

## **TECHNICAL SPECIFICATIONS**

### **DREDGING AND EARTHWORKS**

Dredging areas, dredging depths and dredging limits are specified on drawings and/or specifications.

The dredging works consists of excavation of sand below the existing seabed regardless of the nature of the materials encountered during the course of dredging.

The works include supply of all materials and the provision of all labour, plant and equipment required for the actual dredging, reclamation and other reuse of dredged material as well as for all preparatory works, surveys and testing required for the proper execution and completion of the works. In addition the works shall include all required measures for reduction of the environmental impact of the dredging and be included in the Contractors Environmental Control Programme.

### **References**

The following Standards and Codes of Practice are referred to in this specification and fully or partly incorporated herein as specified:

<u>Designation</u>	<u>Title of Standards/Code of Practice</u>
BS 812	Sampling and Testing of Mineral Aggregates, Sand and Fillers
BS 6349, Part 5	Maritime structures. Code of Practice for dredging and land reclamation
CIRIA/CUR:	Manual on the use of rock in coastal and shoreline engineering. Report no. 83/154
CEM	Coastal Engineering Manual. U.S. Army Corps of Engineers.

### **Utilization of Dredged Material**

Fill is required for reclamation. Graded variations of the dredged materials may be reused subject to the approval by the Engineer.

No materials from the dredging shall be dumped at open sea unless approved by the Employer.

All suitable material removed from the dredging areas shall, subject to the approval by the Engineer mainly be used for reclamation or, either be initially sorted by excavator and manual labour or by means of a grizzly plant and/or hauled to a stockpile for screening, or shall be used for reclamation, sub-grade for paving work, backfill for structures, or for other purposes shown on the drawings and / or specifications or as directed. Materials which are otherwise suitable but contain excess moisture shall be processed and utilized for fill.

Material from the dredging determined by the Engineer as suitable for slope protection in revetments, filter or core material or other purposes shall be conserved and utilized as directed.

Materials from the dredging determined by the Engineer to be unsuitable for use in the Works shall be disposed of at the designated disposal areas or other areas approved by the Engineer. Unless otherwise specified, compaction will not be required. However, the materials taken to disposal areas shall be levelled and shaped attractively to the approval by the Engineer.

All excess material shall be delivered for other utilization on the island or disposed of as directed. It is the Contractor's responsibility to determine if sufficient material is available for the completion of the works before delivering or disposing of any materials. Any shortage of suitable materials for completion of the work caused by premature disposal of materials by the Contractor shall be replaced by the Contractor at no cost to Employer.

### **Materials**

The specific gravity of the coral sand may be ranging from 15 to 26 kn/m<sup>3</sup>. Actual geotechnical parameters including specific gravity and density of dredged materials shall be verified according to the function of the materials used in the structures and the specified quality requirements. Fill and backfill shall consist of selected coral aggregate and sand surplus from the dredging operation and complying with Highway Works, clause 804 Granular Subbase Material Type 2.

### **Testing of Materials**

Testing will be required when the dredged material is used for the reclamation. This testing shall provide sufficient documentation of the material quality and ensure fulfilment of all requirements specified for the material when used in the actual structures.

### **Workmanship**

#### *Setting out of Dredging Works*

All boundaries of dredging areas shall be established on the site by installation of markers in the appropriate reference lines or electronically established subject to the Engineer's approval.

Markers shall be robust and clearly visible from all parts of the dredging area.  
All setting out of dredging works shall be carried out by the Contractor.

#### *Execution of Dredging*

All dredging works and earthworks shall be carried out in compliance with the criteria and environmental mitigating measures outlined in Section 8.2.

Prior to dredging or disposal of materials in any area, such area shall be cleared and its surface level shall be surveyed in the presence of the Engineer.

The survey shall be detailed sufficiently for the recording of any major irregularities in the surveyed surface.

No separate payments would be made for dredging the edge slopes. This dredging is deemed included in the contract price (shown on drawings and / or specifications).

Prior to any dredging and reclamation works, the Contractor shall submit and get the approval from the engineer for a detail dredging and reclamation plan including plant details, discharge and handling methods and mitigation measures to meet the requirements specified in section 02. The Contractor shall notify the Engineer min. 48 hours in advance of dredging or disposal of materials in any area.

Dredging shall be carried out by using a Trailer Suction Hopper Dredger, or other dredging equipment with sufficient capacity.

The Contractor's method and sequence of dredging and reclamation shall be such that localised deterioration of water quality is kept to a minimum. And the Contractor is responsible for undertaking at his own cost, all appropriate mitigation measures deemed necessary to protect the environment.

The supply, placement and compaction of fill and backfill shall be in accordance with the Specification for Highway Works: 1994 – Department of Transport, London.

Placement and compaction of fill and backfill shall be in accordance with clauses 801 and 802.

Unless otherwise permitted, fill and backfill materials from dredging work shall contain no organic or other deleterious matter. The contractor shall ensure that the reclamation is free from accumulation of fines, including pockets of silt. Rock or other solid matter may be placed in a reclamation area subject to the Engineer's approval.

For reclamation below seawater level, dredged materials shall be placed directly in reclamation areas. Large pieces of coral deposited in reclamation areas shall be spread over the full width of the reclamation area with sufficient small coral pieces or other fine material used to fill the voids in order to produce a dense, compact reclamation.

For reclamation above the seawater level, coral material shall be placed in level, horizontal layers not exceeding 0.3 meter (loose measurement) thick and be compacted before the next layer is placed. Effective spreading equipment shall be used on each lift to obtain a uniform thickness prior to compacting.

As the compaction of each layer progresses, levelling and adjustments shall be performed continuously to ensure uniform density.

Material containing more than 25 per cent of large pieces of coral with the greatest diameter of more than 150 mm, and which cannot be placed in layers of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, shall be removed and used for some other purpose.

### **Tolerances**

Dredging shall be carried out to the designated depths in all parts of dredging areas with a maximum permissible over dredging of 0.3 m below the specified level (Maximum Depth) unless noted otherwise by or as agreed with the Engineer.

Excess dredging below Maximum Depth of 2.0m below sea bed is not accepted unless approved by the Engineer and shall be replaced by suitable material at no cost to the Employer.

The tolerances relative to the Specified Depth for dredging in general is +0 mm to 200 mm.

The natural profile of slopes resulting from the dredging has in general been indicated as 1:3 reflecting the expected result of dredging in sand and gravel exposed to moderate wave impact only.

The tolerance on the levels of the land reclamation fill is –100 mm to +100 mm.

### **Loss of material in the fill area**

The Contractor shall allow, in the Contract Sum, for any loss of fill material, which may occur during the course of the works, including but not limited to erosion and losses due to settlement. No claims for payment for filling other than in accordance with the specifications and in the Bills of Quantities will be allowed.

### **Inspection**

#### *General*

The Contractor shall, prior to commencement and after completion of dredging works carry out surveys of the respective areas (in-survey and out-survey)

#### *In-survey of Existing Bottom or Ground*

The entire working area shall be surveyed in the presence of the Engineer's representative. Maps and "raw" data shall be submitted to the Engineer not later than one week after the scheduled execution of the in-survey. If the contractor fails to carry out this survey before the commencement of dredging operations (ANY DREDGING OR EXCAVATION WORKS) it would be deemed that the contractor accepts the survey information given and as such any in-surveys carried out would not be accepted.

#### *Inspection after Completion*

Before the Work is handed over, an out-survey shall be made covering the entire working area.

**The verification of slopes shall be made by soundings. Maps and "raw" data shall be submitted to the Engineer not later than two weeks after the execution of the respective survey.**

## **REVETMENTS**

### **Scope of Work**

The works specified in this Chapter of the Specifications comprises the construction of revetments.

The works include supply or dredging of all materials required. According to Drawings, the specifications and the instructions from the Employer the Contractor shall furnish all materials, equipment, tools, and labour which are required for the construction, testing, measurement and completion of the works.

### **References**

The following Standards and Codes of Practice are referred to in this specification:

<u>Designation</u>	<u>Title of Standards/Code of Practice</u>
BS 6349 Part 1, Part 2	Maritime Structures
ISO 5081	Textiles- Woven Fabrics – Determination of Breaking Strength and Elongation (Strip Method)
CEM	Coastal Engineering Manual. U.S. Army Corps of Engineers.

### **Materials**

#### *Geo bag material*

Geo bag material shall be porous, carpet-like materials, made from synthetic fibres.

The material should be a separation layer and shall be in the form of a thin permeable membrane.

The geo bag material shall be of polypropylene filter fabric and shall be resistant to air, water, chemical and bacteriological attacks. The material shall fulfill the International Classification (DIN 54307) Class 4. The fabric shall be manufactured with and preserve the following mechanical properties according to DIN 54307

Description	Property
Weight of cloth	Min. 400g/m <sup>2</sup>
Tensile strength in: a) warp: b) weft:	Min 20 kN/m Min 20 kN/m
Elongation at break: a) warp: b) weft:	Min 50% Min 50%
Penetration strength	Min. 3.3 kN

## ENVIRONMENTAL REQUIREMENTS

It is the contractors' requirement to undertake environmental monitoring during the construction stage of the project. Monitoring shall be carried out on a monthly basis and a single report should be produced at the completion of the physical works in each island.

The contractor shall follow all Environmental laws and regulations of Maldives in design and during implementation of the project, specifically the following

Dredging and Reclamation Regulation 2013  
Environment Impact Assessment Regulation 2012 and Amendments.