Gladstone Ports Corporation

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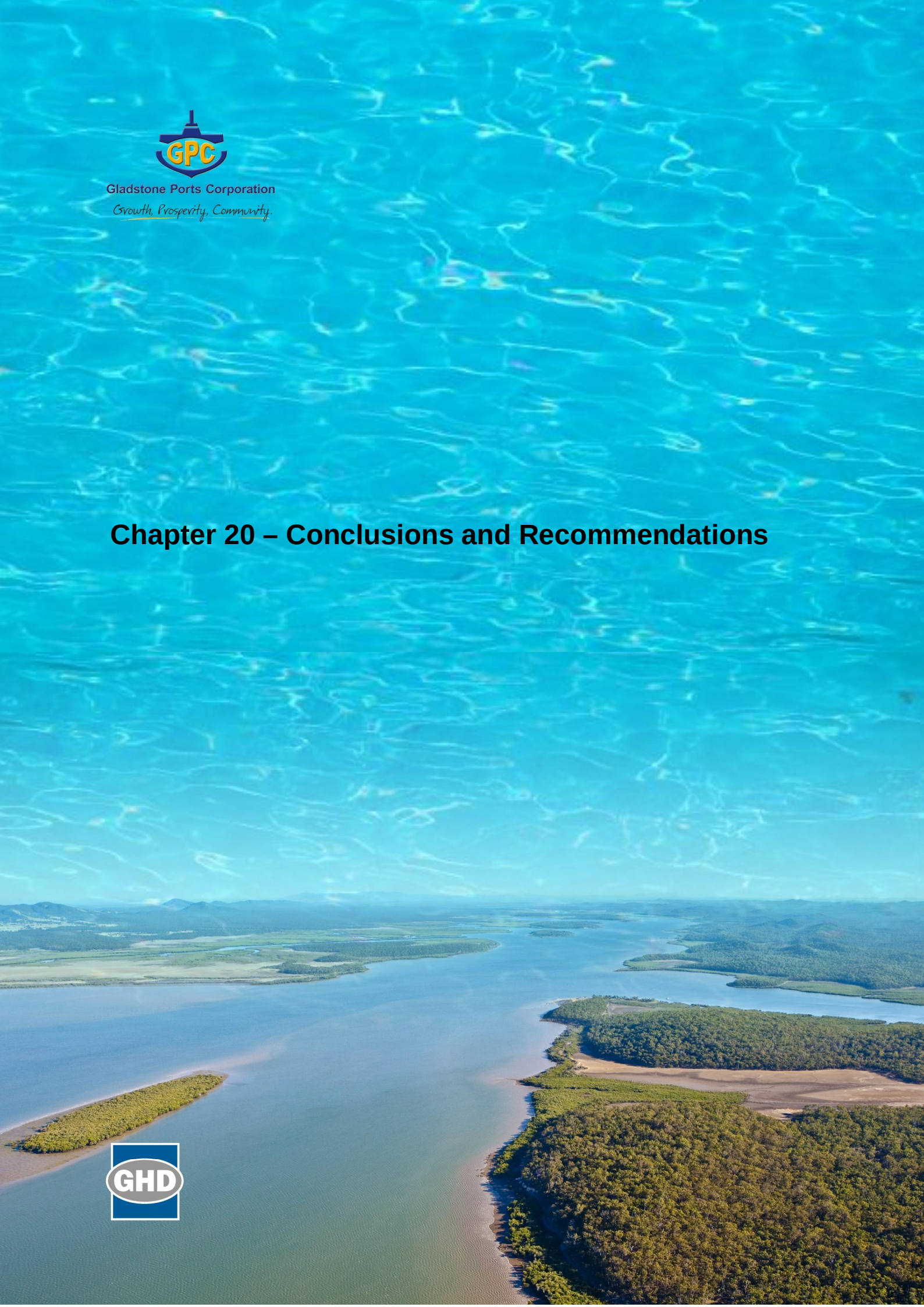
Chapter 20 – Conclusions and Recommendations



20. Conclusions and Recommendations

20.1 Port of Gladstone Western Basin Dredging and Disposal Project

The Port of Gladstone Western Basin Dredging and Disposal Project seeks to accommodate the long term dredging and dredged material disposal that is required to provide safe and efficient access to existing and proposed port facilities in the harbour. The project has been declared a Significant Project under the *State Development Public Works Organisation Act 1971* and is also a Controlled Action under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999*. The project is being assessed under the Bilateral Agreement between the State and Federal Governments.

The project will form a key component of Queensland's import and export infrastructure and will assist in developing industries, specifically the proposed Liquefied Natural Gas (LNG) industry, to be located within the Gladstone region. This EIS has addressed two areas of development required for the long-term strategic development of the Port:

- Dredging of the inner harbour, involving the deepening and widening of existing channels and swing basins, and the creation of new channels, swing basins and berth pockets; and
- The disposal of dredged material from the above dredging works into the Western Basin Reclamation Area, which is adjacent to the existing Fisherman's Landing Reclamation and the proposed Fisherman's Landing Northern Expansion.

Whilst it is not yet known whether all proposed LNG plants will be constructed, this EIS has been prepared with the assumption that all proposed projects would proceed. Hence, the total proposed dredge volume has been estimated at 36 million m^3, with provision for disposal of a further 19 million m^3 to allow for ongoing maintenance dredging activity.

Specifically, this EIS has addressed the following activities:

- Construction of the outer bund wall for the Western Reclamation;
- Capital and maintenance dredging within the nominated dredging footprint;
- Placement of dredged material into the Reclamation Area and management of decant waters; and
- Final capping, surface stabilisation and stormwater management upon completion of the reclamation.

The EIS therefore relates to the act of dredging and reclamation, and does not address the construction or operation of LNG plants and associated infrastructure, which are dealt with in separate EIS processes, prepared by others on behalf of each of the potential proponents.

20.2 Philosophy of Impact Assessment and Mitigation

In accordance with conventional practice, this EIS has been prepared to address the Terms of Reference (ToR), and structured to address the following items for each discipline:

- Assessment of baseline (existing) conditions;
- Consideration of potential impacts on environmental, social and economic matters;
- Determination of possible mitigation and offset measures to ameliorate and compensate for the potential impacts.

Where impacts have been determined, possible mitigation measures have been assessed with a hierarchy in mind; namely prevention, mitigation, and offsets. Whilst specific mitigation measures are detailed in the Environmental Management Plan (refer Chapter 19), and summarised in Table 20-1, consideration must also be given to the Queensland Government Environmental Offsets Policy and the Draft Policy Statement: Use of environmental offsets under the Environment Protection and Biodiversity Conservation Act 1999.

20.2.1 Queensland Government Environmental Offsets Policy

The Queensland Government Environmental Offsets Policy (QGEOP) was developed by the DERM. The policy provides a framework for the appropriate use of environmental offsets across terrestrial and aquatic ecosystems, based on the principles of *Ecologically Sustainable Development* (ESD) and the premise that offsets should only be considered after all environmental impacts have been avoided and minimised.

An environmental offset is a positive action for the natural environment taken to counterbalance unavoidable, negative environmental impacts that result from an activity or a development. It differs from mitigation in that it addresses remaining impacts, after attempts to reduce (or mitigate) the impact have been undertaken. An offset may be located within or outside the geographic site of the impact.

20.2.2 Draft Policy Statement: Use of environmental offsets under the Environment Protection and Biodiversity Conservation Act 1999

The Draft Policy Statement on the use of environmental offsets under the EPBC Act defines environmental offsets as 'actions taken outside a development site that compensate for the impacts of that development - including direct, indirect or consequential impacts'. The policy states that offsets are generally considered to provide compensation for the impacts of a project that cannot be adequately reduced through mitigation, but notes that offsets are not designed to make projects with unacceptable impacts acceptable.

Offsets can be direct or indirect, with direct offsets relating to on-ground maintenance and improvement of habitat or landscape values, while indirect offsets include a range of actions that aim to improve knowledge, understanding and management, leading to improved conservation outcomes.

20.3 Key Matters Considered

Chapters 4 to 18 of the EIS address a range of disciplines and activities undertaken in preparing the EIS. Key findings relating to each are presented in this section of the EIS.

20.3.1 Climate Change

The most significant potential impact pertaining to climate change is that of sea level rise, and the incidence of cyclones. However, with the design height of reclamation being well above all but the most extreme (e.g. 1 in 1000 year) events, little impact is predicted. In addition, the bund can easily be modified in the future, should sea level rises require it. Little, if any, impacts of significance are predicted with respect to wind, air temperature or rainfall, other than through the need to design for variability in future stormwater management systems.

20.3.2 Land

Changes under the land category may be sub-divided into the areas of land creation, acid sulphate soils, and the need for quarry material.

Land Creation

The creation of the reclamation, potentially with a large mounded area on the landward side of the reclamation, will lead to the potential for the erosion of material, and its transport to the ocean, unless mitigation measures are established. However, the risk is manageable, as described in the Water Resources sub-section.

Quarry Material

The bund will be constructed from quarried material, which will be sourced from GPC's own quarry. This material is bluestone, which is not anticipated to result in impacts when placed in the marine environment and is highly resistant to weathering. The main impacts associated with transport of quarried material will be those due to truck movements, as covered in the social and noise sub-sections.

Acid Sulphate Soils

Soils with acid sulphate potential do exist within some of the areas proposed for dredging. Potential impacts may arise from either the dredging process, or construction of the bund. Potential impacts from ASS during the construction of the bund wall, dredging and filling of the reclamation relate principally to the potential for oxidation of PASS materials should they become unsaturated. This could occur if any PASS is displaced above the mean high water neap level as a result of the creation of a 'mud wave' from lateral movement of soft material due to the weight of rock being placed for the bund wall. Oxidation of PASS could occur during dredging if sediments don't remain saturated. Oxidation of PASS could also occur during placement in the reclamation should adequate acid neutralising capacity not be available within the sediments, or if the finer sediments where the acid generating capacity is highest become separated from the coarser sediments that contain the ANC during placement within the Reclamation Area. Some PASS may also be released and redistributed into the harbour during the dredging operations from the dredge overflow.

If PASS is allowed to oxidise, there is the potential for acidic groundwater to be released into the harbour from the reclamation and this groundwater could potentially contain elevated concentrations of metals. Also, metals such as iron, arsenic and manganese may precipitate out of solution if PASS materials are placed at the surface and allowed to oxidise, causing staining at ground surface within the Reclamation Area. There are also potential health issues for workers that handle and work around PASS, any leachate or groundwater.

Mitigation measures to be implemented during bund construction, dredging and filling of the reclamation are detailed in the EIS and include:

- Excavation of unconsolidated materials forming the 'mud wave' above the mean high water neap level, ensuring that the remaining material is inundated each tidal cycle;
- Excavation of disturbed, trapped, unconsolidated materials from the western side of the Reclamation Area which are no longer inundated by the mean high water neap tide and placement of this excavated material permanently below the water table within the bunded area;

- Temporary rehandling adjacent to the Reclamation Area is not to occur with any dredged material that has TPA, TSA or TAA concentrations above the ASSMAC guidelines without appropriate turbidity/siltation control;
- During dredging, dredged material is to be kept in a saturated state;
- Management during placement of the dredged material within the reclamation will be required;
- Verification sampling will be conducted to indicate separation of the neutralising fraction and the acid producing fraction does not occur and the sediments do not produce acidity in high enough concentrations to cause environmental harm;
- A detailed ASS Management Plan will be required outlining the recommended strategy during placement, after completion and any other excavation works for future developments within the Reclamation Area. The EIS details the measures that are to be included in the ASSMP.

20.3.3 Coastal Environment

Consideration of the coastal environment has encompassed three very important facets; namely water quality, sediment quality and coastal processes. Water quality and sediment quality have been informed through extensive data collection programs, with the results of previous water quality monitoring campaigns also available.

Water Quality

The assessment of water quality has been based on processing of the results of field monitoring in order to establish a baseline condition, with comparison then made to the results of the modelling of total suspended solids (TSS). The water quality assessment therefore focuses on both naturally occurring levels of turbidity, and those predicted to occur during the dredging campaign, which will result from the creation of dredge plumes.

In order to compare the measurements (NTU) and predictions (TSS), a relationship was established between the two. This suggests a linear correlation at low values (i.e. TSS (mg/L) = 1.12 x NTU) up to a value of approximately 7, tending towards a 1 to 3.7 correlation at higher values (TSS (mg/L) = 3.68 x NTU – 17.92, where NTU is greater than a value of 7).

Water Quality Data

The baseline water quality monitoring program involved six months of data collection from the following two sources spread across the study area. These comprised:

- Fixed water quality loggers up to 10 locations; and
- Monthly vessel-based monitoring of *in situ* water quality measurements and collection of samples for laboratory analysis of water quality parameters at 12 locations.

The *in situ* turbidity data indicated a dry season turbidity ranging up to 30 NTU, with turbidity generally lower at the surface when compared to levels at the bottom of the water column.

Other parameters are also addressed (including heavy metals, pH, dissolved oxygen and nutrients), but the main factor of concern remaining total suspended solids.

Water Quality Loggers

The water quality loggers deployed in this study measured turbidity, light intensity, sediment accumulation, water depth and wave height, though not all of these parameters were recorded at every station during every deployment.

From the combined data sets, the following conclusions were drawn:

- The median and 95th percentile turbidity ranges during the dry season in deep waters (approximately >2 m LAT) of the Project Area are 3-9 NTU and 11-35 NTU, respectively;
- The median and 95th percentile turbidity ranges during the dry season in shallow waters (approximately <2 m LAT) of the Project Area are 9 NTU and 30-90 NTU, respectively;
- The median and 95th percentile turbidity ranges during the wet season in shallow waters of the Project Area are 10-23 NTU and 127-176 NTU, respectively; and
- During the dry season the turbidity during spring tide conditions is 2-4 times those in neap tide conditions.

It can be seen from the above that the Project Area is subject to high variability with respect to suspended sediment concentrations, with 95th percentile values high.

The following values were therefore established as median and 95th percentile values:

		Turbidity (NTU)		TSS (mg/L)	
Data Source	**Applicability**	**Median**	**95th Percentile**	**Median**	**95th Percentile**
Fisherman's Landing (FL)	Decant receiving environment	9	30	15	92
North of FL	Western Basin seagrass beds	9	55	15	184
West of Wiggins Island	Wiggins Island, South FL seagrass beds	9	91	15	317
8 sites	Deep channels	4.5	20	5	56

The above values serve to provide assumed background conditions (refer median values), and target maximums (refer 95th percentile values). When one is subtracted from the other, a "target" value associated with dredging results. For example, in deep channels, the target dredge plume strength would be 51 mg/L (ie 56 mg/L – 5 mg/L). This target serves to allow comparison with modelled results, rather than denoting a single value for monitoring purposes.

Dredging Activities

Dredging activities for the channels are expected to occur in three phases, each of which has been modelled using hydrodynamic modelling software. The full set of cases simulated therefore comprised:

- Base case – Existing conditions including approved dredge works in the Wiggins Island area (already approved);
- Scenario 1 – Base case with Western Basin reclamation bund and Stage 1A and Stage 1B (Stage 1) dredging;
- Scenario 2 – As for Scenario 1 along with Stage 1B (Full) and Stage 2 dredging; and

- Scenario 3 – As for Scenario 2 along with Stages 3 and 4.

Impacts have been predicted for eight different dredging activities based on the operation of one or more cutter suction dredges (CSD), trailer suction hopper dredges (TSHD), and outflow from the decant pond. These have been combined in order to represent dredging and decant activity in each of the scenarios defined above.

In general, the plumes arising from dredging activity by trailer suction hoppers are larger in extent and significance (concentration of suspended sediments) than those arising from either the CSD or decant activities. TSHDs also generate additional impacts through the rehandling process, whereby material is dumped adjacent to the reclamation area, in order that CSDs can then pump it into the reclamation.

To represent the impact of the TSHDs, large TSS source rates (i.e. 75 kg/s for 1 hour) have been applied to represent overflow while dredging, as compared to a rate of 4 kg/s (operating continuously) for the CSDs.

Presentation of Plume Predictions

Results from modelling were generated in a many different formats, in order that understanding of the impacts, and variability of plume concentrations, can be well understood. When all result formats are considered together, a strong appreciation of potential impacts may be gained. The following discussion focuses on those impacts attributable to Scenario 1B, which generates the most significant plumes owing to the simultaneous operation of a TSHD, CSD (for rehandling of material) and discharge from the decant pond.

Turbidity Impacts

The following conclusions are drawn with respect to Scenarios 1a, 1b and 2, which are dominated by TSHD dredging operations:

- Seagrass beds at Wiggins Island are predicted to be subjected to turbidity levels well below a TSS objective based on the 95th percentile of data;
- Seagrass beds at The Narrows and the northern Western Basin are predicted to be subjected to turbidity levels below a TSS objective based on the 95th percentile of data; and
- Seagrass beds in the middle Western Basin are predicted to be impacted, likely in part because of elevated dredged material plumes from TSHD dumping at the rehandling site coincident with flood tides.

With reference to the spatial and time history plots (the latter being provided within the Appendix J report), it can be seen that:

- Peak TSS values occur adjacent to dredging and rehandling locations;
- Values in these areas exceed 100 mg/L, albeit for short periods of time over the 2 month period of simulation;
- Areas of known sensitivity (including The Narrows and Graham's Creek) tend to be lower than 50 mg/L for all scenarios, other than short periods of time for Scenario 1B when values of 50 mg/L may be reached.

Additional observations are offered for the nominated deep water (channel) TSS objective of 51 mg/L:

- Inspection of animations of the simulated dredge plume clearly show that when TSHD dumping occurs coincidentally with a flood tide, much of the dredged material is transported into the shallow waters of Western Basin, with a strong tendency to accumulate along the northern margin of the developed Reclamation Area. This is particularly the case for the flood phase of large spring tides.
- In contrast, TSHD dumping during ebb tides has a much reduced impact on the seagrass beds in the shallow waters between Fisherman's Landing and Wiggins Island as the majority of the dredge plume material is transported in the adjacent deeper channels. This difference between flood and ebb tides provides a potential operational measure to reduce impacts to the northern Western Basin and The Narrows seagrass beds on the basis of timing TSHD dumping events;
- TSHD operations locales were predicted to have elevated TSS levels because of hopper overflows of 1 hour duration. The proximity of the TSHD dredging location to the dumping location has a substantive effect on the areal extent of plume.

Light Attenuation

An indicative annual light climate impact assessment on the basis of representative tides, high incident a PAR value of 1800 uE/m^2/s and mean water depths of 1, 1.5 and 2 m was undertaken, and can be summarised as follows:

- For a 1 m water depth, relative percentage of incident PAR ranges from 20% (Western Basin) to 30% (Background). The relative decrease in PAR is approximately 10% at Wiggins Island and the Narrows and 30% at Western Basin;
- For a 1.5 m water depth, relative percentage of incident PAR ranges from 7% (Western Basin) to 15% (Background). The relative decrease in PAR is approximately 20% at Wiggins Island and the Narrows and 50% in Western Basin; and
- For a 2 m water depth, relative percentage of incident PAR ranges from 1% (Western Basin) to 5% (Background). The relative decrease in PAR is approximately 30-40% at Wiggins Island and the Narrows and 80-90% in Western Basin.

Mitigation Measures

In terms of mitigation, the primary measure revolves around the types and programming of dredge plant. A Dredge Management Plan (DMP) will be developed for the Western Basin capital dredging, employing a similar monitoring program to that undertaken for the recent Berth 1 dredging at Fisherman's Landing, including daily monitoring of sites adjacent to the dredger, within the final reclamation cell, at the outfall and at the Fisherman's Landing and Wiggins Island seagrass beds.

Several key operational considerations during capital dredging have been identified to reduce dredge plume impacts to sensitive habitats. These include:

- Where possible, reduce occurrence of TSHD dumping during selected periods (such as flood phase of large spring tides) through programming, as this is when much of the dredge plume material will be transported into the Western Basin seagrass beds, and to a lesser extent, beyond these beds; and
- The same constraints are not present during ebb tides as most of the dumped dredge material is predicted to be constrained to the deeper channels and does not greatly elevate TSS levels of the Wiggins Island seagrass beds.

Sediment Quality

The sediment sampling undertaken for the Western Basin Dredging and Disposal Project demonstrated the presence of minor concentrations of anthropogenic contaminants and naturally occurring compounds in individual samples across the areas to be dredged. The analysis of a large number of sediment samples from each of the dredge stages for an extensive suite of potential contaminants has revealed that the overall quality of the sediments in the Project Area are compliant to the NAGD (2009) and the Queensland EPA Environmental Investigation Levels. The only exception to the compliance of the sediment quality with the adopted guideline values are the elevated manganese concentrations observed within the Stage 1B area. However, across all the sediments to be dredged, the manganese concentration is compliant to the QEPA EIL.

Due to the comprehensive nature of the sediment sampling and analysis program, the results are considered representative of the sediments to be dredged for the proposed Western Basin Dredging and Disposal Project. The results of the sediment chemical characteristics are also consistent with a number of other recently approved capital and maintenance dredging sampling programs within Port Curtis. It is therefore considered that the sediments proposed to be dredged are suitable for placement within the proposed Western Basin Reclamation Area, without the requirement for further sampling and analysis and no significant impacts relating to sediment quality are anticipated for the proposed dredging.

The main potential impact of sediment quality is the resuspension of sediments subsequent contaminant resuspension and/or desorption and re-entry into the water column. This may occur through overflow during trailer suction hopper dredging, bottom dumping and rehandling, disturbance of bottom sediments during rock placement during bund wall construction and during filling of the reclamation. As the material to be dredged is considered suitable for dredging and placement in the reclamation, it is not expected that mobilisation of sediments into the water column will result in the introduction of contaminants into the water column. The inner face of the bund wall will be lined with geotextile fabric and internal decant ponds will be established to manage the quality of decant waters discharged from the reclamation.

Coastal Processes

Changes to coastal processes focus on the tidal prism (tide levels and tidal flows), peak velocities, and sediment transport. Changes are predicted in response to (a) the dredged channels, and (b) the presence of the reclamation.

It is not necessary to mitigate the changes to the tidal flows and water levels in themselves as the changes are within the normal bounds of the processes that occur in the natural system (representing the inherent variability of coastal and estuarine environments in a macro tidal area). However, it may be necessary to mitigate against or manage some of the effects that these changes bring about. The effects that appear to have the most impact are:

1. The increased potential for fine silt deposition in the newly dredged channels; and
2. The increased potential for sand sized deposition into the existing channels downstream of the Western Basin.

The project dredged areas are likely to experience significant silt deposition due to the relatively low-energy hydrodynamic regime that will occur following dredging.

The principal areas where silt deposition is predicted to occur are:

- Western side of Fisherman's Landing swing basin; and

- "Curtis" Island channel upstream of South Passage Island and China Bay (including the two swing basins adjacent to Curtis Island).

Silt deposition potential into the above areas increases progressively as the extent of dredging increases with each dredging scenario. A fine material siltation rate of 255,000m^3/year in the dredged channels and new swing basins in the Project Area has been predicted for the ultimate dredging scenario.

The significance of this is that silt deposition is not a major source of sedimentation problems in the existing Port Curtis dredged areas (excluding closed harbours) due to high current speeds and associated bed shear stresses.

Impact of Reclamation

The Reclamation Area affects the hydrodynamics of the harbour through a reduction in the tidal prism and, on a local scale, obstructs flows that previously flowed across its footprint area. This leads to a reduction in flows downstream of the Reclamation Area and an increase in flows adjacent to the Reclamation Area from the reduction in the cross sectional area leading up to The Narrows. Different flow conditions are predicted within the immediate vicinity of the reclamation, particularly in the shallow areas to the north and west.

Specific estimates of the quantum of changes to flows and velocities have been documented previously, and are typically not significant in scale.

20.3.4 Water Resources

Impacts on water resources (surface water and groundwater) are predicted to be low. This arises primarily from the nature of the proposed project, reclamation of an inter-tidal / shallow area within the harbour. With no works proposed on existing land (i.e. that above the mean high water spring or highest astronomical tide marks), there is limited potential for impacts to occur.

Impacts would have been more likely if the reclamation had adjoined existing land areas, with the need to create new flow paths for surface water runoff, and high potential for an impact on groundwater flows, particularly to the north southern end of Kangaroo Island). However, the reclamation has been designed to avoid these problems by (a) minimising its potential footprint, and (b) preventing the reclamation from being "land attached" to either the west or north.

Those potential impacts that do remain are relatively small in nature, with mitigation measures discussed in Chapter 8, Chapter 19 and Section 20.4.

20.3.5 Nature Conservation

Terrestrial Flora and Fauna

The vegetation communities range from eucalypt woodland and open-forest communities to tidally influenced mudflats and mangroves. Condition assessments identified that the majority of the vegetation communities were in good condition. Seven fauna habitat types are represented in the study area and these generally correspond to the delineated vegetation communities. In general, the habitats identified within the study area provide a range of resources for fauna. The intertidal and coastline habitats, such as those with tidal influences or estuarine vegetation complexes, provide a distinctly different fauna assemblage, as do the freshwater areas. The exposure to coastal processes (winds, saline water, tides and wave action) result in an ecotone between estuarine and inland habitats.

Based on desktop assessments and field surveys, 27 fauna species of conservation significance are considered likely to occur in the study area. The majority of these species are considered to inhabit the dryland terrestrial environment adjacent to the reclamation footprint. This area has potential for indirect impacts only. In addition, the reclamation footprint boundary includes marine tidal flats used for foraging and roosting by a number of EPBC Act-listed migratory shorebirds. Mudflats in the north of the study area are considered important habitat for shorebirds within the Gladstone region. A number of pest and weed species were also detected during the assessment.

Impacts and risks associated with the project to the terrestrial ecosystems are generally linked to the loss and potential degradation of marine plant communities and intertidal habitats. The change in coastal processes as a result of the reclamation is likely to reduce the extent and suitability of foraging habitat for shorebirds in the area. How shorebirds will respond to these changes is uncertain. For some shorebird species the predicted changes in hydrology may be beneficial, at least in the short term. For others (and perhaps the majority of species currently utilising habitat in this area) these changes are more likely to be detrimental. Impacts on the marine plant vegetation communities in the intertidal area may also occur as a result of changes in coastal processes. As a result, marine plant offsets will be negotiated in accordance with relevant legislation including the EPBC and Queensland Government offset policies.

In addition to expected offset requirements, mitigation measures proposed include: the use of low wattage, directional lighting, minimising construction of the northern bund wall during critical bird migratory periods if possible, protecting the northern end of the intertidal channel from scouring, establishing speed limits on access roads, installing rubbish disposal facilities and managing tailwater decant to achieve approved water quality objectives. Monitoring of marine plant and migratory shorebird communities will also be undertaken to allow for adaptive management of impacts during the construction and operation of the Project.

Marine Ecology

The Project Area supports a number of key marine benthic habitats, some of which are unique to those areas with regard to the species compositional mix they support, the majority of which are, however, well represented within the Study Area. The taxonomic composition of the macroinvertebrate benthic communities were fairly similar to one another at Western Basin, Fisherman's Landing and the Reference Area, where around half of all the organisms present were molluscs and crustaceans with seagrass and algae the other dominant benthos. These communities differed from those at The Narrows, Channel and Passage Islands where a more diverse, greater proportion of different types of animals were observed. Western Basin and Fisherman's Landing had the least diverse communities of all locations surveyed.

The marine megafauna study supported a number of key findings:

- Dugong distribution recorded in the current survey supports previous aerial survey observations by Marsh *et al.* 2005 and a close association with seagrass habitats. The habitat utilisation by dugongs was notably different at a high tide compared with low tide distributions, suggesting the importance of inter tidal seagrass habitats to dugongs in this area.
- Marine megafauna species are widely distributed throughout Port Curtis and the Gladstone region with observed high habitat utilisation, recognising the importance of Rodds Bay DPA habitat area for these coastal species, particularly on a high tide;
- The environment of Western Basin and adjacent waters represent important habitat for Indo-Pacific humpback dolphins of various age classes as numerous calves were observed on survey;

- Nesting habitats for marine turtles do not occur within the immediate footprint of the Project though inter-nesting habitat is identified within the Project Area; and
- Good quality foraging habitats exist for green turtles and habitat of high conservation value to dugongs is recognised throughout much of the Project Area and Port Curtis.

As the Project involves reclamation of approximately 235 ha of seabed within the Western Basin footprint the marine benthic habitats in this area will be directly impacted. Areas to be dredged in the channels and proposed channels will also be directly impacted. The primary direct impact will involve removal of all seabed environment under the direct footprint of the Reclamation Area and channel dredging areas, which totals approximately 902 ha including habitat that is already dredged and will be deepened. Areas within the channel are expected to be recolonised post dredging within two to five years.

The major indirect impacts expected include degradation of water quality during dredging and disposal activities resulting in displacement of mobile fauna and potential die back of benthic fauna and alteration of the hydrodynamic regime in the Project Area. This is expected to increase sedimentation in some locations, such as along the eastern face of the reclamation footprint, but is also expected to increase scouring potential around the bund.

In addressing the potential risks to the marine system from the Project proposed mitigation measures were examined, where opportunities to mitigate impacts are available. Key mitigation measures include development and implementation of a dredge management plan, restriction of dredging activities to the agreed footprint of channel works, development and implementation of a reactive sensitive habitat monitoring program, removal of marine fauna from the Reclamation Area prior to bund closure, use of marine fauna spotters and turtle exclusion devices on trailer suction hopper dredgers, use of soft starts during pile driving activities and considered use of speed restricted areas.

A number of direct impacts are not able to be mitigated. These primarily relate to loss of habitat as a consequence of the Project activities. Offsets will be implemented for these habitat losses. Some benthic marine habitat will be created by the Project and an estimate of the areas to be lost and gained as a result of the Project activities has been provided in the EIS.

20.3.6 Air Quality, Noise and Vibration

Air Quality

With the likelihood of significant air emissions being low, there are limited mitigation measures required. The primary potential impacts are those relating to dust, and hence mitigation measures also focus on the suppression of dust, and the progressive capping and/or revegetation of the reclamation.

Noise

The results of the modelling show that the predicted noise levels from construction activities are below the ambient and background noise levels and comply with the worst case night time site specific criteria of 45 dB(A) for the receiver on Fisherman's Road and 25 dB(A) for the receivers (located on Targinie Road).

The results of the assessment suggest that construction activities associated with the Project will not significantly impact on:

- The health and biodiversity of ecosystems;

- Human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to sleep, study and be involved in recreation, including relaxation and conversation; and
- The amenity of the community.

Activities that may create underwater noise include dredging activities, placement of rock for the bund wall and pile driving. For the latter, which relates to the placement of navigation beacons, mitigation can be achieved through limitation of the times during which piling occurs, and by utilising a “soft-start” procedure between long breaks in activity.

Impacts from vibration were also considered. There is a very low likelihood that there will be any impacts from vibrations generated by construction activities, and hence, no mitigation measures are required to manage impacts.

20.3.7 Transport

Likely traffic and transport infrastructure impacts from the Project have been considered in terms of construction phase activities, specifically:

- Workforce/commuter traffic generated by the construction of the Western Basin Reclamation Area and dredging activities;
- Haulage of quarry material to the reclamation site for the purposes of bund construction;
- Dredging vessels, shipping and port vessels and small craft during dredging.

Predicted impacts relate to (a) land based impacts, and (b) impacts on marine traffic.

The workforce during the construction of the Reclamation Area will be substantially lower than during dredging operations, with a workforce of 30 – 40 people anticipated. In relation to dredging, it is expected that a total workforce of 225 people will be used during the peak dredging period when it is likely that four dredgers will be in operation simultaneously.

Significant impacts are not predicted in relation to road intersections, pavements, rail or airport. Of greatest interest is the haulage route, with a dedicated haul route proposed.

In terms of potential marine transport and traffic impacts, it is noted that:

- In general, no impact to existing commercial shipping traffic and facilities is anticipated during construction of the reclamation, given the location of the proposed reclamation.
- However, prior to the commencement of dredging operations, it will be necessary to inform the Regional Harbour Master of the specifics of the works and the locations in which dredgers will be operating.
- The conditions of contract for dredging works typically require that dredging contractors avoid any interruption to shipping movements within the Port, with this issue dealt with in the contractual process.
- When cutter suction dredgers (CSD) are being used, with a pipeline extending from the dredge to the reclamation, the option exists for the use of floating or sunken pipelines. Given the reduced restrictions for marine traffic, it is anticipated that Contractors will opt for a sunken pipeline for substantial extents of the pipeline route.

20.3.8 Cultural Heritage

The assessment of potential impacts of the project on Aboriginal cultural heritage will be carried out as part of the CHMP (Cultural Heritage Management Plan) development and implementation process. Protection, management and mitigation measures will be discussed by the parties following the completion of the assessment program incorporating cultural heritage surveys and related consultation. The results of this process will then be developed into a specific Management Plan required under the processes outlined in the CHMP.

No sites or places of Historic Heritage Significance were found to exist within the Project Area. Seven places of Historic Interest were located that may potentially be impacted by the Project. These sites are not considered significant, and therefore do not warrant specific mitigation measures.

20.3.9 Social Impact

The identification of potential social impacts focused on the construction period of the Project, which will involve dredging activities, construction of the revetment (bund) wall and the placement of dredged material into the reclamation, including the consideration of:

- Road safety;
- Safety of recreational and commercial users of the marine environment;
- The direct loss of recreational and natural areas;
- The loss of access to any areas during the construction period;
- The impost of exclusion zones around the LNG industry precincts construction zones;
- Impacts on labour markets;
- Impacts on housing.

The most significant negative impacts identified above relate to the loss of recreational and natural areas, the reduced viability of commercial fishing, and the potential health and safety hazards caused by the Project. Significant positive impacts include employment and increased local business opportunities related to the construction phase of the project. The mitigation plan focuses on communicating project activities, reducing the risk of accidents and maximising local employment and local spend.

One potential option is the consideration of measures that help to offset/minimise impacts on recreational fishers based on the likely loss of recreational fishing sites associated with the Project. This would require a coordinated approach involving local recreational fishers, representative bodies and relevant State Government agencies; and may consider broader cumulative recreational fishing impacts. GPC will participate in any future negotiations lead by the Queensland State Government as part of the management of recreational fishing impacts in the Western Basin of the Port.

The main stakeholders likely to be impacted by any reduction in marine safety are recreational fishers and other recreational users of the project site and surrounding area. While a reduction in marine safety can potentially have significant consequences, including serious accidents, the likelihood of a marine safety incident will be reduced through the implementation of management measures such as safety buffers around dredgers.

20.3.10 Landscape and Visual Impact

The proposed Western Basin Reclamation is located approximately 10 kilometres north of Gladstone, adjacent to the existing Fisherman's Landing port area and proposed Fisherman's Landing Northern Expansion, with existing industrial development extending north from the Gladstone urban area a major feature of the visual landscape. These industrial complexes include Cement Australia, Orica, Rio Tinto's Alcan Yarwun facility (RTAY), the RG Tanna Coal Terminal and the NRG Power Station. Planned/proposed developments in the area include the Wiggins Island Coal Terminal, the Gladstone Pacific Nickel plant, the Fisherman's Landing Northern Expansion, and the LNG facilities on Curtis Island.

These developments will further reinforce the industrial nature of the visual landscape to the north of the city. With each new development comes a change to the landscape and visual character of the area with the cumulative impact being an increasing industrialisation of the visual environment.

The Reclamation Area will be a prominent visual feature when viewed from this part of Port Curtis. The proximity of the viewpoint to the site along with the addition of the new linear element of the bund wall, the extension of the land area through the reclamation and the creation of the mound will all impact on the landscape amenity from this viewpoint and result in an increasingly industrialisation of the visual landscape foreground, offset by a vegetated mound at the rear of the proposed reclamation.

Overall, the view from water level in the vicinity of the site will be substantially modified, subject to viewing location with the introduction of the new landform. For example, views from Port Curtis / Targinie Channel area towards the mainland will be partly lost over time, firstly with the bund wall construction, and then with the construction of the mound on the Reclamation Area. Some of the background views will be lost due to the elevation of the new features above the water level. The extent of the change to the view and the associated visual impact will depend on the viewing location and proximity to the bund wall. The impact will increase with proximity to the bund wall.

20.3.11 Economic Impact

Gladstone is an expanding region with strong population growth, high labour force participation and low unemployment, albeit marginally higher than the Queensland average. There are also a number of projects underway, committed or under investigation within the region. The Western Basin Dredging and Disposal Project will facilitate a range of major industrial projects within the Port of Gladstone.

The Western Basin Dredging and Disposal Project is anticipated to support between approximately 890 and 1,500 full time equivalent positions annually throughout the first ten years of Project works. The labour market has slackened over the past few months resulting in the availability of qualified employees. For positions that are unable to be filled by workers within the region, the existing commercial accommodation appears to have sufficient capacity to accommodate the new workers.

At the target discount rate of 6%, the Project has a positive net present value and is economically viable. For the main case of the cost benefit analysis, the Project remains economically viable across a spread of discount rates, having an internal rate of return of 12.33%. The Project remains economically viable at the test discount rate of 6% in both sensitivity tests. In the first test, the extent of environmental disbenefits is assumed to significantly increase, and in the second test the willingness to pay for Western Basin harbour services is assumed to fall from $2.75/tonne to only $1.00/tonne.

The Project aims to increase the efficiency and expand the capacity of the Port of Gladstone, which is one of the region's most significant pieces of transport infrastructure. Although the Western Basin

Dredging and Disposal Project will be a significant Project within the region, the change to the Gladstone economy would be marginal, rather than general.

20.3.12 Health and Safety, Hazard and Risk

Health and Safety

There are potential risks to health and safety of the workforce and community from the dredging and disposal activity including dust and odour, noise, mosquitos and biting midges and construction safety. A qualitative assessment of potential health and safety hazards to personnel on site and the general public during the dredging and disposal activities was prepared for the Project. The implementation of workplace health and safety procedures and preparation of an Health and Safety Management Plan and a Mosquito and Biting Midge Management Plan for the Project will minimise the potential risks to acceptable levels.

Hazard and Risk

The identification of the major hazards and risks from the construction and operation phase of the Project was undertaken in a workshop format, utilising the GPC likelihood and consequence rating tables. The Hazard and Risk assessment identified the nature and scale of hazards for this project. The study identified a total of 41 hazards that resulted in 16 high risks, 22 medium risks, two low and one very low risk hazards before the implementation of mitigation measures. After mitigation measures, there were no high risks, 28 medium risks, eight low risks and five very low risks hazards. A number of risk reduction recommendations were developed, including management plans for dredging, construction safety, construction environmental management, oil spill response plan, fire emergency response plan, natural hazard emergency response plan.

The proposed Project will not significantly impact on the amenity of sensitive receptors, providing appropriate management procedures are implemented as identified in the assessment studies. The controls identified, when in place, will adequately safeguard against safety, asset and environmental consequences from hazards associated with the project. The risk assessment carried out in this study assumed that the assessment process will continue throughout the project life to refine and update the outcome of the development approval/ environmental risk process.

20.4 Proponent Commitments

The implementation of mitigation measures will predominantly be under the management and responsibility of the Gladstone Ports Corporation. Table 20-1 provides a summary of the various commitments proposed by GPC, in accordance with the findings of the EIS. Further detail, including the potential impacts that are being addressed by these commitments, can be found in the Environmental Management Plan (Chapter 19) and the EIS chapters. The final set of commitments will be defined though the approval process, with conditions to be nominated in the Coordinator General's report.

Table 20-1 Proponent Commitments

Element	Commitment
Climate and Climate Change	The proponent will allow for predicted thermal movements during the design stage.
	The proponent recognises that maintenance and possibly replenishment of the rock armour in places may be necessary after storm events.
Acid Sulphate Soils	The proponent will excavate unconsolidated materials forming the 'mud wave' above the mean high water neap level during bund construction, ensuring that the remaining material is inundated each tidal cycle. ◗ The proponent will provide neutralisation treatment and validation of the above materials as required, or store excavated material under water; or ◗ The proponent will ensure the placement of 'mud wave' material permanently under water within the bunded area, for material compliant with the ASSMAC stockpiling guideline limits in Dear *et al.* (2002).
	The proponent will manage any re-distribution of any material trapped within the bunded area so that it remains permanently under water, within the bunded area.
	The proponent will ensure all disturbed, trapped, unconsolidated materials no longer inundated by the mean high water neap tide from the western side of the Reclamation Area are excavated and – placed permanently below the water table within the bunded area subject to compliance with the ASSMAC ASS material stockpiling guidelines in Dear et al. (2002), or – placed in the bunded area following treatment with lime and validation sampling.
	Other excavation of materials (if required): ◗ The proponent will provide for neutralisation treatment and validation of excavated materials; ◗ The proponent will provide for collection and treatment and appropriate disposal of any potential contaminated leachate as required. ◗ The proponent will undertake lime dusting of excavation surfaces prior to back filling.

Element	Commitment
	The proponent will ensure temporary bottom dumping outside the reclamation area does not occur with any dredged material that has Titratable Peroxide Acidity (TPA), Titratable Sulfidic Acidity (TSA) or Titratable Actual Acidity (TAA) concentrations above the ASSMAC guidelines without appropriate turbidity/siltation control.
	The proponent will ensure that dredged material is kept in a saturated state during dredging to reduce the potential impact of oxidising potential acid sulphate soils (PASS).
	The proponent is to prepare a detailed Acid Sulphate Soils Management Plan (ASSMP) outlining the recommended strategy during placement, after completion and to provide guidance to future proponents that may construct facilities on the reclamation. The details required for the ASSMP are located in Section 19.3.2.
	The proponent will ensure materials identified as PASS or actual ASS (AASS) are dredged in a way to ensure material is not oxidised during the dredging process and any overflow from the dredge is kept to a minimum. Once the materials are ready to be placed within the reclamation area, the same management process used for the capital dredging is to be adopted.
Coastal Processes	The proponent will monitor the actual deposition rates in the newly dredged channels and devise a maintenance dredging plan to arrange its removal and placement within the Reclamation Area so that there is no interruption to future ship movements. This rate of siltation of fine silts could be accommodated by an over-dredging allowance to extend the time between maintenance dredging campaigns.
Water Quality	The proponent will visually monitor and photograph turbid plumes daily during rock placement in the initial construction stages. It is noted that it is difficult to mitigate this plume as the large tidal range and strong tidal currents limit the practicality of silt curtains in this environment.
	The proponent will ensure the fine fraction (<20 mm) is scalped from rock extracted and screened at the quarry site to reduce the potential for generation of turbid plumes through the introduction of fines into the harbour.
	Although it is not anticipated to be a concern, the proponent will identify the potential for acid production from the rock when it is placed in the marine environment prior to the commencement of construction. If any of the analysis results suggest uncertainty (i.e. potential for production of acid), then the proponent will need to undertake additional sampling and management or mitigation measures will need to be implemented as appropriate.
	The proponent will manage the erosion of core material by waves during potential storm conditions by placement of armour material to the exposed face of the core material closely behind the core work face.

Element	Commitment
	The proponent will ensure a stockpile of armour material will be held at the quarry, sufficient to cover any exposed core if a cyclone were to approach. Contingency planning for a storm will require the placement of the stockpiled armour material to cover exposed faces of the core material. A maximum of 50 m of unarmoured length of wall will be maintained during construction.
	The proponent will put in place management strategies to ensure no planned refuelling or maintenance of construction equipment will occur on the site. Further, equipment will not be parked at the site for a significant time, reducing the potential for significant spills of oils and fuels to occur.
	The proponent will ensure all construction equipment undergoes regular maintenance and pre-start inspections on a daily basis to identify any leaks.
	The proponent will ensure spill kits for land and water based spills are kept at the site and personnel trained in their use.
	The proponent will prepare emergency response procedures.
	The bund design will include the placement of geotextile fabric on the inner face of the bund before commencement of filling operations. This will act to minimise the migration of fines through the bund wall and into the surrounding waters from the differential pressures created on either side of the wall by the rise and fall of the tide.
	The proponent will prepare multiple cells within the reclamation area to allow finer materials to settle out of suspension via weir boxes with adjustable gates so that water can be retained for longer periods if needed (the outfall of the weir box must be able to be completely closed if water quality objectives are exceeded).
	The proponent will provide floating booms on site to be deployed into the reclamation cells should wind conditions result in waves stirring up deposited sediments within the reclamation cells.
	Where possible, reduce occurrence of TSHD dumping during selected periods (such as flood phase of large spring tides) through programming, as this is when much of the dredge plume material will be transported into the Western Basin seagrass beds, and to a lesser extent, beyond these beds.
	The proponent will consider the option to pump out TSHDs directly into the reclamation during the flood phase of large spring tides coincident with daytime.

Element	Commitment
Sediment Quality	The proponent will only operate within safe weather conditions to prevent spills from dredgers during relocation to the Reclamation Area.
	The proponent will undertake activities on the appropriate tide and in the appropriate direction of tidal run to reduce cumulative mobilisation of sediments.
	The proponent will line the inner face of the bund wall with geotextile fabric to reduce potential for fines to be moved back into marine environment through wall following placement.
	The proponent will manage tailwater decant to maintain water quality within water quality objectives.
	The proponent will ensure sediments to be used for reclamation works are tested for contamination and the reclamation area is constructed and managed to reduce/remove potential impacts from any contaminants, including PASS.
Hydrology and Stormwater Management	The proponent is to ensure the outlet of the intertidal channel is rock armoured and potentially widened locally to reduce the risk of scour.
	The proponent is to undertake routine monitoring to determine if scour is occurring in the intertidal channel and that in the event that such scour is occurring, the effects on turbidity and stability of the bund wall are reassessed and the bed stabilised where necessary.
	The proponent is to ensure the proposed temporary at-grade construction access road does not impinge upon the intertidal channel either vertically or horizontally.
	The proponent is to remove the proposed temporary at-grade construction access road in its entirety at the earliest opportunity practicable and rehabilitate the intertidal channel.
	Grass lined channels will be used on the reclamation surface to convey stormwater.
	The proponent will develop the design of the stormwater management system (stormwater drainage system and stormwater treatment measures) for the proposed Reclamation. The focus of the conceptual stormwater design is for the final reclamation surface. The final design may differ from the conceptual design, but performance requirements must still be met.
	The proponent will identify whether chemical flocculation is required to ensure water quality objectives are met.

Element	Commitment
	The proponent will limit soil erosion and loss at source by ensuring: ◗ All exposed surfaces on the proposed Reclamation Area be appropriately vegetated as soon as is practicable; ◗ Sediments are capped as soon as practical to limit sediment erosion and resuspension; and ◗ Structural source control systems, such as sediment fences, are employed.
Groundwater	The proponent will ensure storage areas for vehicles, machinery, equipment, chemicals etc. whether on land or within the reclaim area during construction have appropriate facilities to contain spills, leaks and surface water runoff to reduce the potential for contamination of groundwater through infiltration.
	The proponent will install inlets and/or drainage channels at sea level within the proposed Reclamation Area, to minimise groundwater level mounding within the area itself and hence, reducing the potential for increased groundwater levels in onshore areas.
Terrestrial Flora and Fauna	The proponent will seek to, if possible, minimise construction of the northern bund wall during critical migratory bird visitation periods (March-April and September-October).
	The proponent will employ directional lighting pointed towards the Project Area and away from surrounding habitat.
	The proponent will use low wattage lights and glare guards in vicinity of the important shorebird habitat in the north-west of the Project area.
	The proponent will ensure plant and equipment are well maintained.
	The proponent will educate employees of environmental responsibilities during inductions.
	The proponent will establish appropriate speed-limits within the Project Area to restrict incidence of wildlife road-kill.
	The proponent will install appropriate rubbish disposal facilities on site (including recycling option) and ensure that food waste is disposed of in contained bins.
	The proponent will implement vehicle hygiene measures implemented to prevent introduction of weeds and pathogens to the Reclamation Area and the marine environment. This will include regular wash-down of trucks off-site.

Element	Commitment
	The proponent will review all products brought on site, including quarry material and straw bales (if used), and ensure they are free of weeds, seeds and pathogens.
	The proponent will ensure any weed infestations are controlled. If the proponent seeks to use herbicides, a marine ecologist should be consulted and only approved herbicides used at approved application rates.
	The proponent will ensure no domestic animals are to be brought on site. If pest animals are detected, the proponent will develop and implement pest control programs.
Marine Ecology including Megafauna	The proponent will consider implementation of 'like for like' offsets given the importance of the area to be reclaimed as a foraging habitat.
	The proponent will ensure that marine fauna are manually removed prior to reclamation works closing bund. Species will be relocated to adjacent open marine system. A strategy to decrease potential trapping of fauna during bund construction such as use of nets to deter entry into bunded area will be adopted.
	The proponent will design the bund to reduce any long-term scouring potential. The proponent will monitor mangrove and benthic habitat for detrimental change in health and undertake remediation activities in accordance with EMP.
	The proponent will restrict dredging activities to agreed footprint of channel works to minimise impact to critical habitats.
	The proponent will adhere to Commonwealth and State biofouling and ballast water management requirements.
	The proponent will manage dredge activities under a Dredge Management Program (DMP).
	The proponent will monitor water quality turbidity levels against site specific objectives within relevant sensitive ecosystem receptors and adjacent habitats and respond as required by DMP. The objectives and monitoring sites will be determined during development of DMP.
	The proponent will adopt appropriate overflow management for dredge to reduce water quality impacts in identified sensitive areas, if trigger values exceeded. Management provisions to be documented in DMP.
	The proponent will require the dredging contractor to use a tickler chain or deflector head to avoid interaction with turtles resting on seabed. A fauna spotter will be maintained on the dredger and dredging operations will be managed to minimise interaction with megafauna. Dredging will not commence if megafauna noted within 50m of dredge head. Wait until megafauna moves out of immediate area.

Element	Commitment
	The proponent will implement appropriate design and construction of bund, including lining bund with geotextile fabric and installing internal bunding, to reduce potential for fines to be moved back into marine environment through the bund wall or via the decant waters. The proponent will also consider the use of floating booms within internal bunds to reduce potential for wind disturbance within retention ponds stirring up settling material.
	The proponent will manage movement of decant waters between bunds through installation of adjustable weir boxes and control rate of flow to increase sedimentation potential and reduce carriage of fines back to marine environment.
	The proponent will cap and revegetate finished land surface to minimise erosion and sedimentation for management of stormwater run-off.
	The proponent will design the stormwater management system to manage quality of water entering marine environment from run-off and will manage the stormwater pond discharge to maintain water quality to stated objectives.
	The proponent will ensure that sediments to be used for reclamation works are tested for contamination and the Reclamation Area will be constructed to reduce/remove potential impacts from any contaminants, including PASS.
	The proponent will use warning strikes or similar prior to commencement of pile driving (if found to be effective). Soft starts and/or underwater warning noises prior to activity commencement will be implemented where possible to allow megafauna opportunity to leave area of impact. Pile driving activity will be avoided if breeding of megafauna noted in immediate area. The proponent will use a megafauna spotter on vessel to manage conduct of activity to avoid interaction with megafauna when animals within close (50m) proximity to piling vessel.
	The proponent will use speed restriction areas for construction works to minimise risk of strike and educate construction workforce regarding risks to marine megafauna and requirement to avoid interaction with those species.
	If feral cats are detected on site, the proponent will implement feral cat and other pest control programs (which may include trapping/baiting) and will remove and dispose of any cat faeces to prevent introduction of the feline parasite *Toxoplasmosis gondii* into the marine environment.
Air Quality	The proponent will use dust suppression trucks on the reclamation area as required.
	The proponent will ensure all construction vehicles including dredging vessels are properly maintained and standard emission reduction devices remain on vehicles.
	The proponent will implement appropriate revegetation of the reclamation area once construction is complete.

Element	Commitment
Greenhouse Gases	The proponent will minimise the length of the haulage route from the quarry to the reclamation area site, to reduce GHG emissions through reduced fuel usage.
	The proponent will encourage drivers operating on the site to utilise driving methods employed that reduce the GHG emissions associated with the transportation of the quarried materials to the site.
	The proponent may consider options to reduce any possible congestion associated with the filling and emptying of the trucks at the quarry and Reclamation Area. Measures that could be implemented on the quarry and Reclamation Area include single direction loop roads in and out of the sites that allow trucks to enter and leave without unnecessary manoeuvring, and procedures to encourage drivers to turn off engines when any significant delays are experienced along the route.
	The proponent will investigate the potential to switch to the use of bio-fuels for the transport vehicles.
	The proponent will investigate sourcing polyester geotextile manufactured from recycled PET, which will significantly reduce the amount of embodied emissions in the geotextile material used for the Reclamation Area.
	The proponent will choose the most suitable site equipment that can carry out the required tasks with the most efficient fuel consumption rates.
	The proponent will ensure the dredging operation is designed to reduce overall fuel use.
	The proponent will schedule the dredging programs so that the same dredgers can be used for more than one dredging program where possible.
	The proponent will select newer dredges with more efficient engines if possible.
	The proponent will carry out any additional fuel and energy savings measures identified in the Gladstone Port Corporation Energy Efficiency Opportunity assessments, such as the implementation of a system for analysing energy usage, as well as working to ensure that energy efficiency clauses are included in all equipment tender specifications will also contribute to reducing the potential GHG emissions associated with this project.

Element	Commitment
Noise and Vibration	<u>Reclamation Area</u> The proponent will ensure all combustion engine plant, such as generators and compressors are checked to ensure they produce minimal noise. The proponent will ensure all vehicles and boats are kept properly serviced and fitted with appropriate mufflers. Where practical, the proponent will ensure all vehicular movements to and from the dredging site are made during normal working hours. Where practical, the proponent will ensure all machines are operated at low speed or power and will be switched off when not being used. The proponent will ensure activities that cause excessive noise such as pile driving are limited to business days or Saturdays between 6:30 am and 6:30 pm. The proponent will ensure machines found to produce excessive noise compared to industry best practice are removed from the site or stood down until repairs or modifications can be made. <u>Dredging and piling</u> The proponent will participate in active community consultation with noise sensitive receivers prior to works commencing. Where possible, the proponent will avoid dredging in close proximity to noise sensitive receivers during the night time period. The proponent will ensure boats, dredgers and tugs are kept properly serviced and fitted with appropriate mufflers. Low-noise piling methods should be adopted where feasible by the proponent.

Element	Commitment
Traffic and Transport	<u>Waterborne Traffic – General</u> Prior to the commencement of dredging operations, the proponent will inform the Regional Harbour Master of the specifics of the works and the locations in which dredgers will be operating. The proponent will ensure all dredgers are marked with daymarks and lighting to conform to the International Association of Lighthouse Authorities (IALA). To prevent collisions, the proponent will implement site specific training and traffic control, dredging contractor to have well defined procedures and trained crew, communication between vessels. GPC will increase public awareness on activities proposed. <u>Waterborne Traffic – Shipping</u> The proponent will ensure all Trailer Suction Hopper Dredgers (TSHD's) dredging within the existing declared channels liaise with Port Control and adjust their cycle of dredging and material discharge to accommodate the schedule movements of shipping in the channel. If necessary, from time to time, the dredgers may even cease operations and stand clear of the channel to permit the shipping movements. The proponent will ensure stationary dredgers such as Cutter Suction Dredgers (CSD's) or Grab Dredgers will, under the terms of the contract, be required to suspend operations and pull aside from the channel ahead of the shipping movement being committed to sailing the channel reach. Clearing the channel will require that all pipelines and anchors are clear of the channel. At the time of bidding the works, the dredging contractors will need to confirm with the Regional Harbour Master as to whether it will be acceptable to slacken mooring lines – leaving them on the channel bed as the ship transits the channel. The proponent will ensure all dredgers are equipped with radio to facilitate communication between the dredge, shipping and port control through the transit of the vessels. if a Master of a ship has not completed the requisite transits to or from the port, the proponent will ensure that a pilot is taken on-board for the ship's transit. <u>Waterborne Traffic - Port Vessels and Small Craft</u> The proponent will ensure the conditions of contract for dredging works will require that dredging operations to minimise interruptions to Port Vessels and small craft. In the immediate vicinity of the dredge, vessels will need to adhere to standard navigation rules in terms of speed restrictions and passing clearances.

Element	Commitment
	<u>Waterborne Traffic – Operation Phase</u> The proponent will provide education of vessel operators to minimise impact on marine fauna and benthic disturbances, and enforcement of speed limits. <u>Rail Network</u> The proponent will provide adequate signage at the rail crossings to minimise potential collisions between haulage vehicles and trains and a review will need to occur of the signage when the final haulage arrangements are confirmed. <u>Oil and Fuel Spills</u> The proponent will ensure maintenance and servicing of vehicles is undertaken at off-site facilities. The proponent will ensure all plant and machinery (particularly hydraulic hoses, fuel lines, etc) are inspected daily and any defaults or signs of wear and tear reported to the Construction Supervisor for repair as part of a preventative maintenance program. The proponent will provide spill kits including containment and treatment equipment and materials at the site, near where equipment is being used.

Element	Commitment
Cultural Heritage	<u>Places of Historic Interest</u> It is recommended that the proponent, where possible, retain Historic Interest places on the foreshore adjacent to the Reclamation Area. <u>Unexpected Finds of Cultural Heritage Sites</u> During construction, if an item or object that may be considered to be historic heritage appears, then the following applies to the proponent: ◗ All work at the location of the potential find must cease and the Construction Supervisor should be notified. They will then notify the Historical Archaeologist appointed to the Project; and ◗ The Historical Archaeologist will provide a management recommendation to the Site Manager and will undertake appropriate actions. A variety of management initiatives are required by the proponent in order to mitigate potential impact to unexpected cultural heritage material or sites found during the construction and pre-clearing activities during operations of the Project including: ◗ Provide all new employees with suitable training to provide them with the skills to identify cultural heritage sites or objects and report the find to the Site Environmental Officer; ◗ Inform all employees of their obligations to notify the Construction Supervisor of any cultural heritage finds; ◗ Implement a procedure that requires a permit before any relevant employees are able to undertake any clearing or excavations activities; ◗ Develop cultural heritage policies for management of potential cultural heritage sites or finds (if required); ◗ Inform the Construction Supervisor of their obligations to notify the Department of Environment and Resource Management (DERM) of any relevant finds; and The proponent will undertake regular cultural heritage educational sessions and distribute educational material. This material should inform the employees of what cultural heritage material may look like, and give them clear instructions on what to do if they find anything.

Element	Commitment
Social	<u>Health and Safety</u> To ensure safety is maximised on land, the proponent will implement: ◗ GPC and contractor OH&S procedures. ◗ Appropriate signage near project site, quarry and along haul route. ◗ Communicate updates to bund construction activities through GPC communication channels and local media. To maximise marine safety the proponent will implement: ◗ GPC and contractor OH&S procedures. ◗ An appropriate marine exclusion zone, and other measures such as navigational markers. ◗ Signage with project information at Auckland Creek and Calliope river boat ramps. The proponent will communicate updates to dredging activities through GPC communication channels and local media, with particular attention to notification of mariners.
	<u>Economic Impacts and Material Wellbeing</u> The proponent will: ◗ Prioritise local employment in recruitment where possible. ◗ Include appropriate levels of local recruitment as a condition for engaging contractors, where possible. Provide a higher rating for contractors who commit to higher local spend when engaging contractors. Should monitoring undertaken by Queensland Primary Industries and fisheries, establish a loss of fish catch directly linked to the Project, then GPC and the proponent will participate in a collaborative and coordinated review of direct and cumulative impacts with other stakeholders.

Element	Commitment
	Quality of the Living Environment ◗ The proponent will establish appropriate exclusion zones. ◗ The proponent will undertake landscaping and planting of Reclamation Area and mound. ◗ The proponent will provide access points for safe recreation areas during the construction and communicate the location of these access points and areas to user groups and potential visitors. ◗ The proponent may consider measures that help to offset/minimise impacts on recreational fishers based on the likely loss of recreational fishing sites associated with the Project. ◗ The proponent will communicate workforce numbers to GRC and service providers in advance.
	Cultural Impacts ◗ The proponent will identify areas culturally important and work in conjunction with the PCCC and individuals to maintain or develop alternatives access where possible. ◗ The proponent will continue to develop their relationship with the PCCC and explore opportunities to further build the capacity and role of this group. ◗ The proponent will implement an appropriate public information program describing the project and highlighting proposed benefits. ◗ The proponent will identify areas that can be used for environmental education in collaboration with local environmental groups.
	Institutional, legal, political and equity impacts ◗ The proponent will communicate project updates regularly to the general community and keep the GPC Community Working Group updated.

Element	Commitment
Landscape and Visual Character	During the construction phase, the proponent will seek to: ◗ 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 practicable. During the Operation Phase the proponent will stabilise the reclamation mound and improve the visual outcome.
Health and Safety	The proponent will implement a Hazard and Operability Study (HAZOP) system before construction of the dangerous goods storage area at the temporary on site workshop (during dredging) to identify all potential causes of leakage and spillage or hazards to workers and ensure that appropriate protective systems are implemented.
	The proponent will prepare and implement a Safety Management System to address hazards associated with construction and specify safe working procedures.
	The proponent will ensure contractors working on-site adhere to the Safety Management System, Construction Safety Management Plan and complete JSAs as appropriate.
	The proponent will maintain site security systems.

Element	Commitment
	The proponent will carry out construction safety studies before the commencement of the construction (dredging and disposal) and will include the following key elements: ◗ Familiarisation with proposed operations and review of construction program; ◗ Identification of hazards specific to construction operations and assessment of associated safeguards. Assessment of operational safeguards for the construction period; ◗ Review of safety assurance system; ◗ Finalisation of construction programs; and ◗ Review of procedures for management of change during construction.
	GPC will conduct a separate Construction Safety Study before the actual construction phase after identification of the construction contractor.
	The proponent will ensure a Construction Safety Management Plan is prepared by the contractor and will remain onsite at all times. Specific risks to be considered by GPC in the selection of contractors and by the Contractor in development of the Construction Safety Management Plan are detailed in Section 19.3.17.
Mosquito/Biting Midge	The proponent will ensure depressions (natural or manmade) in the ground surface are filled to prevent the ponding of water. Pools of stagnant water will be drained by the proponent and/or the areas filled.
	The proponent will ensure storage containers capable of ponding water will be either discarded after use or stored in an inverted position (care will be taken by the proponent to ensure that ponding does not occur in rubbish storage areas).
	The proponent will remove all vegetation in the zone of water fluctuation in the stormwater disposal pond.
	The proponent will provide straight margins through cutting, deepening and filling of the final decant pond which will be retained as a wetland to which the stormwater will be discharged during operational phase.
	The proponent will provide paths and other means of access to the water storage areas for pesticide applications.

Element	Commitment
	The proponent will repair of open channels (if any) that collect and convey waters if damaged.
	The proponent will avoid creation of favourable habitats for biting midge species.
	The proponent's Environmental Representative will inspect on a weekly basis all ponds and on-site excavations filled with water for the presence of mosquito larvae.
	The proponent's erosion and wash down practices will be controlled to prevent sediment and debris forming standing water pools.
Emergency Response Plan/s	The proponent will implement Emergency Response Plan/s in conjunction with local authorities and emergency services prior to the commencement of construction to guide those responding to a variety of potential emergency situations. The proponent will provide personnel involved in Emergency Response, including spill response, with appropriate training. The proponent will ensure the Emergency Response Plan includes: ◗ Oil Spill Emergency Response; ◗ Fire Emergency Response ◗ Natural Hazard Emergency Response.