First Addendum to ENVIRONMENTAL IMPACT ASSESSMENT for Harbour Development Project at

M. Dhiggaru

October 2016

Proposed by:

Ministry of Housing and Infrastructure

Prepared by:

Ahmed Jameel (EIA 07/07)

Ibrahim Faiz (T06/15)

For **Water Solutions** Pvt. Ltd., Maldives

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Non-Technical Summary

This report discusses the findings of a study undertaken as an addendum to environmental impact study undertaken by Ministry of Housing and Infrastructure for the harbour development project at M. Dhiggaru at the request of Ministry of Housing and Infrastructure. This Fist Addendum to EIA for the Harbour Development Project at M. Dhiggaru report covers fishing vessel beaching area to be developed as additional work for the harbour development project currently being implemented at M. Dhiggaru. This EIA Addendum report is prepared in accordance with Environmental Impact Assessment Regulations, 2012 under the Environmental Protection and Preservation Act (Act No. 4/93). The purpose of this EIA is to fulfill the requirement of the Law and to conduct an assessment of possible impacts on environment arising from the proposed fishing vessel beaching area at M. Dhiggaru.

The project is at the island of Dhiggaru in Meemu atoll. The island is located at the northern edge of the Meemu atoll. The island is situated in a large reef system. The closest island to Dhiggaru is Madduvari which is about 1 km to the east of Dhiggaru.

The harbour development project is proposed by Ministry of Housing and Infrastructure representing the government of Maldives and the Ministry is responsible for all development and regulation of the construction sector. The contractor for the project is Maldives Transport and Contracting Company (MTCC).

The beaching area for the fishing vessel has been proposed as an extension of the harbor development project at M. Dhiggaru. Currently there is no area for beaching of vessel at the island. This has caused a lot of difficulty for the fishing vessel to undertake dry dock repairs which is routinely required. The island has a population size of approximately 1300. The main economic activity of the island is fishing. The island of Dhiggaru is famous for “dhiggaru rihaakuru” which provides a good economic income to the community. The project involves dredging of 60 m by 45 m basin area to a depth of -3.0 m MSL, an entrance channel of 20 m wide and 117 m long. The dredging is expected to generate 12,600m3 of dredged material. This dredged material would be used to reclaim 8,400 m2 of area on western side of the island. The new land created would be used for boat repair work.

All project activities will be in conformance to the laws and regulations of the Maldives, and relevant international conventions that Maldives is party to. The key laws and regulations applicable to this project are Environmental Protection and Preservation Act and Environmental Impact Assessment Regulation 2012 and its subsequent amendments

The study for the addendum to EIA was undertaken to assess the environmental impacts of changes to the harbour development project on the island. The proposed site (lagoon) and entrance channel had no visible live corals and was highly turbid. seagrass is found at the lagoon. Based on the assessment, it has been identified that the major impacts of the project will be felt on the marine environment during the construction stage. Dhiggaru is not a large inhabited island but located on a very large reef system. The development of the beaching area on the island will have impacts on marine environment. During the operational stage, environmental concerns are much less and are associated with waste and wastewater management of the fishing vessels.

The mitigation measures are provided in the report with alternatives. It is vital to conduct the activities, during both construction and operational stage, in line with mitigation measures emphasized in the report. Socio-economic impacts of the proposed beaching area development project will help the community to beach their vessel onto the island for dry dock maintenance work. This project will create economic opportunities both in the construction and operational stage through creation of both short-term and permanent jobs and business opportunities.

Towards the end of the report, a monitoring programme has been suggested which covers components of coastal and marine environment. It is important to follow this monitoring programme not only to comply with the regulation but also to ensure that the impacts are measured in realistic terms.

1 Declaration of the consultants

This EIA has been prepared according to the EIA Regulations 2012, issued by the Ministry of Housing and Environment. I certify that the statements in this EIA study are true, complete and correct, to our best of knowledge and ability.

Name: Ahmed Jameel (EIA 07/07)

Signature:

Name: Ibrahim Faiz (EIA T06/15)

Signature:

2 Proponent Commitment

بسم الله الرحمن الرحيم

Ministry of Housing and Infrastructure
Male', Republic of Maldives.

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މާލެ، ދިވެހިރާއްޖެ.

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Date: 25 October 2016 No: 138-PIS1/203/2016/232

Mr. Ibrahim Naeem

Director General

Environmental Protection Agency,

Ministry of Environment and Energy,

Green Building, Male',
Maldives.

Dear Sir,

This is in reference to the EIA report for the 1st Addendum to M.Dhiggaru Harbor Development Project,
As the Proponent of the project; we assure you our commitment to undertake the proposed mitigation measures and monitoring programme given in the report.

Thanking you

Sincerely,

Fathimath Shaana Farooq,

Director General

Ameenee Magu, Maafannu, Male', 20392, Republic of Maldives.
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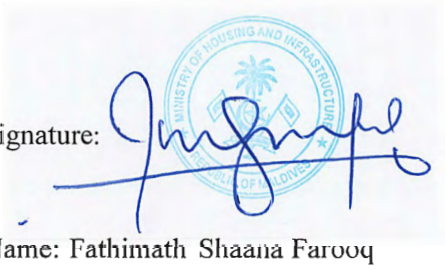
Proponents Declaration

Re: EIA for 1st Addendum to M.Dhiggaru Harbor Development Project

As the proponent of the proposed project we guarantee that we have read the report and to the best of our knowledge, all information relevant to this project in terms of project description, project construction works and operational aspects provided here are accurate and complete.

Signature: 

Name: Fathimath Shaana Farooq

Designation: Director General

On behalf of: Ministry of Housing and Infrastructure

Date: 25 October 2016

4 Introduction

This Addendum to EIA has been prepared to fulfil the requirements of the Environmental Protection and Preservation Act, law no. 4/93 for the development of vessel beaching area at M. Dhiggaru. The project proponent is Ministry of Housing and Infrastructure. The contractor for the project is MTCC.

4.1 Structure of the EIA

The report has been structured to meet the requirements of the EIA regulations 2012 issued by the Ministry of Environment and Energy. Hence, the report will provide an executive summary at the beginning. Sections that will follow include the project description in detail, existing environmental conditions, justifications given by the proponent for undertaking the proposed project components and alternatives. Alternatives to proposed components or activities and environmental considerations would be suggested. A mitigation plan and monitoring programme before, during and after the works will also be suggested.

4.2 Aims and Objectives of the EIA

The objective of the report is to:

- Assist in mitigating impacts caused due to the coastal development.
- Promote informed and environmentally sound decision making.
- To demonstrate the commitment by the proponent on the importance of environmental protection and preservation.
- To fulfill the obligations of the proponent to undertake an EIA under Clause 5 of the Environmental Protection and Preservation Act of the Maldives.
- Undertake the project work with minimum damage to the environment.

4.3 EIA Implementation

This EIA has been prepared by a local environmental consulting firm, Water Solutions. Water Solutions have been chosen by the proponent as the environmental consultants for this project. The team members were:

- Ahmed Jameel, Environmental Engineer (EIA Registration No: EIA 07/07)
- Ibrahim Faiz - (EIA Registration No: EIAT 06/15)

4.4 Terms of Reference

The terms of reference for this EIA have been attached as an annex. This EIA has been prepared based on these terms of reference.

4.5 Desk Study Review

A literature review was conducted to acquire background information on the site and its environment as well as to identify possible environmental impacts of similar developments in island settings. In this context, the EIA Regulations 2012, best practices from similar development activities, studies undertaken in similar settings around Maldives and previous documents/historical publications was considered.

The literature review comprised of, but is not limited to, the following:
- EIA for redevelopment harbor at M. Dhiggaru, 2015
- EIA for proposed boat mooring area at R. Maakurath, 2013

5 Policy, Legal and Administrative Framework

The project conforms to the requirements of the Environmental Protection and Preservation Act of the Maldives, Law no. 4/93. The EIA has been undertaken in accordance with the EIA Regulation 2012 of the Maldives by a registered consultant. Furthermore, it adheres to the principles underlined in the regulations, action plans, programmes and policies of Ministry of Ministry of Housing and Infrastructure, Ministry of Environment and Energy and Environmental Protection Agency. These are discussed in detail in the following sections.

5.1 Laws and Regulations

5.1.1 Environmental Protection and Preservation Act

Article 5 (a) of the Environmental Protection and Preservation Act (Law No. 4/93) addresses the submission of an EIA (Majilis, 1993). It states that an EIA shall be submitted to Ministry of Environment before implementing any developing project that may have a potential impact on the environment. This project complies with this Act.

5.1.2 Protected Areas and Sensitive Areas

Under Article 4 of the Environment Protection and Preservation Act, the Ministry of Environment is vested with the responsibility of identifying and registering protected areas and natural reserves and drawing up of rules and regulations for their protection and preservation.

As part of the Environmental Regulation, EPA has established list of 'sensitive sites' in the Maldives. Although not formalized as a regulation, the sensitive list is mentioned in the recent Regulation on Dredging and Reclamation (Regulation number 2014/R-13, see Section 5.7, page34). The sensitive sites, according to EPA are sites in the Maldives (islands, reefs, mangroves, inter-tidal areas) where developments ought to be restricted, regulated or controlled. Some view those sites mentioned in the sensitive list have no meaning because there is no evidence to show any 'sensitive features' of the areas.

Dhiggaru is not a protected island and the island is not included in an environmentally sensitive area list maintained by EPA. Hence this regulation is not relevant to the proposed project.

5.1.3 Regulation on Sand and Aggregate Mining

The Regulation on Sand and Aggregate Mining was issued by the Ministry of Fisheries, Agriculture and Marine Resources on 13th March 2000. This Regulation addresses sand and aggregate mining from uninhabited islands that has been leased and from the coastal zone of other uninhabited islands. Under this Regulation, it is an offence to mine sand or aggregate from the beach, lagoon or reef of any island leased for the purpose of building a tourist resort. Mining of aggregate or sand for the construction of resorts and associated facilities is discouraged and utilization of alternative construction material is encouraged under the policy of the Tourism Ministry of the Maldives. As an incentive, import duty is exempted for the import of cement, iron, steel, roofing sheets and timber for the construction of tourist resorts. However, sand mining is allowed for reclamation and beach replenishment projects, primarily from the immediate lagoon of the island and in the case of a lack of sand on the island, from an area that is decided by the Ministry of Fisheries, Agriculture and Marine Resources

5.1.4 Environmental Impact Assessment Regulation 2012

The Ministry of Environment has issued EIA regulation on May 2012, which guides the process of undertaking the Environmental Impact Assessment in the Maldives – This guideline also provides a comprehensive outline of the EIA process, including the roles and responsibilities of the consultants and the proponents. This regulation outlines every step of the IEE/EIA process beginning from application to undertake an EIA, details on the contents, minimum requirements for consultants undertaking the EIA, format of the EIA/IEE report and many more.

The guidance provided in this Regulation was followed in the preparation of this EIA report. The EIA has also been prepared by registered consultants.

5.2 Waste management Regulations

The Ministry of Environment has developed national waste management regulations. The key elements of the regulations include: ensure safe disposal of solid waste and encourage recycling and reduction in waste generated, develop guidelines on waste management and disposal and advocate enforcing these guidelines through inter-sectoral collaboration and ensure safe disposal of chemical, industrial and hazardous waste.

Waste management for the proposed project during the construction and operation phase will be in line with this regulation. The waste generated from the project site would be taken to the island waste management facility or *Thilafushi* for processing and disposal.

5.2.1 Post EIA Monitoring, Auditing and Evaluation

The environmental monitoring programme given in EIA report is an important aspect of the EIA process. The monitoring programme outlines the objectives of the monitoring; the specific information to be collected; the data collection program, and managing the monitoring programme. Managing the monitoring programme requires assigning institutional responsibility, reporting requirements, enforcement capability, and ensuring that adequate resources are provided in terms of funds, skilled staff, etc.

The monitoring programme outlined in this report will comply with the EIA Regulations 2012.

5.3 Environmental Permits

5.3.1 Decision Statement (EDS)

The EIA Decision Statement is issued on successful evaluation of the EIA report by the EPA, Ministry of Environment and Energy. EIA Decision Statement governs the manner in which the EIA project activities must be undertaken.

5.3.2 Dredging and Reclamation Permit

Dredging and reclamation permit is required to undertake any dredging or reclamation of the lagoon or island. Dredging and reclamation permit would obtained for this project from EPA when this EIA Addendum is approved from EPA. The dredged materials from the entrance channel and basin will be used to reclaim western side of the island. These areas would be marked in the dredging and reclamation permit.

5.4 Responsible Institutions

The main government institutions that have roles and responsibilities relevant to this project are summarised below.

5.4.1 Ministry of Housing and Infrastructure

Ministry of Housing and Infrastructure is the government ministry responsible for the development and regulation of the construction sector of the country. It is also the agency which oversees the development of public infrastructure of the country. Ministry of Housing and Infrastructure is the proponent of this project.

5.4.2 Environmental Protection Agency

The Environmental Protection Agency (EPA) of the Ministry of Environment and Energy has responsibility for efficient operation of the EIA process. This encompasses a number of tasks, including screening of projects and provision of general procedural advice to the project proponents throughout the EIA process. The EPA manages the review of the EIA report and is responsible for any approvals or recommendations associated with the EIA. It is also responsible for verifying that environmental protection measures are properly implemented by undertaking environmental audits in collaboration with other government as well as non-government agencies with a role for environmental protection and preservation.

5.4.3 Ministry of Environment and Energy

The Ministry of Housing and Environment is mandated for the effective implementation of the Environmental Protection and Preservation Act (law 4/93) of the country and has the statutory power over issues related to the environment. It has the central control over the environment protection, management, conservation and environmental emergencies. The Ministry operates mainly at a policy level and the more regulatory and technical assessment activities are mandated to the Environmental Protection Agency (EPA). In this respect EPA has now been mandated to manage all issues relating to Environmental Impact Assessment of individual projects.

5.4.4 Meemu Atoll Council

The Government has grouped the 20 administrative areas of the Maldives under local governance system and decentralised decision making enshrined in the new constitution of the Maldives adopted in 2008. Meemu Atoll has an elected Atoll Council located in Muli. The Atoll Council Office is the main focal point of Government Ministries in Male' Atoll and they co-ordinate and liaise with Government Ministries and elected island councils on all issues relating to the Atoll. A copy of this EIA Addendum has been submitted to the Atoll Council.

5.5 Relevant Policies

5.5.1 National Climate Change Strategy

The National Climate Change Strategy fosters a programmatic approach that provides institutional and operational contexts for individual projects. The Strategy places emphasis on coordinating activities, taking advantage of synergies of mitigation and adaptation for sustainable development.

It reflects the need to complement other development efforts, due in part to small size of the economy and the highly integrated nature of the society and economy. The focus is on activities that deliver tangible and visible benefits. The proposed project is part of the adaptation programmes which is being implemented under the National Climate Change Strategy.

5.5.2 National Biodiversity Strategy and Action Plan

The National Biodiversity Strategy and Action Plan 2016-2025 (NBSAP 2016-2025) seeks to ensure that threats to biodiversity are addressed, biodiversity is conserved, sustainably used and benefits arising from them are shared equitably. It also encompasses ways of addressing gaps, challenges and constraints highlighted in earlier sections. It is a living document that will have the capacity to adapt to changes in national conditions, capacities and to the changes in the international arena. In implementing the proposed project activities due care would be given to ensure that the national biodiversity strategies are adhered to. The proponent has committed on conservation and protection of the environment while undertaking this proposed project.

5.6 International Conventions

5.6.1 Convention on Biological Diversity

The Maldives is a party to the United Nations Convention on Biological Diversity. The objective of the convention is "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding. The proposed development activities outlined in this project does not fall on any area recognised for its ecological value. Therefore it is unlikely there will be a major loss of biodiversity. The loss is not going to be significant at atoll or national level. Yet, it is recommended that the developer ensures that mitigation measures are taken to reduce the impact of terrestrial biodiversity.

6 Project Descriptions

6.1 Project Proponent

The harbour development project is being implemented by Ministry of Housing and Infrastructure. Ministry of Housing and Infrastructure is responsible for all development and regulation of the construction sector. All harbour development is handled by MHI.

The contractor of the project is Maldives Transport and Contracting Company (MTCC).

6.2 Project Location and Study Area

The project is at the island of Dhiggaru in Meemu atoll. The island is located at the northern side of the Meemu atoll (see Figure 1). The island is situated in a large reef system. The closest island to Dhiggaru is Madduvari which is about 1 km to the east of Dhiggaru.

Figure 1: Project Locations

The island has a population size of approximately 1300 and with land area is approximately 12 hectares. The main economic activity of the island is fisheries. The island of Dhiggaru is famous for "dhiggaru rihaakuru" and main economic activity of the island is fishing.

6.3 Need and Justification

This is a community driven project to cater the needs of the people of Dhiggaru. With the increasing demand of the fishing vessels and the growing sizes of the vessels, the government is undertaking redevelopment of the harbour at the island. Presently MTCC as the contractor for the harbour development project, the civil works of the harbour development is being carried out at the island. As an additional work for the harbour development project, Ministry of Housing and Infrastructur has awarded the development of the vessel beaching area to MTCC. Beaching area is important to Dhiggaru as the island has a large number of fishing and other vessels which need to be beached for dry dock maintenance work. Presently the island does not have such area and the island community is not able to carry out the beaching of vessel at the island. Hence this is an important project for the island community to keep pace with the growing demands for the use of the harbour.

6.4 Project Details

This section outlines the details of the various project components from mobilization, construction methodology to materials and machinery used. The development of beaching area at the island is being undertaken as extension to the harbour development project at the island. The beaching area development component comprises of development of dredging an entrance channel of 20 m wide and 117 m long, 60 m by 45 m basin area to a depth of -3.0 m MSL for the vessel to turn and reclamation of western side fo the island using the 12,600m3 of dredged material from the entrance channel and basin area.

6.4.1 Entrance Channel

The beaching area development component comprises of development of dredging an entrance channel of 20 m wide and 117 m long. The entrance channel will be first dredged. A sand bund would be creted using excavtors. The excavator will dredge the channel being on the sand bund. The sand bund would be moved by reclaiming the entrance channel to a depth of -3m at MSL. It is estimated that dredging of entrance channel would generated around 6,750 m3 of dredge material.

6.4.2 Basin Area

The beaching area development component comprises of developing a basin area which is 60 m by 45 m. The basin area would be dredged to a depth of -3.0 m MSL for the vessel to turn to facilitate the beaching of the vessel. The dredging would be carried out by excavators on sand bund. The dredging of basin area is expected to generate 5,850 m3 of dredge material. The dredged material would be transported to reclamation area on dump trucks.

6.4.3 Reclamation of western side of the island

The dredged material from the entrance channel and basin area will be used fill material to reclaim of western side of the island. It is estimated that 12,600m3 of dredged material would be obtained from the entrance channel and basin area. The dredging and reclamation work would be carried out at low tide.

6.4.4 Project boundary and impact area

As this is a beaching area development project, the impact area will not be very large. The Figure 2 shows the project boundary and the zone of impact. It also shows where the dredged material from the entrance channel and basin will be placed.

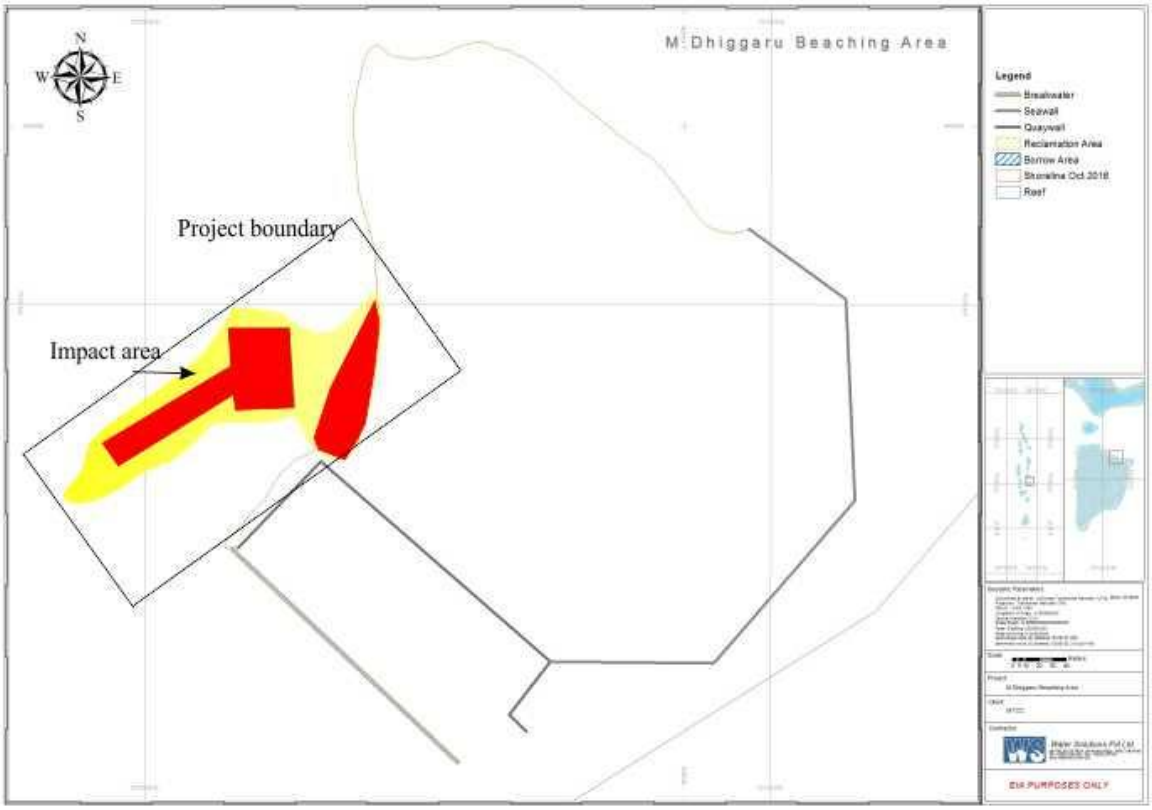


Figure 2: Project Boundary and impact zone

6.5 Process and Materials

6.5.1 Construction methods

Excavators on sand bed will be used for the dredging of the entrance channel and basin area. Dump trucks and other heavy machineries will be used to assist in transportation of dredged materials and other processes.

6.5.2 Project Schedule

The total duration of project is 6 months. Refer to the project schedule attached in the annex. Construction is expected to begin in October 2016 upon receipt of the EIA decision statement. As soon as the EIA is approved and a decision statement is issued, the project activities will initiate, including dredging of entrance channel and basin area.

6.5.3 Waste management

The existing waste removal strategy for the harbor development project would be utilized for this additional component of the project. The contractor have rubbish bins within site area, which is removed and replaced on a regular basis. The contractor works towards better management of waste so the volume of waste to be disposed would be reduced. All domestic wastes from the construction activities, that is from the construction works will enter the present waste management cycle in Dhiggaru, that is only domestic garbage. All other wastes such as hazardous wastes like waste oil, grease and construction waste alike will be stockpiled at the project site and transferred to Thilafushi after the project.

6.5.4 Dust and Debris

The construction areas will be kept clean and tidy at all times and will accord with the safety requirements. Particular attention will be given to preventing the contamination of working areas.

6.5.5 Safety

Full recognition and regard will be taken in the management and execution of project safety plan. Any subcontractors will be obliged to provide safety policies, plans and method statements and will be interviewed prior to order placement on all aspects of safety, health and welfare. All sites are subject to independent site safety checks, inspection and reports by our independent site safety inspectors and advisors.

6.5.6 Housing of temporary labour

Housing of labour will be in the temporary accommodation facilities setup at the project site adjacent to the harbour.

6.5.7 Emergency plan in case of spills (diesel, grease, oil)

Spillages can be an issue in this project if adequate measures are not taken. Hence, oil, grease and other fuel storage will be held on land in a temporary site that has an adequate impervious flooring. Refuelling of excavators, loaders and trucks will be required to be undertaken in hard floor areas setup at the project site during the construction works.

6.5.8 Measures to control sedimentation

In order to minimize the sedimentation, excavators will be working on land for most part of the construction and avoid or minimize their use in the lagoon.

6.6 Expected Environmental Conditions during the Project Implementation Period

The project activities is expected to take place in north east monsoon in 2016/17. Hence, the environmental conditions are expected to be mostly favourable during the construction period (the proposed project area is located on the west side and therefore is very well protected during the north-east monsoon). The project activities may have some disruption in extreme events only. As for the dredging and reclamation, it will mainly be done on land and thus pose limited interruptions from weather, unless in severe conditions.

6.7 Risks Associated with the Project

There are very limited risk factors associated with this project that could possibly have both financial and environmental implications. The most important is the risk of project delays caused by bad weather. The actual construction work is likely to be affect minimally by bad weather unless it is very severe.

6.8 Project Management

The project will be managed by the Ministry of Housing and Infrastructure and the construction works will be carried by MTCC as the contractor. Site engineers and managers from MTCC would be placed at the construction site where they would report to Ministry of Housing and Infrastructure.

6.9 Operation and Maintenance

Once the harbor and beaching area is completed it will be operated and maintained by the island council. Inspections would be undertaken by MHI at regular intervals to assess the condition of the harbor on request from the council.

6.10 Project Inputs and Outputs

6.10.1 Project Inputs

The types of resources that will go into this project and from where and how these will be obtained are given in the following tables.

Input resource(s)	Source/Type	How to obtain resources
Construction workers	Maldivians and foreigners	MTCC 27 man labour force
Water supply (construction period)	Rainwater and desalinated water	Rainwater would be harvested from project site and stored in 5,000L tanks.
Electricity/Energy (construction period)	Electricity	From island grid
Construction machinery	Concrete mixer and general construction tools	Local suppliers
	2 Excavator of size 330	Contractor
	2 Dump truck	Contractor
	1 Loader	Contractor
	1 Concrete mixer	Contractor
	1 Winget machine	Contractor
	1 Crane	Contractor
	1 Workshop container	Contractor
	1 Office container	Contractor
	3 Diesel tank (5000L)	Contractor
	2 Water tank (5000L)	Contractor
	1 Welding Genset 20Kva	Contractor
Transport (sea)	Sea transport by dhoni and speed boats. Materials to be transported in cargo vessels/dhoni.	Contractor to be in charge of this
Food	Mainly imported sources except a few locally available.	Local purchase

Table 2: Matrix of major inputs during construction period

6.10.2 Project Outputs

The type of outputs (products and waste streams) and what is expected to happen to the outputs are given in the table below.

Products and waste materials	Anticipated quantities	Method of disposal
Sewage and wastewater Grey water/laundry wastewater	Estimated to be at 60 liters/person/day	Septic tanks
Construction and general waste from construction activities	2 cubic meters of debris / week during construction phase	Stockpile and send to Thilafushi management center

Hazardous waste	Approximately 100 liters of diesel and oils per month	Barreled and stored until disposal. transported to disposed to a designated waste disposal facility
Noise	Only localized to the island environment	-
Air pollution	Limited quantities of dust	Mainly arising as a result of dust emission from the excavation work. Only localized
Dredged material from entrance channel and basin area	12,600m3	Reclamation on western side of the island

Table 3: Matrix of major outputs of environmental significance during construction stage

7 Methodology

The section covers methodologies used to collect data on the existing environment. The key environmental and socio-economic components of the project that were considered are physical environment, social and coral reef areas as the marine environment.

In order to study the existing environment of the island, the following data collection methodologies were used during the field visits undertaken in 6 – 7th October 2016 to the island. Field visits mainly covered water quality, coastal assessment work, marine environment and lagoon condition of the proposed project sites. In addition, stakeholder consultations were carried out on 6th October at Dhiggaru Island Council.

7.1 General Methodologies of data collection

Conditions of the existing environment were analyzed by using appropriate scientific methods. The environmental components of the study area were divided into marine and terrestrial environment. The marine environment of the island covered the house reef, especially western and southern side of the island, around the area of the proposed vessel beaching area development. The terrestrial environment was not covered vegetation as the project has no impact on the terrestrial vegetation of the island.

7.2 Mapping and Location identification

The entire island, including some section of the reef line, shore line, vegetation line and marine survey locations were mapped. Mapping was undertaken using hand held GPS. The location of data collection sites were marked using handheld GPS. These data collection points include water sampling locations, marine survey areas and shorelines.

7.3 Marine Survey

To assess the benthic composition of the survey site, an LIT transect of 20 meters were undertaken. The benthic categorization was focused on categorizing life forms followed under the Reef Check protocol, which emphasises on benthic composition categorizing such as hard corals, sand, rock and others. The emphasis is not on recording corals to their species levels, but rather the general coral and other life forms such as hard and soft corals. This method is more accurate as the percentage of healthy coral cover and other life forms can be more accurately recorded even by a non-experienced surveyor. Recording corals to their species levels will pose difficulty if the surveyor is not familiar with the different coral types. This method is universally used throughout the world by Reef Check surveyors and hence it has been used.

This LIT method was also complimented by qualitative methods, such as visual observations and through the use of photos. Fish counts were also undertaken to get a snapshot of the fish population. Details of these methodologies are discussed in the methodology section.

The following are definition of benthic categories used in this survey.

- HC: All living coral including bleached coral; includes fire, blue and organ pipe corals
- SC: Include zoanthids but not anemones (OT)
- RKC: Coral that has died within the past year; appears fresh and white or with corallite structures still recognizable
- NIA: All macro-algae except coralline, calcareous and turf (record the substrate beneath for these); Halimeda is recorded as OT; turf is shorter than 3cm.
- SP: All erect and encrusting sponges (but no tunicates).
- RC: Any hard substrate; includes dead coral more than 1 yr old and may be covered by turf or encrusting coralline algae, barnacles, etc.
- RB: Reef rocks between 0.5 and 15cm in diameter
- SD: Sediment less than 0.5cm in diameter; in water, falls quickly to the bottom when dropped.

- SI: Sediment that remains in suspension if disturbed; recorded if color of the underlying surface is obscured by silt.

OT: Any other sessile organism including sea anemones, tunicates, gorgonians or non-living substrate. Under Reef Check protocol, there is no categorization of sea grass hence, it was recorded under OT.

General impression and quantitative results of the sites surveyed are described in the marine environment section

7.4 Bathymetric survey

A bathymetric survey was undertaken for the purpose of EIA to assess the baseline condition of the proposed entrance channel and basin area on western side of the island. The bathymetric survey map is attached as annexed as an annex to this report.

7.5 Marine water quality

The marine water samples were tested onsite using handheld digital water test kit. Using a GeoXT GPS, the positions of the locations were identified.

Figure 3: Marine water sampled locations

7.6 Socio-economic condition and stakeholder consultation

A stakeholder consultation was undertaken as part of this EIA Addendum Study. The purpose of the consultation is to get stakeholders view on the beaching area project and analyse the potential impact of the project might have on the island community. Consultations were held through meetings at Male' with government stakeholder, in Meemu Atoll with local stakeholders during the EIA field visit to the project site.

7.7 Data Analysis

The EIA consultants used their experience and knowledge in their respective fields to analyse the data from the previous studies and field visits in order to determine the potential impacts of the proposed project, the severity of effects arising from these impacts and how any adverse impacts can be best mitigated and positive impacts enhanced. This analysis provides recommendations on actions and mitigation measures and provides the basis for the formulation of the environmental monitoring plan. The process and findings of the study is reported in the EIA report compiled for this project.

7.8 Report Format

The report format and structure presented here follows the report formatting guidelines issued by EPA.

8 Existing Environment

The baseline information of the proposed project and surrounding area were collected through primary data collected during the study period and available secondary data. The environmental baseline data includes general geography, meteorology, geology, terrestrial and marine environment, bathymetry, tidal conditions, etc. A detailed description of baseline data compiled through the surveys and monitoring is provided in the subsections.

8.1 Existing general environment of Maldives

The general environment is described in many reports and literature as well as reference to the following report is made if the reader wishes to refer.

EIA for proposed harbour redevelopment at Meemu Atoll Dhigaru, (MECO, 2015).

8.2 Existing Marin Environment

Three sites were surveyed to assess the marine environment as baseline for reef benthic community. The coral formation in Dhiggaru reef system varies from site to site.

8.2.1 Status of coral reef at site 1

Site 1 was selected on the west side of island lagoon from the proposed dredging area. This area is very shallow and is covered with seagrass and sand. No live corals were observed in this location during the survey. Graph below shows the benthic composition of site 1 and some marine photos from the site are attached below.

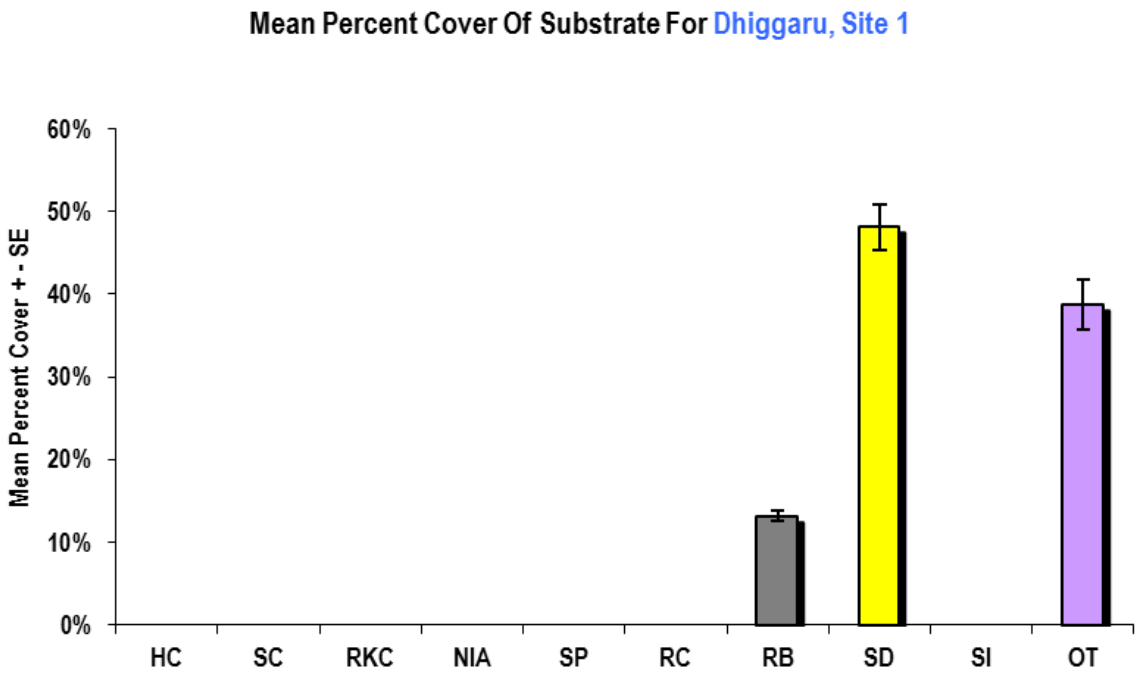


Figure 4: Mean percent cover of bottom substrate at Site 1 (Survey date: 7 October 2016)

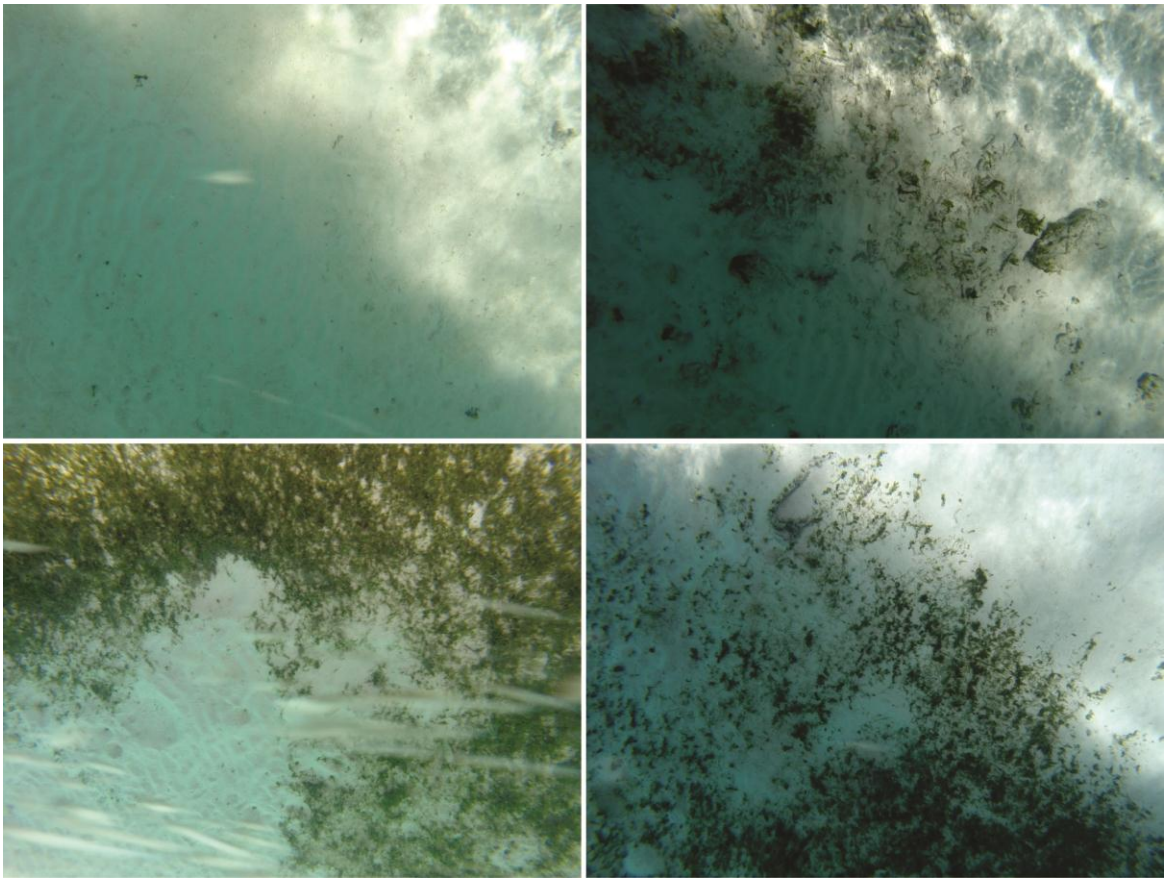


Figure 5: Marine photos from Site 1 (Survey date: 7 October 2016)

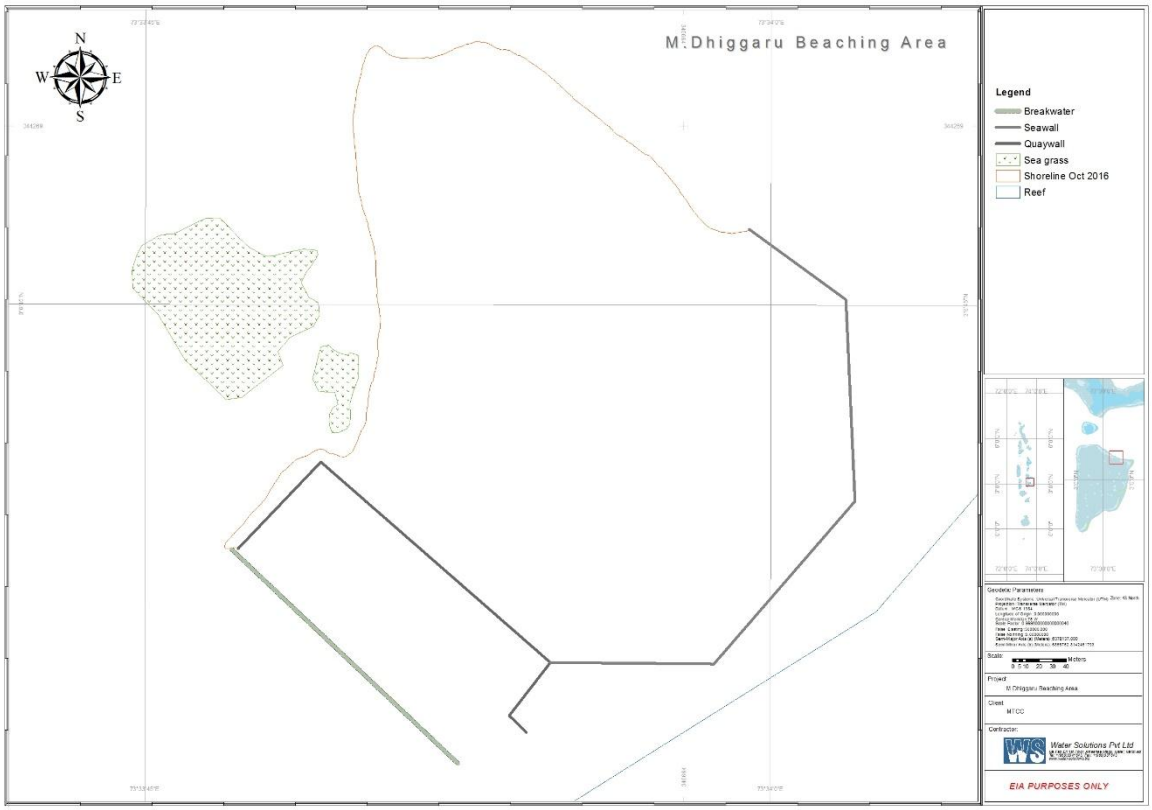


Figure 6: sea grass beds located at the vicinity of the project site

8.2.2 Status of coral reef at site 2

Site 2 was also selected on west side of the island reef the proposed entrance channel to the beaching area. Compare to site 1, this area has live coral patches dominated by Massive coral species. Deep area near the entrance proposed entrance channel is covered with sand. Surgeon fish and Wrasses were observed dominant on the site. Graph below shows the benthic composition of site 2and some marine photos from the site are attached below.

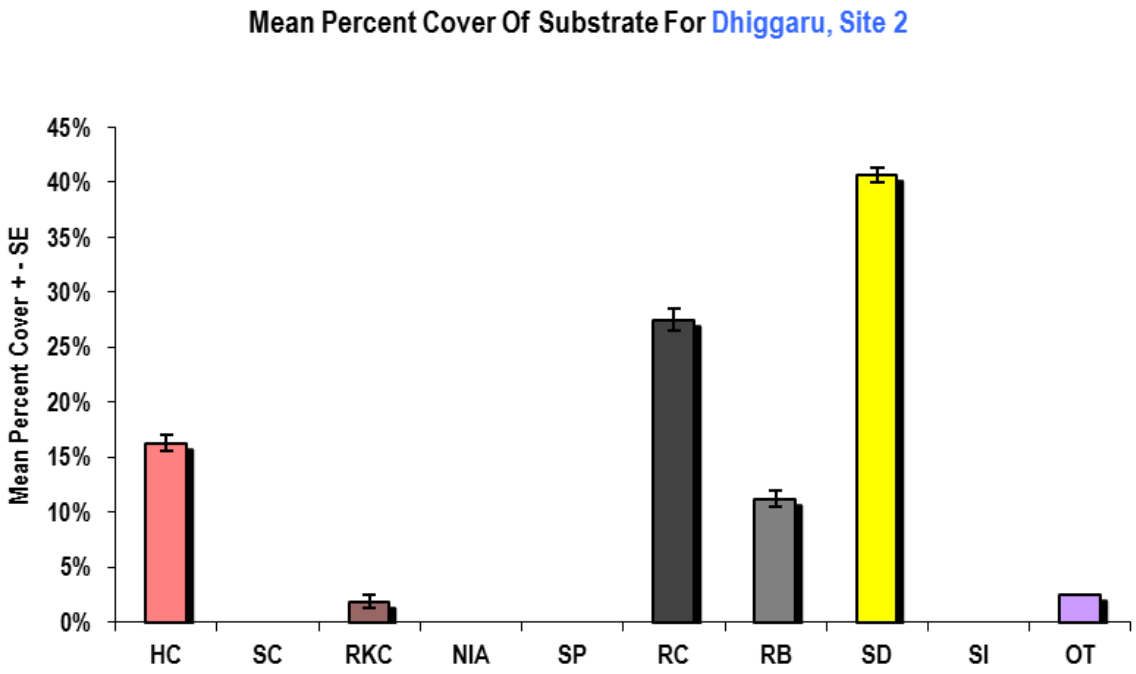


Figure 7: Mean percent cover of bottom substrate at Site 2 (Survey date: 7 October 2016)

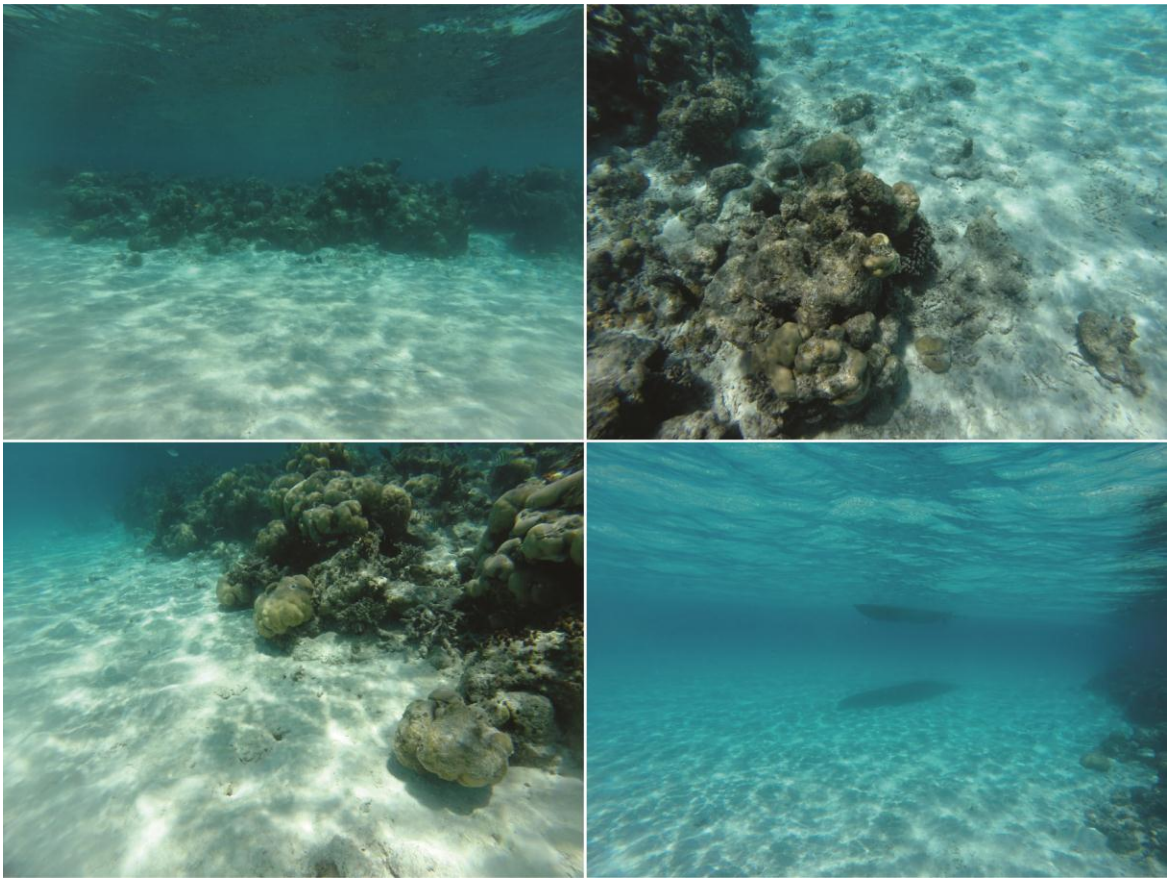


Figure 8: Marine photos from Site 2 (Survey date: 7 October 2016)

8.2.3 Status of coral reef at site 3

Marine survey site 3 is on the east of the island reef as a control site. Benthic composition of the site 3 is dominantly covered with rocks and rubbles. Few Massive coral species were observed in this location. This side of the island reef faces the channel between Dhiggaru and Maduvvari. Reef slope of this area is very steep and resemble like a wall. Underwater photos from this location are attached below.

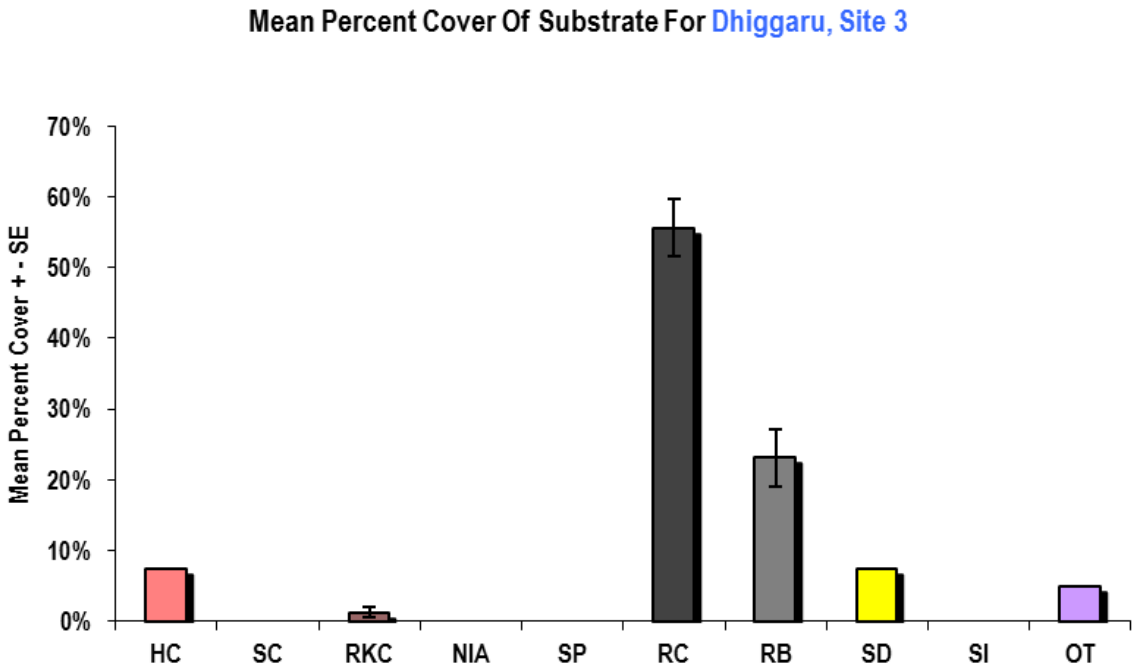


Figure 9: Mean percent cover of bottom substrate at Site 3 (Survey date: 7 October 2016)

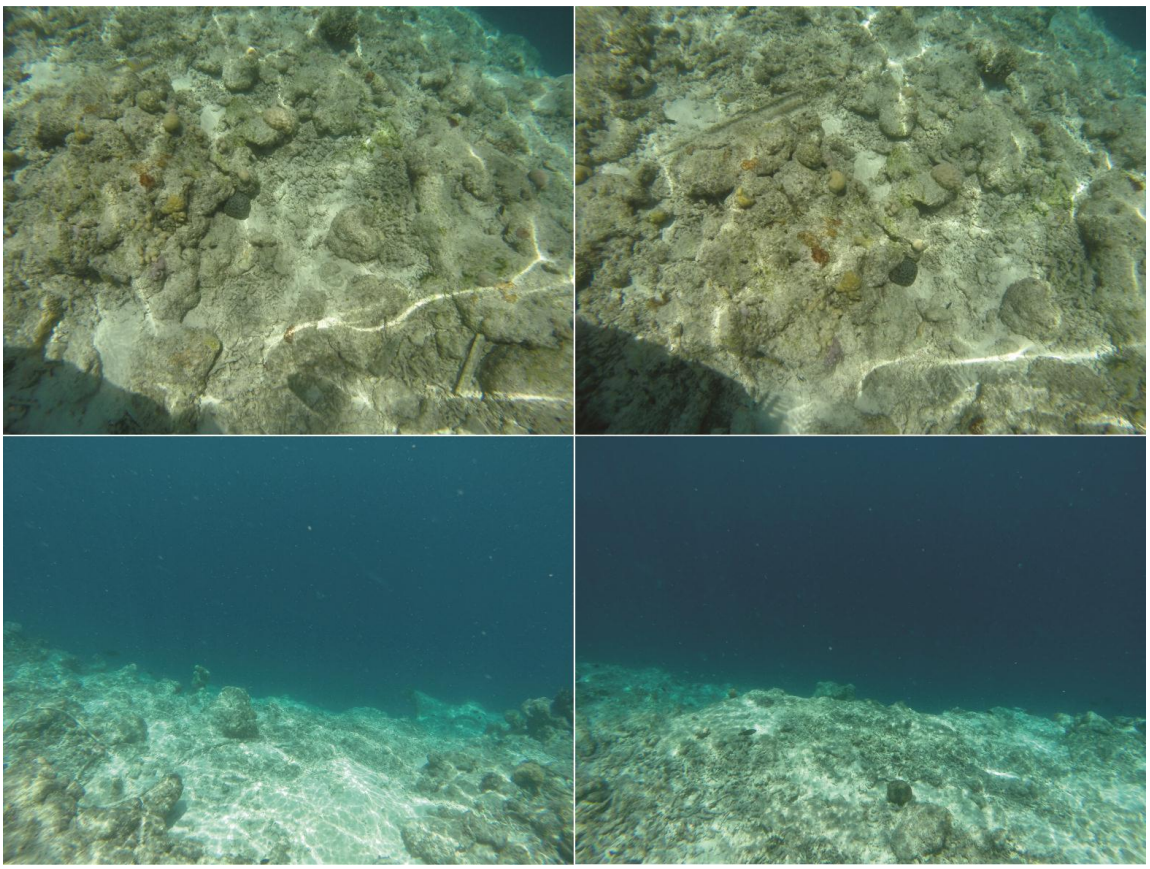


Figure 10: Marine photos from Site 3 (Survey date: 7 October 2016)

8.2.4 Assessment of fish communities in the surveyed area

The result of 20 minutes swim for fish count along transects at sites reveals that the abundance and diversity of fish was moderately good on the reef area but very low on the lagoon. This may be due to the presence of a number of live coral colonies in the outer reef. Since most of the lagoon area was covered with rubble and sand. The dominant fish taxa observed in the surveyed area included grazers like surgeon fishes, parrotfishes and wrasses (see table below).

Table 1: Results of the fish encounter survey (Sites 1 to 3)

Family	**Site 1**	**Site 2**	**Site 3**
Angelfishes (Pomacanthidae)	-	-	-
Anthias	-	-	-
Batfish	-	-	R
Bigeyes (Priancanthidae)	-	-	-
Butterflyfishes (Chaetodontidae)	-	-	-
Damselfishes (Pomacentridae)	-	C	C
Emperors	-	-	-
Fusiliers (Caesionidae)	-	-	-
Goatfishes	-	-	-
Groupers	-	R	R
Hawkfishes	-	-	-
Jacks	-	-	R
Lethrinidae (Emperors)	-	-	-
Moorish idol (Zanclidae)	-	R	R
Parrotfishes (Scaridae)	-	C	-
Rudderfishes (Kyphosidae)	R	-	R
Snappers (Lutjanidae)	-	-	-
Soldier fish	-	-	-
Squirrelfishes (Holocentridae)	-	-	-
Surgeon fishes (Acanthuridae)	-	A	C
Sweetlips	-	-	-
Triggerfishes (Balistidae)	-	R	R
Wrasses (Labridae)	-	C	C

8.2.5 Marine water quality

The primary objective of the marine water quality sampling was to determine the baseline conditions of the marine water in the project site. See Figure 3 locations of the water sampled points. Qualitative and quantitative assessments were made on seawater from four location. The following table illustrates the result of the marine water quality test.

Table 2: Results of the marine water quality tests undertaken at the island

Water Quality	Units	**M1**	**M2**	**M3**
Physical appearance		Clear	Clear	Clear
Electrical Conductivity	us/cm	52,520	55,098	51,120
Temperature	C	29.0	29.0	28.9
Total Dissolved Solids	mg/L	29,734	28,194	26,042
Salinity	mg/l	33,210	33,175	33,220
pH		7.8	7.8	7.8
Turbidity	NTU	0.0	0.0	0.0
Suspended solids	mg/l	9.0	5.0	3.0
Faecal coliforms	count/ml	-	-	-
Total coliforms	count/ml	-	-	-

8.3 Existing Coastal Environment

This section will look at the coastal zone of the island environment which is the area between the vegetation line and the reef flat. Therefore, this section will cover the following:

- Existing environmental conditions of the coastal environment of island
- The different proposed components of the project that will impact upon the coastal environment

Figure 11: Dhiggaru in 2005, 2011 and 2016

8.3.1 Features of the coastal environment

8.3.1.1 Lagoon

The lagoon associated with the island system is very large. It stretches over 5.8 km. The depth of lagoon varies from 1 m to 6 m. The shallow lagoon surrounds the island on eastern and northern side. The deeper lagoon is found on southern side of the island. The lagoon surrounds the island consists of sandy bottom on western and northern side. The island is located on eastern side of the reef system and hence does not have a define lagoon on eastern side of the island. Sea grass was seen on western side of the island. This has been widely spread since 2011 as seen in Figure 11. In terms of the area and the biodiversity the entire lagoon and coral reefs are in healthy state but varying in different areas of the coral reef.

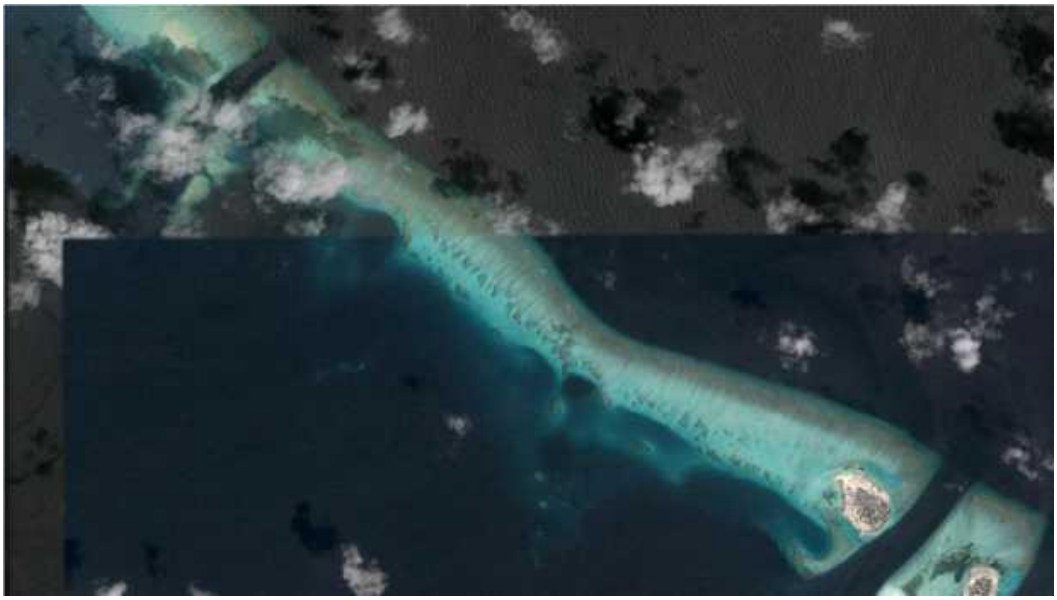


Figure 12: The island has a deep lagoon on southern side of the island

8.3.1.2 Beach

There is distinctive variation in beach composition around the island. However, the beach extent is seen to vary from different parts of the coastline. The island has a modified beach almost around the island. Seawall is found on most part of the beach. Seawall on eastern and northern side of the island is made from sand cement bags. While the southern side of the island has the quaywall of the harbor. The sand pit is found on north eastern corner of the island. The beach moves with the season. The western side of the island has coral rubble. Erosion is evident on western side end of the beach revealing coral rubbles in some areas. Annex provides beach profiles taken at the shoreline of the island.

Figure 13: Island beach on western side of the island

Figure 14: Island beach on northern side of the island

Figure 15: Island beach on Eastern side of the island

Figure 16: Sandpit on north western side of the island

Figure 17: Island beach on southern side of the island

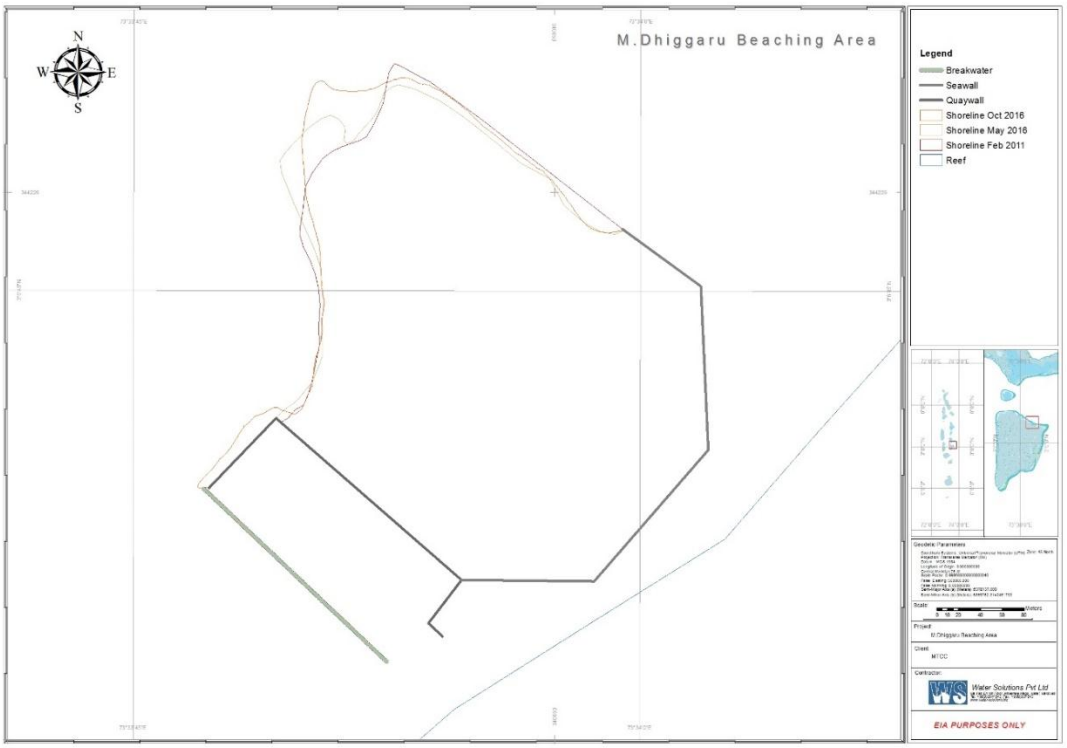


Figure 18: Shoreline of the island

8.3.2 Bathymetry at the proposed site

As part of this assessment, a rapid bathymetric survey was undertaken to assess the condition of the lagoon where jetty is being proposed. The bathymetric survey was undertaken using a spot depth meter and a Trimble GPS. The bathymetric survey results provided in this report shall not be used for engineering designs to estimates the fill volume.

The bathymetry survey result is attached as an annex D of this report.

8.4 Ongoing Harbour Development Project

The harbour development project is ongoing at the island. The harbour basin area has been excavated. The quaywall construction is almost complete. A section of the breakwater has been completed. The breakwater construction will start when a new barge of rock boulder arrives at the island.

Figure 19: ongoing harbour development project

MTCC has set up a temporary project management site at the island. The project management office has space for office work, warehouse for spare parts, garage for repair work and a staff quarter. Staff quarter has staff mess, kitchen and a sleeping quarter.

Figure 20: Project site at the island.

8.5 Existing socioeconomic Environment

8.6 Populations

According to the census in 2014, the population in Dhiggaru is 944. According to Island Council the registered population of the island is approximately 1500. Figure 21 shows the population of the atoll based on the 2014 census.

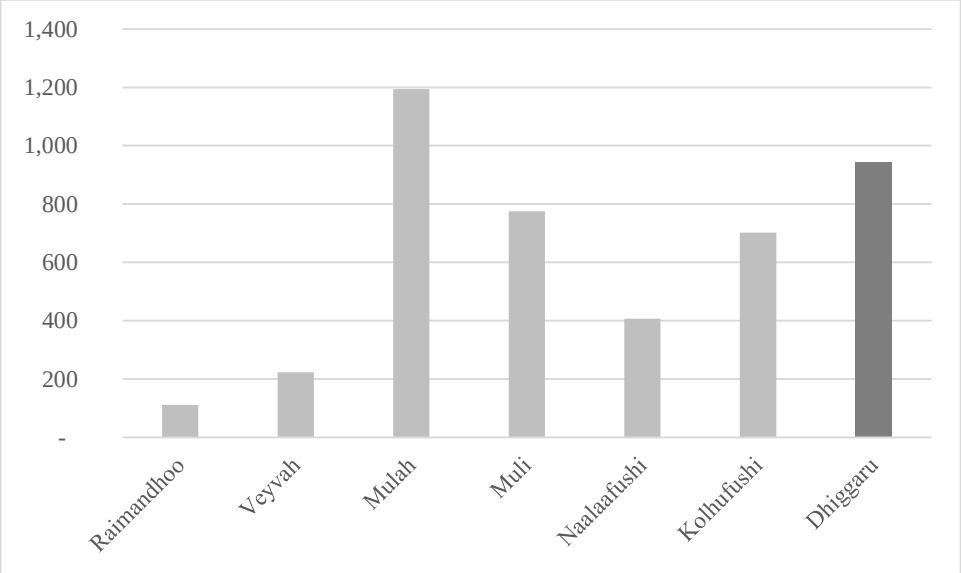


Figure 21: Population of the islands in Meemu Atoll (Census 2014)

8.7 Employment

About 68.2% of the population are above the age of 15 and 63.8% are employed and 33. 7 % is unemployed according to Census 2014. This considered as a high unemployment rate. The main economic activity of the island is fisheries (28%). The second largest sector is manufacturing (15%).

8.7.1 Electricity

The island has diesel generators and all households and institutions are connected with this power grid.

8.7.2 Health

The Island has a government owned Health centre with doctors, nurses and diagnostic equipment's. The centre is visited by people during the week locals from nearby Maduvari and travellers.

8.7.3 Water and Sanitation

Households have been provided with individual rainwater storage tanks and the island has a water distribution system network that have metered house connection. The island has a desalination plant which produces water for distribution. The source water for the desalination is a borehole. This will bring significant benefits to the islanders.

Figure 22: Water Distribution system at the island

8.8 Meteorological Conditions

Meteorology at Maldives is monitored by the Maldives Meteorological Service (MMS) through three stations as detailed in Table 3below. The stations monitor rainfall, temperature, wind and tide levels at the islands. The secondary data presented in this section has been sourced from recordings of MMS monitoring stations.

Table 3: Geographical Coordinates of the Meteorological Centres in Maldives

Location	Latitude	Longitude	Tide gauge
National Meteorological Centre, Malé	04.19°N	73.53°E	Yes
HD. Hanimaadhoo Meteorological Office	06.75°N	73.17°E	Yes
L, Kadhdhoo Meteorological Office	01.86°N	72.10°E	No

Hourly meteorological data was also collected from Hulhule for the period 1995-2015. The data includes parameters such as atmospheric pressure, temperature, humidity, wind speed and direction and precipitation which is provided in the subsequent section

8.8.1 Climate

Maldives is located at the equator and experiences monsoonal climate. Maldives has two distinct seasons; dry season (northeast monsoon) and wet season (southwest monsoon). In these two seasons the temperature remains more or less the same. . Northeast monsoon extends from January to March. Since Maldives consists of small islands and are surrounded by sea, hot days are often tempered by cooling sea breezes and evening temperatures drops. Throughout the year, temperature remains almost same in the Maldives. However, daily temperature ranges from around 31^{o}C in daytime to 23^{o}C in night-time. The mean daily maximum temperature for Central parts (Hulhule) of the Maldives is 30.5^{o}C and minimum temperature is 25.7^{o}C. On the other hand, mean daily maximum and minimum temperature for South (Gan) is 30.9^{o}C and 24.5^{o}C, respectively.

The wet season- southwest monsoon runs from mid-May to November. In this season Maldives experiences torrential rain. Central, Southern and Northern parts of the Maldives receive annual average rainfall of 1924.7mm, 2277.8mm, and 1786.4mm, respectively. The highest rainfall ever recorded in the Maldives with in 24 hour period was on 9th July 2002 at Kaadedhdhoo Meteorological Office and amounts to 219.8mm of rainfall. Maldives being located at the equator, receives plentiful of sunshine throughout the year. On average Southern atolls (Gan) of the Maldives receives 2704.07 hours of sunshine each year. Furthermore, on average central (Hulhule) parts of the country receives 2784.51 hours of sunshine per year. The relative humidity in Maldives ranges from 73% to 85%.The monthly average sunshine and rainfall is presented in the figure below.

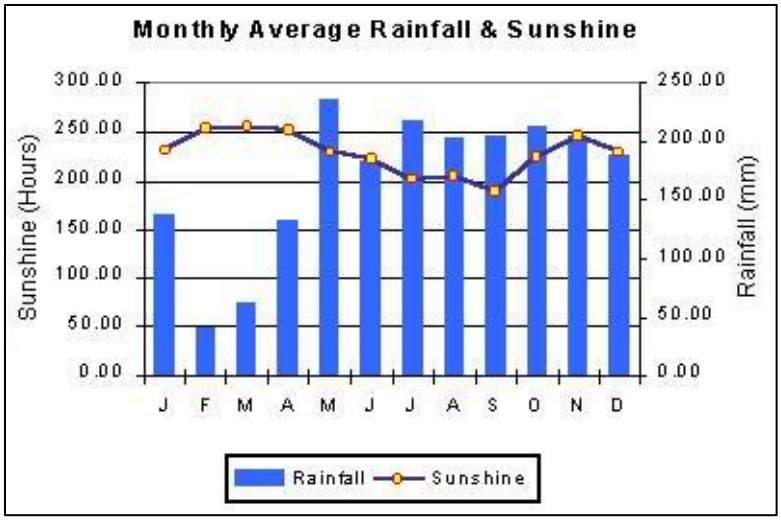


Figure 23: Monthly Average Rainfall and Sunshine

8.8.2 Tide levels

The tidal regime is semi-diurnal with diurnal inequalities (twice daily). That means 2 high tides and 2 low tides per day, with different heights. Typical spring and neap tidal ranges are approximately 1.0 m and 0.3 m, respectively.

8.8.3 Currents

Generally, current flow through the Maldives is driven by the dominating two-monsoon season winds. Westward flowing currents are dominated from January to March and eastwardly from May to November. The change in currents flow pattern occurs in April and December. In April the westward currents flow are weak and eastward currents flow will slowly take place. Similarly in December, eastward currents flows are weak and westward currents will take over slowly.

During the course of the day, currents change twice with the changing tide and monthly with the moon cycles. The result therefore is a very complex change in current direction. In Maldives, it has been well researched and documented that the currents are induced by wind and thus, during the two monsoons, the direction of currents is very much related to the wind direction.

8.9 5.7 Waves

The coastal dynamics such as accretion and erosion of islands depends on wave energy. Waves play a significant role in the modification of the beach environment and the surrounding. There are two major types of waves; wind generated waves and swell waves. Wind waves generated by the monsoon wind usually have a period of 3-8 seconds. Swell waves in Maldives are experienced by the swells generated by distance storms and have a period of 14-20 seconds (Kench et. al 2006). Assessment done by Lanka Hydraulics shows that significant wave height (Hs) for the Male' region was 1.23m which a mean period (Tm) of 7.53s. Maximum Hs was 1.51 with a Tm of 7.74s.

Swell waves in Maldives are generally experienced by swells generated by distance swells generated due to storms. Occasional flooding have occurred in Maldives due to swells and distance storm generated swells were associated with these flooding's. The possible waves and diffraction patterns around the island is shown in Figure 24

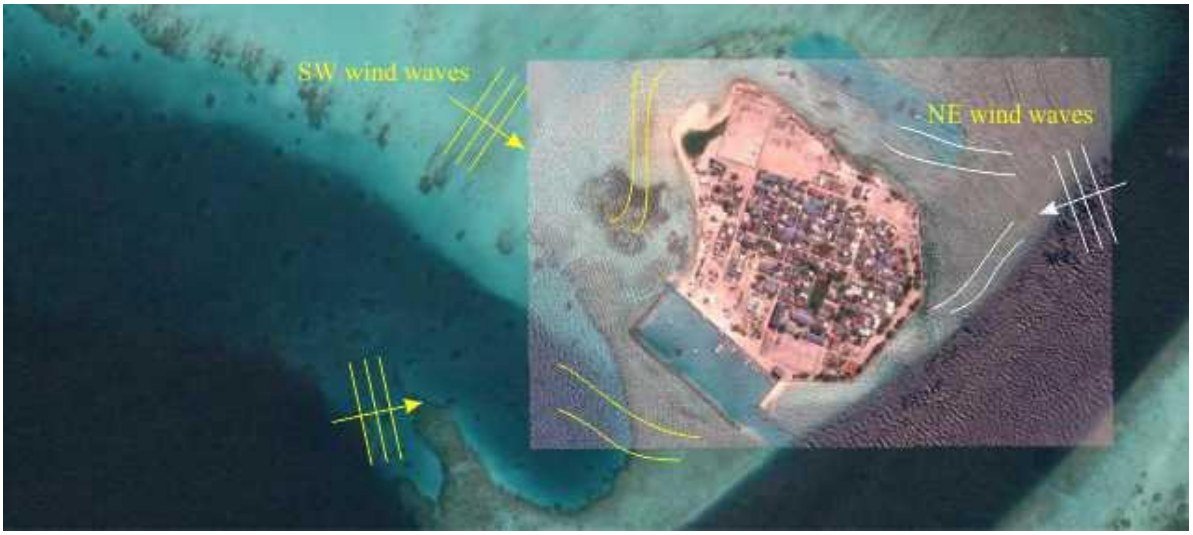


Figure 24: monsoonal wind waves around the island

8.10 Marine Protected Areas and Sensitive Areas

There is no Marine Protected Area (MPA) within 5km radius of the project site. However, there are sensitive areas identified in Meemu Atoll as shown in Figure 25

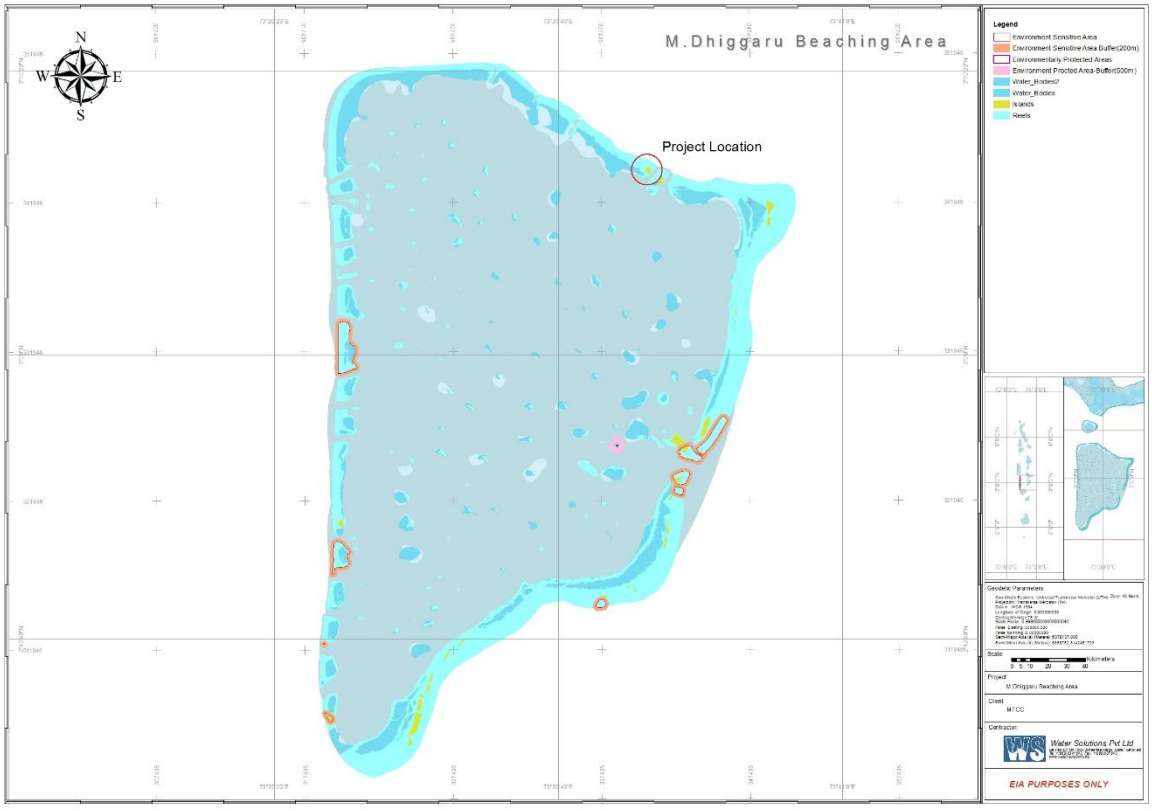


Figure 25: Sensitive areas within the 5km radius of the project site (Data sourced from EPA website)

8.11 Marine Environment

Three sites were surveyed to assess the marine environment as baseline for reef benthic community of the island. The marine survey locations are illustrated in the Figure 26 The geographical coordinates and the locations are outlined below.

Table 4: GPS coordinates of the survey locations

Marine Site 1	3°06'43.9 N	73°33'48.2 E
Marine Site 2	3°06'40.5 N	73°33'45.6 E
Marine Site 3	3°06'36.6 N	73°34'00.1 E

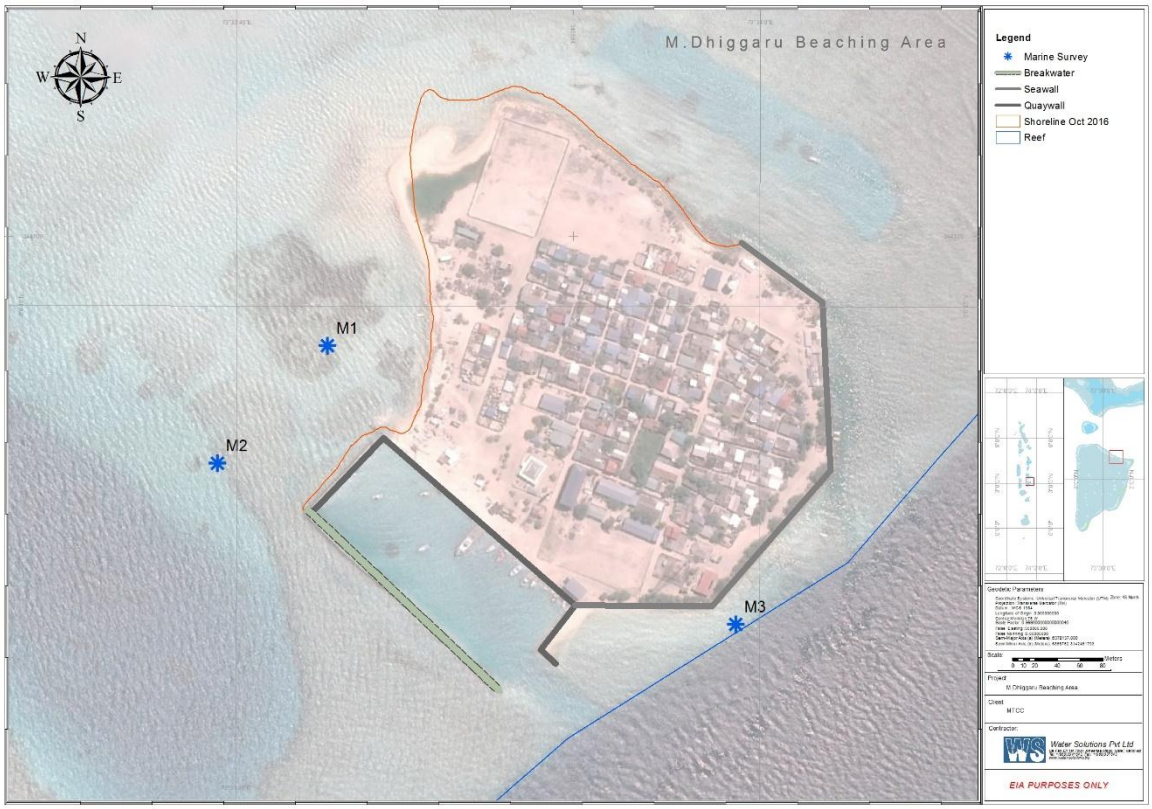


Figure 26: Marine Survey locations

8.12 Terrestrial Environment

There is no clearance of vegetation involved in this project as this involves a rehabilitation of the existing harbour.

Figure 27: No vegetation is found at the proposed project site

8.12.1 Hazards and Disasters

8.12.1.1 Vulnerability to Natural Disasters

The islands of the Maldives are less prone to tropical cyclones and are only impacted in the northern part of the country by weak cyclones that formed in the southern part of the Bay of Bengal and the Arabian Sea. Since 1877, only 11 cyclones crossed the archipelago. Most of the cyclones crossed Maldives north of 6.0o N and none of them crossed south of 2.7o N during the period. All the cyclones that affected Maldives were formed during the months of October to January except one, which formed in April (UNDP, 2006).

The northern atolls have a greater risk of cyclonic winds and storm surges. This reduces gradually to very low hazard risk in the southern atolls. The maximum probable wind speed in Zone 5 is 96.8 knots (180 kilometres per hour) and the cyclonic storm category is a lower Category 3 on Suffir-Simpson scale. At this speed, high damage is expected from wind, rain and storm surge hazards (UNDP, 2006).

The following figure shows historical earthquakes around Maldives; and three events of magnitude above 7.0 struck the region which had their sources in the Indian Ocean (UNDP, 2006).

UNDP (2006) identified that hazard risk from earthquake is low for the Maldives and considered as a disaster risk for only islands located in the south of the country.

Maldives faces tsunami threat largely from the east, and lower threat from the north and south. Islands along the eastern fringe of the atolls are more prone to tsunami hazard than those along the northern and southern fringes. Islands along the western fringe experience a relatively low tsunami hazard. Historically, Maldives has been affected by three earthquakes which had their sources in the Indian Ocean. Of the 85 tsunamis generated since 1816, 67 originated from the Sumatra Subduction zone in the east and 13 from the Makran Coast Zone in the north and Carlsburg Transform Fault Zone in the south. The probable maximum tsunami wave height is estimated at 4.5 metres.

8.12.1.2 Natural Vulnerability of Dhiggaru

The islands of the Maldives have natural characteristics which make them vulnerable to disasters such as tsunami. An island's Natural Vulnerability depends on the geographic and geomorphologic characteristics of the island. These include geographic features of the island like the side of the country where the island is located, the formation of the island, location of the island respect to the atoll, orientation of the island, region of the country where island is located, level of shadow to the island from the reefs and other islands; area of the inland lake found on the island, width of the island's house reef, coastal defence structures on the island, shape of the island and the area of the island. A Model to Integrate the Management of Hazards and Disasters in the National Sustainable Development Planning of the Maldives which was developed as part of the Masters of Science (Hazard and Disaster Management) thesis at the University of Canterbury (2007) identified the relationship between natural characteristics of the island and the *natural vulnerability* of the islands using the data that was collected following the Indian Ocean Tsunami.

Based on this research, the natural vulnerability of Dhiggaru was found to be high for flooding disasters such as that caused by tsunami or high waves approaching the island from the east.

9 Analysis of Alternatives

This section looks at alternative ways of undertaking the various alternatives of the proposed project. There are two basic options: (1) leave the island as its form without undertaking the beaching area (no project option) or (2) undertake development of the proposed beaching area on the island (undertake the project options). If the project were to continue, it would be necessary to take technical and social aspects of the project into consideration and ensure that these concerns are adequately considered before taking decisions. It is therefore important to consider practicable options and ensure that the best available options are chosen. The following section details the development options.

9.1 No Development Option

The "No Development Option" implies not proceeding with the beaching area as part of the harbour development project on the island. The advantage of this option is that adverse environmental impacts associated with the beaching area development of the project can be avoided. The disadvantages are: high cost associating of beaching of fishing vessel for annual dry dock repairs and inconvenience caused to the fishing community on the island.

Hence the socio-economic benefits outweigh the potential negative environmental and social effects. Therefore, the "No Development Option" is not recommended as the harbour development is presently being implemented at this island and contractor is on site.

9.2 Design Alternatives

9.2.1 Levelling the area for beaching

Island Council is planning to zone the western side of the as the vessel beaching area as the land use on this side of the island. Presently, the area had undergone erosion. Coral rubble is exposed. The area need to be levelled as such the area could be used to beach the vessel and to undertake necessary boat repair work by the fisherman.

However, only levelling the area will not be able beach the vessel as the lagoon area and the entrance to the area is very shallow. The entrance need to be deepened and the basin area need to be dredged as to allow the vessel could be brought to the site so that it could be beached.

9.2.2 Creation of basin area and levelling beaching area

Creation of a basin area by dredging the area would allow to obtain fill material to undertake the levelling work on western side of the island. This would allow to create additional land for beaching of vessel and this would allow to have sufficient setback from the mosque which is located less than 80 meters from the proposed site.

Without the entrance channel deepening, it would not be possible to bring the modern fishing vessel through the existing entrance channel. The community will not accept to create only a basin area without the entrance channel.

10 Stakeholder Consultation and Socio Economic Impact

10.1 Socio Economic Profile

The total population of Maldives was 341,256 in 2014 (Census, 2014). In July 2006, the population of the Maldives was 298,968 (Census, 2006). There is 1.56% increase in average annual growth of population from 2006 to 2014. In 2006 the population of the Maldives crossed the 300,000 mark. Total Maldivian population is projected to reach over 400,000 by 2025.

Table 5: Atoll Populations (source: Census 2014)

Locality	2006			2014		
	Both sexes	Male	Female	Both sexes	Male	Female
North Thiladhunmathi (HA)	**13,239**	6,084	7,155	**12,939**	5,876	7,063
South Thiladhunmathi (HDh)	**16,057**	7,377	8,680	**18,515**	8,449	10,066
North Miladhunmadulu (Sh)	**11,745**	5,481	6,264	**12,091**	5,497	6,594
South Miladhunmadulu (N)	**9,921**	4,533	5,388	**10,483**	4,782	5,701
North Maalhosmadulu (R)	**14,544**	6,955	7,589	**14,862**	7,069	7,793
South Maalhosmadulu (B)	**8,782**	4,245	4,537	**8,878**	4,280	4,598
Faadhippolhu (Lh)	**8,266**	3,917	4,349	**7,905**	3,663	4,242
Male' Atoll (K)	**9,888**	5,491	4,397	**12,166**	6,777	5,389
North Ari Atoll (AA)	**4,817**	2,383	2,434	**5,905**	2,991	2,914
South Ari Atoll (ADh)	**6,871**	3,276	3,595	**8,145**	4,045	4,100
Felidhu Atoll (V)	**1,482**	759	723	**1,601**	878	723
Mulakatholhu (M)	**4,634**	2,348	2,286	**4,705**	2,293	2,412
North Nilandhe Atoll (F)	**3,618**	1,708	1,910	**4,119**	1,969	2,150
South Nilandhe Atoll (Dh)	**4,678**	2,305	2,373	**5,305**	2,590	2,715
Kolhumadulu (Th)	**8,353**	4,112	4,241	**8,901**	4,382	4,519
Hadhdhunmathi (L)	**11,554**	5,806	5,748	**11,795**	5,859	5,936
North Huvadhu Atoll (GA)	**7,928**	3,883	4,045	**8,334**	4,335	3,999
South Huvadhu Atoll (GDh)	**10,835**	5,276	5,559	**11,587**	5,857	5,730
Gnaviyani (Gn)	**7,509**	3,471	4,038	**7,984**	3,612	4,372
Addu City (S)	**17,555**	8,074	9,481	**19,319**	9,195	10,124

One third of the population lives in the capital, Male, which has an area of less than 2 sq. km. The rest of the population is scattered over approximately 198 Islands. The average population size of these islands is 900. Only 15 islands have over 2,000 inhabitants, while 11 have less than 200. The dispersed population is not only a constraining factor to equitable and balanced social and economic development, but also imposes serious development challenges – particularly in terms of transportation and utilities.

The Table 5 below shows the population of the islands in Meemu Atoll. There is 0.95% average annual decrease of growth rate from 2006 to 2014. Undertaking the beaching area development project will help to create additional incentive for the development of the atoll. The island is situated strategically on a travel route and is a potential island to create development to the island.

Table 6: Population of islands in Meemu Atoll

Atoll	locality	Resident population								
		Total			Maldivians			Foreigners		
		Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
M	Raimandhoo	112	55	57	111	55	56	1	-	1
M	Veyvah	263	160	103	223	122	101	40	38	2
M	Mulah	1,275	661	614	1,194	589	605	81	72	9
M	Muli	860	441	419	775	382	393	85	59	26
M	Naalaafushi	424	216	208	406	198	208	18	18	-
M	Kolhufushi	735	358	377	702	331	371	33	27	6
M	Dhiggaru	984	459	525	944	427	517	40	32	8
M	Maduvvari	369	202	167	350	189	161	19	13	6

Source: Population and Housing Census 2014

Table 7: Summary of socio economic environment of the atoll

Demography	
Economic Activities	Fishing and government sectors are the main income generating employment in the islands. There are many fishing vessels at the island. Home gardening is also done in some households. There is no space for wide agriculture activities in the island.
Public transport	There are atoll ferries daily. These ferries travels all the islands of the atoll and Dhiggaru is a popular destination for people to travel. Muli is the atoll capital and hence a lot of people travel to the island for health facilities. There are regular ferries of speed boats between Mulah, Muli and Male'.
Water Supply	A desalination plant and a water distribution system has been established at the islands. Groundwater and rainwater are the main source of water.
Waste Management	The island does not have a island waste management centre. Waste is disposed on northern side of the island as a means to increase the land area of the island.
Energy Supply	There is 24 hours electricity provided into all households in all island. Fenaka is the service provider.
Health	Atoll Hospital at Muli and Health Center at island
Education	A level
Road based transport	The road condition of the Dhiggaru is not very good. The island has narrow streets and only few vehicles is found on the island.

10.2 Socio Economic Impact of Harbour Development project

10.2.1 Positive Impact of project

The harbour development project would help to improve the accessibility and safe mooring of fishing vessel at the island. The island's main economic activity is fisheries and hence improving the harbour would have a positive impact on the island's macro economy. The proposed vessel beaching area development as part of the on going harbour development project would help to beach fishing vessel to the island beach. This would help fisherman and crew to be at the island when fishing vessels are taken onto the island for dry dock maintenance work.

This project will increase the economic activity at the islands which would create additional employment opportunity to the resident community.

10.2.1.1 Opportunities for Tourism Sector- Guest Houses

Demand for Guest house are increasing at a faster speed in Meey Atoll. Guest houses are being operated at Dhigaru. It is anticipated, more and more guest houses would be built on inhabited islands. The proposed harbour development project would facilitate increase of marine vessel at the island. The owners will have the opportunity to undertake repair work at the island when beaching area is developed at the island.

10.2.1.2 Opportunities for Construction Industry

The harbour development project will create job opportunities directly and indirectly starting from the planning stage, construction stage, and indirectly or directly to other businesses such as transportation sector, supply of goods & services, retail and whole businesses, cafés and restaurants, and more businesses at Dhiggaru and Maduvari Atoll. This will create an environment for the youth participation in the development of the island and atoll.

10.3 Stakeholder Consultation

10.3.1 Ministry of Environment & Energy

During the stakeholder consultation meeting, the Ministry of Environment and Energy noted that harbour development project is important for the development of the Maldives. Enhancement and development of the transport and fisheries sector is an important step that has been incorporated in the Intended Nationally Determined Contribution of the Maldives that had been developed as part of the Climate Change Paris Agreement. However Ministry of Environment and Energy noted that such development should not be at the expense of the environment. Hence it is important to protect and preserve the natural identity of a typical island of the Maldives while undertaking coastal infrastructure development on the island. The Ministry also notes, the proposed beaching area development as part of the harbour development project would help to address the current erosion problem which is being faced on western side of the island.

10.3.2 Environment Protection Agency

EPA officials were consulted through a meeting held at EPA on 30th August 2016. Following are the main points discussed during the meeting.

- EPA is aware of developing a beaching area as additional work for the ongoing harbor development work at Dhiggaru.
- EPA noted that EIA Addendum application was submitted from Ministry of Housing and Infrastructure and a TOR for the EIA Addendum has been approved on 21st August 2016.
- The island proposed for this project is not a declared protected area or a sensitive area.
- Ministry of Housing and Infrastructure has guidelines and regulations for these kind of coastal infrastructure projects. The Ministry need to meet these guidelines and regulations at all the stages of project implementations.
- All the possible impacts of the proposed project on environment and island communities need to be reported in the EIA.

10.3.3 Ministry of Housing and Infrastructure

Ministry of Infrastructure were consulted on various occasions during the EIA Addendum preparation work. Following are the summary of the consultation which were carried out with the client.

- Ministry of Housing and Infrastructure is proponent for the harbor development project and the proposed beaching area development as part of the harbor development project.
- The contractor selected for the proposed project is MTCC
- The information regarding the design parameters and concepts for the beaching area development were obtained from the MHI.

10.3.4 Contractor and Project Team

MTCC is the main contractor for the harbour development project at the island. MTCC had been consulted on various occasion during the EIA Addendum preparation work. Following are the summary of the consultation which were carried out with the contractor.

- MTCC is the main contractor for the harbour development project
- Beaching area development would be carried out using the MTCC's equipment and labour force at the island
- Excavation work of the entrance channel would be first started following the basin area. The reclamation work using the dredge material would start simultaneously.
- Excavation would be carried out using excavators. The dump trucks will transport the material from the dredged area to the reclamation site.

10.3.5 Meemu Atoll Council

Meemu Atoll Council noted that project is an important project to the atoll. The council welcomes the government effort to implement this project at the atoll. Atoll Council is very positive for the project. Copy of EIA was sent to Atoll Council and receipt slip is attached as annex H.

10.4 Consultation with Island Council

The Island Council was met during the field work at the island on 6th October 2016 at Dhiggaru Island Council. Following are the summary of the consultation which were carried out with the Island Council.

- The island council is well aware and was previously consulted by MHI during the design stage of the project.
- The council noted that beaching area development is a priority for the island
- It was mentioned that the reclaimed land would be used as a boat repair yard.

10.5 Consultation with Residents of Dhiggaru

Residents of Dhiggaru were consulted at the island during the field visit to Dhiggaru. The meeting was held at the Island Council on 6th October 2016 at 2100hrs. Following are the main points discussed during the meeting.

- The residents noted that the development of a beaching area is a priority for the island as this would help the vessel owners to beach the vessels for necessary repairs.
- The residents also noted that the islands need to have space to carry out boat repair work.
- The residents are not concerned about the potential environmental impacts of the project activities on the island, house reef and lagoon.

10.6 List of people consulted

Following are the names and designation of the persons consulted.

Name	Designation	Office
Ahmed Anwar	Assistant Director	MEE
Hamdhoon	Assistant Director	MEE
Nafha Aujaz	Environment Analyst	MHI
Ibrahim Naeem	Director General	EPA
Yazeed	Director	EPA
Fathimath Reema	Assistant Director	EPA
Firdous Hussain	Senior Engineer	MTCC
Abdul Rahman Wafir	Vice President	Dhiggaru Island Council
Abdulla Mufeed	Council Member	Dhiggaru Island Council
Abdul Gafoor Ismail	Council Member	Dhiggaru Island Council
Ahmed Nishan	Council Member	Dhiggaru Island Council
Mohamed Ismail	Fisherman	Resident of Dhiggaru
Ismail Mahir	Fisherman	Resident of Dhiggaru
Ahmed Jameel	Consultant	Water Solutions Pvt Ltd
Abdul Aleem	EIA Consultant	Water Solutions Pvt Ltd
Ibrahim Faiz	Environment Consultant	Water Solutions Pvt Ltd

11 Environmental Impacts and Mitigation

11.1 Impact Identification

The proposed beaching area development at Dhiggaru is expected to have impacts on the existing marine and coastal environment of island. These include dredging of entrance channel, removal of sea grass beds and reclamation of beach on the island. The project is also expected to impact the livelihood of the beneficiaries and also impact the existing community of Dhiggaru. In preparing this EIA Addendum report, various methodologies were used to collect information on the existing environment and identify the impacts of the project. Impact identification has been focused on the marine and coastal environment of the island. Impacts have also been identified for short and long term. It is only though identifying the likely impacts; the mitigation measures can be identified and implemented. It is also one of the objectives of this EIA to identify the impacts and propose mitigation measures.

11.2 Assessing Impacts

Environmental impacts of the proposed project have been examined through a number of processes. These include consultations with the stakeholders, field surveys, observations and assessment, and field experience gained from similar development projects implemented throughout the country. Potential positive and negative impacts on the environment have been considered. In general, the impacts of the project have been assessed for terrestrial, marine and social environment.

The impacts of the proposed project on the marine environment of the proposed area have been looked into and are considered to be significant. The most significant impact on the marine environment due to the project would be widening the existing entrance channel and removal of the sea grass beds during excavation work.

Impacts have been categorized into short-term and long-term. Most of the short-term impacts are related to impact on corals and removal of sea grass beds during constructional phase, while the long-term impacts are associated with risk of marine environment of the project site. Possible negative impacts on the environment have been considered in worst-case scenario to recommend mitigation measures in the best possible ways so that these impacts would be minimized and perhaps eliminated in both constructional and operational phases.

The following table outlines the impact assessment matrix and the scores for the 17 categories derived for this project.

Table 8: Impact assessment matrix for the project

		Impacts		
	Total score	Negative (1-3)	Neutral (4 -7)	Positive (8 -10)
Air pollution	2	x		
Waste	3	x		
Water pollution	3	x		
Noise/Vibration	5		x	
Amenity	5		x	
Ground water conservation	5		x	
Energy	5		x	
Energy efficiency	5		x	
Access to quality green space	5		x	
Flooding	5		x	
Transport	5			x
Biodiversity	1	x		
Local environmental quality	3	x		
Resource depletion	5		x	
Health gain	5		x	
Employment	9			x
Socio-economic implications	8			x

11.3 Magnitude of impacts

This EIA identifies and quantifies the significance of adverse impacts on the environment from the proposed project. Impacts on the environment were identified and described according to their location/attribute, extent (magnitude) and characteristics (such as short-term or long term, direct or indirect, reversible or irreversible) and assessed in terms of their significance according to the following categories:

- Negligible – the impact is too small to be of any significance;
- Minor – the impact is very minor and not serious
- Minor adverse – the impact is undesirable but accepted;
- Moderate adverse – the impact give rise to some concern but is likely to be tolerable in short-term (e.g. construction phase) or will require a value judgment as to its acceptability;
- Major adverse – the impact is large scale giving rise to great concern; it should be considered unacceptable and requires significant change or halting of the project

11.4 Uncertainties in impact prediction

Environmental impact prediction involves a certain degree of uncertainty as the natural and anthropogenic impacts can vary from place to place due to even slight differences in ecological, geo-morphological or social conditions in a particular place. There is also limited data and information regarding the particular site under consideration, which makes it difficult to predict impacts. The level of uncertainty, in the case of this project is expected to be significant due to the unavailability of necessary data, lack of clear understanding of the activities that can change the hydrology of the site. Nevertheless, considering that there will be uncertainties and under taking voluntary monitoring of natural processes as described in the monitoring programme given in this report would reduce the impact of the uncertainty in the impact identification process. .

11.5 Environmental impacts and mitigation measures

Environmental impacts assessed of the project based on the criteria's described above are discussed in detail in Table 9. The matrix provides the impacts during construction stage for marine and coastal environment as well as the cost of mitigation for each impact identified.

Table 9: Matrix of environmental impacts and mitigation measures

Environmental Aspect	Potential Impacts to the environment	Mitigation Measures proposed	Cost of Mitigation
Environmental impacts during construction phase			
Site mobilization and temporary stores	The proposed project is an additional component for the ongoing harbour development project. Hence there is no potential impact due to mobilisation.	No mitigation is required	NA
Sewage and wastewater impacts	The proposed project is an additional component for the ongoing harbour development project. Hence there is no additional potential impact due to labour force	No mitigation is required	NA
Water	Rainwater will be used during construction stage. The groundwater of the island would be used for workforce during the construction stage. Desalinated water would be used as source of water during the construction when it is made available from the plant which had been constructed at the island.	No mitigation is required	NA
Energy generation	Use of energy for construction activities has an indirect negative impact on the environment through consumption of fuel.	No mitigation is required	NA
Widening of the entrance channel	Impact on the lagoon bottom and sedimentation of the lagoon. Impact on the sand movement and sediment hydrodynamics. Sedimentation and siltation on the reef and lagoon due to dredging work	- Creation of a sand bed to reduce the sedimentation impact, this bed would reduce sediment spreading; work to be carried out in low tides. - Dredging at low tide to reduce the spread of sediment and increase of turbidity - Use of efficient dredging techniques - Regular monitoring of suspended solids or turbidity	Cost included as part of the project..
Dredging of the basin area	Impact on the lagoon bottom and sedimentation of the lagoon. Impact on the sand movement and sediment hydrodynamics. Sedimentation and siltation on the reef and lagoon due to dredging work	- Creation of a sand bed to reduce the sedimentation impact, this bed would reduce sediment spreading; work to be carried out in low tides. - Dredging at low tide to reduce the spread of sediment and increase of turbidity - Use of efficient dredging techniques - Regular monitoring of suspended solids or turbidity	Cost included as part of the project.
Reclamation using dredged material	Deposition of sand and reclamation Changing the shape of the island Changing the near shore sediment movement	- Undertake the reclamation work during low tide to reduce the spread of fine sediments and increase turbidity of the marine water.	Cost included as part of the project.

Environmental Aspect	Potential Impacts to the environment	Mitigation Measures proposed	Cost of Mitigation
		- Create settling compartments to for maximum settling of sediments - Contain reclamation areas using bund wall	
Removal of sea grass beds	Permanent adverse, irreversible; large habitat loss of a "nursery" ground for juvenile fish due to excavation of sea grass beds	- Restricting the excavation to the proposed basin area to reduce the impact area on the seagrass beds.	Cost included as part of the project.
Sedimentation and siltation on the reef and lagoon	Dredging of the entrance channel and basin area will create sedimentation and siltation which can impact the house reef and marine environment around the project site.	- Creation of sand bed for the excavator to under the dredging work to reduce the sedimentation impact, - Undertake dredging and reclamation work during low tide periods. - Use excavators to dredge and trucks to transport the material from dredge site to reclamation area.	Cost included as part of the project.
Waste management	The proposed project is not expected to increase the potential of solid waste impact from labour forces. Construction waste, especially hazardous waste will impact the environments if they are not properly disposed. Hazardous materials in the construction period are identified as items like waste oil, chemicals and batteries.	- No additional mitigation is required to minimise the impact of the solid waste from the additional component of the harbour development project. - All construction waste including hazardous materials will be stockpiled and stored on the island. Construction waste will be taken to Thilafushi waste management centre regularly for disposal	Contractors should bear the cost for transportation of construction waste to nearest waste management centre
Noise and air pollution	Proposed site at Dhiggaru is an isolated from the residential area. Noise impacts are therefore going to be localized to the project site. The exhaust gases from excavators and trucks will be very limited in quantity compared to the surrounding environment. The gaseous emissions will be directly released into the atmosphere where there will not be any opportunities for them being trapped and therefore the plume of gas is expected to get diluted.	Noise is not expected to be a concern due to the intermittent nature of noise sources such as excavators and truks. However construction workers, who are prone to high noise levels such as machinery operators, should be provided with proper personal protection equipment (PPE) such as ear muffs.	No mitigation cost.
Environmental impacts during Operation phase			
Use of entrance channel	The entrance channel will spate the reef into two distinctive sections. The entrance channel could change the hydrodynamics of the area and near shore sediment movement.	The impact of widening the entrance channel could be understood after carrying a monitoring programme.	Cost as part of the monitoring cost
Use of basin area	Creation of basin area would remove the sea grass beds and the impact on the sea grassbeds. The dredging of the basin area could change the hydrodynamics of the area and near shore sediment movement.	The impact of creating a basin area could be understood after carrying a monitoring programme.	Cost as part of the monitoring cost
Creation of	Impacts are expected to be positive as employment	-	-

Environmental Aspect	Potential Impacts to the environment	Mitigation Measures proposed	Cost of Mitigation
employment opportunities	opportunities generated clearly has the potential to reconcile economic and environmental concerns and give a practical meaning to sustainable development. Other positive impacts can include the generation of revenues, creating jobs and wealth, development of the transport sector and diversifying the economy.		
Development of human resources	The direct employment generated by the project will stimulate human resource development and increase the number of skilled workforce in the country. Furthermore, employment opportunity will increase in Meemu atoll region.	-	-

Table 10: Summary of the impacts and their characterization

	Impact type (NEG or POS) +	Significant (H/M/L)*	Direct	Indirect	Magnitude # (N/M/MA/MoA/MaA)	Short term	Long term	Unavoidable	Reversible	Irreversible	Cumulative	Mitigation Required
Impacts during construction stage												
Site mobilization	Neg	N	X	X	N	X		X	X			X
Temporary storage of fuels and hazardous materials.	Neg	N	X	X	N	X		X	X			X
Domestic wastewater impacts	Neg	N		X	N	X			X			X
Waste management	Neg	N	X	X	N		X	X			X	X
Impact of widening the entrance channel	Neg	H	X	X	MaA	X	X	X	X	X	X	X
Impact of dredging the basin area	Neg	H	X	X	MaA	X	X	X	X	X	X	X
Undertaking reclamation using dredged material	Neg	H	X	X	MA	X			X		X	X
Noise and air pollution	Neg	L	X		N	X		X	X			X
Sedimentation and Siltation impacts on the lagoon.	Neg	H	X	X	MaA	X	X	X	X	X	X	X
Operational stage impacts												
Entrance Channel	Neg	L		X	N		X		X		X	X
Basin Area	Neg	N		X	N		X		X			X
Socio-economic impacts												
Socio-economic impacts	POS	H	X	X		X	X	X			X	
Creation of employment opportunities	POS	H	X	X		X	X	X			X	
Development of human resources	POS	H	X	X		X	X	X			X	

+ **POS** = positive impacts, **NEG**= negative impacts, * **H**=high, **M**=Moderate, **L**=Low, # **N**=Negligible, **M**=Minor, **MA**=Minor Adverse; **MoA**= Moderate adverse; **MaA**=Major Adverse

12 Recommendation

Based on the findings of the EIA, the EIA team makes the following recommendation to the current project design that is proposed for carrying out the development of a vessel beaching area as additional work for the ongoing harbour development project at M. Dhiggaru.

12.1 Environmental Monitoring

Environmental monitoring is essential to ensure that potential impacts are minimized and to mitigate unanticipated impacts. It is recommended that environmental monitoring to be carried by the contractor during project phase to monitor the impact of project on the island's environment. It is recommended that this activity would be carried out as per the proponent's committed for this development.

12.2 Environmental Supervision

It is recommended that proponents to undertake the environmental supervision during the implementation of the project as to ensure the project is implemented as outlined in the EIA report. The client or its consultant needs to provide necessary technical advice and guidance to the design of the project and undertake supervision and environmental monitoring during the implementation of the project.

13 Environmental Management and Monitoring

13.1 Introduction

Environmental monitoring is essential to ensure that potential impacts are minimized and to mitigate unanticipated impacts. The parameters that had been proposed for monitoring the impacts that may arise from the harbour development have been included as indicators for monitoring for the proposed beaching area development project. Monitoring will be carried out as a follow up activity of the environmental study work as part of the environmental impact assessment addendum and mitigation of possible negative impacts from the proposed project.

13.2 Monitoring Programme

Outlined here are project specific monitoring requirements that the proponent shall include in their annual monitoring programme. This monitoring programme for the proposed project includes at bi-annual monitoring and covers the three stages of the project implementation.

Stage 1**:** Immediately before starting development work

Stage 2**:** During project work

Stage 3**:** 6 months after the completion of the project

The monitoring needs of each stage are discussed in detail below:

Stage 1

- Shorelines of the island
- marine water quality
- Coral reef health
- Aerial photography of the proposed site

Stage 2

- Shorelines of the island
- marine water quality
- Coral reef health
- Aerial photography of the proposed site

Stage 3

- Shorelines of the island
- marine water quality
- Coral reef health
- Aerial photography of the proposed site

13.3 Monitoring Timetable

The following table shows the frequency at which the different parameters may be monitored at different phases of the poultry farm development project implementation.

Table 11: Monitoring framework

Monitoring Schedule	**Monitoring Attribute**	**Indicator**	**Methodology**	**Responsible**	**Monitoring Report**
Start of the project	Shorelines of the islands	Beach dynamics	Low, high and mean tide line as to monitor the beach	Proponent	Monitoring Report 1 – at the start of the project
	Aerial photography of the site	Aerial photo	Drone photography	Proponent	
	Marine water quality	Marine water quality	In-situ and laboratory measurement	Proponent	
	Coral reef health	Coral cover and fish census	Reef survey	Proponent	
	Hydrodynamics	Current pattern,	Drogue	Proponent	
During the implementation of the project	Shorelines of the islands	Beach dynamics	Low, high and mean tide line as to monitor the beach	Proponent	Monitoring Report 2 – during the project implementation work
	Aerial photography of the site	Aerial photo	Drone photography	Proponent	
	Marine water quality	Marine water quality	In-situ and laboratory measurement	Proponent	
	Coral reef health	Coral cover and fish census	Reef survey	Proponent	
	Hydrodynamics	Current pattern,	Drogue	Proponent	
After completion of the project	Shorelines of the islands	Beach dynamics	Low, high and mean tide line as to monitor the beach	Proponent	Monitoring Report 3 – 6 months after completion of the project
	Aerial photography of the site	Aerial photo	Drone photography	Proponent	
	Marine water quality	Marine water quality	In-situ and laboratory measurement	Proponent	
	Coral reef health	Coral cover and fish census	Reef survey	Proponent	
	Hydrodynamics	Current pattern,	Drogue	Proponent	
	Sediment dynamics	Bathymetry	Standard bathymetry methods	Proponent	

13.4 Monitoring Report

An environmental monitoring report would be compiled and submitted to the EPA six months after the completion of the project, based on the data collected for the monitoring the parameters included in the monitoring plan given in the EIA.

The annual environmental monitoring report will include details of the site, strategy of data collection and analysis, quality control measures, sampling frequency and monitoring analysis and details of methodologies and protocols followed.

In addition to this more frequent reporting of environmental monitoring will be communicated among the environmental consultant, proponent, the contractors and supervisors to ensure possible negative impacts are mitigated appropriately during and after the project works.

13.5 Cost of monitoring

It is estimated that during the project implementation phase, the annual monitoring cost would be US$ 10,000.

14 Conclusion

This EIA Addendum report covers proposed beaching area development as a change to the scope of the harbour development at Dhiggaru, Meem Atoll. This report discusses the findings of a study undertaken as an addendum to environmental impact study undertaken by Ministry of Housing and Infrastructure for the harbour development project at M. Dhiggaru at the request of Ministry of Housing and Infrastructure. This EIA Addendum report is prepared in accordance with Environmental Impact Assessment Regulations, 2012 under the Environmental Protection and Preservation Act (Act No. 4/93). The purpose of this EIA is to fulfill the requirement of the Law and to conduct an assessment of possible impacts on environment arising from the proposed fishing vessel beaching area at M. Dhiggaru.

The harbour development project is proposed by Ministry of Housing and Infrastructure representing the government of Maldives and the Ministry is responsible for all development and regulation of the construction sector. The contractor for the project is Maldives Transport and Contracting Company (MTCC).

The beaching area for the fishing vessel has been proposed as an extension of the harbor development project at M. Dhiggaru. Currently there is no area for beaching of vessel at the island. This has caused a lot of difficulty for the fishing vessel to undertake dry dock repairs which is routinely required. The island has a population size of approximately 1300. The main economic activity of the island is fishing. The island of Dhiggaru is famous for "dhiggaru rihaakuru" which provides a good economic income to the community. The project involves dredging of 60 m by 45 m basin area to a depth of -3.0 m MSL, an entrance channel of 20 m wide and 117 m long. The dredging is expected to generate 12,600m3 of dredged material. This dredged material would be used to reclaim 8,400 m2 of area on western side of the island. The new land created would be used for boat repair work.

All project activities will be in conformance to the laws and regulations of the Maldives, and relevant international conventions that Maldives is party to. The key laws and regulations applicable to this project are Environmental Protection and Preservation Act and Environmental Impact Assessment Regulation 2012 and its subsequent amendments

The study for the addendum to EIA was undertaken to assess the environmental impacts of changes to the harbour development project on the island. The proposed site (lagoon) and entrance channel had no visible live corals and was highly turbid. seagrass is found at the lagoon. Based on the assessment, it has been identified that the major impacts of the project will be felt on the marine environment during the construction stage. Dhiggaru is not a large inhabited island but located on a very large reef system. The development of the beaching area on the island will have impacts on marine environment. During the operational stage, environmental concerns are much less and are associated with waste and wastewater management of the fishing vessels.

The mitigation measures are provided in the report with alternatives. It is vital to conduct the activities, during both construction and operational stage, in line with mitigation measures emphasized in the report. Socio-economic impacts of the proposed beaching area development project will help the community to beach their vessel onto the island for dry dock maintenance work. This project will create economic opportunities both in the construction and operational stage through creation of both short-term and permanent jobs and business opportunities.

Towards the end of the report, a monitoring programme has been suggested which covers components of coastal and marine environment. It is important to follow this monitoring programme not only to comply with the regulation but also to ensure that the impacts are measured in realistic terms.

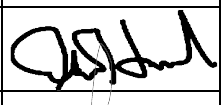
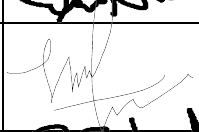
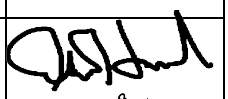
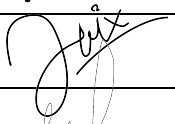
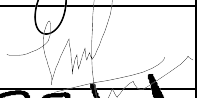
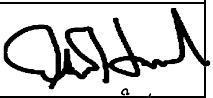
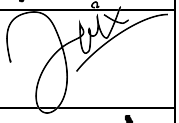
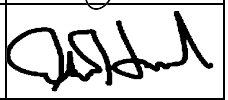
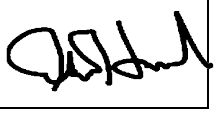
Undertaking any coastal development project will have its impacts on the island environment. It is impossible to develop an island without impacting the environment.

15 Acknowledgements

Water Solutions acknowledge the support and assistance of the following team members who made this project a successful project.

- Ahmed Jameel, Environmental Engineer (EIA Registration No: EIA 07/07)
- Ibrahim Faiz, Environment Consultant (EIA Registration No: EIA T06/15)
- Water Solutions Staff

16 People who have assisted in the preparation of this report

Chapter	Page number	People who assisted in data collection and report writing	EIA registration number (only for those registered consultants)	Signature
Introduction	13	Ahmed Jameel	EIA 07/07	
Project Description	17	Ahmed Jameel	EIA 07/07	
		Hamdhulla Shakeeb		
Project Setting (Legislative section)	14	Ahmed Jameel	EIA 07/07	
Existing Environment	26	Ahmed Jameel	EIA 07/07	
		Ibrahim Faiz	EIA T06/15	
		Hamdhulla Shakeeb		
Impact and Mitigation	48	Ahmed Jameel	EIA 07/07	
Stakeholder Consultations	44	Ahmed Jameel	EIA 07/07	
		Ibrahim Faiz	EIA T06/15	
Monitoring	55	Ahmed Jameel	EIA 07/07	
Recommendations and conclusion	58	Ahmed Jameel	EIA 07/07	

17 References

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18 Annex A: Terms of reference

TOR No: 203-EIARES/138/2016/168

Terms of Reference for the Addendum 1 to the Environmental Impact Assessment for Development of Harbor, at Dhiggaru, Meemu Atoll

The following is the Terms of Reference (ToR) following the scoping meeting held on 21/8/2016 for undertaking the Addendum 1 to the EIA for the proposed *Development of Harbour at Dhiggaru ,Meemu Atoll. This addendum involves development of a beaching area in M. Dhiggaru. The proponent of this project is Ministry of Housing and Infrastructure.*

While every attempt has been made to ensure that this TOR addresses all of the major issues associated with development proposal, they are not necessarily exhaustive. They should not be interpreted as excluding from consideration of matters deemed to be significant but not incorporated in them, or matters currently unforeseen, that emerge as important or significant from environmental studies, or otherwise, during the course of preparation of the EIA report.

1. **Introduction and rationale** – Describe the purpose of the project and, if applicable, the background information of the project/activity and the tasks already completed. Objectives of the development activities should be specific and if possible quantified. Define the arrangements required for the environmental assessment including how work carried out under this contract is linked to other activities that are carried out or that is being carried out within the project boundary. Identify the donors and the institutional arrangements relevant to this project. **This should include the changes that are proposed to be brought to the project and its need and justifications. And also include the changes to the overall project schedule.**

2. **Study area** – Submit a minimum A3-size scaled plan with indications of all the proposed project components. Specify the agreed boundaries of the study area for the environmental impact assessment highlighting the proposed development location and size. The study area should include adjacent or remote areas, such as relevant developments and nearby environmentally sensitive sites (e.g. coral reef, sea grass, mangroves, marine protected areas, special birds site, sensitive species nursery and feeding grounds). Relevant developments in the areas must also be addressed including residential areas, all economic ventures and cultural sites.

3. **Scope of work** – The report should be categorised into the following components:

Task 1. Description of the proposed project – Provide a full description and justification of the relevant parts of the Development of Harbour, slipway Beach nourishment and borehole, using maps at appropriate scales where necessary. The following major project components/activities shall be given emphasis.

Project Management

- Specify materials, equipment, heavy machinery, staff estimate (quantity and period of time), key personnel positions, intermittent technical expertise required;
- Project management: Include communication of construction details, progress, target dates and duration of works, construction/operation/closure of labor camps (if any), access to site, safety, equipment and material storage, waste management from construction operations (mainly earth material), power and fuel supply;

Dredging and filling

Environmental Protection Agency
Green Building, 3rd Floor, HandhuvareeHingun
Male', Rep. of Maldives, 20392
Tel: [+960] 333 5949 [+960] 333 5951
Fax: [+960] 333 5953
Email: secretariat@epa.gov.mv
Website: www.epa.gov.mv

- Location and size of dredge/borrow areas (s) on a scaled map;
- Justification for the selection of the proposed location;
- Method and equipment used for dredging, including description of positioning system, depth control system and operational control procedures;
- Justification for selecting the methods and equipment;
- Duration of dredging activity;
- Fill material disposal location/fill area
- Quantity, quality and characteristics of fill material;
- Justification for selection of fill location

Task 2. Description of the environment – Assemble, evaluate and present the environmental baseline study/data regarding the study area and timing of the project (e.g. monsoon season). Identify baseline data gaps and identify studies and the level of detail to be carried out by consultant. Consideration of likely monitoring requirements should be borne in mind during survey planning, so that data collected is suitable for use as a baseline. As such all baseline data must be presented in such a way that they will be usefully applied to future monitoring. The report should outline detailed methodology of data collection utilized.

The baseline data will be collected before construction. All survey locations shall be referenced with Geographic Positioning System (GPS) including water sampling points, reef transects, vegetation transects and manta tows sites for posterior data comparison. Information should be divided into the categories given below.

If data from the original EIA report is to be used in any of the following sections, please provide reference and include the information in this report where relevant.

Geology and geomorphology

- Bathymetry of dredging areas (use maps);
- (Seasonal) patterns of coastal erosion and accretion

Hydrography/hydrodynamics (use maps)

- Wind induced currents/current patterns
- Sea water quality measuring temperature, pH, salinity, turbidity and total suspended solids from proposed location.

Ecology

- Benthic characteristics/habitats within the impact zone with photographic evidence
- Identify marine protected areas (MPAs) and sensitive sites such as breeding or nursery grounds for protected or endangered species (e.g. coral reefs, spawning fish sites, nurseries for crustaceans or specific sites for marine mammals, sharks and turtles). Include description of commercial species, species with potential to become nuisances or vector.

Hazard vulnerability:

- Vulnerability of area to flooding and storm surge.

Task 3. Legislative and regulatory considerations – Identify the pertinent legislation, regulations and standards, and environmental policies that are relevant and applicable to the proposed project, and identify the

appropriate authority jurisdictions that will specifically apply to the project. Include permits and approvals in the EIA document.

- Dredging and Reclamation Application needs to be submitted with the EIA report

Task 4. Potential impacts (environmental and socio-cultural) of proposed project, incl. all stages The EIA report should identify all the impacts, direct and indirect, during and after construction, and evaluate the magnitude and significance of each. Particular attention shall be given to impacts associated with the following.

The methods used to identify the significance of the impacts shall be outlined. One or more of the following methods must be utilized in determining impacts; checklists, matrices, overlays, networks, expert systems and professional judgment. Justification must be provided to the selected methodologies. The report should outline the uncertainties in impact prediction and also outline all positive and negative/short and long-term impacts. Identify impacts that are cumulative and unavoidable.

Task 5. Alternatives to proposed project – Describe alternatives including the *"no action option"* should be presented. Determine the best practical environmental options. Alternatives examined for the proposed project that would achieve the same objective including the "no action alternative". This should include alternative locations.

Task 6. Mitigation and management of negative impacts – Identify possible measures to prevent or reduce significant negative impacts to acceptable levels. These will include both environmental and socio-economic mitigation measures with particular attention paid to future changes in coastal processes. Measures for both construction and operation phase shall be identified. Cost the mitigation measures, equipment and resources required to implement those measures. The confirmation of commitment of the Proponent to implement the proposed mitigation measures shall also be included. An Environmental management plan for the proposed project, identifying responsible persons, their duties and commitments shall also be given. In cases where impacts are unavoidable arrangements to compensate for the environmental effect shall be given.

Task 7. Development of monitoring plan – Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan for coastal modification, beach morphology, sediment movement around the island. Environmental monitoring reports will be submitted to the Environmental Protection Agency to evaluate the impacts of the project during construction, after project completion and every three months thereafter, up to one year and then on a yearly basis for three subsequent years. The baseline study described in task 2 of section 2 of this document is required for data comparison. Detail of the monitoring program including the physical and biological parameters for monitoring, cost commitment from responsible person to conduct monitoring in the form of a commitment letter, detailed reporting, scheduling, costs and methods of undertaking the monitoring program must be provided.

Task 8. Stakeholder consultation, Inter-Agency coordination and public/NGO participation) – EIA report should include a list of people/groups consulted and what were the major outcomes and their contact details. Identify appropriate mechanisms to supply stakeholders and the public with information about the development proposal and its progress. Major stakeholder consultation shall include:

- Dhiggaru Council
- Public

<u>**Presentation**</u>- The EIA report shall be concise and focus on significant environmental issues. It shall contain the findings, conclusions and recommended actions supported by summaries of the data collected and citations for any references used in interpreting those data. The environmental assessment report shall be organized according

to, but not necessarily limited by, the outline given in the Environmental Impact Assessment Regulations 2012 and all subsequent Amendments.

Timeframe for submitting the EIA report – The developer must submit the completed EIA report within 6 months from the date of this Term of Reference.

.....

21 August 2016

19 Annex B: Project Schedule

Temporay Schedule for Beaching Area Development, M. Dhiggaru

	Months						Duration / Days
Description	**1**	**2**	**3**	**4**	**5**	**6**	
Preliminary works							7
Mobilization							7
Site setup							5
Dredging							90
Out survey							7
Site clearance							5
Demobilization							3

20 Annex C: Project details

M T C C
MALDIVES TRANSPORT &
CONTRACTING COMPANY PLC
SURVEY,DESIGN AND DEVELOPMENT UNIT
CONSTRUCTION AND PROJECTS MANGEMENT
DEPARTMENT, MTCC TOWER, BODU
THAKURUFAANU MAGU, MALE' 20057,
REPUBLIC OF MALDIVES,
PHONE:+(960) 332 6822,FAX: +(960) 333 2835
E-MAIL: survey@mtcc.com.mv

REV	DESCRIPTION	DATE	APPR
2B	ADD BA & REV TO EAST	31/03	-

CONCEPT BY: -
DATE -
FILE NAME: K08 03CH C001 02C.DWG
CONTRACT NUMBER: -
PAPER A3
SCALE 1:2500

SURVEYED BY: HUSNAIN, YAMIN
DATE 07/03/2013
DRAWN BY: ANAS
DATE 31/03/2016
DESIGNED BY: -
DATE -
CHECKED BY: -
DATE -

CLIENT: MINISRTY OF HOUSING AND INFRASTRUCTURE
CONSULTANT: -

PROJECT TITLE: MJDHIGARU HARBOR CONSTRUCTION PROJECT
DRAWING TITLE: CONCEPT DRAWING SET
SHEET TITLE: CONCEPT PLAN

DRAWING NUMBER
MTCC/16/K08/03CH/C001
0101C
SHEET 01 OF 01

PLOTTED ON 5/5/2016 11:56 AM

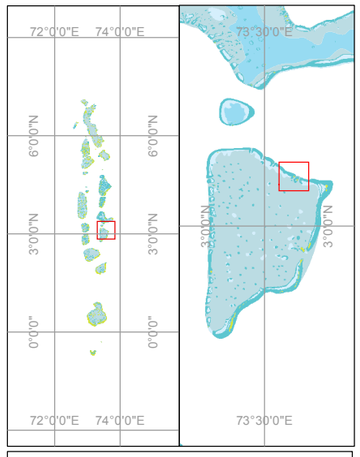
21 Annex D: Shoreline and Bathymetry

M.Dhiggaru Beaching Area

73°33'45"E
340650
73°34'0"E
344226
344226
3°6'45"N
3°6'45"N

Legend

- Breakwater
- Seawall
- Quaywall
- Shoreline Oct 2016
- Shoreline May 2016
- Shoreline Feb 2011
- Reef



Geodetic Parameters

Coordinate Systems :Universal Transverse Mercator (UTM) Zone: 43 North
Projection :Transverse Mercator (TM)
Datum : WGS 1984
Longitude of Origin :0.000000000
Central Meridian:75 W
Scale Factor :0.999600000000000040
False Easting :500000.000
False Northing :0.00000000
Semi-Major Axis (a) (Meters): 6378137.000
Semi-Minor Axis (b) (Meters): 6356752.3142451793

Scale: 0 10 20 40 60 80 Meters

Project:
M.Dhiggaru Beaching Area

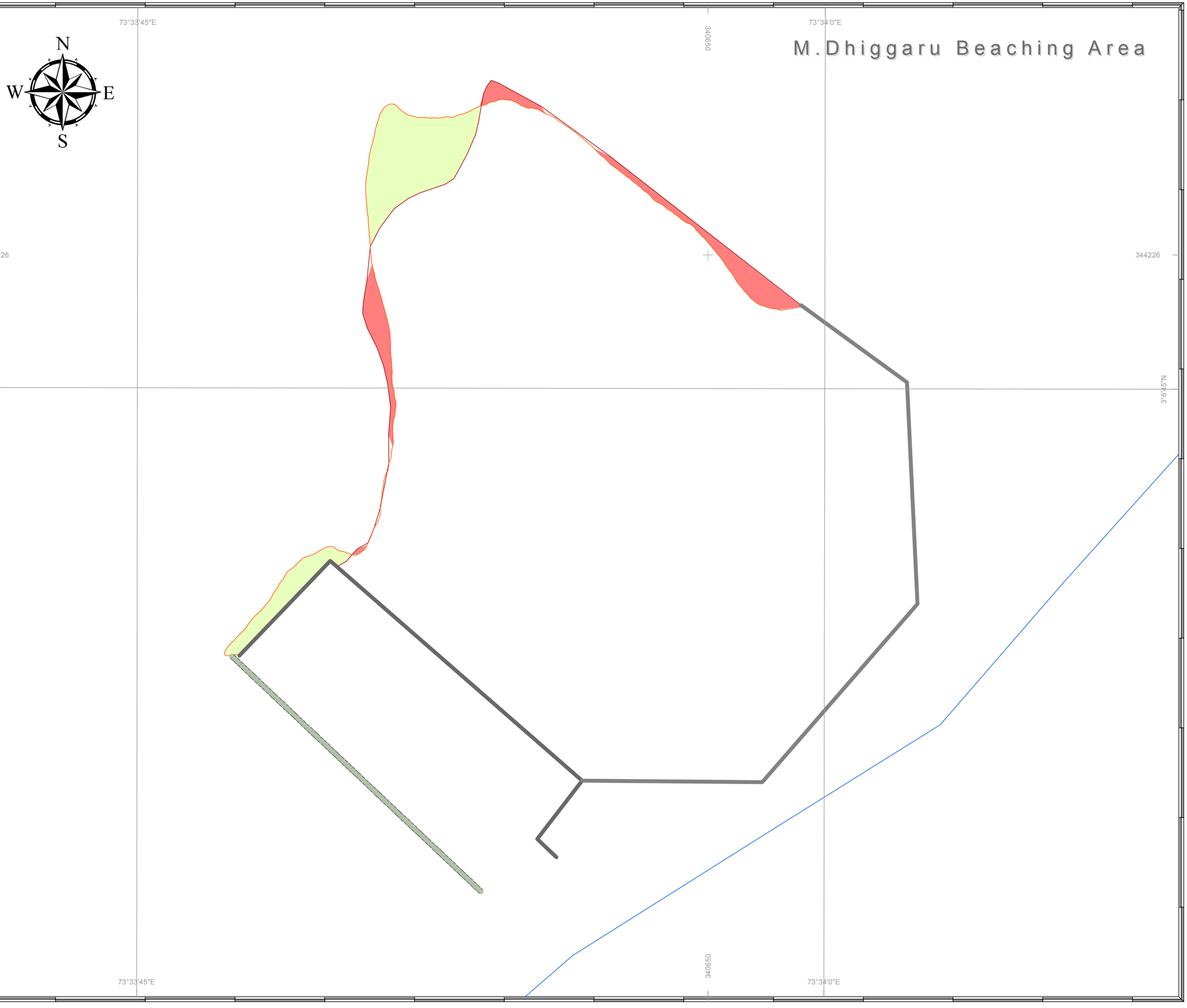
Client:
MTCC

Contractor:

Water Solutions Pvt Ltd
Ma.Fas Eri 1st Floor, Ameenee Magu, Male', Maldives
Tel: +(960)3341643, Fax: +(960)331643
www.water-solutions.biz

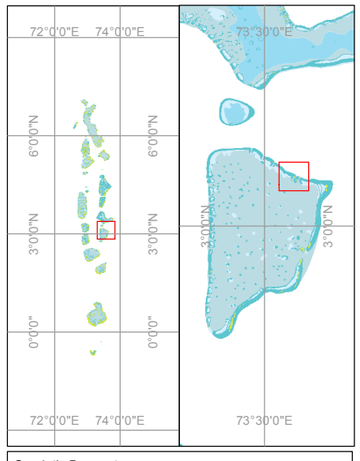
EIA PURPOSES ONLY

M.Dhiggaru Beaching Area



Legend

- Breakwater
- Seawall
- Quaywall
- Shoreline Oct 2016
- Shoreline Feb 2011
- Erosion
- Accretion
- Reef



Geodetic Parameters

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Longitude of Origin :0.000000000
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False Northing :0.00000000
Semi-Major Axis (a) (Meters): 6378137.000
Semi-Minor Axis (b) (Meters): 6356752.3142451793

Scale: 0 10 20 40 60 80 Meters

Project:
M.Dhiggaru Beaching Area

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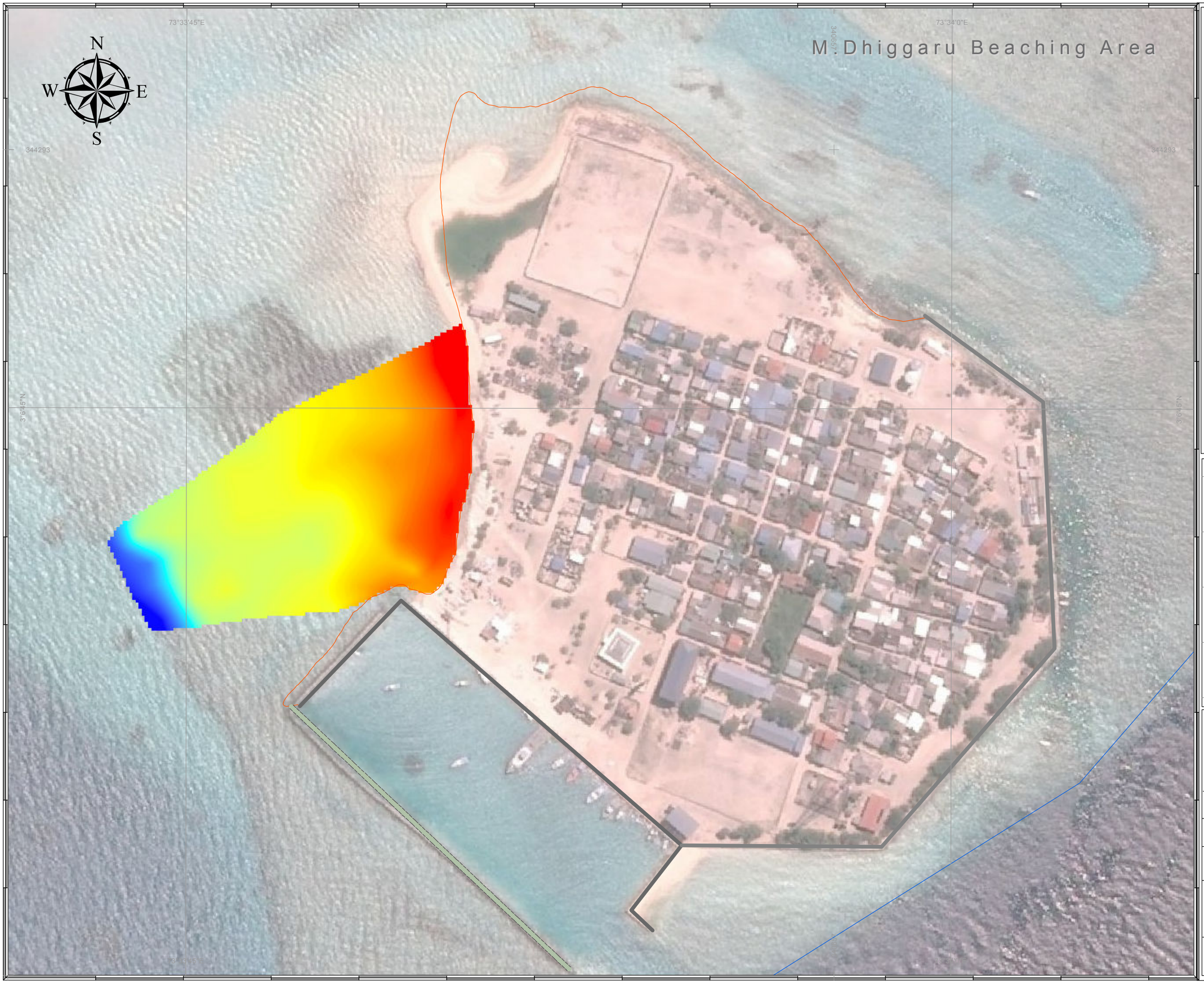
Tel: +(960)3341643, Fax: +(960)331643
www.water-solutions.biz

EIA PURPOSES ONLY

M.Dhiggaru Beaching Area



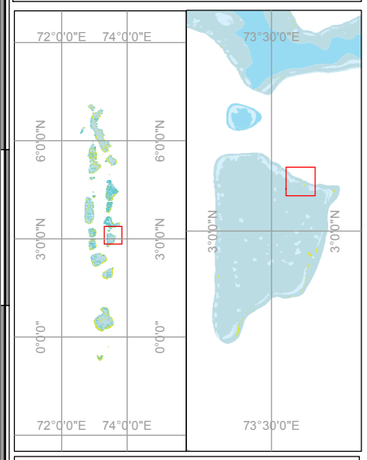
Legend

- Breakwater
- Seawall
- Quaywall
- Shoreline Oct 2016
- Reef

Bathymetry

Shallow : -0.50

Deep : -2.50



Geodetic Parameters

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Projection :Transverse Mercator (TM)
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Central Meridian:75 W
Scale Factor :0.99960000000000040
False Easting :500000.000
False Northing :0.00000000
Semi-Major Axis (a) (Meters) :6378137.000
Semi-Minor Axis (b) (Meters): 6356752.3142451793

Scale: 0 5 10 20 30 40 Meters

Project: M.Dhiggaru Beaching Area

Client: MTCC

Contractor:

Water Solutions Pvt Ltd
Ma:Fas Eri 1st Floor, Ameenee Magu, Male', Maldives
Tel: +(960)3341643, Fax: +(960)331643
www.water-solutions.biz

EIA PURPOSES ONLY

22 Annex G: Beach Profiles

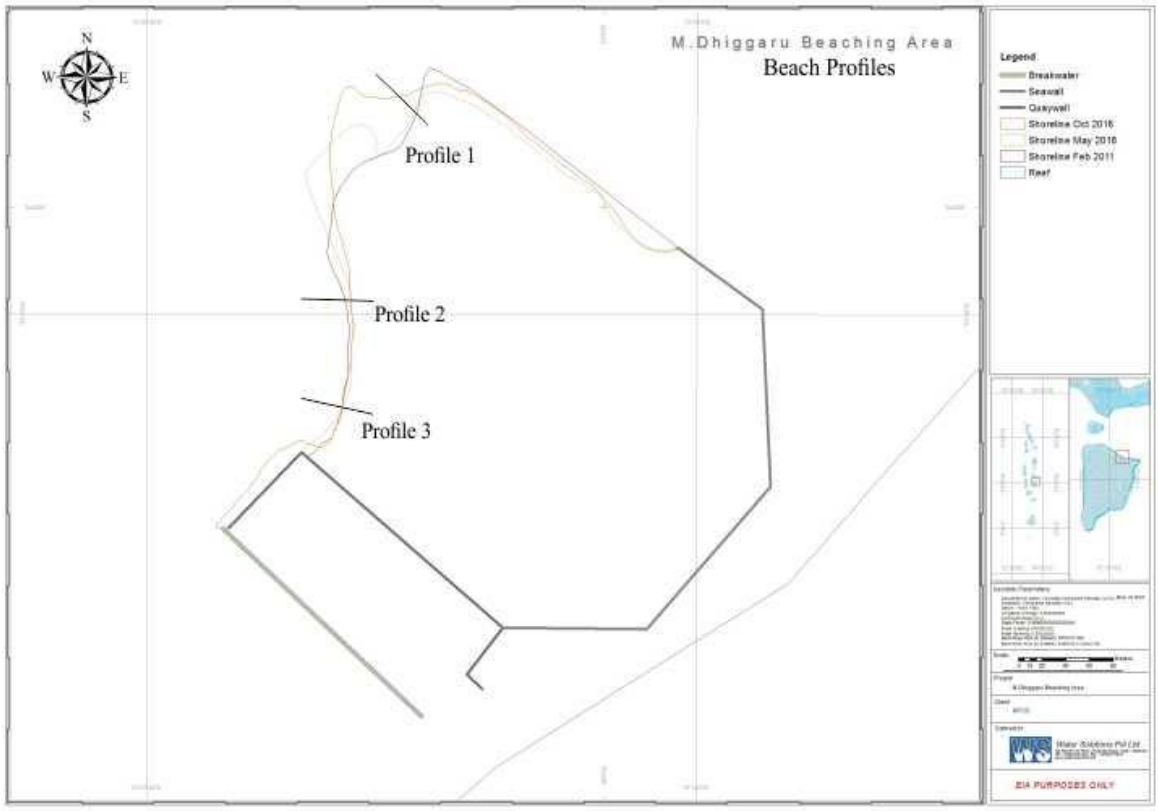

Figure 28: Beach profile locations

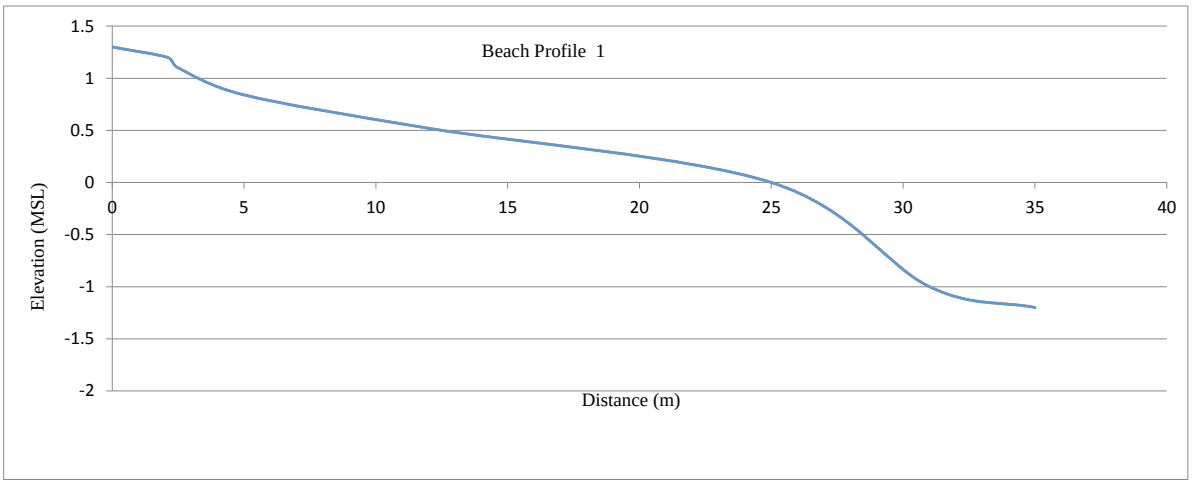

Figure 29: Beach profile 1

Figure 30: Beach profile 2

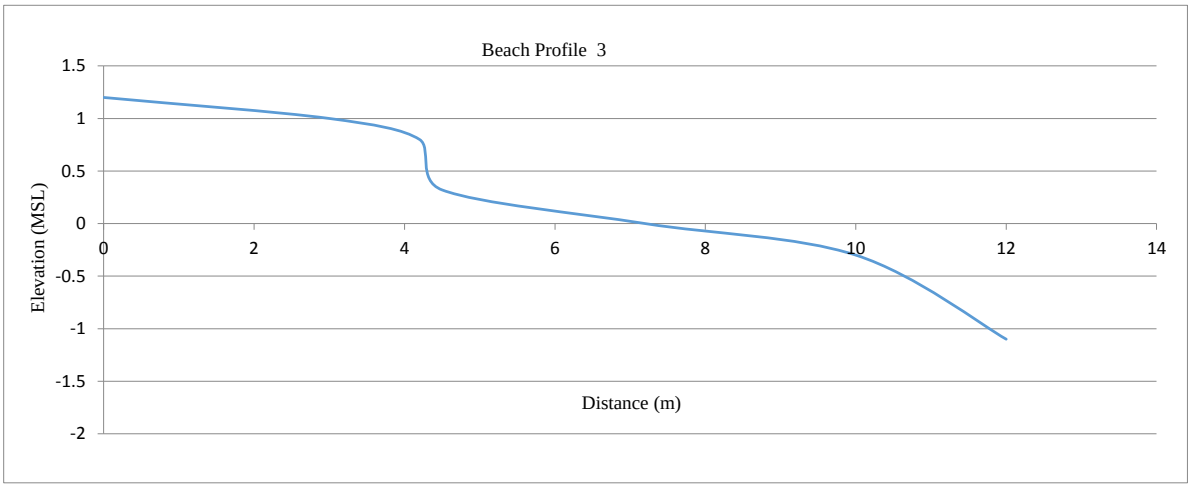

Figure 31: Beach profile 3

23 CV of other consultants

1.	**PROPOSED POSITION**	:	**Surveyor**
2.	**NAME**	:	Hamdhulla Shakeeb
3.	**CONTACT DETAILS**		M.Araaraiykuri, 4th Floor Blookiyaa Magu Male' Maldives Mobile:+(960) 7567075
4.	**DATE OF BIRTH**	:	26th Feb 1988
5.	**NATIONALITY**	:	Maldivian
6.	**EDUCATION**	:	**General Certificate of Education (GCE) Ordinary Level** Cambridge University, 2005 **General Certificate of Education (GCE) Advanced Level** Cambridge University, 2008 **Certificate in Surveying,** University of Moratuwa, Sri Lanka, 2009
7.	**OTHER TRAINING**	:	PADI Open Water Diver Reef Check Eco Diver Program Leica GNSS Training Program Advance Certificate in Computing Multi Beam Training

8. LANGUAGE & DEGREE OF PROFICIENCY :

	Speaking	Writing	Reading
English	Excellent	Excellent	Excellent
Dhivehi	Mother tongue	Mother tongue	Mother tongue

9.	**MEMBERSHIP IN PROFESSIONAL SOCIETIES**	:	-
10.	**COUNTRIES OF WORK EXPERIENCE**	:	Maldives & Sri Lanka
11.	**EMPLOYMENT RECORD**	:	

FROM: **1st August 2008** To: Present
EMPLOYER Water Solutions Pvt Ltd
POSITION HELD AND DESCRIPTION OF DUTIES Surveyor
Undertake field surveys required for environmental studies, development and monitoring. Produce CAD drawings of completed surveys and other drawings required for environment and sewerage projects

PROFESSIONAL EXPERIENCE

Project Name : **Setting out all Structures in L.Olhuveli**
Client : Evason Laamu Financing:
Period : 2008 Time Spent: 2 months
Position Held : Assistant Surveyor
Duties : Setting out of water villas

Project Name : **Bathymetric Survey of K.Summer Island**
Client : Summer island Financing:
Period : 2008 Time Spent: 2 days
Position Held : Assistant Surveyor
Duties : Bathymetric Survey

Project Name : **EIA Survey - redevelopment of in K.Giraavaru**
Client : TBI
Period : 2008 Time Spent: 1 day
Position Held : Assistant Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA for Coastal Protection of Embudu Village**
Client : Embudu Village
Period : 2008 Time Spent: 2 days
Position Held : Assistant Surveyor
Duties : Field data collected for the EIA report

Project Name : **Topographic Survey – Redevelopment of Bolifushi Resort**
Client : Jumeirah Maldives
Period : 2008 Time Spent: 2 Weeks
Position Held : Assistant Surveyor
Duties : Mapping the Existing structures

Project Name : **Environmental Monitoring B.Muhdhoo**
Client : Coastline Group
Period : 2008 Time Spent: 1 week
Position Held : Assistant Surveyor
Duties : Field data collected for the EIA report

Project Name : **K. Thulusdhoo Huraagadu**
Client : Island Community
Period : 2009 Time Spent: 1 week
Position Held : Assistant Surveyor
Duties : Field data collected for the EIA report

Project Name : **Topographic survey of Bolifufushi Resort**
Client : Eon Resorts
Period : 2009 Time Spent: 5 months
Position Held : Surveyor
Duties : Setting Out the all the strucures

Project Name : **AA. Moofushi**
Client : Constance Hotels
Period : 2009 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **Gdh. Madaveli Land Reclamation EIA**
Client : MHTE
Period : 2009 Time Spent: 1 week
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **Ghd. Hoadehdhoo Land Reclamation EIA**
Client : MHTE
Period : 2009 Time Spent: 1 week
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **Environmental Monitoring of Gdh.Meradhoo**
Client : Jumeirah Maldives Financing:
Period : 2009 Time Spent: 2 days
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **Topographic Survey of Lh.Felivaru**
Client : Northern Province Office Financing:
Period : 2009 Time Spent: 1 month
Position Held : Surveyor
Dties : Mapping the structures

Project Name : **Topographic Survey of Sonevafushi**
Client : Sonevafushi Financing:
Period : 2010 Time Spent: 1 day
Position Held : Surveyor
Duties : Mapping the structures

Project Name : **Topographic and Bathymetric Survey of K.Baros**
Client : Baros Financing:
Period : 2010 Time Spent: 1 day
Position Held : Surveyor
Duties : Collecting depths and mapping the island

Project Name : **Coral Planting in K.Boduhithi**
Client : Sunland Financing:
Period : 2010 Time Spent: 3 days
Position Held : Surveyor
Duties : Coral Planting

Project Name : **EIA Survey of K.Summer Island**
Client : Summer Island
Period : 2010 Time Spent: 2 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA Survey of Conventional Centre in Addu City**
Client : MHE Financing:
Period : 2010 Time Spent: 2 days
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA Survey of Maradhoo Football Ground**
Client : - Financing:
Period : 2010 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA Survey of Halaveli**
Client : Halaveli
Period : 2011 Time Spent: 2 Weeks
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **Environmental Monitoring of AA.Nika Island**
Client : Nika Island Financing:
Period : 2011 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA Survey of Nolhivaramfaru**
Client : MHE
Period : 2011 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA survey of Sh.Vagaru**
Client : Viceroy Maldives
Period : 2011 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA survey of Bandos Island Resort**
Client : Bandos Financing:
Period : 2011 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA survey of AA.Maafushivaru**
Client : Maafushivaru Financing:
Period : 2011 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **Topographic Survey of Evasaon Laamu Olhuveli**
Client : Evason Laamu Financing:
Period : 2011 Time Spent: 2 Weeks
Position Held : Surveyor
Duties : Mapping Existing Beach Villas and corrected the map

Project Name : **EIA Survey of Hulhumale' Marina**
Client : HDC Financing:
Period : 2011 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA Survey of Ha.Kela Sewerage project**
Client : DCP Financing:
Period : 2011 Time Spent: 2 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **EIA Survey of Fihaalhohi**
Client : Fihaalhohi Financing:
Period : 2011 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **Topographic Survey of K.Summer Island**
Client : MOOKAI Financing:
Period : 2011 Time Spent: 1 day
Position Held : Surveyor
Duties : Setting out of breakwaters and reclaim area

Project Name : **EIA for 8 island Harbour Project**
Client : MHE Financing:
Period : 2012 Time Spent: 14 day
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **Halaveli Coral Rehabilitation Project**
Client : Halaveli Resort Financing:
Period : 2013 Time Spent: 3 days
Position Held : Surveyor
Duties : Field data collected for the EIA report

Project Name : **Bathymetry Survey of Kihaadhu Resort**
Client : HM Lulu Pvt Ltd Financing:
Period : 2013 Time Spent: 2 days
Position Held : Surveyor
Duties : Field data collection for Bathymetry. This Bar calibration, GPS Setup and echo-sounder operation during data collection

Project Name : **Land Survey of Adh.Thelaveligau**
Client : Thelaveligau Retreat Pvt Ltd Financing:
Period : 2013 Time Spent: 4 days
Position Held : Surveyor
Duties : Field data collection for the Land Survey Report

Project Name : **Bathymetry Survey of Jumerah Dhevanafushi(Meradhoo)**
Client : EON Financing:
Period : 2014 Time Spent: 3 weeks
Position Held : Surveyor
Duties : Field data collection for Bathymetry. This Bar calibration, GPS Setup and echo-sounder operation during data collection

Project Name : **Land Survey of Ga.Innahera with 4 islands**
Client : SIMDI Pvt Ltd Financing:
Period : 2014 Time Spent: 6 days
Position Held : Surveyor
Duties : Field data collected for the Land Survey Report

Project Name : **Land Survey of Sh.Ekasdhoo**
Client : SIMDI Pvt Ltd Financing:
Period : 2014 Time Spent: 4 days
Position Held : Surveyor
Duties : Field data collected for the Land Survey Report

Project Name : **Bathymetry Survey of Maavarufalhu (Faafu Atoll)**
Client : Boston Consulting Group(BCG) Financing:
Period : 2014 Time Spent: 4days
Position Held : Surveyor
Duties : Field data collection for Bathymetry. This Bar calibration, GPS Setup and echo-sounder operation during data collection

Project Name : **Topographic Survey of Rihiveli Resort**
Client : Castaway Financing:
Period : 2014 Time Spent: 7 days
Position Held : Surveyor
Duties : Setting out of all structures

Project Name : **Bathymetry Survey of Rihiveli Resort**
Client : Castaway Financing:
Period : 2014 Time Spent: 4 days
Position Held : Surveyor
Duties : Field data collected for the Bathymetric Survey

Project Name : **Bathymetric Survey of Kuramathi Resort**
Client : Universal Enterprises Pvt Ltd Financing:
Period : 2015 Time Spent: 3 days
Position Held : Surveyor
Duties : Field data collection for Bathymetry. This Bar calibration, GPS Setup and echo-sounder operation during data collection

Project Name : **Bathymetric Survey of S.Gan Bathymetry(Near Main Jetty)**
Client : Blue Logisitics Pvt Ltd Financing:
Period : 2015 Time Spent: 1 day
Position Held : Surveyor
Duties : Field data collection for Bathymetry. This Bar calibration, GPS Setup and echo-sounder operation during data collection

Project Name : **Bathymetry Survey of Maafalhu Survey**
Client : WATG Financing:
Period : 2014 Time Spent: 3 days
Position Held : Surveyor
Duties : Field data collection for Bathymetry. This Bar calibration, GPS Setup and echo-sounder operation during data collection

Project Name: **Land Survey of B.Muthaafushi**
Client : Well land Investment Pvt Ltd Financing:
Period : 2015 Time Spent: 3 days
Position Held : Surveyor
Duties : Field data collected for the Land Survey Report

Project Name: **Land Survey of B.Dhandhoo**
Client : Well land Investment Pvt Ltd Financing:
Period : 2015 Time Spent: 3 days
Position Held : Surveyor
Duties : Field data collected for the Land Survey Report

Project Name : **Land Survey Demarcation of 8 Islands**
Client : LSA Financing:
Period : 2016 Time Spent: 1 month
Position Held : Surveyor
Duties : Setting out of Blocks

CERTIFICATION:

I, THE UNDERSIGNED, confirm that:

(i) To the best of my knowledge, this CV correctly describes myself, my qualifications, and my experience
(ii) I have given my full consent to be included in this Proposal
(iii) I am available for the assignment as indicated/scheduled in this Proposal.

Hamdhulla Shakeeb

24 Annex I: Proof of EIA Submission to Atoll Council

بسم الله الرحمن الرحيم

Water Solutions Pvt. Ltd. Reg No: C-344/2005
Ma. Fas Eri, Ameenee Magu, Male', Maldives

ނަމްބަރު: WS/LTR/2016/123

މ. އަތޮޅު ކައުންސިލްގެ ރައީސް އަށް،
ވެދުން ސަލާމަށްފަހު ދަންނަވަމެވެ.

(އީ.އައި.އޭ) ރިޕޯޓާއި ބެހޭ

މ. ދިއްގަރުގައި ޑްރެއިނޭޖް ސަރަހައްދެއް ހެދުމުގެ މަޝްރޫއުއާއި ބެހޭ އެންވަޔަރަމަންޓް އިމްޕެކްޓް އެސެސްމަންޓް (އީ.އައި.އޭ) ރިޕޯޓް ގެ ކޮޕީއެއް މިސިޓީއާއި އެކު ތިޔަ ކައުންސިލްގެ މަޢުލޫމާތަށްޓަކައި ފޮނުވީމެވެ. އަދި މިސިޓީގެ ތިރީގައި އެވާ އީ.އައި.އޭ. ރިޕޯޓް ލިބުނުކަމުގެ ސްލިޕް ފުރިހަމަ ކޮށްދެއްވުމަށް ފަހު ފޮޓޯ ސްކޭންކޮށް އަދި ފެކްސް (3331643) ނަމްބަރަށް ނުވަތަ އީމެއިލް - (faiz@water-solutions.biz) - އަށް ފޮނުއްވުން އެދި ދަންނަވަމެވެ.

އިޙްތިރާމް ޤަބޫލު ކުރައްވަން އެދެމެވެ.

25 އޮކްޓޫބަރު 2016 މ.

ޚާދިމުކުމް

މުޙައްމަދު މުޖުތަބާ
އެޑްމިން އެގްޒެކެޓިވް

މ. އަތޮޅު ކައުންސިލްގެ އިދާރާ (ފޯން: 6720600) (Email: atollmeemu@gmail.com)

އީ.އައި.އޭ ރިޕޯޓް ލިބުނުކަމުގެ ސްލިޕް.

އީ.އައި.އޭ ރިޕޯޓުގެ ނަން: މ. ދިއްގަރުގައި ޑްރެއިނޭޖް ސަރަހައްދެއް ހެދުމުގެ މަޝްރޫއުއާއި ބެހޭ އެންވަޔަރަމަންޓް އިމްޕެކްޓް އެސެސްމަންޓް (އީ.އައި.އޭ) ރިޕޯޓް

ބަލައިގަތް ފަރާތުގެ ނަން: [illegible]

މަޤާމް: މ. އަތޮޅު ކައުންސިލްގެ [illegible]

އިދާރާގެ ނަން: މުލަކަތޮޅު އަތޮޅު ކައުންސިލްގެ އިދާރާ

ތާރީޚް: 26 އޮކްޓޫބަރު 2016 ގަޑި: 08:30

ސޮއި: .... ސިއްކަ: ....

Tel: (960) 334 1643, Fax: (960) 333 1643 www.water-solutions.biz; info@water-solutions.biz