



Rovuma
LNG

**ENVIRONMENTAL AND SOCIAL
REQUIREMENTS FOR CONTRACTORS:
ANNEX 10 - DREDGING**

ROVUMA LNG PROJECT

MZLN-EL-RBENV-00-0001

TABLE OF CONTENTS

1. PURPOSE AND SCOPE.....	3
1.1. Objectives.....	3
1.2. Scope	3
1.3. Linkage to Other Contractor Requirements.....	4
1.4. Background Context	4
1.5. E&S Risks and Potential Impacts.....	5
2. REQUIREMENTS	7
2.1. E&S Assessment and Evaluation and CIP Development	7
2.2. E&S Control Measures	10
2.3. Pre-Construction Surveys	21
3. DELIVERABLES.....	23

LIST OF TABLES

Table 1-1: A Guide to Activities, Consequences, Risks and Potential Impacts.....	5
Table 2-1: Process for Analysis of Alternatives.....	7
Table 2-2: Process for Risk and Impact Assessment of Project Base Case.....	8
Table 2-3: E&S Control Measures	11
Table 2-4: Pre-Construction Surveys.....	21
Table 3-1: Summary of Deliverables.....	23

 Rovuma LNG	Environmental and Social Requirements for Contractors: Annex 10 – Dredging	MZLN-EL-RBENV-00-0001 Revision: 1 Date: 9/05/2019
		Page 3 of 24

1. PURPOSE AND SCOPE

This document is one of a series of topic-specific supporting annexes contained in the overarching document: Environmental and Social Requirements for Contractors: Environmental and Social Management System (ESMS).

These annexes define the processes that need to be followed and the control measures that must be applied to ensure the delivery and approval of a topic-specific Contractor Implementation Plan (CIP) and other implementation deliverables ahead of commencing activity.

Where the final design basis or execution strategy has not been determined and alternatives exist, an analysis of alternatives (taking environmental and social (E&S) factors into account) shall be undertaken. This analysis shall be based on an accurate characterisation of the local setting using up-to-date baseline data and an assessment of the risks and impacts related to each alternative.

Where the project base case has already been determined, additional baseline information may be required to inform an up-to-date / site-specific E&S risks and impacts evaluation. This evaluation may result in a refinement of control measures relative to the local conditions and licensing requirements.

1.1. Objectives

The overall objective of this document is to set out all the E&S requirements that need to be fulfilled in order to prevent and manage potential E&S risks and impacts associated with Dredging.

1.2. Scope

For the purposes of this document, Dredging encompasses the following activities:

- Capital dredging associated with:
 - the construction of coastal facilities on or adjacent to the Afungi Peninsula
 - the facilitation of vessel access to these facilities
 - the creation of a turning basin and anchoring zone in designated nearshore areas
- The management (including handling, storage, transport, reuse and disposal) of dredged materials from the aforementioned activities.

The term 'dredging' in this document does not refer to capital dredging for installation of pipelines in the nearshore zone or any kind of maintenance dredging. E&S Requirements for maintenance dredging will be developed at a later stage taking into account the lessons learned from capital dredging.

Potential impacts arising from the presence, movement and activities of Project vessels (including dredging vessels) are addressed in the E&S Requirements for Marine Operations. That includes, for example, potential impacts arising from noise and vibration, turbidity caused by vessel / propeller wash in shallow waters, effluent discharges, general disturbance of marine fauna and interruption of their migration patterns, as well as risks of collision between Project vessels and local craft, risks of spills, etc.

 Rovuma LNG	Environmental and Social Requirements for Contractors: Annex 10 – Dredging	MZLN-EL-RBENV-00-0001 Revision: 1 Date: 9/05/2019
		Page 4 of 24

1.3. Linkage to Other Contractor Requirements

This document is an overarching document which is supported by a number of topic-specific annexes. It also needs to be read in conjunction with Section D (Scope of Work) and Section F (Coordination Procedure) to provide a holistic view of E&S requirements.

This document should be read specifically in conjunction with Marine Operations Annex, and Ballast Water and Biofouling Annex.

1.4. Background Context

Dredging will be required in Palma Bay for the construction of and vessel access to coastal facilities, primarily the Materials Offloading Facility (MOF) and LNG Export Jetty, and for the installation of export pipelines transporting natural gas from the Mamba and Golfinho offshore developments to the planned LNG facilities on the Afungi Peninsula of Area 4 and Area 1, respectively. Dredging is the Project activity that is likely to have the most impact on the marine environment in Palma Bay.

While this document relates only to dredging around the coastal facilities, the E&S Requirements for this and other activities are underpinned by a focus on the potential cumulative impacts of the Project and other developments on biodiversity and affected communities in Palma Bay and the wider environment. The combined effects of all dredging works and indeed all development activities need to be managed and controlled.

Palma Bay is located towards the northern end of the Quirimbas Archipelago which extends for some 400 km parallel to the Mozambican coast and comprises 32 islands with associated coral reefs, seagrass beds, mangroves, sandy beaches and mudflats. Quirimbas is part of the wider East African Marine Ecoregion. It is of global importance for biodiversity and has the highest recorded diversity of corals in the Western Indian Ocean.

There is extensive use of Palma Bay by small-scale artisanal fisheries. A Fisheries Livelihood Restoration Plan (FLRP) involving a variety of measures to address loss of fishing grounds and intertidal gathering areas has been developed as part of the Resettlement Plan being implemented by the Area 1 and Area 4 (Rovuma LNG) operators.

There is some use of the local port (Palma), mainly by vessels used in fishing and sometimes local transport, e.g. dhows and other small craft.

Tourism is not well developed but there are some small-scale operators using the bay and islands, e.g. for snorkelling trips.

A Critical Habitat Assessment (CHA) in line with the requirements of IFC Performance Standard 6 (PS6): Biodiversity Conservation and Sustainable Management of Living Natural Resources has been carried out on behalf of the Rovuma LNG Project¹. Critical Habitat (CH) means habitat of high biodiversity value, including, for example, habitat of significant importance to species that are classed as Critically Endangered and/or Endangered on the IUCN Red List of Threatened Species.

CH qualifying features in the marine/coastal environment were assessed as coral, seagrass and mangrove (all highly threatened habitats at a global level), also on a precautionary basis

¹ Mozambique Program. Mozambique Straddling Resources. *Critical Habitat Screening and Assessment Using IFC PS6 Criteria – Interim Report*. CH2M Hill Mozambique Lda for Eni S.p.A. March 2018.



the Critically Endangered Hawksbill Turtle since the Palma Bay area may be a foraging ground for juveniles.

1.5. E&S Risks and Potential Impacts

Table 1-1 outlines the E&S risks and potential impacts identified to date associated with Dredging. This table is meant to provide insight to the risks and potential impacts which are possible and a guide for additional assessment activities required by Section 2.1 of this document. It also provides a reference to the control measures tables (Table 2-3).

Table 1-1: A Guide to Activities, Consequences, Risks and Potential Impacts

Activity	Potential Consequence	Risks and Potential Impacts
Dredging	Seabed excavation	Detrimental impact on natural habitat and populations of indigenous plant and animal species (NR3)
		Fragmentation / Partitioning of habitat (physical barrier) (NR2)
		Changes to bathymetry, seabed topography and water circulation (P13)
		Changes to physical/chemical characteristics of substrate (P14)
		Reduction in abundance and productivity of biological communities dependent on seabed/aquatic habitat (P15)
		Detrimental impacts on local economy or livelihoods (LH2)
		Community disturbance / nuisance (C1)
	Interactions with marine fauna	Pollution of marine environment (P4)
		Injury or death of important domestic animals and/or wildlife (NR8)
		Livelihood impacts on fisheries (LH4)
Dredging and marine deposition of dredged material	Sediment dispersion in dredge/deposition plumes and via remobilisation of sediments deposited on the seabed. Associated turbidity.	Reduced water quality in local waterways due to increased turbidity and sediment loading; fish kills; reduced ecological function (P6)
		Pollution of marine environment (P4)
		Disturbance of important environmentally sensitive receptors (NR7)
		Injury or death of important domestic animals and/or wildlife (NR8)
		Reduced ecological function and diminished quality of ecosystem services (NR13)
	Sedimentation, settlement on the seabed of suspended solids	Reduced water quality in local waterways due to increased turbidity and sediment loading; fish kills; reduced ecological function (P6)
		Pollution of marine environment (P4)
		Disturbance of important environmentally sensitive receptors (NR7)



Activity	Potential Consequence	Risks and Potential Impacts
		<p>Injury or death of important domestic animals and/or wildlife (NR8)</p> <p>Reduced ecological function and diminished quality of ecosystem services (NR13)</p>
Onshore deposition of dredged material	Temporary storage or disposal	<p>Detrimental impact on natural habitat and populations of indigenous plant and animal species (NR3)</p> <p>Disturbance of important environmentally sensitive receptors (NR7)</p> <p>Reduced water quality in local waterways due to increased turbidity and sediment loading; fish kills; reduced ecological function (P6)</p> <p>Contamination of fresh water / water supply (P5)</p> <p>Detrimental impacts on local economy or livelihoods (LH2)</p> <p>Degradation or destruction of natural seed bank and soil quality (NR10)</p>

2. REQUIREMENTS

2.1. E&S Assessment and Evaluation and CIP Development

As discussed in the overarching Environmental and Social Requirements for Contractors: Environmental and Social Management System (Section 2), due to the further refinement of the design since the EIA was prepared, and due to the Project seeking finance (which requires compliance with the International Finance Corporation (IFC) E&S requirements), it is anticipated that additional E&S assessment will be required for some topics which may result in the addition or refinement of E&S controls specified to date. This assessment, as outlined in the overarching ESMS document, includes three stages:

- Stage 1: Analysis of Alternatives
- Stage 2: E&S risk and impact evaluation of the project base case and refinement of control measures
- Stage 3: CIP development (based on the refined control measures).

For Dredging, all 3 stages are required.

Stage 1 – Assessing Alternatives to Develop a Project Base Case

The requirements outlined in Table 2-1 must be completed in order to assess alternatives and determine the Project base case.

Table 2-1: Process for Analysis of Alternatives

Step	Specific Requirements	Responsibility
1	<p>Outline alternative dredging methods/technologies including for each option the dredging footprint, the number of dredging and support vessels, manpower requirements, logistical support required, timing of dredging (season and time of day), duration of works; who will be carrying out the dredging (i.e. is it subcontracted?).</p> <p>Outline options for disposal/reuse of dredged material (onshore vs marine, precise locations, extent of reuse/beneficial use of dredged material, disposal footprint, if/how this varies depending on the dredging method).</p>	Contractor
2	<p>Review existing relevant environmental and social baseline data (including NEBS 2017 survey results) for all dredging and disposal/reuse locations being contemplated including (but not limited to) the following:</p> <p><i>Environmental:</i> habitat type, extent of Critical Habitat, presence of Critically Endangered/Endangered species or other sensitive fauna and flora, metocean conditions, sediment characteristics.</p> <p><i>Social:</i> potential interaction with communities and area users including fishermen, intertidal foraging, maritime transport, tourism operators; cultural heritage features</p>	Contractor

Step	Specific Requirements	Responsibility
3	Document the results of the baseline assessment. Develop a constraints map for dredging and the management of dredged materials. Identify E&S data gaps and the methods/resources to address these to inform updated risk/impact assessment of Project Base Case. Identify any additional stakeholder engagement needs, keeping in mind that all engagement with affected communities and others should be integrated rather than piecemeal.	Contractor
4	Carry out an E&S impact / risk assessment on all options being contemplated for dredging and the management of dredged materials. Consider risks and impacts identified in Table 1-1. Undertake sediment transport modelling to predict impact zones associated with different dredging methods and locations (if any) for marine storage/disposal of dredged materials.	Contractor
5	Take into account cumulative impacts from all dredging/construction activities in Palma Bay as required.	Company
6	Use the results of the risk / impact assessment to inform the alternatives analysis and final decision on the preferred option(s) for dredging and the management of dredged materials.	Company
7	Document results of the alternatives analysis including description of alternatives, environmental and social baseline, methodology for review of baseline data, identification of data gaps and how to address them, impact / risk assessment method, results of the risk / impact assessments, assessment of alternatives and final decision on the base case for dredging method(s) and the reuse/disposal of dredged material.	Company

Stage 2 – Assessing the Project Base Case and Refining Control Measures

Once the base case has been determined, the actions outlined in Table 2-2 are required in order to refine the preliminary E&S control measures outlined in Section 2.2.

Table 2-2: Process for Risk and Impact Assessment of Project Base Case

No	Specific Requirements	Responsibility
1	Drawing on the Alternatives Analysis, outline selected dredging method(s)/technologies including the dredging footprint, the number of dredging and support vessels, manpower requirements, logistical support required, timing of dredging (season and time of day), duration of works; who will be carrying out the dredging (i.e. is it subcontracted?). Outline selected option(s) for disposal/reuse of dredged material (onshore and/or marine, precise locations, extent of reuse/beneficial use of dredged material, disposal footprint). If an option is proposed that is not contemplated in the Alternatives Analysis, the option must be supported by an assessment of the consequential impacts.	Contractor
2	Taking into account the identification of E&S data gaps and additional stakeholder engagement requirements during Alternatives Analysis, define what if any additional baseline data	Contractor

No	Specific Requirements	Responsibility
	is needed and describe methodology to collect and document in Baseline Data Collection Plan. Any recommendations regarding stakeholder engagement should bear in mind that all engagement with affected communities and others should be integrated rather than piecemeal.	
3	<p>Collect additional E&S baseline information as required pertinent to predicted zones of impact associated with selected dredging method(s)/technologies and selected option(s) for disposal/reuse of dredged material. Consider the following:</p> <p><i>Environmental:</i> habitat type, extent of Critical Habitat, presence of Critically Endangered/Endangered species or other sensitive fauna and flora, metocean conditions, sediment characteristics.</p> <p><i>Socio-economic:</i> potential interaction with communities and area users including fishermen, intertidal foraging, maritime transport, tourism operators; cultural heritage features.</p>	Contractor
4	Refine E&S impact / risk assessment on final selected dredging method(s)/technologies and selected option(s) for disposal/reuse of dredged material. Consider risks and impacts identified in Table 1-1. Update and refine sediment transport modelling as required and confirm turbidity thresholds for adaptive management responses taking latest baseline data into account.	Contractor
5	Take into account cumulative impacts from all dredging/construction activities in Palma Bay as required.	Company
6	Assess whether the design and / or execution strategy needs to be modified or optimised in the light of knowledge gained from steps (3) to (5).	Contractor
7	Assess whether there are sufficient / appropriate design and execution control measures in Table 2-3 to mitigate the identified impacts and risks and update if necessary.	Contractor
8	<p>Document results including a summary of project description (final design basis or execution strategy), summary of the environmental and social baseline, risk / impact assessment method, results of the risk / impact assessments including the proposed list of control measures to be applied.</p> <p>Company must be consulted if the Project Base Case materially deviates from the decisions arrived at during the Stage 1 Alternatives Analysis. Any such changes must be approved by Company.</p>	Contractor

Stage 3 – Contractor Implementation Plan

The Contractor shall develop a CIP which outlines how they propose to implement the control measures in the Table 2-3 (including any proposed additions or refinements as applicable to the update and finalisation of the design and execution strategy), and how they propose to implement the management system requirements (as outlined in the E&S Management System Requirements for Contractors) which relate specifically to the topic of this document, in a way that conforms to E&S requirements. The CIP shall include the refined control measures developed in Stage 2.

 Rovuma LNG	Environmental and Social Requirements for Contractors: Annex 10 – Dredging	MZLN-EL-RBENV-00-0001 Revision: 1 Date: 9/05/2019 <hr/> Page 10 of 24
---	--	--

2.2. E&S Control Measures

The control measures in Table 2-3 have been defined ahead of the site-specific risk / impact evaluations defined in Section 2.1. The Contractor shall apply these or seek agreement to apply a refined list, with justification for all changes based on the outcomes of assessments described in Section 2.1.

Where these requirements originate from the Anadarko / Eni EIA (2014), henceforth called the EIA, the EIA section reference is included. Similarly, the Government-approved Environmental Management Plans (EMPs) references are included for those relevant controls. As noted in the overarching ESMS requirements document, a number of additional controls have been identified as being required to meet lender expectations. As such, the EIA / EMP controls have been supplemented by good practice design and control requirements where practicable and appropriate, however, where any overlap is present, the EMP (and EIA) commitments should be considered paramount over good practice guidance in the hierarchy of adoption of such controls.

Table 2-3: E&S Control Measures

ACTIVITY / SOURCE OF POTENTIAL IMPACT	CONTROL MEASURE	IMPACT / RISK BEING ADDRESSED	SOURCE			Notes
			EIA	EMP	Other	
Overarching Requirements						
General	Reduce the dredging footprint and the volume of material dredged to the extent reasonably practicable				A	
	Reduce the volume of dredged material disposed of in the marine environment to the extent reasonably practicable				A	
	Recognise the potential value of dredged material as a resource and give preferential consideration to beneficial uses of this material where reasonably practicable				A	
	Limit changes to the hydrodynamics of the dredge area to the extent reasonably practicable				A	
	Reduce the extent of changes in turbidity, sediment dispersion and oxygen levels in order to limit potential adverse impacts on marine fauna and flora to the extent reasonably practicable				A	
	Limit the extent of habitat loss, degradation and fragmentation to the extent reasonably practicable				A	
	Engage with affected communities and protect their interests, seeking to involve them in activities such as monitoring where this can be done safely and appropriately				A	
	Optimise the dredging process and the management of dredging operations with an integrated and practical focus on engineering, health & safety and environmental protection requirements.				A	
Design Requirements						
Marine Ecology	Design the location and profile of access channels to reduce the need for capital and subsequent maintenance dredging and to avoid areas with sensitive habitats	NR1, NR2, NR13			A	
	Where impacts cannot be avoided, then proposed project design shall aim to minimise impacts (e.g. through iterative design) and the proposed design shall be justified in terms of operational needs and environmental constraints.	NR1, NR2, NR13			A	

	Optimise the schedule for dredging and dredged material disposal activities to avoid particularly sensitive environmental windows such as coral spawning and turtle nesting and hatching where reasonably practicable.	NR1, NR2, NR13			A	
General Management Controls	The dredging schedule shall be finalised after consultation with Company in order to avoid potentially significant impacts on the marine environment, ecosystem services and area users through the combined effects of simultaneous dredging or other construction works in Palma Bay.	NR1, NR2, NR13			A	
Dredging Control Measures	Prior to dredging operations conduct modelling of sediment dispersion with the selected dredging technique(s) to predict turbidity levels created during dredging activities. The objective is not to exceed the defined Project TSS limits.	NR1, NR2, NR13, P4, P6			A	
Dredging Control Measures	If modelling indicates this limit will be exceeded by the proposed methodology / dredging technology employ an alternative method or technique, or other mitigation strategy that does not result in the threshold being exceeded.	NR1, NR2, NR13, P4, P6			A	
Marine Ecology	Selection of dredging equipment by the contractor shall be appropriate to the depths and material types to be dredged, and to minimise the creation of plumes.	NR1, NR2, NR13, P4, P6	EIA 11.11.2	Area 4 ME 41 LNGMT ME 23 MOF ME 23		
	Dredging works and the disposal of dredged material shall be designed to avoid as much direct and indirect impact to coral and seagrass as reasonably practicable.	NR1, NR2, NR13, P4, P6			A	
	A coral specialist shall be deployed prior to dredging to advise on areas to avoid or relocate endangered and vulnerable species of corals (such as <i>Acropora aspera</i>) to, taking into account baseline/pre-construction survey results, and to provide advice on how to promote recovery of corals in the area and other measures to achieve 'Net Gains' for coral.	NR1, NR2, NR13, P4, P6			A	
General Management Controls	Specific Procedures for dredging operations shall be developed, including but not limited to:	NR1, NR2, NR13, P4, P6			A	
	· Dredging Procedure that describes the steps taken during removal of sediment from seabed					

	<ul style="list-style-type: none"> Dredged Material Handling Procedure that describes the steps taken for sampling/analysis, transport, storage, re-use and disposal of the dredged sediment Water Quality Monitoring Procedure that describes the steps taken for monitoring water quality during dredging and any offshore disposal of dredged sediments 					
	Develop separate dredging plans for construction and maintenance dredging that considers at least turbidity and light levels.	NR1, NR2, NR13, P4, P6	EIA 11.10.2	Area 4 ME 37 LNGMT ME 22 MOF ME 22		
Dredged Materials	Reuse of dredged material shall be considered where reasonably practicable (e.g. for onshore site infill).	NR13, P6			A	
Surface Water	Any location for the temporary storage and de-watering of dredged materials must be approved by Company in advance of its construction/usage. The area shall be designed to prevent (e.g. via berms) salt-water run-off spilling out and affecting adjacent habitat including salt-intolerant vegetation.	NR1, NR2, NR13, P4, P6			A	
	Dredge material storage areas will be designed to prevent salt-water run-off spilling out and affecting adjacent salt-intolerant vegetation	NR1, NR2, NR13, P4, P6	EIA 12.9.2	Area 4 SW 10 LNGMT SW 9 MOF SW 9		
	A spill contingency plan shall also be developed for unplanned releases of water from the site. Any entrained or stormwater shall be treated, as required, and monitored to ensure water quality (total suspended solids – TSS) standards are met prior to discharge.	NR1, NR2, NR13, P4, P6			A	
Execution Requirements						
Marine Ecology	Undertake dredging according to the requirements of the EMP, monitoring and ensuring that dredging operations will not adversely affect the quality of use of beaches at Palma Bay. Dredging plans will be developed for the management of dredging activity to avoid and minimize the effects of dredging induced turbidity on sensitive organisms or their habitats. This will include real time monitoring of turbidity levels and where levels exceed	NR1, NR2, NR13, P4, P6	EIA Approval Letter S10 27,28,30	Area 4 ME 39 LNGMT ME 28 MOF ME 28		

	<p>prescribed thresholds (which have potential significant impacts), corrective actions will be taken or dredging activities will be stopped until levels are acceptable (see Section 11.9 of LNG EIA Report). This method is in line with international standards and is deemed acceptable from an environmental perspective.</p>					
	<p>Mitigation measures should be focused on the control of turbidity outside of the dredging footprint which is defined as the zone of high impact (ZoHI), in which acute (lethal) levels of disturbance will occur, but within the boundary of the zone of moderate impact (ZoMI) (in accordance with the dredging guidelines for Western Australia (WA EPA, 2011)).</p>	<p>NR1, NR2, NR13, P4, P6</p>	<p>EIA 11.9.2</p>	<p>Area 4 ME 28 LNGMT ME 13 MOF ME 13</p>		
	<p>During dredging, including reclaim management where applicable, as part of an adaptive management approach dredge plume intensity monitoring shall be conducted on a near real time basis at locations at a minimum within the outer boundary of the zone of moderate impact (ZoMI).</p>	<p>NR1, NR2, NR13, P4, P6</p>	<p>EIA 11.9.2;</p>	<p>Area 4 ME 31 LNGMT ME 16 MOF ME 16</p>		
	<p>A reference station will also be needed outside of the Zone of Influence (ZOI) to track ambient turbidity levels during dredging and disposal activities.</p>			<p>Area 4 ME 32 LNGMT ME 17 MOF ME 17</p>		
	<p>Within the ZOMI the following Total Suspended Sediment (TSS) thresholds apply: Excess TSS* // Max occurrence (cumulative hours)** // Duration of monitoring TSS >100mg/l // 86 hours (6% of time) // 60 day rolling period TSS 30-100 mg/l // 202 hours (14% of time) // 60 day rolling period</p> <p>Notes: *Excess TSS is the TSS above ambient levels. **As measured by turbidity. The correlation between TSS and turbidity will be determined through pre-construction surveys.</p> <p>The monitoring program during the dredging program will comprise in-situ measurement of turbidity (through the combined deployment of Acoustic Doppler Current Profilers (ADCP) and</p>			<p>Area 4 ME 29 LNGMT ME 14 MOF ME 14</p>		

<p>Optical Back Scatter (OBS) sensors for example) to allow real-time monitoring of turbidity as an indicator of TSS. An example monitoring design would be for the moored data collection of turbidity to acquire 10 minute averages every hour and to transmit these to shore/vessel stations. The data can be incorporated into a continuous time series (for easy comparison against the thresholds) for each location and compared against the compliance thresholds. Alarms can be included in the system generating automatic notifications if a threshold condition is, or is close to, being exceeded.</p>					
<p>Outside of the ZOMI, turbidity should not exceed 10 mg/l TSS above ambient levels for more than 72 hours (5% of the time) in any 60 day rolling period.</p>			<p>Area 4 ME 30 LNGMT ME 15 MOF ME 15</p>		
<p>An adaptive dredging management plan will be prepared which comprises two essential elements: 1. The monitoring of dredging TSS values against the thresholds specified above; and 2. Biological monitoring at station locations for sensitive receptors (within the ZOMI and within the ZOI) and reference stations to assess dredging impacts (including determination of health/coverage/indications of stress or mortality of receptors from increased TSS/turbidity and sedimentation.</p>	<p>NR1, NR2, NR13, P4, P6</p>	<p>EIA 11.9.2</p>	<p>Area 4 ME 35 LNGMT ME 20 MOF ME 20</p>		
<p>The dredging management plan will be adapted if any of the following occurs: • If TSS monitoring results indicate exceedances of the specified thresholds, dredging activity will be modified to reduce the generation of suspended sediments with the aim of achieving the prescribed thresholds. • Modification to dredging practices is also required if the following conditions are observed: a. Excess TSS > 1000 mg/l for more than 1% of the time (14 hours) in a 60 day rolling programme; and/or b. Excess TSS > 5000 mg/l for more than 0.2% (3 hours) in a 60 day rolling programme.</p>			<p>Area 4 ME 36 LNGMT ME 21 MOF ME 21</p>		

	<ul style="list-style-type: none"> Potential responses to exceedances will be determined on a case by case basis and may include moderation of dredging rate, temporary relocation of dredging activities to another planned site, disposal of dredge material at depth via slurry pipe and/or deployment of silt curtains. Where biological monitoring suggests that impacts are greater than predicted, adjust TSS thresholds and modify dredging activity as appropriate (on a case by case basis). 					
	Regular monitoring of benthic organisms in the vicinity of dredged sediments, till their regeneration			Area 4 ME 38 LNGMT ME 22 MOF ME 22		
	Surveys will be conducted prior to dredge disposal to identify suitable locations within the Additional Dredge Material Disposal Area.			Area 4 ME 34 LNGMT ME 19 MOF ME 19		
	Undertake monitoring to determine biological responses of corals to dredging inundation			Area 4 ME 42 LNGMT ME 42 MOF ME 42		
Stakeholder Engagement	Communicate timetables and dredging activities to Company in advance of work to allow sufficient time for engagement and community notification.	LH4			A	
	Support Company as required to investigate means of addressing any concerns raised by stakeholders relating to dredging operations.	LH4			A	
Dredged Materials	Record the locations of dredged material disposal and avoid disposal beyond the designated dredged material placement area(s).	NR1, NR2, NR13, P4, P6	EIA 11.14.2	Area 4 ME 51 LNGMT ME 26 MOF ME 26		
	The deposition of dredged material onshore shall be restricted to the areas to be in-filled.	P5, P6	EIA 12.9.2	Area 4 SW 8 LNGMT SW		

				7 MOF SW 7		
Dredging Control Measures	Restrict dredging activities to areas specified during design and agreed with Company.	NR1, NR2, NR13, P4, P6			A	
	Implement other measures, such as modifying dredging practice, to reduce turbidity generation, as necessary during capital dredging to mitigate effects of dredging on sensitive organisms or their habitats (e.g. seagrass, corals). Implement a marine ecology monitoring plan to assess the impacts of dredging on the benthic community, during capital dredging and maintenance dredging, but also throughout the life of the Project.	NR1, NR2, NR13, P4, P6		Area 4 ME 40 LNGMT ME 29 MOF ME 29		
	Dredging methods, techniques and equipment shall be selected in order to minimise the creation and spread of turbidity plumes and reduce the effects of dredging on sensitive seabed habitat (including coral and seagrass) and the fauna which depends on it. This shall include, where required, but not be limited to the following measures: <ul style="list-style-type: none"> Considering the use of mechanical methods (grabs, backhoe, clamshell) rather than hydraulic dredging (cutter suction dredger, trailing suction hopper dredger) where reasonably practicable; Ensuring dredging precision and avoiding over-dredging by monitoring and control; Dredging not to be undertaken during unsuitable wind/wave conditions; Reducing sediment release around the dredger and any offshore disposal operations via specific equipment options or modifications, which could include: the use of a diffuser head for near bed placement / disposal of dredged material via a pipeline/spreader barge; the use of a 'green valve' to limit the entrainment of fines during overflow from a trailing suction hopper dredger. Using silt curtains to restrict the spread of suspended material in dredge plumes; Potential deployment of air curtains for turbidity control shall also be investigated; and Ensuring grab contents are released carefully onto barges, avoiding spillage. 	NR1, NR2, NR13, P4, P6			A	

	Pipelines used for pumping dredged materials shall be kept in good condition and free of leaks.	NR1, NR2, NR13, P4, P6			A	
	Barges, hoppers and other containers used for the storage and transport of dredged material shall be kept in good condition and watertight.	NR1, NR2, NR13, P4, P6			A	
	If the offshore area indicated in the EIA, or a similar site, is used for marine disposal of dredged material, then The discharge pipe shall be regularly relocated during disposal in order to avoid accumulations of sediment, which may slump and generate possibly erosive turbidity flows down the continental slope located close offshore of the disposal area.	NR1, NR2, NR13, P4, P6				
	Where mechanical dredging techniques involving for example grabs, backhoes or clamshells are used, the drop heights of dredged material into the barge shall be kept as low as is reasonably practicable to reduce noise and the risk of sediment spillage to water.	P6			A	
	When starting hydraulic dredging, suction through dredge heads shall be initiated just long enough to prime the pumps, prior to the dredge heads engaging the seabed. When lifting the dredge heads from the seabed, suction through the dredge heads shall be maintained just long enough to clear the suction and pumping lines of dredged material.	P6			A	
Marine Ecology	Dredging vessels shall transit via designated corridors to any offshore deposition zone for dredged material and avoid 'no transit' and 'no anchoring' areas.	P6			A	
Dredged Materials	Analyse and understand the material to be dredged in order to confirm the most appropriate method and location for placement (onshore and offshore).	P6			A	
Marine Ecology	Estuarine areas to be in-filled with dredged material for site reclamation will be filled from the upper reaches towards the bay where reasonably practicable to allow motile organisms (e.g. fish and crabs) to escape downstream towards the bay.	P4, P6, NR7, NR8, NR13			A	
Dredged Materials	It is prohibited to mix marine or estuarine sediments with soil. An impermeable barrier (membrane / liner) shall be installed at any location for the temporary storage and de-watering of dredged materials to prevent contamination / mixing of soils at the recipient	P4, P6, NR7, NR8, NR13			A	

	site unless Contractor can demonstrate similarity of the soil, sediment and water conditions.					
Marine Ecology	Monitor benthos communities adjacent to the placement area pre- and post-dredging including taxonomic, abundance and biomass distributions. Such monitoring may be combined with other dredge related monitoring campaigns.	P4, P6, NR7, NR8, NR13	EIA 11.14.2 EIA Approval Letter S10 30	Area 4 ME 50 LNGMT ME 25 MOF ME 25		
Dredged Materials	Implement a water monitoring program to monitor the impact of onshore deposition of dredged material.	P4, P6, NR7, NR8, NR13			A	
Dredging Control Measures	Since vulnerable fauna (dolphins, whales, turtles, possibly also dugong) including endangered and critically endangered species may be present within the area of dredging activity and/or any offshore deposition zone for dredged material, at the start of daily operations there will be a slow buildup of activities to allow such fauna to gradually adjust or temporarily move away.	P4, P6, NR7, NR8, NR13			A	
Marine Ecology	Implement wildlife protection measures and controls such as propeller guards and turtle deflectors or similar at the dredge head to minimise the risk of fauna injury and entrapment.	P4, P6, NR7, NR8, NR13			A	



	<p>Trained Marine Fauna Observers (MFOs) involved in the monitoring of dredging and related nearshore construction works shall pay specific attention to the presence of marine mammals and turtles in the vicinity of working vessels, requesting that works stop if there is a risk of fauna entrainment during dredging or fauna injury/mortality via interaction with a dredge head, mechanical grab, propellers or other equipment. MFOs shall also follow the general provisions in the Marine Fauna Observation Procedure (MFOP), to be developed by Contractor and approved by Company, which apply to all marine operations, not only dredging, including measures to guard against collisions with marine fauna (boat strike) and the systematic recording of the presence and behaviour of marine mammals and turtles.</p>	<p>P4, P6, NR7, NR8, NR13</p>			<p>A</p>	
--	---	-----------------------------------	--	--	----------	--

2.3. Pre-Construction Surveys

Contractor shall not commence any dredging activity prior to the completion of pre-construction surveys.

Contractor shall carry out the pre-construction surveys outlined in Table 2-4 as well as any other pre-construction survey requirements identified through the impact assessment process.

Table 2-4: Pre-Construction Surveys

No	Specific Requirements	Responsibility	Deliverable
1	Confirm characteristics of sediments to be dredged including particle size, degree of compaction and cohesiveness (if additional data required)	Contractor	Pre-construction geotechnical survey a. methodology b. report
2	Confirm location and status of seabed habitat features in footprint and Direct Area of Influence related to dredging and any marine deposition of dredged material, including Critical Habitat features such as coral bommies/reef, coral colonised sand craters, seagrass beds. Take additional seabed/sediment and water samples if required. Confirm location and characteristics of any seabed features (e.g. coral) which will be removed and translocated prior to commencement of dredging if required. Confirm suitability of seabed locations where these features will be transplanted. Use subsea cameras, RoV, diver support as required.	Contractor	Pre-construction habitat survey (marine) a. methodology b. report c. habitat map d. photo/film record of habitat surveyed



No	Specific Requirements	Responsibility	Deliverable
3	Confirm location and suitability of any onshore sites where dredged material will be stored, reused or disposed of. Take samples of soil, groundwater and surface waters that may be impacted	Contractor	Pre-construction survey of any onshore sites designated for handling dredged material (if required). a. methodology b. report c. analytical results for soil / groundwater / surface water samples d. map identifying site layout, topography, location of E&S receptors and sensitivities including groundwater, surface waters, habitat e. photo/film record of sites surveyed

3. DELIVERABLES

The following deliverables are associated with Dredging. Contractor deliverables shall be submitted to the Company for Company approval.

Table 3-1: Summary of Deliverables

Section Reference	Deliverable	Responsibility	Deliverable Date
STAGE 1			
Table 2-1	Baseline report	Contractor	To be agreed on contract award
Table 2-1	Technical memo on dredging methods/technologies including dredging footprint, number and type of dredging and support vessels, manpower requirements, timing, duration, disposal/reuse of dredged material, disposal footprint.	Contractor	To be agreed on contract award
Table 2-1	Topic-specific Alternatives Analysis Report, which as a minimum includes: <ol style="list-style-type: none"> 1) Overview of E&S baseline relevant to the options assessment screening 2) Alternatives analysis review, including details of E&S risks and impacts evaluation, as well as other relevant drivers for the decision-making process 3) Final recommendation on the Project base case. 	Company	To be advised on contract award
STAGE 2			
Table 2-2	Topic-specific E&S Report, which as a minimum includes: <ol style="list-style-type: none"> 1) Definition of the approved Project base case 2) Updated/refined baseline description, as applicable to the base case 3) Updated E&S risks and impacts evaluations 4) Refined list of E&S control measures. 	Contractor	To be agreed on contract award
STAGE 3			
Section 2.2	Topic-Specific CIP, which as a minimum includes: <ol style="list-style-type: none"> 1) Approved list of E&S control measures 2) Details of how the approved control measures will be implemented (including linkage to other Project plans and 	Contractor	To be agreed on contract award



	procedures, where necessary, to demonstrate the implementation of the E&S controls committed to) 3) Details of the monitoring, reporting and assessment.		
Table 2-4	Pre-construction geotechnical survey (if additional survey required) a. methodology b. report	Contractor	To be agreed on contract award
Table 2-4	Pre-construction habitat survey (marine) a. methodology b. report c. habitat map d. photo/film record of habitat surveyed	Contractor	To be agreed on contract award
Table 2-4	Pre-construction survey of any onshore sites designated for handling dredged material. a. methodology b. report c. analytical results for soil / groundwater / surface water samples d. map identifying site layout, topography, location of E&S receptors and sensitivities including groundwater, surface waters, habitat e. photo/film record of sites surveyed	Contractor	To be agreed on contract award