



The Coordinator-General



Western Basin Dredging and Disposal Project

Coordinator-General's report for an environmental impact statement

July 2010

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Synopsis

This Coordinator-General's report for an environmental impact statement (EIS) provides an evaluation of the potential environmental impacts of the Western Basin Dredging Project (WBDD Project or 'the project'). It has been prepared pursuant to section 35 of *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act). The Department of Infrastructure and Planning (DIP) managed the environmental impact assessment (EIA) process on my behalf in accordance with the SDPWO Act.

The Commonwealth and Queensland Governments have identified Gladstone as a port with the potential to service large scale export oriented, resource processing and value adding industries. The close proximity of Gladstone's international port facilities is essential to the economic viability of the Gladstone State Development Area (GSDA). The GSDA aims to attract industries by offering internationally competitive operating costs and has the capacity to accommodate significant future industrial growth.

Gladstone Ports Corporation Ltd (GPC) is responsible for the provision and maintenance of shipping facilities and navigable channels, swing basins and berth pockets in the port. It is the proponent for this project, which is proposed to accommodate the long-term dredging and dredged material disposal that is required to provide safe and efficient access to the existing and proposed Gladstone Western Basin port facilities (in Port Curtis, from Auckland Point to The Narrows). In particular the project would service the emerging liquefied natural gas (LNG) industry in the Gladstone region.

The project includes:

- capital and maintenance dredging associated with the deepening and widening of existing channels and swing basins, and the creation of new channels, swing basins and berth pockets. A maximum quantity of 42.3 million cubic metres (Mm³) of capital dredged spoil material is estimated
- construction of a bunded reclamation area of approximately 235 hectares (ha), located approximately 10 kilometres (km) north of Gladstone city, contiguous to the north of the proposed 153 ha Fisherman's Landing Port Expansion project (FLPE), which **I have approved** as a separate significant project (also by GPC).

The project is expected to require a total workforce of 225 people during the peak dredging period and an expected construction workforce for the reclamation area of 30 to 40 people.

The capital cost of construction of the reclamation for the project is estimated at \$343 million over 40 years. The cost of capital dredging has been estimated at \$656 million.

The project is central to the Port of Gladstone Western Basin Master Plan, which **I issued** in late March 2010, to provide direction at a high level to government decision making on the cumulative scale and nature of impacts of future industrial development in the Western Basin.

An initial advice statement (IAS) for the project was lodged with the Coordinator-General on 27 February 2009. **I declared** the project to be a 'significant project for which an environmental impact statement (EIS) is required' pursuant to section 26(1)(a) of the SDPWO Act on 24 April 2009.

On 18 May 2009, GPC referred the project to the Commonwealth Minister for the Environment, Heritage and the Arts (referral number 2008/4904) for a determination as to whether the project would constitute a 'controlled action' under section 75 the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act). On 18 June 2009, the Commonwealth Minister determined that the project was a controlled action therefore assessment of the proposal under the EPBC Act is required. The controlling provisions of part 3, division 1 of the EPBC Act for the proposed action are:

- Sections 12 and 15A (world heritage properties)
- Sections 15B and 15C (national heritage places)
- Sections 18 and 18A (listed threatened species and communities)
- Sections 20 and 20A (listed migratory species).

Draft terms of reference (TOR) for the EIS were advertised for public and advisory agency comment on 11 July 2009 inviting submissions until 10 August 2009. Seven submissions on the draft TOR were received.

The EIS was advertised for public and advisory agency comment on 14 November 2009, inviting submissions until 18 December 2009. Nineteen submissions on the EIS were received.

Following compilation and analysis of the EIS submissions, it was determined that GPC must prepare a supplementary information document (SID) to the EIS. The SID was made available to advisory agencies and public submitters to the EIS from 27 April until 19 May 2010. Eight submissions on the draft SID were received.

In undertaking my evaluation of the potential environmental, social and economic impacts of the project, I **have considered** the EIS, the supplementary information document (SID), issues raised in properly made submissions relating to the EIS and SID, the draft environmental management plan (EMP) and advice received on a range of key issues from state government agencies, Gladstone Regional Council (GRC) and the Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA).

I am satisfied that the requirements of the SDPWO Act have been satisfactorily fulfilled and that sufficient information has been provided to enable me to finalise the required evaluation of the potential impacts attributable to the project.

Potential impacts of dredge plume turbidity on seagrasses

Areas of potential direct and indirect impact were estimated based on the known area of seagrasses from field studies carried out for this project, information supplied by DEEDI (2002–2008 DEEDI seagrass mapping) and predicted areas of plume dispersal based on model outputs.

Table 10.1 of the SID shows that approximately 6318 ha of benthic habitat is predicted to be directly (902 ha) or indirectly (5416 ha) impacted as a result of the project. This includes 1665 ha of known seagrass habitat, which could be directly (258.8 ha) or indirectly (1406 ha) impacted.

In addition to expected permanent losses of high value ecological habitats, temporary losses from indirect impacts related to water quality (sediments and light attenuation) from dredge plume footprints are also expected. However, temporary losses would be expected to return to the impacted area over time (within 2–5 years) following cessation of construction and dredging.

The SID predicted an area of indirect impact (5416 ha of benthic habitat, which includes 1406 ha of seagrass), it should be noted that this is the maximum predicted plume area. This is measured as an exceedence of 5 mg/L above background ambient conditions for no more than 10 per cent of the time.

To avoid and minimise the impacts of dredge plume, GPC proposed a reactive dredge program, aligned with water quality and seagrass monitoring, be adopted. It is recognised that there is potential for the loss of a significant area of seagrass, which GPC proposes to offset.

Water quality triggers

The EIS anticipated that, although turbidity objectives have been developed for the dredging and discharge of decant waters, there is a need to improve understanding of the resilience of the various seagrass species in Port Curtis to varying light conditions. The EIS provides a preliminary measure of photosynthetically available radiation, used to measure the light available for photosynthesis, however no conclusions are made.

To further this line of enquiry, DEEDI has commenced a program of research that aims to determine thresholds of seagrass resilience to low light conditions. This would provide a basis for water quality triggers taking into account light incidence and attenuation (if possible, correlated to existing measures of turbidity, i.e. TSS) that would inform the dredge management plan (DMP) so that dredging operations may be adjusted before sensitive habitats are critically affected.

GPC has committed to supporting the ongoing research into seagrass light requirements and conditions of this report require the proponent to integrate ongoing research findings into the continuous adaptive improvement of the DMP via the establishment of a seagrass research technical advisory panel comprising scientific experts in seagrass and benthic ecology as well as GPC management, regulatory agencies and dredge technical advisors.

Impacts on marine fauna

The EIS acknowledges that the project, and the cumulative effect of other proposed industrial developments in the Port Curtis area, will impact on marine megafauna that use the project area. Areas, such as the Narrows and Rodds Bay, are likely to become increasingly important habitats to support displaced animals no longer able to use the Western Basin.

In particular, key potential impacts to marine megafauna are identified due to direct removal of foraging, feeding and inter-nesting habitat for dugongs, turtles and dolphins; decline in water quality from dredging and construction disturbance; and increase in sedimentation that may result in loss of seagrasses and other benthic communities.

Increased vessel traffic (dredges and other shipping traffic) and increased reclamation (WBDD Project and FLPE project) may constrict safe migratory passage in the project area.

The additional lighting and underwater noise disturbance from vessel traffic, construction and operation of other Western Basin projects may further disturb or displace megafauna, for which GPC has proposed a range of mitigation strategies.

The project is not expected to significantly increase the risk of boat strike as the dredging activities are conducted by slow moving vessels with conspicuous noise and lighting, fitted with exclusion devices. The EIS has recommended that enforced vessel lanes with speed restrictions be designated for the construction and operation phases to protect megafauna from boat strike and undue disturbance. In addition, vessel movements in the port are under the control of the Regional Harbour Master (Maritime Safety Queensland).

Marine megafauna are not expected to inhabit the surrounding habitats during dredging and reclamation works, therefore trapping and fatalities are unlikely.

Potential acid sulfate soils

When disturbing large volumes of potential acid sulfate soil (PASS) significant long-term environmental harm and corrosion to built infrastructure may be caused. Given the extent of PASS identified in the EIS assessment and the proximity of the works to sensitive marine environments, the dredged material would require careful monitoring and management of potential impacts. The SID confirms that no actual ASS was identified beneath the reclamation area footprint.

GPC proposed (based on its experience in managing the current Fisherman's Landing reclamation area) that untreated PASS material be placed in the reclamation below the mean low water mark. GPC has proposed that mean sea level is an appropriate water level for maintaining the PASS material in a saturated state. Adoption of this level is would accommodate the significant volumes of PASS material (in the absence of a sea dumping permit).

However, DERM (Queensland Acid Sulfate Soil Investigation Team—QASSIT) expressed concern that the proposed methodology for handling and treatment of untreated PASS in the reclamation area does not qualify as strategic reburial. DERM maintains, in the absence of scientific proof, no untreated PASS material should be located within the reclamation area above mean low water (AHD -1.67 m at RL 0.67 m), unless DERM approves an alternative method of disposal to prevent oxidation of sulphides.

With mean low water as an upper limit, the capacity of the reclamation area for disposal of much of the anticipated PASS material, would be reduced or require expensive treatment prior to placement of such spoil. At the time of writing, GPC was undertaking a technical study on its Fisherman's Landing reclamation in an attempt to resolve the issue with DERM.

Dredge spoil disposal options

The EIS and SID provide GPC's explanation of alternative dredge spoil disposal options, including the advantages and disadvantages of the options and its rationale for selecting the reclamation area and its configuration for the disposal of spoil. In summary these alternatives are:

- Reuse of material—commercial re-use of the dredged material is not considered practical because the material to be dredged generally contains a mix of material types making it difficult to separate. The material is not suitable for beach nourishment as it ranges from large cobbles and gravels to silts and stiff clays. The material has an indirect commercial use in that the predominantly sandy component can be used as structural fill/capping in the upper layers of the reclamation.

- Unconfined disposal in subtidal locations within the port—has the advantage of keeping the material within the marine environment, however is not considered viable because deposited material is likely to be transported into shipping channels, swing basins and berth pockets. This would result in the need for more frequent capital dredging which has the potential to create greater negative environmental impacts in the area. If this material was to be placed in a subtidal location, it would require capping with an inert material to prevent it be remobilised. Such material is typically a dredged sand. No clean sands suitable for the task exist in the immediate area.
- Offshore disposal ground—the East Banks sea disposal area is currently used for maintenance dredging material from the inner and outer harbour area, and has a licenced limit of 1.0 Mm³. At the time of the EIS, the East Bank site was not thought to have the capacity to accommodate the total volume of material proposed for capital and maintenance dredging.
- Alternative reclamation areas within the port—near-shore environments throughout the port generally have the same environmental values, supporting seagrass and fringing mangrove communities and intertidal habitats, with some also supporting soft corals.
- Onshore disposal area (terrestrial disposal)—Hamilton/Boatshed Point and Laird Point disposal sites were considered as part of the EIS. These two sites could accommodate up to 20 Mm³ of dredged material if the retaining walls were developed to a height of approximately 15 metres. However with a number of LNG proponents planning to use the sites for development in the Curtis Island industry precinct, GPC prefers to avoid the placement of dredged material onshore that may prevent these potential sites from being used by the LNG industry. Other onshore sites investigated south of Fisherman's Landing are impacted by the existence of the Stuart Oil Shale deposit and the potential for alienation of the resource by the placement of spoil.

In its submission on the SID, DEWHA recommended that further consideration was required of alternative dredge spoil disposal options, including a comprehensive assessment of alternative onshore disposal options. GPC will present this information to DEWHA subsequent to this report.

Offshore disposal

GPC has a current sea dumping permit, under the Commonwealth *Environment Protection (Sea Dumping) Act 1981* (Sea Dumping Act) with a limit of 1.0 Mm³ that expires in 2012. During the preparation of the EIS, offshore disposal was not considered an option mainly due to uncertainty concerning the remaining capacity of the GPC East Bank offshore spoil ground. Subsequent to the EIS, GPC resurveyed the spoil ground and ascertained that it has additional capacity of up to 15 Mm³. At the time of this report, GPC was preparing an application for a sea dumping permit, for disposal of 8–10 Mm³.

The advantages of offshore disposal of 8–10 Mm³ of material at sea are that it would potentially reduce the quantity of PASS requiring storage in the reclamation area; reduce the overall height of the reclamation mound by approximately 10 m and the batter slope to a maximum of 1-in-10; and avoid or significantly reduce the necessity for rehandling of dredged material extracted by trailing suction hopper dredge (TSHD) thereby significantly reducing the incidence of turbid plumes and the area of impact on nearby seagrasses.

However, this report does not assume approval of a sea dumping permit and assesses the potential impacts of the project under the scenario as originally presented in the EIS and SID—that is, all dredge spoil material is to be placed within the reclamation area.

Alternative land-based disposal areas

Advice from the DIP State Development Areas Branch was that land-based disposal within the adjacent Yarwun and Targinie precincts of the GSDA is not an option for consideration as any land currently vacant is of high value and designated for future industrial development.

Disposal to sites further inland is impractical due to the considerable cost and energy requirements of pumping spoil; treating it for salinity, PASS and other potential contaminants; and the inherent environmental impacts of land-based disposal including clearing of native vegetation and disturbance of surface and ground water hydrology.

Cumulative impacts

A cumulative impact assessment has been completed as part of the WBDD Project evaluation report.

Together, the FLPE project and the WBDD Project, would cause the majority of the impacts on the marine environment of Port Curtis. Other activities of note that may occur over similar timeframes include the Wiggins Island Coal Terminal (WICT) construction, the proposed pipelines crossing of The Narrows and ancillary dredging needed for various LNG projects.

Given the cumulative nature of impacts caused by these various activities, and their expected timing, all relevant projects are considered together taking into account their additive effects both spatially and temporally.

A strategic offset proposal has been provided by GPC to mitigate the residual impacts of the projects under its control—the WBDD, FLPE and WICT projects. In addition, the scope of the strategic offset package has been widened to include the temporary impacts of the proposed construction of marine facilities on Curtis Island and the installation of a co-located pipeline crossing of The Narrows.

The precise details of methodology, timing etc. of these projects cannot be accurately determined due to the number of independently funded projects and their relative dependencies. The assessment provides an indication of a realistic worst-case scenario and is used as the basis of the proposed offset package. Given the potential for one or more projects not proceeding and the likelihood that mitigation strategies will reduce actual impacts (compared to predictions), it is likely that an agreed offset package would be an over-estimate of requirements. Monitoring programs will be designed to enable a comparison of actual impacts against predictions and potentially adjustments of offsets.

Commercial and recreational fishing

Commercial fishing

Potential impacts on commercial fisheries were considered in the EIS and additional information was provided in the SID. The EIS suggested that there would not be significant impacts on the juvenile fishery productivity in this area. This argument is not supported by DEEDI, Queensland Seafood Industry Association (QSIA), GRC and a number of public submitters.

DEEDI suggested that the proposed development would have an impact on commercial, recreational and indigenous fisheries operating in the harbour and that these should be taken into account and compensation paid where negative impacts are demonstrated to have been experienced.

Offsets against potential impacts on commercial fishing have been provided as a part of the offsets package proposed for the project.

Recreational and Indigenous fishing

The EIS acknowledged that the Western Basin is an important resource for the local recreational fishing community and Port Curtis offers protected waters that support a variety of edible and sport fisheries species. The EIS identified that access to fishing sites impacted by the dredging operations may be restricted given the required safety exclusion zone around the dredging activities.

Concerns were raised by GRC and public submissions to the EIS regarding the potential impacts on fisheries of loss of habitat and access.

In response, the SID noted that provision of additional boat ramps would be considered within the context of an offsets package, access to The Narrows would remain and ongoing discussions would continue with the fishing industry.

DEEDI suggested that an offsets package include the enhancement of other recreational fishing locations or provision of facilities that would be useful to recreational and commercial fishers as part of a much broader offsets package that includes consideration of impacts to marine habitats.

Offsets against potential impacts on recreational fishing have been provided as a part of the offsets package proposed for the project.

Visual amenity

The reclamation proposal preferred by GPC included provision for a mound of dredge spoil material. This form was adopted to contain the full volume of dredged material and minimise the areal extent of the reclamation footprint. For a net capacity of approximately 55 Mm³ a mound with a maximum height of 60 metres (m) was initially proposed, with a slope of approximately 1:6 to enable effective management of

stormwater runoff, erosion and surface rehabilitation (vegetation). The mound would become a prominent landscape feature of this locality.

The EIS provided an assessment of the potential visual impact of the reclamation mound, graphically indicating its appearance during reclamation and following the progressive establishment of rehabilitation planting. The mound is generally assessed to have a large adverse visual impact, however GPC intends to examine options that mitigate the visual impact of the reclamation mound. This may include rehabilitating the mound surface with vegetation, seeking to dispose of a proportion of the dredge spoil material offshore in order to reduce the mound volume and height and using the land for industrial purposes.

I have stated conditions that require appropriate contouring and surface treatment of the reclamation to minimise the visual impact.

If GPC obtains approval for offshore disposal of dredge spoil, the overall height and slope of the reclamation mound will be reduced accordingly.

Conclusion

I consider that the proposed Western Basin Dredging and Disposal project is a central component of the Port of Gladstone Western Basin development and is essential to the future development of maritime industries and services in the Port of Gladstone and in particular for development associated with the emerging LNG industries. Overall, there is a significant benefit for the Gladstone and Central Queensland regions to be derived from the project.

I consider that the EIS process for the WBDD Project has addressed the environmental, social and economic impacts of the project and the measures to be adopted to avoid, minimise, mitigate or offset the impacts meet the requirements of the Queensland Government for impact assessment in accordance with the provisions of Part 4 of the SDPWO Act.

Therefore, pursuant to section 52 of the SDPWO Act, **I recommend** that the Western Basin Dredging and Disposal project, as described in detail in the EIS and SID, and summarised in section 2 of this report, can proceed, subject to the conditions and recommendations contained in Appendix 1 of this report.

This report will be provided to the Commonwealth Minister for Environment, Heritage and the Arts, pursuant to section 17(2) of the SDPWO Regulation to enable a decision on the controlled action for the project pursuant to section 133 of the EPBC Act.

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Colin Jensen
Coordinator-General
Date: July 2010

1. Introduction

This report provides my evaluation of the environmental impact statement (EIS) process for the Western Basin Dredging and Disposal (WBDD Project) project proposed by the Gladstone Ports Corporation Limited (GPC). It has been prepared pursuant to section 35 of the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act).

An initial advice statement (IAS, GHD report reference number 42/15386/51438) was lodged on 27 February 2009 and **I declared** the project was to be a 'significant project for which an EIS is required' under section 26(1)(a) of the SDPWO Act, on 9 April 2009.

On 18 June 2009, the project was determined to be a 'controlled action' pursuant to section 75 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act)—reference number EPBC 2009/4904. Under a bilateral agreement with the Commonwealth Government, the Coordinator-General's report will be used by the Commonwealth Minister for the Environment, Heritage and the Arts to make an assessment of the controlled action for the purposes of the EPBC Act.

The purpose of this report is to:

- summarise the key issues associated with the potential impacts of the project on the physical, social and economic environments at the local, regional, state and national levels
- present an evaluation of the project, based on information contained in the EIS, supplementary information document, submissions made on the EIS and information and advice from advisory agencies and other parties
- recommend conditions under which the project may proceed.

In evaluating of the potential environmental, social and economic impacts of the project, **I have considered** the EIS, the supplementary information document (SID), issues raised in submissions relating to the EIS and SID, the draft environmental management plan (EMP), and advice received on a range of key issues from state government agencies, Gladstone Regional Council (GRC) and the Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA).

2. Project description

2.1 The proponent

The proponent for the WBDD Project is the GPC, which is a port authority under the Transport Infrastructure Act 1994 and is responsible for managing the Port of Gladstone. GPC is a government owned corporation under the Corporations Act 2001 (Cwlth) and pursuant to the Government Owned Corporations Act 1993. The shareholding Ministers (2008–09) for GPC are the Queensland Treasurer and Minister for Employment and Economic Development, and the Queensland Minister for Transport.

The Port of Gladstone comprises six major port facilities including Boyne Smelter Wharf, South Trees Wharf, Barney Point Terminal, Auckland Point Terminal (Port central), RG Tanna Coal Terminal and Fisherman's Landing.

2.2 The project

2.2.1 Project components

The project is to accommodate the long-term dredging and disposal of dredged spoil material that is required to provide safe and efficient access to the existing and proposed Gladstone Western Basin port facilities (in Port Curtis, from Auckland Point to The Narrows), particularly for the emerging liquefied natural gas (LNG) industry in the Gladstone region.

The project comprises:

- capital and maintenance dredging associated with the deepening and widening of existing channels and swing basins; and creation of new channels, swing basins, shipping berth pockets and materials offloading facilities (MOFs) associated with proposed LNG projects on Curtis Island (see Figure 2, project site)
- a maximum volume of dredge spoil material of 42.3 million cubic metres (Mm³)
- a reclamation site that is approximately 10 km north of Gladstone City (see Figure 1, Project locality) and is accessed from Landing Road
- disposal of spoil to a reclamation area of approximately 235 ha (see Figure 2.3, Reclamation area) contiguous with and north of the proposed 153 ha northern expansion of Fisherman's Landing (Fisherman's Landing Port Expansion project—FLPE), which is progressing as a separate significant project (also by GPC). The FLPE site is designed to accommodate approximate 10 Mm³ of dredge spoil material

The project is expected to require a total workforce of 225 people during the peak dredging period and an expected construction workforce for the reclamation area of 30 to 40 people.

The capital cost of construction of the reclamation for the project is estimated at \$343 million over 40 years. The cost of capital dredging has been estimated at \$656 million.

The reclamation proposed as part of the EIS includes provision for approximately 55 Mm³ of dredge spoil material which results in a mound with a maximum height of 60 metres (m).

The project footprint is below the highest astronomical tide (HAT)—that is, the high water mark—within the Port of Gladstone Port limits. The site is within the Great Barrier Reef World Heritage Area (GBRWHA) but is outside the Great Barrier Reef Marine Park (GBRMP).

The site is located adjacent to the Gladstone Regional Council (GRC) local government area, the Gladstone State Development Area (GSDA) and the (state) Great Barrier Reef Coast Marine Park (under the *Marine Parks Act 2004*).

The capital cost of construction of the reclamation for the project is estimated by GPC as \$343 million over 40 years. The cost of capital dredging has been estimated by GPC as \$656 million.

The project is central to the Port of Gladstone Western Basin Master Plan (WBMP), which I **issued** in late March 2010, to provide direction at a high level to government decision making on the scale and nature of impacts of future industrial development in the Western Basin.

As mentioned, the assessment of the WBDD Project is occurring in parallel with the FLPE project. I **approved**, in my EIS evaluation report dated 25 May 2010, that the FLPE may proceed. If the FLPE reclamation area is approved during development assessment, then construction of a portion of the FLPE bund wall may commence prior to any approval and construction for the WBDD Project. I **am advised** that GPC intends to integrate the two projects with consequential savings on bunding and a more logical and a more environmentally sensitive sequence of wall construction.

The EIS for the WBDD Project addressed the following activities:

- construction of the outer bund wall from bluestone material sourced from a GPC-owned quarry (subject to a separate approval)
- capital and maintenance dredging from the nominated footprints, associated with new channels, swing basins and berth facilities for the LNG industries; the deepening and widening of existing access channels, swing basins, shipping berth pockets, and early works on marine offloading facilities (MOFs) associated with proposed LNG projects on Curtis Island
- placement of dredge spoil material into the proposed reclamation area
- management of decant water
- surface stabilisation
- stormwater management upon completion of the reclamation.

The project includes a cumulative impact assessment of all of the dredging proposed for the LNG industry and future GPC developments in the Western Basin. This includes the MOFs to support the various LNG proponents on Curtis Island. However, the project does not include any marine works (such as construction docks) subject to earlier works development applications by LNG proponents nor does the project include any dredging associated with the LNG pipelines that may cross Kangaroo Island and The Narrows (between Friend Point and Laird Point), which are or will be subject to separate environmental assessment processes.

The reclamation area bund wall would be fully constructed prior to any dredge spoil disposal. Construction was initially expected to take two years to complete but during the SID process GPC revised the schedule to 24 hours per day seven days per week (24/7) to enable completion within 12 months.

The capital dredging would occur in stages and in locations at a rate commensurate with the needs of industries. Operational works approvals would be sought for each stage as they are required. Table 1 (from EIS Table 1.2) shows the current likely timing for each stage (note that volumes are nominal volumes to RL -13.0 m and do not include an overdredge allowance).

Table 1—Staged timing of proposed capital dredging (see EIS Table 1.2, areas from EIS T.7-29, revised volumes from SID s.4.1.2)

Stage number	Stage name	Stage description	Dredge volume (Mm ³)
Stage 1A	North China Bay Industrial Precinct. Curtis Island LNG proponents (including APLNG initial stages)	Late 2010–2012 (2 years)	22.4
Stage 1B	Fisherman's Landing LNG—including GLNG Ltd	Late 2010–2012 (dredging concurrently with Stage 1A)	5.3
Stage 2	Laird Point	2014 (follows Stages 1A and 1B)	4.6
Stage 3	Fisherman's Landing Development	To be determined (staged over a number of years)	(with Stage 2)
Stage 4	Hamilton Point—including final LNG developments	To be determined (staged over a number of years)	10.0
Total			42.3

Figure 2, project site, shows the spatial extent (footprint) of each dredge stage.

2.2.2 APLNG channel options

During the EIS process, Australia Pacific LNG (APLNG) provided an addendum to its EIS, which assessed two options for accessing its Laird point site and reduced further consideration to a single, easterly alignment near Curtis Island – effectively extending the alignment of the more southerly LNG facilities. The report also informed the WBDD project to the extent of confirming and assessing potential impacts associated with its dredging components, including berth pockets, MOF, access channel and swing basins.

APLNG initially proposed two design options for its dredge footprint—Options 1B and 2A (see Figure 2.4)—and provided information on the characteristics, advantages and disadvantages of each option, which are summarised in Table 2.

Table 2—Comparison of APLNG dredge footprint Options 1B versus 2A

Issue	Option 1B	Option 2A
Location	West of North Passage Island. Partially overlays WBDD Project dredge Stages 2 and 3.	East of North Passage Island. Extends WBDD Project dredge Stage 1A.
Volume of additional dredge material	6.0 Mm ³	12.8 Mm ³
Benthic disturbance	75 ha	105 ha
Maintenance dredging	60 000 m ³ /y	103 000 m ³ /y

Option 2A is preferred despite the additional volume of dredging required. Advantages include improved vessel manoeuvring ability; consistency with planning for other proposed LNG developments on Curtis Island; and less impact to recreational and commercial vessel access to The Narrows and Graham Creek. In addition, Option 2A allows for the staging of the dredging. Option 1B required a longer trestle extending seaward to the main shipping berths, which would involve more pile driving and disturbance of mangroves. It would also have prevented recreational boat usage near Curtis island.

In April 2010, following the public EIS period, APLNG provided me with a design for the dredging required to access its proposed temporary construction dock on Curtis Island and requested that **I include** this revision in my assessment of the WBDD Project. Due to the lateness of this request, **I have not considered** the proposal as part of my assessment and recommend that it be included as part of the assessment for the APLNG project.

I am satisfied that, despite the additional dredge volume required for APLNG's preferred Option 2A dredge footprint, this option would minimise overall environmental impacts, enable easier and safer vessel manoeuvrability, and minimise recreational and commercial restriction within the Western Basin and to The Narrows and Graham Creek. Therefore, **I support** the APLNG Option 2A dredging footprint within the assessment and approval of the WBDD Project.

2.3 Project rationale

The project is being undertaken as a central component of the Port of Gladstone Western Basin Master Plan (WBMP) (March 2010). The WBMP provides direction at a high level to government on the scale and nature of impacts of future industrial development in the Western Basin for the next 30 years. The first two key components of the WBMP to be implemented by GPC are the FLPE and the WBDD Project.

The WBMP acknowledges that the Port of Gladstone is already one of Australia's busiest ports, handling over 1400 vessels annually, and is of considerable strategic economic significance to Queensland and Australia. Additionally, the *GPC 50 Year Strategic Plan* (GPC, 2008) forecasts an ultimate port shipping capacity of over 300 million tonnes per annum (Mtpa), largely due to the emergence of the LNG industry, which is assumed to eventually be in the order of 40 to 50 Mtpa.

In July 2008, the GSDA was extended to include a large area at the southern end of Curtis Island, including the Curtis Island Industrial Precinct, which provides for the establishment of LNG facilities on the south-west coast of the island.

Currently, the port only has one existing channel, Targinie Channel that leads to Fisherman's Landing. All future landside developments in the Western Basin will require a new channel, swing basins and berths for vessel access.

Dredging and dredge spoil disposal are required to facilitate vessel access for the potential LNG and other GPC developments on Curtis Island and Fisherman's Landing, to implement the WBMP and to fulfil the industrial development purpose of the GSDA.

2.4 Project alternatives

2.4.1 Comparison of alternative channel options

The EIS considered alternatives for industry locations (in particular LNG), alternative dredging footprints and alternative dredged material disposal locations. The EIS considered the social, economic, engineering and environmental benefits and disadvantages of the proposed alternatives.

The dredging footprint for the WBDD Project is largely dictated by shipping safety and operational protocols and the location of the sites that are available for development in the port, particularly for the LNG industry.

2.4.2 Comparison of alternative dredge spoil disposal options

Section 1.4.2 of the EIS noted that the initial assessment of dredge spoil disposal options was made in chapter 6 of the Port of Gladstone Western Basin Master Plan¹ (WBMP) that was prepared under section 10(2) of the SDPWO Act and that it was endorsed in March 2010. The WBMP provides the strategic framework for the development and cumulative assessment of potential impacts in the Western Basin. Additional preliminary assessment of site spoil disposal options was carried out during preparation of the *GPC 50 Year Strategic Plan* (GPC, 2008).

Chapter 1.7 and Table 1.4 of the EIS and section 3 of the SID provide an explanation of alternative dredge spoil disposal options, including the advantages and disadvantages of those options and GPC's rationale for selecting the reclamation area and its configuration for the disposal of spoil.

Nine submissions on the EIS queried the selection and evaluation of project alternatives. These are addressed in section 3 of the SID.

In its submission on the EIS, DEWHA recommended that further consideration was required of alternative dredge spoil disposal options.

Table 3 provides a summary comparison of the dredge spoil options presented by GPC during the EIS process.

Table 3—Comparison of dredge spoil disposal options

Spoil disposal option	Reference	Disadvantages	Advantages
Dredge footprint options	EIS s.1.7.2	<ul style="list-style-type: none"> Driven by sites suitable for establishment of land-based industries and their shipping requirements. 	<ul style="list-style-type: none"> Minimised and optimised to accommodate industry requirements.
Re-use of material	EIS T.1-4	<ul style="list-style-type: none"> Spoil contains mixed grades of material making it difficult to separate and re-use. Material grade is not consistent with grades suitable for beach nourishment 	<ul style="list-style-type: none"> Commercial sale benefit.
Unconfined disposal in subtidal zone	EIS T.1-4	<ul style="list-style-type: none"> Unconfined turbid plumes. Remobilisation of sediments resulting in sedimentation. 	<ul style="list-style-type: none"> Retains material in marine environment
Land-based disposal	EIS T.1-4 <ul style="list-style-type: none"> Curtis Island Mainland 	<u>Curtis Island:</u> <ul style="list-style-type: none"> Requires 15 m high retaining wall Land use conflict with proposed Curtis Island LNG developments 	<ul style="list-style-type: none"> Avoids reclamation. Avoids sea dumping. <u>Curtis Island:</u> <ul style="list-style-type: none"> potential to accommodate up to 20 Mm³

¹ Port of Gladstone Western Basin Master Plan (CG, March 2010):
<http://www.dip.qld.gov.au/resources/plan/gladstone/western-basin-master-plan.pdf>

		<u>Mainland (GSDA):</u> <ul style="list-style-type: none"> • Sterilisation of land in Yarwun Precinct, fully committed for future industrial development. • Unsuitable, sloped topography of Targinie Precinct coastal landforms. Significant excavation and removal of material in order to make flat. • Introduction of saline and PASS material to terrestrial landscape • Environmental impact of vegetation clearing, habitat disturbance and altered ground and surface hydrology. • Cost, energy and logistics of long-distance pumping, and treating salinity, PASS and other potential contaminants. • South of Fisherman's Landing, potential sterilisation of mineral resources. 	<u>Mainland:</u> <ul style="list-style-type: none"> • avoid sea dumping, reclamation and Cutis Island disposal.
Use of Wiggins Island Coal Terminal onshore spoil disposal area		<ul style="list-style-type: none"> • Capacity of site is fully committed from WICT. 	<ul style="list-style-type: none"> • Avoids reclamation. • Avoids offshore disposal. • Complements disposal of spoil for WICT project
Reclamation		<ul style="list-style-type: none"> • Removal of benthic habitat. • Impact to marine fauna and migratory shorebirds. • Displacement of recreational, commercial and indigenous fishers. • Displacement of recreational boaters • Time required for consolidation and surface rehabilitation. • Visual impact of 'mound' • Management of decant and stormwater discharge. • Management of PASS. 	<ul style="list-style-type: none"> • Avoids land-based disposal environmental impacts. • Contiguous with existing Fisherman's Landing reclamation and Fisherman's Landing Northern Extension thereby limiting impact to one part of the Western Basin. • Preliminary evaluation of disposal options provided and supported by Western Basin Master Plan.
Other reclamation site options within Port of Gladstone	EIS T.1-4	<ul style="list-style-type: none"> • Require construction of bund and reclamation of sea floor 	<ul style="list-style-type: none"> • Not contiguous with existing reclamation.
Offshore disposal	EIS T.1-4	<ul style="list-style-type: none"> • Permit limit on GPC's existing sea dumping permit of < 1.0 Mm³ remaining. • Uncertainty of East Bank disposal site capacity. • Uncertainty concerning preferences of DEWHA and/or GBRMPA. 	<ul style="list-style-type: none"> • Avoids land-based disposal environmental impacts.
Offshore disposal of approx 8–10 Mm ³	<u>Post-SID</u> <ul style="list-style-type: none"> • Bathymetry and capacity of East Bank disposal site resurveyed 	<ul style="list-style-type: none"> • Requires issuing of sea-dumping permit. • Operational time and expense of barging material to East Bank disposal site. • Potential generation and propagation of turbid plumes at East Bank. 	<ul style="list-style-type: none"> • Resurveyed East Bank shows sufficient capacity for approx. 15 Mm³. • Eliminates need for rehandling at Fisherman's Landing. • Greatly reduces incidence of turbid plumes in vicinity of reclamation area. • Caters for material from Stage 1A Clinton Bypass. • Reduces quantity of PASS to be stored in reclamation. • Reduces overall volume stored in reclamation, so reduces height and visual impact of the mound.

2.4.2.1 Onshore disposal

Advice (to-date) from the DIP State Development Areas Branch was that land-based disposal of dredge spoil within the adjacent Yarwun and Targinie Precincts of the GSDA is not an option for consideration as any land currently vacant is of high value and designated for future industrial development.

A residue storage facility (RSF) location feasibility study² for the GSDA undertaken on behalf of the Coordinator-General in 2007. The study investigated a range of sites throughout the GSDA to determine their suitability for the storage of residue waste from industrial processes.

In essence, as residue is transported to fill areas through pipes in a slurry form and left to settle, there is similarity in site options that would be investigated for potential to locate dredge spoil. Any fill areas will have similar land/topographical requirements.

Nine sites within the GSDA were investigated for residue storage potential. Following analysis, it was determined that due to a range of constraints, many of the sites studied are considered either unsuitable or highly constrained for residue storage. An outline of each site's potential is included in the study report.

Disposal to sites further inland is considered impractical due to the considerable cost and energy requirements of pumping spoil; treating it for salinity, PASS and other potential contaminants; and the inherent environmental impacts of land-based disposal including clearing of native vegetation and disturbance of surface and ground water hydrology.

Unconfined subtidal disposal was excluded as the turbidity impacts to benthic ecosystems were expected to be unacceptable.

The site for the reclamation area adjacent to Fisherman's Landing was selected in the context of the strategic direction of the WBMP, in support of the development of emerging the LNG industry in Gladstone and, in particular, the establishment of the Curtis Island LNG Precinct within the GSDA.

An options assessment was then undertaken on five reclamation configurations to arrive at the option that was assessed in the EIS (EIS Figure 1.6). The final reclamation footprint was selected for the following reasons:

- only the bay to the north is impacted
- no land attachment to the north which is an environmentally sensitive area
- intertidal exchange to the north is not impacted
- recreational access to the northern embayment remains
- reduced impact on seagrass colonies
- reduced impact on discharge of creeks to the northern embayment
- adequate flushing
- reduced bund length
- single land mass and simplified construction staging.

The disadvantage of this option compared to the other four is that the volume of dredge material to be disposed of would require an increased height of reclamation in the form of a mound.

Further analysis of the dredge spoil disposal options is provided in sections 5.2.3 and 8.2.2.3 of this report.

2.4.2.2 Offshore disposal

GPC currently disposes of dredge spoil from maintenance dredging at its East Banks Sea Disposal Site (see Figure 1), which is permitted by the Commonwealth Government under the Commonwealth *Environmental Protection (Sea Dumping) Act 1981* (Sea Dumping Act). The current sea dumping permit has a limit of 1.0 Mm³ that expires in 2012.

² Connell Wagner (2007): *Gladstone State Development Area Residue Storage Facility Study, Final Report*. Prepared for the Coordinator-General, December 2007. Report reference number CW 26210-002.

Offshore disposal is considered with reference to the *National Assessment Guidelines for Dredging* (NAGD—DEWHA, 2009), which states that alternatives to offshore disposal must be evaluated in the first instance, and opportunities for beneficial reuse, including land reclamation, must be considered where possible.

The EIS initially considered that offshore disposal was not a viable option because it was thought the East Bank disposal site had an available capacity of less than 1 Mm³ and therefore not available for capital dredging; and further, that dumping of material may have unacceptable turbidity plume impacts, and that the transport of material offshore would be uneconomic and possibly disruptive to other vessel traffic in the port.

In its submission on the EIS, DEWHA considered that further detailed consideration was required for alternative dredge disposal options, including sea disposal and a combination of sea disposal and land reclamation. Further discussion on this topic is provided in chapter 8 of this report.

As a result of further investigation of its East Bank disposal site for the SID, which indicated additional capacity for dredge spoil, GPC is preparing an application for a sea dumping permit for disposal of 8–10 Mm³ which will be assessed by DEWHA against the Sea Dumping Act. The advantages of offshore disposal of this amount of spoil include reduced visual impact of the reclamation area; avoidance or reduction of the amount of dredged material that may have to be rehandled, thereby reducing the incidence of turbid plumes and area of impact on nearby seagrasses; and potential reduction of the quantity of PASS material to be managed within the reclamation area.

In the absence of any new offshore dumping permit, this report assumes that all dredge spoil material associated with the WBDD Project will be placed within the reclamation area and that management of any impacts would represent a 'worst-case' scenario, as presented in the EIS and supporting documentation. Management and mitigation options presented by GPC in the EIS, SID and other documents for assessment address this 'worst-case' situation.

Further discussion on dredge spoil disposal is provided in sections 5.2.3 and 8.2.2.3 of this report.

Figure 1—Project locality

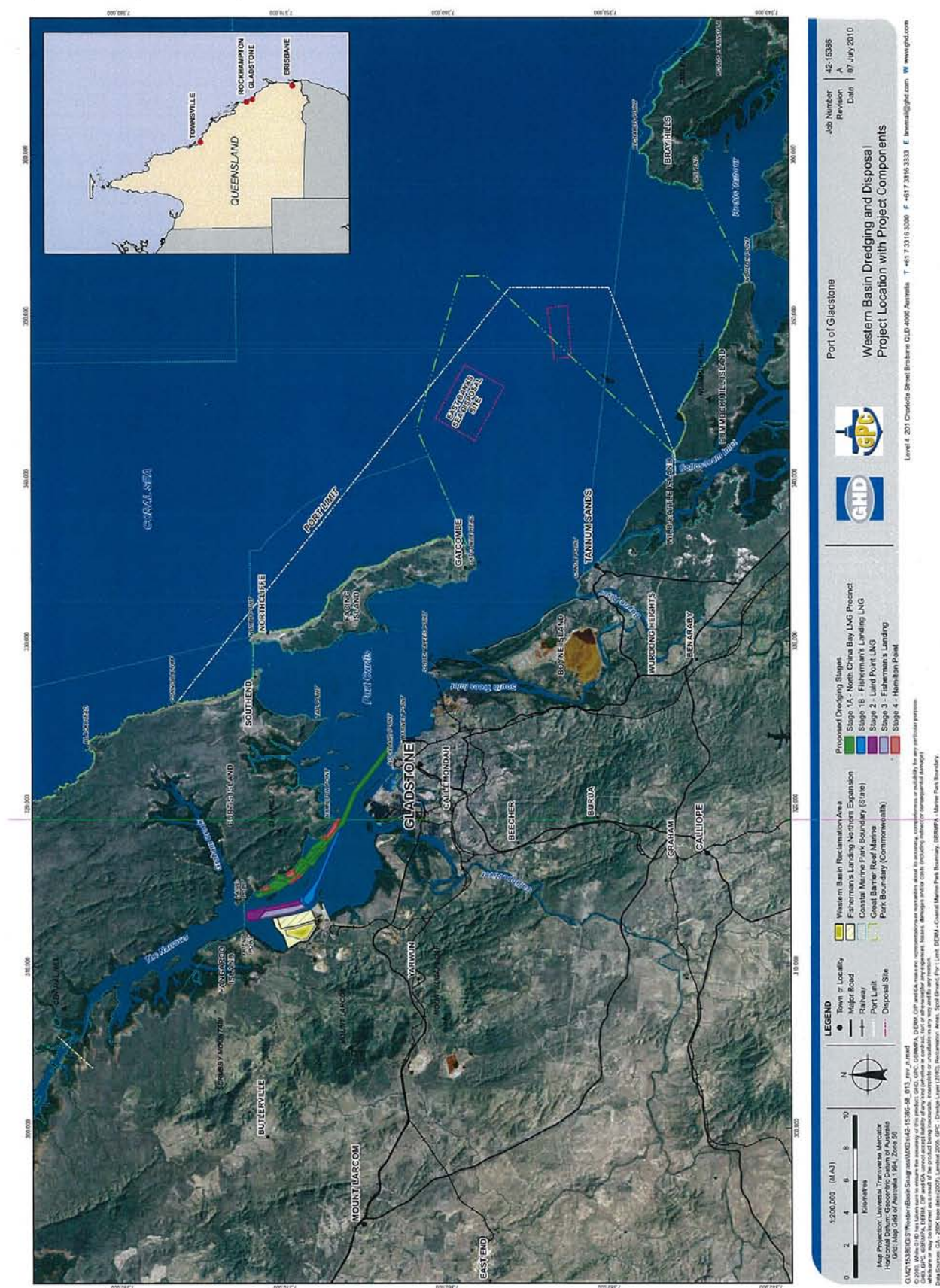


Figure 2—Project site

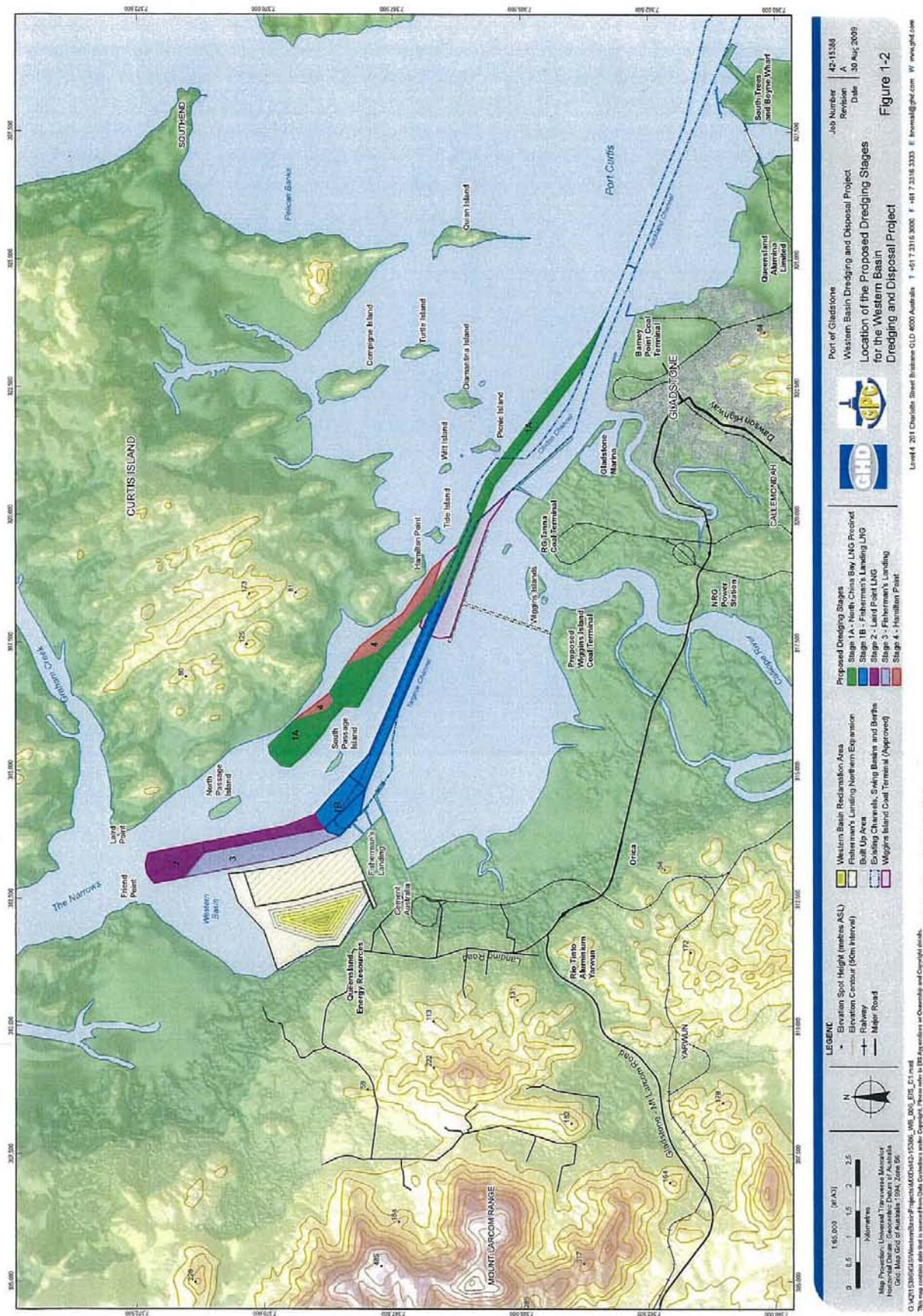


Figure 3—Reclamation area



Figure 4—APLNG Option 1B and 2A dredge footprints

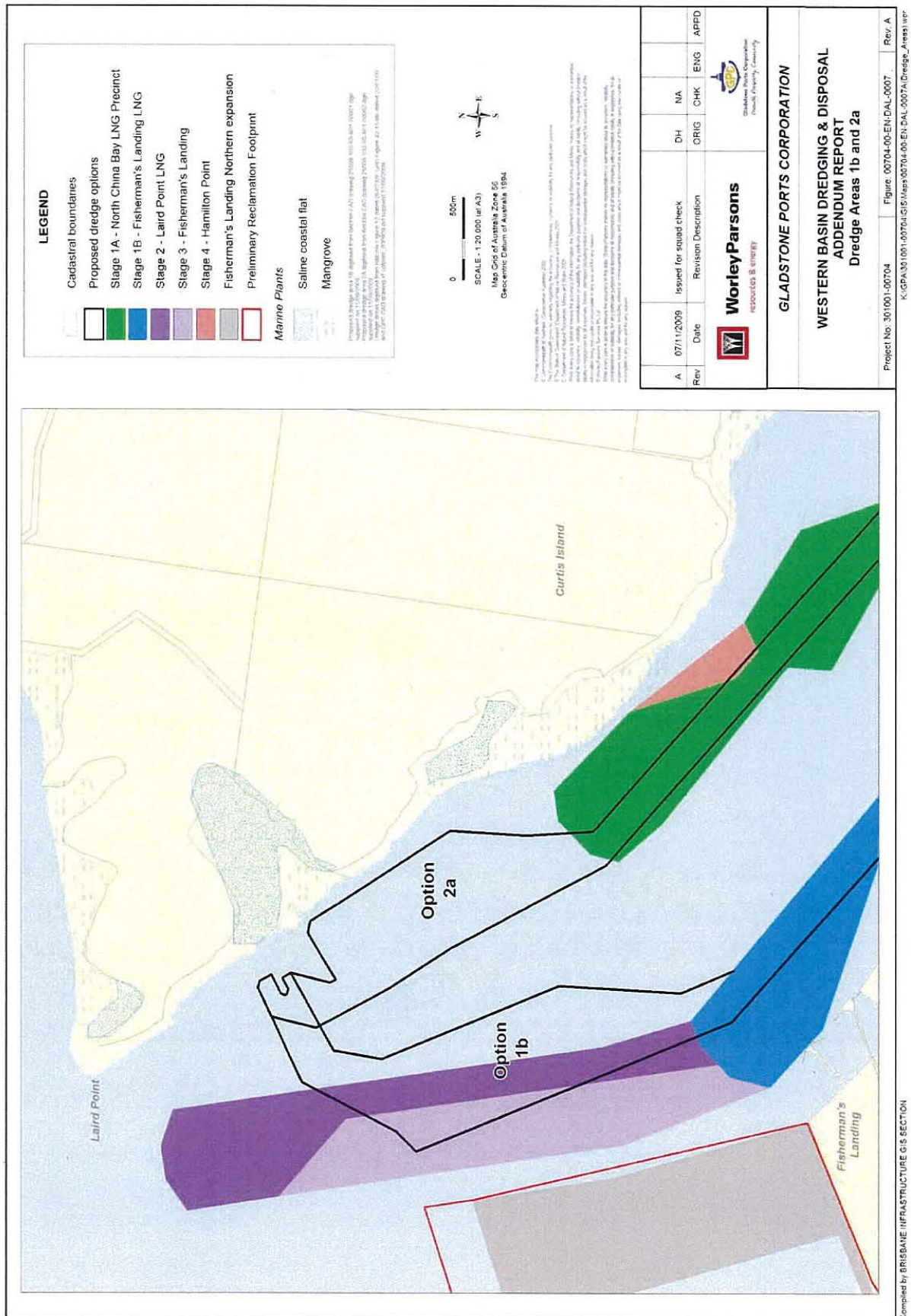
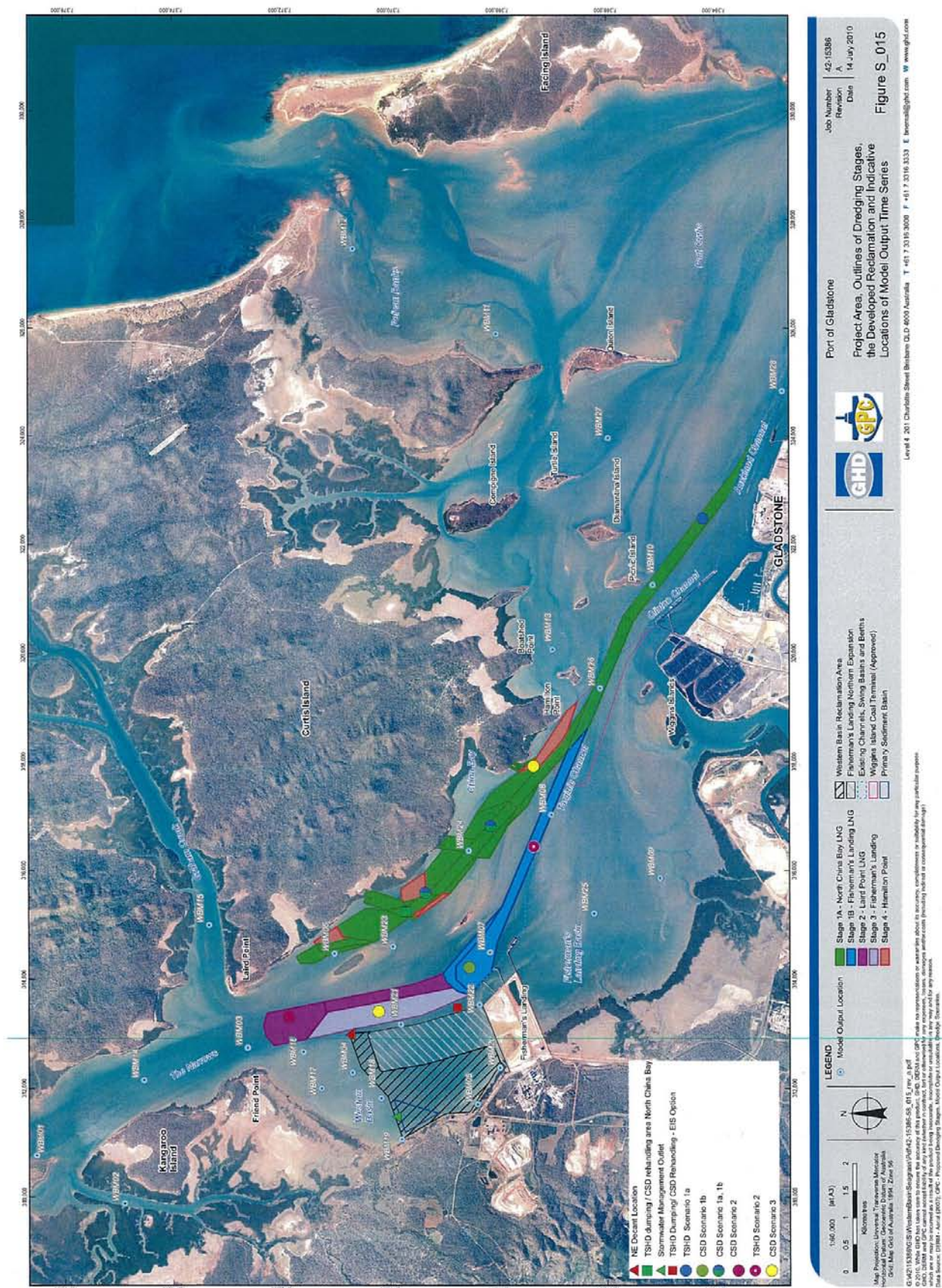


Figure 5—North China Bay alternative TSHD rehandling site



3. The environmental impact assessment process

3.1 Commonwealth impact assessment

On 18 May 2009, the proponent referred the project to the Commonwealth Minister for the Environment, Heritage and the Arts (referral number 2008/4904) for a determination as to whether the project would constitute a 'controlled action' with respect to potential impacts on matters of national environmental significance (MNES) under sections 75 and 87 of the EPBC Act.

The EPBC Act establishes a Commonwealth Government process for environmental assessment and approval of proposed actions that are likely to have a significant impact on MNES or on Commonwealth Government land.

On 18 June 2009, the Commonwealth Minister determined that the project is a controlled action under section 75 of the EPBC Act (reference number EPBC 2009/4904). The controlling provisions of part 3, division 1 of the EPBC Act for the proposed action are:

- Sections 12 and 15A (world heritage properties)
- Sections 15B and 15C (national heritage places)
- Sections 18 and 18A (listed threatened species and communities)
- Sections 20 and 20A (listed migratory species).

In accordance with the Commonwealth Minister's decision on the assessment approach, the project requires assessment and approval under the EPBC Act. The Commonwealth Government has accredited the Queensland state EIS process, conducted under the SDPWO Act, under a bilateral agreement between the Australian and Queensland Governments. Under the bilateral agreement between the Commonwealth Government and the State of Queensland, made under section 45 of the EPBC Act, if a controlled action is a significant project for which an EIS is required under the SDPWO Act then the project does not require assessment under part 8 of the EPBC Act.

Under part 4 of the SDPWO Act and the SDPWO Regulation, the Coordinator-General must ensure the EIS assessment report assesses all relevant impacts that the action has, will have, or is likely to have and provide enough information about the action and its relevant impacts to allow the Commonwealth Minister to make an informed decision whether or not to approve the action under the EPBC Act.

The controlled action may be considered for approval under section 133 of the EPBC Act once the Commonwealth Minister has received the Coordinator-General's EIS evaluation report from the EIS process prepared under section 35 of the SDPWO Act. This will enable the EIS to meet the impact assessment requirements under both Commonwealth and Queensland legislation.

3.2 State impact assessment

Section 35(3) of the SDPWO Act requires the Coordinator-General to prepare a report evaluating the EIS for a significant project for which an EIS is required. Under section 35(1) of the SDPWO Act, following the EIS submission period, the Coordinator-General must consider the EIS, all properly made and other submissions accepted by the Coordinator-General about the EIS, and any other material the Coordinator-General considers is relevant to the project.

This Coordinator-General's report may state conditions under section 39, 45, 47C, 49 or 49B of the SDPWO Act, may make recommendations under section 43 or 52 of the Act and impose conditions under part 4, division 8 of the Act, for the undertaking of the project.

On completion of the Coordinator-General's report, a copy is provided to the proponent and is publicly notified on the DIP website. The notification of this report and its provision to the Commonwealth Minister completes the assessment process under the SDPWO Act.

3.3 Declaration as a significant project

An initial advice statement (IAS, GHD report reference number 42/15386/51438) for the WBDD Project was lodged with the Coordinator-General on 27 February 2009. A revised IAS was provided to the Coordinator-General in May 2009. The project was declared by the Coordinator-General a 'significant project for which an EIS is required' pursuant to section 26(1)(a) of the SDPWO Act on 24 April 2009.

Matters considered by the Coordinator-General in making this declaration (SDPWO Act, s.27) included: information contained in an initial advice statement prepared by the proponent; relevant planning schemes and policy frameworks; infrastructure impacts; employment opportunities; environmental effects; complexity of local, state and Commonwealth Government requirements; level of investment; and the project's strategic significance.

DIP managed the EIS process on my behalf and invited relevant Australian, state and local government representatives, and other relevant authorities, to participate in the process as advisory agencies.

3.4 Terms of reference for the EIS

The terms of reference (TOR) assists the proponent to develop a comprehensive EIS for the project satisfying the requirements of the SDPWO Act.

Draft TOR for the EIS were made available for public and agency comment on Saturday 11 July 2009, with submissions closing on Monday 10 August 2009. Seven submissions on the draft TOR were received, including five from advisory agencies and two from private organisations.

Table 4—Submitters to draft TOR

Sector	Submitter
State government	Department of Transport and Main Roads (DTMR—including Maritime Safety Queensland (MSQ))
	Department of Environment and Resource Management (DERM)
	Department of Employment, Economic Development and Innovation (DEEDI—including Fisheries Queensland)
Local government	Gladstone Regional Council (GRC)
Commonwealth government	Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA)
Public organisations	Capricorn Conservation Council Inc. (CCC)
	Fitzroy Basin Association (FBA)

In finalising the TOR, the Coordinator-General considered all properly made submissions and other submissions and information. The TOR were finalised and approved by the Coordinator-General for presentation to the proponent on 8 September 2009.

3.5 Technical reports

DIP requested key advisory agencies, including DIP, DERM, DEEDI and DTMR, to critique three technical reports designed to inform the EIS process:

- Sampling and Analysis Plan (SAP) (GHD report reference number 42/15386/51958)—prepared with reference to the requirements of the NAGD and the *Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils in Queensland* (QASSMAC, 1998). The SAP provides guidance for the assessment of the contamination status of the material to be dredged, including the appropriate sample collection, handling, storage, analysis methods and quality control requirements.
- Ecology and Water Quality Scope of Work (GHD report reference number 42/15386/51958/98694)—prepared to explain the desktop and field survey methodologies for ascertaining possible impacts to terrestrial and marine flora and fauna, and for monitoring baseline marine water quality
- Hydrogeology Scope of Work (GHD report reference number 42/15386/51958/390038)—prepared to assess terrestrial ground water conditions (geochemistry of the saltwater/freshwater interface,

and likely seasonal water level fluctuations) in the immediate vicinity of the Fisherman's Landing and the proposed WBDD Project reclamation area.

3.6 Public notification and review of the EIS

The EIS (GHD report reference number 42/15386/51970) was approved for release and advertised publicly on Saturday 14 November 2009, inviting submissions until close of business on Friday 18 December 2009. A CD-ROM copy of the EIS was available free of charge from the proponent, and hard copies were available for purchase.

The EIS was displayed at:

- Gladstone Regional Council Library
- State Library of Queensland, Brisbane
- Queensland Parliamentary Library
- Queensland Department of Premier and Cabinet Library
- National Library of Australia.

Information on the project was available via the GPC website at www.GPC.com.au/Project_Western_Basin_Dredging_and_Disposal_EIS.html, and the DIP Significant Projects website www.dip.qld.gov.au/projects.html. Advisory agency briefings were held in Gladstone on 23 July 2009 and in Brisbane on 24 July 2009.

The following advisory agencies were requested formally to conduct an evaluation of the EIS:

- DERM—Central Office, Brisbane, and Central Coast Regional Office, Rockhampton
- DEEDI
- DTMR (including MSQ)
- DIP
- GRC
- Great Barrier Reef Marine Park Authority (GBRMPA)
- DEWHA.

3.7 Submissions received on the EIS

Following the public review of the EIS, 19 submissions were received.

Table 5—Submitters to EIS

Sector	Submitter
State government	DTMR
	DERM
	DEEDI
Local government	GRC
Commonwealth government	DEWHA
Public submissions—organisations	Coffey Natural Systems (for Shell CSG (Australia) Pty Ltd)
	Queensland Seafood Industry Association (QSIA)
	Wiggins Island Coal Export Terminal Pty Ltd (WICET)
	Australia Pacific LNG
	GLNG/Santos-Petronas
	QER Group
	FBA
	CCC
	QGC/BG
	Four general public submissions
Public submissions—individuals	

Substantive issues raised in the submissions on the EIS included:

- potential impacts of dredge plume turbidity on marine flora (seagrasses and mangroves) and consequent impacts to marine fauna (dugongs, turtles and dolphins)
- monitoring of dredge plume turbidity and use of monitoring data to inform dredging operations
- other potential impacts of dredging on marine fauna, such as noise, vibration, lighting and boat strike impacts
- potential impacts of construction of the proposed reclamation area on marine flora and fauna, including scour and mudwave formation
- quantity, characteristics, disposal and placement of potential acid sulfate soils (PASS)
- dredge spoil disposal options including offshore and onshore disposal
- potential water quality impacts of stormwater and decant water contaminants, including turbidity, due to the reclamation
- relationship of the WBDD Project to WBMP, FLPE and other LNG-oriented project proposals in the Western Basin—that is, cumulative impacts
- displacement of commercial, recreational and indigenous fishers and boat operators
- visual amenity of the proposed reclamation mound
- amenity of bund and reclamation construction including noise, vibration, lighting and traffic, particularly due to proposed 24-hour, 7-day per week bund construction
- management of maritime safety and potential ship-sourced pollution.

3.8 Supplementary information to the EIS

Following the compilation and analysis of submissions on the EIS, it was determined by DIP officers that a supplementary EIS (SEIS) would not be required and that unresolved issues could be directly negotiated by an exchange of information between GPC, advisory agencies and public submitters. GPC proceeded to correspond and liaise directly with advisory agencies and public submitters to resolve any outstanding issues.

On 15 April 2010, a supplementary information document (SID, GHD report reference number 42/15386/400126) to the EIS was provided to DIP that addressed the key issues of concern raised by public and agency submitters to the EIS.

The SID was provided to advisory agencies that made a submission on the EIS requesting final endorsement and any recommendations and conditions for consideration in the Coordinator-General's EIS evaluation report (this report). The SID was also made available to public submitters to the EIS and the general public via the DIP and GPC project websites.

Following the three week public review of the SID, from Tuesday 27 April until close of business Wednesday 19 May 2010, eight submissions were received.

Table 6—Submitters to SID

Sector	Submitter
State government	DTMR
	DERM
	DEEDI
Local government	GRC
Commonwealth government	DEWHA
Public submissions—organisations	QSIA
	QER Group
	FBA

4. Approvals, permits and licenses

4.1 State approvals

4.1.1 Overview of key approvals

The SDPWO Act establishes the framework for environmental assessment of declared significant projects in Queensland and is the controlling legislation for the project at the state level.

The approvals framework applicable to the project is set by the *Sustainable Planning Act 2009* (SPA) and the *Environmental Protection Act 1994* (EP Act).

SPA requires certain developments to be assessed for their environmental effects and to be approved. Schedule 3 of the Sustainable Planning Regulation 2009 (SPR) and the relevant local planning instrument determine the types of development requiring approval.

The EP Act provides for the approval of environmentally relevant activities (ERAs) and the dredge management plan (DMP) applicable to the project.

The key approvals necessary for development of the project required under the SPA include:

- a development permit for material change of use, and registration certificate for dredging operations, that is an environmentally relevant activity (ERA 16, extractive and screening activities i.e. dredging)—assessed by DERM against the EP Act (refer to Schedule 1 of this report)
- a development permit for operational works for tidal works comprising:
 - dredging—assessed by DERM, as concurrence agency, against the *Coastal Protection and Management Act 1995* (Coastal Act) (refer to Schedule 2 of this report)
 - bund wall construction—assessed by DERM, as concurrence agency, against the Coastal Act (refer to Schedule 2 of this report)
 - reclamation (disposal of dredge spoil)—assessed by DERM, as concurrence agency, against the Coastal Act (refer to Schedule 2 of this report)
 - removal, destruction or damage of marine plants—assessed by DEEDI, as concurrence agency, against the *Fisheries Act 1994* (refer to Schedule 2 of this report).

DERM advised that approvals for dredging under the EP Act and operational works (tidal works) under the Coastal Act would need to be completed following finalisation and approval of this Coordinator-General's report. In addition, the development application for operational works (tidal) would be accompanied by a DMP (see section 7.2 of this report).

I note that GPC does not intend to seek approval for the DMP under section 89 of the Coastal Act. Rather, the DMP will be considered as part of the development approval for operational works (tidal).

The statutory approvals for the project are summaries in Table 7.

4.1.2 Strategic Port Land

The area of the proposed reclamation is within the GPC's strategic port land (SPL). Under Schedule 3 of the SPR, development on SPL that is consistent with a Strategic Port Land Use Plan approved under the Transport Infrastructure Act is exempt from assessment against a local government planning scheme. Therefore, this project is exempt from assessment by GRC against its planning scheme and GPC is the assessment manager.

4.1.3 Environmentally relevant activities

The Environmental Protection Regulation 2008 defines ERAs that could be associated with the construction and operation of infrastructure.

The EP Act requires that any person carrying out an ERA must hold or be acting under a registration certificate for the activity. It is an offence to carry out an ERA unless the person is a registered operator for the activity or is acting under a registration certificate for the activity.

The dredging operations required for construction of the project and maintenance of navigation channels is classified as ERA 16 'extractive and screening activities' consisting of dredging a total of 1000 tonnes or more of material from the bed of naturally occurring surface waters in a year.

DERM is the assessment manager agency for development approval for undertaking ERAs pursuant to the EP Act and has provided conditions for ERA 16 which are included at Appendix 1, Schedule 1 of this report.

4.1.4 Operational works (tidal)

As mentioned in section 4.1.1, in addition to a development permit under SPA for a material change of use for ERA 16 (dredging), the project would require a development permit under SPA for operational works for tidal works comprising:

- dredging—assessed by DERM, as concurrence agency, against the Coastal Act
- bund wall construction—assessed by DERM, as concurrence agency, against the Coastal Act
- reclamation (disposal of dredge spoil)—assessed by DERM, as concurrence agency, against the Coastal Act
- removal, destruction or damage of marine plants—assessed by DEEDI, as concurrence agency, against the Fisheries Act.

DERM advised that approvals for dredging under the EP Act and operational works (tidal works) under the Coastal Act would need to be completed following finalisation and approval of this Coordinator-General's report. In addition, the development application for operational works (tidal) would be accompanied by a DMP.

In practice, both DERM and DEEDI would assess the development application against a suite of information provided by GPC, including the EIS and SID, this report, and key operational plans such as the EMP, DMP and supporting management plans for acid sulfate soils, water quality, and flora and fauna.

4.1.5 Quarry material allocation

The removal of quarry material from state coastal land below high water mark in a coastal management district under the Coastal Act is regulated by means of either a resource allocation or a DMP approved under the Coastal Act. This applies to the removal of quarry material as part of the capital dredging associated with tidal operational works including dredging.

An application for a quarry material allocation (or an application for approval of a voluntary DMP under section 89 of the Coastal Act) would be made by the proponent prior to obtaining development permits for material change of use (ERA 16) and operational works (tidal works).

Section 75 of the Coastal Act sets out the assessment criteria for deciding an application for quarry material resource allocation. These criteria include:

- relevant policies of the state and regional coastal management plans
- impacts on the physical integrity of river bed and banks
- impacts on water quality and ecological values
- impacts associated with placement of the dredged material
- economic and social implications
- views of the local government and the Regional Harbour Master.

4.1.6 Summary of state approvals

Part 4, division 7 of the SDPWO Act applies to my evaluation of the project. This EIS evaluation report may state conditions under section 39 or 47C of the SDPWO Act, may make recommendations under section 52 of the SDPWO Act, or impose conditions under part 4, division 8 of the SDPWO Act, for the undertaking of the project.

Appendix 1, Schedule 1 provides my stated conditions that apply to a development approval for material change of use for ERA 16 (i.e. dredging).

Appendix 1, Schedule 2 provides my stated conditions for operational works (tidal works) for dredging, bund wall construction and reclamation, disturbance of marine plants, and includes conditions that apply to a DMP and other associated plans.

Appendix 1, Schedule 3 provides my imposed conditions that apply to the project.

The conditions provided in Appendix 1 do not limit the assessment manager's power to assess the development application and impose conditions not inconsistent with the conditions in Appendix 1.

4.2 Commonwealth approvals

In addition to the state and local government approvals necessary for the development of the project, a Commonwealth Government approval under section 133 of the EPBC Act to undertake a controlled action is also required. Further discussion of the assessment against the EPBC Act is provided in chapter 8 of this report.

If ocean disposal of dredged material is to be used for capital and/or maintenance dredging, a sea dumping permit will be required under the Sea Dumping Act.

Table 7—Statutory approvals required for the WBDD Project

Legislation	Agency	Trigger	Project response
Development approval			
<i>Environmental Protection Act 1994 and Sustainable Planning Act 2009 (SPA)</i>	DERM	ERA 16—Dredging	Development permit for material change of use, and registration certificate for ERA 16 (dredging), and dredge management plan.
<i>Coastal Protection and Management Act 1995 and SPA</i>	DERM	Dredging	Development permit for operational works for tidal works.
		Bund wall construction	
		Land reclamation (dredge spoil disposal)	
<i>Fisheries Act 1994 and SPA</i>	DEEDI	Removal, destruction or damage of marine plants	
Other approvals			
<i>Aboriginal Cultural Heritage Act 2003</i>	DERM	Development requires an EIS	Cultural Heritage Management Plan required for the project.
<i>Coastal Protection and Management Act 1995</i>	DERM	Resource allocation	Removal of quarry material from state coastal land below high water mark in a coastal management district.
<i>Land Act 1994</i>	DERM	Tenure	Reclamation area becomes Unallocated State Land (USL). Prior to application being made for Resource Allocation for the reclamation area, application must be made to lease the USL. Once the land is reclaimed, GPC can apply for ownership of the land.
<i>Native Title Act 1993</i>	DERM	Native Title notification	The Assessment Manager is responsible for undertaking Native Title notification at the time when an application for a development permit (tidal works) is lodged. The process runs concurrently with the IDAS development assessment.
<i>Nature Conservation Act 1994</i>	DERM	Possible effects on endangered, vulnerable, or rare wildlife, or the habitat on which that wildlife depends	Permit for taking, using, keeping or interfering with a protected animal or plant (if required). Clearing permit (if required).
<i>Transport Infrastructure Act 1994</i>	DTMR	Creation of land (land reclamation)	The GPC Land Use Plan has to be amended to include the reclaimed area in the plan. This can only occur after completion of the reclamation.
<i>Vegetation Management Act 1999</i>	DERM	Possible clearing of native vegetation.	Operational works approval for clearing native vegetation (if required).
Commonwealth approvals			
<i>Environmental Protection and Biodiversity Conservation Act 1999</i>	DEWHA	Controlled action for possible impacts to MNES.	Development approval to undertake a controlled action.
<i>Environment Protection (Sea Dumping) Act 1981</i>	DEWHA	Application for offshore disposal of dredge spoil material (if sought by GPC)	Sea dumping permit required if ocean disposal of dredged material is required (by application) for capital and/or maintenance dredging.

5. Evaluation of environmental effects

5.1 Introduction

The SDPWO Act defines 'environment' to include:

1. ecosystems and their constituent parts, including people and communities
2. natural and physical resources
3. qualities and characteristics of locations, places and areas, however large or small, which contribute to their biological diversity and integrity, intrinsic or attributed scientific value or interest, amenity, harmony and sense of community
4. social, economic, aesthetic and cultural conditions that affect, or are affected by, things mentioned in paragraphs 1 to 3.

'Environmental effects' mean 'the effects of development on the environment, whether beneficial or detrimental'. These effects can be direct or indirect, of short, medium or long-term duration and cause local or regional impacts.

This section outlines the major environmental effects identified during the EIS process, including those raised in the EIS, SID, in submissions on the EIS, and in consultation with advisory agencies and other key stakeholders.

Where appropriate, **I have provided** comments on these matters and, where necessary, **I have stated or imposed** development approval conditions to mitigate adverse impacts of the project that have been identified in the EIS.

5.2 Coastal environment

5.2.1 Reclamation area

5.2.1.1 Context

The proposed reclamation area is a 235 ha extension of an existing reclamation and shipping berth facility at Fisherman's Landing and an approved (but as yet not constructed) 153 ha extension of the existing Fisherman's Landing facility. The proposed reclamation area experiences a 2.5 m tidal range and a minimum water depth of about 2.9 m. Most of the area to be reclaimed supports seagrass meadow that is significant as habitat for marine species.

The proposal includes retention of a 2188 m long (total area 9 ha) tidal channel between western bund of the reclamation area and the mangrove-lined foreshore. The EIS notes that this area is likely to be permanently altered by the proposed development due to changes in tidal flushing and consequent siltation.

5.2.1.2 Construction of reclamation area

The EIS (section 2.3.4) indicated that approximately 1.8 Mm³ of bluestone rock material for construction of the bund walls would be sourced from the GPC-owned quarry on Guerassimoff Road, approximately 4 km from Fisherman's Landing. The bluestone would be extracted and screened at the quarry site to provide the correct sizing for bund wall construction. In its submission on the EIS, DERM recommended that only clean rock with fine particles (less than 12 millimetres (mm)) removed should be used for the proposed revetment and bunding. **I have stated** conditions (Appendix 1, Schedule 2, Part 5) that require the proponent to adhere to specifications for the bund design, materials, construction and management.

The same quarry, haul route option and screen size provisions for bund rock material were set for the FLPE project.

Three haulage options (including two involving construction over eight hours per day, Monday to Friday and one 24/7) were considered in the EIS and SID. These are addressed in more detail in section 5.4

(Transport and traffic) of this report. The latter option is preferred by GPC because of the very tight time-frame for completing the reclamation site.

The EIS stated that the bund would be constructed with a core of smaller rock and the outer face of the bund wall would be protected from the action of waves by armour rock. However, it is recognised that alternate configurations (based on the distribution of rock size) may be proposed by contractors. GPC has stated that geotextiles would be used to minimise the movement of fines through the bund walls.

In its submission on the SID, DERM noted that no details were provided on the nature of the geofabric to be used (particularly the fabric's pore size) or its location in the bund—for example, at the core or laid over the inside of the wall—and recommended that this information should be provided with a development application for construction of the reclamation bund walls and with an acid sulfate soils management plan (ASSMP) for construction of the reclamation area and management of dredge spoil containing PASS. **I have stated** a condition (Appendix 1, Schedule 2, Part 5) that requires the proponent to specify the characteristics of the geofabric to be used in the construction of the reclamation area.

If the FLPE is constructed first, it will define the eastern boundary of the WBDD Project reclamation area and, instead of requiring 2187 m of rock wall bund with armouring, the eastern wall would only involve a 300 m extension of the FLPE eastern wall. Similarly, the northern and western bund walls of the FLPE may not require armouring as these walls would be within the WBDD bundled area.

The SID provided further advice on the nature and timing of the reclamation. In particular, the FLPE will commence as soon as practicable and, if approved, the current WBDD Project proposal would be integrated with that project.

The height of the bund walls would be relative level (RL) 7 m port datum³. The bund would have a crest width of 10 m to allow for construction machinery and vehicles to operate along the bund wall as it is being constructed and a further 5 m width of armouring on the northern and eastern external faces and 4.5 m of armouring on the western external face. Armouring details are current at SID stage and may vary subject to final design works being carried out.

Once the bund wall is complete and enclosed, dredged material would be pumped into internally bundled cells within the reclamation site. The bund would be filled using capital and maintenance dredge material. The SID indicated that, when fully constructed, the proposed reclamation area would contain:

- 42.3 Mm³ of capital dredge spoil
- 4 Mm³ sourced from the dredging for the FLPE project and
- approximately 6 Mm³ sourced from dredging requirements of other projects and future port-related dredging activities.

The net capacity of the reclamation area, excluding bunds (both internal and external) and capping requirements would be approximately 55 Mm³.

The EIS stated that cells would be capped with material sourced from the existing quarry overburden and that the capping would be completed progressively on completion of filling with dredge spoil. The capping would then be grassed. In this regard, GPC must maintain the grass to ensure its success until final uses of the reclamation area have been determined.

The EIS did not provide specifications for the quarry overburden. Therefore, **I have stated** conditions (Appendix 1, Schedule 2, Part 5) that requires the proponent to specify the permeability and chemical stability to ensure containment of ASS fill. Longer term stabilisation through grassing may require surface treatment of the capping and **I have also stated** conditions (Appendix 1, Schedule 2, Part 5) that require the proponent to address the longer term stabilisation of the reclamation mound through surface treatment.

In addition, **I have stated** condition (Appendix 1, Schedule 2, Part 5) that requires the proponent to specify the approach to be taken to achieve a stable vegetation of the finished surface and all surface drainage paths for stormwater until future land use of the reclaimed area has been established. When future industries develop on the final reclamation, they will be required to install appropriate stormwater

³ The height of the tide (expressed as metres and decimals) is referred to as the port datum (lowest astronomical tide (LAT) datum). See EIS, Appendix M, Table 3-1.

management measures to manage both clean and potentially contaminated stormwater on their sites through the relevant development approvals processes.

The SID stated that completion of the reclamation area would be determined by the rate of development of Gladstone Harbour, estimated to be about 15 years.

Stormwater runoff from completed areas of the reclamation would be directed via grassed channels to weir boxes and settlement ponds to manage the quality of tail-waters and stormwater prior to discharge into the harbour (EIS, section 2.4.3).

The SID indicated that the final reclamation area stormwater management network would have several discharge points and appropriate treatment measures, including a major pond and discharge in the north-west corner of the reclamation area. GPC agreed to move the dredge spoil decant outfall to the north-east corner of the reclamation area during dredging to comply with DERM recommendations.

GPC has not provided any detail of the structural details or layout of internal cell construction, deferring this advice until the DMP has been completed (SID, section 4.1.5).

The EIS indicated that climate change- induced sea level rise has been taken into consideration in determining the design wave heights for the rock armour for the bund. The rock armour has also been designed for extreme wave conditions with an average return interval of 50 years as recommended by DERM's operational policy for building and engineering standards for tidal works.

DERM has made several comments on the content of the EIS and the SID, in particular regarding the reclamation area, stormwater management arrangements and the potential for failure of surface vegetation.

In particular, DERM expressed concern regarding:

- capacity of the reclamation area to accept the quantity of dredge spoil
- ASS management principles, including testing and monitoring for the reclamation area
- height proposed for location of PASS material (above mean low water)
- design of the external bund - to retain the spoil/prevent seepage of ASS
- geotextile specification and its location in or on the surface of the bund
- mud wave caused by bund wall on soft substrates
- management of decant water and location options for its discharge
- potential scouring of the bund
- stabilisation of the mound and erosion potential
- the potential for formation of monosulphides in the western tidal channel
- stormwater management and discharge arrangements.

Several other submissions on the EIS were concerned with the capacity of the reclamation area, alignment of the eastern wall, the layout of the internal cells within the reclamation area, internal bunds, capping of dredge spoil and stormwater management.

5.2.1.3 Potential impacts—summary

The EIS noted that the potential impacts that may result from the construction of the bund wall include:

- as rock is placed onto the seabed, soft sediments would be remobilised in the water column. Soft sediments would also be pushed out the front and sides of the bund wall which is likely to result in the generation of a 'mud wave'
- the turbid plume would reduce light penetration over the adjacent seagrass beds (however, these seagrasses experience elevated turbidity on a regular basis due to natural tidal re-suspension of the soft seabed sediments)
- while it is likely that any disturbed sediments that deposit over the seagrass beds would be remobilised and transported away from the tidal flats during tidal movements and elevated wave

conditions, the construction operation is likely to continue 24/7 and for a period of between 12 and 18 months

- the 24/7 construction schedule would suggest that the effected seagrass beds would receive no respite from sediment deposition for 12 to 18 months
- increased tidal currents at the northern end of the bund wall on both ebbing and flooding tides. This is anticipated to initially increase turbidity through increased scour of the soft seabed sediments at this location
- changes to hydrodynamics which may result in changes to the flushing efficiency of the area, thereby impacting on water quality
- restricted access for recreational, indigenous and commercial fishing in the area
- complete loss of marine vegetation within the footprint of the reclamation
- corresponding loss of benthic habitat.

GPC has responded to these issues satisfactorily, except in relation to the issue of capping and vegetating the completed cells and mound.

I have considered the issues raised in the submissions and further considered in the SID. **I am satisfied** that the conditions listed in Appendix 1 adequately deal with these issues.

5.2.2 Dredging

5.2.2.1 Dredging requirements

The WBDD Project proposes capital and maintenance dredging from the nominated footprint (see Figure 2, Project site), associated with the deepening and widening and northern extension of existing access channels, swing basins, shipping berth pockets, and early works including marine offloading facilities (MOFs) associated with proposed LNG projects on Curtis Island.

Capital dredging required for the WBDD Project is summarised in Table 1. Maintenance dredging would account for a further 10 Mm³.

In this regard **I have noted** elsewhere in this report that on-going silting of some of the dredged channels is likely to be around 250 000 m³ per year. Thus, the provision for 10 Mm³ would be adequate for the projected life of the LNG development and production program. Provision for longer term placement of maintenance dredge spoil is not considered to be a part of this project and has not therefore been considered in this report.

5.2.2.2 Dredging process

In its submission on the EIS, DERM indicated that the EIS did not provide sufficient detail on the characteristics of the dredge material, type of dredges to be used, the dredging rate, or the mode of operation (overflow or non-overflow) for the dredging activity. In response, the SID indicated that 80–90 per cent of dredging is likely to be by way of cutter suction dredge (CSD), with trailer suction hopper dredge (TSHD) as an option, if needed (based on technical and transport requirements). Backhoes are also likely to be used. The EIS stated that further detailed information on the dredging program would be provided with the relevant operational works' applications together with detailed dredge management plan for such works.

Suitable backhoe dredges may also be used in the shallower areas and during the early works stages. Backhoe dredges would be used in conjunction with the offshore disposal site.

The EIS stated that the proposed dredging regime would directly affect 902 ha of benthic habitat and modelling indicated that an additional 5416 ha could be indirectly affected by dredge plumes. The direct and indirect impacts of the dredge plume on the marine ecology are discussed in section 5.2.6 of this report.

The SID provided more detailed description of the likely dredging operational regime and identifying the nature of the substrates. Particular concerns about the potential extent of the dredge plume generated by different dredging equipment were assessed in more detail.

DERM has reviewed the SID and submitted draft conditions to apply to an environmental authority for the dredging activity and for a development permit for operational tidal works. These are included in Appendix 1 of this report at Schedule 1 and Schedule 2 respectively.

The SID stated that the required dredging equipment is available on the world market but its availability cannot be guaranteed before contracts have been settled (SID, section 5.5.6).

A combination of dredges—CSD, TSHD and backhoe—is likely. The DMP would address:

- type and duration of dredges
- trigger values (especially those at the site of any decanting, and at sensitive areas likely to be impacted)
- disposal methods associated with each dredge type
- actions should any trigger values be exceeded.

Bottom dumping by trailing suction hopper dredges of some of the plastic clay dredge spoil in the project area as an interim activity prior to its placement in the reclamation area. This activity has the potential to cause significant turbidity issues during dumping, which could extend the area of impact over seagrass beds and other benthic communities.

DERM has expressed similar concerns in its review of the SID, stating that the major contributors to sediment loading to waters and, therefore, impact on water quality and aquatic ecosystems are:

- use of TSHD in overflow mode
- bottom dumping of spoil from the TSHD off Fisherman's Landing and re-handling using a CSD for placement in the reclamation area.

DERM recognised that use of TSHD and overflow dredging cannot be eliminated for technical reasons relating to distance between the dredging and the reclamation area. However, rehandling of TSHD spoil in order to transfer material to the reclamation area can be substantially reduced by offshore disposal of this material or if rehandling is necessary then it should not occur offshore from Fisherman's Landing. A firm commitment to no rehandling would give much greater certainty to the modelling of turbidity and impacts on seagrass communities.

Similarly, in its submission on the EIS, DEEDI expressed concern at bottom dumping and rehandling using TSHD, recommending that the technique should be avoided wherever practicable and, even then, should not occur during flood tides.

DEEDI reinforced the importance of the preparation of the DMP for this project, recommending that the following provisions should also be included in the DMP:

- details of the frequency and location of monitoring
- a set of appropriate minimum light requirements for the seagrass communities likely to be impacted
- modelling and monitoring of dredge plumes and the resulting light levels reaching seagrass communities
- sub-lethal indicators of seagrass health that would allow detection of stress in seagrass communities and would trigger the implementation of mitigation strategies
- detailed mitigation measures that would provide appropriate respite for seagrass communities, preventing mortality.

GPC is unable to confirm availability of an appropriate sea dumping area at this stage, although application has been made for offshore disposal of this spoil. Therefore, **I must consider** the impact of the bottom dumping and rehandling activities.

While **I acknowledge** that some of this information is not currently available, detailed environmental management plans for dredging will be made available to DERM prior to and for consideration in the context of applications for works..

I note GPC has committed to ensure dredging activities would be managed in accordance with the requirements of the *Queensland Acid Sulfate Soil Investigation Team Guidelines* in the *Queensland Acid*

Sulfate Soils Technical Manual Soil Management Guidelines and the NAGD. The SID also indicated that a habitat monitoring program would be tied into the dredging program for the project and refined during the planning of the dredging activities as part of the DMP. **I also note** the intention to adopt an adaptive management plan overseen by a technical reference panel.

5.2.2.3 Potential impacts—summary

The primary impact of dredging occurs in the direct destruction of the sea bed where dredging must occur. The design and footprint of such dredging is defined by the declared uses of the harbour and port facilities. **I consider** that GPC has prepared the proposal in a manner that minimises unnecessary direct destruction of seagrasses and other benthic communities. However, the dredging activities must also be considered in terms of the:

- proposed dredging equipment and techniques
- timing of activities
- safeguards that can be applied to minimise the risk of secondary (or indirect) impacts
- unavoidable impacts.

Potential secondary impacts of the dredging and decanting activities for the project extend much further than the dredging footprint. Secondary impacts include changes in the water column such as elevated turbidity and mobilised chemicals that can be attached to the colloidal particles and deposition of sediment that can overwhelm benthic organisms, altering the health and productivity of fish and marine mammal habitat areas adjacent to the reclamation area.

The EIS indicated that:

- variable turbidity regimes in the project area suggest that existing seagrass species distributions are adapted to temporal changes in turbidity
- the presence of healthy seagrasses in the vicinity of the Port of Gladstone indicates that the seagrass meadows can co-exist with the port activities and development
- significant impacts may occur affecting the taxonomic composition and/or biomass of meadows when the severity or duration of any particular impact exceeds levels of natural variation.

Seagrass has a light requirement of between 15 and 25 per cent (depending on species) of surface irradiance to maintain key physiological processes. The reduction in light due to turbidity plumes from dredging appears to be a key factor in seagrass mortality in Australia.

The EIS stated that the mangrove communities in the vicinity of the project are adapted to the turbid near shore environments. The expected turbid plume from the Targinie Channel and Fisherman's Landing swing basin dredging and decanting from the reclamation is not expected to substantially increase turbidity along the shoreline where there are mangroves within the project area.

Potential impacts of dredging on water quality are discussed in more detail in section 5.2.6 of this report.

5.2.3 Dredge spoil disposal—alternative locations

The decision to develop the proposed reclamation area was initially taken during the 1980s with establishment of the Fisherman's Landing port facility. At that time an appreciation of natural attributes of Port Curtis as a harbour and Gladstone's strategic importance for Queensland's industrial development were guiding principles.

In May 2010, **I approved** a proposal to extend the port facility provided by Fisherman's Landing. When completed, the reclamation would provide additional land to support the future construction of six wharves for the development of transport, storage, loading and unloading facilities.

The development also addressed proposed capital dredging to deepen and widen the Targinie Channel and Fisherman's Landing swing basin, which provides shipping access to the current Fisherman's Landing reclamation. The reclamation area would also provide a disposal location for other future port-related dredging activities.

In considering the FLPE proposal I **reviewed** the primary effects of the development on the hydrology and ecology of the locality. In this respect the current reclamation area is an infill extension on the landward side of an approved development. The new reclamation area has a larger footprint that would result in destruction of a significant area of seagrass and other benthic habitat. The ecological impacts have been considered elsewhere in this report.

Section 2.3.2 of the EIS provided an assessment of alternative dredged material disposal locations.

Further analysis of the dredge spoil disposal options is provided in sections 2.4.2 and 8.2.2.3 of this report.

Taking into consideration all options discussed in the EIS, I **consider** the proposed Western Basin reclamation area, as shown in Figure 2 of this report, to be the most suitable option available for disposal of capital dredge material for this and other projects and future maintenance dredging activities of the GPC.

5.2.4 Coastal processes

5.2.4.1 Context

The marine environment of the project area is not homogeneous and it includes relatively shallow embayments with a heterogeneous mosaic of soft sediment, rocky reef, coral, seagrass and algae, with variable water depths partitioned by islands, mud banks and channels.

The project area is sheltered by Curtis Island and Facing Island to the east and south-east. To the north of the project area is The Narrows, which is a narrow but navigable waterway between the mainland and Curtis Island that forms a complex system of creeks, mudflats and mangrove habitats.

Numerical modelling was undertaken for the EIS (EIS, chapter 6 and Appendix J) to describe the existing tidal hydrodynamic processes of Port Curtis and to understand the circulation, wave conditions, flushing patterns, turbid dredge plume dispersion and sedimentation processes across the project area. The model was used as a tool to quantify the physical processes and to assess the potential impacts of proposed dredging and reclamation works for the project.

Two-dimensional (2D), depth averaged, calibrated and validated modelling (TUFLOW-FV) was undertaken, which was selected to be appropriate for the high energy, macro-tidal and well-mixed conditions of Port Curtis (EIS, section 6.7).

The model mesh covered an area of approximately 635 km² extending a reach of approximately 80 km from Richard Point in the south-east to Division Point in the north-west (EIS section 6.6.1 and Figure 6.2). Simulations were carried out to represent a two month period using tidal boundaries derived from data recorded in February and March 2009, selected to include large spring tides and small neap tides.

A sensitivity analysis comparing 2D to 3D modelling showed that there was only marginal improvement in results using the more complicated 3D model. The SWAN wave modelling package was used for wave assessments and was linked to TUFLOW-FV as required. The model bathymetry was based on digital elevation modelling of the port derived from various existing survey data.

Several hydrodynamic modelling scenarios were also investigated in order to provide an assessment of the combined impacts of tides, waves and winds and a 100 year average return interval flood event in the vicinity of the proposed marina and channel dredging works.

The modelling was undertaken for a base case and three development scenarios containing four stages of dredging and the proposed reclamation (EIS, Table 7-17):

- Base case— existing channels + recent dredging at Fisherman's Landing + proposed Wiggins Island Coal Terminal dredging
- Scenario 1— base case + Stage 1A (Clinton Bypass channel dredging + Curtis spur channel and China Bay swing basins dredging) + Stage 1B commenced (initial Targinie Channel and Fisherman's Landing swing basin dredging) + Western Basin reclamation area completely constructed
- Scenario 2— scenario 1 + Stage 1B completed (additional dredging of Targinie Channel and Fisherman's Landing swing basin) + Stage 2 (Channel extension to Laird Point and swing basin)

- Scenario 3— scenario 2 + Stage 3 (additional dredging to Laird Point) + Stage 4 (additional dredging between swing basins and near China Bay and Hamilton Point on Curtis Island).

The results of the modelling of developed case scenarios were compared to the base case to assess the potential impacts of the works.

The physical processes of the marine environment adjacent to the project area are predominantly characterised by tidal flows with effects from locally generated waves and storm events, which can cause extreme waves and elevated water levels (storm surge).

The processes that transport sediment around the area are dominated by tidal currents of up to 1.5 metres per second (m/s) driven by the relatively large tide range (4.69 m measured at Auckland Point), coupled with a mild wave climate that stirs up sediments in the shallower areas at times of low tide. Important but infrequent drivers are extreme events such as cyclones, which can generate high waves and water levels that can have major effects on the environment and affect areas that would not normally be affected under prevailing conditions.

5.2.4.2 Coastal morphology

The existing reclamation at Fisherman's Landing was constructed in the early 1980s and consists of a perimeter bund armoured on the outside with a widely graded rock. The perimeter bund has formed a stable revetment for the existing reclamation, as well as providing an abutment for the approved FLPE and the proposed WBDD Project. The closest channel to Fisherman's Landing is the Targinie Channel, which provides shipping access to the four berths that use the existing reclamation for their connecting infrastructure (conveyors, pipelines, services and access). Currently, the Targinie Channel is 120 m wide and is maintained to a depth of -10.6 m LAT through maintenance dredging.

Port Curtis has a relatively high tidal range and tidal compartment producing tidal currents up to 1.5 m/s in the main channels and up to 0.3 m/s in some of the shallower areas. These velocities are capable of moving large amounts of sediment depending on the water depth and wave action. In deep areas, tidal currents are the dominant force for sediment movement and in shallower areas, where tidal currents are smaller, it is the combination of wave action and tidal currents that is important.

5.2.4.3 Wave climate

The EIS included an analysis of the wave climate (EIS, Appendix M, section 3.1.2). The wave climate was calculated at seven points of reference around the proposed project site for both the existing and developed scenarios (reclamation and dredging). Results have been provided for a range of wind-generated wave conditions including significant storm and cyclones. Overall the report concluded that the reclamation and the dredging works would have negligible effect on high tide levels and relatively minor effects on low tide levels, except in the channel on the western side of the reclamation.

5.2.4.4 Tidal currents

Modelling of the hydrodynamics for the proposal is presented in the EIS (Appendix M, section 4).

The report suggested that the reclamation would affect the hydrodynamics of the harbour through a reduction in the tidal prism and obstructing flows that previously flowed across its footprint area. In turn this leads to flows downstream of the reclamation area and an increase in flow rates adjacent to the reclamation caused by a reduction in the cross-sectional area leading up to The Narrows.

The modelling undertaken for the EIS showed that the most noticeable effect of the reclamation and dredging on the tidal flow occur to the north of the proposed FLPE, where increases in tidal velocities are evident on both the ebb and flood flows. In an area where the base case velocities are a maximum of around 0.3 m/s, increases to 0.6 m/s and 0.8 m/s have been calculated for the ebb and flood tide flows respectively. These maximum velocities occur adjacent to the northern extent of the reclamation. Increased velocities occur over the area of the embayment to the north of the proposed FLPE, gradually tapering off to base-case conditions approaching Friend Point.

There is expected to be an increase of up to 0.3 m/s in the velocities in the main channel north of the existing reclamation for both ebb and flood flows. This can be attributed to the narrowing of the waterway due to the reclamation. Another noticeable effect is the reduction of around 0.3 m/s in the flows (depth averaged) in the vicinity of the existing Fisherman's Landing berths under both ebb and flood flow

conditions. Comparing the with/without dredging cases, it is evident that this reduction is directly attributable to the increased water depths from dredging of the channel.

Some minor impacts are also expected along the main channel south-east of Fisherman's Landing and in between the small unnamed island opposite RG Tanna coal terminal. These differences are all less than 0.2 m/s and are not considered to be significant compared to the maximum tidal velocities, which reach 1.5 m/s in this area under existing conditions.

To the east of the proposed FLPE, the effects on the tidal flows are relatively small and can be attributed to the increased water depths as a result of dredging. However, the increased velocities at the northern end of the reclamation are much more significant as the tidal flows into the embayment to the west and the mangrove areas to the north-west are squeezed through a much smaller opening than currently exists.

5.2.4.5 Water levels

The EIS indicated that the modelling undertaken for the project reveals that there is no significant difference in the predicted water levels between the 'reclamation only' and the 'reclamation with dredging' cases.

The EIS reported no significant difference in water levels for any of the developed cases in comparison to the base case for any of the locations in the main harbour—Auckland Point, Fisherman's Landing berth and the entrance to The Narrows.

The naturally occurring tidal range at the Standard Port location (Auckland Point) is 4.69 m. At The Narrows the range is stated to be between 5 and 6 m. Only minor changes to tide levels are expected. Some of the expected minor changes include:

- the level of low tide has been increased by around 0.4 m and the time of low is about one hour later, close to the western side of the reclamation area, at the north-east tidal flat
- increases to low tide levels greater than 0.02 m are generally restricted to the shallower inter-tidal and subtidal flat areas in the immediate vicinity north and west of the project site.

5.2.4.6 Coastal sedimentation

The EIS contained details of the impacts of the proposed development on silt and sediment transport in Gladstone harbour.

The EIS Addendum (section 3.3) reported on the modelling assessment of sediment transport and potential impacts. Generally:

- sand transport potential is confined to the dredged channels
- the rate of sand transport is decreased due to a reduction in velocities.

Modelling predicts an increase in the net sediment transport in the ebb tide direction in the main channel adjacent to the reclamation and reduction in the swing basin area off Fisherman's Landing. Increases in the net sand transport potential are also predicted near the north-western and north-eastern corners of the reclamation area. The calculations indicate the potential for scour in these areas, particularly as the sediments in these areas are relatively fine. The scoured material is likely to be deposited in the swing basin that services the existing Fisherman's Landing berths. Therefore, there is potential for an increase in the maintenance dredging required in the swing basin after the reclamation has been constructed, although it is difficult to quantify the increase as it depends on the availability of material for transport.

Material scoured from the north-west corner is likely to be carried into and deposited in the area between the reclamation and the mainland. At the north-east corner the net transport is towards the main channel and hence material scoured from this area is likely to be deposited in the channel.

5.2.4.7 Summary of impacts on benthic soft sediment seabed communities

Table 11-11 in the EIS provided a summary of potential indirect impacts on benthic soft sediment seabed communities due to predicted changes in physical processes. The impacts are:

- area potentially impacted by increased deposition (predicted from decreased bed shear stress)—29.02 ha

- potential area of increased scouring (predicted from increased bed shear stress)—115.33 ha
- area where water level is predicted to change at low tide—246.23 ha
- total area of potential indirect impact (excluding areas that overlap)—461.52 ha.

A potential decrease in water quality (discussed previously) and predicted changes in the hydrodynamic regime (tidal velocities, bed shear stress and water levels) around the project site are expected to indirectly impact on seagrass communities. The predicted changes have the potential to:

- partially or completely smother the existing benthic assemblages, seagrass beds and/or seed banks with sediment in some areas on the western side of the reclamation. It is noted however that this area is already turbid and has low tidal velocities, therefore some sediment deposition is already experienced in this area and seagrasses currently persist in this environment
- alter the area of suitable seagrass habitat at the northern end of the reclamation, where it is predicted that scouring of fine sediments would occur
- result in reduction of water quality due to predicted decrease in flushing, which may impact on the health of marine communities
- increase the amount of subtidal seagrass habitat compared to intertidal habitat as a result of increased water depth at low tides. This is not expected to affect the presence of seagrass rather the ratio of subtidal to intertidal meadow.

These predicted changes are discussed in section 5.2.6 of this report.

5.2.4.8 Coordinator-General's conclusion—coastal processes

Hydrodynamic modelling and sediment transport assessments for the EIS indicated that the significant coastal process impacts of the reclamation and dredging are restricted to that part of the harbour between the existing Fisherman's Landing facility and the entrance to The Narrows. The only exception to this is some minor increases in the net sand transport potential in the main channel extending down harbour to Auckland Point. It is not expected that these latter increases would have any significant effects.

5.2.5 Marine water quality

5.2.5.1 Context

Water quality baseline assessment

A review of previous water quality studies around Fisherman's Landing between 1995 and 2009 was included with the EIS documentation provided to me for consideration of the FLPE proposal earlier this year. This information has been reproduced as background water quality information for the current proposal is provided in Appendix K of the EIS (EIS, Appendix K, Water Quality Report, Appendix A: Review of previous water and sediment quality studies May 2009).

The available water quality data were compared with water quality objectives in the *Queensland Water Quality Guidelines* (2006) (QWQG) and the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (2000) (ANZECC).

Water quality monitoring data indicate that the study area, encompassing the project site and the adjoining waters of the harbour, experiences highly variable turbid conditions. In addition, elevated levels (compared to the relevant guidelines) of nutrients and other contaminants were observed in recent surveys. Sediments also exhibit some low level contamination (within acceptable limits) in a few locations, and more generally, potential for acid generation.

A summary of water quality surveys included in the Table 7-4 in the EIS indicates that in the Fisherman's Landing area:

- pH was mostly within the range of the ANZECC guidelines (ranging from pH 7.0 to pH 8.5) and generally, around pH 8
 - pH at Fisherman's Landing adjacent to the dredge head, pH 7.7–8.2
 - pH in the northern seagrass meadow between reclamation area and The Narrows, pH 7.7–8.1

- total suspended solids were generally affected by tidal movements, with increased suspension in shallower areas
 - intertidal areas adjacent to Wiggins Islands and Mud Island, TSS—30.5 and 55 mg/L for May and September periods respectively
 - Flying Fox Creek, TSS—57 mg/L during dry season
 - Sandfly Creek, TSS—44 mg/L dry season
 - Fisherman’s Landing reclamation area, TSS—29 mg/L average
- nutrients measured in the vicinity of the Fisherman’s Landing include total phosphorus (P) and total nitrogen (N), substantially exceeded ANZECC guidelines for all 13 sampling sites
 - shipping channel near Tide Island, total P= 0.02 mg/L and total N < 0.2 mg/L
 - shipping channel South Passage, total P = 0.01 mg/L and total N < 0.6 mg/L
- metals sampling for nickel, cobalt, silver, chromium, copper and zinc at the following sites
 - shipping channel near South Passage Island, Fisherman’s Landing, Targinie Creek (middle reaches and at the mouth), Boat Creek, Flying Fox Creek, Nutmeg Creek and Calliope River—nickel levels exceed ANZECC guideline water quality trigger values (TV) at many sites
 - Boat Creek, Flying Fox Creek and Nutmeg Creek—cobalt, chromium and copper levels exceed the TV
 - Boat Creek and Flying Fox Creek—silver exceeded the TV
 - Flying Fox Creek and Nutmeg Creek—zinc exceeded the TV, but was compliant to the 95 per cent protection limit for the ANZECC guideline.

The EIS indicated that tidal movements, water depth and runoff as well as wind direction and speed can all influence turbidity in Port Curtis because of the shallow depths and soft sediments of the region.

The EIS stated that baseline water quality studies for this project were commenced in 2009. These include fixed (*in situ*) loggers and vessel-based monitoring to test the hydrodynamic conditions of the sites for all parameters identified in the ANZECC guidelines.

While recognising that dredging activities will mobilise substances that would otherwise lay in bed sediments, the general conclusions in the EIS were that:

- all measured parameters (temperature, electrical conductivity, pH, dissolved oxygen (DO), turbidity, oxidation reduction potential (ORP)) were well mixed throughout the water column
- seasonal variability in parameters was identifiable through changes in temperature, electrical conductivity, ORP, turbidity, pH
- pH tended to be lower than the QWQC guideline range, as did turbidity. However, turbidity tended to be near the upper limit of the ANZECC guideline range. DO saturation tended to be within the QWQC guideline range of 90 to 100 per cent, with occasional measurements above or below this range
- vessel-based sampling (grab samples) analysis showed hydrocarbon-based samples were consistently below the limit of reporting for a broad range of chemical and physical properties. These included BTEX⁴ carcinogens and mutagens, tributyl tin, polyaromatic hydrocarbons, volatile organic compounds, cyanide and organo-pesticides with the exception of chlorpyrifos, which was detected at levels above the limit of reporting (< 0.005 µg/L) at 6 out of 36 sampling points. The range of exceedences was 0.008—0.024 µg/L
- a herbicide, metachlor, was recorded above the threshold (0.005 µg/L) at 7 of the 35 measurement points at levels ranging from 0.009—0.271 µg/L

⁴ BTEX: organic compounds benzene, toluene, ethylbenzene and xylenes

- cadmium was the only metal /metalloid sample that exceeded its trigger value (during May at WQ06 (adjacent to north face of reclamation area and WQ09 in the proposed dredge area Stage 4 Hamilton Point)
- samples tested for nutrients identified high concentrations of ammonia (QWQG x 10 times and ANZECC guideline x 6 times). Total oxidised nitrogen was above QWQG 26 times out of 48 measurements with the median value 0.004 mg/L (guideline level is 0.003 mg/L). Total Kjeldahl nitrogen exceeded the QWQG guideline level twice in 48 samples tested. Reactive phosphorus exceeded the ANZECC guideline level on six occasions
- samples were also tested Chlorophyll a, exceeding the 2 µg/L guideline level on several occasions, reaching a maximum of 5 µg/L.

The EIS states that in general the project areas generally met the relevant adopted guidelines.

The EIS states that turbidity is an indirect measure of water quality. However, the amount of natural or background turbidity in the water column throughout Port Curtis is itself a function of wave, wind and tidal velocity on variations in water depth. Shallow areas of the port are more likely to experience amounts of suspended solids that are greater than in the deeper areas and with exception of shipping channels and most of the Port Curtis carrying a bed load of fine sediments, the port is a naturally turbid system.

Data loggers recorded turbidity levels elevated above QWQG and ANZECC guidelines. The EIS characterises turbidity the project area as:

- during the dry season in waters deeper than 2 m LAT the median range is from 3–9 NTU and from 11–35 NTU for the 95th percentile
- during the dry season for shallow waters less than 2 m deep, LAT the median is approximately 9 NTU and a range from 30–90 NTU for the 95th percentile
- during the dry season, turbidity during spring tide conditions is quoted as 2–4 times the turbidity during neap tides.

The wet season range for the deeper waters in shallow waters the median is 10–23 NTU and 127–176 NTU for the 95th percentile. The EIS suggests that elevated turbidity levels are likely to be induced by wet season inflows.

Overall the EIS finds that the quality of the *in situ* sediments in the study area is compliant to the *National Ocean Disposal Guidelines for Dredged Material* (Environment Australia 2002) (NODGD), NAGD and the Environment Investigations Levels (EIL) of the *Draft Guidelines for the Assessment and Management of Contaminated Land* sediment quality guidelines. It is noted that the NAGD (2009) supersede the NODGD (2002).

Acid sulfate soils

Acid sulfate soils (ASS) are a characteristic feature of low lying coastal environments in Queensland. Undisturbed, these soils can be present in an anaerobic state within marine muds and sands in the form of potential acid sulfate soil (PASS). Actual ASS are the oxidised (disturbed) form, which may occur as the result of natural or anthropogenic disturbance from changes in groundwater levels and/or exposure to oxygen.

ASS in an undisturbed environment may have neutral acidity or be slightly alkaline and no visual appearances indicating its acidic potential. However, when exposed to air either by direct excavation or by indirect changes to the surrounding water table, pyritic material inherent in the soil is oxidised by sulphur oxidising bacteria leading to the formation of sulphuric acid. High concentrations of acid released into receiving waters can potentially cause significant impacts on ecosystem health.

The EIS indicated that PASS was identified in the investigations for the project. Laboratory analysis of results from 30 drill locations under the proposed bund wall revealed that the existing acidity in the seabed sediments to around 2 m depth is not significant, however, concentrations of sulphide material in 96 per cent of the samples analysed suggests the potential for acid generation if the material becomes oxidised.

If large volumes of PASS are disturbed there is the potential to cause significant long-term environmental harm and corrosion to built infrastructure. Given the extent of PASS identified in the EIS assessment and

the proximity of the works to sensitive marine environments, the dredged material will require careful monitoring and management of potential impacts.

In the EIS, GPC committed to develop and implement an ASSMP for the reclamation area construction and for the dredge spoil to be placed in the reclamation area from dredging subject to this EIS and from other dredging projects. The ASSMP will form part of the construction EMP. The ASSMP will also cover the placement of dredge spoil within the reclamation area, prior to dredge placement and will include validation testing. No actual ASS will be placed within the reclamation area without treatment.

The ASSMP will be prepared in accordance with the *Queensland Acid Sulfate Soil Technical Manual Soil Management Guidelines* and submitted for approval prior to bund construction.

The ASSMP will be managed in accordance with Sections 4.8 and 4.9 of the *State Planning Policy 2/02: Planning and Managing Development involving ASS*. The ASSMP will recommend treatment and management options as required. If investigations indicate that the material could not be placed within the reclamation without resulting in unacceptable impacts to the surrounding waters, then the material would not be accepted into the reclamation and alternative means of disposal will be negotiated with the relevant agencies. More detailed information on the process to be followed to manage ASS for the reclamation and dredging processes is covered in section 10 of the SID.

I have stated condition (Appendix 1, Schedule 2, Part 2) to ensure the proponent prepares and implements the project ASSMP in accordance with statutory and policy requirements.

5.2.5.2 Potential impacts and mitigation associated with the reclamation

The major processes that have the potential to impact on water quality within the receiving environment as a result of the Western Basin reclamation component of the project include:

- construction
 - construction of the bund wall
 - dredging and placement of material within the bund
 - decant of tail-waters from placement of dredged material within the bund
- operation
 - runoff/discharge of stormwater following final capping of the reclamation.

Impacts of bund construction

Construction of the bund would involve the placement of rock material into the harbour by trucks (as described in section 3.3.2 of the EIS).

As rock is placed onto the seabed, soft sediments would be remobilised into the water column. Soft sediments would also be pushed out the front and sides of the bund wall, thereby creating a 'mud wave' and generating a visible turbid plume. The turbid plume is likely to temporarily reduce light penetration over the adjacent seagrass beds. It is also likely that any sediment disturbed by the bund wall construction over seagrass would be remobilised and transported away from the tidal flats during tidal movements and elevated wave conditions.

Most disturbance should be limited to the first layer of rock, as any additional rock for the section would be placed on rock, not the soft seabed. The total area of the first layer for the eastern, northern and western outer bunds would be about 20 ha. Laying additional rock is likely to generate further disturbance, however to a lesser degree. Therefore, the generation of plumes through the placement of rock is likely to be transient both in time and spatially.

Other potential impacts of the bund construction include:

- increased risk of remobilisation of the mud wave during elevated wind and wave conditions, or during spring tides
- erosion of rock material during storm (cyclone) conditions that may occur during construction
- spillage of oils and fuels from construction equipment impacting on marine water quality.

The EIS noted a number of measures that GPC would employ to mitigate potential turbid plumes including:

- visually monitor and photograph turbid plumes caused by placement of rock on a daily basis during the initial stages of construction. Silt curtains may be employed if plumes are visible above the natural background turbidity, they are substantial in area and constantly present. GPC would consult with DERM about the use of silt curtains
- fine material (less than 12 mm) would be removed from the core material of the bund wall
- armour material would be placed on the exposed face of the core material closely behind the work face
- any material that is displaced above LAT or its current elevation would be monitored and managed in accordance with an ASSMP
- no refuelling or maintenance of construction equipment would occur on the site, nor would equipment be parked at the site overnight. Equipment would undergo regular maintenance and pre-start inspections. Spill kits would be present on site and emergency response procedures would be established.

As noted, if the project adopts a 24/7 construction schedule this would create a situation where there would be very little opportunity for rest or recovery periods for the entire construction phase (i.e. around 12 to 18 months). The lack of rest or recovery periods has implications for both benthic communities that may be impacted by the plume—via effects of shading and/or burial—and communities that use these areas, including marine mega fauna. It is likely that the area that would be impacted by the plume would suffer from chronic loss of light for the entire construction period. It is also noted that the effected areas will change as the wall construction progresses.

Impacts of filling of bund

The EIS maintained that minimal impacts to water quality are expected from the filling of the bund with dredged material.

The EIS indicated that a geotextile fabric would be placed on the inner face of the bund prior to commencement of filling operation to minimise the migration of fines through the bund wall and into the surrounding waters. Dredged material placed against the inner wall would also act as a filter layer to assist in preventing the migration of fine material.

Management of potential acid sulphate soils within the reclamation area

When disturbing large volumes of PASS there is the potential to cause significant long-term environmental harm and corrosion to built infrastructure. Given the extent of PASS identified in the project area and the proximity of the works to sensitive marine environments, the dredged material would require careful monitoring and management to avoid and/or minimise potential environmental impacts. The SID confirmed that no actual ASS was identified beneath the footprint of the reclamation area footprint.

GPC is required to develop and implement an ASSMP for the reclamation area construction and for the dredge spoil to be placed in the reclamation area from dredging subject to this project and from other dredging projects. The ASSMP would form part of the construction EMP. The ASSMP would also cover the placement of dredge spoil within the reclamation area, prior to dredge placement and would include validation testing. No actual ASS may be placed within the reclamation area without treatment.

GPC proposed (based on its experience in managing the current Fisherman's Landing reclamation area) that untreated PASS material be placed in the reclamation below the mean low water mark. GPC has proposed that mean sea level is an appropriate water level for maintaining the PASS material in a saturated state. Adoption of this level is would accommodate the significant volumes of PASS material (in the absence of a sea dumping permit).

Although DERM (QASSIT) considers the overall dredge disposal strategy to be broadly satisfactory, it stated that the proposed methodology for handling/treatment of untreated PASS in the reclamation area does not qualify as strategic reburial. DERM maintains, in the absence of scientific proof, that the upper limit for placement of untreated PASS material within the reclamation area is mean low water (MLW—that is, AHD -1.67m / RL 0.67m), unless DERM approves an alternative method of disposal to prevent oxidation of sulphides.

With MLW as an upper limit, GPC is unable to use the reclamation area for disposal of much of the anticipated PASS material without expensive treatment prior to placement in the reclamation.

GPC has commissioned a technical study on its Fisherman's Landing reclamation to demonstrate the effectiveness of its approach to PASS management and resolve the issue with DERM. Part of the study includes a bore sampling program to more accurately ascertain the groundwater levels and quantify the volumes of PASS, acid neutralising capacity (ANC)—that is, calcium carbonate—and clay in the proposed dredging areas. GPC has advised that it will be able to confirm the performance of its management technique and incorporate the strategy in the ASSMP.

I am informed that placement of dredge spoil will be carried out, as follows to address risks:

- PASS spoil will then be deposited until a maximum level of RL 0.67 m (MLW) so that at all times the untreated PASS will be below mean low water mark and remain wet
- neutralised PASS spoil will be added until the fill height reached the maximum design height (less capping)
- for material to be considered self-neutralising, the quantity of calcium salts will be 300 per cent of the minimum neutralising requirement for the PASS.

The ASSMP is a key issue affecting the approval process for the dredging activities. In this regard, **I have stated** a condition (Appendix 1, Schedule 2, Part 2) that requires the ASSMP to be reviewed by DERM prior to endorsement.

Impacts of hydrodynamic and flushing efficiency

The EIS confirmed that construction of the reclaimed area would alter the hydrodynamic (current direction and velocity), sedimentation patterns and flushing characteristics of the local area.

The EIS indicated that construction of the reclamation area is expected to result in increased tidal currents at the northern end of the bund wall on both ebbing and flooding tides. Initially, it is anticipated that this would result in increased turbidity through increased scour of the soft seabed sediments in this location. However, post-construction an equilibrium should be reached and it is not anticipated that the natural range and patterns in turbidity in the area surrounding the bund would change substantially, because the overall change to tidal velocity behind the bund is minimal, although now the currents would flow around the bund instead of in a more east/west direction across the flats from the shoreline to deeper areas.

The EIS also stated that predicted changes to hydrodynamics would result in changes to the flushing efficiency of the area, which in turn impact water quality. Modelling undertaken as part of the EIS indicated that:

- There is good flushing potential for the main harbour up to Fisherman's Landing and reduced flushing potential beyond that point.
- Flushing efficiency of the water body to the west of the reclamation area becomes less efficient with increasing distance from the northern end of the reclamation area resulting in a maximum difference at the south east flats of 10 per cent (50 per cent flushing for the reclamation plus dredging scenario compared with 60 per cent for the base scenario for this location). This would reduce the efficiency of flushing of contaminants and nutrients that may be in the area.
- Slight reductions in flushing efficiency of areas surrounding the Passage islands and the western shoreline of Curtis Island (modelling predicts decreased tidal velocities resulting from increased cross-sectional area of the dredged channels).

Impact of stormwater and catchment runoff

Once the reclaimed area is filled, the final surface would be capped with suitable material to stabilise and maintain the reclaimed area until future land-use allocation. Stormwater runoff is particularly important and management is required to ensure erosion of the capping does not occur and discharges to the open environment do not carry unacceptable contamination. In this regard the EIS noted that there are two stages to the management of stormwater from the reclaimed area:

- stormwater runoff from the bund walls once they are above sea level
- stormwater runoff from the final surface following completion of infilling and capping.

There is a potential for sediments to be entrained in the stormwater runoff and released to the harbour. Initially stormwater from the site is unlikely to be contaminated with nutrients, organics, hydrocarbons or metals as initially there would be no activities on the undeveloped area that would result in the introduction of contaminants to the area.

GPC has committed to routinely monitoring water quality surrounding the reclamation throughout the construction process. After construction, GPC would continue the monitoring in accordance with the EMP, in order to determine whether there is a change in water quality characteristics compared to the pre-construction values. Event-based monitoring would also take place in accordance with the EMP to capture effects of runoff events during rainfall. If significant changes in water quality compared to baseline are identified, further mitigation measures would be considered.

When future industries develop on the final reclamation, they would be required to install appropriate stormwater management measures to manage stormwater on and discharges from their sites through the relevant development approvals processes. **I have stated** a condition (Appendix 1, Schedule 2, Part 3) that requires stormwater discharges from settlement facilities must comply with Contaminant release limits to water as set out in Appendix 1, Schedule 2, Part 3, Table 1.

Impacts of sediment quality during dredging and reclamation

Sampling and analysis undertaken for the project indicate that the concentration of contaminants in the sediments underlying the proposed FLPE is generally compliant with the NAGD and EIL. Therefore, the mobilisation of these sediments into the water column during construction of the bund wall is not expected to result in the introduction of contaminants into the water column.

The EIS provided results of previous sediment sampling and analysis. Based on the analysis, the EIS stated that it is likely that all sediments to be dredged in future programs would be suitable for placement in the reclamation area.

I note that GPC has committed to undertake sampling and analysis of sediments for the capital dredging component of this project and all related future dredging programs.

5.2.5.3 Potential impacts and mitigation associated with the dredging operations

Management of water discharged from reclamation area

The EIS indicated that:

- Monitoring of the decant plume from previous dredging and reclamation projects at Gladstone Port has indicated that the plume cannot generally be seen or measured approximately 20-50 m from the outfall.
- Background turbidity in the vicinity of Fisherman's Landing has been monitored for up to six months and regularly exceeded the QWQG and ANZECC guidelines.
- The predicted increase in bed shear stress at the northern end of the reclamation means that seagrass is unlikely to be present in the immediate vicinity of the northern wall, which is where discharges are intended.
- Based on various recent studies, DERM would prefer that site-specific water quality objectives for turbidity for decant waters from the site be developed.

In its submission on the EIS, DERM indicated that it generally seeks to limit dredge spoil decanting water quality at the point (or points) of discharge to a maximum turbidity or suspended solids (TSS) equivalent

to the 80th percentile of the receiving waters, which was reported as ranging from 10 NTU to 31 NTU between June and October 2008 at Fisherman's Landing. DERM also advised that the discharge limit for turbidity of 100 NTU originally proposed in the EIS, based on the dilution of the discharge water to achieve acceptable quality rather than the adoption of an 80th percentile target, is inconsistent with the best practice in protection of receiving water quality. Consequently, the SID provided a re-assessment of the modelling and argued that targeting a value of 40 NTU at the discharge point is more appropriate given the flushing characteristics along the north eastern region of the reclamation.

DERM has nominated 30 NTU as the maximum turbidity level at the outfall. This is reflected in the conditions stated in Appendix 1, Schedule 2, Part 3, Table 1. The limit would be enforced unless it can be demonstrated to DERM in the DMP that a higher limit can still protect the values of the receiving environment.

To achieve the nominated water quality objectives, GPC has indicated that multiple cells, connected via weir boxes with adjustable gates, would be established within the reclamation area to allow the finer materials to settle out of suspension.

Due to the large scale of the reclamation (55 Mm³), the total quantity of sediment released to waters from the reclamation area over the life of the project would be substantial. Once settled this sediment may be partially resuspended and could then combine with suspended sediment from other dredging projects and from scouring around the reclamation area. Discharge from the reclamation area may also continue for two or more years beyond construction meaning that any impact on water quality arising from the discharge of sediment in the decant would be long lasting. For these reasons, a conservative approach to limiting sediment release to waters from the reclamation area is considered to be appropriate.

In its submission on the EIS, DERM also indicated that a monitoring program is needed to confirm the accuracy of information contained in the EIS in relation to water quality and ecological impacts, and to inform future assessment and regulation of similar activities. In the SID, GPC has committed to include monitoring of the decant pond and outfall region in the EMP and, if needed, additional reclamation cells can be incorporated.

I have stated a condition (Appendix 1, Schedule 2, Part 3) that requires the proponent to adhere to specific water quality objectives for this project as recommended by DERM. This will ensure that the impacts of turbidity and sedimentation can be suitably managed. **I also agree** that these conditions may be varied by agreement with DERM if demonstrated that a higher limit would be acceptable.

Management of dredging operations

A detailed dredging strategy and dredging contract is yet to be prepared for the proposed capital dredging of Targinie Channel and the Fisherman's Landing swing basin and berth pockets. Proposed dredging activities are described in chapter 5 of the SID. Based on previous dredging programs undertaken by GPC, the spatial extent of the visible plume from a cutter suction dredge is typically not large. Results of turbidity monitoring during the 2009 dredging of Berth 1 at the existing Fisherman's Landing wharf indicated that the elevation in turbidity in the vicinity of the dredge was not higher than at the reclamation cell or outfall and was not elevated above 44 NTU during the daily measurements.

As part of the EIS a plume model was conducted to assess the potential for the migration of a turbid plume from the bund outfall. The EIS provided the following conclusions from the modelling:

- The water body in the vicinity of the reclamation area shows a high potential for the dispersion of turbidity. This can be seen in the maximum turbidity reading of 12 NTU above ambient recorded at the closest point monitored to the modelled outflow location in the north-east corner of the reclamation. This indicates substantial mixing of the plume in the immediate receiving environment, resulting in minimal increase in turbidity above ambient. The increase above ambient is also well within the natural range and variability in turbidity within the project area.
- Results from the modelling show low levels of turbidity above ambient extending both ways along the main channel and higher levels of turbidity centred on the northern half of the reclamation. This demonstrates that there would be no discernable impact on turbidity anywhere in the harbour apart from the immediate area in the vicinity of the reclamation and in the embayment to the north and west of the site.

Modelling undertaken for the SID (section 10, Table 10-1, summarised as Table 8 of this report) estimated that, in the indicative worst-case scenario for the WBDD Project, approximately 5416 ha of

benthic habitat has the potential to be indirectly impacted in terms of being touched by the dredge plume at least once (based on 10th percentile exceedences)—that is, this area may be affected by a plume of 5 mg/L above background for 10 per cent of the time. While these exceedences could impact benthic communities, for such a small increase in TSS, it is considered highly unlikely that benthic communities under this spatial footprint would be affected.

The SID suggested that a dredge plume concentration of 29 mg/L TSS above background could start to cause shading effects on benthic communities. This increase in TSS is predicted to occur over an area of 406.8 ha for only 10 per cent of the time and over 2.12 ha for 50 per cent of the time. Analysis of the scenarios presented in the SID therefore suggests that while dredge plumes could extend for some hundreds of hectares actual impacts to benthic communities may only be realised over a much reduced area.

Future maintenance dredging also has the potential to produce turbid plumes from the dredge head during the dredge operations. Therefore, maintenance dredging would be undertaken in accordance with a DMP and would require approval under relevant legislation.

Water quality modelling and monitoring

GPC has committed to develop a DMP for the capital dredging, which employs an adaptive water quality monitoring program, similar to that undertaken for the recent Berth 1 dredging at Fisherman's Landing. Daily monitoring of key sites adjacent to the dredge would also be included in the DMP, undertaken within the final reclamation cell, at the outfall and at the seagrass beds. The SID indicated that a habitat monitoring program would be tied into the dredging program for the project and refined during the planning of the dredging activities as part of the DMP. GPC has committed to continue monitoring of seagrass and algal meadow health within the study area. More specific detail of GPC's proposed monitoring program is addressed in section 6.8.2 of the SID.

In its submission on the SID, DERM recommended that an objective of the DMP should be to minimise the loss of seagrass communities as a result of reduced photosynthetically available light resulting from increased turbidity associated with dredging and dredge spoil activities.

Also, DEEDI, in its submission on the SID, recommended that ecologically relevant water quality triggers, related to the light conditions required to maintain key seagrass species growth, be developed for a WQMP, as part of the DMP, to protect seagrasses from turbid plumes.

DEEDI also recommended that the DMP include a seagrass monitoring program for seagrass health assessment at key sensitive locations to complement the use of incident light-based water quality triggers.

The EIS (Appendix G, section 2.3) anticipated that, while turbidity objectives have been developed for the dredging and discharge of decant waters, there is a need to improve understanding of the resilience of various seagrass species to varying light conditions. The EIS (Appendix K, section 5.5.3) provides a preliminary measure of photosynthetically available radiation, used to measure the light available for photosynthesis (e.g. of seagrasses), however no conclusions are made.

To further this line of enquiry, DEEDI has commenced a program of research that aims to determine thresholds of seagrass resilience to low light conditions. This would provide a basis for water quality triggers based on light incidence and attenuation (if possible, correlated to existing measures of turbidity that would inform the DMP so that dredging operations may be adjusted before sensitive habitats, such as seagrasses, are critically affected).

5.2.5.4 Coordinator-General's conclusion—marine water quality

I note that GPC has committed to undertake ongoing monitoring of turbidity and nutrient levels during construction, and for a period after construction, to detect adverse trends in water quality related to dredging and other construction activities. **I am confident** that early detection would enable active management of these impacts prior to their affecting any sensitive ecosystem receptors, including seagrass meadows.

I have stated conditions (Appendix 1, Schedule 2, Part 3) that require the proponent to prepare a water quality management plan (WQMP), to be prepared as a component of the DMP and implemented in conjunction with the EMP, to identify, assess and manage impacts from the dredging and construction of the reclamation area on the water quality of the project area. The WQMP will include a monitoring

component, in conjunction with monitoring of sensitive ecological areas, such as seagrasses, that will inform dredging operations through the DMP.

In particular, A technical reference panel will be established for the duration of the project to oversee all aspects of water quality monitoring, including a transition from a water quality monitoring program that is based on turbidity towards a program that is based on light attenuation and seagrass health.

I note that GPC has committed to the management of potential impacts through the implementation of the EMP.

I note the extent of similar dredging and reclamation works that have been successfully undertaken by GPC in developing port land and operating the port and **I am confident** that similar, or better, management would be applied in the construction of the WBDD Project.

I have stated conditions (Appendix 1, Schedule 2, Part 5.3) that require the proponent to implement stormwater management measures that minimise impacts on surrounding waters from contaminated stormwater discharge

I have stated conditions (Appendix 1, Schedule 2, Part 2) to ensure the appropriate management of marine water quality. Also, **I have stated** conditions (Appendix 1, Schedule 2, Part 2) relating to ERA 16 to ensure appropriate management of the dredging activities.

5.2.6 Marine flora

5.2.6.1 Context

This section of the report provides an evaluation of the potential impacts of the project on marine flora of state significance. Matters of national environmental significance are addressed in chapter 8 of this report. Section 9.3 and Appendix Q of the EIS addressed marine flora and ecology, and additional information was provided by GPC in the SID. The marine ecological assessment presented as EIS Appendix Q, report focuses on benthic marine ecological values of the project area and adjacent surrounds. Marine flora species are afforded protection by the Fisheries Act.

5.2.6.2 Mangroves and saltpan communities

Approximately 1.9 ha of intertidal vegetation occurs in the 40 m wide channel between the reclamation area and the mainland. The majority of the vegetation is closed mangrove forest to 5 m tall, dominated by *Rhizophora stylosa* (red mangrove). Smaller patches of *Avicennia marina* (grey mangrove) and *Ceriops tagal* (yellow mangrove) also occur on the site. These species, landform and substrate correspond with the regional ecosystem (RE) 12.1.3, which is classified as not of concern under the *Vegetation Management Act 1999* (VMA).

A small area (0.45 ha) of sparse saltpan vegetation on marine clay occurs behind the mangrove community. This community consists primarily of patches of *Sporobolus virginicus* (saltwater couch), samphire species and bare mud. This species, landform and substrate correspond with the RE 12.1.2, which is classified as not of concern under the VM Act.

The loss of intertidal mangrove and saltpan communities as a result of the WBDD Project is expected to be minimal and the retention of the 40 m wide channel is designed to ensure tidal flushing and hence survival of these communities.

All marine vegetation, including mangroves and seagrasses, are protected under the Fisheries Act. Consequently, the proponent will be required to obtain a permit from DEEDI for relevant construction activity relating to the project that involves the disturbance of marine plants. This is discussed in section 4.1.1 of this report.

5.2.6.3 Seagrasses and other benthic communities

A long-term seagrass monitoring program in Port Curtis and Rodds Bay was initiated by GPC in collaboration with DEEDI (formerly the Department of Primary Industries and Fisheries) known as the Port Curtis Integrated Monitoring Program (PCIMP). An initial baseline study was undertaken in 2002 which identified 129 discrete seagrass meadows. Thirteen of these were selected for long-term monitoring which was conducted from 2004 to 2008.

The studies showed that, despite the ambient turbidity, the locality supports extensive seagrass beds that vary seasonally and annually in area and biomass but still persist under existing port operational conditions. These seagrasses support the direct and indirect foraging habitat of marine fauna including dugongs and turtles. Seagrasses are considered as nursery grounds for juvenile fish and may be targeted by commercial, recreational and indigenous fishers.

The project area supports a number of marine benthic habitats including soft silty habitats, clay and rubble habitats and seagrass meadows. The assemblages sampled for each habitat type, during a benthic marine ecology survey undertaken for the EIS, were reflective of the sediment habitat observed. Crabs, worms, small gastropods, seagrasses and algal assemblages occurred in soft sediments and pebble habitats. Crabs, gorgonians, echinoderms, sponges and similar were present in clay and rubble sediments.

Figure 6 shows the general distribution of seagrass and benthic fauna habitat in the Western Basin project area and Figure 7 shows the variable annual distribution of seagrass meadows in the vicinity of Fisherman's Landing for PCIMP monitoring period of 2002–2008.

5.2.6.4 Potential impacts and mitigation measures

Potential impacts

The EIS (section 9.3) stated that seagrasses and benthic habitat in the vicinity of the project area may experience a range of potential direct and indirect, permanent and temporary impacts due to the dredging operations and the construction of the reclamation area.

A potential decrease in water quality, due to turbidity associated with dredge plumes and reclamation bund wall construction, and predicted changes in the hydrodynamic regime (tidal velocities, bed shear stress and water levels) around the reclamation area site, are expected to indirectly impact on seagrass and other benthic communities. The predicted changes have the potential to:

- partially or completely shade and/or smother the existing benthic assemblages, seagrass beds and/or seed banks with sediments settling from the water column during the dredging and decant activities for the project
- alter light penetration to marine flora thereby reducing photosynthesis
- alter the area of suitable seagrass habitat for marine fauna at the northern end of the reclamation, where it is predicted that scouring of fine sediments may occur
- decrease in flushing in the embayment north of the reclamation, which may impact on the health of marine communities.

Table 10-1 of the SID summaries the maximum potential losses of seagrass and benthic communities, based on merged data from the PCIMP 2002–2008 surveys, as follows:

Table 8—Potential impact to benthic habitats

Impacts	Total benthic area (ha)	Known seagrass area (ha)
Total direct impact	902	259
Total indirect impact	5416	1406
Total potential (combined) impact	6318	1665

It is noted that 221.6 ha of known seagrasses occur directly within the reclamation area footprint but the areas of impact do not account for displacement of sediment during placement of the bund wall rock—that is, the mud wave. Whilst these figures represent a worst-case scenario, measured as an exceedence in total suspended solids (TSS) of 5 mg/L above the average background ambient conditions (taken to be TSS 29 mg/L) based on a 10th percentile exceedence, that is, the area of seagrasses that for no more than 10 per cent of the time may experience a plume of >5 mg/L above background conditions. While these exceedences may impact benthic communities, such small and infrequent increases in TSS are not considered to likely to affect these communities.

Figure 6—Seagrass and benthic fauna habitat distribution (EIS, Figure 5-1)

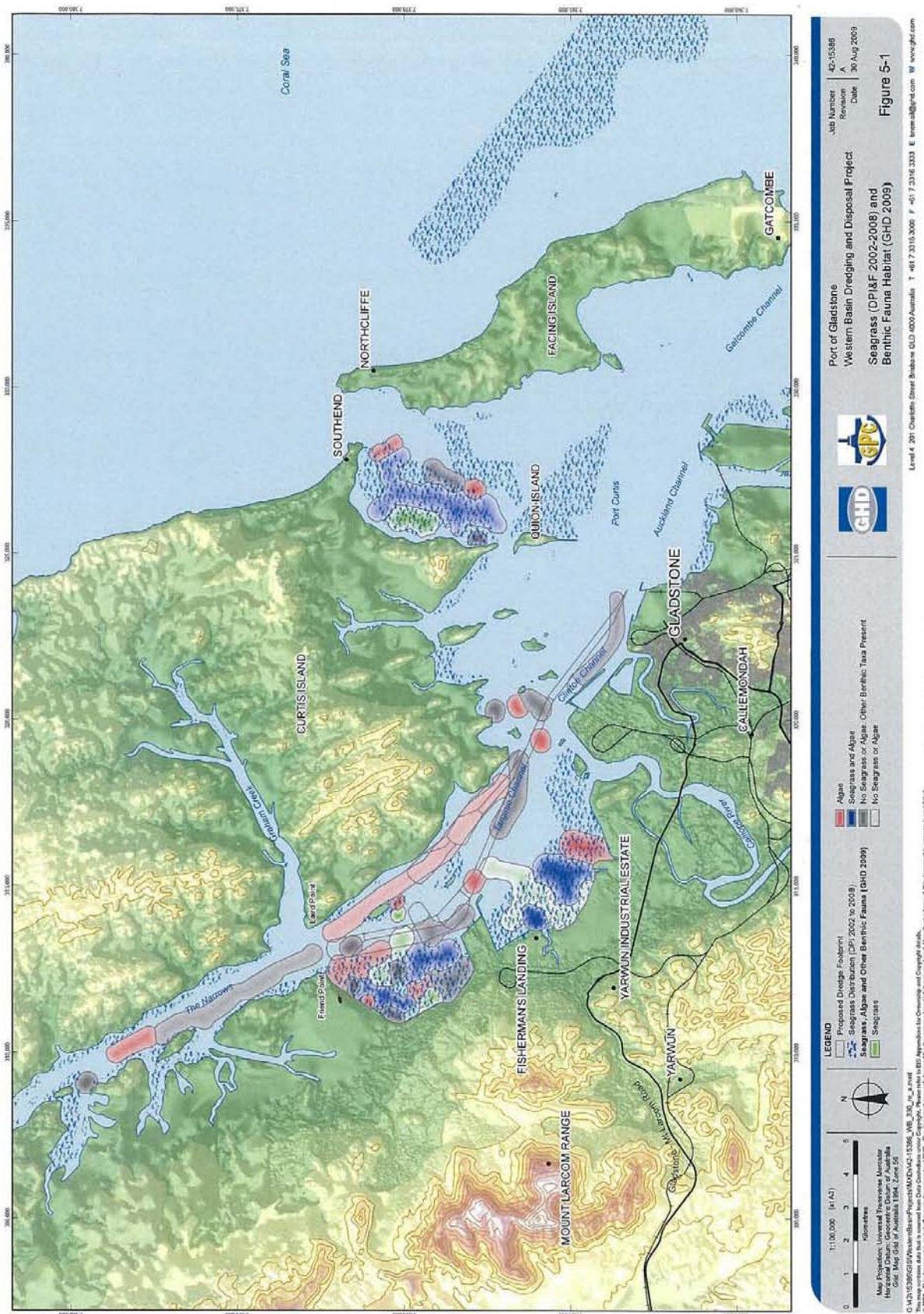


Figure 7—Annual seagrass monitoring meadows 2002–2008 (EIS, Figure 9-22)

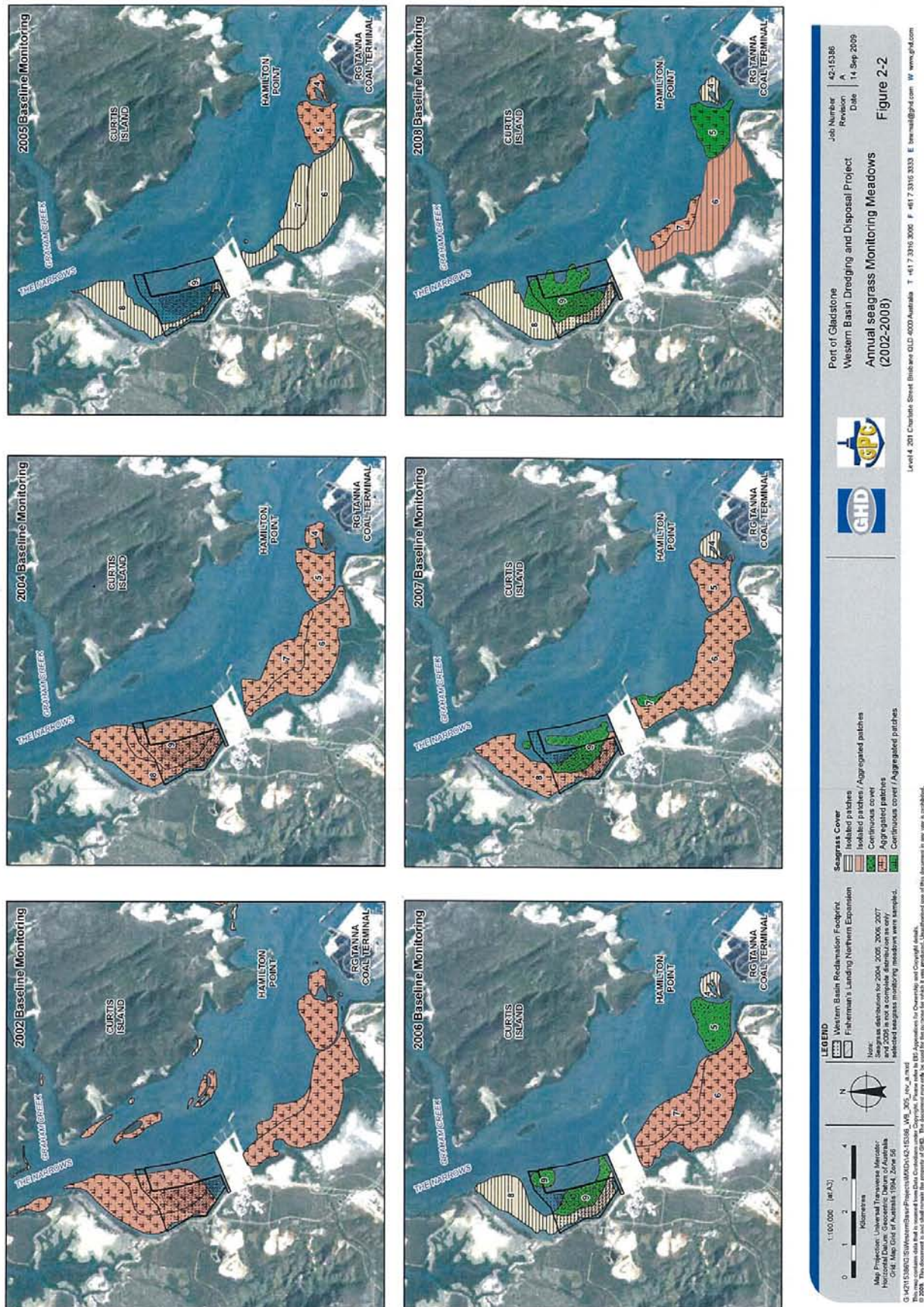


Table 10-2 of the SID provides a more realistic estimate of cumulative seagrass habitat areas predicted to be affected by differing plume concentrations under different dredge scenarios (see EIS Table 6-1 and section 5.2.4 of this report) and is represented by SID Figures 10-02 to 10-05. These figures clearly show that, under a worst-case scenario involving rehandling from TSHD at Fisherman's Landing, the seagrass in the embayment north of the reclamation area are at risk of impact.

Modelling (EIS, section 6.5.2) has indicated that the turbid plume discharged from the decant and stormwater outfall point at the north-eastern point of the reclamation is expected to reduce in concentration at a very short distance from the outfall, indicating that any sediment deposition is likely to be localised around the outfall. Nonetheless, **I have stated** a condition (Appendix 1, Schedule 2, Part 3, Table 1) that sets contaminant release limits to the receiving waters.

Changes to the coastal processes around the project site, discussed in section 5.2.4 of this report, may lead to changes in the existing benthic communities and may also change the amount of habitat suitable for benthic communities, particularly around the northern end of the project site. However, the EIS concluded that changes to coastal processes were expected to be within the normal bounds of the physical processes that naturally occur in the system.

Mitigation

Options proposed to reduce water quality impacts due to dredging that will be incorporated into the DMP include:

- reduction in the use of TSHD, particularly in 'overflow mode' in silty sediments
- reduced need for rehandling of spoil from TSHD at Fisherman's Landing, including further investigation of an offshore dredge spoil disposal option, and an alternative rehandling site located at North China Bay (near the south-west end of Curtis Island)
- closer correlation of water quality monitoring and seagrass habitat monitoring to the DMP
- a transition from using turbidity-based water quality indicators to light-based indicators of seagrass health (discussed in section 5.2.6.5 of this report).

Further modelling undertaken subsequent to the SID demonstrated that the elimination of rehandling from TSHD at Fisherman's Landing substantially reduces the incidence of turbid plume propagation towards the seagrasses in the embayment north of the reclamation area.

I have stated conditions (Appendix 1, Schedule 2, Part 1.2) that require the proponent to implement measures through the DMP that aim to reduce the incidence of turbidity particularly associated with rehandling at Fisherman's Landing and use of the TSHD.

I have also stated conditions (Appendix 1, Schedule 2, Part 3.1) that require the proponent to prepare and implement a water quality management plan (WQMP) for the duration of the project to identify, assess and manage the impacts from the dredging and construction of the reclamation area on the water quality of the project area.

In addition, **I have stated** a condition (Appendix 1, Schedule 2, Part 4) that requires the proponent to prepare a flora and fauna management plan (FFMP). The FFMP will provide the framework for all flora monitoring and impact mitigation measures. The FFMP will include a component for monitoring of sensitive ecological areas—such as seagrasses—to be implemented in conjunction with the WQMP, which will inform dredging operations through the DMP.

The WQMP and FFMP are to be prepared and implemented as components of the DMP.

5.2.6.5 Water quality monitoring—turbidity and light

Context

The EIS (Appendix G, Table 3) presented an initial set of water quality objectives (WQO) to be used in the DMP as trigger values for the dredging operations at various sensitive ecological locations. The WQO based on turbidity set TSS limits, in milligrams of sediment per litre (mg/L) for the 95th percentile and, alternatively, the 80th percentile of background levels. Baseline monitoring for Port Curtis has established

a mean TSS value of 29 mg/L, which likely represents a threshold of resilience for seagrass persistence and is therefore a potential trigger value for monitoring impacts and informing the DMP.

In its submission on the SID, DEWHA noted that though turbidity plume modelling had been undertaken, the essential link to seagrass light attenuation requirements and tolerances had not been thoroughly considered, making it difficult to accurately estimate the likely turbidity impacts on the extensive seagrass beds of the project area.

In its submission on the SID, DERM recommended that an objective of the DMP should be to minimise the loss of seagrass communities as a result of reduced photosynthetically available light resulting from increased turbidity associated with dredging and dredge spoil activities. This acknowledges the difficulty of distinguishing ambient or background turbidity from anthropogenic turbidity associated with dredging.

Also, DEEDI, in its submission on the SID, recommended that ecologically relevant water quality triggers, related to the light conditions required to maintain key seagrass species growth, be developed for a WQMP, as part of the DMP, to protect seagrasses from turbid plumes.

DEEDI also recommended that the DMP include a seagrass monitoring program for seagrass health assessment at key sensitive locations to complement the use of incident light-based water quality triggers.

The EIS (Appendix G, section 2.3) anticipated that, while turbidity objectives have been developed for the dredging and discharge of decant waters, there is a need to improve understanding of the resilience of various seagrass species to varying light conditions. The EIS (Appendix K, section 5.5.3) provides a preliminary measure of photosynthetically available radiation, used to measure the light available for photosynthesis (e.g. of seagrasses), however no conclusions are made.

A coordinated water quality monitoring program and a seagrass health monitoring program are proposed to assist in informing an adaptive dredging operation schedule to manage the potential indirect impacts to benthic communities. By actively collecting data on water quality and seagrass habitat health during dredging, impacts to habitats will be able to be correlated to degraded water quality associated with dredging so the dredge operations can be modified accordingly.

To further this line of inquiry, DEEDI has commenced a program of research that aims to determine thresholds of seagrass resilience to different light conditions. This would provide a basis for water quality triggers based on light incidence and attenuation (if possible, correlated to existing measures of turbidity that would inform the DMP so that dredging operations may be adjusted before sensitive habitats—particularly seagrasses—are critically affected.

Proposal

GPC has committed to support the ongoing research into seagrass light requirements and move towards the use of water quality triggers based on light incidence and attenuation (if possible, correlated to existing measures of turbidity and seagrass health to inform dredging operations.

The water quality monitoring program will initially be based on the use of turbidity as the water quality indicator, with limits set for key environmentally sensitive locations that trigger operational responses.

The future water quality monitoring program, linking turbidity and depth to light attenuation and seagrass health, will be developed and phased into implementation of the DMP through an adaptive management approach.

A technical reference panel is proposed to be established for the duration of the project to oversee the development and implementation of a light-based approach to water quality monitoring and management to enhance the initial water quality monitoring program.

The technical reference panel would comprise scientific experts in seagrass and benthic habitat as well as management, regulators and dredge technical advisors.

The technical reference panel would assess any exceeding of trigger values and seagrass changes and implement changes to dredging practices, through the DMP, as required.

Accordingly, **I have stated** conditions (Appendix 1, Schedule 2, Part 3.4) that require the proponent to undertake water quality monitoring and modelling, in conjunction with seagrass monitoring (through the FFMP) to inform dredging operations through the DMP.

In addition, **I have stated** conditions (Appendix 1, Schedule 2, Part 3.4.4 and 3.4.5) that requires the proponent move towards a program that uses light-based water quality triggers and seagrass health to inform dredging operations. These conditions require the establishment of a technical reference panel, for the duration of the project, to oversee the water quality monitoring program.

5.2.6.6 Coordinator-General's conclusion—marine flora

I consider that the project will have some adverse direct and indirect impact on marine flora and benthic communities of the project areas.

I consider that GPC has endeavoured to identify and avoid and/or mitigate the potential adverse impacts on the marine flora that occur or use the project area, particularly seagrasses, through the combined and coordinated implementation of the DMP, WQMP, seagrass monitoring and FFMP.

I am satisfied that the identified mitigation measures, to be implemented by the proponent, will minimise the impact of the project on marine vegetation.

I support the approach proposed by the proponent to move towards a program that uses light-based water quality triggers and seagrass health to inform dredging operations.

I have stated a condition (Appendix 1, Schedule 2, Part 4.3) that requires the proponent to obtain a development permit for operational works (tidal) for works requiring the removal, destruction or damage of marine plants.

In accordance with the Queensland Government Environmental Offsets Policy (QGEOP) an environmental offset is required for the loss of marine habitat. The requirement for offsets for the proposed clearing of marine plants is discussed in chapter 6 of this report.

5.2.7 Marine fauna

This section of the report provides an evaluation of the potential impacts of the project on marine fauna of state significance. Matters of national environmental significance are addressed in chapter 8 of this report. Section 9.3 and Appendix R of the EIS addressed marine fauna, and additional information was provided by GPC in the SID. Marine fauna species are afforded protection by the *Nature Conservation Act 1994* (NCA) and the conservation status of fauna in Queensland is listed in the Nature Conservation (Wildlife) Regulation 1994 (NC(W) Reg).

A marine megafauna survey was undertaken for the EIS and the results were presented as EIS Appendix R, Marine Megafauna Baseline and Impact Assessment with additional discussion summarised in EIS chapter 9 (Nature conservation).

During an areal survey, extending from Rodds Bay in the south, the Curtis Island coast and to Port Alma, dugong, dolphins, turtles, sharks rays and sea snakes were observed. None of these was shown to be exclusively using the project area.

5.2.7.1 Marine megafauna

Dugongs

The dugong (*Dugong dugon*), which is listed as vulnerable under the NC(W) Reg, is recorded to occur in the project area. Dugongs prefer shallow and sheltered areas where their primary food source, seagrasses, occur.

The project area is located at the northern limit of the Rodds Bay Dugong Sanctuary, which is a Zone B (restricted use) Dugong Protected Area (DPA) declared under the Fisheries Act. The Gladstone coastline and the Rodds Bay DPA are recognised as important habitat for dugong populations despite being within and closely associated with commercial port activities.

Dolphins

The following dolphin mammal species were identified as likely or possibly occurring in the project area (listing NC(W) Reg status):

- Australian snubfin dolphin (*Orcaella heinsohni*)—rare
- Indian bottlenose dolphin (*Tursiops aduncus*)—rare

- Indo-Pacific humpback dolphin (*Sousa chinensis*)—rare.

The majority of dolphins recorded in the project area in surveys undertaken for the EIS were Indo-Pacific humpback dolphins.

Marine turtles

The EIS (Table 9-9 and Appendix R) identified six species of marine turtles identified as occurring or possibly occurring within the project area. These are (with NC(W) Reg status):

- loggerhead turtle (*Caretta caretta*)—endangered
- olive ridley turtle (*Lepidochelys olivacea*)—endangered
- leatherback turtle (*Dermochelys coriacea*)—endangered
- green turtle (*Chelonia mydas*)—vulnerable
- hawksbill turtle (*Eretmochelys imbricata*)—vulnerable
- flatback turtles (*Natator depressus*)—vulnerable.

The majority of turtles recorded in the project area in surveys undertaken for the EIS were green turtles.

Curtis Island is recognised as a consistent and stable, medium density nesting and breeding area for flatback turtles over the 35 years since monitoring of nesting females began in 1969.

The area is also an important nesting and foraging area for green turtles that prefer to feed on seagrasses so they have a high predicted association with the seagrass beds that occur in the project area. The EIS also noted that dredged channels provide resting habitats for turtles.

Whales

Humpback whales (*Megaptera novaengliae*) (listed as vulnerable and migratory under the EPBC Act) generally occurs in offshore areas and are observed off Curtis Island.

One whale species was observed during field surveys conducted for the EIS, near the northern tip of Curtis Island in relatively shallow waters. It was considered most likely to be the melon-headed whale (*Peponocephala electra*).

Given the shallow, inshore location of the Western Basin, it is considered unlikely that whales would inhabit or traverse the project area. Furthermore, due to the vessel traffic associated with port operations and the levels of background turbidity, whale species are likely to avoid the project area. Therefore it is considered highly unlikely that this project will impact on whale species.

Crocodiles

The estuarine crocodile (*Crocodylus porosus*), listed as vulnerable under the NC(W) Reg, is identified as possibly occurring in the project area, however it is nearing the southern limit of its known extent. Suitable habitat for this species occurs in and within the vicinity of the project area, including The Narrows.

Given the highly mobile nature of the species, the very small area of habitat to be affected, the disturbed/urban nature of the site and ongoing presence of marine vessel traffic, the project is considered unlikely to affect this species.

5.2.7.2 Potential impacts and mitigation measures

Potential impacts

In general, potential impacts to marine fauna are due to:

- direct loss of food resources and foraging habitat
- contamination of marine waters from sediment disturbance, spills of fuel or other chemicals, stormwater runoff animal waste (feline pathogens)—feral or domestic
- entrapment of marine fauna (including fish) by the reclamation works when the bund is closed

- injury/mortality to individual animals from direct contact related to construction activities or boat strike
- noise and vibration impacts to marine fauna from in-water construction or ongoing operational activities.
- lighting impacts to nesting turtles and hatchlings in the area
- disturbance and displacement due to light spill.

Dolphins may be impacted by the removal of foraging habitat. However, as these species are highly mobile predators and in the regional context the habitat loss is minimal, it is unlikely the project will have a significant adverse effect on these species.

Dugong and green turtles are the most likely species to be impacted by the direct removal of seagrass meadows in the project area, as seagrass is the main component of both these species' diets.

I have noted that dugong are migratory, possibly as a response to water temperature and certainly in search of ephemeral sea grass meadows. Some dugong fitted with tracking devices, have been tracked over several hundred km. In this regard **I have noted** that within 20 km of the reclamation site there are some 3370 ha of sea grasses and a further 7000 ha within 40 km (SID, Table 10.3).

Underwater noise will mainly be generated by dredging. The nature of dredging noise is that it occupies the mid to low-frequency range, it is tonal and it is usually continuous. The EIS notes that available information relating to the sensitivity of cetaceans and dugongs to dredging noise indicates that dredging is not considered to pose a significant risk. Information available on noise impacts on turtles is limited, however turtles do not appear to change behaviour due to noise.

Vessel-related impacts to marine fauna as a result of increased shipping in the Port Curtis region may potentially include: vessel strike, interrupted communication of marine fauna, and habitat displacement from increased noise and presence.

Dolphins are highly mobile species and not as vulnerable to boat strike injuries or mortality as dugongs.

The increase in vessel traffic (dredges and other shipping traffic), and increased reclamation (WBDD Project and FLPE project) may constrict safe migratory passage in the project area and result in localised fauna displacement. However, in the regional context this impact is unlikely to be an issue.

The SID (section 16.5.1) notes that some invertebrates and fish species may be attracted to construction and dredging lighting, which may in turn attract feeding dolphins. Marine fauna currently exist with extensive industrial and commercial lighting in the Port of Gladstone with no observed detrimental effect noted.

Concerns were raised in several EIS submissions relating to potential marine megafauna impacts. These included:

- direct (reclamation) and indirect (increased sedimentation and disturbance) loss of marine megafauna migratory, feeding habitat, including snubfin and Indo-Pacific humpback dolphin habitats in the Western Basin
- increased potential for boat strike of megafauna resulting from increased vessel traffic
- impacts on dugong and other marine fauna due to removal of seagrass and habitat
- potential mortality or injury to marine turtles due to dredging operations
- impacts on marine fauna due to increased light, noise and vibration
- entrapment of marine fauna in the bund area.

Mitigation measures

To address the wide range of potential impacts to marine fauna, GPC has proposed a range of mitigation strategies including:

- monitoring of water quality turbidity levels and operational response through the DMP
- dredge head technology to deflect or avoid interaction with resting turtles and other megafauna

- strategies to decrease the risk of trapping animals in the reclamation are and manual removal of any marine fauna from the reclamation area prior to closure of the bund wall
- management of decant, stormwater, waste and other pollutant discharges
- management of construction and dredging noise, vibration and lighting
- education of the construction workforce regarding the risks to marine megafauna and the requirement to avoid interaction with those species.

The EIS indicates that the dredging activities will operate under an approved EMP that includes as a minimum the following provisions:

- dredge activities to be restricted to agreed footprint of channel and swing basin works
- where a TSHD is used, the drag heads of the dredge vessels will be fitted with turtle exclusion devices for the duration of the dredging
- the amount of off-bed suction time will be minimised to reduce the risk of turtle capture
- a fauna spotter will be present on the vessel during dredging
- a log of listed marine fauna observed during dredging operations will be kept and provided to GPC at the end of the dredging campaign.

A review of underwater noise impacts studies was undertaken for the project, in relation to in-water construction works completed for other shallow marine dredging and reclamation works projects⁵. That review examined the acoustic intensity and frequency of noise sources relative to the known sensitivity ranges for marine mammals. The study indicated that of all potential noise generating activities pile driving was most likely to have an impact. Pile driving would be used to install approximately 19 navigational channel marker navigation aids for newly dredged shipping channels and to construct jetty/wharf facilities for proposed LNG facilities. Wharf construction is not being undertaken for the project.

Precautionary mitigation measures, including soft-start pile driving, use of spotters, no pile driving if megafauna are within 5 m, and use of warning noises prior to pile driving, are to be included in the EMP for the project.

Construction lighting will be directionally controlled and shielding may also be used to minimise light spill that could cause disturb marine fauna. Further discussion on potential lighting impacts is included in section 5.5.3 (Lighting) of this report.

The project is not expected to significantly increase the risk of boat strike as the dredging activities are conducted by large, slow moving commercial vessels with conspicuous noise, vibration and lighting. GPC has reported that there have been no reported vessel strikes by large vessels within the port. The EIS has recommended that enforced vessel lanes with speed restrictions be designated for the construction and operation phases to protect megafauna from boat strike and undue disturbance. In addition, vessel movements in the port are under the control of the Regional Harbour Master (of DTMR / Maritime Safety Queensland).

To confirm GPC's commitments **I have stated** a set of complementary conditions concerning seagrass monitoring and research, water quality monitoring, and marine megafauna monitoring in the Western Basin (Appendix 1, Schedule 2, Parts 3 and 4).

In addition, **I have stated** a condition (Appendix 1, Schedule 2, Part 4) that requires the proponent to prepare a FFMP, to be included in the EMP for the project. The FFMP will provide the framework for all fauna monitoring and impact mitigation measures, will be prepared and implemented in conjunction with the WQMP that aims to move towards a regime using light-based indicators for seagrass health, and will inform the dredging operations through the DMP

The studies for inclusion in the FFMP include (but are not limited to) the following:

- continue annual long-term seagrass monitoring surveys of seagrass distribution and abundance in the Port of Gladstone (within the PCIMP framework)

⁵ SVT Engineering Consultants (January 2010): *QCLNG Gladstone Channel Underwater Noise Assessment*. Prepared for the BG Group. Report reference Rpt01-0951823-Rev2-20 Jan 2010.

- undertake ongoing monitoring to assess marine megafauna inhabitation of the Western Basin. The extent, methods and timing of monitoring should be similar to the programs undertaken for the EIS
- monitor underwater noise impulse during construction and during the first stages of dredging and reclamation and conduct research on the effects of noise on marine megafauna
- monitor light spill during bund construction and during the first stages of dredging and reclamation and conduct research on the effects of light spill on marine megafauna.

I have stated a condition (Appendix 1, Schedule 2, Part 4.4) to minimise entrapment of marine fauna and to manage release of any trapped fauna during the construction of the containment area. **I have also stated** conditions (Appendix 1, Schedule 2, Part 4.4.1) relating to ERA 16 to ensure appropriate protection to turtles and other marine fauna from dredging works related to the WBDD Project.

Environmental offsets

While seagrass resources will be removed locally and may result in a local-level displacement of turtles, dugongs and dolphins (expected to relocate to other habitat areas), the project is not expected to have a significant net negative effect on the diversity of the systems within the Port Curtis region, nor is it expected to have flow on impacts to the communities that use the habitats within the project area.

In accordance with the Queensland Government Environmental Offsets Policy (QGEOP) an environmental offset is required for the loss of marine habitat.

A strategic offset package is discussed in section 6 of this report.

5.2.7.3 Coordinator-General's conclusion—marine fauna

I consider that the project will have some impact on the feeding or migratory behaviours of marine megafauna that use the project area, notably turtles, dugongs and dolphins, through the loss and disturbance of marine habitat (particularly seagrasses) and intertidal foreshore areas.

Also, the additional obstruction of the northern Western Basin due to construction of the reclamation area, and an increase in vessel traffic associated with dredging may impede the migratory pathways of marine fauna using the Narrows and Port Curtis.

However, **I do not consider** that the construction and operation of the project is expected to have a significant impact on the key marine mammals and reptile species, either in terms of direct disturbance construction noise and or potential vessel strike.

Based on the EIS, draft EMP and SID, **I have stated** conditions concerning marine fauna.

In particular, **I refer** to the conditions in Appendix 1, Schedule 2, Part 4 that **I stated** to ensure that the proponent prepares and implements a FFMP for the duration of the project that will establish a framework for baseline monitoring (including review of historical records), assessment of impact (including threshold triggers), and inform management and operation response, to avoid, minimise and/or mitigate impacts to terrestrial and marine flora, fauna and ecosystems.

I consider that GPC has endeavoured to identify and avoid and/or mitigate the potential adverse impacts on the marine fauna that occur or use the project area, particularly seagrasses, through the combined and coordinated implementation of the DMP, WQMP, seagrass monitoring and FFMP.

I also consider that the mitigating measures contained in the EIS, SID and draft EMP for the proposed project are satisfactory and sufficient to avoid or greatly minimise adverse impacts to the migratory marine megafauna.

Therefore, **I conclude** that the project does not pose a significant risk to populations of dugongs, dolphins, turtles and other marine fauna in the Western Basin project area.

5.2.8 Terrestrial flora

5.2.8.1 Context

This section of the report provides an evaluation of the potential impacts of the project on terrestrial flora of state significance. Matters of national environmental significance are addressed in chapter 8 of this

report. Section 9.2 and Appendix P of the EIS addressed terrestrial ecology, and additional information was provided by GPC in the SID.

5.2.8.2 Flora species

A total of 16 flora species of conservation significance (national and/or state significance) were recorded within five km of the project area, mostly associated with the peak and slopes of Mount Larcom. Of these, three were afforded particular assessment in the EIS (Appendix G, section 4.1.1):

- cycad (*Cycas megacarpa*)—common on Mount Larcom, no records in lower-lying areas closer to the project area, conspicuous when mature
- Bailey's indigo (*Indigofera baileyi*)—occurs in sclerophyll woodlands and open forest on soils derived from basalt and granite, core populations are located south of Fraser Island
- quassia (*Quassia bidwillii*)—occurs in closed forests and vine thickets, usually in association with riparian vegetation and freshwater.

None of these species were identified in the project area during the field surveys conducted for the EIS.

5.2.8.3 Terrestrial communities

The VMA provides the conservation status for REs in Queensland. REs that are considered threatened are those that are listed under the VMA as endangered or of concern.

One RE listed as threatened under the VMA was identified from desktop studies to potentially occur in the vicinity of the project area (EIS, Figures 9-6 and 9-7): RE 12.3.3, comprising open forest to woodland on alluvial soils, generally dominated by *Eucalyptus tereticornis* (Queensland blue gum) with *E. crebra* (narrow leaf ironbark) and/or *E. moluccana* (gum-topped box).

Field surveys conducted for the EIS found that areas (within the project area) thought to contain RE 12.3.3 were composed entirely of RE 11.3.29, which is classified as not of concern under the VMA.

Two ecological communities listed as threatened under the EPBC Act (see also section 8.4.3 of this report) were identified from desktop studies to occur in the vicinity the project area:

- semi-evergreen vine thicket (SEVT) of the Brigalow Belt and Nandewar bioregions—classified under the EPBC as an endangered ecological community (EEC), and represented by several SEVT REs
- weeping myall woodlands—classified as an EEC, dominated by myall (*Acacia pendula*) and restricted in Queensland to REs 11.3.2 and 11.3.28.

Neither of these EECs was found to occur directly within the project area.

5.2.8.4 Coordinator-General's conclusion—terrestrial flora

The WBDD Project is essentially a marine project comprising dredging and the construction of a reclamation area within the intertidal zone. Activities relevant to the project that occur inland relate primarily to the transport of quarry materials to the reclamation area construction site via a designated haul route. The approvals for the use of the quarry and haul route are managed under separate processes to this EIS. In addition, **I have considered** transport and traffic impacts relating to the WBDD Project in section 5.4 of this report, and amenity and safety issues in section 5.5 of this report.

I recognise that no flora species or ecological communities of listed state or national significance occur in the project area. Therefore, **I consider** that the project would not have a significant impact upon terrestrial flora species or ecological communities.

5.2.9 Terrestrial fauna

5.2.9.1 Context

This section of the report provides an evaluation of the potential impacts of the project on terrestrial fauna of state significance. Matters of national environmental significance are addressed in chapter 8 of this report. Section 9.2 and Appendix P of the EIS addressed terrestrial ecology, and additional information

was provided by GPC in the SID. Terrestrial fauna species are afforded protection by the *Nature Conservation Act 1994* (NC Act) and the conservation status of fauna in Queensland is listed in the NC(W) Reg).

Terrestrial fauna diversity was assessed from desktop studies and field surveys. A total of 125 terrestrial fauna species was recorded from the study area.

Twenty-seven terrestrial fauna species of conservation significance were considered likely to occur in or immediately adjacent to the project area. Of these, three species were listed as endangered under the NC Act:

- Troughton's sheath-tailed bat (*Taphozous troughtoni*)
- yellow chat (Dawson subspecies) (*Epthianura crocea macgregori*)
- little tern (*Sterna albifrons*).

The majority of the total species were considered to inhabit the dryland/woodlands habitats adjacent to the project area, which were not considered to be core habitat to any of these species.

5.2.9.2 Terrestrial birds

Five EPBC Act-listed threatened bird species were recorded in the project area or identified as likely (\geq moderate likelihood) to occur within the project area. These are:

- yellow chat (Dawson subspecies) (*Epthianura crocea macgregori*)—critically endangered
- squatter pigeon (southern) (*Geophaps scripta scripta*)—vulnerable.

Neither of these species was identified during the field surveys conducted for the EIS. Habitat suitable for each of these species does not occur with the project area.

Although habitat for Dawson's yellow chat may occur in the vicinity of the reclamation area, neither species was identified during field surveys conducted for the EIS.

The terrestrial migratory white-throated needletail (*Chaetura caudacuta*) and fork-tailed swift (*Apus pacificus*) are considered likely to forage at the project area when visiting eastern Australia in spring and summer, however the available habitat is not considered important for these species.

Therefore, the project is not expected to impact upon the ecological values of the terrestrial bird species.

5.2.9.3 Migratory birds and shorebirds

Migratory bird species are those species that migrate to Australia and its external territories, or pass through or over Australian waters during their annual migration. All species on the list of migratory species are also matters of national environmental significance under the EPBC Act (see section 8.5 of this report). Migratory bird species are those listed in the:

- China-Australia Migratory Bird Agreement (CAMBA)
- Japan-Australia Migratory Bird Agreement (JAMBA)
- Korea-Australia Migratory Bird Agreement (KAMBA).

A number of EPBC Act-listed migratory bird species, including migratory shorebirds, occur or are likely to occur in the project area. Suitable habitats include woodlands, riparian vegetation, mangroves and mudflats. The intertidal areas, in particular, are used for foraging and roosting by migratory shorebirds.

The EIS (Table 9-7) identified six other migratory marine birds to occur in the project area:

- white-bellied sea eagle (*Haliaeetus leucogaster*)
- osprey (*Pandion cristatus*)
- great egret (*Ardea modesta*)
- Caspian tern (*Hydroprogne caspia*)
- red-necked avocet (*Recurvirostra novaehollandiae*)

- whimbrel (*Numenius phaeopus*).

The EIS (sections 9.2 and 9.3) also specifically noted three species of migratory shorebirds that have been recorded to use the mudflats in the east of project area for foraging and/or roosting in spring and summer. These include:

- bar-tailed godwit (*Limosa lapponica*)
- red-necked stint (*Calidris ruficollis*)
- eastern curlew (*Numenius madagascariensis*).

The SID (section 16.4.1) noted that the Gladstone region is generally not recognised as an area of international significance for migratory shorebirds. However, while the intertidal mudflats seaward of the fringing mangroves immediately north of the reclamation area provide some feeding and roosting habitat for wading and migratory shorebirds, the area north towards Friend Point and the Narrows, further from the industrialised foreshore, is used more extensively.

5.2.9.4 Terrestrial mammals and reptiles

The EIS (Appendix G, section 4.1.2) identified two species of terrestrial mammals considered likely to occur within the project area:

- large-eared bat (*Chalinolobus dwyeri*)—vulnerable
- grey-headed flying fox (*Pteropus poliocephalus*)—vulnerable.

The terrestrial environment of the project area is not considered to be core or significant habitat for either of these species so it is considered highly unlikely that this project will impact on these species.

5.2.9.5 Potential impacts and mitigation measures

The EIS (section 9.2.3) and SID (section 16.4.1) noted that construction impacts included disruption to wildlife behaviour as a result of light, noise and vibration disturbance particularly associated with the 24/7 construction schedule for the bund wall. These include:

- disruption to wildlife behaviour due to light, noise, vibration and other construction disturbances
- direct mortality during construction (e.g. 'road kill' or strike)
- direct habitat loss or disturbance
- indirect degradation due to pollution, contaminants, pests and weeds and ASS
- change or degradation of water quality
- formation of new habitat on or within the reclamation area.

The EIS acknowledged that these disturbances can have a significant impact on migratory birds if they restrict access to a limited resource or inhibit natural behaviour during a critical phase of the animal's lifecycle. Appendix S of the EIS (Noise and vibration) notes a study (Larkin, 1996) that observed that some birds may habituate to noises that are not biologically relevant to them. Examples were provided of seabirds that inhabit loud, noisy location such as airports or adjacent to busy motorways.

Concerns were raised in a public submission to the EIS regarding threats to shorebirds due to loss of feeding and roosting habitat and disturbance due to noise, vibration and light.

In response, the SID noted that populations of migratory shorebirds continue to use the project area despite the history of intensive industrial development and port operation, suggesting a degree of adaptation or resilience to persist irrespective of noise and other disturbances.

However, proposed mitigation measure to minimise nuisance to migratory and shorebird species include:

- directional control of lighting on the haul route and on the reclamation area
- use of low wattage lighting, glare guards and shielding to minimise light spill.

Further discussion on potential lighting and noise impacts and mitigation is included in section 5.5 (Lighting) of this report.

In its submission on the SID, DEWHA considered that the EIS and SID had not adequately addressed potential impact to migratory birds. In response, GPC has committed to undertaking further monitoring, particularly of migratory shorebirds that may be affected by construction of the reclamation area, during periods when they are known to be locally in transit.

5.2.9.6 Coordinator-General's conclusion—terrestrial fauna

As with terrestrial flora, **I note** that the WBDD Project is essentially a marine project comprising dredging and the construction of a reclamation area within the intertidal zone.

I recognise that no terrestrial mammals or reptiles of listed state or national significance occur in the project area. **I consider** that the project will not have significant impact on the feeding, nesting or migratory behaviours of the terrestrial fauna species in the vicinity of the project area. Therefore, **I consider** that the project would not have a significant impact upon terrestrial mammals or reptiles.

I have stated conditions (Appendix 1, Schedule 2, Part 4) to ensure that the proponent prepares and implements a FFMP for the duration of the project that will establish a framework for baseline monitoring (including review of historical records), assessment of impact (including threshold triggers), and inform management and operation response, to avoid, minimise and/or mitigate impacts to terrestrial and marine flora, fauna and ecosystems.

I consider that GPC has endeavoured to avoid and/or mitigate the potential adverse impacts on the migratory fauna that use the project area through the combined and coordinated implementation of the DMP, WQMP and FFMP.

I acknowledge that the project area is inhabited by migratory birds, however **I am satisfied** that the project area is not an important or critical habitat for the listed migratory species or other shorebirds. Furthermore, **I am satisfied** that the mitigation measures, listed in section 9.2.3 the EIS, committed to by GPC will help to minimise any potential impacts on migratory birds species.

Nonetheless, **I acknowledge** that disturbance to the intertidal foreshore in the vicinity of the reclamation area may impact upon the feeding, breeding and transit of migratory shorebirds.

I have stated a condition (Appendix 1, Schedule 2, Part 4.5) that requires the proponent to specifically undertake seasonal monitoring of migratory seabirds, for the summer season transit period (between October and March), with particular focus on the population peak in January. Monitoring will occur at the localities immediately impacted by the reclamation area, including the embayment immediately north of the reclamation area.

Monitoring will be undertaken within the context of a FFMP for the project (FFMP—refer to Appendix 1, Schedule 2, Part 4) that will establish a framework for baseline monitoring (including review of historical records), assessment of impact (including threshold triggers), and inform management and operation response, for the duration of the project, to avoid, minimise and/or mitigate impacts to terrestrial and marine flora, fauna and ecosystems.

5.3 Social and economic issues

5.3.1 Context

The EIS (chapter 13 and Appendix W) identified a range of social impact issues likely to be derived from activities associated with the project and provided a qualitative assessment of each, including:

- road safety
- employment
- business
- housing real estate values
- social infrastructure and services.

The assessment methodology used permitted consideration of stakeholder groups, duration and scale, likelihood and consequences of social impact. The consequences were rated to account for the likely

impact from: 'insignificant' to 'minor', 'moderate', 'major' and 'extreme'. Consequences were rated as: 'high', 'medium', 'low' and 'negligible'.

No extreme impacts were identified. The most significant impacts were assessed as likely to impact on:

- health and social well-being
 - reduced road safety due to increased worker traffic (unlikely, but significant consequence, in the short-term)
 - reduced marine safety (unlikely, but significant consequence in the short-term)
- economic and material well-being
 - positive benefits from employment opportunities (certain, but minor consequence, short duration)
 - positive benefits from business and community opportunities (highly likely, short duration)
 - negative impacts on commercial fishing (highly likely, potentially long-term)
- quality of living environment
 - negative impacts on visual amenity and aesthetic quality (certain but minor long-term impact on commercial and recreational fishers)
 - loss of natural and recreational areas (highly likely, significant long-term impact on the Gladstone community covering recreational, environmental, indigenous groups)
- cultural impacts
 - negative effect on accessibility to culturally important areas and landscapes (likely moderate, long-term impact)
 - negative effect on community aspirations (medium likelihood, long-term)
- institutional, legal, political and equity impacts
 - formation of community opinions and attitudes about the project (highly likely, long-term).

Issues raised in submissions on the EIS and SID relating to potential social and economic impacts of the project tended to focus on potential cumulative impacts of all the current developments and activities being undertaken in Port of Gladstone by GPC, other future port developments, including the recently-approved FLPE project and proposed LNG developments such as the Gladstone LNG (Santos) project (GLNG) and Queensland Curtis LNG project (QGC).

Regarding those impacts directly attributable to the WBDD proposal, submission on the EIS focussed on:

- the extent of impact on sea grass meadows
- loss of natural and recreational areas
- impact on the viability of commercial fishing
- indigenous employment
- compensation for commercial fishing losses and
- offsets for loss of recreational access.

In its submission on the EIS, DEEDI expressed support for the influence the project would have on resource and industrial development and employment in the Gladstone region. At the same time DEEDI stated that the project impact on fish habitat and commercial fishing was likely to be significant, offering assistance to GPC to address these issues.

GRC also focussed on natural environment, social and recreational impacts and addressing these through mitigating safeguards, compensation and offsets.

The QER response to the SID focussed on the potential for sterilisation of oil shale deposits adjacent to the reclamation development area.

In its response to the SID, the QSIA emphasised the potential loss to commercial fisheries caused by direct and indirect impacts on sea grasses and access to developed areas. QSIA identified the need for compensation to offset losses incurred.

In summary, the WBDD Project would be likely to make a significant contribution to the potential cumulative impacts from the multiple projects in the Western Basin and therefore has the potential to add to impacts on commercial, recreational or indigenous fisheries, including loss of fish habitat, loss of access to harvest stock, impacts on the local seafood chain, and potential to displace fishing effort to other habitats within the Gladstone region.

Potential impacts on commercial fisheries and recreational fishing and boating were considered in the EIS (sections 13 and 15). Additional information was provided in the SID (sections 11 and 12). Issues specifically relating to impacts on commercial and recreational fishing and the need for appropriate compensation were raised in submissions from the QSIA, GRC and QER on the EIS and SID and a number of public submissions on the EIS.

Results of a social impact assessment undertaken as part of the EIS are addressed in Appendix W and summarised in section 13 of the EIS. I note that GPC has committed to ensure all mitigation measures relating to social impacts included through the EIS documents are actioned throughout the life of the project.

5.3.2 Impacts on fisheries and boating

5.3.2.1 Recreational and indigenous fishing

Context

The EIS (section 13.1.12) confirmed that fishing is a major recreational activity throughout the Gladstone region, with Gladstone having one of the highest rates of boat ownerships of any community in Australia. Fishing is by far the most prominent recreational activity undertaken in and around the project area.

The EIS indicated that use of the area by recreational fishers is governed by the seasonality of targeted species, the tidal signature of the area and the amount of time available for fishing activities. The majority of recreational fishing in the area is undertaken on the weekend, both from the shore and recreational vessels.

Species caught in the area include mud crab, mullet, shark, blue salmon and barramundi.

Indigenous fishing activities are undertaken by Traditional Owners in the study area. Indigenous fishers are able to use recreational fishing apparatus and stone fish traps to take fish. Possession, size and gender limits do not apply to indigenous fishers who are fishing for traditional purposes.

The EIS acknowledged that the Western Basin is an important resource for the local fishing community and Port Curtis offers protected waters that support a variety of edible and sport fisheries species. It was identified during the EIS process that access to fishing sites impacted by the dredging operations may be restricted given the required safety exclusion zone around the dredging activities.

Potential impacts

As noted, potential impacts to recreational and indigenous fishing in Gladstone harbour are not specific to the WBDD Project but are related to all current and proposed future activities.

The EIS stated that the potential impacts on the local indigenous, recreational and commercial fisheries during construction of the project include the reduced access to recreational and culturally important areas and the establishment of restricted areas in the vicinity of the project area during dredging and reclamation area construction for security and safety reasons. Construction activities may also lead to a reduction in local catch as species temporarily relocate to other areas to avoid the disturbance (including noise, vibration and light). This impact is considered to be limited as most recreational fishing in the vicinity of the existing Fisherman's Landing wharf is conducted in an area to the north of the proposed reclamation, in The Narrows and Graham Creek.

Recreational and indigenous fishers may also be impacted by dredging operations for this project as the dredges will limit access to fishing in these areas. However, it is expected that fishers have adapted to past dredging operations which are continually occurring in Gladstone harbour and have adjusted their

fishing patterns accordingly and therefore will make similar adjustment for the proposed dredging operations for this project. Increased sedimentation from dredging operations may also impact on fish availability in some areas and smother local seagrass beds, which has the potential to impact fish breeding and feeding cycles.

Reduced access to recreational and indigenous fishing may have an economic impact on recreational and indigenous fishers and their families as it is possible that fishing catches from the Fisherman's Landing area may provide a food source and supplement to family income. The area along the coast north of the existing Fisherman's Landing (locally referred to as 'The Pines' due to a distinctive rows of pine trees positioned there) offers informal road access to crabbing areas and is one of the few local access points for crabbing.

Concerns were raised by public submissions to the EIS regarding the potential impacts on fisheries of loss of habitat and access. In its submission on the SID, GRC considered that the EIS and SID had not adequately addressed the loss of public access for recreational and commercial boating and fishing and loss of linkage to The Narrows.

In response, the SID noted that provision of additional boat ramps would be considered within the context of an offsets package, access to The Narrows would remain and ongoing discussions would continue with the fishing industry. Recreational offsets are further discussed in chapter 6 (Environmental offsets) of this report.

Coordinator-General's conclusion—recreational and indigenous fishing

I accept that the impact of the WBDD Project on recreational and indigenous fishing in Gladstone harbour has been investigated as part of the EIS process and **I consider** that the preferred project area provides the least restrictions to The Narrows and to the northern part of the Western Basin.

I note that GPC has indicated that the proposed development would restrict access to some areas of the Western Basin but that these restrictions would have minimal affect on the recreational and indigenous use of the harbour. While the affects on fish numbers is unquantified, the EIS indicated that the rock bund walls will provide some alternative fishery habitat possibly offering a greater quantity of spatial refuge for juvenile taxa than does open seabed.

I note that GPC has indicated that it is considering the construction of a boat ramp and parking facilities in the vicinity of the Fisherman's Landing site, in the context of the offsets package for the project (see chapter 6 of this report) to provide boat launching facilities for recreational and indigenous fishers, however specific details have not been provided at this time.

5.3.2.2 Commercial fishing

Context

The EIS estimates that approximately six commercial fishing operations use the project area and adjacent surrounds. DEEDI has indicated that approximately 10–15 per cent of commercial fishing operations based in Gladstone are conducted in the wider Port Curtis area. Consultation with GPC and the local fishing community revealed that there are six commercial fishing operations that use the project area and adjacent surrounds. The main commercial fishing activities include setting pots to collect mud crabs, fish netting and trawler thoroughfare (but trawling is not allowed in the port area). The species targeted by the local commercial fishing industry include mud crab, mullet, shark, blue salmon and barramundi. In its submission on the EIS, the QSIa stated that the proposed reclamation area is a productive mullet, salmon and shark fishery.

There is currently a 500 m exclusion zone around existing wharves and vessels at berth. Gladstone harbour is closed to commercial fishers from Friday 6 pm until Sunday 6 pm to provide access for recreational fishers.

Potential impacts

As noted in the discussion concerning recreational and indigenous fishing, potential impacts to commercial fishing in Gladstone harbour are not specific to the WBDD Project, but are related to all current and proposed future activities of GPC.

The EIS (section 13.2) stated that the potential impacts on the commercial fisheries during construction of the project include the direct removal of approximately 236 ha of potential fishing grounds and the establishment of restricted areas in the vicinity of the project area during construction for security and safety reasons. Construction activities may also lead to a reduction in the local yield as the targeted species may move away from the area to avoid the disturbance (including noise, vibration and light).

Commercial fishing may also be impacted by dredging operations for this project as the dredges would limit access to fishing in these areas. However, it is expected that fishers have adapted to past dredging operations that are continually occurring in Gladstone harbour and have adjusted their fishing patterns accordingly and therefore will make similar adjustment for the proposed dredging operations for this project. Increased sedimentation from dredging operations may also smother local seagrass beds and impact on fish availability in some areas, which has the potential to impact fish breeding and feeding cycles.

There is concern among the Gladstone commercial fishery community that removal of soft sediment and seagrass habitat, resulting from the construction of the reclamation area and turbidity and sedimentation associated with dredging, would reduce juvenile fishery species habitat, having flow-on effects to catch rates and economic viability of the fishery in the future.

The seagrasses within the project area that are likely to be impacted occur in aggregated patches, have little vertical structure and are highly variable in their prevalence.

The SID (section 11.1) stated that commercial fishery data for the Gladstone area from 2002 to 2008 do not show a decline in catches in the years following a decline in available seagrass habitat (which naturally fluctuates erratically). This would be expected if the reproductive success of species using the habitats to be affected was correlated to the availability of that habitat. Instead, a decline in catches is observed corresponding with the time of reduction in available habitat, suggesting commercially targeted species prevalence was more affected by those events that lead to the loss of seagrass (such as extreme stormwater runoff events from the surrounding catchment) than they were to the loss of seagrass itself.

It is evident that the marine communities using this habitat already persist under an erratically fluctuating regime of meadow availability and absence. It is predicted that any species using the habitat to be affected would relocate to the other seagrass meadows (approximately 7000 ha) in the Gladstone area.

QSIA has been advised by local fishers that they believe ASS in the region has led to ulcerated crab shells. Local fishers are concerned that potential impacts of the release of ASS may lead to more deformed crabs, thereby limiting marketable catches. The SID indicated that scientific evidence to support this claim is not well documented.

In its submission on the EIS, QSIA concerns for the industry relate to loss of habitat, loss of access, displaced effort and seafood supply chain issues. QSIA considers local fishers are entitled to appropriate compensation for loss of income and resource access as a result of various GPC projects.

In its submission on the EIS, GRC suggested that monetary compensation should be made available to commercial fisherman for the loss of productive fishing areas and to the community for the social impacts of direct loss of fisheries habitat.

GRC also requested that **I set** appropriate mitigation actions of the proponent to account for the social impacts of the project, such as a recreational offsets package to mitigate impacts to indigenous and recreational fishers.

The need for compensation for these potential losses was raised in a number of public submissions on the EIS. **I note** that GPC has indicated that it would participate in any state government-led negotiation on the matter. **I note** that the fishery communities are already adapted to using other meadows in the Gladstone region for those times during which seagrass meadows in the Western Basin are sparse.

Coordinator-General's conclusion—commercial fishing

The EIS suggested that there would not be significant impacts on the juvenile fishery productivity in this area. This argument is not supported by DEEDI, QSIA, GRC and a number of public submitters. DEEDI suggested that the proposed development would have an impact on commercial, recreational and indigenous fisheries operating in the harbour and that these should be taken into account and compensation paid where negative impacts are demonstrated to have been experienced. DEEDI also suggested that an offsets package include the enhancement of other recreational fishing locations or

provision of facilities that would be useful to recreational and commercial fishers as part of a much broader offsets package that includes consideration of impacts to marine habitats.

I acknowledge that the full impact of the WBDD Project on fisheries in the Western Basin would be a very difficult to accurately establish. However, **I agree** with DEEDI, GRC and QSIA that there would be some degree of impact and this impact needs to be determined and analysed in more detail and an appropriate compensation package (if considered necessary) prepared to cover the relevant impacts.

As noted, potential marine impacts in the Western Basin harbour are not specific to the WBDD Project, rather to all current and proposed future activities of GPC. Therefore, my consideration of impacts to commercial fishing in Gladstone harbour is considered in the overall cumulative impact assessment in section 6 of this report.

5.3.2.3 Boating safety

The project may impact on the safety of marine-based activities, such as fishing, boating and jet skiing, particularly where industrial equipment is used in close proximity to recreational areas. The bund construction and dredging will result in reduced access to recreational areas. Exclusion zones are proposed to be introduced to mitigate public safety and help to ensure the security of the construction and dredging equipment. The requirements of DTMR, MSQ and the RHM concerning marine safety are addressed in section 5.4.4 of this report.

I am satisfied that there are sufficient alternative areas within Port Curtis that can be accessed by the public for recreational purposes.

5.3.3 Cultural heritage

5.3.3.1 Indigenous cultural heritage

The key legislation in Queensland with regard to Aboriginal cultural heritage is the *Aboriginal Cultural Heritage Act 2003*. This Act requires that a cultural heritage management plan (CHMP) be prepared to manage Aboriginal cultural heritage.

The project area is situated partially within the external boundaries of the registered Port Curtis Coral Coast (PCCC) Native Title claim. The PCCC claim area takes in the small area of land in the south-west of the project area near the shoreline. The claim does not include the waters of the Gladstone harbour.

I note that a CHMP has recently been prepared and is awaiting its final signatures.

5.3.3.2 Non-indigenous cultural heritage

Several pieces of Commonwealth and state legislation provide a legislative basis for non-indigenous cultural heritage including the EPBC Act, *Australian Heritage Council Act 2003* (Commonwealth), *Queensland Heritage Act 1992* and the *Historic Shipwrecks Act 1976*.

The EIS provided details of desktop research undertaken on non-indigenous cultural heritage. In its submission on the EIS, DERM sought additional information on shipwreck data. This data was presented in the supplementary document.

I note that GPC has committed to take steps in accordance with sections 89 and 90 of the *Queensland Heritage Act 1992* and the *Historic Shipwrecks Act 1976*, including reporting details to DERM, if any archaeological artefacts (including shipwrecks) are discovered during the course of construction.

5.3.4 Mineral resource deposits

5.3.4.1 Context

The project area traverses and is adjacent to the state's oil shale deposits under tenements MDL225, MDL177, ML(A) 80081 and ML80003 (Stuart oil shale deposits) and exploration permit EPM3215 held by Queensland Energy Resources Limited (QER) and its related entities. QER is investigating the potential to develop oil shale deposits within the Stuart area immediately landward of the reclamation area.

QER is supportive of GPC's proposal to develop the WBDD Project but wishes to ensure that the project does not lead to the inadvertent sterilisation of the underlying oil shale resource.

5.3.4.2 Coordinator-General's conclusion—mineral resource deposits

As the potential construction and operation of the QER's facility may have minor constructional and possibly operational interface issues with the WBDD Project, mainly associated with the transport of quarry material for the construction of the reclamation area bund wall.

I have stated a condition (Appendix 1, Schedule 3, Part 3) that requires the proponent to maintain satisfactory communication with QER and DIP during the WBDD Project to sure that QER's interests are not adversely affected.

5.4 Transport and traffic

5.4.1 Road network

5.4.1.1 Context

The proposed reclamation area is located in the Gladstone harbour to the north-west of Gladstone and is accessed by Landing Road. This two-lane, two-way sealed road is under the jurisdiction of GRC with a speed limit of 80 km/h and forms the main north-south access spine for this area of the Yarwun Precinct of the GSDA.

The major road in the study area is the Gladstone–Mt Larcom Road, which is a state-controlled sealed road under the jurisdiction of DTMR. Gladstone–Mt Larcom Road is a two-lane, two-way road, with a speed limit of 80 km/h in the vicinity of Landing Road.

The GPC-owned quarry that will provide material for construction of the reclamation bund wall is situated west of Landing Road near Guerassimoff Road, located approximately 4 km south-west of the reclamation area. The operation of the quarry was subject to a separate planning and environmental approvals process, which has included the assessment of traffic impacts associated with the long-term operation of the quarry.

A detailed assessment of traffic impacts on the road network was not undertaken for the EIS. However, a general assessment was provided in the EIS. Chapter 11 of the EIS indicated that there is potential for impacts on transport infrastructure from workforce traffic and the haulage of approximately 1.8 Mm³ of rock from the quarry.

The EIS described two possible production schedule options for construction of the bund wall, including a high-rate production schedule, to be completed in one year, and a low-rate production schedule, to be completed in four and a half years. For reasons of construction timing and efficiency GPC has identified in the SID that it will adopt the high-rate production schedule option, which would require a 24/7 bund construction schedule. My evaluation of workforce and rock haulage traffic (sections 5.4.1.2 and 5.4.1.3 respectively) has therefore only considered potential impacts associated with the high-rate 24/7 production schedule option.

Although the WBDD Project and the FLPE project are different projects and subject to separate approvals processes, at a certain stage of the bund construction and reclamation, the two projects overlap. Accordingly, **I note** that the two projects have been assessed together within the traffic analysis for EIS and SID to consider the worst-case traffic scenario.

5.4.1.2 Workforce traffic

In its submission on the EIS, DTMR identified that assumptions made in the traffic analysis for the EIS were inconsistent with DTMR traffic count data, raising concern regarding the creditability of the GPC's data and therefore accuracy of the analysis undertaken. In response, GPC has used the traffic counts provided by DTMR to re-create the traffic analysis that was presented in chapter 11 of the EIS.

The following bund construction and dredging activity assumptions were used in the revised traffic analysis report (SID, Appendix I) to calculate peak workforce traffic generation as set out in Table 9.

Table 9—Project construction traffic timing

Construction phase	Timing and traffic
Bund construction period	September 2010–September 2011
Commencement of dredging operation	April 2011
Construction operation	24 hours, 7 days a week
Workers shift change-over	6.00 am and 6.00 pm (bund construction) 6.00 am (dredging activities)
Bund construction workforce (2 shifts/day)	23 workers start at 6.00 am, 16 workers start at 6.00 pm 23 workers finish at 6.00 pm, 16 workers finish at 6.00 am
Dredging workforce (1 shift every 1–2 weeks)	20 workers start at 6.00 am, 20 workers finish at 6.00 am

The bund construction workforce would commute directly to the reclamation area and would be separated into two separate shifts with changes between shifts occurring daily at 6 am and 6 pm. The dredging workforce would change shift once every 1–2 weeks, however it has been assumed that both activities would have the same shift time change over as a worst-case scenario.

Table 10 shows the calculated peak workforce directional volumes for the bund construction and dredging workforce, with vehicular volumes based on an average occupancy rate of one person per vehicle.

Table 10—Workforce directional volumes (see SID, Appendix, section 2.3)

Peak period	Towards reclamation area (trips/hour)	Towards Gladstone City (trips/hour)
am. peak	43	36
pm. peak	16	23

In 2011 (when both the bund construction and dredging activities would occur concurrently), it is estimated that 79 trips per hour would be generated during the morning peak and 39 trips per hour during the evening peak.

Chapter 11 of the EIS identified the intersection of Gladstone–Mt Larcom Road and Landing Road as the most critical intersection to be affected by the construction traffic due to the high volume of vehicles on the right-turn movement from the western approach to the intersection (see Figure 8). Three scenarios were modelled to assess the possible impact of the traffic associated with the project on the intersection, including: existing traffic (2009); future traffic (2011) without construction traffic; and future traffic (2012) with construction traffic.

The analysis indicated that the traffic generated by the bund construction and dredging workforce activities would not significantly impact the performance of the existing Gladstone–Mt Larcom Road/Landing Road intersection. With the predicted workforce traffic identified in Table 10, the intersection is expected to perform satisfactorily and remain at the highest level of service for all traffic movements. The existing Gladstone–Mt Larcom Road/Landing Road intersection would therefore not require any upgrading as a result of workforce traffic generated by the proposed project activities.

The traffic analysis also indicated that the predicted volume of workforce traffic would be well within capacity limits on the Gladstone–Mt Larcom Road, representing a relatively small proportion of the road's vehicle traffic (16 per cent in the am. and 7.8 per cent in the pm.).

With regard to pavement impacts, the majority of vehicles used by workers to commute to and from the reclamation area along Gladstone–Mt Larcom Road during construction of the reclamation area and dredging would consist of cars and light trucks. These vehicles are expected to have a minimal impact on the pavements of the roads used.

In summary, there are not likely to be any impacts on traffic or road surfaces resulting from workforce traffic (including construction of the reclamation area and dredging) associated with the project.

5.4.1.3 Rock haulage traffic

As noted, GPC identified in the SID that it requires the high-rate production schedule option for the construction of the reclamation area bund, which would require the construction of the bund 24/7. This option would involve a production schedule of 1.8 Mm³ (total), equating to approximately 10 truck circuits

per hour (based on a fleet of six CAT 777 trucks) 24/7, and is expected to take approximately 12–18 months to complete.

An off-road haul route is proposed (see Figure 8) thereby removing the bulk haulage of quarry material on council controlled road infrastructure and minimising potential impacts on traffic, road user safety and local road surfaces.

The proposed route runs through the GSDA, land held by Cement Australia, Queensland Energy Resources Limited (QER) and a small section of forestry land. The haul route runs predominantly to the west of Landing Road, crossing Forestry Road to the north and then runs parallel to Forestry Road leading to Fisherman's Landing Wharf. The haul route currently involves only one heavy vehicle crossing of Forestry Road, which would be designed in consultation with GRC and QER.

Section 16 of the SID reported that the haul route is currently subject to the design and documentation process in preparation of construction tenders. As the alignment is generally fixed, the haul route would only be subject to further refinement by the appointed contractor with respect to profile, drainage structures and traffic control. Preliminary approval has been reached with the affected land owners along the route and agreements are being negotiated for the use of the land for the haul route.

GPC is undertaking a separate approvals process to gain the required development approvals for the off-road haul route. Pavement, intersection and traffic impacts would be reviewed at that time.

The 24/7 production schedule option may result in risks to the public which would be managed as part of the haul operation. Schedule 13 of the EMP includes the following measures to minimise these risks:

- grade separation (preferred option) or other manned gate type operations with stop signals, where haulage vehicles would interact with road registered or other traffic
- exclusion of all unauthorised traffic on the haul road (including trail bikes), through the construction of safety bunds and fencing along both sides of the route
- greater security patrols to ensure exclusion of the public from the haul route.

A number of safety measures have been highlighted in section 16 of the SID that would be deployed by GPC to ensure the safety of heavy equipment operators and construction workers for the 24/7 operation, including:

- regular traffic inspections and more traffic controllers for night time construction
- provision of appropriate lighting
- management of vehicle driver and traffic controllers fatigue of haul vehicle drivers on the construction site and for the haulage operation to avoid collisions.

Additional impacts of the 24/7 option include impacts of night lighting and additional night noise. These are addressed in section 5.5 of this report.

5.4.1.4 Coordinator-General's conclusion—road network

I am satisfied that there are not likely to be any impacts on traffic or road surfaces resulting from workforce traffic associated with the project.

I recognise that the approval for the haul route lies outside the scope of this report and is subject to a concurrent approvals process. However, **I am satisfied** that the proposed off-road route for rock haulage requirements would minimise potential impacts on traffic, road user safety and GRC road surfaces.

5.4.2 Rail

The Fisherman's Landing Branch rail line runs along the GSDA Materials Transportation and Services Corridor to Cement Australia, enabling the delivery of raw materials to the cement plant. Two level crossings exist along Serrant Road where it crosses the rail loop.

Workforce commuter traffic for the construction of the reclamation area would be instructed to use the route consisting of Landing Road and then curving around to the north of the cement plant onto the strategic port land. This would not impact on the local rail infrastructure.

Figure 8—Road access to Fisherman's Landing



1:25,000 (at A4)
0 0.2 0.4 0.6 0.8 1
Kilometers
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56



Port of Gladstone
Western Basin Dredging and Disposal Project

Job Number 42-15386
Revision A
Date 15 July 2010

Proposed Haul Route

G:\42\15386\GIS\WesternBasinSeagrass\MXD\42-15386-58_14_rev_a.mxd Level 4 201 Charlotte Street Brisbane QLD 4000 Australia T +61 7 3316 3000 F +61 7 3316 3333 E bnmall@ghd.com W www.ghd.com
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Data Source: DERM - Aerial Imagery (2006), DCDB (2010), GHD/GPC - Haul Route (42-16100-SK127.dwg)

Section 14 of the SID confirms that no heavy vehicle crossings of the Fisherman's Landing Branch rail line are envisaged within the proposed off-road haul route. Should the haul route change and the need to cross the Fisherman's Landing Branch rail line be required, a separate level crossing assessment would be undertaken and an associated approval of the railway crossing would be obtained from the DTMR, under section 255 of the Transport Infrastructure Act.

In summary, **I consider** that there are not likely to be any rail impacts resulting from workforce traffic or rock haulage traffic associated with the project.

5.4.3 Airport

5.4.3.1 Context

All developments in the vicinity of airports, aerodromes and airfields must take into consideration the specifications stated in the Civil Aviation Safety Authority's (CASA) *Manual of Standards Part 139 - Aerodromes*. The manual contains specification (standards) prescribed by CASA to be necessary for the safety of air navigation including obstacle restrictions and limitations and is referenced in the Civil Aviation Safety Regulations Part 139—Aerodrome Certification and Operation.

The closest operational airport to the reclamation area and quarry is the Gladstone airport. The construction of the reclamation area is not expected to adversely impact the operation of the Gladstone airport. Separate investigations would be carried out for the construction of any structure on the completed reclamation.

In its submission on the EIS, GRC expressed concerns surrounding the potential penetration of the Obstacle Limitation Surface (OLS) for the proposed Kangaroo Island Airport by the reclamation mound and the need for the state government to address the loss of the airport site.

To avoid projection into the operational airspace around any future airport on Kangaroo Island, GRC suggested a 40 m height restriction for the reclamation site associated with the FLPE project. **I note** that a maximum height of 60 m has been proposed for the WBDD Project reclamation area, which is contiguous with and north of the proposed northern expansion of Fisherman's Landing.

5.4.3.2 Coordinator-General's conclusion—airport

The construction of the reclamation area and the dredging are not expected to impact on the Gladstone airport operations.

I acknowledge that future development proposed to be located on the reclaimed area would undergo relevant assessment including assessment of potential impacts on airport operations (current and future). However, **I have stated** a condition (Appendix 1, Schedule 3, Part 3) to ensure CASA requirements are met in relation to aviation matters for future development on the reclaimed area.

5.4.4 Marine traffic

5.4.4.1 Reclamation construction

The proposed reclamation area is located west of the current port facilities, therefore no impacts to the existing commercial shipping traffic and facilities are anticipated during construction of the reclamation. Notwithstanding this, there may be an exclusion zone around the bund wall itself, which may place restrictions on recreational and commercial fishing activities in this area. These potential impacts are discussed in section 5.3 (Social and economic) of this report.

5.4.4.2 Additional shipping traffic

In its submission on the EIS, DEWHA recommended that project assessment should address cumulative and consequential impacts of potential developments in particular increased shipping activity and the various proposals relating to linear infrastructure across The Narrows, from Friend Point on the mainland to Laird Point on Curtis Island.

GPC informed that currently there are five LNG industry proponents undertaking various approval processes for their facilities. The final determination on the number facilities to be developed will only come about from the final commitment through Financial Investment Decision for each of the proponents.

Vessels to be used by the LNG industry vary from 145 000 m³ to 170 000 m³ and are effectively equivalent to the current Panamax Class vessels operating in the Port of Gladstone.

Drafts for the vessels are 11.0 m to 12.0 m and can therefore use the outer harbour channel at any state of the tide. The proposed channel development at RL -13.0 m is sufficient for the channels to be also used at any time

The industry has provided staging numbers based on their individual EIS submissions. This is summarised in the Table 11.

Table 11—Shipping projections for proposed LNG industry proponents in the Western Basin

LNG industry proponent	Initial development	Ultimate development
LNG Ltd	24	48
Shell	50	200
Gladstone LNG (Santos)	49	163
QCLNG (BG-GQC)	61	122
APLNG	135	270
Total number of vessels	319	803

During the construction phase of LNG facilities on Curtis Island, considerably greater levels of shipping traffic are expected to be generated by the need to transport workers and materials by barges and ferries. At peak construction, each project is expected to require 120 plus ferry services per month to transport personnel to and from the construction site. Assuming the construction of three LNG projects on Curtis Island that are broadly concurrent, approximately 10 to 12 ferry trips per day could be expected. A similar number of barge trips, primarily transporting materials and components, would also be expected although these vessels are likely to be relatively slow moving.

GPC modelled the capacity of the port to handle increased trade to determine the triggers for potential channel duplication. The model was developed to assess all aspects of vessel interaction and project growth impacts on the port.

Scenarios were run with the introduction of likely industrial development in addition to the existing trades and their projected growth. New trades were introduced for the Rio Tinto Alumina stage 2 development and for the growth of WICT from 25 Mtpa to 70 Mtpa. LNG trades were run at 20 Mtpa to reflect the anticipated initial development.

The resultant growth reflected an increase from approximately 1600 to 2600 vessel calls per annum.

The model indicated that shipping associated with these scenarios can be accommodated without duplication of the channel.

Section 6.2.5 of this report provides additional discussion on the projections and cumulative impacts of recreation boating in the Western Basin.

5.4.4.3 Dredging traffic

Chapter 2 of the EIS indicates that it is possible that up to four dredgers and associated support craft would be operating concurrently in the harbour to meet the anticipated construction schedule for the development of the various LNG facilities. The dredging works would be undertaken with reference to the requirements of the *Transport Operations (Marine Safety) Act 1994* and *Transport Operations (Marine Pollution) Act 1995*.

In their submissions on the EIS, both GRC and the Fitzroy Basin Association (FBA) raised concerns about the possible disruption of the passage of marine craft on the eastern side of North Passage Island. **I recognise** the proposed final location of APLNG's wharf to be significant issue and **I find** that the final location of any APLNG wharf would be a matter for specific determination as part of the separate and concurrent APLNG EIS process. Notwithstanding this, **I understand** that the proponent for the APLNG

project has now dismissed the wharf option extending past North Passage Island which could potentially disrupt the passage of marine craft on the eastern side of the island.

In its submission on the SID, DTMR recommended that GPC continues to liaise with Maritime Safety Queensland (MSQ) through the Regional Harbour Master (RHM, Gladstone) to ensure that all parties are aware of the project's development, and that MSQ as a state agency within the DTMR must be recognised as the appropriate concurrence agency for maritime matters as they relate to safety of navigation and prevention of ship-sourced pollution. Accordingly, **I have stated** a condition (Appendix 1, Schedule A, Part 2.2) to address maritime safety in the area, as per the requirements of MSQ and the RHM, during construction and dredging.

5.5 Amenity and safety

5.5.1 Air emissions

5.5.1.1 Air quality

Section 10 of the EIS stated that only minor impacts on air quality are expected from the project. During construction, potential sources of air emissions include:

- dust emissions from mechanical disturbance during the placement of rock in the bund wall once it is above the high water mark
- dust emissions from mechanical disturbance during the placement of capping material on the final reclamation surface
- vehicle emissions from workforce and construction traffic, including trucks delivering quarry materials along the proposed unsealed, off-road, haul route and the operation of construction machinery at the bund wall
- exhaust emissions from dredging vessels.

During the operational phase of the project, the only potential impact is dust from the surface of the completed reclamation area from wind erosion.

Dust would be managed during the construction of the project through the use of water trucks on the reclamation area, as required. Wind erosion from the completed reclamation area would be minimised through the progressive vegetation of the reclamation area in stages as construction is complete.

GPC is required to provide dust mitigation measures, such as watering and grading, for management of the haul route as part of the separate approvals process to use that route.

Vehicle emissions would be kept to a minimum through regular vehicle maintenance of all construction vehicles (including dredging vessels), and ensuring standard emission reduction devices remain on all vehicles.

5.5.1.2 Greenhouse gas emissions

Appendix T of the EIS provides an assessment of potential greenhouse gas emissions resulting from the construction of the reclamation area and proposed capital dredging operations of the project. The EIS indicates that approximately 300 500 tonnes CO₂-e of greenhouse gas would be produced during the project, representing 0.17 per cent of Queensland's annual emissions. Almost 97 per cent of these emissions would result from the use of fuel for the capital dredging activities. Other sources of emissions identified include:

- transportation of bund armour and core material from the quarry to the reclamation area
- embodied emissions from the manufacturing of the geotextile material to be used to line the bund
- diesel fuel consumption of the on-site machinery.

Schedule 11 of the EMP outlines several mitigation options to reduce greenhouse gas emissions, including:

- defining the most direct and efficient haulage route from the quarry to the reclamation area

- sourcing the dredge material from the closest possible dredging operations
- selecting newer dredgers with more efficient engines where possible and including energy efficiency clauses in all equipment tender specifications
- encouraging efficient driving methods by the truck and machinery operators to reduce the amount of fuel used
- sourcing geotextile manufactured from recycled PET plastics
- investigating the potential to switch to the use of bio-fuels for vehicles and onsite machinery
- staged vegetation of the reclamation area.

5.5.1.3 Coordinator-General's conclusion—air quality

I am satisfied that the level of air emissions that may be generated by this project are minor and would be appropriately managed by GPC undertaking the mitigation measures proposed in section 10 of the EIS and in formalising these in Schedule 10 of the project's EMP.

I am satisfied that the level of greenhouse gas emissions that may be generated by this project are relatively minor and may be reduced by GPC undertaking the mitigation measures proposed in section 10 of the EIS and in formalising of these in Schedule 11 of the project's EMP.

I have stated conditions (Appendix 1, Schedule 2, Part 5.6) that require the proponent to minimise the impacts of airborne contaminants and develop and implement a greenhouse gas strategy for the project.

5.5.2 Noise and vibration

5.5.2.1 Context

As a major industrial port on Australia's east coast, Gladstone harbour has baseline noise and vibration values that are contributed by shipping, handling of commodities, large and small vessel traffic and other minor construction activities along the Gladstone foreshore. While issues associated with cumulative 'noise creep' on background noise levels and other impacts associated with expansion of major heavy industrial development were not identified in EIS submissions, they are elemental parts of amenity considerations. In this regard **I consider** that there is a case for compiling and reporting on background noise levels in order to confirm the effectiveness of control and mitigation measures as may be applied to each development.

In particular, the area surrounding the project area has been noted to experience elevated evening and night-time noise levels due to existing industrial noise. This includes rail shunting, existing annual maintenance dredging in the Clinton Bypass Channel, industrial noise from Port Central and road traffic noise in the area. Residents are also located within 200 m of road, rail and industrial activities that operation 24 hours a day.

The EIS identifies a range of potential noise and vibration sources from project activities including:

- construction of the reclamation area, including tip trucks, earthmoving machinery, vibratory rollers and other smaller construction vehicles
- dredging activities including the operation of
 - large and medium trailing suction hopper dredgers
 - large and medium cutter suction dredgers
 - backhoe dredger (if possibly required)
 - workboats, survey boats and tug boats
- pile driving for the 19 navigational beacons and channel markers to be installed.

Chapter 19 of the EIS identifies 10 sensitive receiver locations that have been assessed for potential noise and vibration impacts attributable to the project (see Figure 9). Three sensitive receivers are located less than 1 km from the proposed dredging areas, including:

- R04: residential receiver on Tide Island (450 m from dredging)

- R10: habitat protection zone of the Great Barrier Reef Coast Marine Park (GBRCMP) (State) between Friend Point and Laird Point (600 m from dredging)
- R05: residential receiver on Witt Island (750 m from dredging).

Construction of the reclamation area

Noise modelling results presented in chapter 10 of the EIS were based on construction activities undertaken in the reclamation area between the hours of 6.30 am and 6.30 pm, Monday to Saturday.

For reasons of construction timing and efficiency, GPC has since identified in the SID that it requires construction activities in the reclamation area to be undertaken 24/7. This would involve approximately 10 haul truck movements per hour (based on a fleet of five CAT 777 trucks). Additional noise modelling was therefore conducted and reported in section 16.2 of the SID for the following scenarios:

- dozers and trucks tipping at the reclamation area
- dozers at reclamation area and trucks on haul road in the vicinity of the quarry (closest point to receiver R1, Fisherman's Road).

The SID reports that site works are expected to meet the project specific noise goals⁶ identified for each of the sensitive receivers. The sleep disturbance 45 dB(A) L_{max} noise goal is also expected to be met. No significant adverse noise impacts are therefore anticipated resulting from activities associated with the construction of the reclamation area.

5.5.2.2 Potential noise impacts

Dredging activities

Two dredging scenarios (Stage 1A and Stage 2) have been modelled as they each represent the worst-case scenario in terms of noise emissions. As described in section 2.2 and shown in Figure 2.2 of this report, these stages would comprise the following:

- Stage 1A: late 2010–2012 (2 years)
- Stage 2: 2014 (follows stages 1A and 1B).

I note that sensitive receiver R10 (habitat protection zone of the GBRCMP) is a sensitive receiver to both the construction of the reclamation area and Stage 2 of the dredging activities. However, given that the reclamation area bund wall would be fully constructed prior to any dredging, an assessment of combined impact from both noise sources has not been required.

Noise modelling results presented in section 10 of the EIS indicate that during neutral weather conditions, noise from dredging activities has the potential to exceed the night-time (10 pm to 7 am) project specific noise goal of 38 dB(A) by 3 dB at two receivers: R04 (Tide Island) and R10 (habitat protection zone of the GBRCMP). During noise enhancing weather conditions, noise from dredging activities also the potential to exceed the:

- evening (6 pm–10 pm) noise goal of 43 dB(A) by 2 dB at receivers R04 and R10
- night-time noise goal (38 dB(A)) by 1 dB at receiver R09 (Gladstone residents near Port Central, located 1.1 km from dredging).

Modelling suggests that noise levels experienced on nearby tidal flats would range from 40-55 dB(A) during assumed dredging activities. These levels are similar to noise levels experienced adjacent to other sites within the GSDA and comparable to noise levels in natural environments during windy conditions.

⁶ Chapter 10 of the EIS states that project specific noise goals have been set based upon the principle that noise from continuous sources should be no more than 3 dB(A) above the background noise level, as specified in the *Planning for Noise Control (PNC) Guideline* (EPA, 2004). For R10 (habitat protection zone of the Great Barrier Reef Coast Marine Park), the appropriate noise criteria is specified in the EPP (Noise) 2008 as being 'the level of noise that preserves the amenity of the existing marine park'. Appendix T of the EIS presents details of how the project specific noise goals have been calculated.

Underwater noise

Chapter 10 of the EIS indicates that activities that may create underwater noise include dredging activities, placement of rock for the bund wall and pile driving. Potential impacts of this elevated background noise on marine megafauna include:

- limiting the detection of natural sounds
- disturbing normal behaviour resulting in possible displacement from areas
- causing temporary or permanent reductions in hearing sensitivity.

The construction of marine structures for the project would result in increased occurrence of underwater noise. Additional discussion on underwater noise impacts on marine fauna and shorebirds is provided in sections 5.2.6 and 5.2.7 of this report.

Potential vibration impacts

Chapter 10 of the EIS indicates that the nature and levels of vibration emitted by equipment at the site would vary with the activities being carried out. However, due to the distance between the reclamation area and the nearest sensitive receivers, vibration investigations undertaken for the EIS indicate that there should be no appreciable impact at all sensitive receivers.

Submissions on the EIS were concerned with impact noise from pile driving, potential noise impact on shorebirds particularly when feeding (low tide) and potential noise impacts on megafauna breeding.

The submission from DERM provided advice on acceptable noise limits at sensitive receptor sites. The DERM submission also provided advice on appropriate arrangements for complaint management procedures.

Mitigation

Noise and vibration mitigation measures have been included in Schedule 12 of the EMP for the project.

These include:

Reclamation area

- all combustion engine plant, such as generators and compressors would be checked to ensure they produce minimal noise
- vehicles would be kept properly serviced and fitted with appropriate mufflers
- where practical, all vehicular movements to and from the dredging site would only be made during normal working hours
- where practical, machines would be operated at low speed or power and would be switched off when not being used rather than left idling for prolonged periods
- activities that cause excessive noise such as pile driving would be limited to Saturdays or business days between 6:30 am and 6:30 pm
- machines found to produce excessive noise, compared to industry best practice, would be removed from the site or stood down until repairs or modifications can be made
- controls will be placed on vehicles which use reversing alarms/beepers (if identified as an issue during works).

Dredging and piling

- active community consultation with noise sensitive receivers prior to the commencement of works
- where possible, the avoidance of dredging in close proximity to noise sensitive receivers during the night time period
- boats, dredgers and tugs would be kept properly serviced and fitted with appropriate mufflers
- use of low-noise piling methods, where feasible
- use of warning strikes or similar prior to the commencement of pile driving.

With regard to impacts of underwater noise on megafauna, Schedule 12 of the EMP also specifies the following mitigation measures:

- use of 'soft starts' between long breaks in activity, where piling energy is gradually increased over a 5-10 minute period to allow megafauna opportunity to leave the area of impact
- avoidance of activity where breeding of megafauna is noted in the project area
- bubble curtains which reduce the sources level of the piling noise
- acoustic deterrents which 'scare' marine species from the immediate vicinity of construction activity
- acoustic and human observation techniques to ensure that species are not in the area during pile driving activities
- piling at low tide, where possible
- where a marine mammal is observed within the vicinity of pile driving activities, piling would be halted until the mammal has departed.

Table 16-3 of the SID provides additional construction noise and vibration management controls. **I note** this includes a noise and vibration complaints monitoring and management component.

5.5.2.3 Coordinator-General's conclusion—noise and vibration

Predicted noise levels associated with the construction of the reclamation area comply with site specific noise criteria for all identified noise sensitive receivers. Therefore, **I am satisfied** that potential noise impacts from the construction of the reclamation area would not significantly impact on the amenity of the sensitive residential receivers.

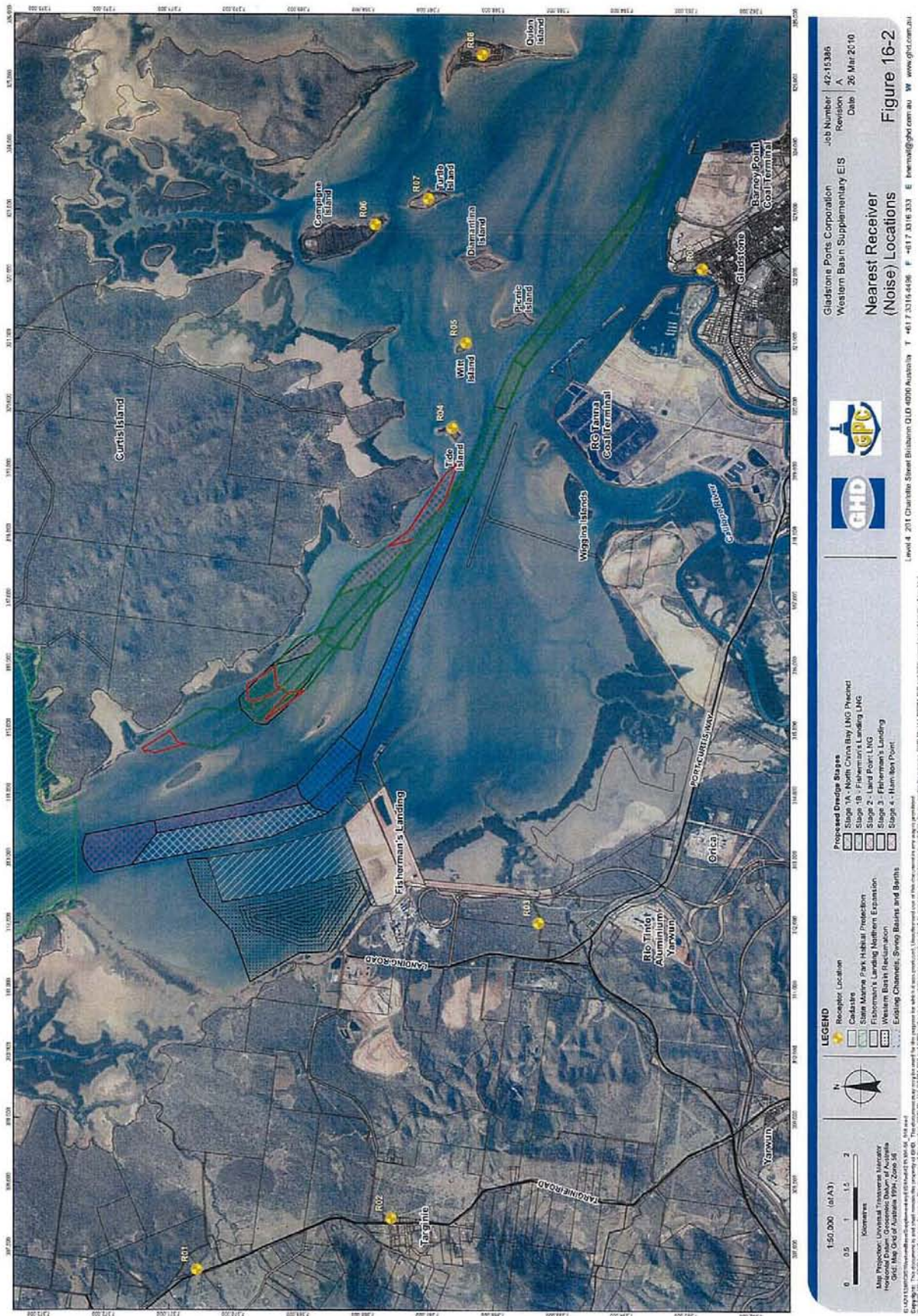
However, **I find** that noise from dredging activities has the potential to exceed the adopted night-time noise goal by 3 dB at two sensitive receivers (a residential receiver at Tide Island and the habitat protection zone of the GBRCMP) during neutral meteorological conditions, and the evening noise goal by 2 dB during noise enhancing meteorological conditions. An additional receiver (R9—Gladstone residents near Port Central) would also be exceeded by 1 dB during noise enhancing meteorological conditions.

Notwithstanding this, given that the area surrounding the project area has been noted to experience elevated evening and night-time noise levels due to existing industrial noise, and that dredging activities are considered transient in nature and any exceedence of noise goals would be temporary, **I am satisfied** that the potential noise impacts on identified sensitive receivers would be minor and could be managed through the inclusion of appropriate management controls in the project's construction EMP.

Due to the distance between the reclamation area and the nearest sensitive receivers, **I am also satisfied** that there should be no appreciable vibration impact at all sensitive receivers.

I have stated a condition (Appendix 1, Schedule 2, Part 5.7) that requires the proponent to accommodate provisions in the EMP that specify noise limits for noise sensitive places. I have also stated conditions (Appendix 1, Schedule 3, Part 5) that provide the arrangements that the proponent must implement to deal with complaints, should noise nuisance issues arise.

Figure 9—Noise sensitive receivers (see EIS Figure 16-2)



5.6 Lighting

Although the EIS states that no construction will be undertaken at night, the GPC proposes a second option in the SID of road haulage and bund construction which would involve operations 24/7.

Additional discussion on lighting impacts on marine fauna and shorebirds is provided in sections 5.2.7 and 5.2.9 of this report respectively.

5.5.3.1 Dredging

Dredging associated with the Targinie Channel and Fisherman's Landing swing basin will be undertaken as 24 hour a day operation and the lighting on the dredge and supporting vessels required to maintain safe shipping will be specified by MSQ.

5.5.3.2 Construction of the reclamation area

The SID indicates that lighting requirements for the night works are likely to consist of:

- reclamation area
 - two mobile lighting towers (four to six lights each tower) at each work face (likely to be three)
 - one mobile tower at each change in direction and turn-around points
- haul route
 - temporary lighting towers at all changes in direction points, intersections, major creek crossings and intervals along the haul route.

The lights will be directionally controlled and shielding may also be used to minimise light spill that could cause nuisance to residents, motorists, other users of adjacent land and marine and terrestrial fauna (including wading/migratory bird species).

5.5.3.3 Coordinator-General's conclusion—lighting

Environmental impacts associated with lighting during construction of the reclamation and dredging have been covered earlier in this report. **I note** the SID proposes a mitigation strategy which involves implementing lighting solutions to reduce potential marine fauna attraction to the site. Management of lighting will be included in the construction and operational EMPs. Based on my assessment of the information provided throughout the EIS process, **I concur** with the findings that there will only be minimal impacts from lighting on the public, marine birds and nocturnal marine fauna.

5.6.1 Landscape and visual amenity

5.5.4.1 Context

The Port of Gladstone has a long history of industrial coastal development and the waters of Port Curtis are subject to high volumes of shipping traffic, coastal infrastructure and disturbance. The declaration and extension of the GSDA immediately north of Gladstone and on the south-western portion of Curtis Island is in recognition of the future industrial development intention for the locality, including the emergent LNG industry.

The reclamation area is located 10 km north of the urban residential area of Gladstone and is adjacent to established, heavy industrial development in the GSDA including Cement Australia, Orica, Rio Tinto Aluminium Yarwun, RG Tanna Coal Terminal, NRG power station and Queensland Energy Resources. In addition, the existing Fisherman's Landing and proposed FLPE are intended to be developed for industrial port facilities. A visual impact assessment was undertaken for the EIS (chapter 14 and Appendix X).

The reclamation proposal preferred by GPC included provision for a 'mound' of dredge spoil material to contain the full volume of dredged material within a minimal areal footprint area. For a net capacity of approximately 55 Mm³ a mound with a maximum height of 60 m was initially designed, with a slope of approximately 1:6 to enable effective management of stormwater runoff, erosion and surface rehabilitation (vegetation). The mound would be sufficiently high to become a prominent landscape

feature of this locality. The EIS (section 14.2.3) provides an assessment of the potential visual impact of the reclamation mound, indicating its appearance during reclamation and following the progressive establishment of rehabilitation planting. The mound is generally assessed to have an adverse visual impact, however, this would, to some extent be lessened by rehabilitation planting. The EIS also indicates potential visual impacts resulting from the visibility of activities proposed to be undertaken within the dredging channels and the construction of the reclamation bund wall. An increase in the industrial focus of the area may affect the level and nature of public use of the area, particularly for those who visit the area for environmental appreciation and/or recreation.

Retention of the tidal channel between the western bund wall of the reclamation area will enable the retention of foreshore mangroves, which should soften the visual impact when the mound is viewed from the west.

5.5.4.2 Mitigation

Schedule 16 of the EMP outlines GPC's commitments to reducing and/or managing adverse visual impacts of construction on landscape and visual amenity. The following mitigation measures would be implemented during the construction of the reclamation area:

- avoid loss or damage to landscape features including minimising the clearance of mangroves
- where possible, protect trees prior to construction and/or trim vegetation to avoid total removal
- minimise light spillage through design to ensure the site is not over-lit and to minimise spread and light off the site
- temporary hoardings, barriers, traffic management and signage to be removed when no longer required
- materials and machinery to be stored tidily during the works
- roads providing access to the site and work areas to be maintained free of dust and mud as far as reasonably practical.

To stabilise the reclamation mound and improve the visual outcome, GPC has also committed to:

- the progressive planting of native vegetation, including trees, shrubs and groundcovers on the mound created from dredging and reclamation activities
- minimising light spillage through designing the lighting to ensure the site is not over-lit to minimise spread and light off the site including sensitive placement and specification of lighting to minimise any potential increase in light pollution in the natural environment.

In its submission on the EIS and SID, GRC requested that the proposed design allows for progressive capping and vegetation of the outer side walls of the reclamation mound as it is created to reduce the duration of visual impact. In section 4.3.2 of the SID, GPC responded by acknowledging the need to progressively vegetate the mound both in terms of visual impact and erosion control. However, until the extent and timing of the dredging associated the LNG industry is confirmed, GPC state that it is unable to prepare a draft vegetation plan.

5.5.4.3 Coordinator-General's conclusion—landscape and visual amenity

I accept that some visual impacts resulting from the project would be unavoidable and cannot be mitigated due to the permanent nature of the resulting landscape. However, **I consider** that the site is not proximate to nor would it obstruct view lines from residential areas of Gladstone, and is located adjacent to a precinct intended for intensive, large-scale industrial development associated with the Port of Gladstone and the GSDA. **I am satisfied** that the visual character of the proposed project reclamation is therefore generally not incompatible with the existing and intended future adjacent industrial landscape of the Port of Gladstone and the GSDA.

I note the retention of the tidal channel between the western bund of the reclamation area and the benefit this may have in softening the visual impact of the reclamation area.

To reduce the duration of visual impact resulting from the disposal of dredge spoil on the reclamation mound, **I have stated** conditions (Appendix 1, Schedule 2, Part 5.6) to ensure the progressive vegetation of the outer side walls of the mound as it is being created.

5.6.2 Hazard, risk, health and safety

5.5.5.1 Context

A hazard and risk assessment conducted for the EIS identified the nature and scale of hazards that may occur during the construction of the reclamation bund, haulage of rocks for construction from the quarry, dredging, and filling and decanting from the bund. The study identifies a total of 41 hazards including 16 high risk, 22 medium risk, two low and one very low risk hazards. High risks identified for the project relate to the following:

- noise during dredging and piling, introduction of marine pests
- marine fauna getting struck by vessels or getting trapped in the bund during construction
- destruction of seagrass and mangroves and construction workplace accidents.

5.5.5.2 Mitigation

Opportunities to mitigate these potential risks are noted in Tables 17-8 and 17-9 of the EIS. These issues would be covered in the relevant management plans. A construction safety management plan would be prepared before commencement of the construction by the contractor to address issues relating to workplace health and safety.

The EIS identifies air quality, noise levels and community safety as the main community values for public health and safety that may be affected by the construction of the reclamation bund, haulage of rocks for construction from the quarry, dredging, and filling and decant from the bund. The EIS also addresses worker health and safety and provides a qualitative summary of worker hazards, consequences and mitigation measures.

GPC has committed to preparing a number of emergency response plans (ERP—Schedule 20 of the EMP) to guide those responding to potential emergency situations, such as oil spill, fire and explosion and natural hazards. The EIS indicated that GPC routinely prepares a risk management plan (RMP) for the life of all of its projects. **I note** that GPC commits to engage with the Queensland Police Service, Department of Community Safety, GRC and other relevant agencies in the development of the RMP and the ERP, including high level planning.

With the implementation of mitigation measures identified in chapter 17 of the EIS, the project is not expected to significantly impact on the amenity of sensitive receptors. The controls identified, when in place, would adequately safeguard against safety, asset and environmental consequences from hazards associated with the project.

The implementation of workplace health and safety procedures and the relevant management plans aims to minimise the potential risks to workers and the community to an acceptable level 'no harm' level. These documents include measures to address the risk to plant operators and haulage vehicles under the 24/7 construction scenario.

5.5.4.3 Coordinator-General's conclusion—hazard, risk, health and safety

I have imposed conditions (Appendix 1, Schedule 3, Part 7) that establish provisions for the management of incidents, including release of contaminants, uncontained spills, emergencies, accidents and other incidents that may arise as a result of the project.

6. Cumulative impacts

6.1 Context

The purpose of a cumulative impact assessment is to identify impacts from one or more projects, which individually might not be significant but, when considered together, could create a significant cumulative impact. For cumulative impacts to occur:

- there must be some proximity in time and/or location for projects to interact
- there must be a mechanism or opportunity for the interaction.

The assessment would generally identify an impact different from, or additional to, the sum of the collective actions and identify mitigation requirements that may be additional to other measures. Cumulative impacts may arise as a result of multiple activities occurring together or the combination of individual impacts—for example, noise, release of turbid plumes—from one operation on a particular receptor.

The cumulative impact assessment has considered the occurrence of the following potential projects in Port of Gladstone Western Basin in conjunction with the WBDD Project.

Wiggins Island Coal Terminal (WICT)

Status: CG report issued in January 2008, EPBC approval (2005/2374) granted in April 2008.

Comprises: up to six new berths (four coal loading berths and two for other products, e.g. nickel ore), reclamation of 260 ha of intertidal wetlands and dredging of 6 Mm³ (3.2 Mm³ in the first stage).

Anticipated timing: dredging and reclamation to commence in Q1 2012, above ground construction to commence in Q3 2012. Initial export operations are expected by Q3 2013.

Fisherman's Landing Port Expansion (FLPE)

Status: CG report issued in May 2010.

Comprises: reclamation of 174 ha of seabed adjacent to existing reclaimed area and dredging of 4 Mm³.

Anticipated timing: bund construction to commence in Q4 2010, dredging and filling of reclamation area to commence in mid 2011.

Three LNG projects on Curtis Island

- **Gladstone Liquefied Natural Gas (Santos)**

Status: CG report issued in May 2010

- **Queensland Curtis Liquefied Natural Gas (BG-QGC)**

Status: CG report issued in June 2010

- **Australia Pacific LNG (Origin)**

Status: EIS released for public notification in March 2010

Comprises: dredging for site access structures (e.g. materials offloading facilities), export terminals, operational shipping, construction vessels (e.g. barges and ferries) and pipeline crossing of The Narrows.

Anticipated timing of three LNG projects: construction of Curtis Island facilities to commence in late 2010 or early 2011, initial operations to commence before 2015.

A fourth LNG project, Shell Australia LNG, at Hamilton Point is in very early stages of formulation and has not been explicitly included however dredging works are expected to be relatively minor and are likely to be implemented as part of the WBDD Project (Stage 4).

The timing of many projects and their various components is difficult to accurately estimate, mainly due to their respective commercial considerations. **I have considered** the current best estimate of timings for a relatively optimistic development scenario. Subject to the abovementioned commercial decisions, this is expected to have a reasonable degree of accuracy up to 2015 only.

Over the period from 2010 to 2015, the following activities have reasonable potential to occur:

- Stage 1 of WBDD Project completed
- FLPE reclamation completed
- construction of up to four LNG trains on three sites on Curtis Island commencing in Q1 2011. Export shipping operations (in the order of 240 vessels per year) would commence in 2015
- construction of WICT stage 1 (two coal berths only) over the period from Q1 2012 to Q3 2013.

The following may occur beyond 2015:

- remaining WBDD stages completed (e.g. Laird Point and Hamilton Point sections)
- construction of additional four berths at WICT including associated dredging of berth pockets
- operations of LNG export facilities on Curtis Island potentially including discharge of desalination and sewage treatment wastewater into the marine environment
- construction of additional LNG trains on Curtis Island and additional export berths. A mid-range estimate of industry development would see LNG export approximately doubling to 28 million tonnes per annum
- industrial development on FLPE including jetty and wharf construction.

An indicative sequence of potential activities for the period 2010 to 2015 comprises the following:

- Dredging for access to the GLNG and QCLNG project sites commencing in late 2010 or early 2011. These relatively minor early works are not part of the WBDD Project and will be subject to a separate approval process. Environmental impacts would be broadly similar although at a smaller scale.
- Early works on the mainland side of the Western Basin may be needed to support logistics for LNG plant construction. This could include a jetty structure at Fisherman's Landing and a ramp facility in the Calliope River.
- Bund construction for the FLPE reclamation area to commence in Q4 2010. This work would be combined with construction of the WBDD reclamation bunds. The majority of these works, including closure of an initial bunded area, is expected to be completed by May 2011 to enable filling operations to commence.
- Following closure of a reclamation area in approximately May 2011, the major WBDD dredging and reclamation works would commence and continue through to 2014. Dredging activity is likely to rapidly escalate from mid 2011 (depending on availability of dredge plant) with up to four dredges working simultaneously, including at least one TSHD.
- Dredging for access channels to the APLNG site would also start in mid 2011 using CSD and backhoe equipment. Disposal of dredged material to the WBDD reclamation area.
- Major activity for LNG plant construction on Curtis Island would occur over approximately two to three years peaking in mid 2012. Construction vessel traffic (barges and ferries) would be expected to be generally in proportion with workforce levels.
- The installation of the pipeline crossing across The Narrows is scheduled to commence in mid 2011. This component is planned to commence relatively early to allow sufficient time for commissioning stages.
- WICT construction is estimated to occur over the period from Q1 2012 to Q3 2013.

6.2 Potential cumulative impacts in the Western Basin

6.2.1 Permanent alteration of marine habitat

Section 5.2.5.3 of this report notes the potential impacts associated with the proposed reclamation of 410 ha of seabed for the combined WBDD and FLPE projects. The primary impact would be the direct loss of the shallow, inshore marine habitat in this area including significant seagrass communities (396 ha). Considered together with the WICT reclamation of 260 ha of intertidal wetlands, this is a significant step change in the character of the marine habitat of the Port of Gladstone Western Basin.

Secondary impacts of the WBDD/FLPE reclamation are expected to affect the adjacent marine areas including:

- an anticipated increase in tidal velocities in the vicinity of the WBDD and FLPE reclaimed areas that may cause scour as the seabed adjusts to the changes
- a reduction in flushing potential is also expected together with the potential for stormwater runoff, which may result in a permanent change to the water quality regime in the embayment north of Fisherman's Landing.

The potential changes to the coastal environment along the Curtis Island shoreline are less significant due to the proposed use of jetty structures for port operations. Some disturbance and removal of marine plants, including seagrass, would occur for the construction of site access works however the areas involved are relatively minor. As a general observation, shallow inshore areas support greater diversity and abundance of benthic species therefore dredging in these areas causes greater impacts. Accordingly, the most significant impacts would be associated with the proposed access channels to the APLNG project site due to the scale (approximately 1.5 Mm³ of dredging) and extent of shallow water habitat affected.

The proposed capital dredging of Curtis Channel, berth pockets and swing basins represents a further loss of inshore coastal habitat (of varying depth) including 37 ha of seagrass areas.

6.2.2 Temporary impacts to water quality and seagrass

6.2.2.1 Context

Temporary impacts on marine habitats within Port Curtis associated with the release and dispersion of fine sediments caused by dredging and reclamation works are expected. A key concern is the potential for the adverse effects of light attenuation and smothering on seagrass areas.

Sections 5.2.5 and 5.2.6 of this report discuss potential impacts to marine water quality associated with the WBDD Project and the likely effects on marine flora in the Western Basin, particularly seagrass beds. Based on information provided in the EIS and advice provided to me by advisory agencies, it is clear that potential impacts of turbid plumes on seagrass communities are relatively complex and affected by a range of factors including:

- intensity of impact— that is, high levels of light attenuation and/or smothering generally lead to high impacts
- duration of impact
- interaction with seasonal periods of dormancy and high growth and recovery from periodic extreme events such as floods
- species composition within an area and its response to natural variability of suspended sediment concentrations
- the pre-existing health of seagrass communities prior to impacts.

In section 5.2.6 of this report **I have concluded** that there is potential for adverse impacts to marine plants and benthic communities of the project area. **I have required** that the management of this project

includes the development of a reactive monitoring program that incorporates consideration of light availability to seagrass areas and seagrass health. Based on these requirements, **I am confident** that management of dredging works will become more responsive to key ecological processes and will lead to a relative reduction of impacts.

In terms of managing potential cumulative impacts, **I recommend** that this approach be adopted for all future dredge management plans for the various dredging operations in the Western Basin.

EIS information for various projects included numerical modelling of tidal hydrodynamics and dredge plume dispersion within the Western Basin. In general these results demonstrate that the tidal flushing efficiency decreases further into the harbour. Additionally, dredge plumes tend to disperse with the dominant tidal flows in the direction of the main channel. Implications are:

- concurrent dredging operations separated across the main channel are less likely to interact and cause cumulative impacts
- the generation of turbid plumes by dredging operations located further northward (toward The Narrows) is likely to cause higher impacts than operations further south.

6.2.2.2 Interaction of WBDD Project with other projects

The WBDD Project comprises a number of components that may be sequenced differently depending on the implementation of other projects. Based on the state of knowledge at the time of writing, the preliminary program provided by GPC indicates that significant dredging and reclamation activities for the WBDD Project are scheduled to commence in mid 2011. Site access dredging for the APLNG project would commence at this time. Additionally, several LNG proponents have indicated that the pipeline crossing of The Narrows would also commence approximately at this time.

The seagrass areas north of Fisherman's Landing are likely to be impacted first and over an extensive period. This would initially be caused by construction impacts of the bund (seabed scour and resuspension of fine sediments from the mudwave) followed by the effects of the discharge of decant waters from the dredging and reclamation operations. Once the reclamation area is closed in mid 2011, an almost continuous discharge of CSD tailwater may be expected into this area until 2014. Although the mitigation measures specified in this report would be implemented, there is potential for a temporary loss of seagrass in this area sustained over several years.

Capital dredging of the Curtis Channel commencing in mid 2011, including TSHD operations, is likely to affect the smaller areas of seagrass in that vicinity. Higher generation rates of suspended sediments are associated with TSHDs operating in overflow mode and rehandling. GPC has made commitments to minimise TSHD impacts, however at least 100 000 m³ of material would need to be rehandled and potentially up to 1.5 Mm³ depending on the extent of difficult material types that may be encountered. All rehandling would occur in North China Bay and its timing would be controlled by conditions in the DMP.

Dredging and reclamation works for the WICT stage 1 project commencing in 2012 are also predicted to affect adjacent seagrass beds to the south of Fisherman's Landing. GPC has estimated indirect impacts on up to 200 ha of seagrass although, given the proposed use of CSD plant only and the regulation of decant water discharge, much of this area would only be affected in a minor sense. It is noted that the effects of the WICT dredging and reclamation on water quality are relatively independent to other projects (in terms of interactions between dredge plumes) and therefore not likely to cause cumulative impacts.

Dredging of channels for access to the APLNG project site involves a significant quantity of material (in the order of 1.5 Mm³) and is located in a relatively sensitive area adjacent to Laird Point. In addition, access through shallow inshore areas is likely to require barge mounted backhoe operations. Although new equipment and techniques are available to limit overflow spillage and generation of suspended sediments, these operations are expected to generate relatively higher rates of suspended sediments compared to a CSD.

The timing of the APLNG access dredging coincides with commencement of the main Curtis Channel dredging, including TSHD works. In order to avoid significant cumulative effects, the co-location of dredging activities in this area should be carefully considered. **I note** that, at the time of writing, the EIS for APLNG project has not been evaluated and there is opportunity for further consideration of this matter at that time. This should include an update to this cumulative impact assessment.

Similarly, the potential timing of dredging operations for the proposed pipeline crossing of The Narrows should be carefully considered to avoid interaction with any concurrent dredging operations located in the vicinity of the APLNG project site. Conditions of approval for the pipeline crossing works and the APLNG project are yet to be determined. It is likely that measures in respective environmental management plans will be specified to ensure impacts from the release of suspended sediments are minimised. This matter is discussed further in section 6.2.3.

The information in the SID for the WBDD Project indicates that significant impacts on seagrass would occur over smaller areas than initially predicted in the EIS. Depending on the requirements of a finalised dredge management plan and further refinements throughout the course of the works, further reductions are expected.

Based on the available information, an upper level estimate of combined temporary seagrass impacts in the Western Basin has been made. As a result of the peak combined dredging and construction activity over the period 2011 to 2013, the extent of the cumulative temporary disturbance to seagrass areas is estimated to be no greater than:

- moderate to severe impact (highly degraded or complete loss of seagrass cover for the duration of dredging works) of 350 ha of seagrass. It is expected that these areas would recover after the majority of the dredging and reclamation works are complete
- minor to moderate impact (decreased production or reduced seagrass cover sustained over the duration of dredging works) of an additional 1000 ha of seagrass.

The discussion above is based conditions that **I stated** for the LNG operations on Curtis Island that provide for limited discharge of treated wastewater from sewage treatment or desalination plants to the Western Basin receiving waters. **I note** that at the time of writing this report (July 2010) further investigations are being undertaken regarding the viability of connecting to mainland water and wastewater treatment services via a co-located infrastructure service corridor crossing The Narrows, however the study is not yet complete.

In the event that wastewater discharge is included within LNG projects, **I am confident** that licensing requirements of the EP Act will adequately assess any cumulative effects and impose appropriate regulation of operations.

6.2.3 Pipeline crossing of The Narrows

6.2.3.1 Concurrent dredging operations

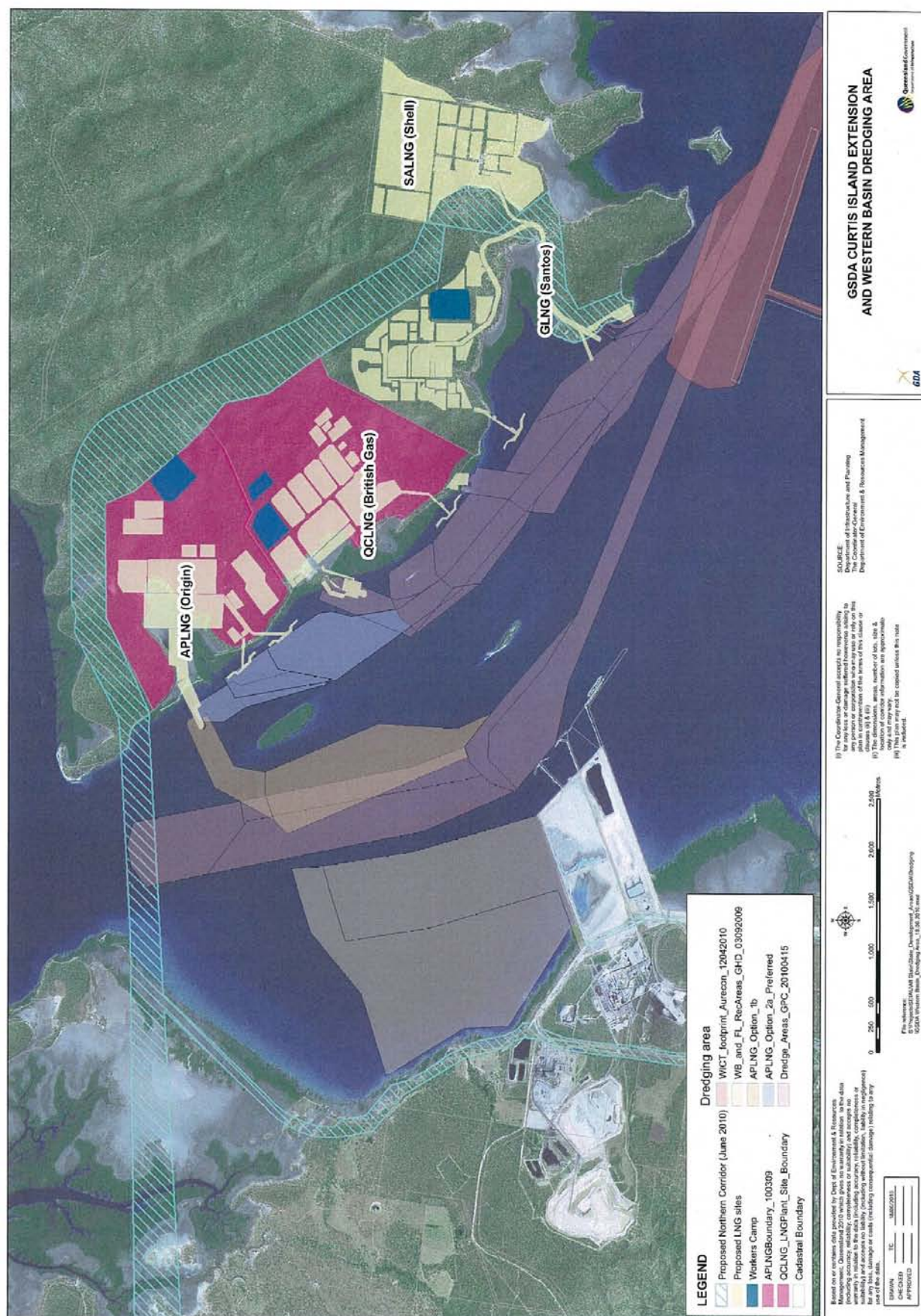
The Kangaroo Island intertidal wetlands and The Narrows are high value marine environments located within the GBRWHA and lie directly adjacent to the state Great Barrier Reef Coast Marine Park to the north. A proposed infrastructure corridor has been identified for crossing The Narrows between Friend Point and Laird Point immediately south of the state marine park (see Figure 10).

The proposed infrastructure corridor between Friend Point and Laird Point is likely to be implemented as an extension of the GSDA. **I note** that the corridor overlaps with the northernmost extent of the proposed WBDD Stage 2 dredging footprint.

To avoid future conflicts, **I have stated** a condition (Appendix 1, Schedule 2, Condition 15) that restricts the extent of the dredge footprint of Stage 2 to a northern limit that does not encroach on the proposed extension of the GSDA across The Narrows, with the extent of the final Stage 2 dredge footprint to be negotiated between GPC and DIP to account for any required safety or operational buffer requirements.

The proposed crossing of the Narrows was considered in my evaluation of the GLNG and QCLNG projects. At that time limited detail was available on the location and methodology of the construction works. **I note** that at the time of writing this report (July 2010) further engineering studies have been provided to me regarding the viability of a co-located infrastructure service corridor, however the final configuration is not yet confirmed.

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The pipelines will be subject to a separate approvals process involving the LNG proponents (either separately or combined). Currently my requirements for the pipeline crossing, specified in both the GLNG and QCLNG evaluation reports, include:

- works must be contained to a single corridor
- a bundled approach, including water and wastewater services, is preferred to avoid unnecessary cumulative impacts of several sequential construction activities
- EMPs for the works must consider all environmental impacts including cumulative impacts and determine appropriate environmental offsets.

In accordance with these requirements it may be assumed that a co-located pipeline crossing involving several LNG proponents will be implemented as part of the overall Curtis Island LNG precinct development. **I note** that a relatively early start to these works in Q2 2011 has been indicated. **I further note** that a material change of use development approval is required before works may commence.

The subtidal section of the pipeline crossing between Kangaroo Island and Laird Point may involve a trenching operation. This component has potential to interact with any concurrent dredging operations in the vicinity of the APLNG project site and may lead to unnecessary cumulative impacts. My preference is to avoid concurrent dredging operations in this area unless a detailed investigation demonstrates that cumulative impacts would be avoided.

6.2.3.2 Shorebirds

The proposed infrastructure corridor lies near the intersection of two wetlands listed in the *Directory of Important Wetlands in Australia*; Port Curtis and The Narrows. The area is locally important as shorebird feeding and roosting habitat however is not listed as a wetland of international importance.

Section 5.2.9 of this report discusses the potential impacts of the combined WBDD and FLPE projects on terrestrial fauna including migratory shorebirds. **I have concluded** that the disturbance to the intertidal areas in the vicinity of the reclamation works may impact on shorebird feeding and roosting although some existing disturbance is likely due to its proximity to urban and industrial uses. Adverse impacts would be the result of the permanent loss of intertidal wetland areas within the reclamation site and the associated changes to local morphology, hydrology and water quality of adjacent areas. Construction activity and noise may also potentially disturb birds.

The EIS indicates that the intertidal areas likely to be disturbed by the WBDD and within the proposed GSDA corridor (in the vicinity of Friend Point) form part of a continuous shorebird habitat. The interaction between construction activities at both locations may therefore lead to cumulative impacts. In accordance with my requirements specified in the evaluation reports for the GLNG and QCLNG projects, this matter is to be fully investigated as part of the EMP for the pipeline crossing construction program. It is likely that mitigation measures will include avoidance of construction activity in wetland areas over key periods that are important for migratory shorebirds; typically between September and April.

The EIS notes that the WBDD reclamation area will include water bodies that may provide a beneficial habitat for shorebirds. These may be temporary ponds created for decant water treatment or permanent features designed to treat stormwater runoff. Opportunities to provide shorebird habitat within the WBDD Project should be maximised where practicable particularly where concurrent impacts are occurring for the pipeline crossing works. This may include management of water levels within key areas, fencing and other access controls, management of lighting and noise nuisance etc. **I have stated** a condition for the inclusion of bird-friendly structures in the design of the reclamation area as part of the flora and fauna management plan for the project (Appendix 1, Schedule 2, Condition 64).

I am satisfied that pipeline construction works would be temporary and that the potential for significant cumulative impacts will be investigated and assessed as part of the necessary approvals. The permanent impacts to shorebird habitat areas associated with the WBDD and FLPE projects are unavoidable and appropriate mitigation should be provided. Environmental offsets are discussed in section 6.3.2.

6.2.4 Underwater noise during construction

Section 5.2.7 of this report discusses potential impacts on marine fauna arising from underwater noise sources associated with the WBDD. Relatively minor impacts are expected from dredging plant and the installation of 19 piles for navigation beacons.

The indicative construction schedule for all projects in the Western Basin indicates an almost continuous underwater noise generation over the period from 2011 to 2014 in various locations. Primary impacts would be expected from dredging plant (the majority associated with WBDD) and piling operations, particularly jetty construction for LNG export facilities and the WICT project.

Dredging noise would be generated from multiple locations within the proposed channels, berths and swing basins. Also booster pumps may be required between CSDs and the discharge point at the Fisherman's Landing reclamation. Pile driving for jetty construction is scheduled to occur from approximately mid 2012, starting with the WICT jetty, through to approximately mid 2014.

EIS information and subsequent reports indicates that underwater noise levels from the various construction activities (primarily dredges and piling) would not be sufficiently severe to cause significant harm to marine fauna. Finalised environmental management plans for the relatively noisy operations would specify contemporary mitigation techniques such as soft-start pile driving and the use of fauna spotters to ensure works were not conducted in close proximity to individual animals.

Although the risks of injury are very low, marine fauna may alter transit routes or avoid habitat areas in response to noisy operations. Concurrent operations in close proximity could cause a barrier effect where animals are unable or unwilling to navigate a way around a series of multiple sources. Interaction of impacts of various noise sources within the relatively narrow configuration of the Western Basin may cause this type of cumulative impact.

In relative terms, the information reviewed as part of this assessment indicates that piling operations are likely to cause greater impacts than shipping or dredging noise. The effects of concurrent piling operations, such as jetty construction, should be carefully considered. In particular it is considered that pile driving activities for construction of LNG export facilities should be scheduled to not occur while similar work is underway for the WICT project or the installation of navigation beacons in the vicinity of Fisherman's Landing. This would avoid a scenario where relatively high levels of underwater noise are occurring on both sides of the main channel through the Western Basin at the same time.

6.2.5 Shipping traffic

Although considerable shipping already exists in Gladstone harbour, there is limited vessel movement in some sections of the Western Basin, particularly the Curtis Channel area. Increases in shipping traffic during construction and operation are likely to increase the risk of impact on the marine environment.

Vessel movements can disturb animals such as dugongs, marine turtles and cetaceans from their habitat, interfere with behaviour or result in injury or death as a result of boat strikes. Boat strike injuries are generally associated with fast craft (e.g. less than six metres long) operating in shallow water.

Section 5.2.7 of this report discusses potential impacts of shipping traffic on marine fauna associated with the WBDD. Minor impacts are expected from the relatively slow moving dredging plant and associated work boats.

Assuming four LNG trains are constructed on Curtis Island, export shipping traffic would increase by approximately 240 vessels per year from 2015. Similar to dredges, LNG vessels are large and slow moving and will be under pilotage within the Port of Gladstone and not expected to pose a significant risk of boat strike injury.

During the construction phase of LNG facilities on Curtis Island, considerably greater levels of shipping traffic are expected to be generated by the need to transport workers and materials by barges and ferries. At peak construction, each project is expected to require 120 plus ferry services per month to transport personnel to and from the construction site. Assuming the construction of three LNG projects on Curtis Island that are broadly concurrent, approximately 10 to 12 ferry trips per day could be expected. A similar number of barge trips, primarily transporting materials and components, would also be expected although these vessels are likely to be relatively slow moving.

The Gladstone region has one of the highest levels of boat ownership per capita in Queensland (in the order of 12 per cent). The vast majority of these boats are small trailerable vessels used for recreational fishing. The EIS estimates that approximately 14 600 boat trips departed from the various boat ramp facilities in the harbour during 2008/09. The destinations of approximately half of these trips were northward utilising fishing and recreation areas in the Western Basin, The Narrows and Graham Creek areas. Many of these trips would be concentrated to weekends, holiday periods and relatively calm weather conditions. The average number of recreational boat trips through the Western Basin area is estimated to be 20 trips per day and peak levels could exceed 50 trips per day.

Recent forecasts of population increase in Gladstone region have estimated a growth of 35 000 residents over 20 years (in the order of 55 per cent). Based on these projections, the proportional increase in boat numbers would be in the order of 4200. In simple terms, a 55 per cent increase in the population of the Gladstone region by 2031 would increase the average numbers of recreational boats in Western Basin to 31 trips per day.

The projected shipping traffic during the construction phase on Curtis Island would therefore approximately double the average number of boat trips in Western Basin on a daily basis. However construction vessels would travel directly across the harbour and are not likely to be traversing shallow areas at high speed.

Boat speed limits in key locations where dugongs and marine turtles consistently frequent are the recognised approach to mitigating the risk of boat strike injury. In addition, fast ferries should utilise regular routes predetermined to minimise the chance of collisions with marine fauna and incorporating go-slow zones where necessary. Propeller guards or other mitigation measures could be included in the design of vessels.

As part of my evaluation of the GLNG and QCLNG projects **I have required** the proponents to prepare and submit for the approval of Maritime Safety Queensland and the Regional Harbour Master (Gladstone) a Marine Traffic Management Plan and a Harbour Management Plan. These are primarily to ensure navigational safety is maintained at all times for the life of the project, both for harbour traffic during construction and LNG export shipping.

I have also imposed conditions on the GLNG and QCLNG projects that require the preparation of a Gladstone Logistics Plan to ensure that all potential impacts of the construction and operation of all marine loading and unloading facilities within the Port of Gladstone can be properly managed. This plan is to be approved by GPC, GRC, DTMR and DIP. **I require** that the Gladstone Logistics Plan shall ensure that appropriate routes through sensitive marine areas and associated speed limits for fast ferries and construction barges will be established.

I anticipate that similar requirements will be specified for the APLNG project in my evaluation report.

6.2.6 Coordinator-General's conclusion—marine fauna

6.2.6.1 Habitat

Around 20 per cent of the intertidal (7246 ha) and subtidal (6332 ha) seabed of Port Curtis are covered by seagrass. Generally, the area of the seagrass bed and seagrass biomass peaks in later spring and summer and is lowest over winter.

The permanent loss of 443 ha of seagrass area associated with the combined WBDD, FLPE and WICT projects represents approximately 16 per cent of that total. The predicted temporary loss of 350 ha of seagrass during the peak dredging period between 2011 to 2013 represents a further 13 per cent reduction. Viable seagrass areas in the order of 1000 ha would remain between Wiggins Island and Fisherman's Landing over that period although some impacts could be expected due to periodic exposure to elevated suspended sediment concentrations.

In terms of the estimated 7000 ha of seagrass habitat in the Rodds Bay Dugong Protection Area (extending from The Narrows into the southern extent of Rodds Bay) the permanent loss represents six per cent of the total.

I note that the majority of predicted impacts to seagrass can be attributed to the combined WBDD and FLPE projects. Other concurrent development activities in Western Basin would contribute to temporary seagrass impacts in a minor sense.

Additional potential impacts to marine water quality and marine plants in The Narrows and Graham Creek would be associated with works for the LNG pipeline crossing and the proposed dredging for access to the APLNG project site. These two activities need to be closely coordinated. As discussed in section 6.2.3 the finalisation of management plans for the pipeline crossing and my evaluation of the APLNG project will ensure potential cumulative impacts are appropriately managed.

I am satisfied that the existing requirements for the WICT project are sufficient to avoid potential for significant cumulative impacts to adjacent seagrass habitat areas. **I recommend** that a finalised dredge management plan for the WICT project includes an objective to incorporate light attenuation and seagrass health based reactive management as required for the WBDD Project.

6.2.6.2 Dugongs and marine turtles

Dugongs and marine turtles using the Western Basin would be potentially subject to a range of direct and indirect impacts including degradation and removal of feeding habitat, degraded water quality, risk of boat strike injury and disturbance by underwater noise.

Dugongs are associated with seagrass beds in the Port Curtis region but the region is not identified as supporting large populations of these animals. The nearest large populations of dugongs occur in Shoalwater Bay to the north and Hervey Bay to the south. The dugongs that do occur in the Port Curtis region are centred around the Rodds Bay area, although they have been observed using seagrass beds in the Western Basin such as those near Wiggins Island.

It is known that the flatback turtle nests on the eastern beaches of Curtis, Facing and Hummock Hill Island. The South End area of Curtis Island is the key flatback turtle nesting area in the region and it is identified nationally as a medium density rookery. Green turtles and loggerhead turtles may also nest sporadically in similar areas as the flatback turtle, however important rookeries for these two species lie elsewhere.

The Western Basin is an important foraging area for both adult and juvenile marine turtles. Green turtles in particular prefer to feed on seagrasses so they have a high predicted association with the seagrass beds that occur in the Western Basin. Deeper water, including dredged channels, provides resting habitat for turtles.

Although a range of mitigation measures would be implemented, it is clear that the expected loss of up to 30 per cent of seagrass areas in the Western Basin during the peak construction period (permanent and temporary) would lead to unavoidable impacts on marina fauna such as dugongs and turtles that depend on seagrass areas for essential habitat. These impacts would be compounded by the effects of underwater noise and periods of degraded water quality during construction periods.

The most likely response to the combined impacts would be a displacement of some animals to adjacent feeding areas such as Rodds Bay and the Port Curtis outer harbour (in the vicinity of South End and Facing Islands). This is not expected to pose a significant risk to populations of dugongs and marine turtles in the region although some local effects may occur as a response to the reduced habitat availability such as a short term increase in mortality and/or reducing breeding rates.

It is expected that the seagrass area in the vicinity of Wiggins Island will remain largely intact throughout the construction period although some degradation may occur from WBDD and WICT dredging works. Due to the expected displacement of a proportion of a number of animals using the area, the risk of boat strike injury during the peak construction period may be reduced. Despite this, measures should be introduced to minimise further disturbance to dugongs and marine turtles in the area. In particular fast ferry routes to Curtis Island in the vicinity of these seagrass area should be carefully designed to avoid potential impacts.

The predicted impacts to dugongs and marine turtles associated with the proposed development activities in the Western Basin are unavoidable and appropriate mitigation should be provided. Environmental offsets are discussed in section 6.3.

6.2.6.3 Cetaceans

The EIS identified ten cetacean species occurring in the Gladstone region including offshore areas. Of these, the Indo-Pacific humpback dolphin, the Australian snubfin dolphin and the bottlenose dolphin are known to occur within the Western Basin area. Coastal dolphins are recognised among the most

threatened species of cetaceans due to their close proximity to a range of direct and indirect human impacts.

Both the Australian snubfin dolphin and the Indo-Pacific humpback dolphins usually inhabit shallow coastal waters of less than 20 metres depth and are often associated with rivers and estuarine systems, enclosed bays and coastal lagoons. Being highly mobile, dolphin species are likely to occur throughout the Western Basin although preferred areas of the Australian snubfin dolphin and the Indo-Pacific humpback dolphins are likely to be the shallow inshore waters of The Narrows and the Fitzroy River estuary. There are no reliable estimates of dolphin abundance in Port Curtis or their use of the Western Basin as a transit route between areas of preferred habitat.

It is considered that the disturbance associated with the proposed development activities in the Western Basin is likely to temporarily discourage a proportion of the dolphins from utilising the area over extended periods. Principal impacts are expected to be caused by the generation of underwater noise and periods of degraded water quality from dredging operations. Being highly mobile, dolphin species are not prone to boat strike injury.

Given that the Western Basin doesn't appear to be a preferred habitat, the level of impact is not expected to pose a significant risk to populations of Indo-Pacific and Australian snubfin dolphins that may inhabit the region. By avoiding pile-driving operations occurring concurrently, the works are not expected to significantly interrupt the transit of dolphins through Port Curtis.

6.2.7 Coordinator-General's conclusion—fishing activities

Section 5.3.2 of this report discusses the likely impacts of the WBDD Project on recreational, Indigenous and commercial fishing. **I have concluded** that the project is likely to lead to some degree of impact although, in the case of commercial fisheries, further investigation would need to determine the extent of this impact and any mitigation. Adverse impacts are associated with the loss of access to fishing areas within the WBDD and FLPE reclamation sites and within exclusion zones near dredging activity. Degraded water quality and temporary loss of seagrass resources may also affect fisheries productivity and fishing opportunities in the short term.

The additional construction and operational activities in the Western Basin would lead to further impacts on fishing activities, including:

- degraded water quality associated with dredging of access channels to LNG construction sites and the installation of the pipeline crossing of The Narrows
- loss of intertidal wetlands associated with the WICT reclamation
- temporary construction impacts from the WICT project, including periods of degraded water quality and reduced productivity of seagrass areas
- reduced access of non-port shipping due to exclusion zones around WICT berths and LNG export terminals, both during construction and subsequent operations.

Overall, it is clear that some loss of availability of fisheries in Western Basin would occur attributable to a number of proposed activities. **I note** that the majority of impacts would be associated with projects that GPC is directly responsible for.

Adverse impacts may be offset by certain components of projects such as providing 'fish friendly' structures as part of the reclamation bund walls. Additionally, as discussed in section 6.3.1, an environmental offset for impacts on marine fish habitat has been determined for the proposed development activities in the Western Basin that GPC is directly responsible for. Also, **I note** that, separate to the offset proposal, GPC has committed to a further contribution of up to \$5.0 million over ten years to support fish habitat enhancement projects within the Gladstone Port area. This additional funding contribution would assist in addressing potential impacts to recreational and commercial fishing activities in the port area caused by the dredging and development projects and would also provide a significant addition to the overall environmental offset package.

Taking into account the extent of the potential net adverse impacts on commercial fishing, **I have imposed** conditions (Appendix 1, Schedule 3, Part 4.2) that require GPC to fund the investigation and implementation of a mitigation program for commercial fishing businesses the Gladstone region. DEEDI would be responsible for the administration of this program.

In addition, taking into account the extent of the potential net adverse impacts on recreational and indigenous fishing **I have imposed** a condition (Appendix 1, Schedule 3, Condition 22) that requires GPC to provide financial contributions to DTMR's recreational boating infrastructure program for the Gladstone region of up to \$1.5 million.

6.3 Environmental offset requirements

As defined by the Queensland Government Environmental Offsets Policy (QGEOP), an environmental offset is an action taken to counterbalance unavoidable, negative environmental impacts that result from an activity or a development. An offset may be located within or outside the geographic site of the impact. Environmental offsets are only applicable when the impacts cannot be avoided or minimised, and if all other environmental standards have been met.

The QGEOP provides an overarching framework for deciding and implementing environmental offsets. Specific-issue offsets policies provide detailed direction for offsets that address specific environmental matters. These policies are developed from requirements of the various pieces of controlling legislation.

I have considered offsets in two parts: mitigation of the predicted impacts on marine fish habitat; and additional requirements for potential effects on shorebirds and marine fauna.

6.3.1 Offsets for loss of marine fish habitat

The specific-issue offset policy that applies to the WBDD Project relates to the *Fisheries Act 1994*. It has been developed by DEEDI to detail mitigation measures for the conservation and enhancement of Queensland's fisheries resources and fish habitats. The current version of the policy is *Fish Habitat Management Operational Policy FHMOP 005 – Mitigation and Compensation for Works for Activities Causing Marine Fish Habitat Loss*.

6.3.1.1 Combined GPC project impacts

GPC submitted an offset proposal (updated March 2010 and April 2010) addressing the coastal environmental impacts associated with four projects currently under its consideration, namely:

- Fisherman's Landing Port Expansion
- Western Basin Dredging and Disposal
- Wiggins Island Coal Terminal
- Gladstone LNG Stage 1 channel dredging.

The combined impacts of the projects on marine fish habitat estimated by GPC at that time are summarised in Table 12.

Table 12—Combined impacts of the projects on marine fish habitat

Project	Permanent loss	Temporary disturbance
Fisherman's Landing Port Expansion	Reclamation of 174 ha of seabed including 90 ha of seagrass and 84 ha of 'potential' seagrass	Indirect effects on up to 180 ha of seagrass
Western Basin Dredging and Disposal	Reclamation/dredging affecting 259 ha of seagrass	Indirect effects on up to 1406 ha of seagrass
Wiggins Island Coal Terminal	Reclamation of 260 ha including intertidal wetland and 10 ha seagrass	Indirect effects on up to 200 ha seagrass
Gladstone LNG Stage 1 channel dredging		Approx 0.12 ha of seagrass and other marine plants on the pipeline route
Total	443 ha of seagrass and 250 ha of intertidal wetland	See discussion below

6.3.1.2 Temporary disturbance to marine fish habitat

Although the likely impacts on seagrass areas cannot be accurately predicted until the detailed design of dredging programs is completed, **I am satisfied** that the extent of indirect impact on seagrass areas in Table 12 is an over estimate, as follows:

- the areas of seagrass in Table 12 for each project have been double counted in some cases when considering the overall impacts
- impact assessment in the EIS assumed a large proportion of TSHD rehandling in the vicinity of Fisherman's Landing. GPC has committed to minimise the use of rehandling and to relocate operations to North China Bay therefore reducing the impacts of turbid plumes.

As discussed in section 6.2.2, the extent of the cumulative temporary disturbance to seagrass areas in the Western Basin is estimated to be no greater than:

- moderate to severe impact (highly degraded or complete loss of seagrass cover for the duration of dredging works) of 350 ha of seagrass
- minor to moderate impact (decreased production or reduced seagrass cover sustained over the duration of dredging works) of an additional 1000 ha of seagrass.

6.3.1.3 Agreed GPC marine fish habitat offset

In consultation with DEEDI and DERM, **I have determined** that an appropriate offset package sufficient to acquit the requirements for impacts to marine fish habitat (described by Table 12) is as follows:

- the protection of 5000 ha of coastal land currently within the GPC's strategic port land at Port Alma
- contribution of \$5 million to support Fisheries Queensland initiatives for future research and studies and/or appropriate works for fish habitat rehabilitation and enhancement.

Policy principles of the QGEOP require that offsets must achieve an equivalent or better environmental outcome and that offsets must provide environmental values as similar as possible to those being lost. In determining an appropriate outcome, **I have considered** the following:

- the nature (type, quality etc.) of marine fish habitat and coastal environmental values that would be lost compared to those in the offset site(s)
- the practical constraints of providing like-for-like offsets for particular types of marine plants—in this case seagrass
- the time lag between development impacts and the provision of offsets
- the geographic separation between the area of impacts and the offsets
- the likelihood of successful recovery of seagrass areas that may be significantly affected by dredging and reclamation works.

I have also noted that components of the proposed works would provide a substantial fish habitat benefit particularly the creation of artificial rocky habitat in the toe section of revetment structures enclosing the proposed reclamations.

The Port Alma offset site is located east of Balaclava Island and comprises estuarine wetlands with significant fish habitat values—although no areas of seagrass. The site includes an estimated 330 ha of terrestrial area (above the level of the highest astronomical tide) adjacent to the Rundle Range National Park. Approximately 70 per cent of the site lies within the Habitat Protection Zone of the (state) Great Barrier Reef Coast Marine Park and therefore can be considered to be already under a level of protection. In addition, given the new port capacity proposed in the Port of Gladstone Western Basin, the potential development horizon of the Port Alma site would be in the order of 20+ years. This reduces the value of the site as an offset although its development potential is clearly defined by its SPL designation. This development potential would be removed in perpetuity by taking it out of the SPL designation and including the terrestrial portion in the protected area estate. In addition, it is proposed the marine areas be included in the adjacent declared Fitzroy River Fish Habitat Area and/or state marine park.

The offset site comprises extensive areas of mangrove communities and intertidal wetlands. The site represents valuable fish habitat including nursery and recruitment areas. Marine megafauna (including dugongs, dolphins and turtles) are known to inhabit the tidal waterways within the site.

The \$5 million funding contribution is intended to be staged over a five year period. The funding would be directed to a range of projects aimed at enhancing marine fish habitat resources in the region. Some of the work would involve scientific research and investigation however a large proportion would fund rehabilitation and enhancement projects in the Port Curtis region. An indicative list, developed by DEEDI, includes:

- creation of additional fish habitats \$0.2 million
- rehabilitation works \$0.7 million
- implement marine plant management plans \$0.3 million
- declared fish habitat area (FHA) investigations \$0.7 million
- enhanced FHA management \$1.1 million
- applied fish habitat research \$0.5 million
- fish habitat mapping \$0.8 million.

I note that the intention of the funding contribution is to provide mitigation of impacts on fisheries resources within the local area. The mitigation program would be undertaken over a five year period and is designed to complement the long term nature of the Port Alma offset site. **I acknowledge that** providing a 'like for like' offset for loss of seagrass is impractical.

6.3.1.4 Additional impacts of LNG projects on marine fish habitat

Section 6.2 of this report discusses cumulative impacts predicted to occur from other activities in Port of Gladstone western basin that are not addressed by GPC's offset proposal, including:

- smaller scale dredging works adjoining Curtis Channel for access to LNG project sites
- dredging and excavation works for the pipeline crossing of The Narrows.

I have concluded that the additional impacts of the site access works for the GLNG and QCLNG projects are relatively minor in comparison to those associated with the adjacent WBDD channel dredging and would not contribute significantly in a cumulative sense. Construction of these marine facilities for GLNG and QCLNG were not considered in my evaluation reports for the projects therefore a separate approvals process will be followed. **I am satisfied** that any requirements for a marine fish habitat offset would be determined through that process and, for the purposes of determining an offset, that each can be considered as a stand-alone proposal.

The additional dredging proposed for access to the APLNG project site is more extensive than that proposed for GLNG and QCLNG and is located in a relatively sensitive area close to The Narrows and Graham Creek. As my evaluation of the APLNG project is not complete, **I have not** had the opportunity to fully assess the implications although in section 6.2 of this report I have noted the potential cumulative effects of the proposed dredging for APLNG. **I will include** any requirements for an additional marine fish habitat offset taking into account likely cumulative impacts as part of my evaluation of the APLNG project.

In my evaluation of the GLNG and QCLNG projects, **I considered** the proposed pipeline crossing of The Narrows and its potential impacts. As an outcome of my evaluation **I have required** proponents to prepare a specific EMP for that component of their projects, including an appropriate offset.

6.3.1.4 Coordinator-General's conclusion—offsets for loss of marine habitat

A requirement of QGEOP is that the design of a project should seek to avoid and minimise impacts prior to considering offsets. In the case of the present project **I am satisfied** that GPC has adequately investigated project options and alternative designs that would lead to reduced impacts.

The intention of GPC's proposal is to establish a strategic offset that is sufficient for all four projects. **I agree** with this approach as it potentially offers advantages over a series of smaller and independent offsets in terms of environmental outcomes and ongoing management.

In the event that temporary impacts are not as extensive as initially predicted by GPC, **I state** that a reduction in the offset would not be considered.

To ensure the required offset is appropriately secured, **I have imposed** a condition (Appendix 1, Schedule 3, Condition 19) that must attach to a development permit for the proposed works.

6.3.2 Additional biodiversity considerations

In addition to marine fish habitat considerations, several policies of the State Coastal Management Plan and the Curtis Coast Regional Coastal Management Plan apply. These specify that coastal development projects in sensitive areas should generally show a net increase in coastal environmental values. A specific-issue offset policy under the QGEOP has not been developed for coastal management plans however the broad principles have been considered.

The agreed strategic offset package includes measures that would provide valuable biodiversity conservation outcomes within the region. The Port Alma offset site comprises tidal waterways that support a range of marine fauna, including listed species. The protection of this site in perpetuity therefore provides a significant positive biodiversity protection outcome. In addition the funding package includes components that, whilst primarily aimed at marine fish habitat conservation and enhancement, also have benefits for the overall marine environment of the region.

I consider that further extension to the agreed offset package is necessary to address the likely worst-case impacts on marine environmental values. In particular, certain marine species such as dugongs and turtles are likely to be affected by the loss of seagrass areas and periods of degraded water quality in the vicinity of the proposed works. Potential impacts on shorebird habitat have also been identified.

In section 5.2.7 of this report **I have specified** the requirement for GPC to prepare and implement a flora and fauna management plan (FFMP) for the WBDD Project. **I have imposed** additional conditions (Appendix 1, Schedule 3, Part 4.4) that provide additional offset measures for shorebirds and marine fauna to be included in the FFMP (as provided for by conditions stated in Appendix 1, Schedule 2, Part 4). These could include, but not be limited to:

- enhanced understanding of the displacement of key marine fauna species from affected habitat areas in Western Basin and any associated effects on regional populations
- contribution to species protection programs in the region or the wider bioregion. This may include funding of additional boating and fisheries patrols, education campaigns for recreational fishers on risks of marine fauna boat strike and improved management of key shorebird habitat areas
- contribution to habitat enhancement/restoration actions in the region or the wider bioregion such as 'seagrass friendly' mooring systems, wetland rehabilitation projects and water quality improvement programs.

Assessment of applications for maritime infrastructure on Curtis Island for LNG projects (dredging/construction of access facilities and construction of export terminals) should recognise the potential for impacts on marine species and include requirements for appropriate mitigation and offsets, if required.

FFMPs (or equivalent) that are required for other projects in the Western Basin should comprise measures that are compatible with the FFMP for the WBDD Project. Preferably, all projects should contribute toward an overall strategic package.

Given the potential for reduced opportunities for fishing in Western Basin **I am concerned** that displaced fishing effort doesn't impact on key species in other areas, for example Rodds Bay. This matter will be addressed in the FFMP and in the consideration of any mitigation for commercial fishing operations.

6.3.3 Summary of recommendations for future development approvals

1. **I have required** that the management of the WBDD Project includes the development of a reactive monitoring program that incorporates consideration of light availability to seagrass areas

and seagrass health. In terms of managing cumulative impacts, **I recommend** that this approach be adopted for all future DMPs for the various dredging operations in the Western Basin.

2. The EIS notes that the WBDD reclamation area will include water bodies that may provide a beneficial habitat for shorebirds. **I recommend that** opportunities to provide shorebird habitat within the WBDD Project should be maximised where practicable particularly where concurrent impacts are occurring in the vicinity of Friend Point for the pipeline crossing works.
3. The effects of concurrent piling operations, such as jetty construction, should be carefully considered. In particular, **I considered** that pile driving activities for construction of LNG export facilities should be scheduled to not occur while similar work is underway for the WICT project or the installation of navigation beacons in the vicinity of Fisherman's Landing.
4. **I recommend that** assessment of applications for maritime infrastructure on Curtis Island for LNG projects (dredging and construction of access facilities and construction of export terminals) should recognise the potential for impacts on marine species and include requirements for appropriate mitigation and offsets, if required.
5. **I recommend that** FFMPs (or equivalent) that are required for other projects in the Western Basin should comprise measures that are compatible with the FFMP for the WBDD Project. Preferably, all projects should contribute toward an overall strategic package.
6. **I recommend that** outcomes of a commercial fishing impact mitigation program should minimise the potential for displaced fishing effort to affect key marine species in nearby sensitive areas, for example Rodds Bay.

6.3.4 Summary of Coordinator-General's future actions

1. The timing of the APLNG access dredging coincides with commencement of the main Curtis Channel dredging, including TSHD works. In order to avoid significant cumulative effects, the co-location of dredging activities in this area is to be carefully considered as part the evaluation of the APLNG project. This would include further modelling of turbid plumes likely to be generated by the works and their interaction with other dredging activities.
2. The evaluation report for the APLNG project is to include an update to this cumulative impact assessment.
3. The potential timing of dredging operations for the proposed pipeline crossing of The Narrows is to be carefully considered to avoid interaction with any concurrent dredging operations located in the vicinity of the APLNG project site. Preferably, concurrent dredging operations in this area would be avoided unless a detailed investigation demonstrates that cumulative impacts can be avoided.
4. The Gladstone Logistics Plan will include consideration that appropriate routes through sensitive marine areas and associated speed limits for fast ferries and construction barges will be established.

6.3.5 Summary of offset requirements

1. Marine fish habitat offset for combined GPC projects within the Western Basin comprising:
 - the protection of 5000 ha of coastal land currently within the GPC's strategic port land at Port Alma
 - contribution of \$5 million to support DEEDI (Fisheries Queensland) initiatives for future research and studies and/or appropriate works for fish habitat rehabilitation and enhancement.

Note: GPC has committed to a further contribution of up to \$5.0 million over ten years to support fish habitat enhancement projects within the Gladstone Port area.

2. Additional biodiversity offsets for combined GPC projects to be included in the flora and fauna management plan (FFMP) for the WBDD Project. These could include, but not be limited to:

- enhanced understanding of the displacement of animals from key habitat areas in Western Basin and any associated effects on regional populations
- contribution to species protection programs in the region or the wider bioregion. This may include funding of additional boating and fisheries patrols, education campaigns for recreational fishers on risks of marine fauna boat strike and improved management of key shorebird habitat areas
- contribution to habitat enhancement and/or restoration actions in the region or the wider bioregion such as 'seagrass friendly' mooring systems, wetland rehabilitation projects and water quality improvement programs.

Note: these requirements are additional to the following measures specified for the FFMP:

- establish pre-development baseline data of relevant marine and terrestrial flora, fauna and ecological communities within the project area
 - continue annual long term seagrass monitoring surveys of seagrass distribution and abundance in the Western Basin
 - more frequent additional monitoring of seagrass areas during the construction period and for a minimum of three years following completion of dredging
 - monitoring of marine megafauna at the localities immediately impacted by the reclamation area
 - additional monitoring of migratory shorebirds.
3. Offsets for Curtis Island LNG projects to be determined on a site specific basis as part of assessment of applications for maritime infrastructure development permits (dredging/construction of access facilities and construction of export terminals). Offset requirements would cover impacts to marine fish habitat, shorebirds and marine species. Preferably, impact mitigation for shorebirds and marine species would be in the form of a contribution towards GPC combined offset package.
 4. Offsets for the proposed pipeline crossing of The Narrows to be determined as part of the environmental management plan for the works.
 5. Recreational fishing and boating in the Western Basin:
 - Prior to the completion of stage 1 of WBDD, GPC shall contribute funding and/or works to the value of \$1 million towards new or upgraded recreational fishing infrastructure within the Gladstone region
 - A further \$0.5 million will be paid at the completion of stages 2 and 3 of WBDD.
 6. Commercial fisheries:
 - GPC must mitigate all reasonable financial losses to existing commercial fishing operators attributable to the maritime development in the Western Basin of the Port of Gladstone. This is to cover temporary and permanent loss of access to fishing areas and marine fish habitat.
 - GPC must meet all costs associated with the investigation, negotiation and administration of any compensation package.

7. Operational management plans

7.1 Environmental management plan

Potential environmental issues requiring attention have been identified during the impact assessment process. The purpose of the environmental management plan (EMP) is to detail the actions, procedures and responsibilities to be carried out during the implementation of the project in order to mitigate adverse and enhance beneficial environmental and social impacts.

The objectives of the EMP are to provide:

- a practical framework for establishing best practice environmental management standards and guidelines to mitigate potential environmental harm for each activity
- a mechanism to assist managers, supervisors and construction crews to comply with current legislation
- a means of identifying environmental issues and to provide general procedures which must be considered when undertaking construction and operational activities
- a mechanism to reduce the potential impacts of construction and operational activity
- a preliminary basis for establishing environmental due diligence during the construction and operational phases.

The EMP establishes the framework, including environmental protection objectives, standards, measurable indicators and control strategies—that is, to demonstrate how the objectives will be achieved—to ensure that the measures are implemented during each stage of the project.

This is also achieved by specifying the monitoring, reporting and auditing requirements, with nominated responsibilities and timing, to ensure that the commitments are met. The EMP also identifies corrective actions if monitoring indicates that the performance requirements have not been met.

A draft EMP has been prepared by GPC for the construction and operation of the project (EIS chapter 19). The draft EMP outlines commitments to protect the environmental values potentially affected by the construction and operation of the marine precinct.

Based on the outcomes of the technical studies and risk assessments, a draft EMP was prepared for the project and is structured to include Environmental Management Schedules for each topic that requires management consideration. The content of the schedules is shown in Table 13.

Table 13—Elements of the EMP (from EIS, Table 19.1)

Element	Environmental aspect requiring management attention (construction and/or operation)
Potential impacts	Summary of potential impacts
Policy	Guiding operational policy
Implementation	Mechanisms and actions through which policy will be achieved
Performance requirements	Criteria by which success of implementation of the policy will be determined
Monitoring	Process of measuring actual performance
Auditing	Format, timing and responsibility for auditing
Reporting	Format, timing and responsibility for reporting
Corrective action	Action to be implemented in case performance requirement is not met, and responsible party

The Environmental Management Schedules of the draft EMP relate to the chapters of the EIS and the supporting technical reports as shown in Table 14.

Table 14—Environmental Management Schedules of the draft EMP (see EIS, Table 19.2)

No.	EMP schedule	EIS chapter	Supporting technical report/s
1	Climate and climate change	4. Climate and climate change	Climate and climate change assessment
2	Acid sulfate soils	5. Land	Acid sulfate soils assessment
3	Coastal processes	7. Coastal environment	Coastal processes assessment
4	Water quality		Water quality assessment
5	Sediment quality		Sediment quality assessment
6	Hydrology and stormwater	8. Water resources	Groundwater resources assessment
7	Groundwater		
8	Terrestrial flora and fauna	9. Nature conservation	Terrestrial ecology report
9	Marine ecology		Marine ecology report
10	Marine megafauna		Marine megafauna baseline assessment
11	Air quality	10. Air quality, noise and vibration	Greenhouse gas assessment
12	Greenhouse gases		Noise and vibration assessment
13	Noise and vibration		
14	Traffic and transport	11. Transport	Nil
15	Cultural heritage	12. Cultural heritage	Historic cultural heritage investigation
16	Social	13. Social impact	Social impact assessment
17	Landscape and visual	14. Landscape and visual character	
18	Economic	15. Economic impact	Economic assessment
19	Health and safety	16. Health and safety	Nil
20	Mosquito and biting midges		
21	Environmental emergency plans	17. Hazard and risk	Hazard and risk assessment risk register

I note that with regard to the cultural heritage element of the EMP, a draft Cultural Heritage Management Plan has been completed for the project site to fulfil the requirements of the *Aboriginal Cultural Heritage Act 2003*.

The EIS and SID refer to a number of other specific management plans to inform the construction and operation of the project, including:

- acid sulfate soils management plan (ASSMP), to be endorsed by DERM prior to construction and to cover the dredging and reclamation developments
- weed and pest management plans, as part of the EMP
- safety management plan, as part of the EMP
- emergency response plans, as part of the EMP.

The construction contractor will be responsible for preparation of a detailed construction phase EMP that must address the requirements set out in the draft EMP and any other conditions as required by the approval authorities.

The construction EMP will take into consideration the specific construction methods proposed, including capital dredging, and tailor appropriate mechanisms, monitoring and reporting requirements to these methods. For the purposes of this EMP, construction is taken to include all land and marine based construction activity, including dredging.

Operational phase environmental management will be addressed as part of the GPC Environmental Management System (EMS), which is certified to International Standards AS/NZS ISO14001:2004. Operational requirements set out in the EMP for the project will be incorporated into the EMS subject to the final design.

I have imposed a condition (Appendix 1, Schedule 3, Part 1) that requires the proponent to finalise the EMP and implement it during the life of the project, and to ensure the operational elements of the EMP are included within GPC's EMS.

The proponent and/or its contractor(s) must finalise the WBDD Project EMP to the satisfaction of DERM at least one month prior to commencement of construction of the project.

The EMP must include all relevant approval conditions arising from the project's approval and subsequent permits, authorities and/or licences.

The proponent and/or its contractor(s) must comply with all requirements of approved EMP.

I have imposed a condition (Appendix 1, Schedule 3, Part 6) that requires the proponent to undertake periodic reporting and compliance auditing for the implementation of the EMP and other associated management plans.

7.2 Dredge management plan

The EMP also provides the framework for the dredge management plan (DMP) that details information relating to the potential environmental impacts of the dredging and operational measures to avoid, minimise or mitigate potential adverse impacts.

The purpose of the DMP is to detail the actions, procedures and responsibilities to be carried out during the implementation of the dredging (removal of quarry material below high water mark) and disposal of spoil (reclamation) in order to mitigate adverse and enhance beneficial environmental and social impacts.

The DMP for the WBDD Project must provide detailed information relating to:

- dredge type and capacity
- dredging methodology and particularly whether, and to what extent, overflow dredging will be used, and any measures adopted through contractual arrangements for overflow dredging to limit discharge of sediment to waters
- if a trailing suction hopper dredge is used, the design and operational measures to be implemented through contract arrangements with the dredge operator to minimise risk to turtles, and the monitoring and reporting of turtle mortality
- specific minimisation and mitigation strategies to be implemented for potential impacts of light attenuation and sedimentation on seagrass communities, including specific turbidity and/or seagrass impact trigger levels associated with specified and practicable requirements to alter dredging operations to reduce impacts and
- monitoring programs for sensitive ecosystems to demonstrate the effectiveness of proposed mitigation measures.

The DMP will also be prepared and implemented in close conjunction with other components of the EMP, in particular the ASSMP for monitoring and management responses of both dredging and reclamation. A specific WQMP will be prepared to guide the monitoring of water quality, and the use of trigger limits to inform operational response. Also a FFNP will be prepared to guide the monitoring of terrestrial and marine flora, fauna and ecological communities and inform management response to avoid, minimise or mitigate impacts as necessary. In particular, the FFMP will be closely tied to the WQMP and DMP so that the monitoring of seagrass health, related to water turbidity and light conditions, can be used to inform operational responses implemented through the DMP.

Further specific details to inform the approvals for dredging operations—that is, a DMP—and reclamation construction (as required for the granting of the approvals) can be provided to DERM during the SPA development approval process. Therefore, the DMP and associated management plans would accompany the development application for operational works (tidal).

For the purpose of a development approval for ERA 16, the DMP satisfies the requirements of an EMS for the dredging operation provided that the conditions stipulated by this report and the approval agency (DERM) are implemented.

I note that GPC does not intend to seek approval for the DMP under section 89 of the Coastal Act. Rather, the DMP will be considered as part of the development approval for operational works (tidal).

I have stated conditions for the DMP to accompany a development permit for operational works (tidal) that are set out in Appendix 1, Schedule 2 of this report.

8. Matters of National Environmental Significance

8.1 Project assessment and approvals

On 18 May 2009, the proponent referred the project to the Commonwealth Minister for the Environment, Heritage and the Arts (referral number 2008/4904) for a determination as to whether the project would constitute a 'controlled action' with respect to potential impacts on 'matters of national environmental significance' (MNES) under sections 75 and 87 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act).

The EPBC Act establishes a Commonwealth Government process for environmental assessment and approval of proposed actions that are likely to have a significant impact on MNES or on Commonwealth Government land.

On 18 June 2009, the Commonwealth Minister determined that the project is a controlled action under section 75 of the EPBC Act (reference number EPBC 2009/4904). The controlling provisions of part 3, division 1 of the EPBC Act for the proposed action are:

- Sections 12 and 15A (world heritage properties)
- Sections 15B and 15C (national heritage places)
- Sections 18 and 18A (listed threatened species and communities)
- Sections 20 and 20A (listed migratory species).

In accordance with the Commonwealth Minister's decision on the assessment approach, the project requires assessment and approval under the EPBC Act. The Commonwealth Government has accredited the Queensland state EIS process, conducted under the SDPWO Act, under a bilateral agreement between the Australian and Queensland Governments. Under the bilateral agreement between the Commonwealth Government and the State of Queensland made under section 45 of the EPBC Act, if a controlled action is a significant project for which an EIS is required under the *State Development and Public Works Organisation Act 1971* (SDPWO Act), then the project does not require assessment under part 8 of the EPBC Act.

Under part 4 of the SDPWO Act and the State Development and Public Works Organisation Regulation 1999 (SDPWO Regulation), the Coordinator-General, in preparing his assessment report, must ensure the report assesses all relevant impacts that the action has, will have or is likely to have and provide enough information about the action and its relevant impacts to allow the Commonwealth Minister to make an informed decision whether or not to approve the action under the EPBC Act.

The controlled action may be considered for approval under section 133 of the EPBC Act once the Commonwealth Minister has received the Coordinator-General's EIS evaluation report from the EIS process prepared under section 35 of the SDPWO Act.

This will enable the EIS to meet the impact assessment requirements under both Commonwealth and Queensland legislation.

This section of the report provides the state's evaluation of the potential impacts of the project on those MNES determined as controlling provisions under the EPBC Act. Chapter 9.4 and Appendix G of the EIS address MNES.

8.2 World heritage properties

8.2.1 Context

The project's proposed dredging activities and reclamation area would be located wholly within the Great Barrier Reef World Heritage Area (GBRWHA) but are outside the Great Barrier Reef Marine Park (GBRMP).

The Great Barrier Reef was inscribed on the World Heritage List in 1981 in recognition of its outstanding natural universal values. The relevant world heritage criteria are to:

- contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance
- be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features
- be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals
- contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

As the project area is within the GBRWHA, all of the criteria for which the GBRWHA was listed are applicable to the assessment. However, **I note** that the WBDD Project area is wholly within the Port of Gladstone, which has an established history of development, modification, use and impacts as a major industrial port.

8.2.2 Potential impacts

8.2.2.1 Visual and aesthetic values

The Port of Gladstone has a long history of industrial coastal development and the waters of Port Curtis are subject to high volumes of shipping traffic and port operations. The declaration and extension of the Gladstone State Development Area (GSDA) immediately north of Gladstone and on the south-western portion of Curtis Island is in recognition of the future industrial development intention for the locality, including the emergent LNG industry.

The proposed dredge footprint mainly comprises a new dredge area but partly includes the existing dredged Targinie Channel. The majority of the dredge footprint area comprises sands, silts and clay sediments. The proposed reclamation area is adjacent to the existing Fisherman's Landing reclamation and the proposed FLPE reclamation.

The adjacent terrestrial area is characterised by flat, tidal and intertidal mudflat areas, dominated by mangroves, extending landward to open woodlands of the Mount Larcom foothills. Offshore, Curtis Island has a low, undulating, vegetated form.

The reclamation area is 10 km north of the urban residential area of Gladstone and is adjacent to established, heavy industrial development in the GSDA including Cement Australia, Orica, Rio Tinto Aluminium Yarwun, RG Tanna Coal Terminal, NRG power station and Queensland Energy Resources. In addition, the existing Fisherman's Landing and proposed FLPE are intended to be developed for industrial port facilities. A visual impact assessment was undertaken for the EIS (chapter 14 and Appendix X).

The proposed project reclamation is generally compatible with the existing and intended future adjacent industrial landscape of the Port of Gladstone and the GSDA and therefore not expected to impact on the natural beauty of the GBRWHA areas containing 'superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance'.

The reclamation proposal preferred by GPC included provision for a 'mound' of dredge spoil material to contain the full volume of dredged material within a minimal footprint area. For a net capacity of approximately 55 Mm³, a mound with a maximum height of 60 m was initially designed, with a slope of approximately 1:6 to enable effective management of stormwater runoff, erosion and surface rehabilitation (vegetation). The mound would be sufficiently high to become a prominent landscape feature of this locality.

Should a permit be issued by DEWHA, under the Commonwealth *Environmental Protection (Sea Dumping) Act 1981*, for offshore dumping of a proportion of the dredge spoil (approximately 8–10 Mm³) then the volume of material required to be disposed of in the reclamation area would be reduced by approximately 20–24 per cent reduction of the total 42.3 Mm³ capital dredging volume. This would provide GPC with an opportunity to design a lower, recontoured reclamation mound with the potential to create additional useful reclaimed port land that would be visually consistent with the adjacent industrial development intended for Fisherman's Landing.

The EIS (section 14.2.3) provides an assessment of the potential visual impact of the reclamation mound, graphically indicating its appearance during reclamation and following the progressive establishment of rehabilitation planting. The mound is generally assessed to have an adverse visual impact, however, this would be substantially lessened by rehabilitation planting.

Retention of the tidal channel to the west of the western bund wall of the reclamation area will enable the retention of foreshore mangroves, which should soften the visual impact when the mound is viewed from the west.

I acknowledge the potentially adverse visual impact of the proposed reclamation mound. However, **I consider** that since the site is not proximate to the residential areas of Gladstone and is located in a precinct intended for intensive, large-scale industrial development associated with the Port of Gladstone and the GSDA.

To reduce the visual impact resulting from the disposal of dredge spoil on the reclamation mound, **I have stated** conditions (Appendix 1, Schedule 2, Part 5.6) to ensure the progressive vegetation of the mound as it is being created.

8.2.2.2 Physical coastal features and coastal processes

The marine environment of the project area is characterised by a relatively shallow embayment with a heterogeneous mosaic of soft sediment, rocky reef, coral, seagrass and algae, with variable water depths partitioned by islands, mudbanks and channels.

The project area is sheltered by Curtis Island and Facing Island to the east and south-east. To the north of the project area is The Narrows, which is a shallow constriction between the mainland and Curtis Island that forms a complex system of creeks, mudflats and mangrove habitats.

Numerical modelling was undertaken for the EIS (EIS chapters 6 and 7 and Appendix J) to describe the existing tidal hydrodynamic processes of Port Curtis and to understand the circulation, wave conditions, flushing patterns, turbid dredge plume dispersion and sedimentation processes across the project area. The model was used as tool to quantify the physical processes and to assess the potential impacts of proposed dredging and reclamation works for the project.

Two-dimensional (2D), depth averaged, calibrated and validated modelling (TUFLOW-FV) was undertaken, which was selected to be appropriate for the high energy, macro-tidal and well-mixed conditions of Port Curtis⁷ (EIS, section 6.7). A sensitivity analysis comparing 2D to 3D modelling showed that there was only marginal improvement in results using the more complicated 3D model. The SWAN wave modelling package was used for wave assessments and was linked to TUFLOW-FV as required. The model bathymetry was based on digital elevation modelling of the port derived from various existing survey data.

⁷ The model mesh covered an area of approximately 635 km² extending a reach of approximately 80 km from Richard Point in the south-east to Division Point in the north-west (EIS section 6.6.1 and Figure 6.2). Simulations were carried out to represent a two month period using tidal boundaries derived from data recorded in February and March 2009, selected to include large spring tides and small neap tides.

A range of hydrodynamic modelling scenarios was also investigated in order to provide an assessment of the combined impacts of tides, waves and winds and a 100 year average return interval flood event in the vicinity of the proposed marina and channel dredging works.

The modelling was undertaken for a base case and three development scenarios containing four stages of dredging and the proposed reclamation (EIS Table 7-17):

- Base case—existing channels + recent dredging at Fisherman's Landing + proposed Wiggins Island Coal Terminal dredging
- Scenario 1—base case + Stage 1A (Clinton Bypass channel dredging + Curtis spur channel and China Bay swing basins dredging) + Stage 1B commenced (initial Targinie Channel and Fisherman's Landing swing basin dredging) + Western Basin reclamation area completely constructed
- Scenario 2—scenario 1 + Stage 1B completed (additional dredging of Targinie Channel and Fisherman's Landing swing basin) + Stage 2 (Channel extension to Laird Point and swing basin)
- Scenario 3—scenario 2 + Stage 3 (additional dredging to Laird Point) + Stage 4 (additional dredging between swing basins and near China Bay and Hamilton Point on Curtis Island).

The results of the modelling of developed case scenarios have been compared to the base case to assess the potential impacts of the works.

The key conclusions derived from the studies include:

- the proposed dredging of the channels and swing basins and construction of the reclamation area would have an effect on the hydrodynamics of the Western Basin, particularly in the immediate vicinity of the reclamation area and the dredged channels
- areas at the toe of the bund wall and in the embayment immediately to the north of the reclamation area may be subject to increased bed shear stresses—that is, potential scouring
- the project would cause some changes to tidal current velocities as far as Auckland Point due to the reduction in the tidal prism occupied by the reclamation
- minor changes in water levels (mm) in The Narrows are expected
- slight phase shift (minutes) in the tidal cycle within the project area and The Narrows, and potential increase in water retention during low tide, with fewer periods of foreshore exposure (drying)
- the effects of the project on local hydrodynamics are highly variable across the project area and with time (tidal, seasonal).

Significantly, the modelling predicted an increase in the potential quantity of sand and fine silt deposition in the newly formed channels that would require an increase in maintenance dredging activity.

In general terms however, the predicted changes to the project area's hydrodynamics would be within the normal bounds of the physical processes that naturally occur in the system as a result of the inherent variability of the coastal and estuarine characteristics of the locality.

8.2.2.3 Coastal and marine ecosystems

Context

The area is naturally highly and variably turbid with concentrations of suspended solids regularly elevated above the *Queensland Water Quality Guideline* (2006) (QWQG) and *ANZECC Guidelines for Fresh and Marine Water Quality* (2000).

However, despite the ambient turbidity, the locality supports extensive seagrass beds that vary seasonally and annually and persist under existing port operational conditions. These seagrasses support the direct and indirect foraging habitat of marine fauna including dugongs and turtles. Seagrasses are considered as nursery grounds for juvenile fish and may be targeted by commercial, recreational and indigenous fishers.

Direct, indirect, permanent and temporary impacts on the benthic marine ecosystems within the project area, and therefore within the GBRWHA, are expected from construction and operation of the project.

Permanent loss of seabed

The majority of the impacts involve the direct removal of an area (approximately 235 ha) of intertidal and subtidal habitat from the footprint of the reclamation area.

Other potential and probable impacts associated with the dredging and reclamation on marine ecological values include:

- removal or damage to benthic organisms
- reduced use of the area by marine fauna
- increased disturbance to marine habitats
- alteration of benthic habitat types—for example, soft sediment to hard substrate, intertidal to subtidal substrate.

The permanent loss of seabed and the small area of marine plants is partly balanced by the creation of new rocky substrate habitat and sheltered/shaded waters in the constructed reclamation area bund wall.

I note that GPC acknowledges the loss of marine habitats due to the project with its commitment to minimise and mitigate adverse impacts wherever possible (see section 8.6 of this report).

Impacts on water quality

Two natural environmental variables are considered to primarily influence sediment concentrations in the water column in the project area: tidal current speeds, which induce resuspension of bottom sediments; and wet season inflows from the surrounding catchments.

The EIS (Appendix G, sections 2.1–2.3) notes a range of additional potential impacts to water quality due to the project:

- dredging—generation and migration of turbidity plumes, alteration of siltation and sedimentation regimes, mobilisation of contaminants into the water column
- construction—disturbance of soft seabed sediments with placement of bund wall rock (mudwave), oxidation of potential acid sulfate soils, alterations to stormwater and decant water discharged from the reclamation area, and pollutant/contaminant spills as a result of construction waste or land use changes.

A decline in water quality may impact on marine benthic communities including sedimentation and smothering of taxa (notably seagrasses), reduction in photosynthesis, scouring and mobilisation of contaminants—for example, nutrients/nitrogen, potential acid sulfate soils and elutriates/metals/ammonia.

Data from GPC's program of ongoing monthly water quality monitoring indicated that anthropogenic contaminant inputs are minor, however nitrogen regularly exceeds water quality guideline limits, though this is not directly correlated to a point-source discharge so may be due to diffuse inputs from urban and rural sources or naturally elevated level.

As described in section 8.2.2.2 of this report, numerical modelling was undertaken for the EIS (EIS chapters 6 and 7 and Appendix J) to describe the existing tidal hydrodynamic processes of Port Curtis. The impact of dredging activities associated with the project was assessed by modelling the advection (horizontal transfer), dispersion and settling of fine sediments introduced into the water column. The modelling quantified the dredge plume, which is the quantity of total suspended solids (TSS) in the water column due to dredging above the natural background levels.

A range of dredging activities was assessed, including: CSD; TSHD, including overflow mode; hopper dumping adjacent to the extended Fisherman's Landing reclamation; CSD for rehandling of dumped material into the reclamation and decant discharge from the reclamation. These activities were modelled in eight separate simulations, which were subsequently super-imposed to represent the likely dredging activities associated with four stages of the Western Basin expansion, to ascertain the best and worst-case scenarios.

Modelling of dredge plumes undertaken for the EIS and SID (Table 10-1) predicted that (in addition to the direct lost) approximately 5416 ha of benthic habitat outside the dredge and reclamation areas footprint has the potential to be indirectly impacted by elevated turbidity caused by the dredging activities. Of this area, approximately 1406 ha is known seagrass habitat.

Higher turbidity is associated with dredging by TSHD works, which is generally preferred where:

- dredging depth is sufficient for the TSHD vessel draft
- maintenance of access to the shipping channel is required
- pumping distance is too great to use the CSD.

Use of TSHD for the project may also be considered to facilitate easier access to the offshore disposal ground.

The EIS (section 2.3.3) described that placement of some material extracted by the TSHD to the reclamation area would require 'bottom dumping' adjacent to Fisherman's Landing then double handling (or rehandling) of the softened, bottom dumped material into the reclamation. This action greatly increases turbidity immediately west and extending into the embayment immediately north of the reclamation area. TSHD operation also operates in an overflow mode (when the hopper approaches its capacity), which can cause locally elevated levels of turbidity in the immediate vicinity of the extraction. Dredge spoil material extracted by the CSD can be directly pumped into the reclamation area.

In its submission on the SID, DERM recommended that use of TSHD in overflow mode should be reduced to a minimum and that there should not be rehandling from the TSHD at Fisherman's Landing. DEWHA also recommended additional consideration of alternative dredge scenarios in order to reduce turbidity and avoid rehandling.

In response to the DERM and DEWHA SID submissions, GPC has proposed measures to avoid rehandling at Fisherman's Landing.

Whilst it is GPC's preference is to seek a sea dumping permit for this material from DEWHA, GPC has proposed measures to avoid rehandling at Fisherman's Landing. It estimates that the minimum quantity of material that would require rehandling (in the event that offshore disposal is not approved) is approximately 1.5 Mm³. GPC investigated an alternative location for rehandling in the vicinity of North China Bay at the south-west end of Curtis Island (see Figure 5). If it is necessary to rehandle at North China Bay then this would only be permitted during the last hour of the flood tide and first three hours of the ebb tide to ensure that turbid plumes are directed seaward. An additional advantage of the North China Bay site is that is not proximate to any seagrass beds that may be impacted by local turbidity.

In addition, when turbidity levels exceed designated trigger levels at sensitive sites then overflow dredging of TSHD will be limited to only occur in ebb tide periods. During flood tides, dredging would be limited to only occur without overflow, provided water quality limits are still maintained.

Whilst GPC's focus is to avoid or minimise the impacts of dredge plume turbidity, it is recognised that there is potential for the loss of a significant area of seagrass.

To ensure there is no rehandling at Fisherman's Landing, and to minimise the quantity and potential impacts of rehandling, **I have stated** conditions (Appendix 1, Schedule 2, Part 1.2) that require the proponent to minimise TSHD dredging in silty sediments and undertake any rehandling, if necessary, at the nominated North China Bay site, and only to be permitted during the last hour of flood tide and the first three hours of the ebb tide to ensure that turbid plumes are directed seaward, and limited to a maximum total quantity of rehandled material of 1.5 million m³.

I have also stated conditions (Appendix 1, Schedule 2, Part 1.2) that require overflow mode to be used to the minimum extent practicable.

The EIS (Appendix G, Table 3), summarised in Table 15, presented an initial set of water quality objectives (WQO) to be used in the DMP as trigger values for the dredging operations at various sensitive ecological locations. The WQO set TSS limits, in milligrams of sediment per litre (mg/L) for the 95th percentile and, alternatively, the 80th percentile of background levels.

Numerical modelling suggests that the increase in turbidity associated with dredge plumes is generally less than the 95th percentile of the background level.

In its submission on the SID, DEWHA noted that though turbidity plume modelling had been undertaken, the essential link to seagrass light attenuation requirements and tolerances had not been considered, making it impossible to accurately estimate the likely turbidity impacts on the extensive seagrass beds within the project area.

Table 15—Dredge plume total suspended solids objectives (see EIS, Appendix G, section 2.2.1, Table 3)

Location	TSS Objective (95 th %-ile) (mg/L)	TSS Objective (80 th %-ile) (mg/L)
Middle Western Basin	77	29
North Western Basin	169	55
The Narrows	77	29
Wiggins Island	302	59

In its submission on the SID, DERM recommended that an objective of the DMP should be to minimise the loss of seagrass communities as a result of reduced photosynthetically available light resulting from increased turbidity associated with dredging and dredge spoil activities.

Also, DEEDI, in its submission on the SID, recommended that ecologically relevant water quality triggers, related to the light conditions required to maintain key seagrass species growth, be developed for a WQMP, as part of the DMP, to protect seagrasses from turbid plumes.

DEEDI also recommended that the DMP include a seagrass monitoring program for seagrass health assessment at key sensitive locations to complement the use of incident light-based water quality triggers.

The EIS (Appendix G, section 2.3) anticipated that, while turbidity objectives have been developed for the dredging and discharge of decant waters, there is a need to improve understanding of the resilience of various seagrass species to varying light conditions. The EIS (Appendix K, section 5.5.3) provides a preliminary measure of photosynthetically available radiation, used to measure the light available for photosynthesis (e.g. of seagrasses), however no conclusions are made.

To further this line of enquiry, DEEDI has commenced a program of research that aims to determine thresholds of seagrass resilience to low light conditions. This would provide a basis for water quality triggers based on light incidence and attenuation (if possible, correlated to existing measures of turbidity that would inform the DMP so that dredging operations may be adjusted before sensitive habitats, such as seagrasses, are critically affected).

I have stated conditions (Appendix 1, Schedule 2, Part 3) that require the proponent to prepare a WQMP, to be prepared as a component of the DMP and implemented in conjunction with the EMP and other associated topical management plans, to identify, assess and manage impacts from the dredging and construction of the reclamation area on the water quality of the project area. The WQMP will include a monitoring component, in conjunction with monitoring of sensitive ecological areas, such as seagrasses, that will inform dredging operations through the DMP.

In particular, a technical reference panel will be established for the duration of the project to oversee all aspects of water quality monitoring, including a transition from a water quality monitoring program that is based on turbidity towards a program that is based on light attenuation and seagrass health.

GPC has committed to supporting the ongoing research into seagrass light requirements and **I have stated** conditions (Appendix 1, Schedule 2, Part 3.4) that require the proponent to continue seagrass monitoring and integrate ongoing research findings into the continuous adaptive improvement of the DMP via the establishment of a technical reference panel for the project comprising scientific experts in seagrass and benthic ecology as well as GPC management, regulatory agencies and dredge technical advisors.

Comparison of alternative dredge spoil disposal options

Section 1.4.2 of the EIS noted that the initial assessment of dredge spoil disposal options was made in chapter 6 of the Port of Gladstone Western Basin Master Plan⁸ (WBMP) that was prepared under section 10(2) of the SDPWO Act and that **I endorsed** in March 2010. The WBMP provides the strategic framework for the development and cumulative assessment of potential impacts in the Western Basin.

⁸ Port of Gladstone Western Basin Master Plan (CG, March 2010):
<http://www.dip.qld.gov.au/resources/plan/gladstone/western-basin-master-plan.pdf>

Additional preliminary assessment of site spoil disposal options comes from the *GPC 50 Year Strategic Plan* (GPC, 2008).

Chapter 1.7 and Table 1.4 of the EIS and section 3 of the SID provide GPC's explanation of alternative dredge spoil disposal options, including the advantages and disadvantages of those options and its rationale for selecting the reclamation area and its configuration for the disposal of spoil.

In its submission on the EIS, DEWHA recommended that further consideration was required of alternative dredge spoil disposal options.

Table 16 provides a summary comparison of the dredge spoil options presented by GPC during the EIS process.

Table 16—Comparison of dredge spoil disposal options

Spoil disposal option	Reference	Disadvantages	Advantages
Dredge footprint options	EIS s.1.7.2	<ul style="list-style-type: none"> Driven by sites suitable for establishment of land-based industries and their shipping requirements. 	<ul style="list-style-type: none"> Minimised and optimised to accommodate industry requirements.
Re-use of material	EIS T.1-4	<ul style="list-style-type: none"> Spoil contains mixed grades of material making it difficult to separate and re-use. Material grade is not consistent with grades suitable for beach nourishment 	<ul style="list-style-type: none"> Commercial sale benefit.
Unconfined disposal in subtidal zone	EIS T.1-4	<ul style="list-style-type: none"> Unconfined turbid plumes. Remobilisation of sediments resulting in sedimentation. 	<ul style="list-style-type: none"> retains material in marine environment
Land-based disposal	EIS T.1-4 <ul style="list-style-type: none"> Curtis Island Mainland 	<p><u>Curtis Island:</u></p> <ul style="list-style-type: none"> Requires 15 m high retaining wall Land use conflict with proposed Curtis Island LNG developments <p><u>Mainland (GSDA):</u></p> <ul style="list-style-type: none"> Sterilisation of land in Yarwun Precinct, fully committed for future industrial development. Unsuitable, sloped topography of Targinie Precinct coastal landforms. Significant excavation and removal of material in order to make flat. Introduction of saline and PASS material to terrestrial landscape Environmental impact of vegetation clearing, habitat disturbance and altered ground and surface hydrology. Cost, energy and logistics of long-distance pumping, and treating salinity, PASS and other potential contaminants. South of FL, potential sterilisation of mineral resources. 	<ul style="list-style-type: none"> Avoids reclamation. Avoids sea dumping. <u>Curtis Island:</u> potential to accommodate up to 20 Mm³ <u>Mainland:</u> avoid sea dumping, reclamation and Cutis Island disposal.
Use of Wiggins Island Coal Terminal onshore spoil disposal area		<ul style="list-style-type: none"> Capacity of site is fully committed from WICT. 	<ul style="list-style-type: none"> Avoids reclamation. Avoids offshore disposal. Complements disposal of spoil for WICT project
Reclamation		<ul style="list-style-type: none"> Removal of benthic habitat. Impact to marine fauna and migratory shorebirds. Displacement of recreational, commercial and indigenous fishers. Displacement of recreational boaters Time required for consolidation and surface rehabilitation. Visual impact of 'mound' Management of decant and stormwater discharge. Management of PASS. 	<ul style="list-style-type: none"> Avoids land-based disposal environmental impacts. Contiguous with existing Fisherman's Landing reclamation and FL Northern Extension thereby limiting impact to one part of the Western Basin. Preliminary evaluation of disposal options provided and supported by Western Basin Master Plan.

Other reclamation site options within Port of Gladstone	EIS T.1-4	<ul style="list-style-type: none"> Require construction of bund and reclamation of sea floor 	<ul style="list-style-type: none"> Not contiguous with existing reclamation.
Offshore disposal	EIS T.1-4	<ul style="list-style-type: none"> Permit limit on GPC's existing sea dumping permit of < 1.0 Mm³ remaining. Uncertainty of East Bank disposal site capacity. Uncertainty concerning preferences of DEWHA and/or GBRMPA. 	<ul style="list-style-type: none"> Avoids land-based disposal environmental impacts.
Offshore disposal of approx 8–10 Mm ³	<u>Post-SID</u> <ul style="list-style-type: none"> Bathymetry and capacity of East Bank disposal site resurveyed 	<ul style="list-style-type: none"> Requires issuing of sea-dumping permit. Operational time and expense of barging material to East Bank disposal site. Potential generation and propagation of turbid plumes at East Bank. 	<ul style="list-style-type: none"> Resurveyed East Bank shows sufficient capacity for approx. 15 Mm³. Eliminates need for rehandling at Fisherman's Landing. Greatly reduces incidence of turbid plumes in vicinity of reclamation area. Caters for material from Stage 1A Clinton Bypass. Reduces quantity of PASS to be stored in reclamation. Reduces overall volume stored in reclamation, so reduces height and visual impact of 'mound'.

Further to the SID, DEWHA⁹ requested further consideration of alternative dredge disposal options, including a comprehensive assessment of alternative onshore disposal options.

Advice (to-date) from the DIP State Development Areas Branch was that land-based disposal of dredge spoil within the adjacent Yarwun and Targinie Precincts of the GSDA is not an option for consideration as any land currently vacant is of high value and designated for future industrial development.

A residue storage facility location feasibility study¹⁰ for the GSDA undertaken on behalf of the Coordinator-General in 2007. The study investigated a range of sites throughout the GSDA to determine their suitability for the storage of residue waste from industrial processes.

In essence, as residue is transported to fill areas through pipes in a slurry form and left to settle, there is similarity in site options that would be investigated for potential to locate dredge spoil. Any fill areas will have similar land/topographical requirements.

Nine sites within the GSDA were investigated for residue storage potential. Following analysis, it was determined that due to a range of constraints, many of the sites studied are considered either unsuitable or highly constrained for residue storage. An outline of each site's potential is included in the RSF study report.

Disposal to sites further inland is considered impractical due to the considerable cost and energy requirements of pumping spoil; treating it for salinity, PASS and other potential contaminants; and the inherent environmental impacts of land-based disposal including clearing of native vegetation and disturbance of surface and ground water hydrology.

Section 1.7.4 of the EIS explained that five configurations were evaluated and compared for the design of the WBDD Project reclamation area. These are shown in Figure 1.6 of the EIS. Advantages of the final selected configuration included:

- no reclamation of embayment to the north of Fisherman's Landing
- reduced direct impact to seagrasses and other benthic communities north of Fisherman's Landing
- maintenance of intertidal exchange north of Fisherman's Landing

⁹ DEWHA correspondence reference: EPBC 2009/4904

¹⁰ Connell Wagner (2007): *Gladstone State Development Area Residue Storage Facility Study, Final Report*. Prepared for the Coordinator-General, December 2007. Report reference number CW 26210-002.

- maintenance of recreational and commercial fishing access to embayment north of Fisherman's Landing
- 40 m channel retained between reclamation and mainland to retain mangroves, tidal flushing and onshore surface hydrology
- reduced bund construction.

The principal disadvantage of the selected reclamation configuration option is the height of the mound required to contain the total volume of spoil.

GPC has a current sea dumping permit, under the Commonwealth *Environment Protection (Sea Dumping) Act 1981* (Sea Dumping Act) with a limit of 1.0 Mm³ that expires in 2012. During the preparation of the EIS, offshore disposal was not considered an option mainly due to uncertainty concerning the remaining capacity of the GPC East Bank offshore spoil ground. Subsequent to the EIS, GPC resurveyed the spoil ground and ascertained that it has additional capacity of up to 15 Mm³. At the time of this report, GPC was preparing an application for a sea dumping permit, independent of the EIS process, assessed by DEWHA against the Sea Dumping Act for disposal of 8–10 Mm³.

Offshore disposal is considered principally as a mitigating measure to avoid or reduce the necessity for rehandling at Fisherman's Landing of material extracted by TSHD thereby significantly reducing the incidence of turbid plumes and the area of impact on nearby seagrasses, as shown by modelling undertaken for the SID (section 18, SID Figures 18-02 and 18-03). Offshore dumping would have additional benefits including reducing the quantity of PASS requiring storage in the reclamation area and reducing the overall height of the reclamation mound.

However, this report does not assume the issuing of a sea dumping permit and assesses the potential impacts of the project under the scenario as originally presented in the EIS and SID, that is, all dredge spoil material placed within the reclamation area.

Further analysis of the dredge spoil disposal options is provided in sections 2.4.4 and 5.2.3 of this report.

Sediment quality

GPC prepared a Sampling and Analysis Plan¹¹ (SAP—EIS section 7.2 and Appendix L) that provided guidance for the assessment of the contamination status of the material to be dredged, including the appropriate sample collection, handling, storage, analysis methods and quality control requirements.

Comprehensive sediment sampling undertaken for the project (EIS Figures 7-20 and 7-21a-c) detected minor concentrations of anthropogenic contaminants as well as naturally occurring compound.

Elutriate concentrations (metals, metaloids and ammonia) were generally potentially higher within sediments than those recorded in the water column. Therefore mobilisation of elutriates requires monitoring and assessment in the context of the DMP.

Overall, the quality of sediments in the project area is compliant to the National Assessment Guidelines for Dredging (NADG, 2009) and the Environment Investigation Levels (EIL) of the *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland* (DERM, 1998). The only exception was elevated concentrations of manganese within the upper layer of the Stage 1B dredge area, however across the full depth of Stage 1B to be dredged the manganese concentrations were compliant with the guidelines.

Therefore, dredging is not expected to result in the detrimental release of contaminants to the water column.

Acid sulfate soils

The presence of acid sulfate compounds (pyritic material) can result in the formation of a dilute sulphuric acid if exposed to air and allowed to oxidise.

An acid sulfate soils (ASS) study was undertaken for the EIS (chapter 5 and Appendix I). This included sampling and testing of boreholes distributed across the dredge and reclamation area footprints and the

¹¹ (GHD report reference number 42/15386/51958) – prepared with reference to the requirements of the NAGD and the *Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland* (QASSMAC, 1998).

embayment north of Fisherman's Landing (SID, Appendices F and G). The net acidity of each test boreholes is a function of the base pH (acidity) and the acid neutralising capacity (ANC—presence of calcium carbonate) for each site. This study presents the distribution of potential acid sulfate soils (PASS) in the project area

Given the extent of PASS identified in the EIS and the proximity of the works to sensitive marine environments, the dredged material will require careful monitoring and management of potential impacts. This would be controlled by an ASSMP that is to be agreed by DERM and is required as part of the overall construction environmental management plan. A framework for ASS management is presented in the SID Appendix E that has the objective of outlining the principles of ASS management, validation testing and monitoring for bund construction, dredging and the reclamation area.

The ASS study undertaken for the EIS provides sufficient information to commence 3D modelling of the distribution of net acidity to inform the DMP and ASSMP.

The EIS notes a range of measures for consideration in the ASSMP including dredging, bund construction, placement of spoil and ongoing management to reduce the risk of oxidising PASS. These included measures such as: testing of actual ANC of dredged material, identification of high risk PASS to inform the sequence of the dredge campaign, placement of PASS to keep it in a saturated state, thorough mixing and careful placement to ensure optimal neutralising of PASS in the reclamation, neutralisation treatment with lime dosing as required, validation testing of placed sediments, groundwater monitoring of the reclamation to enable early detection of any risk, implementation of a water management strategy for the reclamation to mitigate the risks of contaminated leachate entering marine waters.

In its submission on the SID, DERM recommended that, in order to safely ensure complete saturation, the upper limit for placement of untreated PASS in the reclamation area is the mean low water level (MLW = AHD -1.67 m / RL 0.67 m). DERM is, however, prepared to consider alternative methods of disposal, including alternative water levels provided GPC presents a sufficiently detailed and justified proposal. Further to the SID, GPC is testing the water levels and chemical characteristics of groundwater within the existing adjacent Fisherman's Landing reclamation area in order to inform the placement of dredge spoil to DERM's satisfaction.

I have stated conditions (Appendix 1, Schedule 2, Part 2) that require the proponent to prepare an ASSMP, as a component of the DMP providing detailed information on the distribution, characteristics and management of PASS.

I have also stated conditions (Appendix 1, Schedule 2, Part 2) that sets the upper limit for placement of untreated PASS material within the reclamation area at mean low water (AHD -1.67m / RL 0.67m), unless DERM approves an alternative method of disposal to prevent oxidation of sulphides.

Marine pests

The Port of Gladstone was one of 18 Australian ports targeted for ongoing monitoring of marine pests under the Australian Government's *National System for the Prevention and Management of Marine Pest Incursions*, using new monitoring guidelines produced by the Commonwealth Department of Agriculture, Fisheries and Forestry.

The marine baseline assessment undertaken for the EIS (Appendix Q, Marine ecology report) sought to identify any marine pests of concern. Twenty-five of the 94 sites in the marine survey area were sampled (EIS, Appendix Q, section 3.2.2 and Figure 3.1). However no marine pests were detected during the benthic ecology sampling across the Port Curtis area.

Nonetheless, GPC acknowledges the risk for vessels undertaking the dredging to introduce marine pests to the port and GBRWHA/GBRMP, and has identified mitigating measures to manage this risk including management of marine biofouling agents and ballast and adherence to statutory border controls for incoming vessels.

8.2.3 Coordinator-General's conclusion—world heritage properties

I consider that the hydrodynamic modelling undertaken for the project demonstrates that water levels, flushing characteristics and sedimentary processes of the Western Basin are not significantly affected by the project and would be within the normal bounds that naturally occur as a result of the inherent variability of this coastal and estuarine characteristics of the locality.

I acknowledge that the dredging operation would result in the temporary generation and propagation of turbidity plumes, and that this may adversely impact upon, and result in the loss of benthic ecosystems, including seagrasses, by sedimentation and light attenuation.

I also acknowledge that construction of the reclamation area would result in the direct loss of benthic habitat. Combined with the FLPE project, the reclamation would affect 410 ha of seabed including significant areas of seagrass communities (396 ha). Considered together with the WICT reclamation of 260 ha of intertidal wetlands, this is a significant step change in the character of the landscape of the Western Basin. These impacts are an unavoidable effect of the continuing industrial expansion of the Port of Gladstone and in particular are necessary to accommodate the emerging LNG export industry on Curtis Island. **I note that** the permanent changes to intertidal areas for the WICT project has received EPBC approval. Similarly, **I note that** my evaluation of the FLPE reclamation has recommended approval and that the FLPE project was determined to be a non-controlled action on two occasions (30 January 2001 and 15 August 2004).

I consider that any direct or indirect impact on or loss of loss of benthic ecosystems, including seagrasses, may have consequential adverse effects upon the feeding and breeding behaviour of marine megafauna that use these resources, notably turtles, dugongs and dolphins.

In addition, loss of marine habitat and the reclamation of intertidal foreshore may also impact upon the access and activities of commercial and recreational fishers and boaters that use the area.

I consider that GPC has endeavoured to avoid and/or mitigate the potential adverse impacts on the water quality of world heritage coastal waters, and associated marine ecosystems through a commitment to the combined and coordinated implementation of the DMP, WQMP, seagrass monitoring and a FFMP (see sections 8.4, 8.5 and 5.2 of this report).

I also consider that the mitigating measures contained in the EIS, SID, draft EMP, and draft ASSMP framework (subject to finalisation and approval by relevant agencies) for the proposed project are satisfactory and sufficient to avoid or greatly minimise adverse impacts to the world heritage values for which the GBRWHA is listed.

8.3 National heritage places

8.3.1 Context

National heritage places are listed under the EPBC Act.

The GBRWHA is listed as a national heritage place, within which the project area lies, and has been addressed in section 8.2 of this report.

The Narrows and Balaclava Island, to the north of the project area, are listed as national heritage places and are significant as estuarine tidal passages with mixed mangrove and saltmarsh communities that support a diverse assemblage of estuarine and marine fauna. Both wetlands are included on the Directory of Important Wetlands in Australia (DIWA – DEWHA, 2004).

Impacts due to the project are expected to include a temporary increase in turbidity, for the duration of dredging, and a slight phase shift (in the order of minutes) in the tidal cycle and a slight increase in water level of The Narrows due to the construction of the reclamation area. The project may also interfere with the migratory pathways of marine megafauna that use The Narrows and Port Curtis due to the cumulative development of shipping channels, marine berths and MOFs associated with the emergent LNG and other industries in the Western Basin.

No terrestrial National Heritage places nor wetlands of listed international importance (i.e. 'Ramsar' wetlands) occur in the project area.

8.3.2 Coordinator-General's conclusion—national heritage places

I consider that implementation of the mitigation measures contained in the EIS and SID and GPC's commitment to the combined and coordinated implementation of the EMP and DMP (subject to finalisation and approval by relevant agencies) for the proposed project will avoid or greatly minimise any potential adverse impacts to the national heritage values of the GBRWHA.

8.4 Listed threatened species and communities

8.4.1 Context

The EPBC Act provides protection for listed nationally threatened flora and fauna species and ecological communities, and marine species that occur in Commonwealth marine areas. All cetaceans (dolphins and whales) are protected by the EPBC Act regardless of their listed conservation status. Commonwealth protection is irrespective of the conservation status offered by state legislation.

8.4.2 Listed threatened species

8.4.2.1 Flora

A total of 16 flora species of conservation significance (national and/or state significance) were recorded within five km of the project area, mostly associated with the peak and slopes of Mount Larcom. Of these, three were afforded particular assessment in the EIS (Appendix G, section 4.1.1):

- cycad (*Cycas megacarpa*)—common on Mount Larcom, no records in lower-lying areas closer to the project area, conspicuous when mature
- Bailey's indigo (*Indigofera baileyi*)—occurs in sclerophyll woodlands and open forest on soils derived from basalt and granite, core populations are located south of Fraser Island
- quassia (*Quassia bidwillii*)—occurs in closed forests and vine thickets, usually in association with riparian vegetation and freshwater.

None of these species was identified during the field surveys conducted for the EIS as occurring in the project area. Therefore the project is not expected to impact upon the ecological values of the listed threatened terrestrial bird species.

8.4.2.2 Fauna

Birds

Five EPBC Act-listed threatened bird species were recorded in the project area or identified as likely (≥ moderate likelihood) to occur within the project area. These are:

- yellow chat (Dawson subspecies) (*Epthianura crocea macgregori*)—critically endangered
- squatter pigeon (southern) (*Geophaps scripta scripta*)—vulnerable.

Neither of these species was identified during the field surveys conducted for the EIS. Habitat suitable for each of these species does not occur with the project area.

Therefore the project is not expected to impact upon the ecological values of the listed threatened terrestrial bird species.

Terrestrial mammals

The EIS (Appendix G, section 4.1.2) identified two species of terrestrial mammals considered likely to occur within the project area:

- large-eared bat (*Chalinolobus dwyeri*)—vulnerable
- grey-headed flying fox (*Pteropus poliocephalus*)—vulnerable.

The terrestrial environment of the project area is not considered to be core or significant habitat for either of these species so it is considered highly unlikely that this project will impact on these species.

Marine mammals (whales)

Humpback whales (*Megaptera novaengliae*—vulnerable, migratory) generally occur in offshore areas and are observed off Curtis Island.

One whale species was observed during field surveys conducted for the EIS, near the northern tip of Curtis Island in relatively shallow waters. It was considered most likely to be the melon-headed whale (*Peponocephala electra*).

Given the shallow, inshore location of the Western Basin, it is considered unlikely that whales would inhabit or traverse the project area. Furthermore, due to the vessel traffic associated with port operations and the levels of background turbidity, whale species are likely to avoid the project area. Therefore it is considered highly unlikely that this project will impact on whale species.

Potential impacts on dugongs and dolphins are addressed in section 8.5.2 of this report.

Marine turtles

The EIS (Appendix G, section 4.2, Table 7) identifies EPBC Act-listed threatened marine megafauna possibly found within the project area. Four listed turtle species were identified as possibly occurring within the project area. These are:

- flatback turtles (*Natator depressus*)—vulnerable
- green turtles (*Chelonia mydas*)—vulnerable
- loggerhead turtles (*Caretta caretta*)—endangered
- olive ridley turtle (*Lepidochelys olivacea*)—endangered.

Curtis Island is recognised as a consistent and stable, medium density nesting and breeding area for flatback turtles since monitoring of nesting females began in 1969.

The area is also an important nesting and foraging area for green turtles that prefer to feed on seagrasses so they have a high predicted association with the seagrass beds that occur in the project area.

Records suggest that the project area is an important foraging area for both adult and juvenile marine turtles.

The EIS noted that dredged channels provide resting habitats for turtles.

Marine turtles using the area are subject to a range of potential and probable direct and indirect impacts including degradation and removal of feeding and nesting habitat due to the industrial development of the Gladstone coastline and the Port of Gladstone, decreased water quality from dredging and disturbance of sediments around the construction of the reclamation area, vessel strike and marine pollution.

GPC has proposed a range of mitigation measures including monitoring of water quality turbidity levels and operational response through the DMP, management of stormwater and decant water discharges from the reclamation area, and management of construction noise, vibration and lighting.

Further overall discussion on marine fauna is provided in section 8.5.4 of this report.

8.4.3 Listed threatened ecological communities

Two threatened ecological communities identified from desktop studies to occur in the vicinity the project area:

- semi-evergreen vine thicket (SEVT) of the Brigalow Belt and Nandewar bioregions—classified under the EPBC as an endangered ecological community (EEC), and represented by several SEVT REs
- weeping myall woodlands—classified as an EEC, dominated by myall (*Acacia pendula*) and restricted in Queensland to REs 11.3.2 and 11.3.28.

Neither of these EECs was found to occur directly within the project area.

8.4.4 Coordinator-General's conclusion—listed threatened species and communities

I consider that the project will have some impact on the feeding, nesting or migratory behaviours of the listed threatened species in the vicinity of the project area through the loss and disturbance of benthic communities (i.e. seagrasses) and intertidal foreshore areas.

I note that the nature of impacts to listed threatened marine species, in particular marine turtles, are common to other marine megafauna that use the project area, such as dugongs and dolphins. My general conclusions regarding marine megafauna are included in section 8.5.5 of this report.

Based on the EIS, draft EMP and SIR, **I have stated** conditions (Appendix 1, Schedule 2, Part 4) concerning marine and terrestrial flora and fauna (see also sections 5.2 of this report). In particular, **I require** the proponent to prepare a flora and fauna management plan (FFMP) as a component of the DMP, to be implemented in conjunction with the EMP, DMP and WQMP. The FFMP will focus on species and communities of listed national and state significance. In particular, the FFMP will focus on monitoring seagrass communities, migratory shorebirds (see section 8.5.1) and marine megafauna likely to be directly or indirectly impacted by the project. The FFMP will be integral with water quality monitoring and will be used to inform dredging operations through the DMP.

In response to the cumulative impact assessment in section 6 of this report, **I have imposed** a condition (Appendix 1, Schedule 3, Part 4.4) that requires additional offset measures for shorebirds and marine fauna to be included in the FFMP. Measures could include, but not be limited to:

- enhanced understanding of the displacement of key marine fauna species from affected habitat areas in Western Basin and any associated effects on regional populations
- contribution to species protection programs in the region or the wider bioregion. This may include funding of additional boating and fisheries patrols, education campaigns for recreational fishers on risks of marine fauna boat strike and improved management of key shorebird habitat areas
- contribution to habitat enhancement/restoration actions in the region or the wider bioregion such as 'seagrass friendly' mooring systems, wetland rehabilitation projects and water quality improvement programs.

I have also stated conditions (Appendix 1, Schedule 2, Part 4.4.1) that requires the DMP to provide measures, including use of turtle exclusion devices, to minimise the risk of impacts to turtles.

I consider that GPC has endeavoured to avoid and/or mitigate the potential adverse impacts to listed threatened species and communities through a commitment to the combined and coordinated implementation of the DMP, WQMP, seagrass monitoring and a FFMP (see sections 8.2.3 and 5.2 of this report).

I also consider that the mitigating measures contained in the EIS, SID, draft EMP, and draft ASSMP framework (subject to finalisation and approval by relevant agencies) for the proposed project are satisfactory and sufficient to avoid or greatly minimise adverse impacts to the listed threatened species and communities for which the GBRWHA is listed.

8.5 Listed migratory species

8.5.1 Migratory birds

8.5.1.1 Context

A number of EPBC Act-listed migratory bird species, including migratory shorebirds, occur or are likely to occur in the project area. Suitable habitats include woodlands, riparian vegetation, mangroves and mudflats. The intertidal areas, in particular, are used for foraging and roosting by migratory shorebirds.

The migratory white-throated needletail (*Chaetura caudacuta*) and fork-tailed swift (*Apus pacificus*) are considered likely to forage at the project area when visiting eastern Australia in spring and summer, however the available habitat is not considered important for these species.

The EIS (Table 9-7) identified six migratory marine birds to occur in the project area:

- white-bellied sea eagle (*Haliaeetus leucogaster*)
- osprey (*Pandion cristatus*)

- great egret (*Ardea modesta*)
- Caspian tern (*Hydroprogne caspia*)
- red-necked avocet (*Recurvirostra novaehollandiae*)
- whimbrel (*Numenius phaeopus*).

The EIS (Appendix G, section 4.1.3) also specifically noted three species of migratory shorebirds that have been recorded to use the mudflats in the east of project area for foraging and/or roosting in spring and summer. These include:

- bar-tailed godwit (*Limosa lapponica*)
- red-necked stint (*Calidris ruficollis*)
- eastern curlew (*Numenius madagascariensis*).

The SID (section 16.4.1) noted that the Gladstone region is generally not recognised as an area of international significance for migratory shorebirds. However, while the intertidal mudflats seaward of the fringing mangroves immediately north of the reclamation area provide some feeding and roosting habitat for wading and migratory shorebirds, the area north of Friend Point including The Narrows, further from the industrialised foreshore, is used more extensively.

The EIS (section 9.2.3) and SID (section 16.4.1) noted that potential construction impacts included disruption to wildlife behaviour as a result of light, noise and vibration disturbance particularly associated with the 24/7 construction schedule for the bund wall. The EIS acknowledged that these disturbances can have a significant impact on migratory birds if they restricted access to a limited resource or inhibit natural behaviour during a critical phase of the animal's lifecycle. Appendix S of the EIS (Noise and vibration) notes a study (Larkin, 1996) that observed that some birds may habituate to noises that are not biologically relevant to them. Examples were provided of seabirds that inhabit loud, noisy location such as airports or adjacent to busy motorways.

Proposed mitigation measure to minimise nuisance to wading/migratory bird species include:

- directional control of lighting on the haul route and on the reclamation area
- use of low wattage lighting, glare guards and shielding to minimise light spill.

Further discussion on potential lighting and noise impacts and mitigation is included in section 5.5 (Lighting) of this report.

Concerns were raised in a public submission to the EIS regarding threats to shorebirds due to loss of feeding and roosting habitat and disturbance due to noise, vibration and light.

In response, the SID noted that populations of migratory shorebirds continue to use the project area despite the history of intensive industrial development and port operation, suggesting a degree of adaptation or resilience to persist irrespective of noise and other disturbances.

In its submission on the SID, DEWHA considered that the EIS and SID had not adequately addressed potential impact to migratory birds. In response, GPC has committed to undertaking further monitoring, particularly of migratory shorebirds that may be affected by construction of the reclamation area, during periods when they are known to be locally in transit.

Therefore, **I have stated** a condition (Appendix 1, Schedule 2, Part 4.5) that requires the proponent to specifically undertake seasonal monitoring of migratory seabirds, for the summer season transit period (between October and March), with particular focus on the population peak in January. Monitoring will occur at the localities immediately impacted by the reclamation area, including the embayment immediately north of the reclamation area.

Monitoring will be undertaken within the context of a FFMP for the project (refer to Appendix 1, Schedule 2, Part 4) that will establish a framework for baseline monitoring (including review of historical records), assessment of impact (including threshold triggers), and inform management and operation response, for the duration of the project, to avoid, minimise and/or mitigate impacts to terrestrial and marine flora, fauna and ecosystems.

In response to the cumulative impact assessment in section 6 of this report **I have recommended** that opportunities to provide shorebird habitat within the WBDD Project should be maximised where

practicable, particularly where concurrent impacts are occurring in the vicinity of Friend Point for the pipeline crossing works. In addition, **I have imposed** a condition (Appendix 1, Schedule 3, Part 4.4) that requires additional offset measures for shorebirds to be included in the FFMP.

8.5.1.2 Coordinator-General's conclusion—migratory birds

I acknowledge that the project area is inhabited by EPBC Act-listed migratory birds, however **I am satisfied** that the project area is not an important or critical habitat for the listed migratory species or other shorebirds.

Nonetheless, **I acknowledge** that disturbance to the intertidal foreshore in the vicinity of the reclamation area may impact upon the feeding, breeding and transit of migratory shorebirds.

However, **I am further satisfied that** the mitigation measures, listed in section 9.2.3 the EIS, committed to by GPC will help to minimise any potential impacts on migratory birds species. **I am further satisfied** that the additional conditions for environmental offsets and requirements for monitoring of migratory shorebirds in the context of a FFMP for the project, will assist to inform appropriate ongoing mitigation and management measures with regard to migratory shorebirds.

8.5.2 Migratory mammals

Dugongs and dolphins

The following EPBC Act-listed migratory marine mammal species were identified as likely or possibly occurring in the project area:

- dugong (*Dugong dugon*)
- Australian snubfin dolphin (*Orcaella heinsohni*)
- Indian bottlenose dolphin (*Tursiops aduncus*)—EPBC Act-listed as cetacean only.

The Indo-Pacific humpback dolphin (*Sousa chinensis*) and Australian snubfin dolphin (*Orcaella heinsohni*) have also been recorded from the Gladstone region. Both species share a similar coastal niche and have been recorded from the Gladstone region (EIS, Appendix R, section 3.3.1).

The project area is located at the northern limit of the Rodds Bay Dugong Sanctuary, which is a Zone B (restricted use) Dugong Protected Area (DPA) declared under the Fisheries Act. The Gladstone coastline and the Rodds Bay DPA are recognised as important habitat for dugong populations despite being within and closely associated with commercial port activities.

Concerns were raised in several EIS submissions relating to potential marine megafauna impacts. These included:

- direct (reclamation) and indirect (increased sedimentation/disturbance) loss of marine megafauna migratory, feeding habitat, including snubfin and Indo-Pacific humpback dolphin habitats in the Western Basin
- increased potential for boat strike of megafauna resulting from increased vessel traffic.

In response to the EIS submissions, the SID provided by GPC addressed the issues raised.

Dugongs are considered more vulnerable to potential impacts than dolphins due to the loss of seagrass resources. Dolphins are highly mobile species and not as vulnerable to boat strike injuries or mortality as dugongs. However the project is not expected to significantly increase the risk of boat strike as the dredging activities are conducted by slow moving vessels with conspicuous noise and lighting. The EIS has recommended that enforced vessel lanes with speed restrictions be designated for the construction and operation phases to protect megafauna from boat strike and undue disturbance. In addition, vessel movements in the port are under the control of the Regional Harbour Master Gladstone (MSQ).

The SID (section 16.5.1) notes that some invertebrates and fish species may be attracted to construction and dredging lighting, which may in turn attract feeding dolphins. Marine fauna currently exist with extensive industrial and commercial lighting in the Port of Gladstone with no observed detrimental effect noted.

Potential impacts to dugongs and dolphins are similar to those for other marine megafauna species. Further overall discussion on marine fauna is provided in section 8.5.4 of this report.

8.5.3 Migratory reptiles

The estuarine crocodiles (*Crocodylus porosus*) is identified as possibly occurring in the project area, however it is nearing the southern limit of its known extent. Suitable habitat for this species occurs in and within the vicinity of the project area, including The Narrows.

Given the highly mobile nature of the species, the very small area of habitat to be affected, the disturbed/urban nature of the site and ongoing presence of marine vessel traffic, the project is considered unlikely to affect this species.

8.5.4 Marine megafauna—general statements

The EIS acknowledges that the project, and the cumulative effect of other proposed industrial developments in the Port Curtis area, will impact upon marine megafauna that use the area. Adjacent areas, such as the Narrows and Rodds Bay, will therefore become increasingly important habitats to support animals no longer or less able to use the Western Basin.

In particular, key potential impacts to marine megafauna are identified due to direct removal of foraging, feeding and inter-nesting habitat for dugongs and turtles, decline in water quality from dredging and construction disturbance, and increase in sedimentation that may result in smothering of seagrasses and other benthic communities.

The increase in vessel traffic (dredges and other shipping traffic), and increased reclamation (WBDD Project and FLPE project) may affect safe migratory passage in the project area.

The additional lighting and underwater noise disturbance from vessel traffic, construction, and operation of other Western Basin project may further disturb or displace megafauna.

To address these potential impacts, GPC has proposed a range of mitigation strategies including:

- monitoring of water quality turbidity levels and adaptive management of dredging operations to minimise impacts through a DMP
- dredge head technology to deflect or avoid interaction with resting turtles and other megafauna
- strategies to decrease the risk of trapping animals in the reclamation and manual removal of any marine fauna from the reclamation area prior to closure of the bund wall
- management of stormwater, waste and other pollutant discharges
- management of construction noise, vibration and lighting
- education of the construction workforce regarding the risks to marine megafauna and the requirement to avoid unnecessary interaction with those species.

A review of underwater noise impacts studies was undertaken for the project, in relation to in-water construction works completed for other shallow marine dredging and reclamation works projects¹². That review examined the acoustic intensity and frequency of noise sources relative to the known sensitivity ranges for marine mammals. The study indicated that of all potential noise generating activities pile driving was most likely to have an impact. Pile driving would be used to install approximately 19 navigational channel marker navigation aids for newly dredged shipping channels and to construct jetty/wharf facilities for proposed LNG facilities. Wharf construction for GPC is not being undertaken for the project.

Precautionary mitigation measures, including soft-start pile driving, use of spotters, no pile driving if megafauna are within 5 m, and use of warning noises prior to pile driving, are to be included in the EMP for the project.

¹² SVT Engineering Consultants (January 2010): *QCLNG Gladstone Channel Underwater Noise Assessment*. Prepared for the BG Group. Report reference Rpt01-0951823-Rev2-20 Jan 2010.

To confirm GPC's commitments **I have stated** conditions concerning seagrass monitoring and research, water quality monitoring, and marine megafauna monitoring in the Western Basin (Appendix 1, Schedule 2, Parts 3 and 4).

In addition, **I have stated** a condition (Appendix 1, Schedule 2, Part 4) that requires the proponent to prepare a FFMP, to be included in the EMP framework for the project.

The studies for inclusion in the FFMP include (but are not limited to) the following:

- Continue annual long-term seagrass monitoring surveys of seagrass distribution and abundance in the Port of Gladstone.
- Undertake ongoing monitoring to assess marine megafauna inhabitation of the Western Basin. The extent, methods and timing of monitoring should be similar to the programs undertaken for the EIS.
- Monitor light spill and underwater noise impulse during bund construction and during the first stages of dredging and reclamation and conduct research on the effects of light and noise on marine megafauna.

In response to the cumulative impact assessment in section 6 of this report, **I have imposed** a condition (Appendix 1, Schedule 3, Part 4.4) that requires additional offset measures for marine fauna to be included in the FFMP. Measures could include, but not be limited to:

- enhanced understanding of the displacement of key marine fauna species from affected habitat areas in Western Basin and any associated effects on regional populations
- contribution to species protection programs in the region or the wider bioregion. This may include funding of additional boating and fisheries patrols and education campaigns for recreational fishers on risks of marine fauna boat strike
- contribution to habitat enhancement/restoration actions in the region or the wider bioregion such as 'seagrass friendly' mooring systems, wetland rehabilitation projects and water quality improvement programs.

I consider that the positive outcomes resulting from the FFMP would additionally mitigate the potential impacts on matters of national environmental significance relating to the project.

8.5.5 Coordinator-General's conclusion—migratory mammals and reptiles

I consider that the loss of marine habitat would have a consequential impact upon the feeding and breeding behaviour of marine megafauna, notably turtles and dugongs, and to a lesser extent dolphins. Also, the additional obstruction of the northern Western Basin due to construction of the reclamation area, and an increase in vessel traffic associated with dredging, may impede the migratory pathways of marine fauna using the Narrows and Port Curtis.

I have stated conditions (Appendix 1, Schedule 2, Part 4) to ensure that the proponent prepares and implements a FFMP for the duration of the project that will establish a framework for baseline monitoring (including review of historical records), assessment of impact (including threshold triggers), and inform management and operation response, to avoid, minimise and/or mitigate impacts to terrestrial and marine flora, fauna and ecosystems.

I consider that GPC has endeavoured to avoid and/or mitigate the potential adverse impacts on the migratory fauna that use the project area through a commitment to the combined and coordinated implementation of the DMP, WQMP, seagrass monitoring and FFMP.

I also consider that the mitigating measures contained in the EIS, SID, and draft EMP for the proposed project are satisfactory and sufficient to avoid or greatly minimise adverse impacts to the migratory fauna for which the GBRWHA is listed.

Therefore, **I conclude** that the project does not pose a significant risk to populations of dugongs, dolphins and other marine megafauna such as turtles in the project area or wider Port Curtis area.

8.6 Potential environmental offsets for MNES

8.6.1 Context

The draft Commonwealth policy statement *Use of environmental offsets under the Environment Protection and Biodiversity Conservation Act 1999* provides guidance on projects that may trigger consideration of an offset by the Commonwealth Government. The policy states:

Environmental offsets are not applicable to all approvals under the EPBC Act. Each approval must be assessed on a case-by-case basis and must take into account the scale and intensity of impact from the development on the site and the potential for conservation outcomes through offsets. They should not be applied when the impacts from the development are considered to be minor in nature or could reasonably be mitigated.

Based on the findings of the EIS, **I consider** the proposed project would cause a degree of unavoidable impact to matters of national environmental significance relating to the project area, in particular, the direct loss of 902 ha of benthic habitat (including 258.8 ha of seagrasses) due to dredging and construction of the reclamation area. An additional 5416 ha of benthic habitat (including 1406 ha of seagrasses) may be indirectly lost in the short to medium term due to turbidity plume impacts such as light attenuation and sedimentation.

The loss of marine habitat would have a consequential impact upon the feeding and breeding behaviour of marine megafauna, notably turtles, dugongs and dolphins. Also, the additional obstruction of the northern Western Basin due to construction of the reclamation area, and an increase in vessel traffic associated with dredging, may impede the migratory pathways of marine fauna using The Narrows and Port Curtis. Disturbance to the intertidal foreshore in the vicinity of the reclamation area may also impact upon the feeding, breeding and transit of migratory shorebirds. However, the mitigation measures identified in the EIS and SID, for inclusion in the EMP, DMP and other operational management plans aim to reduce the extent of loss.

In accordance with the Queensland Government Environmental Offsets Policy (QGEOP), the State Government requires an environmental offset to counterbalance unavoidable negative environmental impacts that result from an activity or a development. The specific-issue State Government offset policy that applies to marine habitat is the *Fish Habitat Management Operational Policy FHMOP 005 – Mitigation and Compensation for Works for Activities Causing Marine Fish Habitat Loss*, under the Fisheries Act. This policy, administered by DEEDI (Fisheries Queensland), details mitigation measures for the conservation and enhancement of fisheries resources and fish habitats.

8.6.2 Coordinator-General's conclusion—potential environmental offsets for MNES

I acknowledge that the dredging operation would result in the temporary generation and propagation of turbidity plumes, and potentially mobilise contaminants that are within the marine sediments, and that this may adversely impact upon, and result in the loss of benthic ecosystems, including seagrasses, by sedimentation and light attenuation.

I also acknowledge that construction of the reclamation area would result in the direct loss of benthic habitat.

Therefore, **I consider** that any direct or indirect impact on or loss of loss of benthic ecosystems, including seagrasses, may have consequential adverse effects upon the feeding and breeding behaviour of marine megafauna that use these resources, notably turtles, dugongs and dolphins.

As part of the EIS, GPC investigated and calculated a series of offset opportunities in the local area for cumulative loss of marine fish habitat associated with the WBDD Project, the FLPE project and the WICT project. The proposed offsets also factor the dredging components (e.g. of MOFs) for those LNG projects proposed for the Western Basin that were considered with the WBDD Project. These potential offsets are discussed in detail in chapter 6 of this report.

I note the Commonwealth Government may require an offset, in accordance with Commonwealth policy, for the residual impacts, including the net loss of benthic habitat within the reclamation area.

I have stated conditions (Appendix 1, Schedule 3, Part 4) that requires the proponent to submit a package of offsets for the loss of marine habitat. Specifically, **I have imposed** a condition (Appendix 1, Schedule 3, Part 4.4) that requires additional offset measures for shorebirds and marine fauna to be included in the FFMP. Measures could include, but not be limited to:

- enhanced understanding of the displacement of key marine fauna species from affected habitat areas in Western Basin and any associated effects on regional populations
- contribution to species protection programs in the region or the wider bioregion. This may include funding of additional boating and fisheries patrols, education campaigns for recreational fishers on risks of marine fauna boat strike and improved management of key shorebird habitat areas
- contribution to habitat enhancement/restoration actions in the region or the wider bioregion such as 'seagrass friendly' mooring systems, wetland rehabilitation projects and water quality improvement programs.

9. Conclusion

Having regard to the documentation provided and commitments made by GPC during the EIS process for the Western Basin Dredging and Disposal project, **I am satisfied** that the requirements of the Queensland Government for impact assessment in accordance with the provisions of part 4 of the SDPWO Act have been met.

The EIS process has provided sufficient information to the State Government, Gladstone Regional Council and the community to allow evaluation of potential environmental impacts that could be attributed to the project.

I am satisfied that careful management of the key dredging, construction, reclamation and operational activities should ensure that potential environmental impacts will be minimised or avoided.

GPC has developed a draft EMP (which will be progressed further to detailed planning and design) to address specific environmental issues identified during the EIS process associated with the construction and operation of project. GPC has committed to finalising the project EMP in consultation with other relevant agencies.

In reaching a conclusion on the acceptability or otherwise of the management of potential impacts of the project, **I have considered** the draft EMP and requirements for a DMP.

Where necessary, **I have stated and imposed** conditions that GPC and other relevant entities are to implement.

On the basis of the information provided, including that from advisory agencies, **I am satisfied** that the potential environmental impacts associated with the project are able to be addressed through:

- implementation of stated conditions listed in Appendix 1, Schedule 1 of this report as conditions for aspects of the project that are subject to a development approval under the SPA for material change of use for ERA 16 (dredging)
- implementation of conditions listed in Appendix 1, Schedule 2 of this report as conditions for aspects of the project that are subject to a development approval under the SPA for operational works (tidal) and includes conditions for a DMP, ASSMP, WQMP and FFMP
- implementation of conditions listed in Appendix 1, Schedule 3 of this report as imposed conditions for aspects of the project that are not subject to development assessment under SPA, including finalisation and implementation of the project EMP.

With respect to the options proposed by APLNG in the Addendum to the EIS for its access channel and berthing arrangements, **I do not approve** Option 1B.

I consider that the proposed Western Basin Dredging and Disposal project is a central component of the Port of Gladstone Western Basin development and is essential to the future development of maritime industries and services in the Port of Gladstone and in particular for development associated with the emerging LNG industries.

I consider that, on balance, the proposed dredging and disposal project would provide an important general economic benefit to the Gladstone and Central Queensland economy by expanding the capacity and increasing the efficiency of the Port of Gladstone to cater for new and emerging port-based industries.

I note my decision (25 May 2010) to approve the EIS in full for the adjacent FLPE project and recommend that it may proceed.

I note that aspects of the project, in particular the dredging methodology to be included in the DMP and the program for placing, monitoring and managing dredge spoil into the reclamation area, as described in the EIS documentation, require additional detailed design before the project can be implemented. However, **I consider** that the information presented during the EIS process is sufficient to enable my approval of the EIS.

Therefore, **I recommend** that the Western Basin Dredging and Disposal project, as described in detail in the EIS and summarised in section 2 of this report, can proceed, subject to the conditions contained in Appendix 1 of this report.

In the event of any inconsistencies between the EIS documents and the recommended requirements in this report, the recommended requirements in this report prevail.

GPC and its agents must implement the conditions and recommendations of this report and all commitments presented in the EIS, SID, EMP and DMP.

Under the provisions of part 9 of the EPBC Act, the Commonwealth Minister may approve or refuse the taking of the proposed action. In approving a proposed action, the Commonwealth Minister may attach conditions to the approval if he is satisfied that the condition is necessary or convenient to protect a matter of national environmental significance, or to repair or mitigate damage to a matter of national environmental significance.

Copies of this report will be issued to:

- GPC, in accordance with section 35(5)(a) of the SDPWO Act
- the Commonwealth Minister for the Environment, Heritage and the Arts to make an assessment of the controlled action for the purposes of part 9 of the EPBC Act, in accordance with section 17(2) of the SDPWO Regulation
- the shareholding Ministers for GPC—the Queensland Treasurer and Minister for Employment and Economic Development, and the Queensland Minister for Transport.

Copies of the report will be also issued to agencies responsible for implementation of approvals and conditions including:

- DERM
- DEEDI
- DTMR
- GRC.

Other advisory agencies and public submitters who participated in the EIS process will be notified about the availability of this report.

In accordance with section 35(5)(b) of the SDPWO Act, a copy of this report will also be made available to the public on the DIP Significant Projects web site at www.dip.qld.gov.au/projects

10. Acronyms and abbreviations

The following acronyms and abbreviations have been used in this report:

2D	two dimensional
3D	three dimensional
24/7	24 hours per day, seven days per week
AHD	Australian height datum
ANC	acid neutralising capacity
ANZECC	Australia and New Zealand Environment and Conservation Council
APLNG	Australia Pacific LNG
ARI	average return interval
ASS	acid sulfate soils
ASSMP	acid sulfate soils management plan
AtoN	aid to navigation
BTEX	benzene, toluene, ethylbenzene and xylenes
CAMBA	China–Australia Migratory Birds Agreement
CASA	Civil Aviation Safety Authority
CCC	Capricorn Conservation Council Inc.
CG	The Coordinator-General of the State of Queensland
CHMP	cultural heritage management plan (under the <i>Aboriginal Cultural Heritage Act 2003</i>)
CO ₂ -e	carbon dioxide equivalent
Coastal Act	<i>Coastal Protection and Management Act 1995</i>
CSD	cutter suction dredge
CSMP	construction safety management plan
dB	decibel (unit of noise measurement)
dB(A)	acceptable decibels (unit of noise measurement)
DEEDI	Department of Employment, Economic Development and Innovation
DERM	Department of Environment and Resource Management
DEWHA	(Commonwealth) Department of the Environment, Water, Heritage and the Arts
DIP	Department of Infrastructure and Planning
DIWA	Directory of Important Wetlands (DEWHA, 2004)
DMP	dredge management plan
DO	dissolved oxygen
DPA	Dugong Protection Area
DTMR	Department of Transport and Main Roads
EEC	endangered ecological community (under the EPBC Act),
EIA	environmental impact assessment
EIL	environmental investigation levels (contaminants)
EIS	environmental impact statement
EMP	environmental management plan
EMS	environmental management system
EP Act	<i>Environmental Protection Act 1994</i>
EPBC Act	<i>Environment Protection and Biodiversity Conversation Act 1999</i> (Cwlth)
EPP	Environmental Protection Policy
EP Reg	Environmental Protection Regulation 1998
ERA	Environmentally Relevant Activity
ERP	emergency response plan
FBA	Fitzroy Basin Association
FFMP	flora and fauna management plan
FHA	fish habitat area (declared under the <i>Fisheries Act 1994</i>)
FLPE	Fisherman's Landing Port Extension
GBRCMP	Great Barrier Reef Coast Marine Park (State)
GBRMP	Great Barrier Reef Marine Park
GBRWHA	Great Barrier Reef World Heritage Area
GHG	greenhouse gas
GLNG	Gladstone LNG Santos (LNG proponent)
GPC	Gladstone Ports Corporation Limited (the proponent)

GRC	Gladstone Regional Council
GSDA	Gladstone State Development Area
ha	hectare
HAT	highest astronomical tide
IAS	initial advice statement
IDAS	Integrated Development Assessment System (of the <i>Sustainable Planning Act 2009</i>)
IMO	International Maritime Organisation
ISQG	Interim Sediment Quality Guidelines
JAMBA	Japan–Australia Migratory Birds Agreement
KAMBA	Korea–Australia Migratory Bird Agreement
km	kilometre
L_{\max}	maximum noise level
LAT	lowest astronomical tide
LNG	liquefied natural gas
$\mu\text{g/L}$	microgram per litre
m^3	cubic metre
MCU	material change of use (under SPA)
MDL	mining development
MHWS	mean high water spring (tide level)
ML	mining lease
ML(A)	mining lease application
MLWS	mean low water spring (tide level)
mm	millimetre
Mm^3	million cubic metres
MNES	matters of national environmental significance
MOF	marine offloading facility
m/s	metres per second
Mt	million (or ‘mega’) tonnes
Mtpa	million (or ‘mega’) tonnes per annum
MWL	mean water level
NAGD	National Assessment Guidelines for Dredging (DEWHA, 2009)
NC Act	<i>Nature Conservation Act 1994</i>
NC(W) Reg	Nature Conservation (Wildlife) Regulation 1994
NEPC	National Environmental Protection Council
NEPM	National Environmental Protection Measures
NODGD	National Ocean Disposal Guidelines for Dredged Material, superseded by NAGD (Environment Australia, 2002)
NTU	nephelometric turbidity unit (measure of water quality/turbidity)
OLS	obstacle limitation surface (aviation)
ORP	oxidation reduction potential
PAH	polycyclic aromatic hydrocarbon
PASS	potential acid sulfate soils
PCB	polychlorinated biphenyl
PCCC	Port Curtis Coral Coast Native Title Claim Group
PCIMP	Port Curtis Integrated Monitoring Program
QASSIT	Queensland Acid Sulfate Soil Investigation Team
QASSMAC	Queensland Acid Sulfate Soil Management Advisory Committee
QER	Queensland Energy Resources Ltd
QGEOP	Queensland Government Environmental Offsets Policy
QPIF	Queensland Primary Industries and Fisheries (part of DEEDI)
QGC	Queensland Curtis LNG project
QSIA	Queensland Seafood Industry Association
QWQG	Queensland Water Quality Guideline (2006)
RE	regional ecosystem
RHM	Regional Harbour Master
RIA	road impact assessment
RMP	risk management plan
RL	relative level
RSF	residue storage facility

SAP	sampling and analysis plan
SDPWO Act	<i>State Development and Public Works Organisation Act 1971</i>
SEVT	semi-evergreen vine thicket
SID	supplementary information document
SPA	<i>Sustainable Planning Act 2009</i>
SPL	strategic port land
SPP	State Planning Policy
SPR	Sustainable Planning Regulation 2009
SRTAP	seagrass research technical advisory panel
GRC	Gladstone Regional Council
TBT	tributyl-tin
TIA	<i>Transport Infrastructure Act 1994</i>
TMP	traffic management plan
TOR	terms of reference
TSHD	trailing suction hopper dredge
TSS	total suspended solids (measure of water quality/turbidity)
TV	trigger value (water quality)
VMA	<i>Vegetation Management Act 1999</i>
VTs	vessel traffic service
WBDD Project	Western Basin Dredging and Disposal Project (the project)
WBMP	Western Basin Master Plan
WICT	Wiggins Island Coal Terminal
WQMP	water quality management plan
WQO	water quality objective

Appendix 1. Conditions

Schedule 1—Coordinator-General's stated conditions for material change of use

Schedule 2—Coordinator-General's stated conditions for operational works

Schedule 3—Coordinator-General's imposed conditions

Schedule 1. Coordinator-General's stated conditions for material change of use

This schedule provides the Coordinator-General's recommended stated conditions, pursuant to part 4, division 4 of the *State Development and Public Works Organisation Act 1971*, that apply to the Western Basin Dredging and Disposal Project (WBDD Project).

The development approval is for an environmentally relevant activity, ERA 16 'extractive and screening activities', (i.e. dredging), pursuant to the *Environmental Protection Act 1994* (EP Act) and is assessed by the Department of Environment and Resource Management (DERM) as concurrence agency under the *Sustainable Planning Act 2009* (SPA).

These conditions are taken to be concurrence agency conditions for ERA 16, consisting of dredging a total of 1000 tonnes or more of material from the bed of naturally occurring surface waters in a year.

The Chief Executive of DERM is the entity with jurisdiction for these conditions.

To simplify presentation, this Schedule 1 is divided into five parts as follows:

- Part 1. General conditions for the dredging, which establish the general responsibilities of parties to these conditions
- Part 2. General conditions for the dredge management plan (DMP): ERA 16 must be conducted in accordance with a DMP
- Part 3. Conditions that establish the standard of equipment to be used for the dredging.
- Part 4. Environmental harm, which ensures that the general environmental duty of care under the EP Act applies to the project.
- Part 5. Complaint response, which ensures that measures are implemented to appropriately respond to public complaints.

Note that some conditions in each part could also have some relevance to the other schedules and parts and are cross-referenced accordingly.

Part 1. Dredging – general

- Condition 1 This approval is granted for the environmentally relevant activity of dredging for the purpose of construction, operation and maintenance of lawful structures associated with the Western Basin Dredging and Disposal Project.
- Condition 2 The Gladstone Ports Corporation Limited must maintain direction of any personnel carrying out an activity authorised by this permit.
- Condition 3 All dredging plant personnel must be trained and made aware of the conditions of this approval.

Part 2. Dredging Management Plan – general (see Schedule 2, Part 1)

- Condition 4 Any dredging conducted under this approval must comply with:
- a) an approved dredge management plan (DMP)
 - b) the National Assessment Guidelines for Dredging (NAGD, 2009)
 - c) Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland (EPA, 1998).
- Condition 5 The project must be carried out generally in accordance with the Western Basin Dredging and Disposal Project Environmental Impact Statement (EIS) (November 2009) for the project, and the Western Basin Dredging and Disposal Project EIS Supplementary Information Document (SID) for the project (April 2010), and Appendices 1 and 2 of this report.

- Condition 6 The final placement of all dredge spoil must occur within the reclamation area defined in the EIS, or at an approved sea dumping site.

Part 3. Equipment (use, measures and maintenance)

- Condition 7 Any dredging conducted under this approval must use equipment that is equal to or better than the following equipment being the minimum technical standard.

- a) Cutter Suction Dredge (CSD) – minimum technical specification:
 - i) Vessel must have electronic positioning system for defining the location and depth of dredging activities. Vessel must have a continuous connection, for example, a floating or submerged pipeline, to an approved placement site.
 - ii) Vessels must have a system or process to ensure the delivery system integrity is maintained at all times.
 - iii) Vessel must have systems for determining solids water ratio or density of dredged material during operations. Vessel must be registered and in survey with the International Maritime Organisation (IMO).
 - iv) Vessel must be registered and in survey with the IMO
- b) Trailing Suction Hopper Dredge (TSHD) – minimum technical specification:
 - i) Below keel discharge of tailwaters via an anti-turbidity control valve.
 - ii) Vessel must have on-board systems for determining solids to water ratio or density of dredged material.
 - iii) Vessel must have electronic positioning system for defining the location and depth of dredging activities. Dredge heads must be capable of, and have fitted, fauna exclusion devices, including but not limited to, turtle deflectors.
 - iv) Vessel must be registered and in survey with the IMO.

- Condition 8 The registered operator of the ERA to which this development approval relates must:
- a) install all measures, plant and equipment necessary to ensure compliance with the conditions of this approval
 - b) maintain such measures, plant and equipment in a proper and efficient condition
 - c) operate such measures, plant and equipment in a proper and efficient manner.

Part 4. Environmental harm – general

- Condition 9 Dredging activities must not cause damage to banks or other natural coastal features.

- Condition 10 Any direct or indirect discharge, including water and anything in water, from the reclamation area must not cause any or all of the following:

- a) environmental harm
- b) adverse impacts on water quality objectives that apply to the area surrounding the containment site
- c) sediment build up or erosion of any land including the bed of any receiving waters (see Schedule 2, Part 5).

- Condition 11 The release of airborne contaminants from the activity must not cause environmental nuisance.

- Condition 12 Noise from the activity must not cause environmental nuisance.

Part 5. Complaint response (see Schedule 3, Part 6)

Condition 13 The operator of the ERA must record the following details for all complaints received and provide this information to the administering authority on request:

- a) time, date, name and contact details of the complainant
- b) reasons for the complaint
- c) physical location of the area and/or source of the subject of the complaint
- d) any investigations undertaken
- e) conclusions formed
- f) any actions taken.

END OF COORDINATOR-GENERAL'S STATED CONDITIONS FOR MCU FOR ERA 16, SCHEDULE 1

Schedule 2. Coordinator-General's stated conditions for operational works (tidal)

This schedule provides the Coordinator-General's recommended stated conditions, pursuant to part 4, division 4 of the *State Development and Public Works Organisation Act 1971* (SDPWO Act) that apply to the Western Basin Dredging and Disposal Project (WBDD Project).

These conditions are taken to be concurrence agency development approval conditions for operational works (tidal), consisting of the following components:

- 1) works pursuant to part 5, division 2 of the *Coastal Protection and Management Act 1995*, assessed by the Department of Environment and Resource Management (DERM) as concurrence agency under the *Sustainable Planning Act 2009* (SPA) including:
 - dredging
 - bund wall construction
 - reclamation.
- 2) works requiring the removal, construction or damage of marine plants, under the *Fisheries Act 1994*, assessed by the Department of Employment, Economic Development and Innovation (DEEDI) as concurrence agency under SPA.

To simplify presentation, this Schedule 2 is divided into five parts as follows:

- Part 1. Dredge management plan (DMP), which ensures that the DMP is finalised and carried forward for the construction and operational phases of the project.
- Part 2. Acid sulfate soils management plan (ASSMP), which ensures that the ASSMP is finalised and carried forward for the construction and operational phases of the project.
- Part 3. Water quality management plan (WQMP), which ensures that the WQMP is finalised and carried forward for the construction and operational phases of the project.
- Part 4. Flora and fauna management plan (FFMP), which ensures that the FFMP is finalised and carried forward for the construction and operational phases of the project.
- Part 5. Construction and operations, which provides additional conditions for the construction of the bund wall and the disposal of spoil that are not otherwise considered by other operational works conditions (e.g. construction noise, vibration, light and air quality etc.).

Note that some conditions in each part could also have some relevance to the other schedules and parts and are cross-referenced accordingly.

Part 1. Dredge Management Plan (DMP) (see Schedule 1, Part 2, and Schedule 3, Part 1)

1.1 DMP – General

- Condition 1 The DMP may be a part of another environmental management plan (EMP) or environmental management system (EMS) that applies to the activity or the business of the port authority generally.
- Condition 2 The proponent must comply with all requirements of an approved DMP.
- Condition 3 The DMP must achieve the following outcomes:
- a) significant and sensitive receptors, including but not limited to, wetland and ecosystem features, in the port area are identified, mapped and included in the DMP.
 - b) risks to environmental values are identified and managed
 - c) control measures for construction and operations to minimise likelihood of environmental harm are in place

- d) the impacts of dredging operations are monitored through the ASSMP, WQMP and FFMP (see Schedule 2, Parts 2, 3 and 4)
 - e) contingency plans and emergency procedures are in place
 - f) organisational structure and responsibility is recorded
 - g) effective communication both internally and with the administering authority and other stakeholders
 - h) appropriate records relating to all aspects of the dredging operation, including monitoring, management and maintenance are kept
 - i) environmental performance is reviewed periodically and continual improvement measures applied accordingly
 - j) the proponent must ensure that the construction of the works is carried out only by means of suitable plant and equipment.
- Condition 4 The DMP must provide detailed information of the selection of dredge type, disposal options and operational constraints and location for each particular dredging stage or sections.
- Condition 5 In addition to DERM, DEEDI (Fisheries Queensland) must also be consulted in the preparation of the DMP.
- Condition 6 Where construction and dredging methods with lower environmental impacts are identified to be practical, these methods should be implemented.
- Condition 7 The DMP must specify events, based upon results of water quality and seagrass monitoring, when dredging operations must be varied or ceased to prevent an adverse impact on the environment or water quality, and the actions required to be taken.
- Condition 8 The DMP must address future maintenance dredging requirements and cumulative impacts of other dredging that may occur consequential to the project.
- Condition 9 Dredging must not commence until provision has been made to lawfully place or dispose of the dredge material.

1.2 Dredge operations

- Condition 10 The DMP must ensure:
- a) use of CSD or backhoe dredge should be maximised to the greatest practicable extent in shallow areas of areas of high ecological sensitivity
 - b) use of TSHD operating in overflow mode must be reduced to the minimum necessary based on technical considerations including
 - i) characteristics of spoil material
 - ii) maintenance of access to shipping channels
 - iii) pumping distances
 - c) when dredging in predominantly silty material, TSHD will not operate in overflow mode for a period in excess of 30 minutes per cycle
 - d) use of backhoe dredger will be undertaken in a manner that does not cause turbidity greater than TSHD in overflow mode
 - e) final placement of dredged material in the reclamation area must not use rehandling, that is of bottom dumping, off Fisherman's Landing and subsequent re-dredging using a CSD
 - f) where it is necessary for rehandling of the material to occur, the material will be placed into an alternative rehandling area, in the vicinity of North China Bay, during the last hour of flood tide and the first three hours of the ebb tide. In addition, the maximum total quantity of material to be rehandled will be limited to 1.5 million m³

- g) in the event that offshore disposal is permitted under the under the Commonwealth *Environmental Protection (Sea Dumping) Act 1981*, the maximum volume of material to be rehandled will be limited to 100,000 m³ unless a higher volume is approved by DERM.

Condition 11 Regarding the use of the TSHD , the following factors will be considered:

- a) overflow dredging with TSHD shall be permitted provided that monitoring of the turbidity levels within the harbour demonstrate that the levels of turbidity are compliant with the general conditions
- b) where turbidity levels exceed the accepted levels at sensitive sites, dredging will be limited to overflow dredging on ebb tide periods and dredging without overflow on flood tide periods, provided the accepted turbidity levels are achieved as a result of the revised dredging practice
- c) in the event that the modified practice does not achieve the required levels, use of TSHD should be limited to non-overflow dredging.

1.3 DMP reporting and auditing

Condition 12 The operator must maintain a record of sites where dredging is carried out and the volumes of material removed, and submit them to the Gladstone Ports Corporation Limited on completion of each dredging program authorised under this approval.

Condition 13 The Gladstone Ports Corporation Limited must keep the records provided to it under condition 12 and attach them to the annual return or deliver them to the administering authority (DERM) upon request from the administering authority.

Condition 14 Data collected under the DMP, including but not limited to the results of testing and monitoring, must be submitted to the administering authority when any of the following occurs:

- a) a test indicates the presence of a contaminant under the National Assessment Guidelines for Dredging (NAGD, 2009) or any revision of this guideline
- b) with the annual return.

1.4 Northern extent of Stage 2 dredge footprint

Condition 15 The northern extent of the dredge footprint of Stage 2 will be limited to an extent that does not encroach on the proposed extension of the GSDA across The Narrows, with the extent of the final Stage 2 dredge footprint to be negotiated between GPC and DIP to account for any required safety or operational buffer requirements.

Part 2. Acid sulfate soils management plan (ASSMP)

Condition 16 Dredging and disposal of sediments containing potential acid sulfate soils (PASS) must be undertaken in accordance with a site-specific acid sulfate soil management plan (ASSMP) for the project approved by DERM and incorporated into the DMP (see Schedule 1 and Schedule 2, Part 1).

Condition 17 The ASSMP will be prepared as a component of the DMP and implemented in conjunction with the EMP, DMP and WQMP for the project (see Schedule 2, Part 1).

Condition 18 The ASSMP must be prepared and approved in consultation with DERM prior to commencement of any part of the construction of the reclamation area.

Condition 19 Preparation of the ASSMP and any ASS investigations must be conducted in accordance with:

- a) State Planning Policy 2/02: Planning and Managing Development Involving Acid Sulfate Soils

- b) the SPP 2/02 Guideline: Acid Sulfate Soils, and with reference to the Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils in Queensland (Ahern et al. 1998)
- c) the Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines (Dear et al., 2002)
- d) Instructions for the Treatment and Management of Acid Sulfate Soils (Queensland Government Environmental Protection Agency, 2001) or any updates of them as they become available, hereafter referred to as the ASS Instructions.

- Condition 20 The ASSMP must include detailed information on:
- a) the location and characteristics of dredge material containing PASS for management of dredge spoil containing ASS
 - b) PASS sampling depth related to depth of dredging and justification of the adequacy of PASS data, provided in support of an ASSMP for management of dredge spoil containing ASS
 - c) PASS including maps and cross-sectional diagrams showing zones of PASS requiring placement below low water mark or lime treatment, PASS with sufficient natural ANC and non-PASS materials, coupled with geotechnical information needed to determine how the material can be dredged, where the material can be disposed, and the PASS treatment process if required
 - d) the source, characteristics, and width/volume of non-PASS material to be used as a barrier against the reclamation area bund wall for management of dredge spoil containing PASS
 - e) the methodology to ensure effective and reliable neutralisation of PASS for management of dredge spoil containing PASS
 - f) planning to prevent or account for particle size separation for management of dredge spoil containing PASS
 - g) any proposal to justify a reduced rate of verification testing for management of dredge spoil containing PASS.
- Condition 21 A copy of the WBDDP study used to justify a lowered sampling rate for management of dredge spoil containing ASS must be provided to DERM in support of the ASSMP.
- Condition 22 Monitoring plans for water quality and biodiversity must seek to identify any significant effect of oxidation of sulphidic fines in the water column and at inter-tidal depositional areas. This will inform future dredging programs involving significant quantities of PASS.
- Condition 23 The need for further testing of acid neutralising capacity, or the findings of further laboratory testing such as column leaching tests, must be provided to DERM in support of the ASSMP for management of dredge spoil containing PASS.
- Condition 24 The upper limit for placement of untreated PASS material within the reclamation area is mean low water (AHD -1.67m / RL 0.67m), unless DERM approves an alternative method of disposal to prevent oxidation of sulphides.
- Condition 25 Untreated PASS in the free water area of the reclaim bund must be maintained in a saturated state and must not be exposed for a period in excess of 0.5 hours on any tide cycle
- Condition 26 ASS must be managed to ensure that contaminants are neither directly nor indirectly released from the works to any receiving waters unless otherwise authorised under a condition of this approval.

Part 3. Water quality management

3.1 WQMP – general

- Condition 27 Prior to the commencement of construction of the reclamation area and dredging, the proponent, in consultation with DERM, DEEDI and DEWHA, must prepare a water quality management plan (WQMP) for the duration of the project, to identify, assess and manage the impacts from the dredging and construction of the reclamation area on the water quality of the project area.
- Condition 28 The WQMP will be prepared as a component of the DMP and implemented in conjunction with the EMP, DMP, ASSMP and FFMP for the project (see Schedule 2, Part 1).

3.2 Coastal processes

- Condition 29 The tidal development works must be undertaken in a manner that:
- a) maintains the local drainage and/or hydrological systems
 - b) ensures that changes in water chemistry will not impact on ecological values of the project area
 - c) ensure that any changes in surface water hydrology do not impact on any natural wetlands, habitat values, and/or rare and endangered species as listed under the *Nature Conservation Act 1992* (see Schedule 2, Part 4).

3.3 Contaminant discharge

- Condition 30 The release of water-borne contaminants from the activity must not cause environmental nuisance.
- Condition 31 Any direct or indirect discharge, including water and anything in water, from the containment area must not cause any or all of the following:
- a) environmental harm
 - b) adverse impacts on water quality objectives that apply to the area surrounding the containment site
 - c) sediment build up or erosion of any land including the bed of any receiving waters.
- Condition 32 No contaminants may be released from the site to any waters or the bed and banks of any waters (including groundwater) unless otherwise authorised.
- Condition 33 Water quality management must avoid release of sediment to receiving waters or build-up in any stormwater drain.
- Condition 34 All dredge spoil proposed to be placed in the reclamation area must be sampled and analysed for contaminants in accordance with the Draft Guidelines for the Assessment and Management of Contaminated Land (EPA, 1998) prior to dredging.
- Condition 35 Any material that exceeds the Draft Guidelines for the Assessment and Management of Contaminated Land must be subject to a risk assessment to determine the likelihood that contaminants will be mobilised into the surrounding environment and any management and monitoring that is required.
- Condition 36 Contaminants resulting from dredge spoil disposal (drain waters and stormwater from settling ponds) must be released only to surface waters at the north-east corner of the reclamation area.
- Condition 37 Water discharged from the dredge spoil disposal area must comply with the release limits listed in Table 1—Contaminant release limits to water.

Table 1—Contaminant release limits to water

Quality characteristics	Type of release limit		
	Minimum	80th percentile	Maximum
Turbidity ¹³	-	-	-
Suspended Solids	-	-	100 mg/L
pH	6.5	-	9.0
Ammonia	-	-	1.0 mg/L ¹⁴
Cadmium (filtered)	-	-	0.7 µg/L ¹⁴
Chromium (filtered)	-	-	4.4 µg/L ¹⁴
Copper (filtered)	-	-	1.3 µg/L ¹⁴
Lead (filtered)	-	-	4.4 µg/L ¹⁴
Mercury (filtered)	-	-	0.1 µg/L ¹⁴
Nickel (filtered)	-	-	7.0 µg/L ¹⁴
Silver (filtered)	-	-	1.4 µg/L ¹⁴
Zinc (filtered)	-	-	15.0 µg/L ¹⁴

3.4 Water quality modelling and monitoring

3.4.1 Technical reference panel

- Condition 38 A technical reference panel will be established prior to and for the duration of the project to oversee all aspects of water quality monitoring, including the implementing of a transition from a water quality monitoring program that is based on turbidity towards a program that is based on light attenuation and seagrass health.
- Condition 39 The technical reference panel will comprise scientific experts in seagrass and benthic habitat, project proponent representatives, regulators and dredge technical advisors.
- Condition 40 The technical reference panel will assess any exceedence of trigger values and seagrass changes at key monitoring locations and advise changes to dredging practices, through the DMP, as required.

3.4.2 Water quality monitoring – general

- Condition 41 Prior to the commencement of dredging activities, a water quality monitoring program, to assess the impacts from the dredging on ecological health and water quality, must be developed in consultation with, and approved by, DERM and DEEDI with the following provisions:
- monitoring will commence a minimum of 6 months prior to commencement of dredging
 - monitoring must continue over the full period of dredging, and for a period prior to and after dredging as defined by the monitoring program
 - all data obtained from the monitoring program must be made available to DERM and DEEDI within 28 days of survey or data acquisition
 - methods of water quality sampling must comply with the DERM Water Quality Sampling Manual.
- Condition 42 The primary purposes of the proposed water quality monitoring program will be to:
- establish a baseline for background water quality
 - measure background water quality
 - measure increased turbidity associated with the dredging program

¹³ Turbidity limits are to be determined (correlated to SS) by proponent to ensure suspended solids limit is not exceeded when sampled. Turbidity is to be monitored, *in situ*, every 15 minutes.

¹⁴ Limits for metals are trigger values only.

- d) introduce a transition to the implementation of a light-based approach to water quality monitoring and management
- e) provide some level of validation against predictions made in the EIS and for use in plume modelling of dredging conducted during the project
- f) provide a trigger for action where impacts are felt in areas not predicted to be impacted.

3.4.3 Dredge plume modelling

Condition 43 The proponent is to undertake hydrodynamic and plume modelling during dredging, to assist the validation of water quality predictions associated with dredging operations.

3.4.3 Seagrass assessment

Condition 44 For the purpose of water quality monitoring, the assessment of seagrass communities at key locations must include:

- a) establishment of permanent seagrass assessment sites, with at least quarterly measurements of seagrass health and resilience
- b) consideration of natural seasonal seagrass variation
- c) assessment of seagrass resilience to impact and capacity for recovery.

3.4.4 Initial water quality monitoring program

Condition 45 The water quality monitoring program initially used to assess the impacts from the dredging on ecological health and water quality, will be based on the use of turbidity as the water quality indicator, with limits set for key environmentally sensitive locations that trigger operational responses.

Condition 46 The initial water quality monitoring program must include:

- a) mapping of key environmentally sensitive locations (primarily seagrass beds)
- b) monitoring locations based on (a) above (approximately 6 to 12 sites) agreed by DERM and DEEDI
- c) measurement of turbidity and light conditions
- d) trigger values (relating to turbidity values above background)
- e) derivation of the initial turbidity trigger values will be based on the current understanding of the light requirements of seagrasses in Gladstone and modified as new research information becomes available.
- f) the means of presenting turbidity measurements (measurements will be collected and processed into a rolling average)
- g) rolling average to be determined over an agreed timeframe (minimum 24 hours)
- h) reporting requirements to DERM and DEEDI
- i) planned movement of dredgers (in order to maximise respite opportunities)
- j) details of actions should triggers in nominated low impact zone be exceeded for specified durations
- k) details of background water quality variation, and key factors that influence this including spring tide, wind in shallow areas, flood events etc.
- l) where viable, a method for determining correlations between turbidity at reference sites, and that at key monitoring locations
- m) details of how background water quality is to be taken into account, in order to account for significant variation in background turbidity

- n) a mechanism to identify and remove outliers (e.g. turbidity spikes not associated with dredging)
- o) consideration of how the monitoring framework might be modified, as seagrass tolerances to loss of light arising from increased turbidity are further refined.

3.4.5 Future water quality monitoring program

Condition 47 The future water quality monitoring program will be developed and phased as part of implementation of the DMP through an adaptive management approach informed by the ongoing results of scientific study being undertaken in the Western Basin. This approach to water quality links turbidity and depth to light attenuation and seagrass health. Key elements to be addressed include:

- a) trigger values of turbidity using information on seagrass minimum light requirements based on the relationship between light, turbidity, depth and other factors
- b) high, medium and low impact zones will be nominated and mapped. Initially, these will be based on turbidity levels. For the final DMP, linkages between turbidity, depth and light attenuation should allow a more refined estimate of high, medium and low impact zones
- c) monitoring for action (reactive monitoring) will need to occur in the low impact zone
- d) monitoring of impact will need to occur in the moderate impact zone
- e) where possible, reference water quality monitoring stations should be established outside the low impact zone to record background or ambient water quality conditions.
- f) in accordance with the ANZECC Guidelines, the high impact zone will be defined as that point where the median water quality exceeds the 80th percentile of background water quality
- g) the low impact zone will represent a small increase above background (e.g. +10 mg/L)
- h) recognition that the moderate impact zone will experience a range of impacts, with deeper seagrass beds most likely to be impacted.

Condition 48 The future water quality monitoring program, based on maintaining the minimum light requirements for seagrass species that occur in the project area, should incorporate:

- a) appropriate values for the minimum light requirements of the different species of local seagrasses
- b) use of sub-lethal indicators of seagrass light stress to assess seagrass condition should seagrass light requirement triggers be exceeded.

Part 4. Flora and fauna management plan (FFMP)

4.1 FFMP – general

Condition 49 Prior to the commencement of construction of the reclamation area and dredging, the proponent, in consultation with DERM, DEEDI and DEWHA, must prepare a specific flora and fauna management plan (FFMP) for the duration of the project, to identify and assess the impacts from the dredging and construction of the reclamation area on the marine and terrestrial plants and animals that inhabit the project area.

Condition 50 The FFMP will focus on species and ecological communities of listed state and national significance. In particular, the FFMP will focus on monitoring seagrass communities, marine megafauna and migratory shorebirds likely to be directly or indirectly impacted by the dredging and construction of the reclamation area.

Condition 51 The FFMP will be prepared as a component of the DMP and implemented in conjunction with the EMP, DMP and WQMP for the project (see Schedule 2, Part 1).

Condition 52 All data obtained from the monitoring program must be made available to DERM and DEEDI within 28 days of survey or data acquisition.

4.2 Baseline conditions

Condition 53 In conjunction with the WQMP, the FFMP is to establish sufficient pre-development baseline data of relevant marine and terrestrial flora, fauna and ecological communities within the project area to ensure the range of seasonal and inter-annual changes are characterised to enable comprehensive assessment of the effects of dredging and construction of the reclamation area.

4.3 Marine flora

4.3.1 Additional seagrass monitoring

Condition 54 In conjunction with monitoring identified in the EIS, SID and other project documentation, or required for the project EMP or water quality monitoring program, the proponent must undertake additional monitoring including, but not limited to the following:

- a) continue annual long term seagrass monitoring surveys of seagrass distribution and abundance in the Western Basin
- b) survival and recovery of seagrass and other marine communities in the project area during the construction period and for a minimum of three years following completion of dredging.

4.3.3 Disturbance of marine plants

Condition 55 For any construction and associated operational tidal works requiring the removal, construction or damage of marine plants as defined under the *Fisheries Act 1994*, the proponent must submit an application for approval of marine plant disturbance to the Chief Executive of DEEDI prior to any works.

4.3.4 Marine fish habitat and coastal structures

Condition 56 Where practicable, the final design of all coastal structures should incorporate fish-friendly structures using the DEEDI (Fisheries Queensland) Fisheries Guidelines for Fish Friendly Structures.

Condition 57 DEEDI (Fisheries Queensland) must be consulted in completing the plans for all works that may impact on fish habitats or fishing activities during construction and operation of the project.

4.4 Marine fauna

Condition 58 The FFMP will contain provisions that aim to:

- a) minimise the risk of trapping mobile marine fauna, especially turtles, dugong and cetaceans, including in the reclamation area
 - i) during construction and
 - ii) when the bund wall is closed
- b) define the actions to be taken in the event of capture.

Condition 59 In conjunction with monitoring identified in the EIS, SID and other project documentation for the project, or required for the EMP for the project, the proponent must undertake additional monitoring of marine megafauna with the following provisions:

- a) monitoring will occur at the localities immediately impacted by the reclamation area, including the embayment immediately north of the reclamation area
- b) monitoring will focus on those activities potentially affecting the megafauna, including but not limited to:
 - i) dredge vessel movement

- ii) pile driving
 - iii) construction dredging
 - iv) bund wall construction during dredging
 - v) construction of the bund wall
 - vi) filling of the reclamation area
- and will address matters including:
- i) underwater noise impulse levels
 - ii) light spill
 - iii) decreased access to intertidal foreshore habitat
- c) the results of monitoring will be used to inform an adaptive response to impact mitigation in the EMP.

4.4.1 Turtles

- Condition 60 Where a TSHD is used, the drag heads of the dredge vessel must be fitted with a turtle exclusion device for the duration of the dredging.
- Condition 61 Operation of the TSHD must be in accordance with a written operational procedure forming part of DMP that ensures the amount of off-bed suction time is minimised to reduce the risk of turtle capture.
- Condition 62 Any marine megafauna captured by the dredge head must be recorded and reported to the DERM and Gladstone Ports Corporation with 30 business days.

4.5 Shorebirds

- Condition 63 In conjunction with monitoring identified in the EIS, SID and other project documentation for the project, or required for the EMP for the project, the proponent must undertake additional monitoring of migratory shorebirds with the following provisions:
- a) monitoring will occur during the peak summer season transit period (between October and March), with particular focus on the population peak in January
 - b) monitoring will occur at the localities immediately impacted by the reclamation area, including the embayment immediately north of the reclamation area
 - c) monitoring will focus on those activities potentially affecting the shorebirds, including but not limited to
 - i) dredge vessel movement
 - ii) pile driving
 - iii) construction dredging
 - iv) bund wall construction during dredging
 - v) construction of the bund wall
 - vi) filling of the reclamation area

and will address matters including:

 - i) noise impulse levels
 - ii) light spill
 - iii) water quality reduction
 - iv) decreased access to intertidal foreshore habitat
 - v) increased sedimentation
 - d) the results of monitoring will be used to inform an adaptive response to impact mitigation in the EMP.
- Condition 64 The final design of the reclamation area must have regard to the DEWHA Draft EPBC Act Policy Statement 3.21 – Significant Impact Guidelines for 36 Migratory Shorebirds.

Part 5. Construction and operations

5.1 Bund design, materials, construction, management

- Condition 65 The proponent must ensure that the design, construction materials, construction methodology and management for the outer bund wall of reclamation area for the project:
- a) is structurally sound
 - b) is designed for the purpose of preventing emissions from the containment area that may cause environmental harm
 - c) has been certified as fit for purpose by a registered professional engineer of Queensland
 - d) is maintained to the condition certified in (c).
- Condition 66 The design, construction materials, construction methodology and management for the outer bund wall of the reclamation area will be generally in accordance with the details provided in chapter 2 of the EIS and section 16 of the SID, which ensure the following:
- a) Only clean rock with fines (<12 mm) removed will be used for the core of the revetment and breakwater walls
 - b) All material used for walls and capping must be free from contaminants consistent with the Queensland Draft Guidelines for the Assessment and Management of Contaminated Land Environmental Investigation Levels (1998).
- Condition 67 In addition to the provisions for bund wall construction identified in the EIS and SID, the design, construction materials, and construction methodology and management for the outer bund wall of the reclamation area should be generally in accordance with the following requirements:
- a) ensure appropriate design of the reclamation area to reduce water quality impacts from leaching material through the bund wall, decant waters and storm-water run-off
 - b) a geofabric liner must be applied to the internal side of the wall to prevent release of fine sediments from the reclamation area other than through the designated discharge point in accordance with specified discharge limits
 - c) details of the location and fines' retention properties of the geofabric liner must be provided with an application for a development permit for construction of the reclamation bund walls
 - d) no excavation of sediments within the reclamation area is permitted, except in accordance with the ASSMP (see Schedule 2, Part 2)
 - e) outer rock armour for the reclamation bund walls must be in place within 28 days of completion of bund walls, and not more than 100 metres of unprotected bund wall is to be exposed to prevailing winds at any time unless a greater length is agreed in writing with DERM
 - f) any access constructed across the western channel for bund wall construction must be designed to prevent scouring of sediments on the ebb tide following construction of the western wall. Design drawings will be provided to DERM for approval prior to construction
 - g) the final bund closure point will be at a location where the seabed is not shallower than 0.5 metres on Port Datum (see EIS, Appendix M, Table 3-1).
 - h) final bund closure will occur on a neap flood tide to minimise the potential for scour of seagrass beds due to discharge from the reclamation area
 - i) additional quarry rock will be placed as deemed necessary to further protect the seabed from scour immediately adjacent to the wall if the velocity constraint is not achievable

- j) the outlet of the intertidal channel on the western side of the reclamation area will be designed to minimise scouring of bottom sediments due to increased tidal flow velocities and mitigation measures must be constructed prior to completion of the western bund wall
 - k) any material that is deposited outside the alignment of the works area, or any debris that falls or is deposited on tidal lands or in tidal waters during the construction of the works must be removed by the proponent at its cost prior to the practical completion of the works
 - l) any ASSMP for construction of the reclamation area and management of dredge spoil containing ASS (see Schedule 2, Part 2).
- Condition 68 Further assessment of the potential for formation of monosulphidic conditions in the western channel must be carried out and provided to DERM to support an application for a development permit for construction of the reclamation bund walls.

5.2 Reclamation and dredge spoil disposal

- Condition 69 Material dredged under this approval must not be placed at sea except at a disposal site lawfully authorised under an authority, licence or other permit issued by either, or both, the Commonwealth or Queensland Government, as necessary, to receive material dredged for the project.
- Condition 70 Material dredged under this approval must not be placed on land, except in the reclamation area:
- a) in accordance with the requirements of the State Planning Policy 2/02: Planning and Managing Development Involving Acid Sulfate Soils and the associated Guideline (see Schedule 2, Part 2)
 - b) if the placement would result in the concentration of contaminants in the soils exceeding the Health Investigation Levels (HILs) for Exposure Setting A (Standard settings), provided in Table 5-A 'Soil Investigation Levels (mg/kg)' of Schedule 2(1) of the National Environmental Protection (Assessment of Site Contamination) Measure (NEPC, 1999).
- Condition 71 All dredge spoil proposed to be placed in the reclamation area must be sampled and analysed for contaminants in accordance with the Draft Guidelines for the Assessment and Management of Contaminated Land (EPA, 1998), or as agreed by DERM, prior to dredging. In addition:
- a) any material that exceeds these guidelines must be subject to a risk assessment to determine the likelihood that contaminants will be mobilised into the surrounding environment and any management and monitoring that is required
 - b) placement of material that exceeds these guidelines in the reclamation area must be subject to approval by DERM.
- Condition 72 All rock, stone, gravel, sand or other material used in the reclamation must be suitable for the purpose having regard to the location of the subject land and to the proposed use of the land after reclamation.
- Condition 73 All rock, stone, gravel, sand or other material that has slipped or been deposited outside the reclamation area and that is causing an obstruction in a waterway must be removed from the waterway.
- Condition 74 Details of the source, quantity and type of material to be used in the reclamation must be submitted to the administering authority.
- Condition 75 The finished level of the proposed bund should be specified to be RL 7.0 metres on Port Datum (EIS, Appendix M, Table 3-1), unless a detailed risk analysis indicates otherwise, to render it fit for the purpose of the reclamation.
- Condition 76 Any person placing material dredged under this approval into the containment area must not cause or allow structural or functional failure of the containment area.

5.3 Reclamation area wastewater management (see Schedule 2, Part 3)

- Condition 77 Prior to an approval being issued for a development permit for operational works (tidal) for the reclamation area, DERM must be provided with documentation, such as design drawings, demonstrating that appropriate wastewater management will be applied during construction and post-construction such that discharges will have no adverse impact on receiving water quality. Documentation must demonstrate that:
- a) during reclamation, a dedicated decanting point is established into which all wastewaters – that is, both the tailwaters from the dredged material and any surface stormwater flow – will be directed
 - b) all wastewater from the reclamation area is adequately contained and treated before being discharged into the receiving waters, including gross pollutant and sediment removal
 - c) the discharge points include appropriate structures to prevent erosion of the receiving environment
 - d) capping of the reclamation area will be profiled such that stormwater drains to internal collection and treatment prior to discharge to waters.
 - e) the design has regard to management of erosion of any short term surface soils or capping material as well as the longer term/finished surface treatment
- Condition 78 If, during construction of the reclamation area, stormwater and wastewater discharge is not possible from the approved discharge points then a revised stormwater management plan for any additional discharge points will require approval from DERM.
- Condition 79 Any waste water discharge outlet from the reclamation area must be constructed and maintained to prevent or minimise localised erosion or scouring, and any erosion or scouring that occurs must be rectified as soon as reasonably practicable after its occurrence.

5.4 Water quality monitoring for bund construction

- Condition 80 Prior to the commencement of construction of the bund walls for the reclamation area, a monitoring program to assess the impacts of construction on water quality and ecological health must be developed in consultation with, and approved by DERM.
- Condition 81 The approved monitoring program must be implemented over the full period of construction and may form part of a broader WQMP plan addressing the impact of dredging and disposal of dredge spoil.
- Condition 82 Information obtained from the monitoring program must be made available to the DERM within 28 days.
- Condition 83 Monitoring of the impacts of bund wall construction shall include monitoring of:
- a) any elevation of suspended solids resulting from bed sediment scour at the northern end of the eastern bund wall and bed sediment scour in the western channel.
 - b) the turbidity resulting from scour at the northern end of the eastern bund wall and scour in the western channel.

5.5 Reclamation area waste management

- Condition 84 All temporary works associated with the construction of the reclamation area are to be removed from the site prior to completion of the works and all wastes must be disposed of at a licensed waste facility.
- Condition 85 All reasonable and practicable measures must be taken to prevent pollution as a result of silt run-off, oil and grease spills from machinery, concrete truck washout and the like. Concrete agitator wash out must be conducted only in a specified area to facilitate the removal of waste concrete from the area to landfill.

Condition 86 Wastewater from cleaning equipment must not be discharged directly or indirectly to any watercourses or stormwater system.

5.6 Reclamation area stabilisation and rehabilitation

Condition 87 The proponent is to provide an erosion and sedimentation plan and report, as a supplement to the project EMP, that show the methodology and strategies to stabilise the reclamation mound throughout the reclamation formation.

Condition 88 The proponent is to provide details of:

- a) the means by which the surface of the reclamation area will be capped and stabilised, including specification of the capping material, growing substrate, plantings and management
- b) capping and profiling of the reclamation such that stormwater drains to internal collection and treatment prior to discharge to receiving waters
- c) management of erosion of any short-term surface soils or topping material as well as the longer-term and finished surface treatment

Condition 89 The proponent must include in the EMP information on surface stabilisation and progressive vegetation to reduce the visual impact of the spoil mound. In particular, the proponent shall consult with GRC and DERM to review opportunities to minimise the visual impact of the mound.

Condition 90 The surface fill material for the reclamation area must be stabilised to resist wind and storm water erosion, in the short and longer terms.

Condition 91 The surface treatment of the reclaimed area must be designed to ensure the leachate of contaminants will be avoided.

5.6 Air quality

Condition 92 The release of airborne contaminants from the project activity must not cause environmental nuisance.

5.7 Noise

Condition 93 The following noise limits must be achieved:

Noise level at a nuisance sensitive place Measured as the Adjusted Maximum Sound Pressure Level L Amax adj, T	Period
Background noise level plus 5 dB(A)	7 am - 10 pm
Background noise level plus 3 dB(A)	10 pm - 7 am
Noise limits at a commercial place Measured as the Adjusted Maximum Sound Pressure Level L Amax adj, T	Period
Background noise level plus 10dB(A)	7 am - 10 pm
Background noise level plus 8 dB(A)	10 pm - 7 am

END OF COORDINATOR-GENERAL'S STATED CONDITIONS FOR OPERATIONAL WORKS (TIDAL), SCHEDULE 2

Schedule 3. Coordinator-General's imposed conditions

This schedule provides the Coordinator-General's imposed conditions, pursuant to part 4, division 8 of the *State Development and Public Works Organisation Act 1971* (SDPWO Act), that apply to the Western Basin Dredging and Disposal Project (WBDD Project).

In accordance with section 54A and 54B of the SDPWO Act, the following imposed conditions apply to the project to the extent that:

- 1) the project does not involve a material change of use that, under the *Sustainable Planning Act 2009*, is impact assessable
- 2) division 4, subdivision 2 and divisions 5, 6, 6A, and 7 of the SDPWO Act do not apply to the project.

I have nominated an entity with responsibility for implementing each of these imposed conditions.

To simplify presentation, this Schedule 3 is divided into six parts as follows:

- Part 1. General conditions for the environmental management plan (EMP), which establishes that the project must be conducted in accordance with the project EMP.
- Part 2. Transport, which includes conditions provided by DTMR concerning marine safety and the role of Maritime Safety Queensland (MSQ) and the Regional Harbour Master (RHM).
- Part 3. Land use, which provides for the amendment of Port of Gladstone Land Use Plan.
- Part 4. Environmental offsets, which provides a comprehensive package of measures to compensate for the loss of marine habitat. This also includes measures to compensate for impacts to commercial and recreational fishers and boaters.
- Part 5. Complaints and response, which ensures that appropriate measures are implemented to respond to public complaints.
- Part 6. Compliance and auditing, which ensures that the conditions of development are implemented and reported to the responsible entities.
- Part 7. Incident management, which provides procedures in the event of an incident, including release of contaminants, uncontained spills, emergencies, accidents and other incidents.

Note that some conditions in each part could also have some relevance to the other schedules and parts and are cross-referenced accordingly.

Part 1. Environmental Management Plan – general

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| Condition 1 | The project must be carried out generally in accordance with the Western Basin Dredging and Disposal Project Environmental Impact Statement (EIS) (November 2009) for the project, and the Western Basin Dredging and Disposal Project EIS Supplementary Information Document (SID) for the project (April 2010), and Appendices 1 and 2 of this report (see Schedule 1, Condition 6). |
| Condition 2 | The proponent (or the proponent's contractors) must finalise the project environmental management plan (EMP) to the satisfaction of DERM prior to commencement of operational works for the project. |
| Condition 3 | The EMP must be based on the draft EMP (provided as Chapter 19 of the EIS). |
| Condition 4 | The EMP must include all project commitments made by proponent in the EIS, SID and other impact assessment documentation, and all conditions arising from the project's approval and subsequent permits, authorities and/or licences. |

- Condition 5 In addition to the provisions of the draft EMP (provided as Chapter 19 of the EIS), specific requirements must be included for:
- a) flood events, cyclone and storm surge
 - b) seagrass monitoring and studies
 - c) shorebirds
 - d) waste.
- Condition 6 The proponent and/or its contractor(s) must undertake any tidal operational works in accordance with all requirements of the approved EMP or any subsequently endorsed amendments to that plan (see Schedule 2).
- Condition 7 The proponent must conduct all works to ensure that no environmental harm as defined under the *Environmental Protection Act 1994* is caused (see Schedule 1, Part 4).
- Condition 8 All relevant components of the EMP that relate to the operation of the Port of Gladstone must be incorporated into the GPC environmental management system.
- The Chief Executive of DERM is the entity with jurisdiction for these conditions.

Part 2. Transport

2.1 Cumulative marine transport impacts

- Condition 9 12 months prior to the first operations of LNG shipping tankers the proponent must prepare and submit to DTMR/Maritime Safety Queensland (MSQ) and the Regional Harbour Master Gladstone (RHM), for review, approval and subsequent implementation, a marine traffic management plan for vessel traffic management services required in Port Curtis during the construction and dredging for the project.
- Condition 10 The proponent must identify all aids to navigation and/or vessel traffic management services that will be required for this project and in the cumulative management of shipping in Port Curtis, in accordance with the plans required by condition 9.
- The Chief Executive of DTMR is the entity responsible for this condition.

2.2 Marine safety

- Condition 11 The proponent must ensure that safety of navigation must be maintained during all stages of development. Navigation aids are to be provided as specified by the RHM and MSQ.
- Condition 12 The proponent must, prior to the commencement of construction:
- a) identify and assess all risks to maritime safety and ship-sourced pollution relating to all stages of the project (i.e. bund construction and related dredging activities)
 - b) define required mitigation measures for identified risks and include details in the following management plans to the satisfaction of the RHM and MSQ:
 - i) vessel traffic service management plan
 - ii) aids to navigation management plan
 - iii) ship-sourced pollution prevention management plan.
- (Management plans may already be in existence. If so, they may require modification to address this condition.)
- a) consult with DTMR through MSQ and the RHM when preparing the management plans and take account of the reviews and incorporate any proposed amendments
 - b) discuss funding arrangements for new and modified maritime infrastructure and systems requirements resulting from the project with DTMR through MSQ and the RHM.

- Condition 13 Within three months of appointing a construction contractor for the project, and prior to the commencement of any construction works on the project, the proponent will:
- a) finalise and submit to MSQ and the RHM, and any other relevant parties for review and approval, an assessment of maritime safety and ship-sourced pollution potential impacts and mitigation requirements of the project. The assessment of impacts and provision of mitigation measures should ensure that navigational safety and ship based-pollution prevention is maintained at all times for the life of the project. Information should include, but not be limited to:
 - i) DMP including the type, size and operation of ships associated with the proposed dredging activity
 - ii) detailed information about any plans to dispose of dredged material offshore (as outlined in section 17.2 of the SID), specifically any impacts on marine safety
 - iii) detailed information about cumulative impacts of related projects (as outlined in section 19.8 of the SID), specifically any impacts on marine safety
 - iv) plans to ensure construction lighting does not adversely impact on the effectiveness of Aids to Navigation in the area and the bund wall, outlined in section 16 of the EIS supplementary information document, is appropriately lit to advise mariners of the obstruction to navigation.
 - b) prepare a management plan for new or upgraded aids to navigation and/or vessel traffic management services required by the project. DTMR must approve the plan prior to implementation.
 - c) provide / upgrade all aids to navigation and/or vessel traffic management services required by the project
 - d) liaise with the RHM to update the Gladstone Pilotage Area Port Procedures and Information to Shipping Manual to reflect the changes to navigation areas in Gladstone Harbour and determine what restrictions on shipping are required to support the construction of this project and ensure marine safety is maintained
 - e) the proponent will detail and undertake all identified resolutions in the proponents 'statement of commitments'.
- Condition 14 All proposed management plans in relation to DTMR shall incorporate a provision to ensure that, prior to commencing any program of works, the proponent will consult with DTMR through MSQ and the RHM, and take account of the reviews and incorporate any proposed amendments.

2.3 Cumulative marine transport impacts

- Condition 15 12 months prior to the first operations of LNG shipping tankers the proponent must prepare and submit to DTMR (MSQ) and the RHM, for review, approval and subsequent implementation, a marine traffic management plan for vessel traffic management services required in Port Curtis during the construction and dredging for the project
- Condition 16 The proponent must identify all aids to navigation and/or vessel traffic management services that will be required for this project and in the cumulative management of shipping in Port Curtis, in accordance with the plans required by condition 14.
- The Chief Executive of DTMR is the entity responsible for this condition.

Part 3. Land use

3.1 Strategic Port Land Use Plan

- Condition 17 Once the reclamation is complete, the proponent must seek an amendment to the Strategic Port Land Use Plan (in accordance with section 285 of the *Transport Infrastructure Act 1994*) to include a requirement that all future development on the reclaimed area is in accordance with Civil Aviation Safety Authority (CASA) requirements, such as CASA's Manual of Standards Part 139 - Aerodromes, including issues such as building and infrastructure height restrictions/ limitations and lighting.

The Chief Executive Officer of GPC is the entity with jurisdiction for this condition.

3.2 Sterilisation of mineral resources

Condition 18 The proponent shall maintain satisfactory communication with QER and DIP during the WBDD Project to ensure that QER's interests are not adversely affected.

The Chief Executive Officer of GPC is the entity with jurisdiction for this condition.

Part 4. Environmental offsets

4.1 Marine habitat offset

Condition 19 Prior to the commencement of dredging works for the WBDD Project, GPC must:

- a) submit documentation to the satisfaction of the Coordinator-General that the agreed offset for marine fish habitat, as referenced in section 6.3 of the WBDD Project CG's report dated July 2010 has been secured
- b) if condition 19(a) cannot be achieved, submit for approval to the Coordinator-General an alternative offset proposal that is equivalent to or better than the agreed offset for marine fish habitat.

The Chief Executive Officer of GPC is the entity with jurisdiction for these conditions.

4.2 Commercial fisheries offset

Condition 20 GPC must mitigate all reasonable financial losses to existing commercial fishing operators attributable to the maritime development in the Western Basin of the Port of Gladstone. This is to cover temporary and permanent loss of access to fishing areas and marine fish habitat.

Condition 21 GPC must meet any costs associated with the investigation, negotiation and administration of any compensation package, including all costs incurred by DEEDI in the management of development of any compensation package.

The Chief Executive Officer of DEEDI is the entity with jurisdiction for these conditions.

4.3 Recreational fishing and boating offset

Condition 22 Prior to the completion of stage 1 dredging works, GPC shall contribute funding and/or works to the value of \$1 million towards new or upgraded recreational fishing infrastructure within the Gladstone region as determined by DTMR. A further \$0.5 million of funding will be provided for all tide public boat ramps within the Western Basin area prior to the completion of the stages 2 and 3 dredging.

The Chief Executive Officer of DTMR is the entity with jurisdiction for these conditions.

4.4 Marine and coastal biodiversity offset

Condition 23 In addition to the provisions required for a flora and fauna management plan (FFMP) stated by conditions in Appendix 1, Schedule 2, Part 4 of this report, GPC shall provide additional offset measures for shorebirds and marine fauna to be included in the FFMP. These should consist of funding and/or in-kind contributions to the value of at least \$2 million towards measures including, but not be limited to:

- a) enhanced understanding of the displacement of key marine fauna species from affected habitat areas in Western Basin and any associated effects on regional populations
- b) contribution to species protection programs in the region or the wider bioregion. This may include funding of additional boating and fisheries patrols, education campaigns for recreational fishers on risks of marine fauna boat strike and improved management of key shorebird habitat areas

- c) contribution to habitat enhancement/restoration actions in the region or the wider bioregion such as 'seagrass friendly' mooring systems, wetland rehabilitation projects and water quality improvement programs.

Part 5. Complaint monitoring, management and response

5.1 Noise complaint monitoring management and response

Condition 24 In the event of a complaint, the proponent will:

- a) in the first instance change procedures to reduce the noise that is the cause of the nuisance complaint
- b) liaise with DERM and/or complainant over remedial action.

Condition 25 Where the actions of condition 19 do not resolve the noise issue, and when requested by the administering authority, noise monitoring will be undertaken to investigate any complaint of environmental noise nuisance and the results notified within 7 days to the administering authority. Monitoring must include:

- a) L_{Amax}, adj T
- b) L_{AN}, T (where N equals statistical levels of 1, 10, and 90)
- c) the level and frequency of occurrence of impulsive or tonal noise
- d) atmospheric conditions including temperature, relative humidity and wind speed and direction
- e) effects due to extraneous factors.

The method of measurement and reporting of noise levels must comply with the latest edition of the DERM Noise Measurement Manual.

5.2 Managing complaints

Condition 26 If the administering authority advises the holder of a complaint alleging nuisance (e.g. caused by light, dust or noise), the holder must investigate the complaint and advise the administering authority of the action proposed or undertaken in relation to the complaint.

Condition 27 If the administering authority is not satisfied with the proposed or completed action, the holder must undertake monitoring or other action requested by the administering authority.

Condition 28 Maintain a record of complaints and incidents causing environmental harm, and actions taken in response to the complaint or incident. Retain the record of complaints required by this condition for five (5) years.

5.3 Complaint response

Condition 29 The holder of this authority must record the following details for all complaints received and provide this information to the administering authority on request:

- a) time, date, name and contact details of the complainant
- b) reasons for the complaint
- c) any investigations undertaken
- d) conclusions formed
- e) any actions taken.

Part 6. Compliance and auditing

- Condition 30 The following third party auditing requirements must be applied for the project:
- a) compliance with the Coordinator-General's imposed conditions of this report must be audited by an appropriately qualified and experienced third party auditor or auditors appropriate to the matters being audited, nominated by the proponent and accepted by the Coordinator-General, within one year of the project receiving approval to proceed and annually thereafter
 - b) the proponent must submit the third party audit report(s) to the Coordinator-General within 42 calendar days of the end of the relevant period
 - c) the audit report must identify the segment of the project being audited, the conditions that were activated during the period, and a compliance/non-compliance table. A description of the evidence to support the compliance table must be provided. The audit report will also contain recommendations on any non-compliance or other matter to improve compliance. The third party auditor must certify the findings of the audit report
 - d) the financial cost of the third party audit is borne by the proponent
 - e) the holder of the environmental authority(s) must immediately act upon any recommendations arising from the audit report and:
 - i) investigate any non-compliance issues identified, and
 - ii) as soon as practicable, implement measures or take necessary action to ensure compliance with this authority.
 - f) subject to condition 25(a), and not more than 30 calendar days following the submission of the audit report, the proponent must provide written advice to the Coordinator-General addressing the:
 - i) actions taken by the proponent promptly and routinely to ensure compliance with the Coordinator-General's imposed conditions, and
 - ii) actions taken to routinely prevent a recurrence of any non-compliance issues.
- Condition 31 The proponent must, when first becoming aware of a non-compliance of any Coordinator-General imposed condition:
- a) authorise and undertake action to bring the matter into compliance within an effective time frame as approved by the Coordinator-General
 - b) report the non-compliance and remedial action to the Coordinator-General within five business days of becoming aware of the non-compliance matter.

The Coordinator-General is the entity with jurisdiction for these conditions.

Part 7. Incident management

- Condition 32 The holder of this authority must telephone the DERM's Pollution Hotline (1300 130 372) or local office as soon as practicable after becoming aware of any release of contaminants or any event where environmental harm has been caused or may be threatened.
- Condition 33 Subject to condition 28, the holder of this authority is required to report in the case of uncontained spills (including fuel lubricants, hydraulic fluid or other chemicals) of the following volumes or kind:
- a) releases of any volume to water
 - b) releases of volume greater than 200 litres to land
 - c) releases of any volumes where potential serious or material environmental harm is considered to exist.
- Condition 34 The notification of emergencies or incidents as required by conditions 28 and 29 must include but not be limited to the following:

- d) the holder of the authority
- e) the location of the emergency or incident
- f) the number of the authority
- g) the name and telephone number of the designated contact person
- h) the time of the release
- i) the time the holder of the authority became aware of the release
- j) the suspected cause of the release
- k) the environmental harm caused, threatened, or suspected to be caused by the release
- l) actions taken to prevent any further release and mitigate any environmental harm caused by the release.

Condition 35 Not more than fourteen (14) days following the initial notification of an emergency or incident, written advice must be provided of the information supplied in accordance with condition 29 in addition to:

- a) proposed actions to prevent a recurrence of the emergency or incident; and
- b) outcomes of actions taken at the time to prevent or minimise environmental harm.

Condition 36 As soon as practicable, but not more than six (6) weeks following the conduct of any environmental monitoring performed in relation to the emergency or incident, which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with the conditions of this authority, written advice must be provided of the results of any such monitoring performed to the administering authority.

Condition 37 A record of incidents must be maintained to include a record of all incidents occurring in the previous five (5) years.

The Coordinator-General is the entity with jurisdiction for these conditions.

END OF COORDINATOR-GENERAL'S IMPOSED CONDITIONS, SCHEDULE 3

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