a secondary placement site external to the primary dredged material placement area for use as a general fill, a capping material or as replacement fill.

Due to the need to dewater and consolidate the material in the primary placement site, sufficient storage capacity needs to be available in the primary placement site to accommodate the volume of dredged material from a number of dredging campaigns, over the time needed to dewater and consolidate the material, before it is reshaped or exported to a secondary placement site.

For this reason, the secondary beneficial reuse of dredged material does not eliminate or reduce the area required for the primary dredged material placement site.

6.3.7 Justification for reclamation area footprint

The Project has a requirement for the beneficial reuse and placement of 12.85Mm^3 of dredged material, being 16.06Mm^3 of material, allowing for the bulking factoring. There is also the requirement within the WBE reclamation area footprint for:

- Approximately 1.8Mm^3 of rock material for the outer reclamation area bund walls (which represents approximately 15ha of the WBE reclamation area footprint)
- Imported rock and earth material to establishment of the WBE reclamation area internal road network for the placement of dredged material at various locations within the reclamation area (which represents approximately 5ha of the WBE reclamation area footprint)
- Approximately 2.5Mm^3 to 3Mm^3 imported earth material for capping to facilitate the development of port and industrial land uses on the reclamation area (post Project dredging).

With the limitations of the capacity and area of the existing Western Basin reclamation area to accommodate Project dredged material (refer Section 4.3.3), a new site reclamation area is required of a sufficient area to accommodate and manage the rate of material dredged during each stage of dredging, the dewatering of the material to meet licenced discharge limits and to accommodate space for the material in preparation for an end land use for port and industrial purposes.

The preferred dredged material placement option identified in the Revised DMPOI is the WBE reclamation area. The conceptual WBE reclamation area footprint has been developed during the Project EIS process, and has been based on the following:

- Concept design for the dredged material dewatering process and dredged material placement area requirements based on the volume and nature of the Project dredged material
- Locating the outer bund walls so that direct impacts on foreshore mangroves and the Kangaroo Island wetlands are avoided, and potential Project indirect impacts are minimised
- Providing a channel between the WBE northern and southern reclamation areas to ensure appropriate intertidal flushing occurs and potential impacts to foreshore mangroves are avoided, and potential indirect Project impacts are minimised
- Aligning the proposed WBE northern reclamation area outer bund wall with the existing Western Basin reclamation area to allow future wharves to be constructed.

The approximate 275ha area of the WBE reclamation area, including both the northern and southern reclamation areas will be required for the Project due to the:

- High percentage of silts and clays within the Project dredged material that needs to be managed as part of the dewatering process
- Volume of Project dredged material that is required to be placed and the time required for the settlement of material within the reclamation area ponds
- Area required for WBE reclamation area to accommodate the outer bund walls and the internal road network for dredged material placement by trucks.

A key consideration in the WBE reclamation area size required for the dewatering process is the time between the initial dredged material placement within the reclamation area and the licenced discharge into the marine environment. This time period for the water and fine sediment mixture needs to be sufficiently long enough within the WBE reclamation area, and move in a horizontal matter through a series of internal ponds to ensure the settlement of fine material occurs to achieve the Project licenced discharge limit (i.e. 100mg/L). Based on the Project dredging volume and nature of material, the construction of a series of dewatering and polishing ponds is required that covers an area of approximately 255ha (noting that approximately 15ha is required for the WBE reclamation area outer bund walls and approximately 5ha for the WBE reclamation area internal roads).

Taking into account the series of dewatering ponds required within the WBE reclamation area, the conceptual WBE reclamation area footprint design has determined that approximately 6Mm^3 to 6.5Mm^3 of Project dredged material can be accommodated within the WBE southern reclamation area, and approximately 9.56Mm^3 to 10.06Mm^3 of Project dredged material can be accommodated within the WBE northern reclamation area. These volumes are based on an average dredged material level of approximately 7m LAT within the WBE northern and southern reclamation areas, however the dredged material level is likely to range between 6m to 8m LAT to allow for internal stormwater drainage towards the polishing ponds.

It is important to note the above information is based on the Project EIS and AEIS conceptual design, and that the WBE reclamation area footprint will be confined during the detailed design phase of the Project.

The dredged material from future Port of Gladstone dredging projects has the potential to be included within the WBE reclamation area if mounding of the dredged material occurs on the western portion of the WBE reclamation area and/or the WBE reclamation area outer bund wall height is increased.

7 Conclusion

A DMPOI was undertaken between 2013 and early 2015 to support the Port of Gladstone Gatcombe and Golding Cutting Channel Duplication Project EIS. The methodology and findings of the DMPOI were originally published in a standalone DMPOI report. 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, triggering the need to undertake a review of the findings of the DMPOI, and detail the review findings in a Supplementary DMPOI.

The findings of the Supplementary DMPOI completed in 2017 and 2018 were provided in the Project EIS (refer EIS Appendix B1). During the statutory public notice period for the Project EIS the DAF and DES provided comments on the Supplementary DMPOI and the proposed WBE reclamation area in relation to the selection of the WBE reclamation area as the preferred dredged material placement area for the Project.

Both the original DMPOI and Supplementary DMPOI were prepared in response to the EIS ToR and EIS Guidelines requirements to assess placement options for both capital and maintenance dredged material and provide justification for the final dredged material placement option site.

This report has been prepared to review and update the findings of the original DMPOI and Supplementary DMPOI. The legislative changes that occurred in 2015 and 2016 (and more specifically, the mandating of the beneficial reuse of port-related capital dredged material) and the requirement for the WBDDP LTSDP, have required that greater consideration be given to the future approved dredged material placement needs of future approved capital dredging projects within the Port of Gladstone.

The opportunities for dredged material placement to accommodate dredged material from other (yet to be approved) future Port of Gladstone dredging projects to 2050 (to align with priority port master planning, introduced under the Ports Act) are considered in the LTSDP (refer Section 4.2).

Through undertaking the additional consultation in June and July 2019 and additional desktop investigations 14 potential dredged material placement sites were identified. Targeted desktop investigations of each of the potential dredged material placement sites was undertaken to assess potential site availability, feasibility and potential impact to support the identification of a short-list of feasible sites to take forward into the phase four MCA. The investigations included an assessment of:

- The future intended use of privately owned sites, including commercial restrictions and dredging campaign timing
- Dredging equipment and placement methods
- Dredged material placement capacity
- Potential environmental and other constraints.

The additional consultation and investigations identified the following sites as no longer being feasible:

- Targinnie Valley Investigation Area (conflict with future QER development)
- Landing Road Investigation Area (conflict with future QER development)
- QAL Red Mud Dams (conflict with future red mud storage)
- Tannum Sands North (conflict with future silica sand extraction)
- Tannum Sands South (conflict with future silica sand extraction)
- Ash Ponds (conflict with future flyash storage)
- Gladstone Mount Larcom Rd (South) (conflict with future WICT dredged material placement)
- Kangaroo Island (significant environmental constraints).

The Revised DMPOI MCA process assessed the five remaining short-listed sites (i.e. Western Basin Extension, Port Central Expansion, Fisherman's Landing Expansion (South)/Boat Creek (South) and West Banks Island and Fisherman's Landing Expansion (South)/Callemondah West), adopting the same objectives as the Supplementary DMPOI MCA process.

At the conclusion of the Revised DMPOI, the WBE reclamation area has been identified as the preferred dredged material placement option in conjunction with the use of the existing Western Basin reclamation area. The key reasons for the WBE reclamation area scored higher that the other placement area options in the Revised DMPOI MCA process were that the site has:

- Been identified as the preferred dredged material placement area to receive dredged material from future stages of the WBDDP (as detailed in the LTSDP)
- Avoids the need to have additional impacts on intertidal and marine habitats associated with constructing multiple reclamation areas to accommodate dredged material from the Project and future stages of the WBDDP
- Potential impacts to terrestrial vegetation and fauna that are lower when compared to all other short-listed options
- The lowest potential impact to intertidal vegetation (i.e. mangroves) when compared to all other short-listed options
- Potential impacts to aquatic environmental values are lower than that of Fisherman's Landing Expansion (South) and Boat Creek (South) option, and Fisherman's Landing Expansion (South) and Callemondah West option
- Potential impacts to social and cultural heritage values (land use intent, community and recreational activities, amenity and traffic) are lower than the West Banks Island option, and Fisherman's Landing Expansion (South) and Callemondah West option and comparable to those of the Fisherman's Landing Expansion (South) and Boat Creek (South) option
- Potential impacts to economic values and objectives are lower when compared to all other short-listed options.

Appendix A
Mapping of key environmental values

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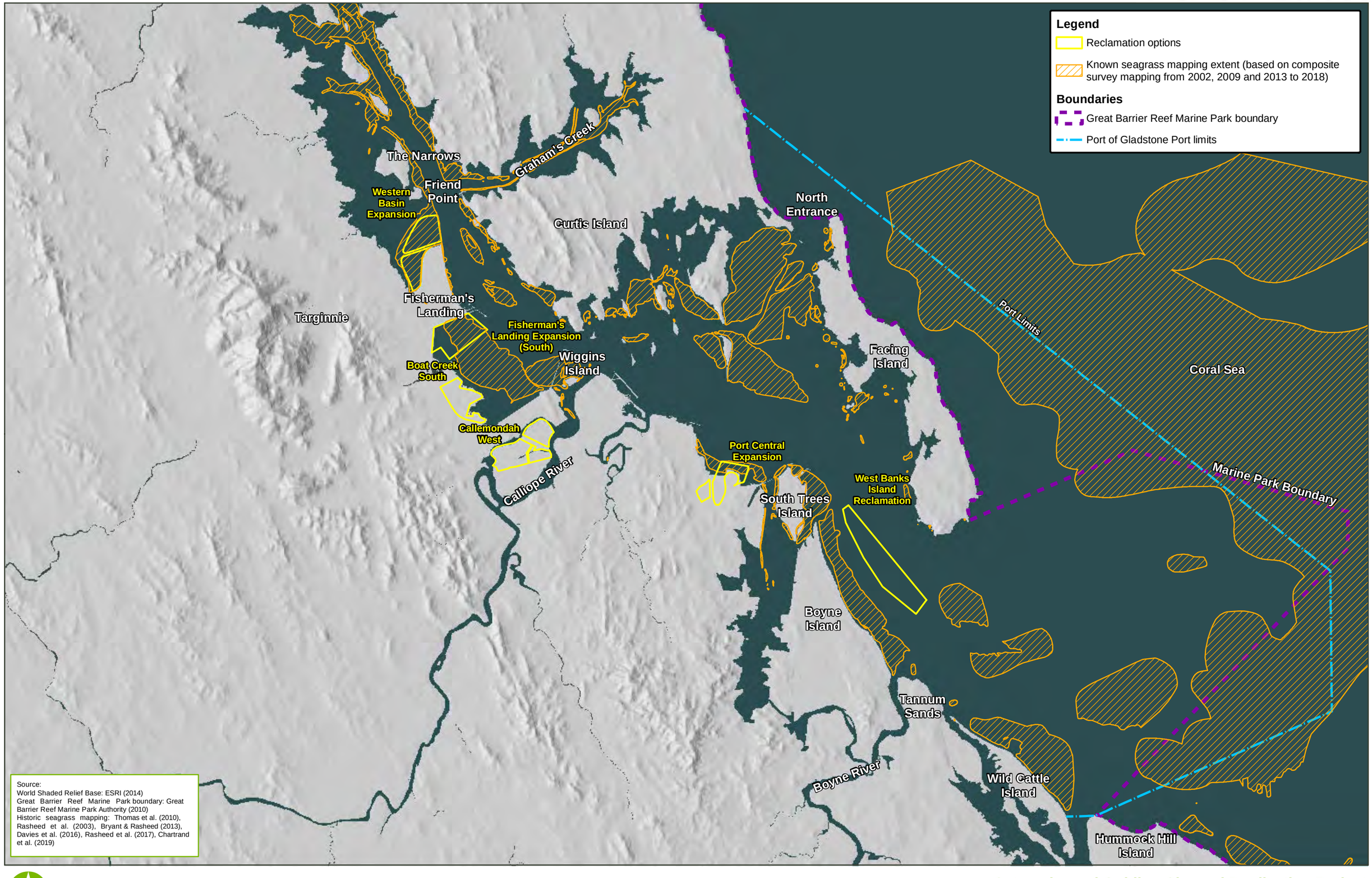

Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Historic seagrass mapping: Thomas et al. (2010), Rasheed et al. (2003), Bryant & Rasheed (2013), Davies et al. (2016), Rasheed et al. (2017), Chartrand et al. (2019)

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_381.mxd 05/08/2019 17:22

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Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A1: Seagrass

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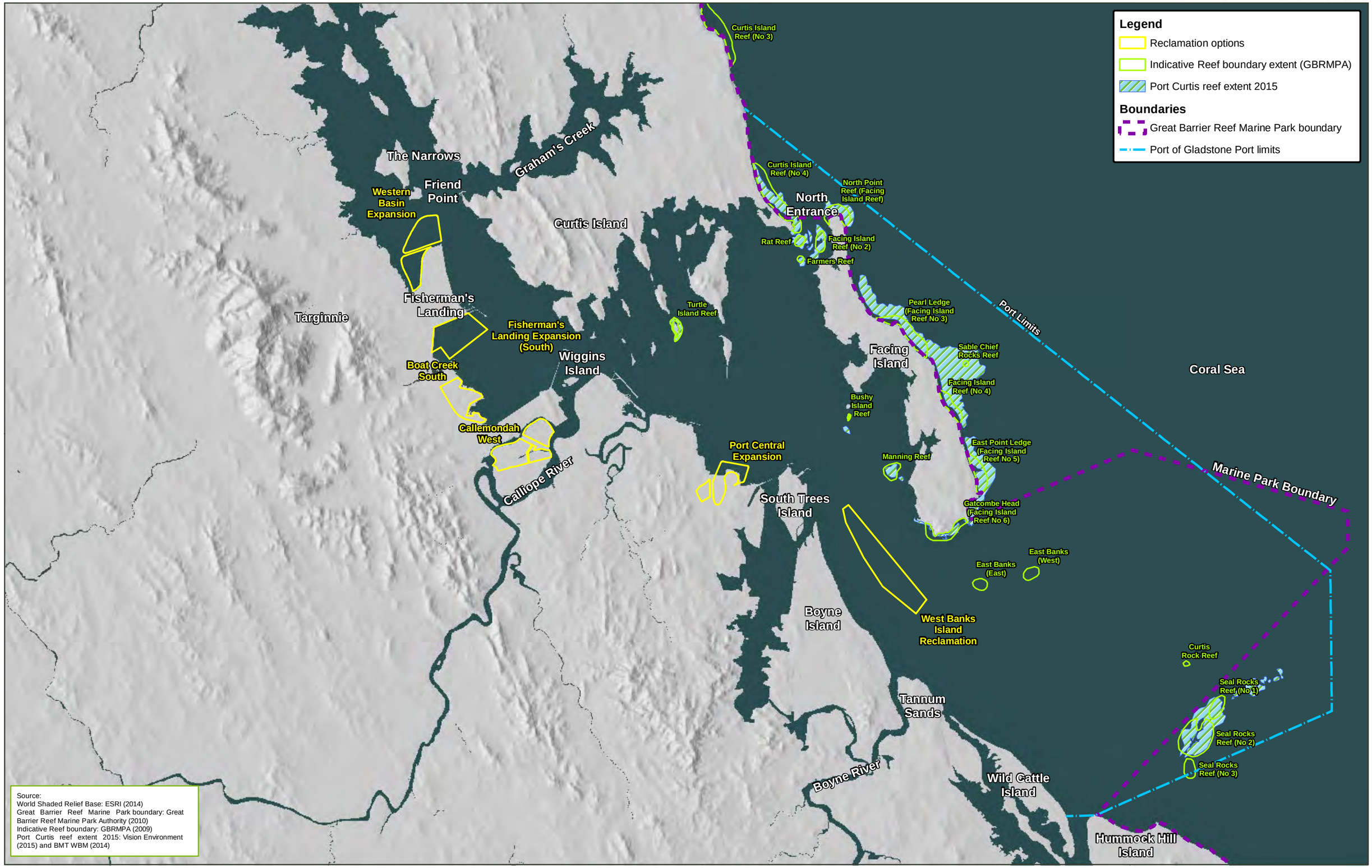

Source:
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Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Indicative Reef boundary: GBRMPA (2009)
Port Curtis reef extent 2015: Vision Environment (2015) and BMT WBM (2014)

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_382.mxd 05/08/2019 17:27

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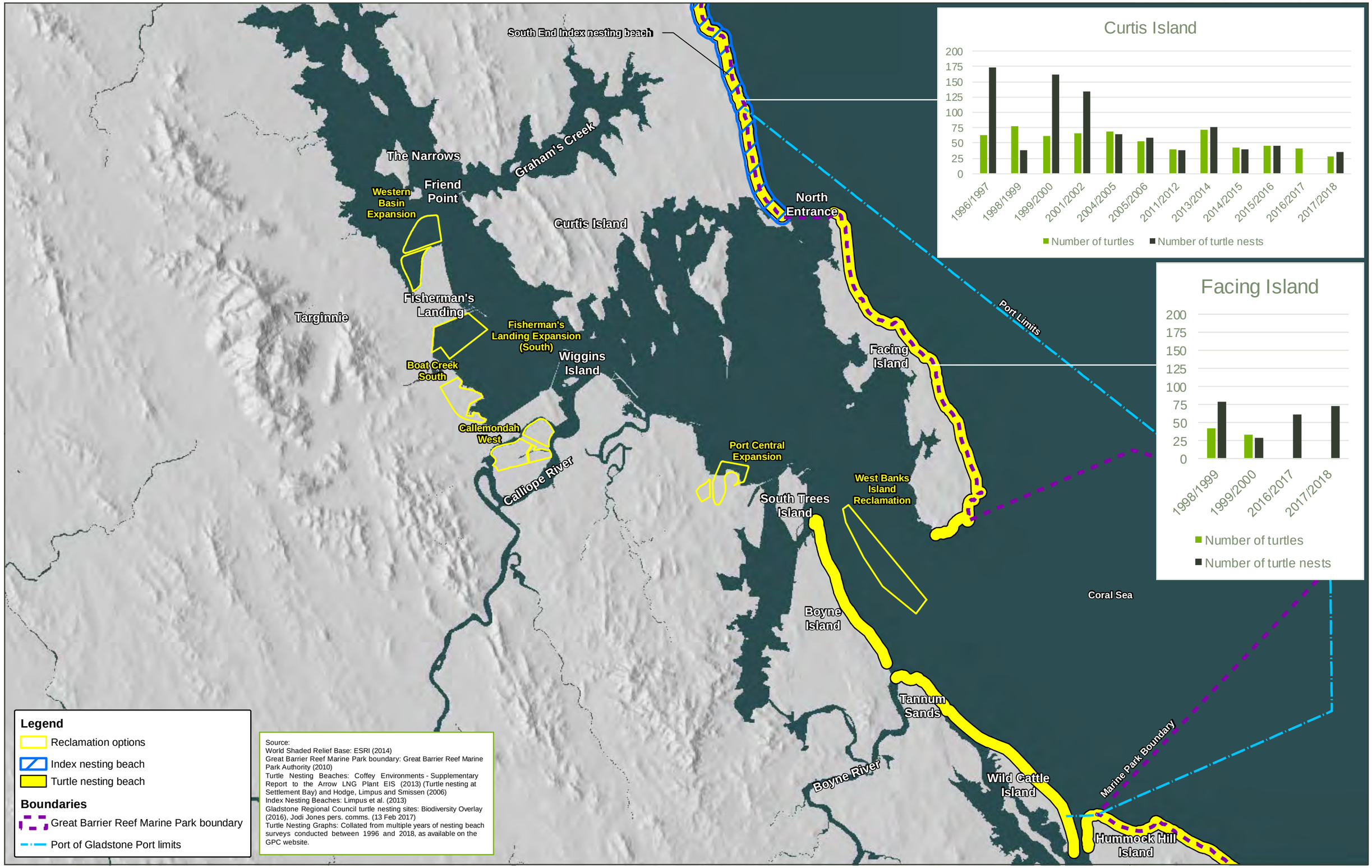
Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A2: Coral



Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A3a: Turtle nesting beaches

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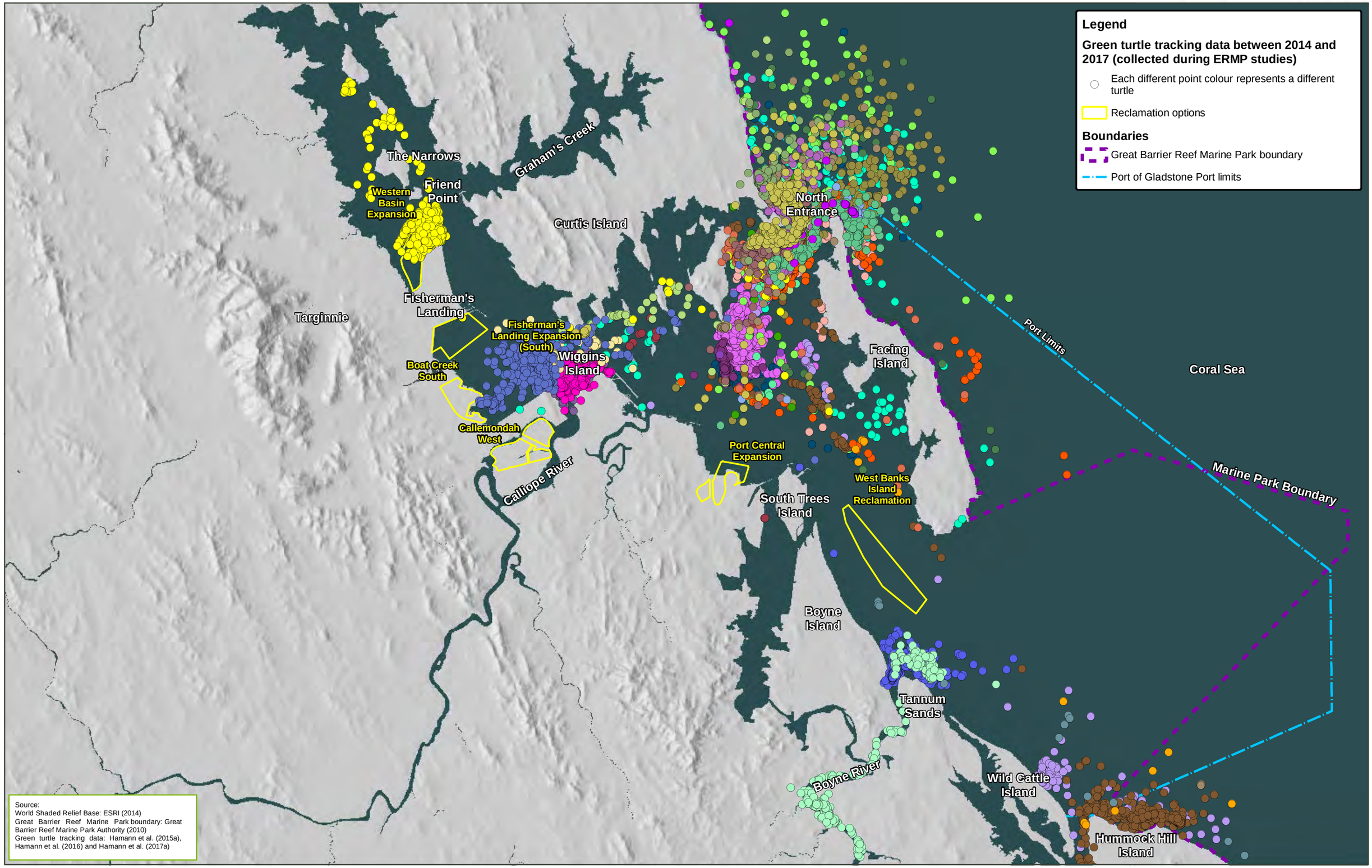


Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Green turtle tracking data: Hamann et al. (2015a), Hamann et al. (2016) and Hamann et al. (2017a)

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_387.mxd 05/08/2019 17:30

0 2,000 4,000 Metres

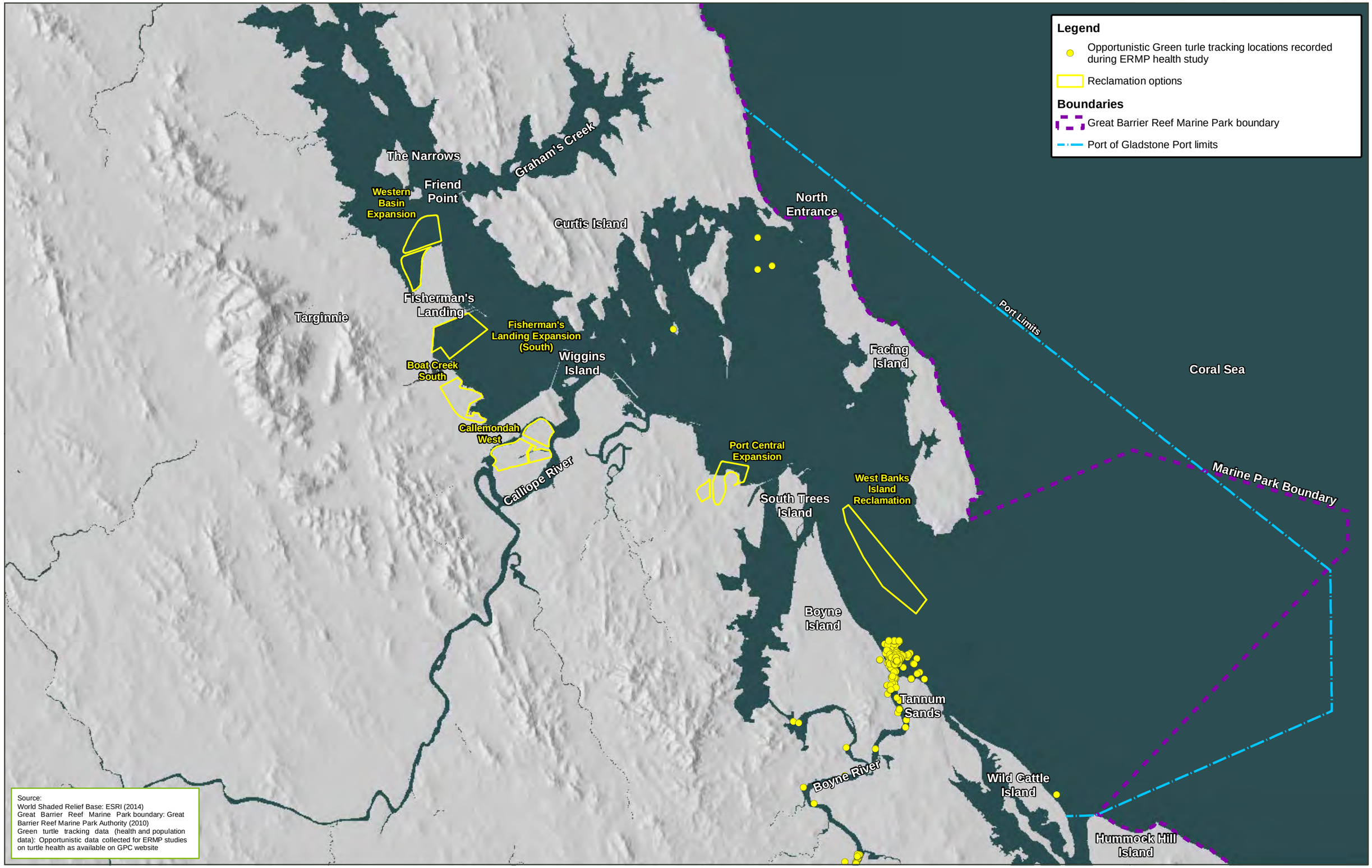
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A3b: Green turtle tracking data during 2014, 2015, 2016 and 2017

aurecon



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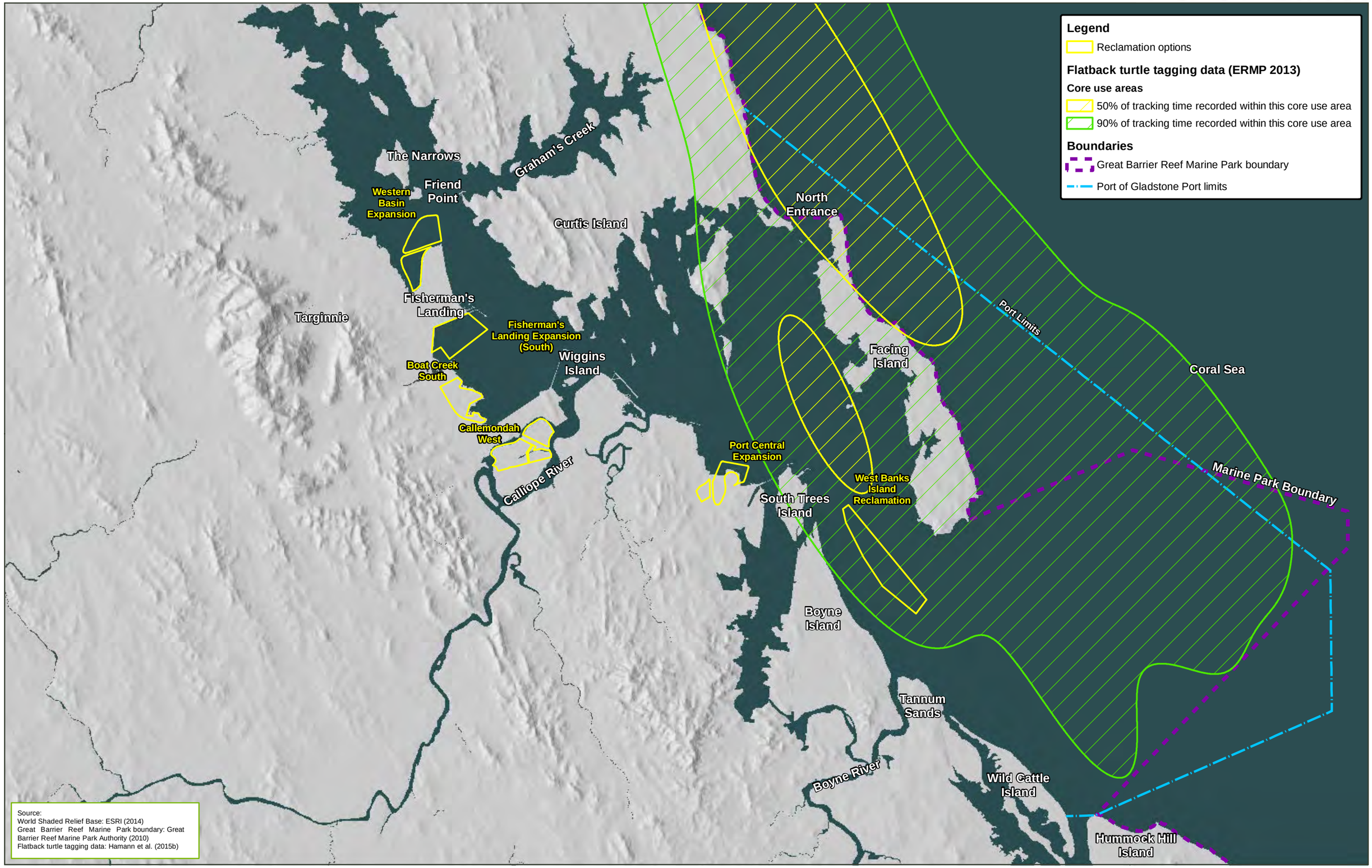
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A3c: Green turtle tracking data (health and population data) during 2010 and 2017

aurecon



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0 2,000 4,000 Metres

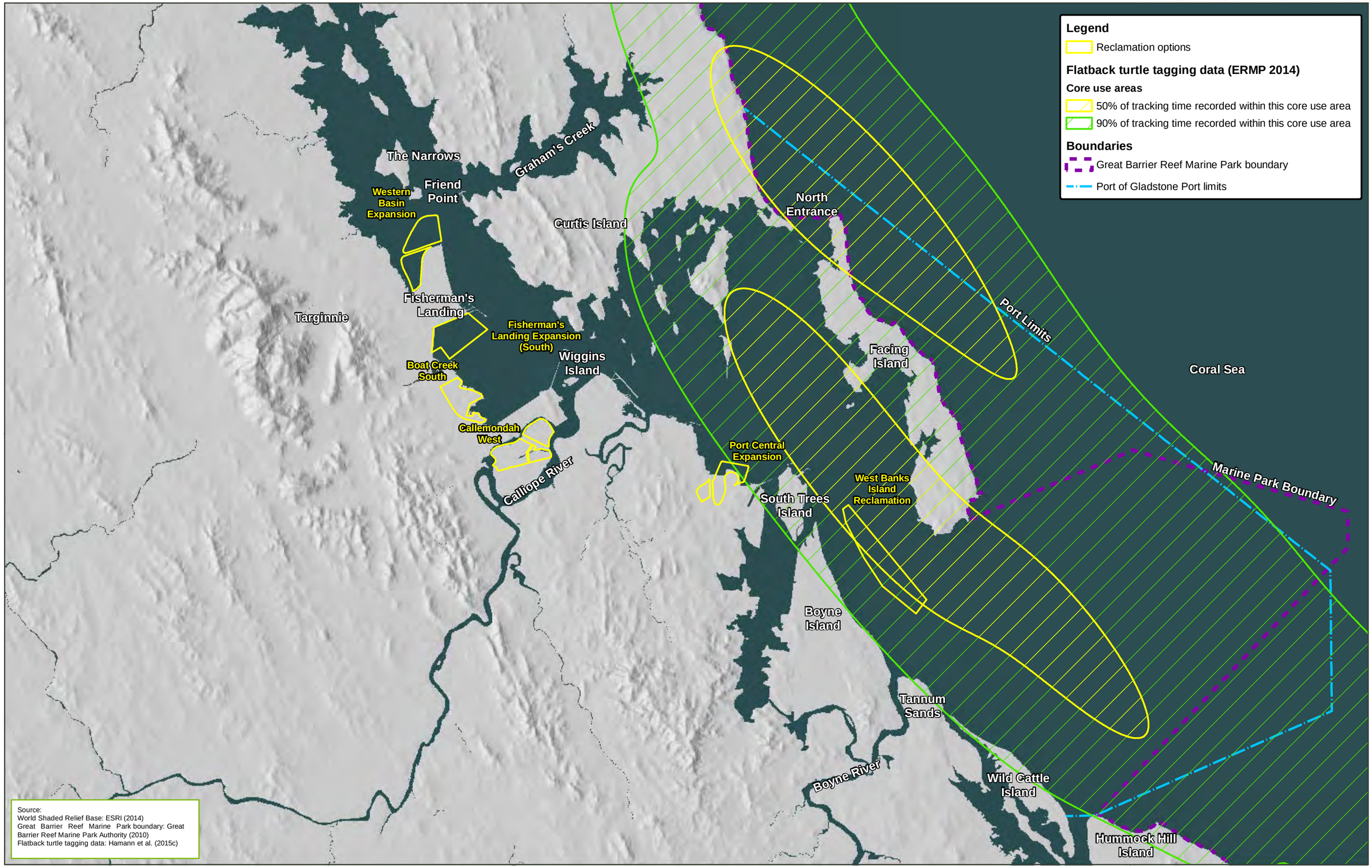
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A3d: Core use areas of Flatback turtles tracked during internesting period in 2013

aurecon



Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_390.mxd 05/08/2019 17:35

Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

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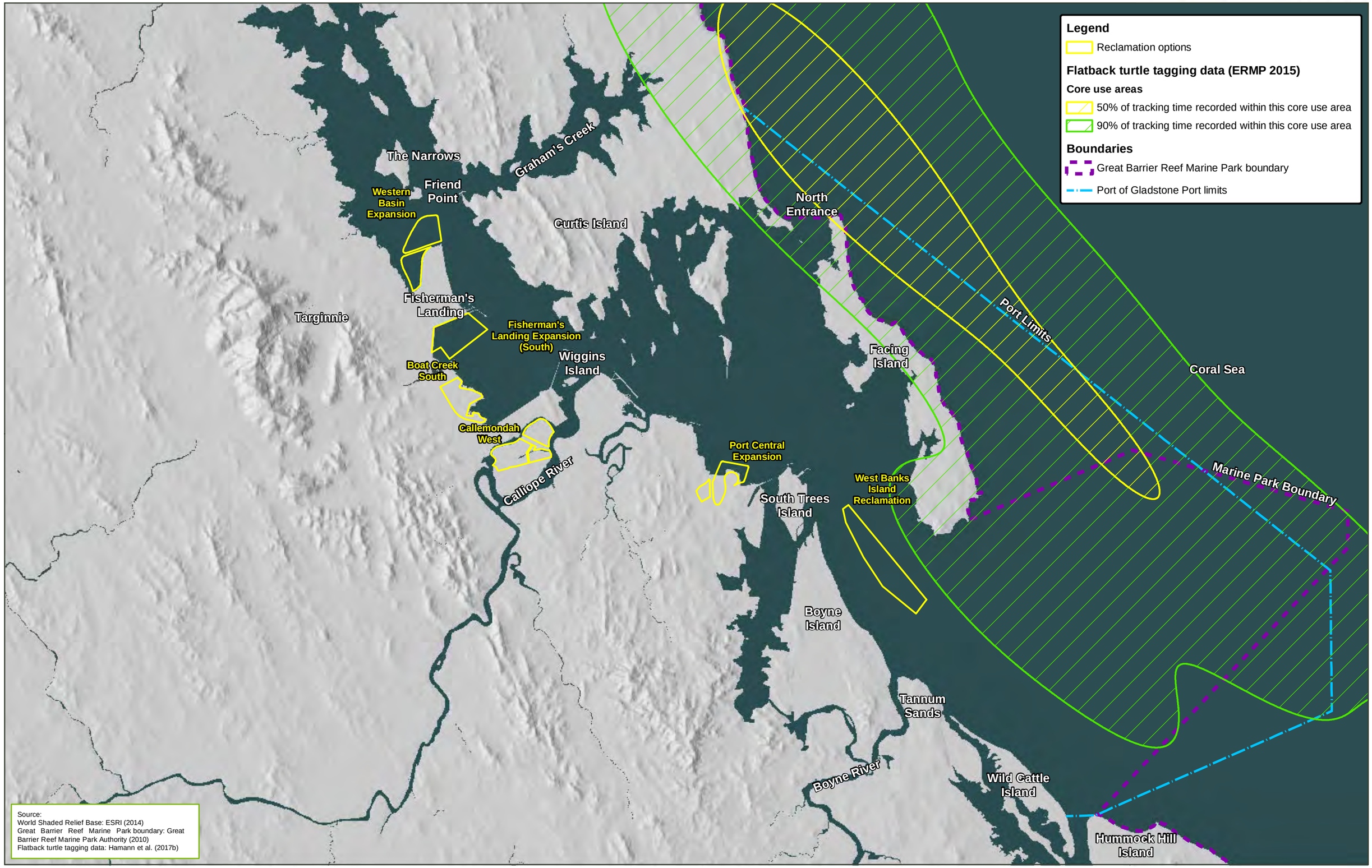
Figure A3e: Core use areas of Flatback turtles tracked during internesting period in 2014

aurecon



Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_391.mxd 05/08/2019 17:36

0 2,000 4,000 Metres

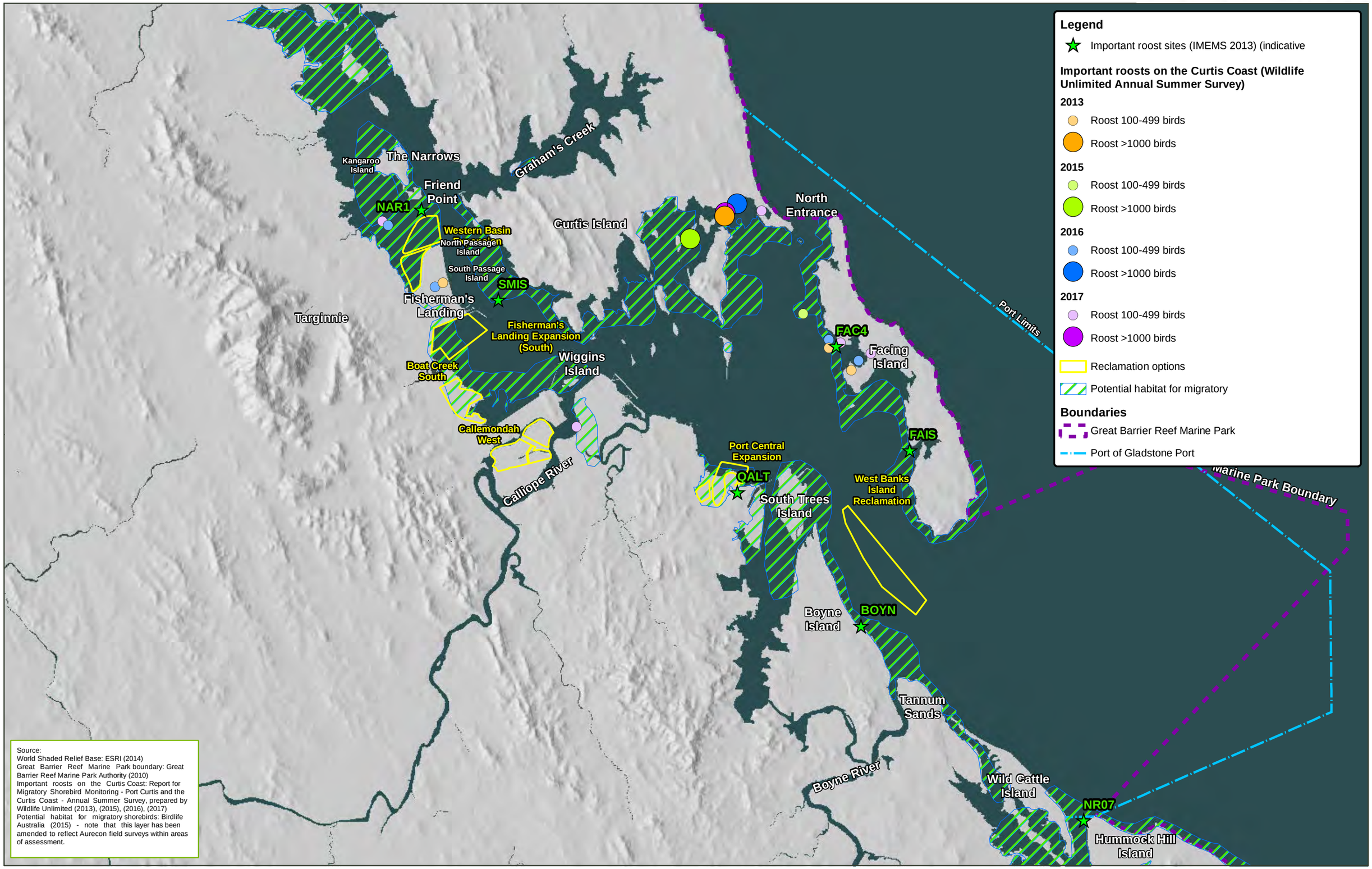
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A3f: Core use areas of Flatback turtles tracked during internesting period in 2015

aurecon



Legend

- Important roost sites (IMEMS 2013) (indicative

Important roosts on the Curtis Coast (Wildlife Unlimited Annual Summer Survey)

2013
- Roost 100-499 birds
- Roost >1000 birds

2015
- Roost 100-499 birds
- Roost >1000 birds

2016
- Roost 100-499 birds
- Roost >1000 birds

2017
- Roost 100-499 birds
- Roost >1000 birds

- Reclamation options
- Potential habitat for migratory

Boundaries
- Great Barrier Reef Marine Park
- Port of Gladstone Port

Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Important roosts on the Curtis Coast: Report for Migratory Shorebird Monitoring - Port Curtis and the Curtis Coast - Annual Summer Survey, prepared by Wildlife Unlimited (2013), (2015), (2016), (2017)
Potential habitat for migratory shorebirds: Birdlife Australia (2015) - note that this layer has been amended to reflect Aurecon field surveys within areas of assessment.

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_392.mxd 05/08/2019 17:37

0 2,000 4,000 Metres

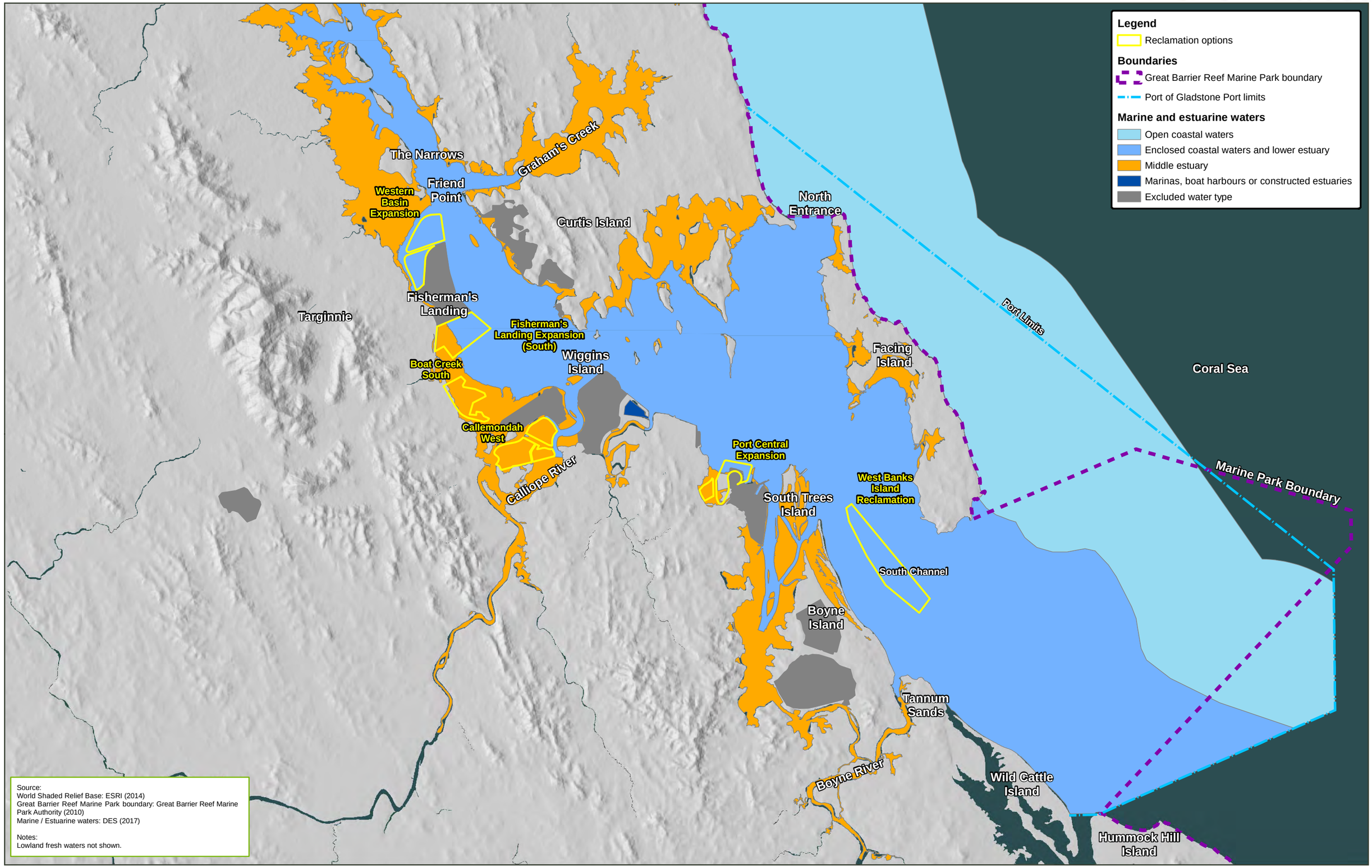
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A4: Migratory shorebird habitat

aurecon



Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Marine / Estuarine waters: DES (2017)

Notes:
Lowland fresh waters not shown.

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_393.mxd 05/08/2019 17:38

0 2,000 4,000 Metres

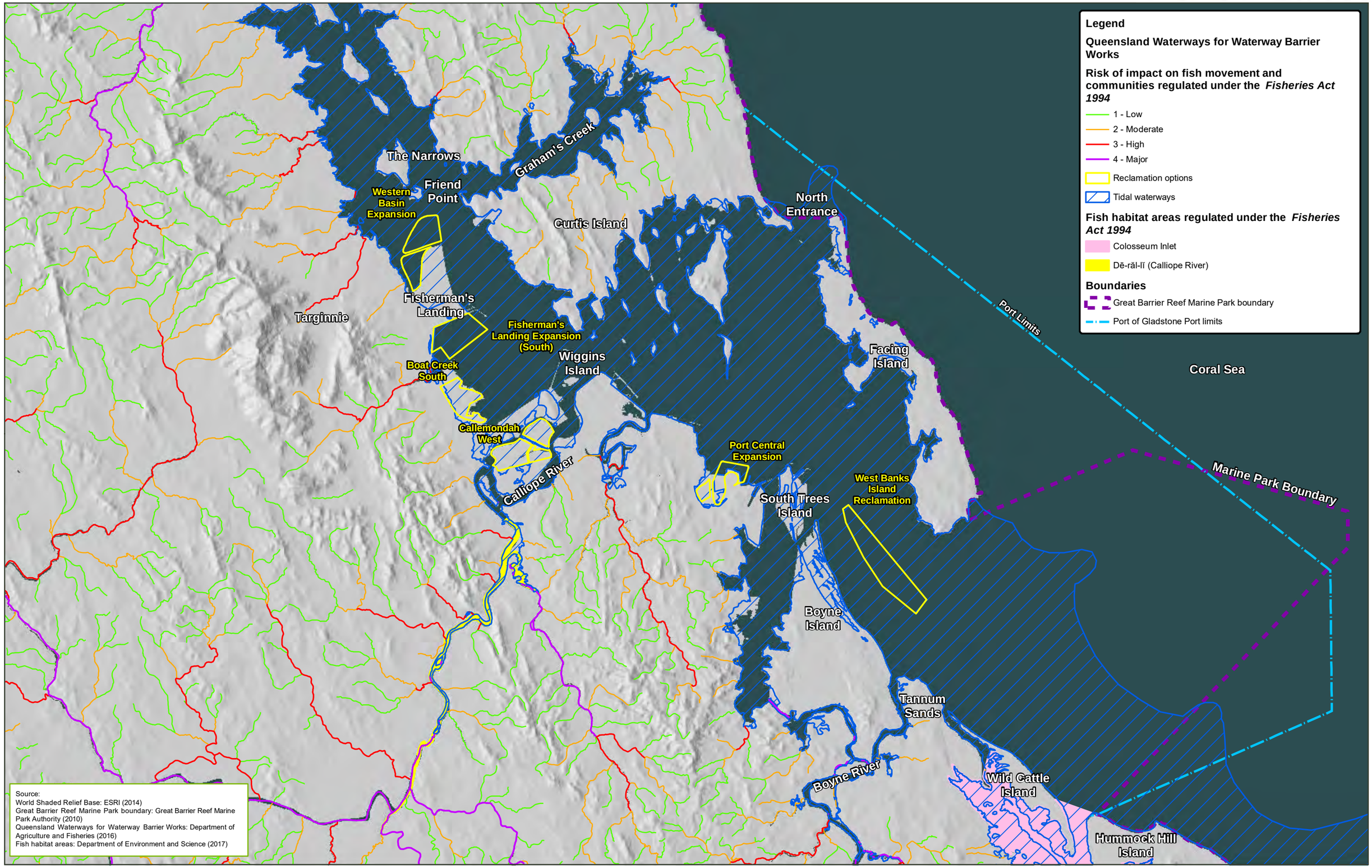
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A5: Marine and estuarine water types

aurecon



Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Queensland Waterways for Waterway Barrier Works: Department of Agriculture and Fisheries (2016)
Fish habitat areas: Department of Environment and Science (2017)

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_394.mxd 05/08/2019 17:40

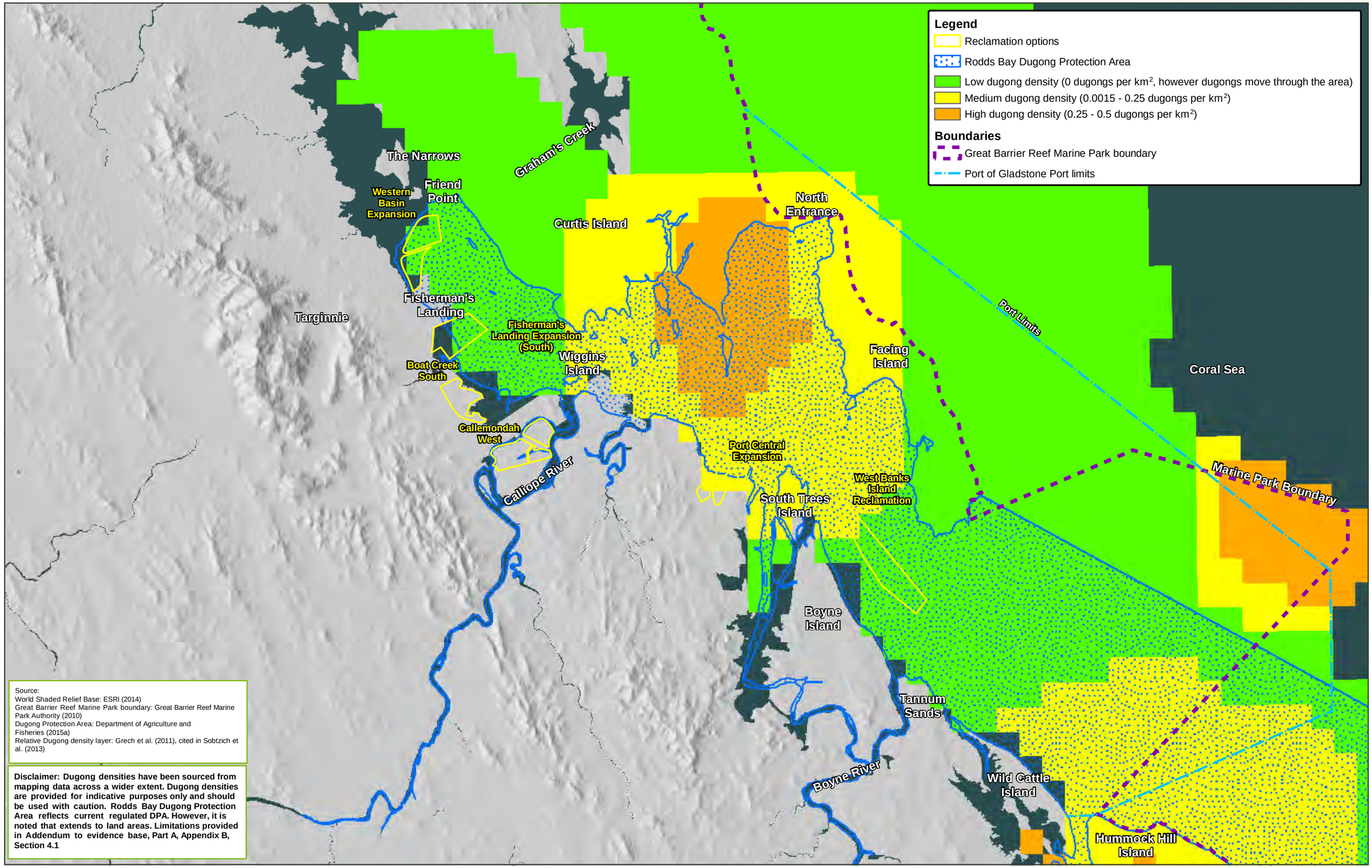
0 2,000 4,000 Metres

Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A6: Fish habitat areas and waterways providing for fish passage



Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Dugong Protection Area: Department of Agriculture and Fisheries (2015a)
Relative Dugong density layer: Grech et al. (2011), cited in Sobtzich et al. (2013)

Disclaimer: Dugong densities have been sourced from mapping data across a wider extent. Dugong densities are provided for indicative purposes only and should be used with caution. Rodds Bay Dugong Protection Area reflects current regulated DPA. However, it is noted that extends to land areas. Limitations provided in Addendum to evidence base, Part A, Appendix B, Section 4.1

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_395.mxd 05/08/2019 17:41

0 2,000 4,000 Metres

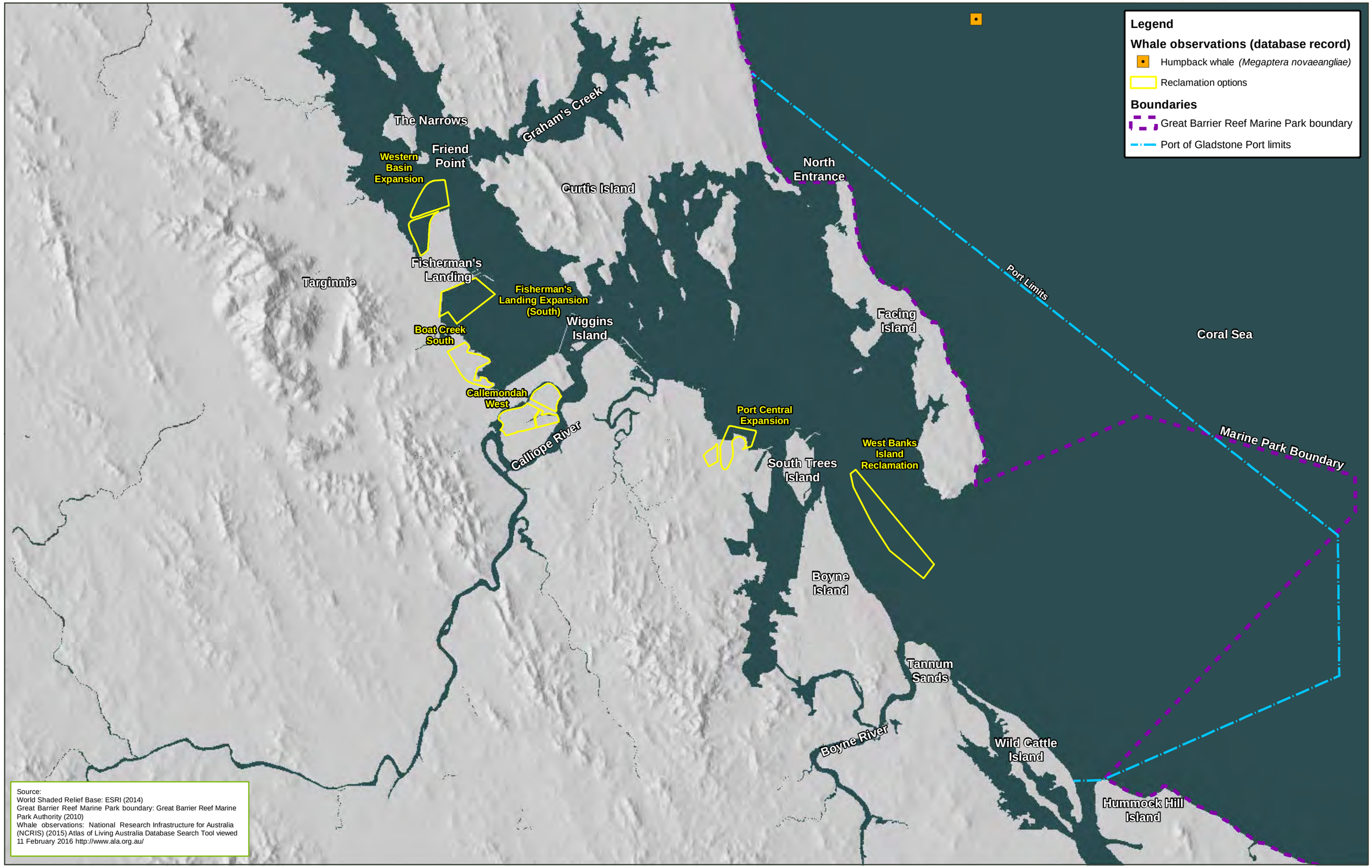
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A7: Rodds Bay Dugong Protection Area and relative Dugong density based on aerial surveys (1986 to 2005)

aurecon



Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Whale observations: National Research Infrastructure for Australia (NCRIS) (2015) Atlas of Living Australia Database Search Tool viewed 11 February 2016 http://www.ala.org.au/

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_396.mxd 05/08/2019 17:45

0 2,500 5,000 Meters

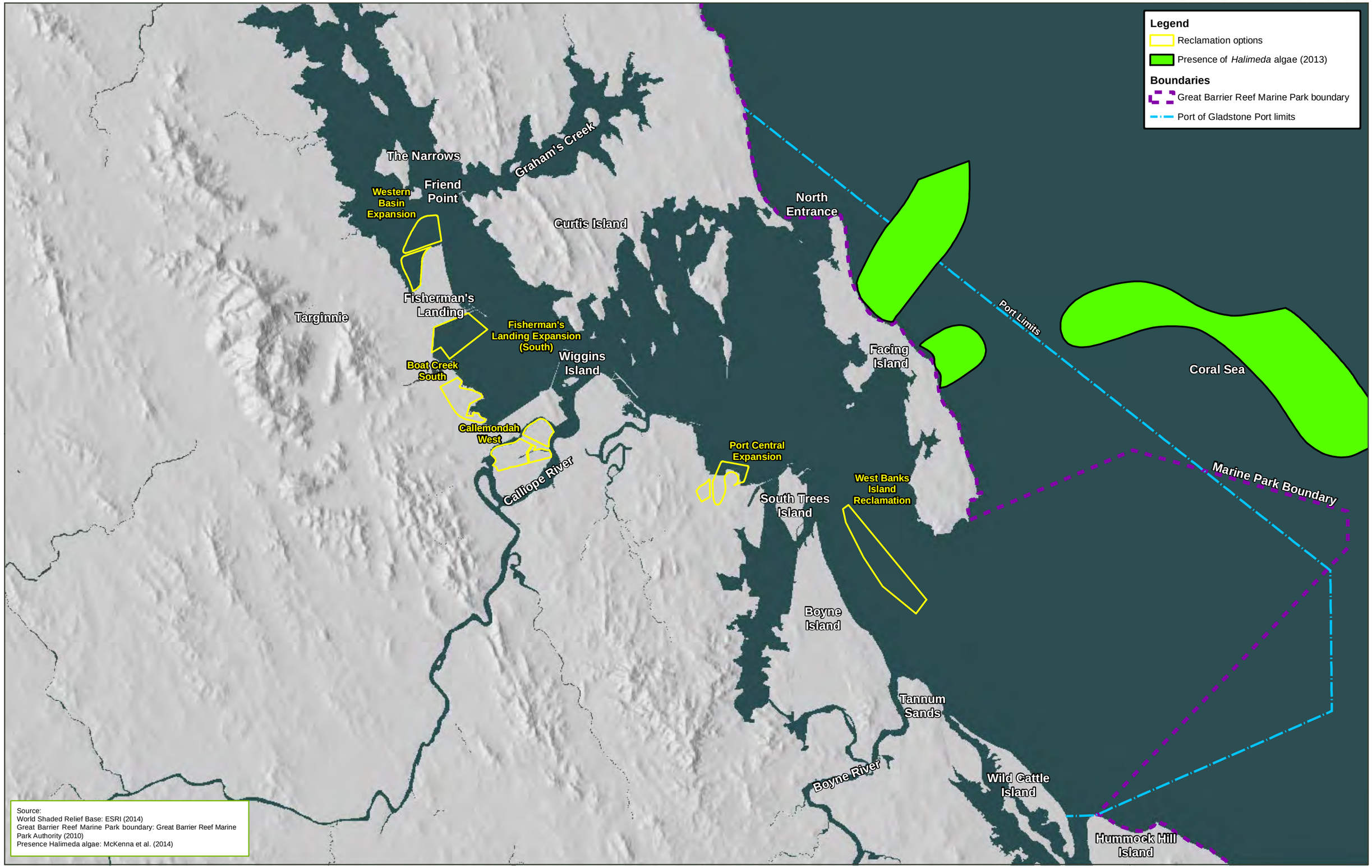
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A8: Migrating whales

aurecon



Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Presence Halimeda algae: McKenna et al. (2014)

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_397.mxd 05/08/2019 17:46

0 2,000 4,000 Metres

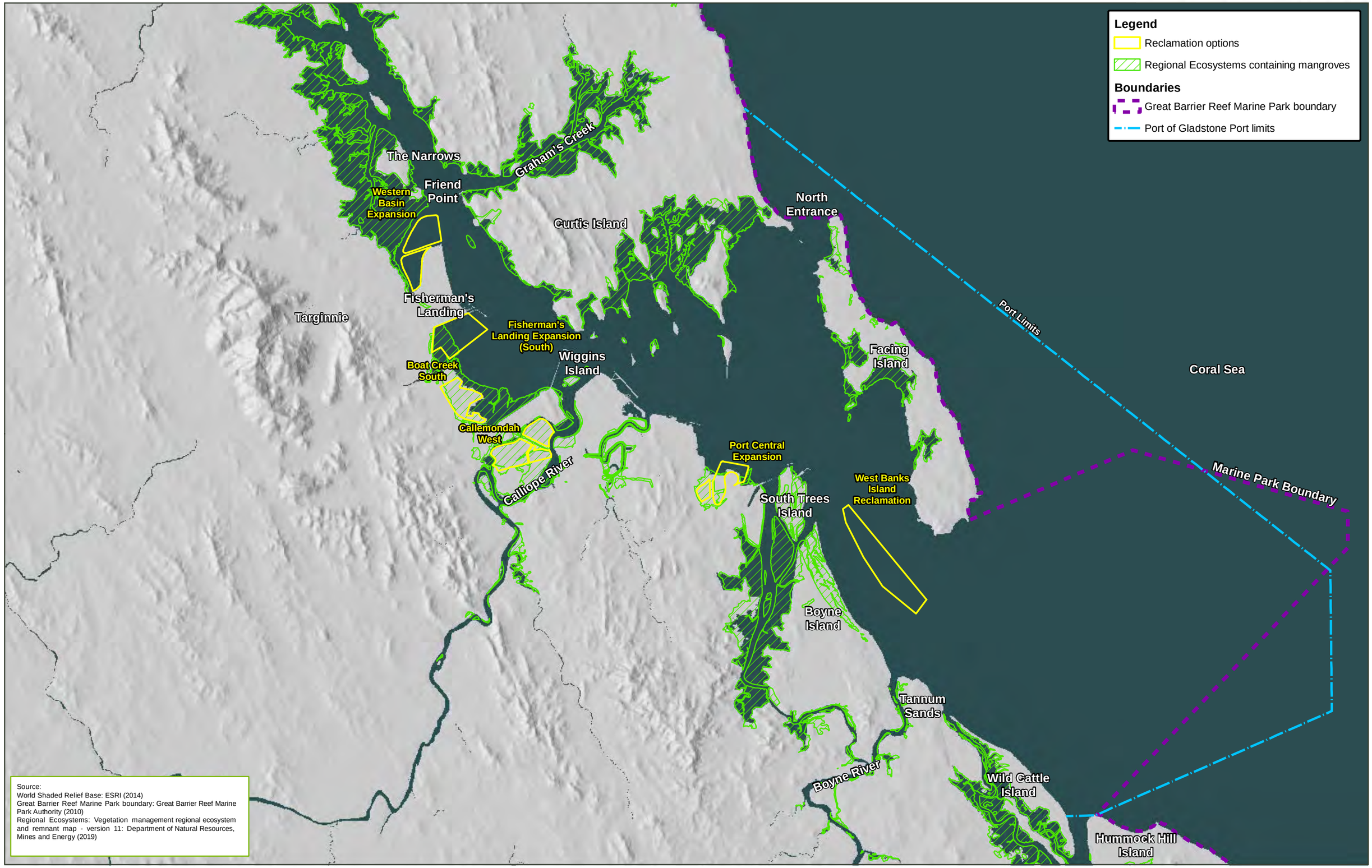
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A9: Presence of *Halimeda* algae

aurecon



Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Regional Ecosystems: Vegetation management regional ecosystem and remnant map - version 11: Department of Natural Resources, Mines and Energy (2019)

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_398.mxd 05/08/2019 17:48

0 2,000 4,000 Metres

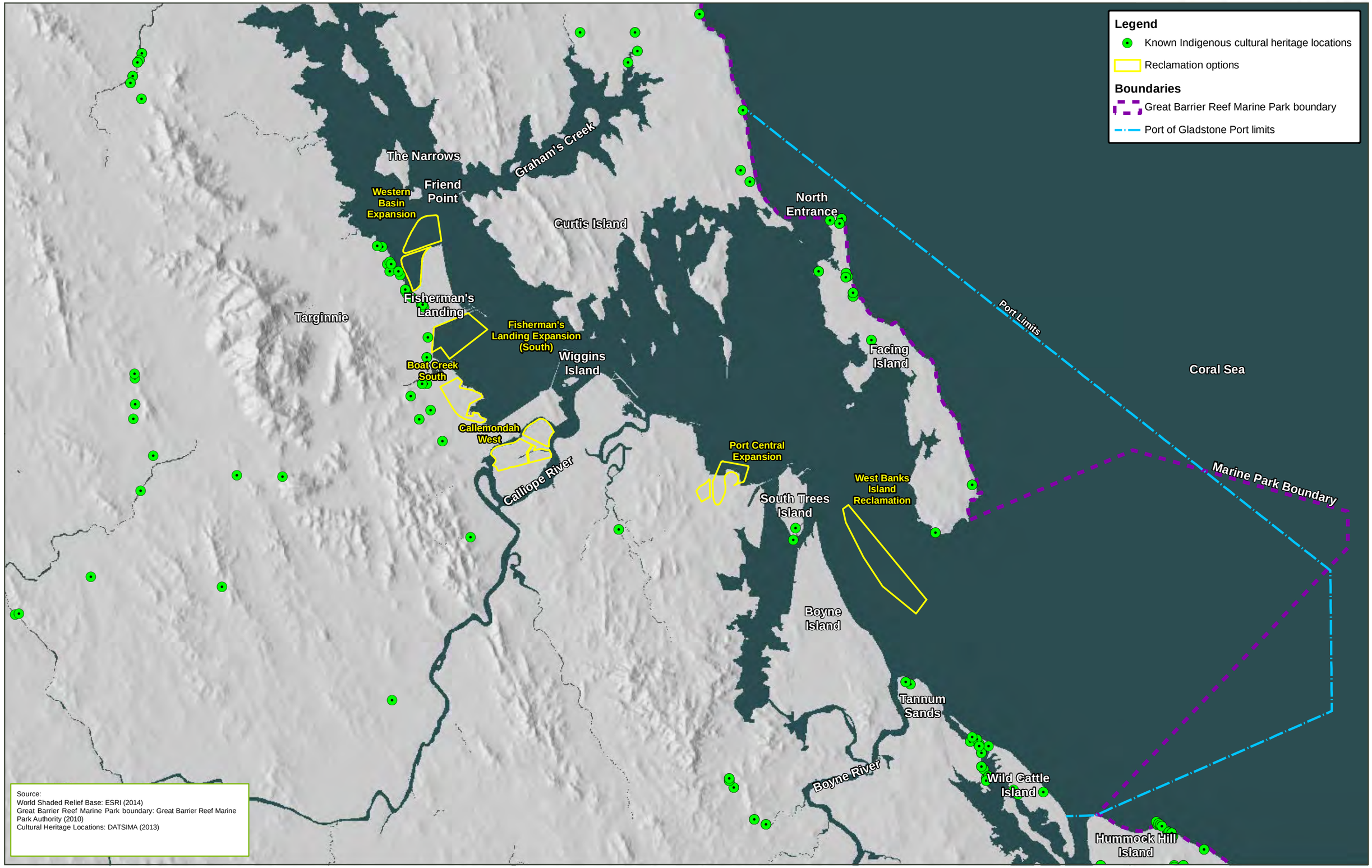
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A10: Regional Ecosystems containing mangrove communities

aurecon



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Map by: RB

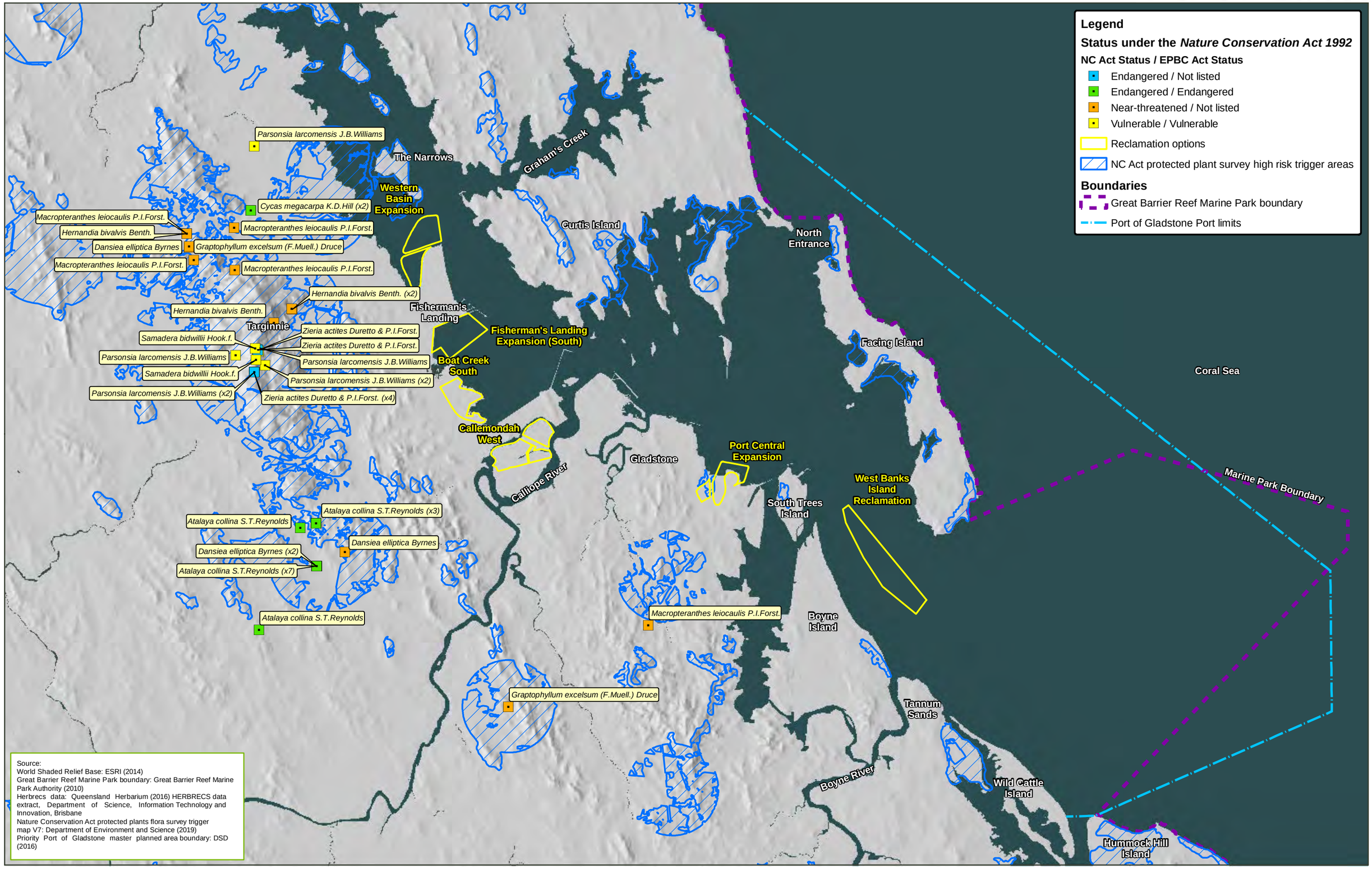
0 2,000 4,000 Metres

Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A11: Known Indigenous cultural heritage sites regulated under the *Aboriginal Cultural Heritage Act 2003*



Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_400.mxd 05/08/2019 17:50

0 2,000 4,000 Metres

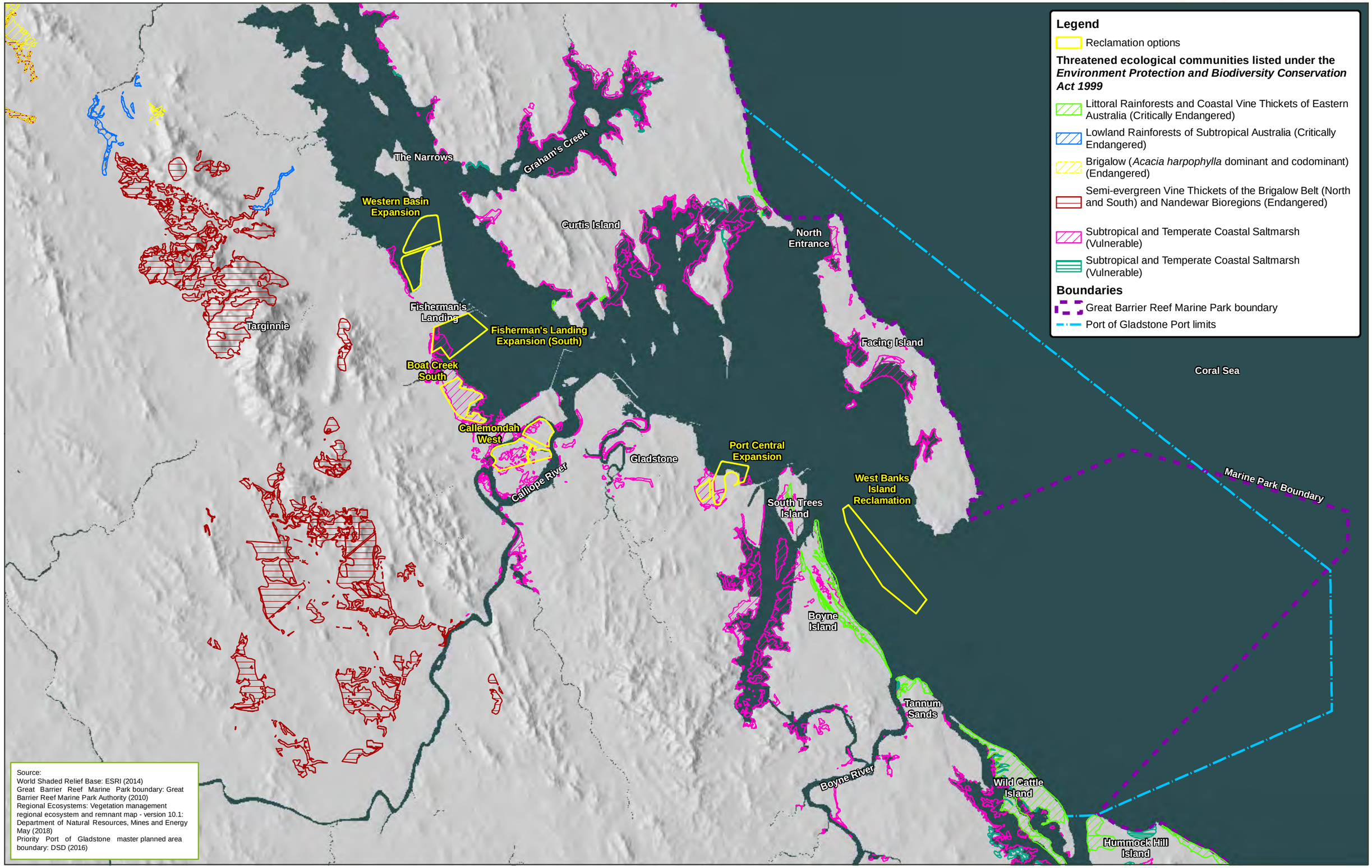
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A12: *Nature Conservation Act 1992* listed threatened flora species records from Herbrecs database and protected plant survey 'high risk' trigger areas

aurecon



Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Regional Ecosystems: Vegetation management regional ecosystem and remnant map - version 10.1: Department of Natural Resources, Mines and Energy May (2018)
Priority Port of Gladstone master planned area boundary: DSD (2016)

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_401.mxd 05/08/2019 17:51

0 2,000 4,000 Meters

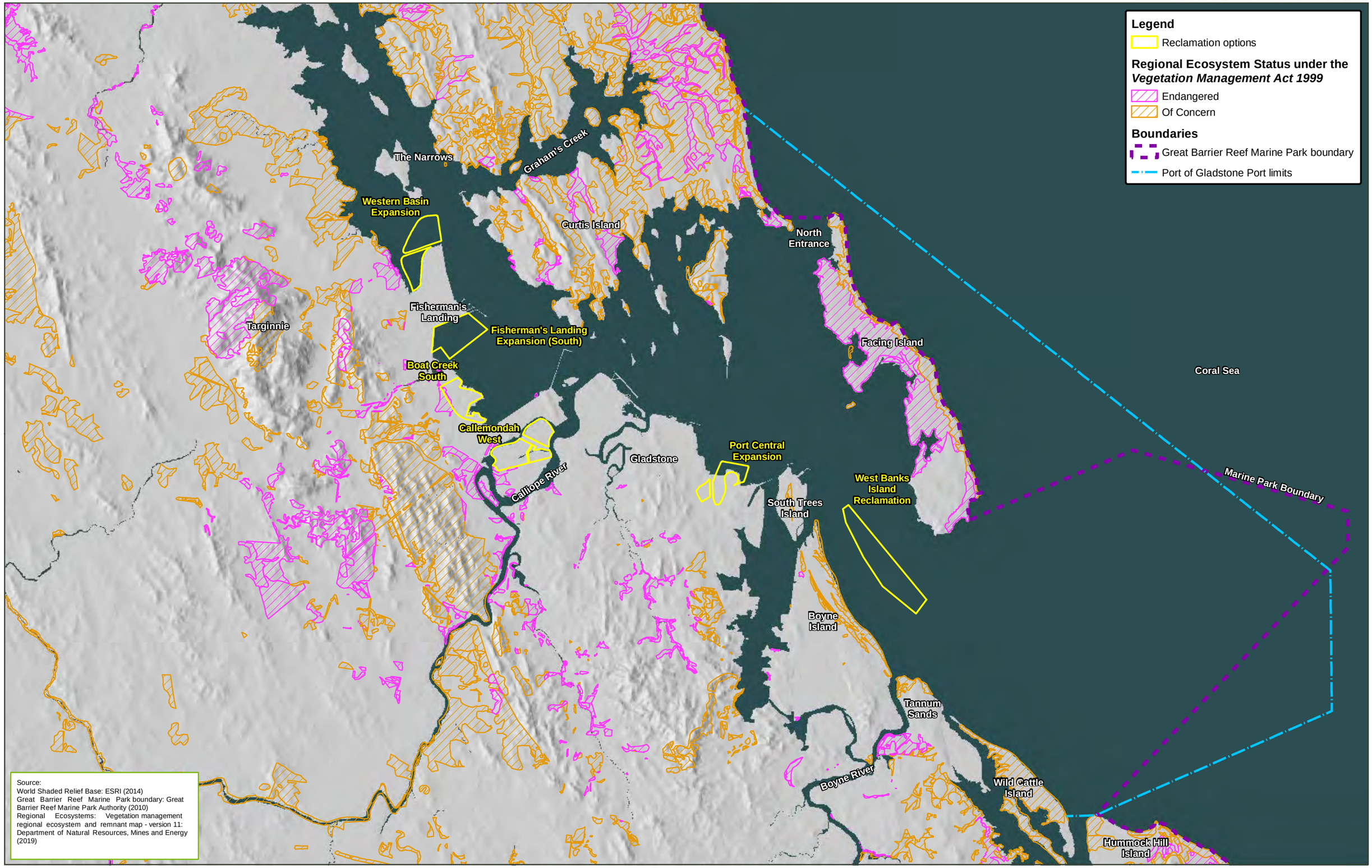
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A13: Threatened ecological communities listed under the *Environment Protection and Biodiversity Conservation Act 1999*

aurecon



Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Regional Ecosystems: Vegetation management regional ecosystem and remnant map - version 11: Department of Natural Resources, Mines and Energy (2019)

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_402.mxd 05/08/2019 17:52

0 2,000 4,000 Metres

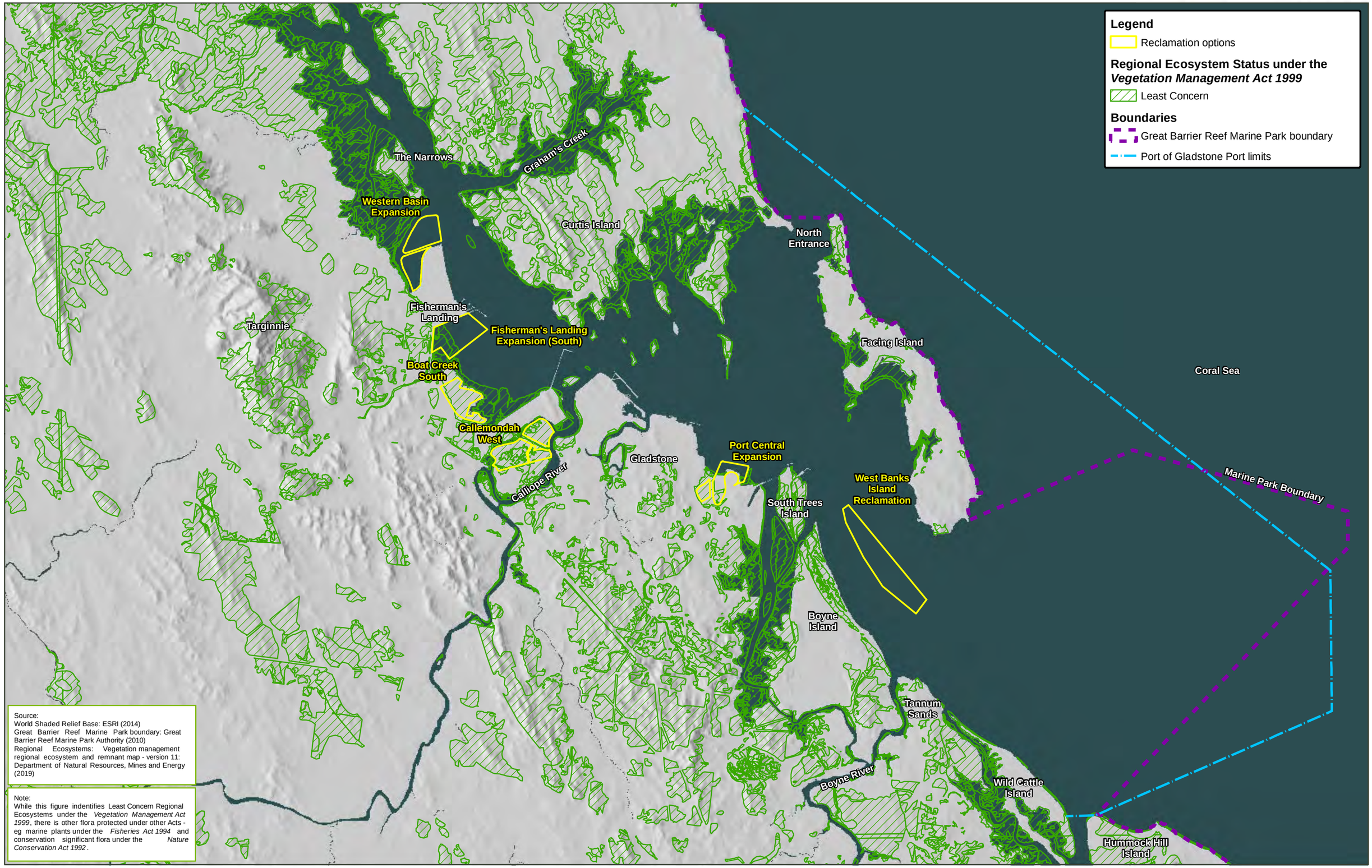
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A14: Endangered and Of concern Regional Ecosystems as listed under the *Vegetation Management Act 1999*

aurecon



Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Regional Ecosystems: Vegetation management regional ecosystem and remnant map - version 11: Department of Natural Resources, Mines and Energy (2019)

Note:
While this figure indentifies Least Concern Regional Ecosystems under the *Vegetation Management Act 1999*, there is other flora protected under other Acts - eg marine plants under the *Fisheries Act 1994* and conservation significant flora under the *Nature Conservation Act 1992*.

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_403.mxd 05/08/2019 17:53

0 2,000 4,000 Metres

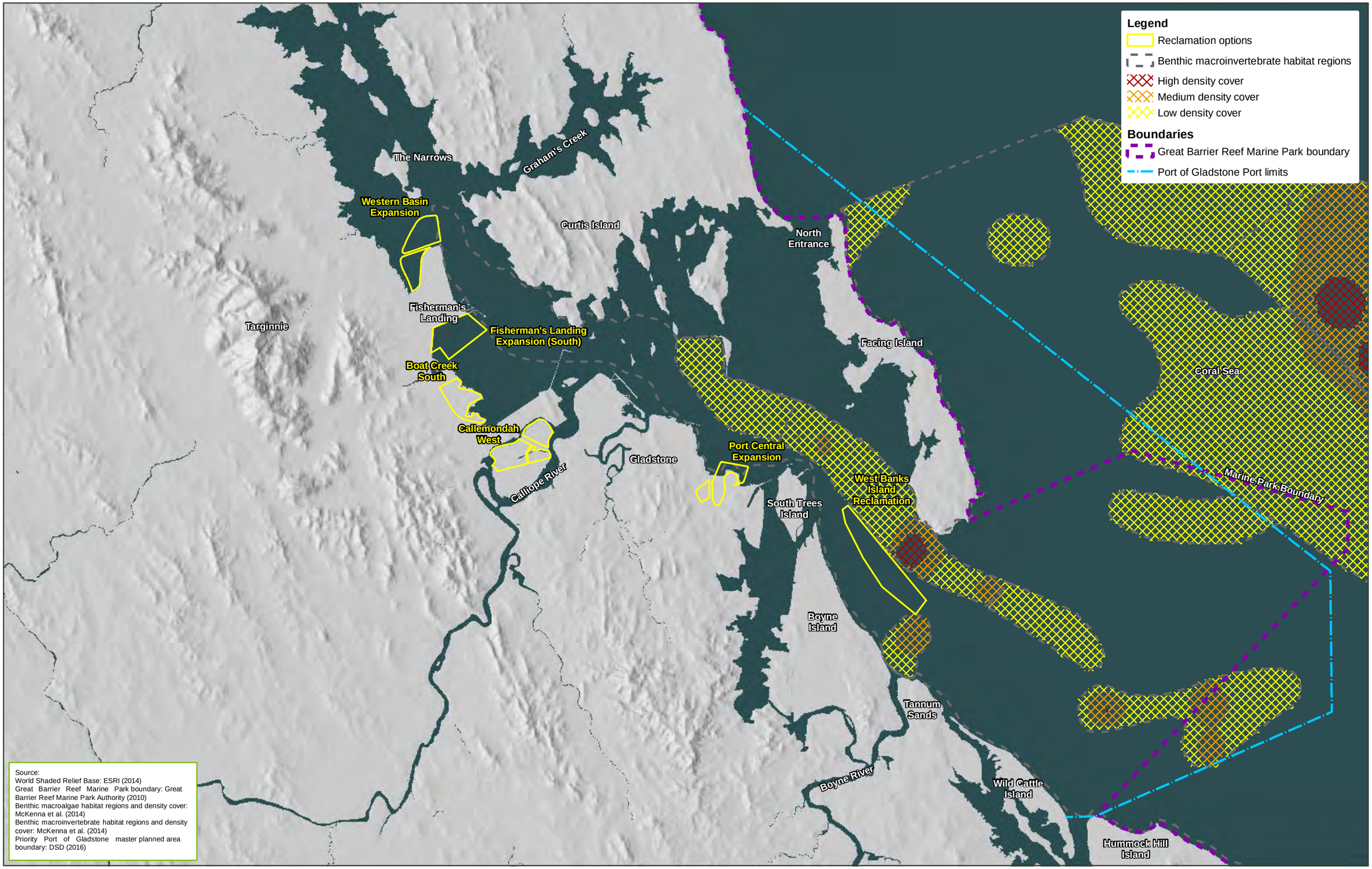
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A15: Least concern Regional Ecosystems as listed under the *Vegetation Management Act 1999*

aurecon



Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Benthic macroalgae habitat regions and density cover: McKenna et al. (2014)
Benthic macroinvertebrate habitat regions and density cover: McKenna et al. (2014)
Priority Port of Gladstone master planned area boundary: DSD (2016)

Map by: RB
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0 2,000 4,000 Metres

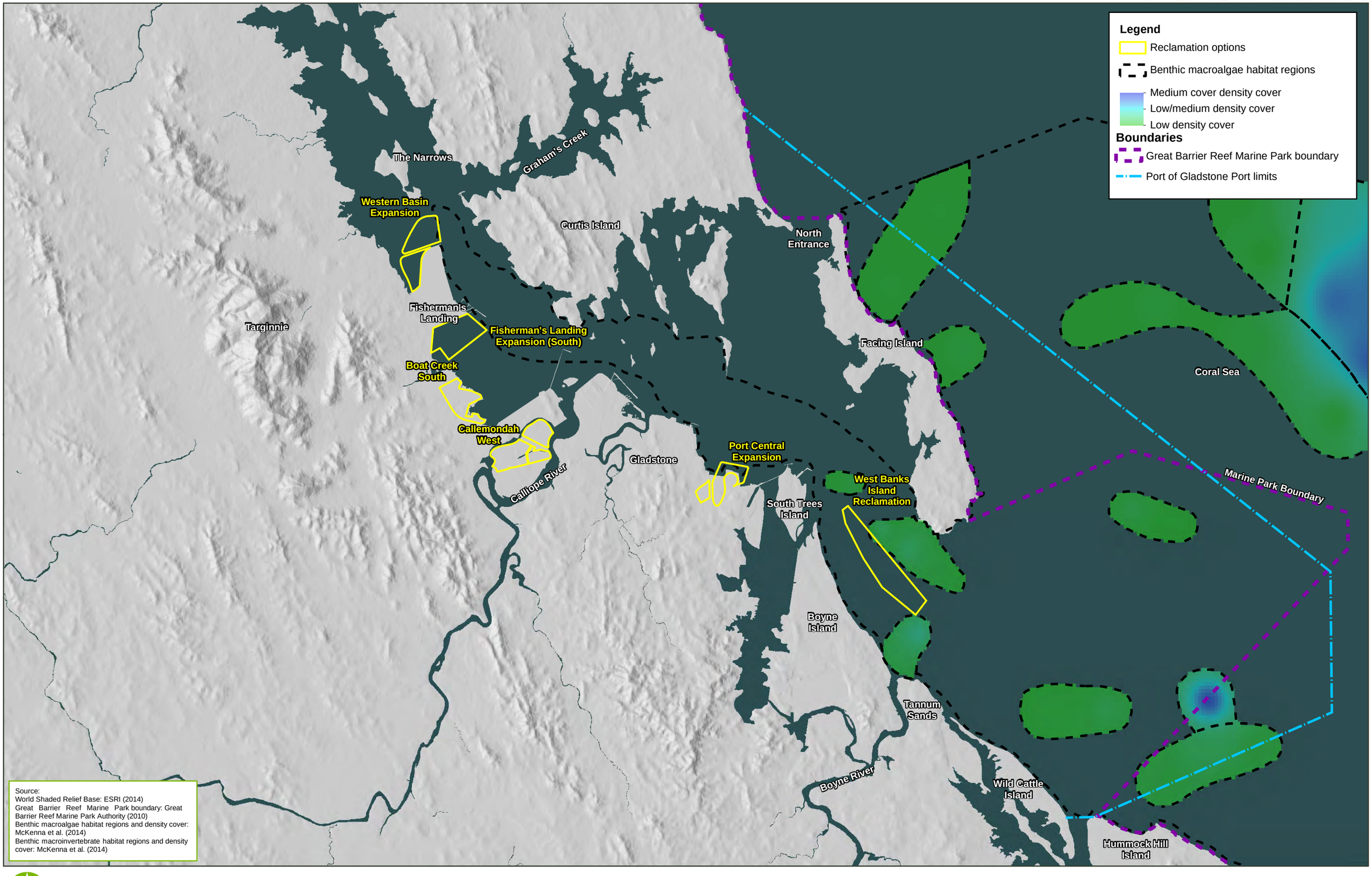
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A16: Benthic macroalgae and macroinvertebrate distribution and density

aurecon



Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Benthic macroalgae habitat regions and density cover: McKenna et al. (2014)
Benthic macroinvertebrate habitat regions and density cover: McKenna et al. (2014)

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_405.mxd 05/08/2019 17:55

0 2,000 4,000 Metres

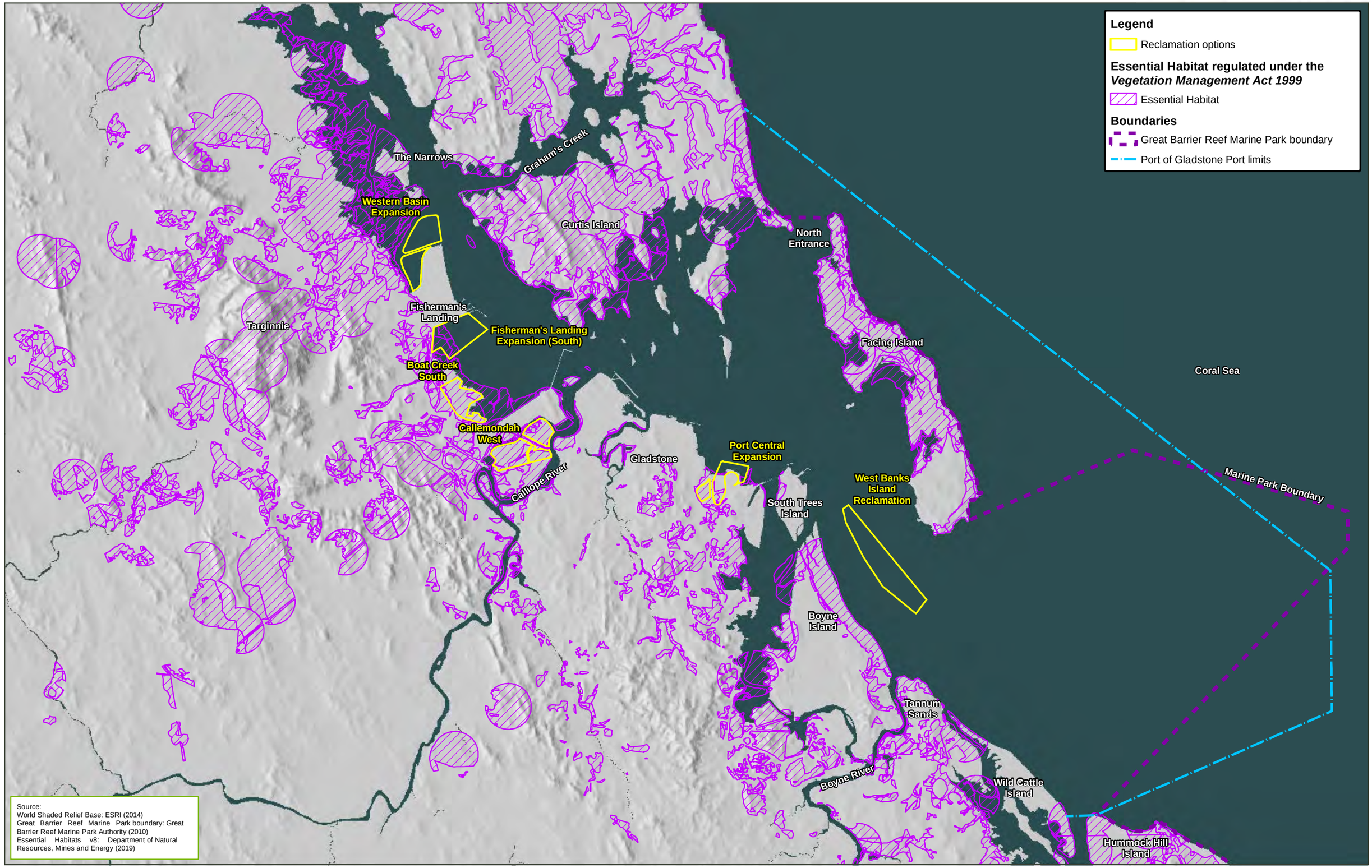
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A16: Benthic macroalgae and macroinvertebrate distribution and density

aurecon



Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Essential Habitats v8: Department of Natural Resources, Mines and Energy (2019)

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_406.mxd 05/08/2019 17:56

0 2,000 4,000 Metres

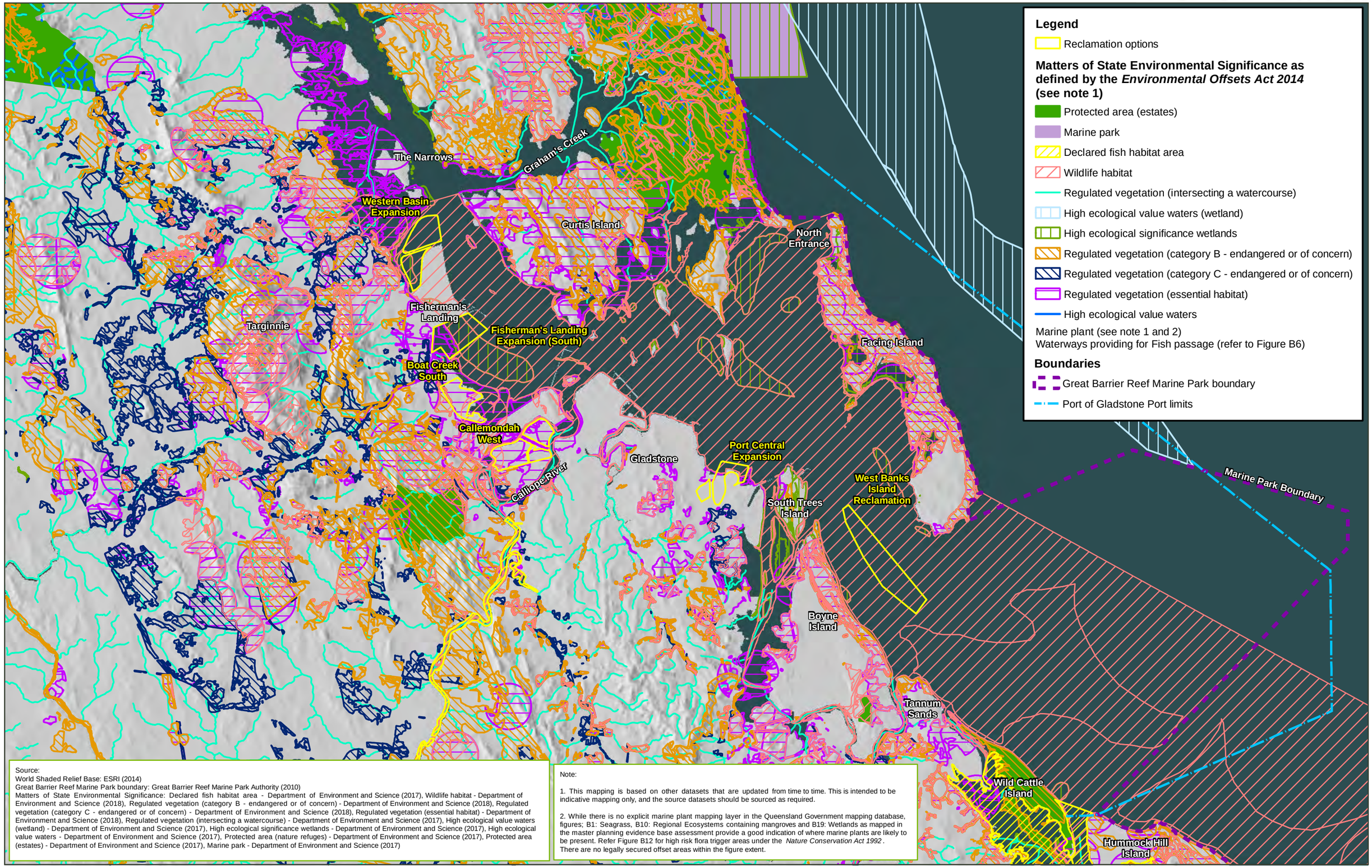
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A17: Essential Habitat for threatened terrestrial flora and fauna species regulated under the *Vegetation Management Act 1999*

aurecon



Legend

- Reclamation options

Matters of State Environmental Significance as defined by the *Environmental Offsets Act 2014* (see note 1)

- Protected area (estates)
- Marine park
- Declared fish habitat area
- Wildlife habitat
- Regulated vegetation (intersecting a watercourse)
- High ecological value waters (wetland)
- High ecological significance wetlands
- Regulated vegetation (category B - endangered or of concern)
- Regulated vegetation (category C - endangered or of concern)
- Regulated vegetation (essential habitat)
- High ecological value waters

Marine plant (see note 1 and 2)
Waterways providing for Fish passage (refer to Figure B6)

Boundaries

- Great Barrier Reef Marine Park boundary
- Port of Gladstone Port limits

Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Matters of State Environmental Significance: Declared fish habitat area - Department of Environment and Science (2017), Wildlife habitat - Department of Environment and Science (2018), Regulated vegetation (category B - endangered or of concern) - Department of Environment and Science (2018), Regulated vegetation (category C - endangered or of concern) - Department of Environment and Science (2018), Regulated vegetation (essential habitat) - Department of Environment and Science (2018), Regulated vegetation (intersecting a watercourse) - Department of Environment and Science (2017), High ecological value waters (wetland) - Department of Environment and Science (2017), High ecological significance wetlands - Department of Environment and Science (2017), High ecological value waters - Department of Environment and Science (2017), Protected area (nature refuges) - Department of Environment and Science (2017), Protected area (estates) - Department of Environment and Science (2017), Marine park - Department of Environment and Science (2017)

Note:

1. This mapping is based on other datasets that are updated from time to time. This is intended to be indicative mapping only, and the source datasets should be sourced as required.

2. While there is no explicit marine plant mapping layer in the Queensland Government mapping database, figures; B1: Seagrass, B10: Regional Ecosystems containing mangroves and B19: Wetlands as mapped in the master planning evidence base assessment provide a good indication of where marine plants are likely to be present. Refer Figure B12 for high risk flora trigger areas under the *Nature Conservation Act 1992*. There are no legally secured offset areas within the figure extent.

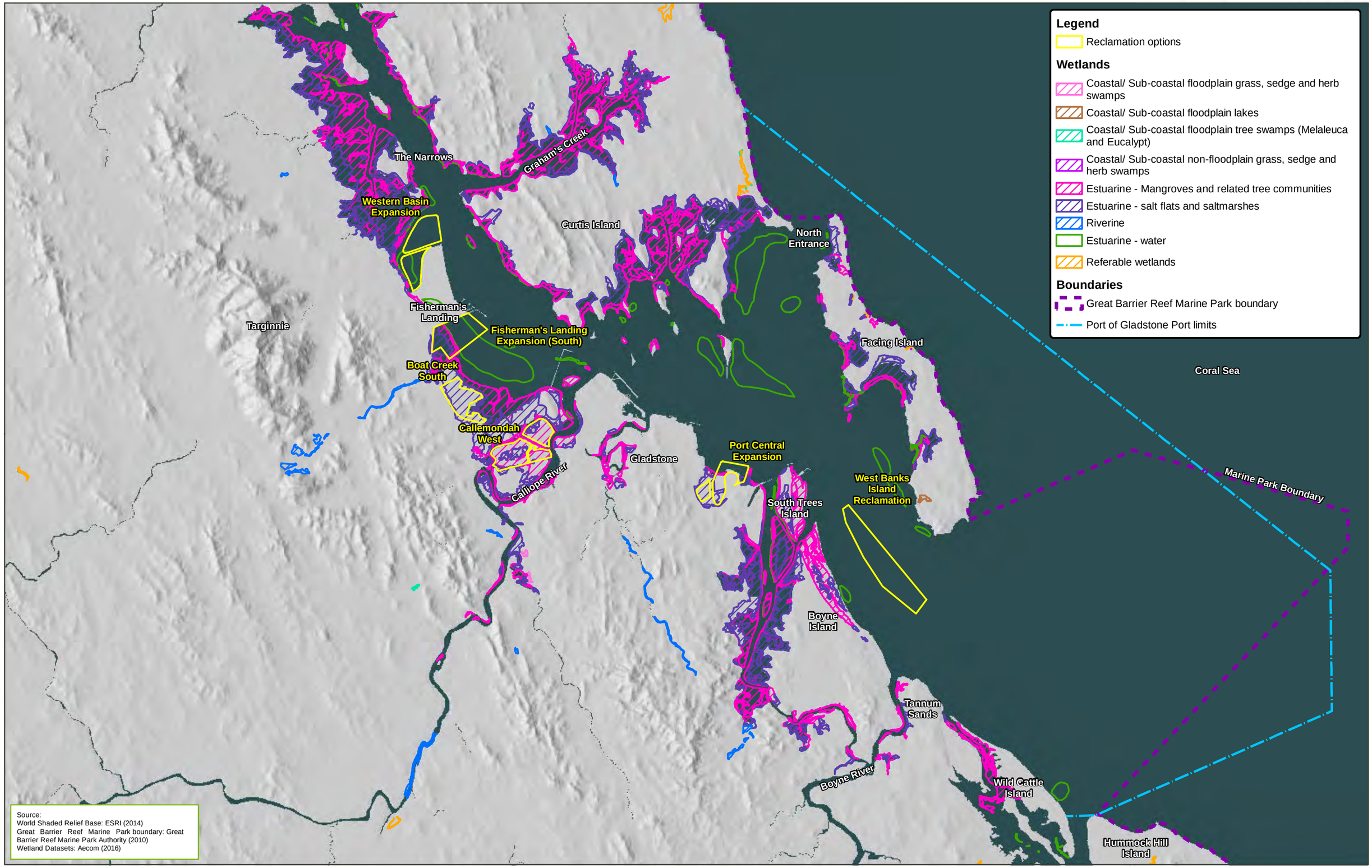
Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_407.mxd 05/08/2019 17:58

Metres
0 2,000 4,000

Date: 05/08/2019 Version: 1 Job No: 237374
Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A18: Matters of state environmental significance defined under the *Environmental Offsets Act 2014*



Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_408.mxd 05/08/2019 17:59

0 2,000 4,000 Metres

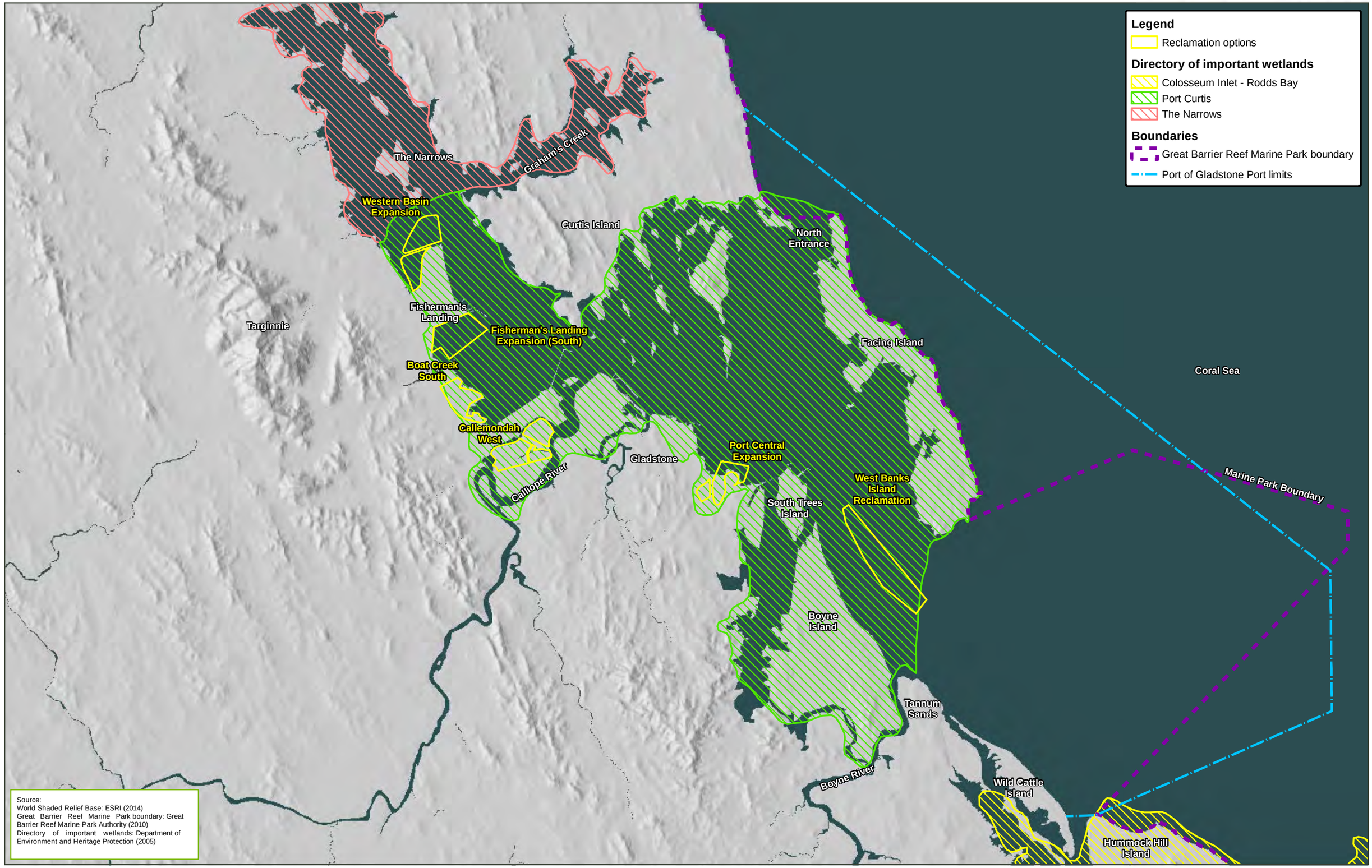
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A19: Wetlands as mapped in the Master Planning Evidence Base Assessment

aurecon



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Map by: RB

0 2,000 4,000 Metres

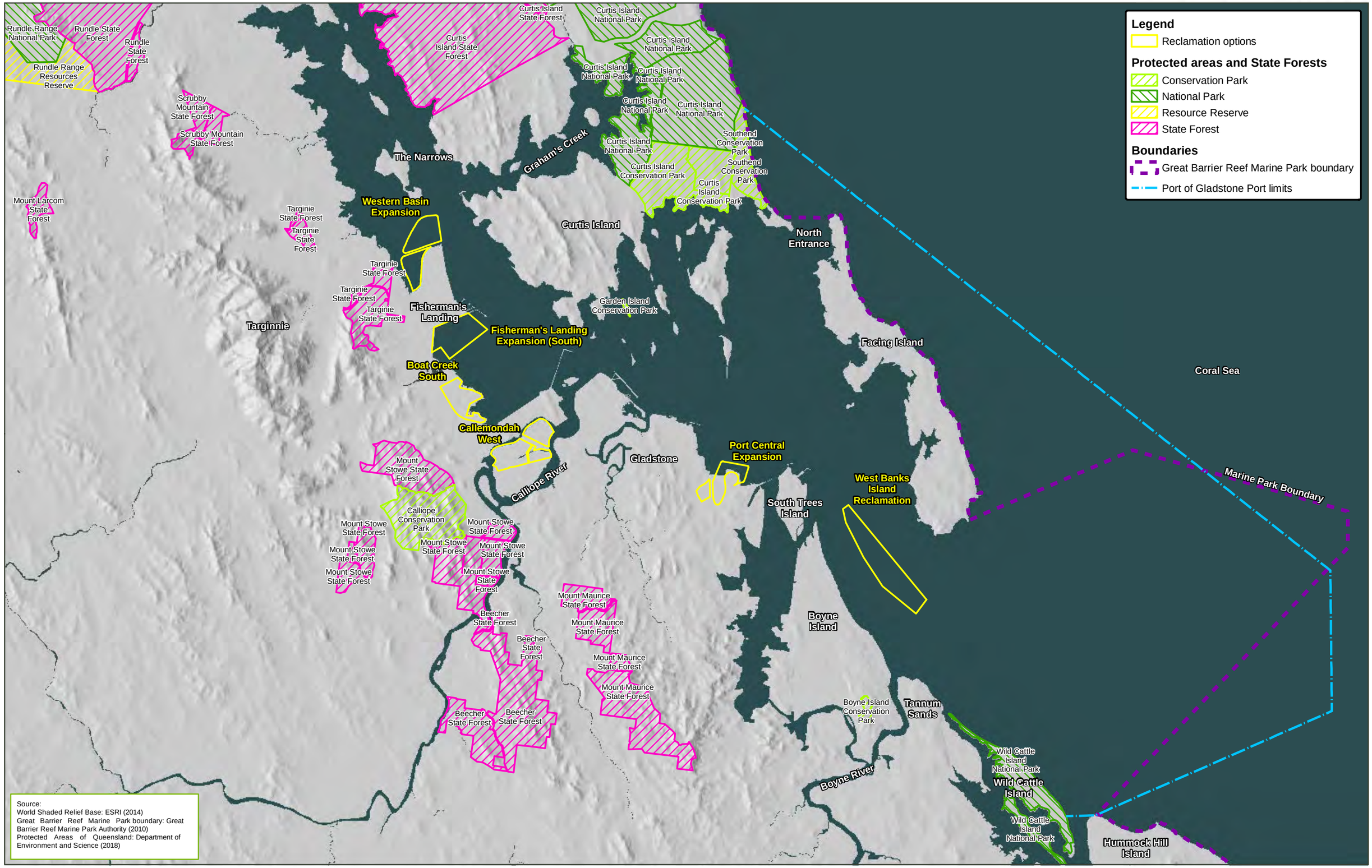
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A20: Directory of important wetlands

aurecon



Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_410.mxd 05/08/2019 18:01

0 2,000 4,000 Metres

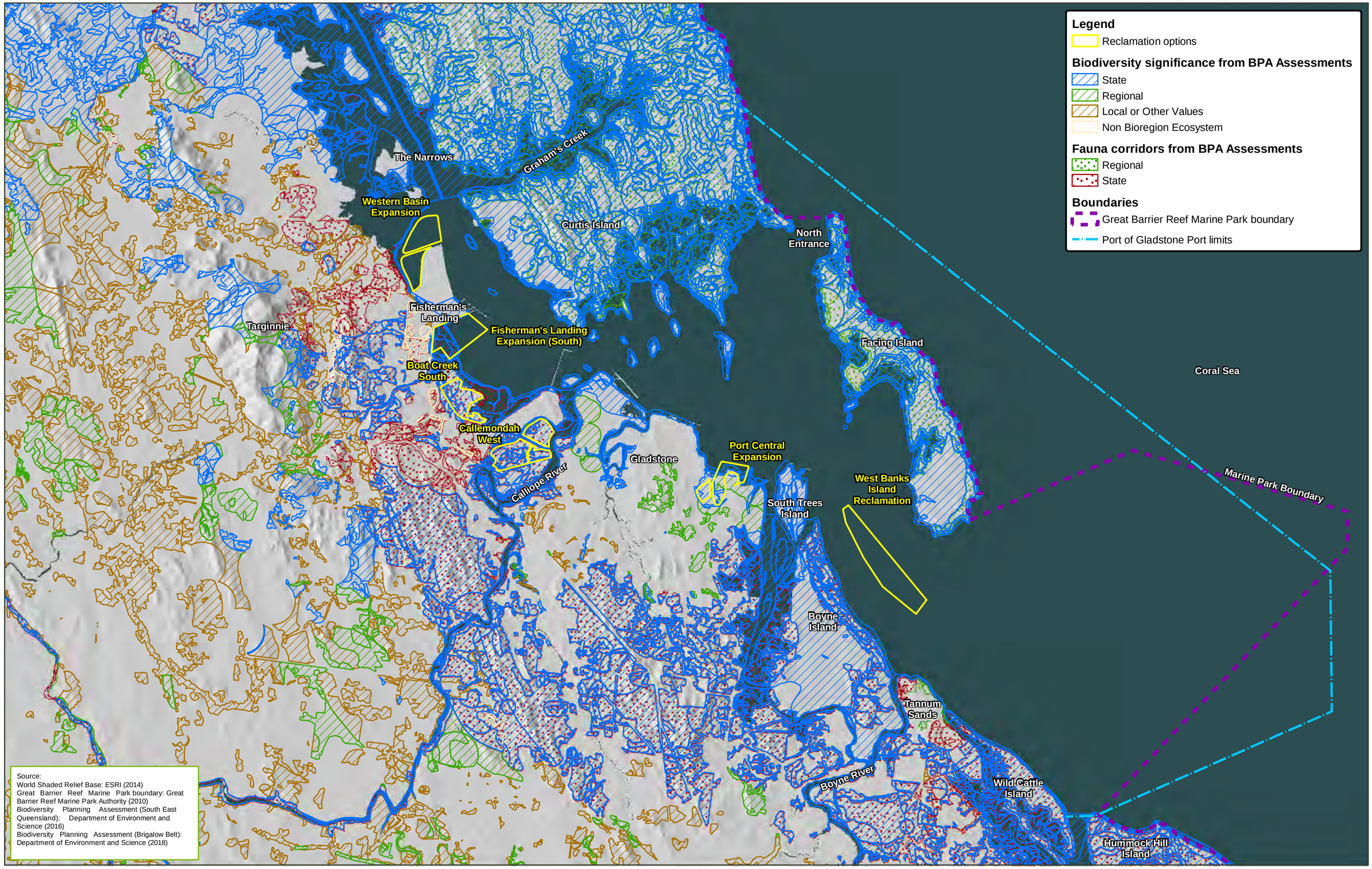
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A21: Protected areas regulated under the *Nature Conservation Act 1992* and State Forests regulated under the *Forestry Act 1959*

aurecon



Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_411.mxd 05/08/2019 18:02

0 2,000 4,000 Metres

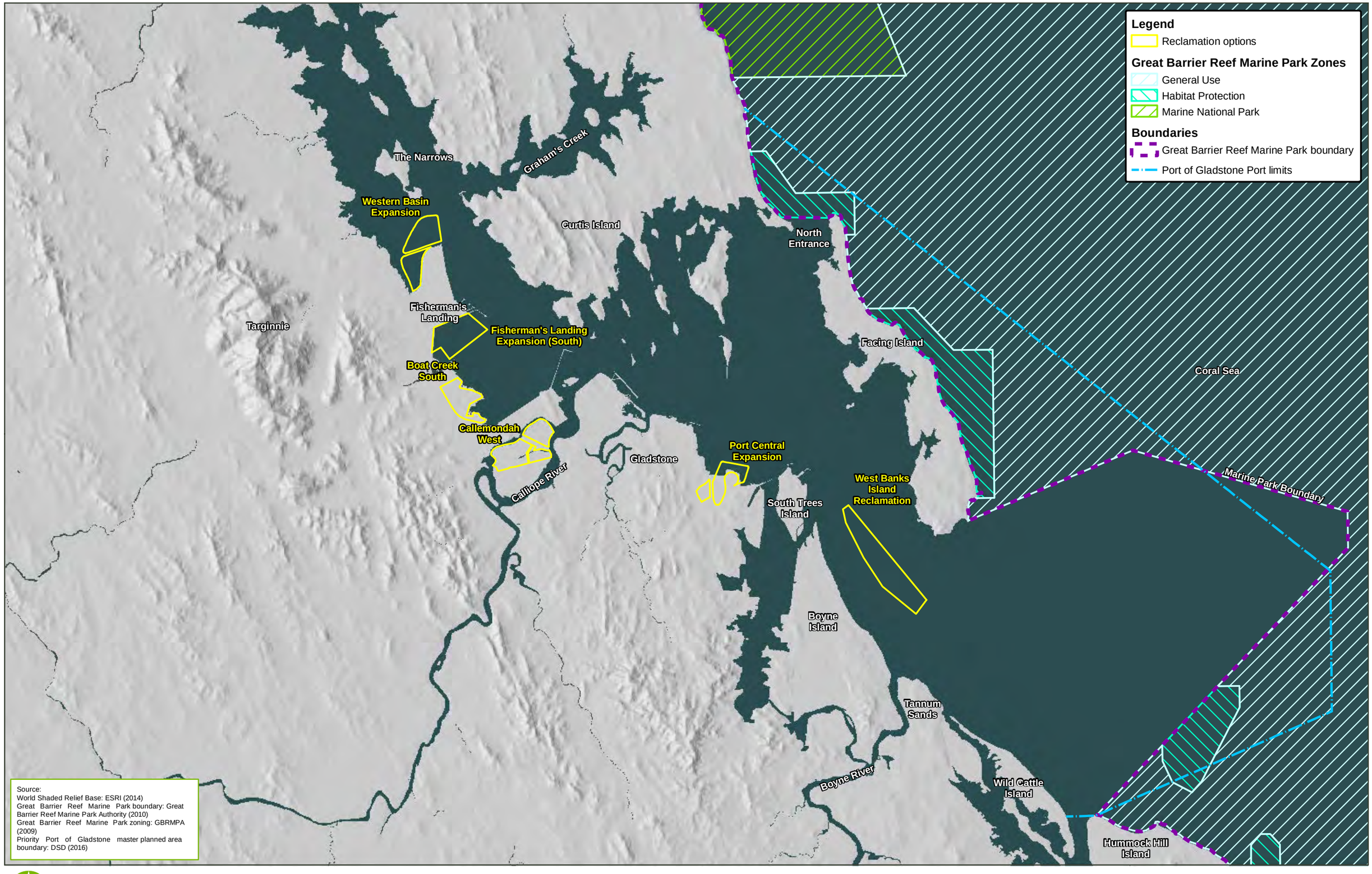
Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A22: Biodiversity Planning Assessment areas mapped using the Biodiversity Assessment and Mapping Methodology

aurecon



Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Great Barrier Reef Marine Park zoning: GBRMPA (2009)
Priority Port of Gladstone master planned area boundary: DSD (2016)

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_412.mxd 05/08/2019 18:03

0 2,000 4,000 Metres

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Coordinate system: GDA 1994 MGA Zone 56

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Figure A23: Great Barrier Reef Marine Park Zones (Commonwealth)

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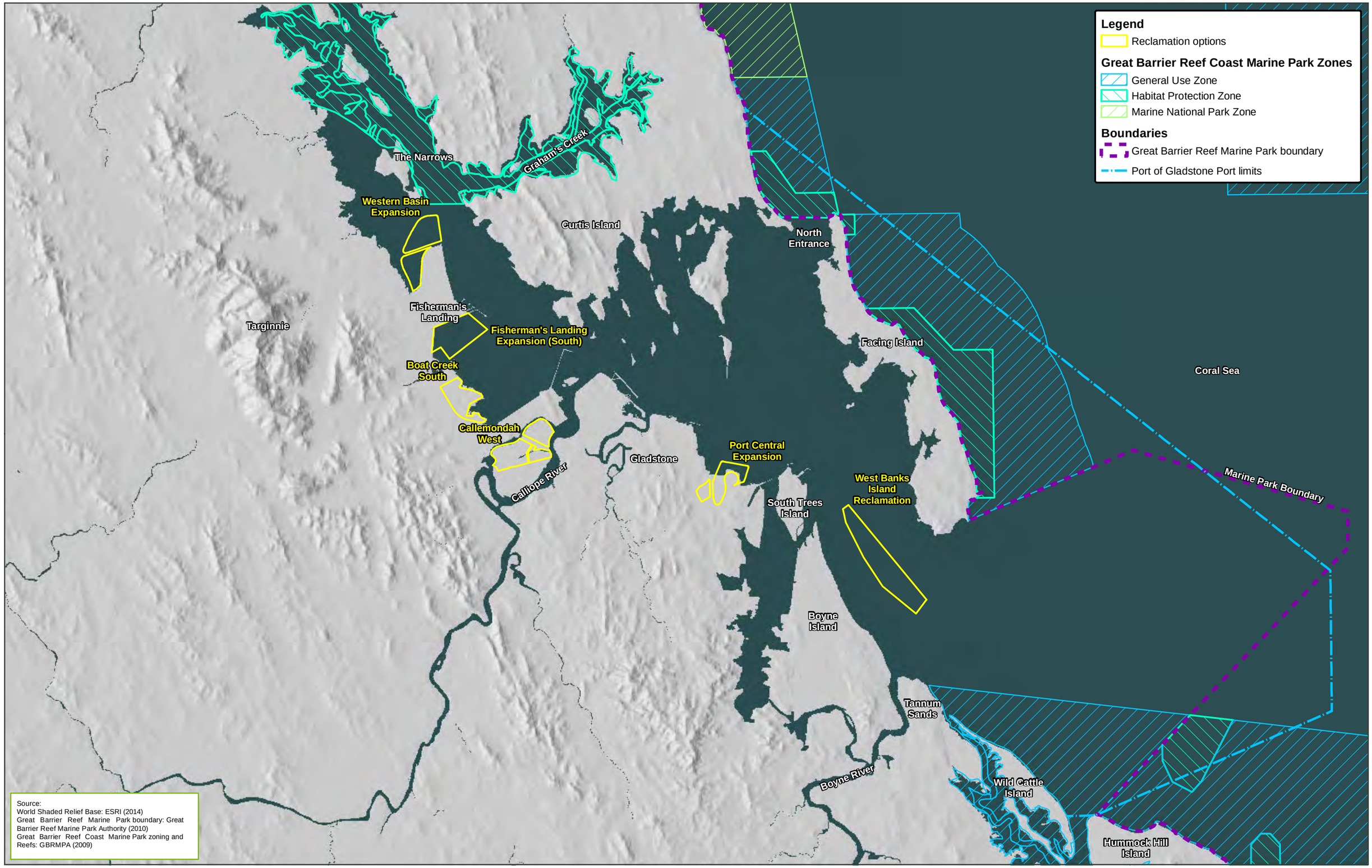

Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Great Barrier Reef Coast Marine Park zoning and Reefs: GBRMPA (2009)

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_413.mxd 05/08/2019 18:04

0 2,000 4,000 Metres

Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

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Figure A24: Great Barrier Reef Coast Marine Park Zones (State)

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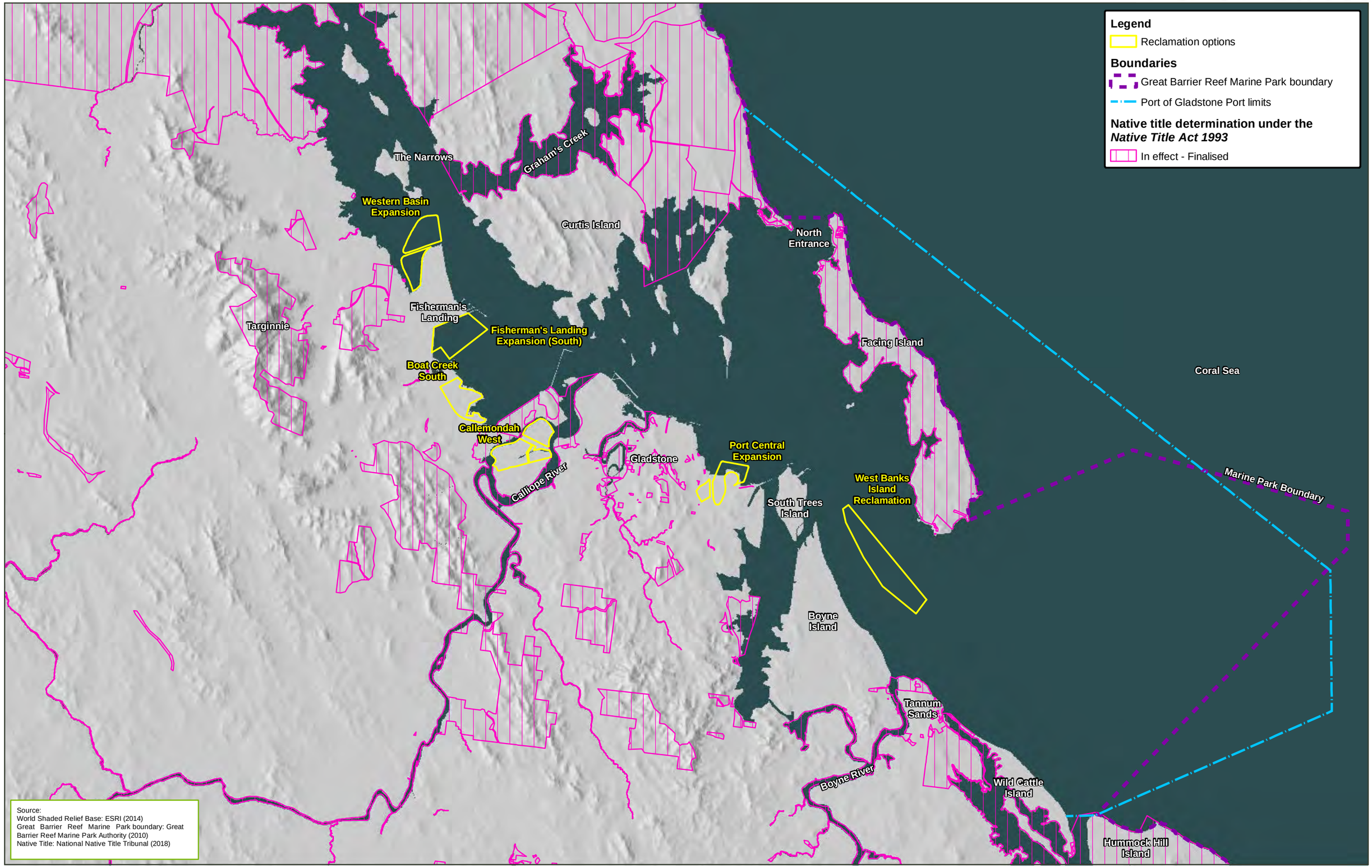

Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Native Title: National Native Title Tribunal (2018)

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_414.mxd 05/08/2019 18:05

0 2,000 4,000 Metres

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Figure A25: Native title determination under the *Native Title Act 1993*

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Legend
- Reclamation options
- Indigenous land use agreements coverage area

Boundaries
- Great Barrier Reef Marine Park boundary
- Port of Gladstone Port limits

The Narrows
Graham's Creek
Western Basin Expansion
Curtis Island
North Entrance
Fisherman's Landing
Targinnie
Fisherman's Landing Expansion (South)
Facing Island
Coral Sea
Boat Creek South
Callemondah West
Port Central Expansion
Gladstone
Calliope River
West Banks Island Reclamation
South Trees Island
Marine Park Boundary
Boyne Island
Tannum Sands
Boyne River
Wild Cattle Island
Hummock Hill Island

Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Indigenous land use agreements: NNTT (2018)

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_415.mxd 05/08/2019 18:06

0 2,000 4,000 Metres

Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

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Figure A26: Coverage of Indigenous land use agreements notified or registered under the *Native Title Act 1993*

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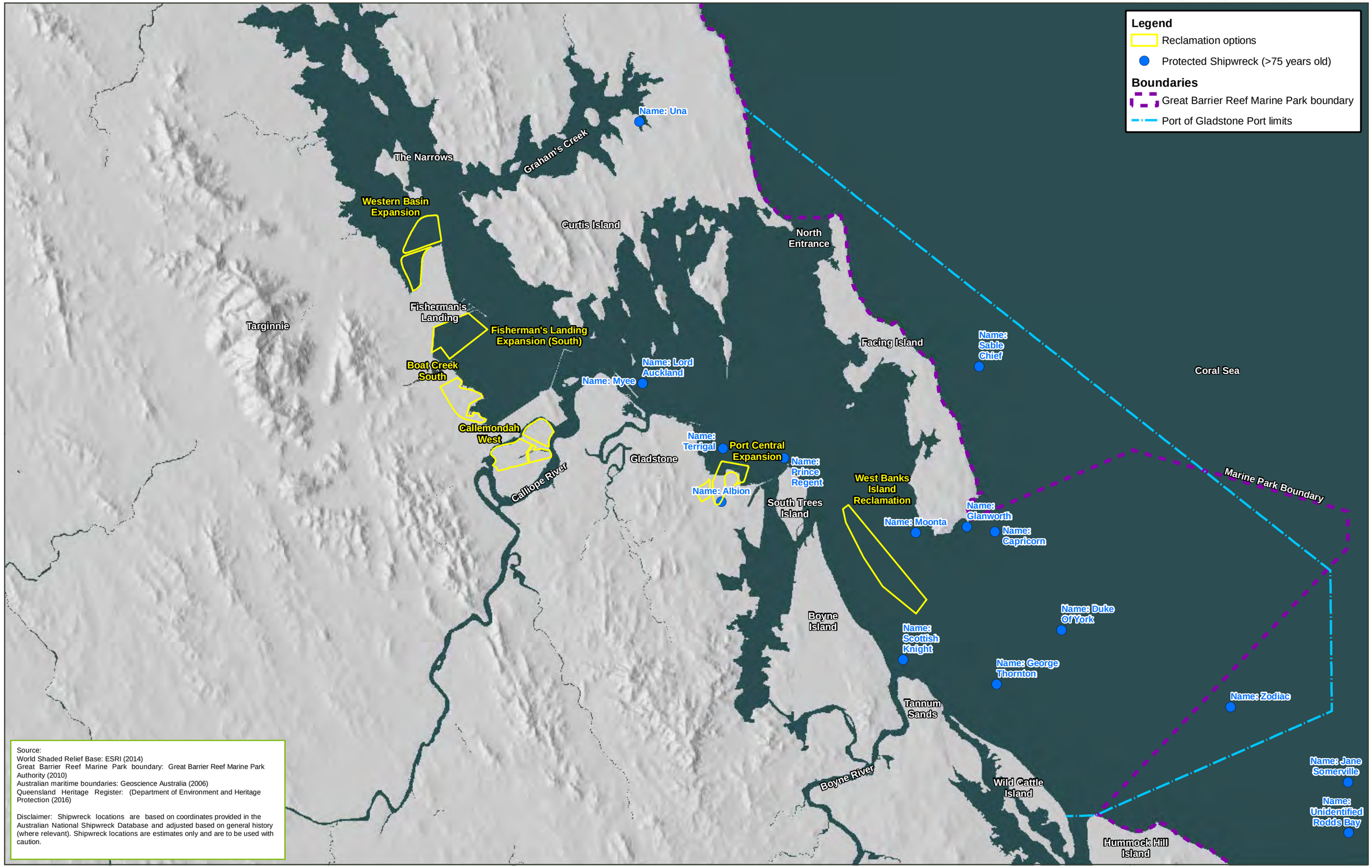


Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
Australian maritime boundaries: Geoscience Australia (2006)
Queensland Heritage Register: (Department of Environment and Heritage Protection (2016)

Disclaimer: Shipwreck locations are based on coordinates provided in the Australian National Shipwreck Database and adjusted based on general history (where relevant). Shipwreck locations are estimates only and are to be used with caution.

Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_416.mxd 05/08/2019 18:07

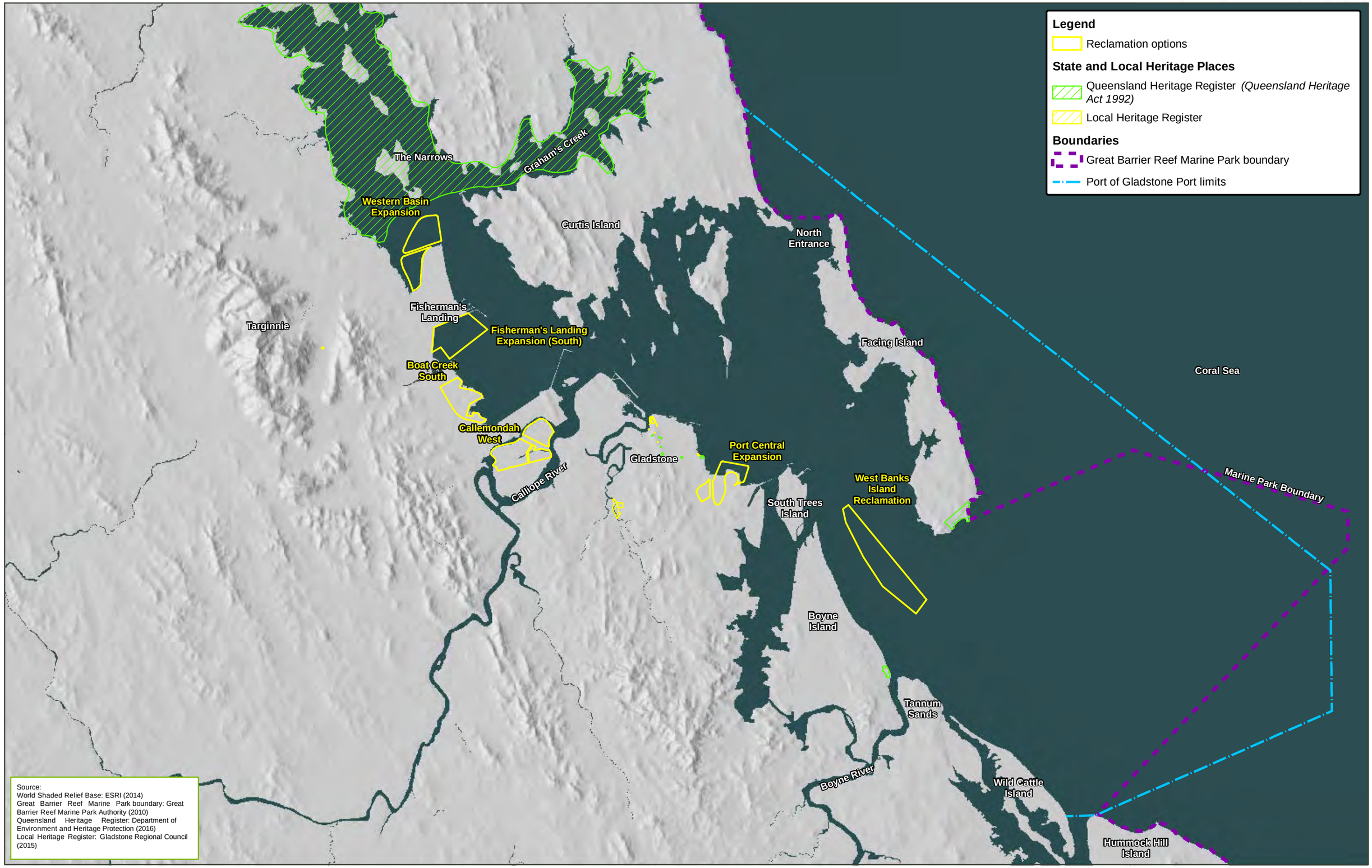
0 2,000 4,000 Metres

Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A27: World, Commonwealth and National Heritage Places protected under the *Environment Protection and Biodiversity Conservation Act 1999* and Shipwrecks protected under the *Historic Shipwrecks Act 1976*



Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_417.mxd 05/08/2019 18:08

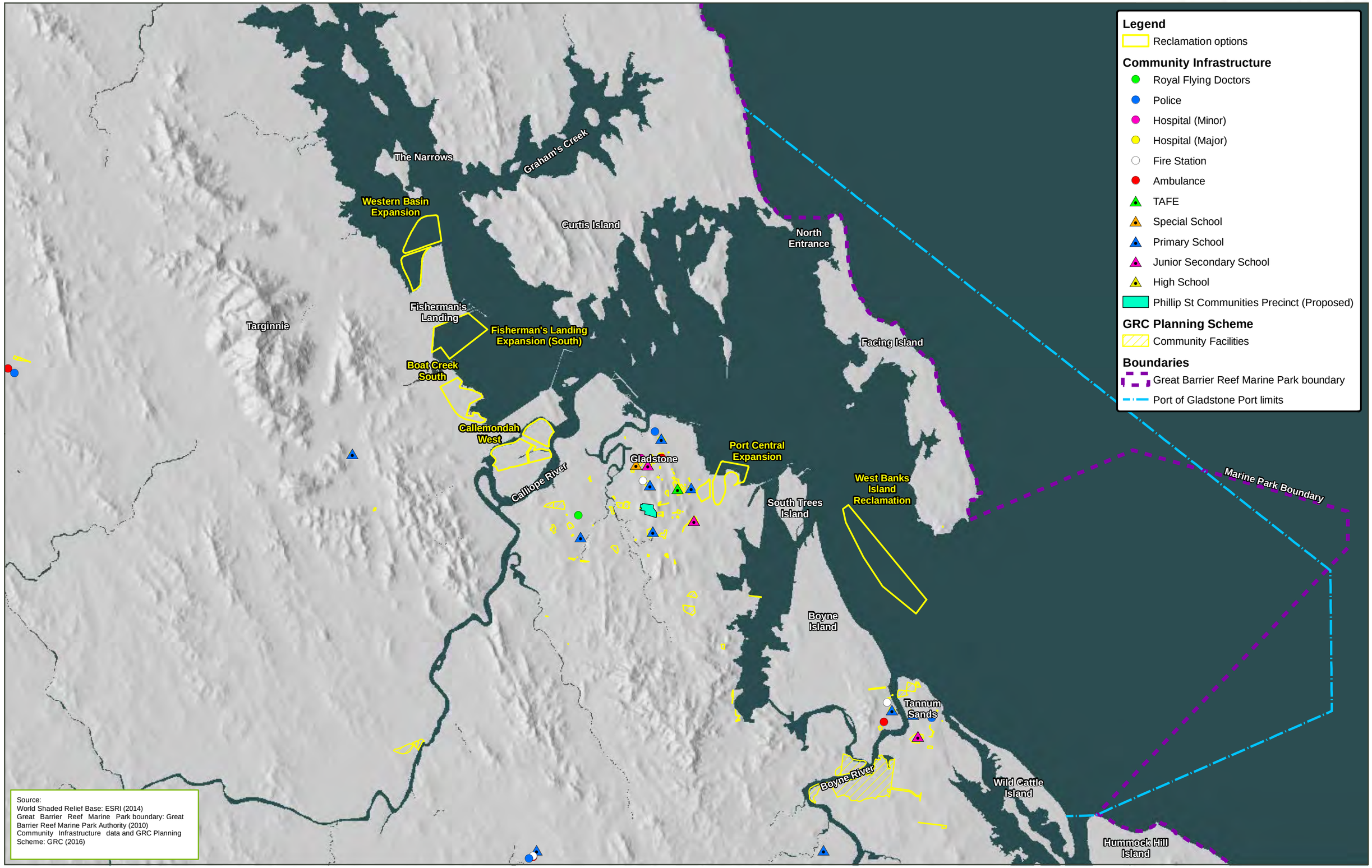
0 2,000 4,000 Metres

Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A28: State heritage places protected under the *Queensland Heritage Act 1992* and local heritage places



Map by: RB P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_418.mxd 05/08/2019 18:09

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Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A29: Social and community infrastructure identified in the Gladstone Regional Council Planning Scheme

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Legend

Reclamation options

GRC Planning Scheme

Conservation
Environmental Management
Major Tourism
Minor Tourism
Open Space
Sport And Recreation

Boundaries

Great Barrier Reef Marine Park boundary
Port of Gladstone Port limits

The Narrows
Graham's Creek
Western Basin Expansion
Curtis Island
North Entrance
Fisherman's Landing
Fisherman's Landing Expansion (South)
Targinnie
Facing Island
Coral Sea
Boat Creek South
Callemondah West
Port Central Expansion
Gladstone
Calliope River
West Banks Island Reclamation
South Trees Island
Marine Park Boundary
Boyne Island
Tannum Sands
Boyne River
Wild Cattle Island
Hummock Hill Island

Source:
World Shaded Relief Base: ESRI (2014)
Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
GRC Planning Scheme Zones: GRC (2016)

Map by: RB
P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_EIS_419.mxd 05/08/2019 18:09

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Date: 05/08/2019 Version: 1 Job No: 237374

Coordinate system: GDA 1994 MGA Zone 56

Gatcombe and Golding Channel Duplication Project

Figure A30: Recreational opportunities and natural amenity as identified by the Gladstone Regional Council Planning Scheme

Appendix B
Revised DMPOI MCA outcomes

Appendix B - Multi-criteria analysis process outcomes

Objectives, issues and aspects		Weighting (%)	Western Basin Expansion		Fisherman's Landing Expansion (South) and Boat Creek (South)		Fisherman's Landing Expansion (South) and Callemondah West		Port Central Expansion		West Banks Island Reclamation	
Objective	**Issue/aspect**		**Score**	**W Score**	**Score**	**W Score**	**Score**	**W Score**	**Score**	**W Score**	**Score**	**W Score**
SCORING OF OPTIONS BY WEIGHTED ASPECT												
1. Aquatic environmental objectives												
1.1	Intertidal vegetation	11	5	55	2	22	2	22	4	44	4	44
1.1	Seagrass (direct impacts)	12	2	24	2	24	2	24	4	48	4	48
1.2	Water quality and ecological impacts (indirect impacts)	11	4	44	4	44	4	44	4	44	3	33
1.2	Macroinvertebrate habitat	11	4	44	4	44	4	44	4	44	4	44
1.2	Acid sulfate soils	11	4	44	4	44	4	44	4	44	3	33
1.3	Marine fauna	11	3	33	3	33	3	33	4	44	2	22
1.3	Migratory birds	11	2	22	3	33	3	33	3	33	3	33
1.3	Wetland values	11	4	44	3	33	3	33	4	44	5	55
1.3	OUV of GBRWHA (biodiversity conservation values)	11	3	33	3	33	3	33	4	44	3	33
Total		100	343		310		310		389		345	
Rank			3		4		4		1		2	
2. Terrestrial environmental objectives												
2.1	Terrestrial vegetation	33	5	165	3	99	3	99	3	99	2	66
2.1	Terrestrial fauna	33	4	132	3	99	3	99	4	132	3	99
2.2	Amenity (World Heritage Values - aesthetics)	34	4	136	4	136	4	136	4	136	3	102
Total		100	433		334		334		367		267	
Rank			1		3		3		2		5	
3. Social and cultural heritage objectives												
3.1	Strategic land use intent	12	6	72	6	72	3	36	6	72	3	36
3.2	Community and recreational activities	12	3	36	3	36	3	36	4	48	2	24
3.2	Amenity (air, noise, vibration)	12	4	48	4	48	4	48	3	36	3	36
3.2	Amenity (visual)	12	5	60	5	60	4	48	6	72	2	24
3.2	Traffic	12	4	48	4	48	4	48	4	48	3	36
3.3	Amenity (World Heritage Values - human appreciation/enjoyment)	12	4	48	4	48	4	48	4	48	2	24
3.4	Indigenous cultural heritage	16	3	48	3	48	3	48	3	48	3	48
3.4	Non-indigenous cultural heritage	12	5	60	5	60	5	60	5	60	5	60
Total		100	420		420		372		432		288	
Rank			2		2		4		1		5	
4. Economic objectives												
4.1	Commercial and recreational fishing	50	2	100	2	100	2	100	2	100	2	100
4.2	Reclamation area establishment and dredged material placement costs	50	4	200	3	150	3	150	4	200	2	100
Total		100	300		250		250		300		200	
Rank			1		3		3		1		5	
5. Long term dredged material placement (beneficial reuse) objectives												
5.1	Capacity of placement area	15	6	90	3	45	3	45	3	45	4	60
Total			90		45		45		45		60	
Rank			1		3		3		3		2	
SCORING OF OPTIONS BY WEIGHTED OBJECTIVE CATEGORY												
1. Aquatic environmental objectives		27	343	9261	310	8370	310	8370	345	9315	345	9315
2. Terrestrial environmental objectives		20	433	8660	334	6680	334	6680	367	7340	267	5340
3. Social and cultural heritage objectives		18	420	7560	420	7560	372	6696	267	4806	288	5184
4. Economic objectives		20	300	6000	250	5000	250	5000	300	6000	200	4000
5. Long term dredged material placement (beneficial reuse) objectives		15	90	1350	45	675	45	675	45	675	60	900
Total		100		32,831		28,285		27,421		28,136		24,739
Rank			**1**		**2**		**4**		**3**		**5**	

Table note: W Score - Weighted score (objective weighting x score)

Document prepared by

Aurecon Australasia Pty Ltd
ABN 54 005 139 873

Ground Floor, 25 King Street
Bowen Hills QLD 4006

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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