

**Republic of Maldives**

**Appendix B**

**Prequalification Document**

**Coastal Protection at Gn. Fuvamulah**

**Project no: TES/2019/W-038**

**Funded by**

**The Netherlands Enterprise Agency (ORIO)**

**and**

**Kuwait Fund for Arab Economic Development**

**(KFAED)**

**April 2019**

Issued by:

National Tender

Ministry of Finance

Republic of Maldives

**Appendix B – project information**

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# Background to the project

The Employer, the Ministry of Environment and Energy, hereafter abbreviated to MEE, will develop a coastal protection scheme on the island of Gn Fuvahmulah, the Republic of Maldives. The coastal protection scheme will be developed under a D&C contract using the FIDIC ‘Conditions of Contract for Plant and Design-Build’ (FIDIC yellow book). The Employer has assigned Royal HaskoningDHV to execute supporting studies, draft the tender documents, and provide assistance in the tendering process.

# Project description

The project ‘Coastal Protection at Gn. Fuvahmulah, Maldives’ is defined as the development, implementation and maintenance of sustainable coastal protection to prevent erosion and flooding on one of the most southern islands of Maldives: Fuvahmulah.

The main objective of this project is to decrease erosion and flooding through the construction of a sloped revetment. The long term overall objective is to provide the population on the island with both a safe and healthy environment to live and work in as well as to provide a sustainable basis for further socio-economic development.

|  |
| --- |
| **9X0096_Project area**  Figure 1 - Project location Fuvahmulah and envisaged coastal protection indicated in red |

The design envisages a rock revetment over a length of approximately 2650m, between the harbour and Anbul Neru (Figure 1). The revetment aims to provide an immediate and sustainable protection against erosion with a minimum need for maintenance.

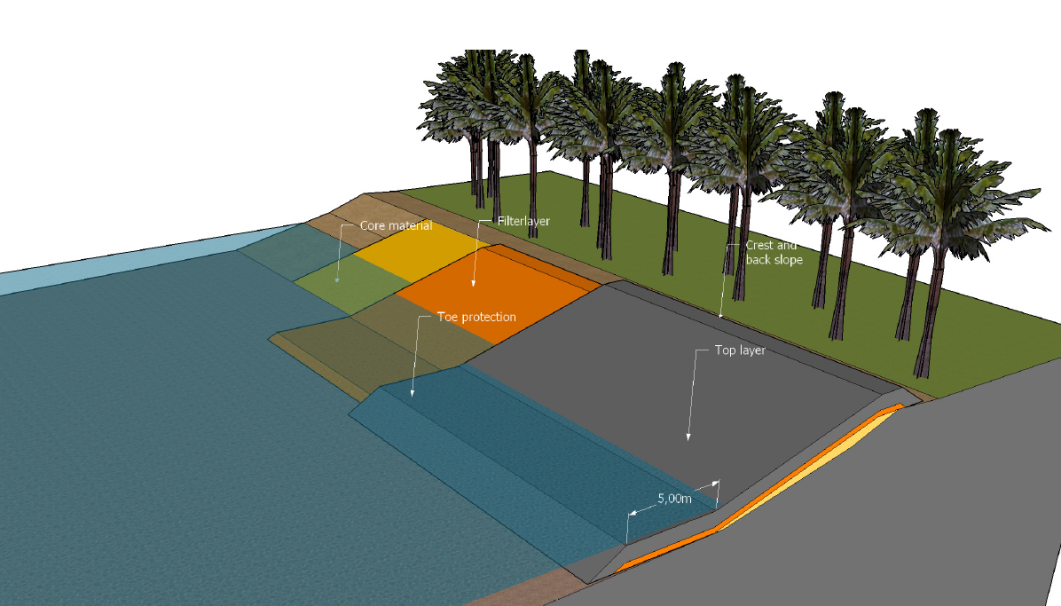


Figure 2: indicative visualisation of the revetment structure

In addition to the main structure, some relatively minor project components are envisaged which include (among others) the inclusion of access to the foreshore on a number of locations, modifications to an existing drainage outfall and rock works on the foreshore to provide sheltered swimming areas for the local population.

The aim is to minimize the environmental impacts during the construction, as the project is located in an environmentally sensitive and valuable area. The surrounding area includes unique marine life, a protected coastal vegetation belt and protected beach area (called Thundi beach).

The project is being developed as the result of an ORIO grant application by the Ministry of Finance and Treasury (MoFT) of the Maldives towards the Dutch Government. The grant arrangement for the implementation and the Operation and Maintenance phase was signed on the 28th of November 2017 and covers part of the project costs.

The Kuwait Fund of Arabic Economic Development (KFAED) is providing a loan to the MoFT, enabling the MoFT to finance the project, the loan agreement has been signed.

The Ministry of Environment and Energy (MEE) is the competent authority (and Employer) of the project and will be in charge of the actual implementation of the project in accordance with the agreements, contracts and envisaged timeline. The MoFT is the grantee of the ORIO grant and borrower of the KFAED loan, thereby responsible for securing the overall project budget.

# preliminary drawings / FIGURES

The following drawings/figures give an indication of the scope and type of work to be carried out:

* Figure 1 shows the location of the protection scheme in red. The length of the entire scheme is about 2,650 meters.
* Figure 2 shows an indicative visualisation of the proposed revetment design.
* Figure 3 shows a schematisation of the erosion problem. Most of the sand in the foreshore has eroded in the last years, exposing the coral ridge.
* Figure 4 shows a typical case of coastline decrease due to erosion.
* Figure 5 shows cross sections of the existing situation (indicative below -5m MSL).

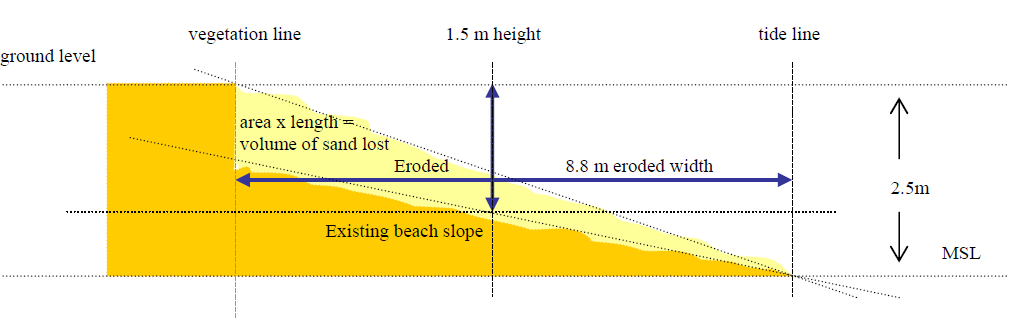


Figure 3: Schematisation of erosion problem



Figure 4: Typical erosion location



Figure 5: Existing situation cross sections (2016)

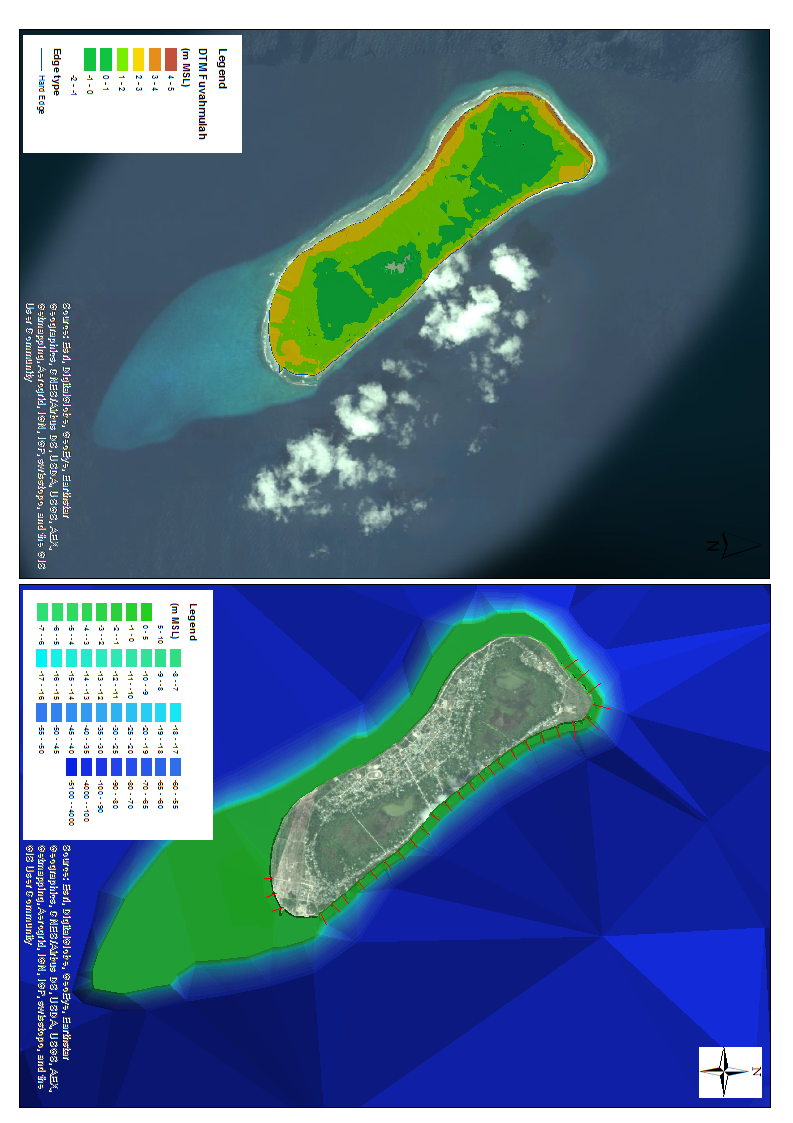
The project site is still being defined but will probably be restricted to the footprint of the envisaged structures (works boundary), the site access, the landfall location in the outer port basin, a stockpiling area at the north side of the harbour and a limited storage / parking area near Rasgefannu Neru.

No soil investigations within the works boundary are available. There are soil investigations available on the western coastline of Fuvahmulah which show a heterogeneous layering of mainly hard and soft corals.

The eastern shore mainly consists of exposed beach rock and (dead) coral and boulders due to extensive beach erosion. Deposition of pebbles and sand can be found on more northerly parts of the project area.

The elevation of the coastal areas around the island is relatively higher than the central area of the island. The ridge lies at around 2-3 meters above MSL. The coastal vegetation is mostly coconut palms and sea-lettuce. A significant number of coconut palms have been washed away due to the coastal erosion.

An indicative topography and bathymetry of Fuvahmulah can be found on the following page.



# Site conditions

Table 1 shows the characteristic tidal levels at S. Gan, approximately 50km south of the project area.

Table 1: Characteristic tidal levels at S. Gan

|  |  |  |
| --- | --- | --- |
| Tidal level | Description | Water level  [m +MSL] |
| HAT | Highest Astronomical Tide | +0.63 |
| MHWS | Mean High Water Spring | +0.55 |
| MHW | Mean High Water | +0.34 |
| MSL | Mean Sea Level | 0.00 |
| MLW | Mean Low Water | -0.34 |
| MLWS | Mean Low Water Spring | -0.56 |
| LAT | Lowest Astronomical Tide | -0.65 |

Design water levels for a 50 year design period (including sea level rise) will be around + 1.4 m MSL. Design waves on the seaward edge of the reef flat are swell dominated waves with large periods (>20 s) and wave heights of around 2.9 meters. The reef flat acts as a natural protection by breaking the waves and thus reducing the wave load at the coastline.

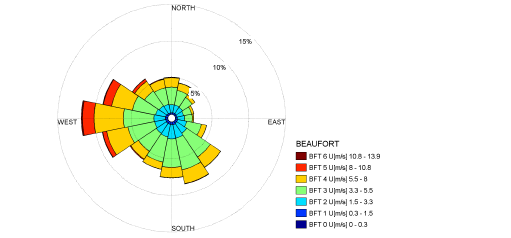
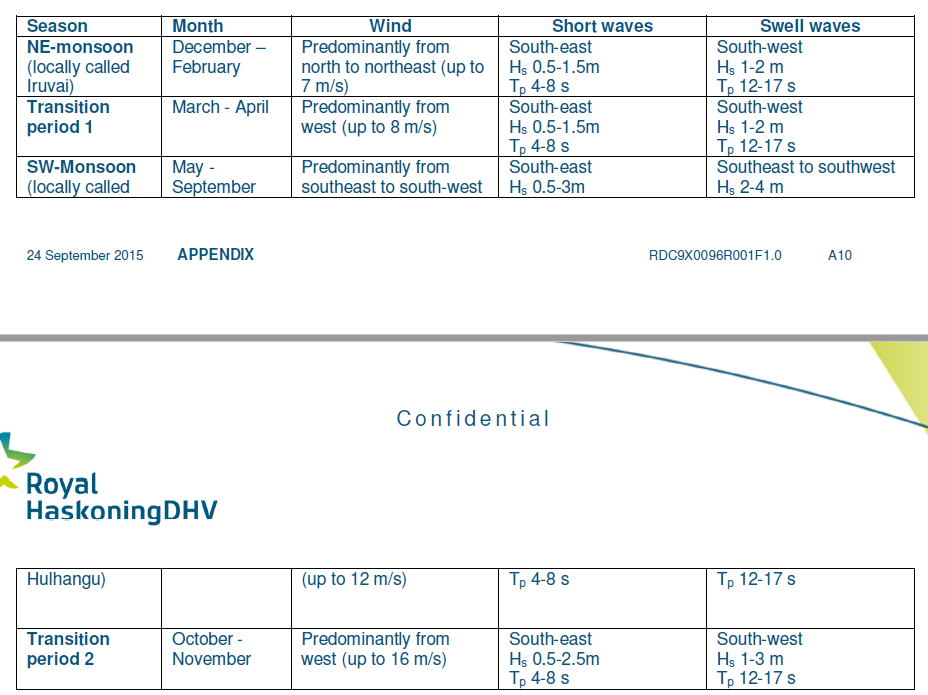
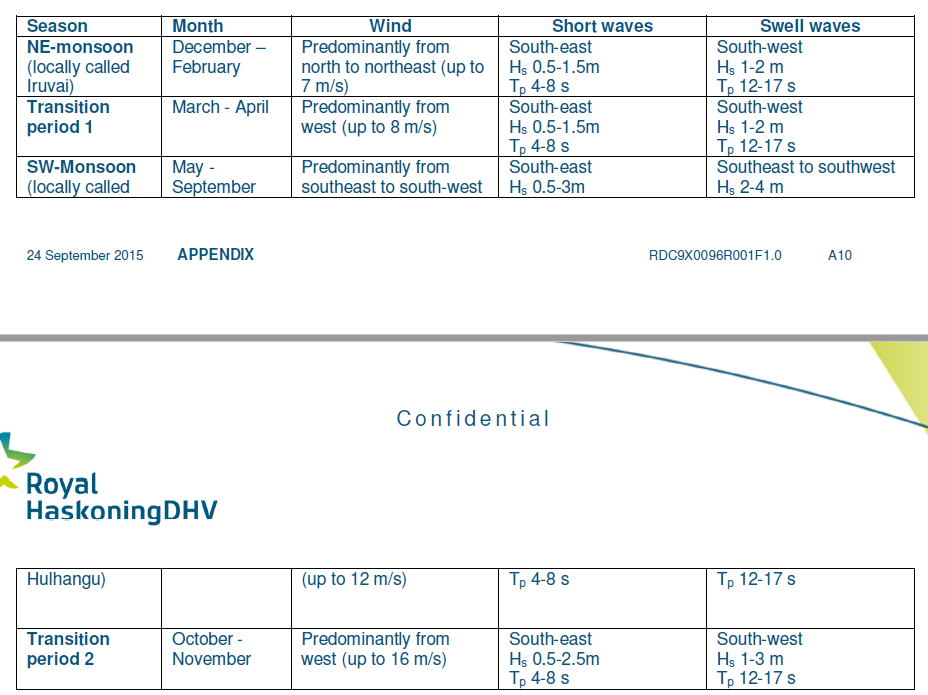


Figure 7: Annual wind climate

During the North-Eastern monsoon (December-February) wind direction is mainly from north to north-east. During a transition period (March-April) the wind turns to western direction. From the start of the SW-monsoon the predominant wind direction turns from west towards south-west and south-east. In the second transition period the predominant wind direction is west again. The monsoon periods, associated wind climate and typical offshore wave conditions are summarized in the table below.

Table 2: Annual wind and wave climate





The outer port basin can most likely (partly) be used for (un)loading of construction materials / equipment and potentially for limited stockpiling. The harbour entrance depth is around 3 meters during low tide, the distance between the two breakwater heads is around 40m.



Figure 8: Port of Fuvahmulah

Fuvahmulah is the most southern island of the Maldives, located remotely from the other islands and especially the capital Male’. The Island Community has a strong cohesion, strong religious values and has a distinct language from the rest of the Country. The main economic sectors are farming, fishery and since recently tourism (mainly for Maldivian tourists). Infrastructure is relatively well developed with a port and an airport in the Island.

Fuvahmulah is a single atoll, build-up from coral reefs and with valuable life corals habitats around this Island, abundant marine bio-diversity, including manta rays, sharks and commercially valuable fish resources. The shoreline of the Island is vegetated with a protected belt of palm trees and other species. The northern tip of the Island is the legally protected area of Thundi. The centre of the Island has a fresh water wetland, which is rare in the Maldives.