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22 Environmental management plan

22.1 Chapter content

The environmental mitigation measures and commitments for the Project were provided in the Project EIS Appendices Q1 to Q4.

This chapter replaces the Project EIS Chapter 22 (environmental management plan), and the AEIS Appendices F to I replace the Project EIS Appendices Q1 to Q4, respectively.

The key issues raised from the Project EIS submission process, relevant to the Project environmental mitigation measures and commitments, are summarised Table 22.1.

Table 22.1 Summary of submission issues received in relation to the Project EIS environmental mitigation measures and commitments

Submitter ID number (refer Appendix A)	Summary of submission issue raised	Project EIS section (public notification version)	AEIS section containing information to address submission comments	Complete replacement section for Project EIS	Supplements the Project EIS information
12.28	Include additional BPAR monitoring sites located in close proximity to seagrass meadows near the WBE reclamation area	Appendix Q3	Appendix H (Section 6.2.2, Table 7 and Figure 4)	✓	
12.35	Clarify whether BPAR is proposed to be monitored at RBN and RBS during the proposed Project	Appendix Q3	Appendix H (Tables 8 to 10 and Figure 4)	✓	
	Nominate appropriate water quality monitoring reference sites (for BPAR, physicochemical parameters and toxicants) sites outside the predicted zone of influence of dredging	Appendix Q3	Appendix H (Section 6.2.2, Table 7 and Figure 4)	✓	
	Reference the BPAR monitoring methods described in the Queensland Monitoring and Sampling Manual, is available at: https://environment.des.qld.gov.au/water/monitoring/sampling-manual/pdf/biological-assessment-measuring-light-using-par.pdf	Appendix Q3	Appendix H (Section 6.2.1)	✓	
12.36	Clarify if BPAR would also be measured and include more detailed descriptions of PAR monitoring methods, as per the Queensland Monitoring and Sampling Manual	Appendix Q3	Appendix H (Section 6.2.1)	✓	
			Section 22.3		✓

Submitter ID number (refer Appendix A)	Summary of submission issue raised	Project EIS section (public notification version)	AEIS section containing information to address submission comments	Complete replacement section for Project EIS	Supplements the Project EIS information
12.37	Include and detail appropriate monitoring points and indicators to identify any potential impacts of dredge plumes on the hard and soft coral reefs in and around the Port	Appendix Q3	Appendix H (Tables 10 to 12)	✓	
			Section 22.11		✓
12.39	<p>Justify the lack of appropriate weightage for the historical baseline data in the EWMA control chart at each compliance site during dredging. EWMA control charts should be reliable and weighed against the baseline value.</p> <p>Describe in detail how a lack of historic data at some proposed compliance monitoring sites would be managed with during the proposed Project</p>	Appendix Q3	Section 22.4 Appendix H (Section 6.6.1)		✓
12.40	<p>Present summary statistics for the proposed turbidity triggers (in Table 11, Appendix Q3) and demonstrate that these values are representative of baseline conditions</p> <p>State the source of data used to derive numerical criteria for turbidity monitoring in Table 11 of Appendix Q3</p>	Appendix Q3	Appendix H (Section 6.6.1)	✓	
			Section 22.5		✓
12.41	Set site specific compliance limits for each offshore site separately (i.e. add separate triggers for CD1, CD2, CD4 and CD5 in the compliance monitoring Table 11, Appendix Q3)	Appendix Q3	Appendix H (Section 6.6.1 and Table 11)	✓	
	Clarify that compliance checking and reporting would be undertaken for each site independently using site specific triggers	Appendix Q3	Appendix H (Tables 7 and 8)	✓	
	Describe why site CD3 was excluded, from Table 11. The department recommends that this site be reinstated.	Appendix Q3	Appendix H (Section 6.6.1 and Table 11)	✓	
Section 8.3.2.1				✓	
12.42	Revise the turbidity triggers in Table 11, Appendix Q3 for site NW50 to reflect the management intent of Slightly Disturbed (SD) under the EPP (Water)	Appendix Q3	Appendix H (Table 11)	✓	

Submitter ID number (refer Appendix A)	Summary of submission issue raised	Project EIS section (public notification version)	AEIS section containing information to address submission comments	Complete replacement section for Project EIS	Supplements the Project EIS information
12.44	Include end-of-pipe monitoring for the full suite of nutrients i.e. TN, TP, DON, ammonia, oxidised nitrogen, particulate phosphorus, dissolved organic phosphorus and filterable reactive phosphorus	Appendix Q3	Section 22.12		✓
12.46	Include continuous monitoring of all physiochemical parameters for all stages of the proposed Project	Appendix Q3	Section 22.6 Appendix H (Tables 8 to 10 and Figure 4)		✓
12.47	Include numerical triggers for pH, EC, DO, metals and metalloids in Appendix Q3, Tables 5 and 6. Triggers should be defined according the Australian Water Quality guidelines, 2018, the State, regional, baseline or literature data as appropriate.	Appendix Q3	Appendix H (Section 6.1.2 and Table 6)	✓	
12.48	Consider and describe the relevance of human drinking values of water in Port Curtis, given it is listed as a relevant environmental value within the EPP (Water)	Appendix Q3	Section 22.7		✓
	Include available monitoring limits for the total concentration of metals and metalloids as per national, state and regional guidelines	Appendix Q3	Appendix H (Table 6)	✓	
12.105	Describe how the proponent would ensure project contractors and subcontractors would implement commitments and proposed mitigation measures described in the draft EIS	Chapter 13 Appendix Q2	Appendix F (Sections 5.2, 6.7 and 6.11) Appendix G (Sections 5.1, 6.7 and 6.11)	✓	
12.110	Propose draft conditions for all coastal approvals required for the proposed Project, including the environmental authority needed for ERA 16	Chapter 22	Section 22.10		✓
12.111	Describe effective monitoring and mitigation measures to ensure bund wall leakages are detected and can be responded to appropriately	Appendices Q2 and Q3	Appendices G and H	✓	
			Section 22.8		✓
12.112	Discuss in detail how breaks in construction would be	Appendices Q2 and Q3	Appendices G and H	✓	

Submitter ID number (refer Appendix A)	Summary of submission issue raised	Project EIS section (public notification version)	AEIS section containing information to address submission comments	Complete replacement section for Project EIS	Supplements the Project EIS information
	managed to ensure protection of the partially constructed bund wall and assess the risks and potential impacts of a partial wall failure	Appendix Q2	Section 22.9		✓
12.114	Cross check the draft EIS to ensure all proposed management strategies, mitigation measures and commitments listed in the draft EIS chapters are included in the relevant management plan	Appendices Q1 to Q3	Appendices F to H	✓	

22.2 Overview

The identified impacts and mitigation measures outlined in the Project EIS and AEIS, inform the actions contained in the Dredging EMP and Project EMP. These documents contain the mechanisms for implementation of the Project EIS commitments which aim to ensure the potential environmental impacts of the Project are avoided, mitigated and/or offset.

The Project EMP and Dredging EMP will be amended during the post EIS environmental approvals process, and the detailed design and dredging contractor tendering phases of the Project. During the review and amendment process for these Project documents, the consultation and management arrangements with regulatory agencies and the community will be reviewed.

In order to facilitate the effective implementation of these management measures, the Project's activity components have been divided into two categories and two subsequent EMPs. Non-dredging components of the Project have been included under the scope of the Project EMP and components relating to capital dredging activities have been included within the scope of the Dredging EMP. The Project activities included in the EMPs are summarised below.

■ Project EMP

- Construction of the WBE reclamation area and bund walls, including transport of quarry material for construction of the bund walls
- Construction of the BUF, including placement of sheet piles (or similar earth retaining structure) and transport of quarry material and fill
- Environmental management of the WBE reclamation area prior to dredging
- Removal and installation of new navigational aids in the Port of Gladstone
- Stabilisation and maintenance activities on the WBE reclamation area post dredging

■ Dredging EMP

- Initial dredging works to establish the barge access channel
- Duplication of the Gatcombe and Golding Cutting shipping channels
- Dredged material unloading, transport and placement in the WB and WBE reclamation areas
- Dewatering of the dredged material within the WB and WBE reclamation areas, and licenced discharge into the Port.

The environmental management of the quarry operation for the construction of the WBE reclamation area and a BUF is not included in the scope of the Project EMP and potential environmental impacts will be managed by the quarry operator.

The Project EMP and Dredging EMP are intended to be working management documents to be implemented during the Project. They provide a structured program for the management of the works for GPC and relevant contractors to follow in order to best achieve desired environmental outcomes. They aim to ensure that all reasonable and practicable measures will be implemented within an adaptive management framework to prevent and/or minimise the likelihood of environmental harm being caused during the works.

In order to fulfil the objectives of the Project EMP and Dredging EMP, the following information is included in the plans:

- Defined roles and responsibilities for the implementation of the relevant management plans
- Control measures/actions that will be taken to prevent adverse environmental impact
- Corrective actions that will be taken in the event of an environmental incident or non-conformance
- A monitoring procedure to monitor the effectiveness of the environmental controls being implemented
- Project staff training required to ensure all staff are adequately trained in order to fulfil the requirements of the relevant EMP
- Reporting requirements to ensure good record keeping practices are being maintained
- Audit and review requirements to ensure regular reviews of environmental performance to ensure continual improvement is maintained.

The estimated cost of implementing the Project mitigation measures is in the order of \$15 million to \$23 million. This cost will be confirmed during the detailed design and dredging contractor tendering phases.

The Project EMP and Dredging EMP will operate within the framework provided by the existing GPC EMS, which is an overarching framework for managing environmental risk at all GPC managed sites. The intent of the EMS is to provide a user friendly directory which quickly directs the user to the desired area of the EMS for guidance and actions to undertake.

The Project EMP and Dredging EMP will sit within the EMS framework. GPC staff and relevant contractors are directed to follow reporting, incident and record keeping procedures outlined in the EMS, while also following the site specific management actions and monitoring outlined in the Project EMP and Dredging EMP. Figure 22.2 demonstrates the role the Project EMP, Dredging EMP and GPC EMS have within the EIS framework.

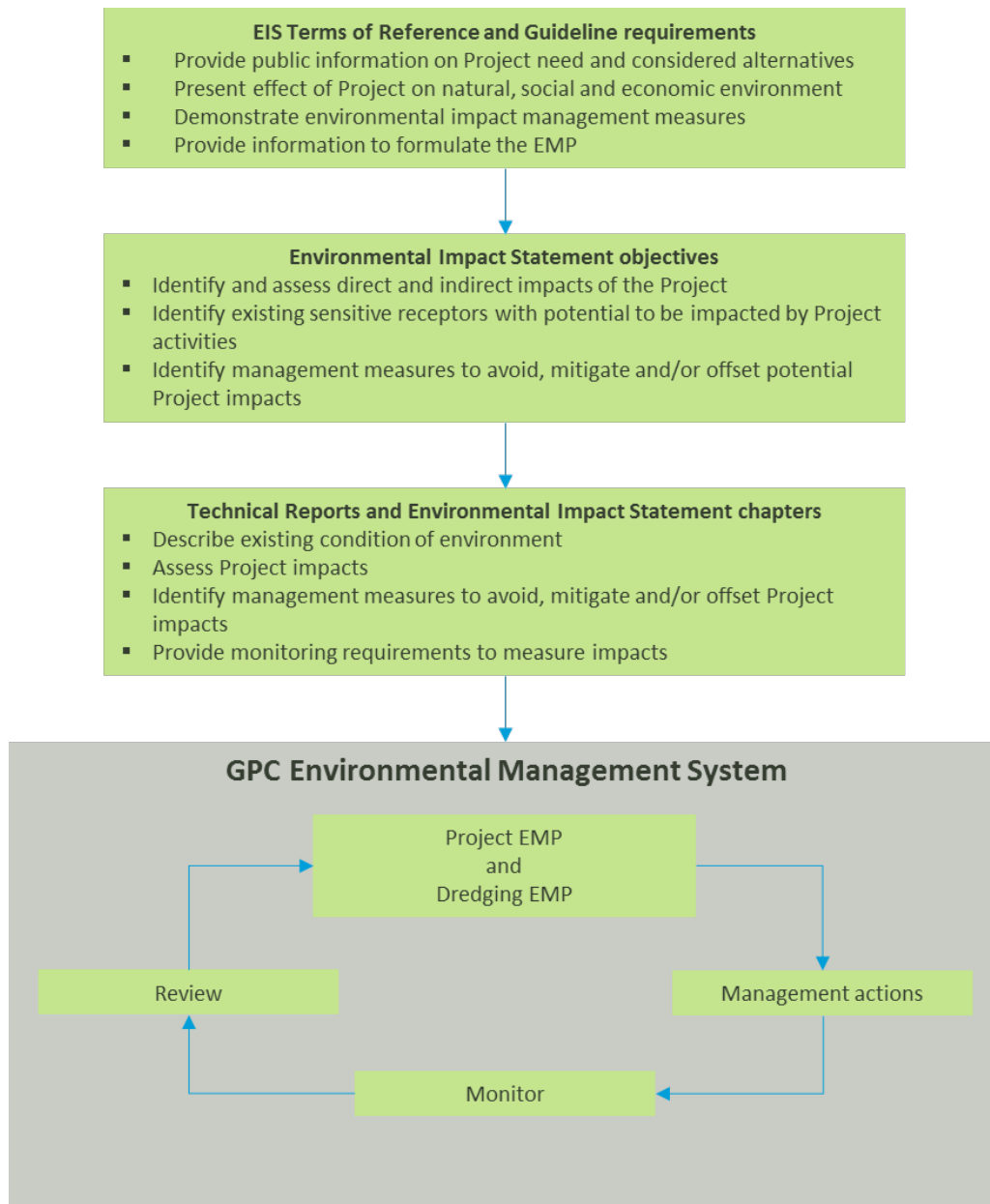


Figure 22.2 Role of Project Environmental Management Plan, Dredging Environmental Management Plan and Gladstone Ports Corporation Environmental Management System within the Environmental Impact Statement framework

22.3 Photosynthetically active radiation reference monitoring sites

This section supplements the AEIS Appendix H.

Monitoring locations PAR1 and PAR2 as shown in the Project Environmental Monitoring Procedure (refer AEIS Appendix H) will be implemented as surface photosynthetically active radiation (PAR) reference sites for the Project marine onshore and offshore benthic photosynthetically active radiation (BPAR) monitoring sites, respectively. These Project PAR reference monitoring sites are located near the BPAR monitoring sites on the surface, in the air.

All Project BPAR monitoring is undertaken as per the Queensland Monitoring and Sampling Manual. Two BPAR loggers are deployed at each monitoring location. PAR will be logged and recorded every 15 minutes. Management and reporting will be undertaken as per manual requirements, detailed within the Project Environmental Monitoring Procedure (refer AEIS Appendix H).

22.4 Project Environmental Impact Statement baseline water quality data and exponentially weighted moving average

This section supplements the AEIS Appendix H.

The Project EIS baseline water quality data set was used to establish Project water quality trigger values contained in the Project Environmental Monitoring Procedure (refer AEIS Appendix H). Exponentially weighted moving average (EWMA) utilises historic data (from the outset of monitoring of potential impact from Project activities) to produce continually exponential data derived from the previous EWMA value with weighting. This smoothing technique creates a rolling average that incorporates all data into the rolling average with increasingly minor input from data collected at the commencement of EWMA value calculation. Furthermore, the 60:40 split has been identified as appropriate for dredging activities as sensitivity is focused on current values to identify short term shifts in turbidity values.

EWMA smoothing on background water quality data (collected June 2014-July 2015) is used to smooth data for the calculation of trigger thresholds to identify potential Project impacts during monitoring.

For new Project water quality monitoring sites with minimal historical data and no Project EIS baseline water quality data, a six month monitoring program is proposed to be conducted prior to Project construction and data received will be used for establishing Project baseline/trigger water quality values.

In addition to the above monitoring and reporting a SMART algorithm 24 hour rolling average is proposed, recorded every 15 minutes and reported hourly to supplement the above data sets. Raw water quality data is captured every 15 minutes.

22.5 Project Environmental Impact Statement baseline water quality data and Project turbidity triggers

This section supplements the AEIS Appendix H.

Trigger values given in the Project EIS Appendix Q3 (Table 11) were derived from the Project EIS baseline water quality monitoring data sets and the EWMA calculations were applied. The Project water quality trigger values differ from the raw water quality data and associated 80th percentiles provided within the Project EIS Water Quality Technical Report (Appendix H1 (Appendix B)) as the EWMA methodology was not applied to this water quality data. Recent studies by Fox (2016) states the following on the use of EWMA:

'The exponentially weighted moving average or EWMA is a statistical smoothing procedure that has its origins in a branch of industrial statistics known as Statistical Process Control (SPC) and is one of a number of devices that are collectively referred to as "control charts". Over recent years, control charting techniques have been successfully used to monitor environmental processes following their recommended use in the ANZECC/ARMCANZ (2000b) National Water Quality Guidelines.'

The EWMA has previously been successfully applied as a water quality management and compliance tool on other capital dredging projects within Australia.

The Project water quality trigger values for the proposed new monitoring locations will be developed from six months of water quality monitoring prior to Project construction commencing.

22.6 Continuous physiochemical monitoring

Continuous monitoring of all physiochemical parameters is not feasible for those parameters requiring field sampling and subsequent laboratory testing. Current continuous monitoring proposed for the Project includes turbidity, pH, temperature, electrical conductivity and dissolved oxygen. Monthly monitoring will occur for the other parameters which require laboratory testing, including metals, nutrients, TSS, chlorophyll a. Quarterly monitoring will occur for organic contaminants which involves in situ sampling and laboratory testing.

22.7 Consideration of human drinking values of water for Port of Gladstone

The Project EIS Section 8.3.5 (Port Curtis water quality objectives) provides a summary of the environmental values identified with the EPP (Water) for Port of Gladstone, adjacent coastal waters and nearby lower and mid Calliope River, lower and mid Boyne River and lower and upper Graham's Creek estuaries. The range of environmental values for these Port of Gladstone marine waters and freshwater estuaries include:

- Aquatic ecosystems – biodiversity, ecological interaction, plants, animals, key species (turtles, seagrass, dugongs etc) and their habitat, food and drinking water
- Human consumption – humans consuming aquatic food from this area, including fish, crustaceans and shellfish
- Primary recreation – activities with full body contact with water include swimming, windsurfing, diving and water skiing
- Secondary recreation – indirect contact and low probability of water being swallowed including wading, boating, rowing and fishing
- Visual recreation – amenity of waterways for recreation which does not involve contact with water such as walking or picnicking
- Drinking water (waters in which desalination for drinking water may apply) – suitability of a raw drinking supply assuming minimal treatment required
- Industrial use – suitability of water supply for industrial use. Industries usually treat water supply for their individual needs
- Cultural and spiritual values
- Aquaculture – health of aquaculture species and human consuming aquatic food from commercial ventures in this area.

The drinking water environmental values in the EPP (Water) for the Gladstone region are relevant to the mid Calliope River and mid Boyne River estuaries. It is unlikely that the marine waters of Port Curtis will be utilised for desalination for drinking water within the Project dredging timeframes.

The drinking water environmental values in the EPP (Water) for the marine waters in Port Curtis are not relevant for the Project impact assessment and not appropriate for inclusion into the Project Environmental Monitoring Procedure as the predicted water quality zones of impact and zone of influence occur in the marine waters of Port Curtis.

22.8 New water quality monitoring site near Western Basin Expansion reclamation area

This section supplements the AEIS Appendix H.

A new Project water quality monitoring site (i.e. C3 shown on Figure 8.4) has been included in the Project Environmental Monitoring Procedure to measure turbidity in close proximity to the existing Western Basin reclamation area and proposed WBE reclamation area.

The site will be used for identification of potential Project water quality impacts during the construction of the BUF and WBE reclamation area, and will also be used to measure the potential water quality impacts of the tailwater discharges from the Western Basin reclamation area during Project dredging activities. The site will be monitored for water quality parameters as per the other Project water quality monitoring sites as detailed in the Project Environmental Monitoring Procedure (refer AEIS Appendix H). Adaptive management measure will be implemented in accordance with the Project Environmental Monitoring Procedure to ensure that marine water quality and ecological impacts are minimised.

At this stage of the Project the water quality site C3 does not have an appropriate level of current historic water quality data. Therefore the Project water quality triggers will be developed from six months of water quality monitoring prior to Project construction commencing.

22.9 Breaks in Project construction of the Western Basin Expansion reclamation area bund walls

While no significant breaks in construction of the WBE reclamation area bund walls are anticipated, the Project EMP requires a stockpile of armour material to be held at the quarry, sufficient to cover any exposed core material if a cyclone were to approach Gladstone or if breaks occur during the construction of the reclamation area bund walls.

The reclamation construction contractor will prepare an emergency plan which will include procedures to address severe climatic events such as cyclones and minimise where practicable the potential environmental impacts from the reclamation works. The emergency plan will also include procedures to address breaks in the construction of the reclamation area bund walls to minimise the risks of a bund wall failure and minimise impacts on marine waters.

The risks associated with a partial bund wall failure are considered to be low given the Project specifications of the core and armour material (refer Project EMP (Table 7.2) in AEIS Appendix G).

22.10 Draft conditions for Project environmental approvals

GPC will provide the Office of the Coordinator-General with proposed draft conditions for Project environmental approvals (timing at this stage is proposed in October and November 2019) as part of the Office of the Coordinator-General's preparation and finalisation of the Coordinator-General's report on the Project.

22.11 Potential impacts of dredge plumes on coral reefs

The predominant potential indirect impact on ecological values from Project dredging activities will be a short term decline in water quality from an increase in turbidity and sedimentation, including the suspension and resuspension of fine sediments. The extent of the predicted Project dredge plume that could potentially cause ecological impacts does not extend to coral reef locations. The small increase in turbidity and the low deposition rates (refer AEIS Appendix D (Section 5.4.1 and Figures 5.15 to 5.17)) are not predicted to cause any long term impacts to these environments, and therefore the risk is predicted to be low.

The potential impacts of Project dredging activities on reef communities are represented by zones of impact from the hydrodynamic model. The modelling predicts that the reef communities fall within the zone of low impact or within the zone of influence (refer AEIS Appendix D (Section 5.4.2 and Figure 5.18)) therefore indicating that Project dredging activities will not result in any long term decline in reef communities.

Based on the Project EIS, AEIS hydrodynamic modelling and coral reef impact assessment, additional water quality monitoring sites at hard and soft coral reefs within or outside of the zone of low impact and zone of influence are not considered necessary due the following:

- Project dredging will result in only a small increase in turbidity and low deposition rates at coral reef locations within and outside of the Port of Gladstone
- The Project surface and benthic water quality monitoring of turbidity and BPAR at CD1 and CD2 (located in close proximity to coral reef locations) will identify any elevated turbidity levels caused by the Project dredging activities, and the implementation of adaptive management measures within the Environmental Monitoring Procedure (refer AEIS Appendix H) will ensure no long term decline in reef communities from Project dredging activities.

22.12 End-of-pipe monitoring for the full suite of nutrients

The Project activities will not use any nitrogen/phosphorous laden materials for constructing or operation of Western Basin and WBE reclamation areas. Decant water from the dredged material and marine water mix will not introduce any new/additional source of nitrogen or phosphorous to the receiving environment via the licenced discharge points. Therefore, the nitrogen/phosphorous compounds in the discharging tailwater are not expected to be higher than those in the receiving water. However, as a Project water quality compliance measure, Ammonia nitrogen (known as common product of synthesis of many nitrogen-containing organic and inorganic chemicals) has been included in the Project water quality tailwater testing parameters. Furthermore, the Project due diligence water quality monitoring program requires monthly examination for Total Nitrogen (TN), Total Phosphorous (TP) and Ammonia nitrogen (refer AEIS Appendix H (Table 6)) at water quality monitoring sites to ensure no significant Project impacts on the sensitive receptors.