Environmental Impact Assessment for Coastal Works at G. Dh. Maguhdhdhuva

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1. INTRODUCTION

1.1. *Object of EIA*

Since the beginning of the construction phase of the 200 bed resort project by Ahmet Aydeniz Pvt. Ltd. authorized by the MHTE (MEEW at the time) through a decision note (88-ES/NI-MAG/2008/3), a number of issues have arose and a number of changes in the site plan have been made. Since some of these have an implication in terms of environmental impacts, MTDC, Ahmet Aydeniz Pvt. Ltd. and the environmental consultant were notified during a meeting with EPA that an amendment to the initial EIA should be submitted to get an authorization for these new developments. The present addendum is the Fourth for this project, and deals with the issue of Beach Replenishment.

1.2. *Project location*

Magudhdhuvaa is one of the closest islands to the equator in the Maldives, with geo-coordinates 0º 16’ 35” N, 73º 21’ 25” E, and is located in the southern part of Huvadhoo Atoll (G. Dh.) (Figure 3).

Figure 1: Location map of G.DH. Magudhdhuvaa

1.3. *Purpose and objectives of the project*

The assessment of the impacts to the environment investigates the activities proposed as part of the project and analyses the environmental conditions at the site in order to forecast the impacts. The Environmental Impact Assessment then proposes alternatives and mitigation measures to minimize the negative impacts while trying to derive the maximum positive impacts from the project. It is a requirement to submit an EIA report under the Environmental Protection and Preservation Act (EPPA; Law no. 4/ 93) for any development in the tourism industry

1.4. *The proponent and consultants*

Ahmet Aydeniz Maldives Pvt Ltd is a newly incorporated company in the Maldives whose mother company, Ahmet Aydeniz Insaat, a Turkish company which is mainly involved in construction of large scale civil works such as dams or airports and other important infrastructures in many different countries. It is also involved in agriculture products and food products and is one of the major companies in this field in Republic of Turkey. The development in Magudhdhuvaa will be their first venture in the tourism sector in terms of operation although the construction of different facilities has already been carried out by the company.

Seamarc Pvt. Ltd. is a company registered at the Ministry of Trade and Industries of the Government of the Republic of Maldives, under the act no. 10/96, since June 2000. The aim of the company is to provide quality advice on dealing with environmental problems arising from the rapid developments in infrastructure taking place in the Maldives. Seamarc Pvt. Ltd has been appointed as the consultant for this project by the proponent.

1.5. *Study area*

The whole island is under consideration as sediment transport cannot be treated partially, but the focus is on the Southern tip where most of the erosion was previously noticed and where the proposed coastal works will be happening. The island being alone on its reef system and situated at the middle of it, in terms of sediment transport, it is ruled out that the coastal works on Magudhdhuva will affect negatively other reefs or islands outside the reef system. The boundaries of the survey area are shown in the figure below (Fig. 2)

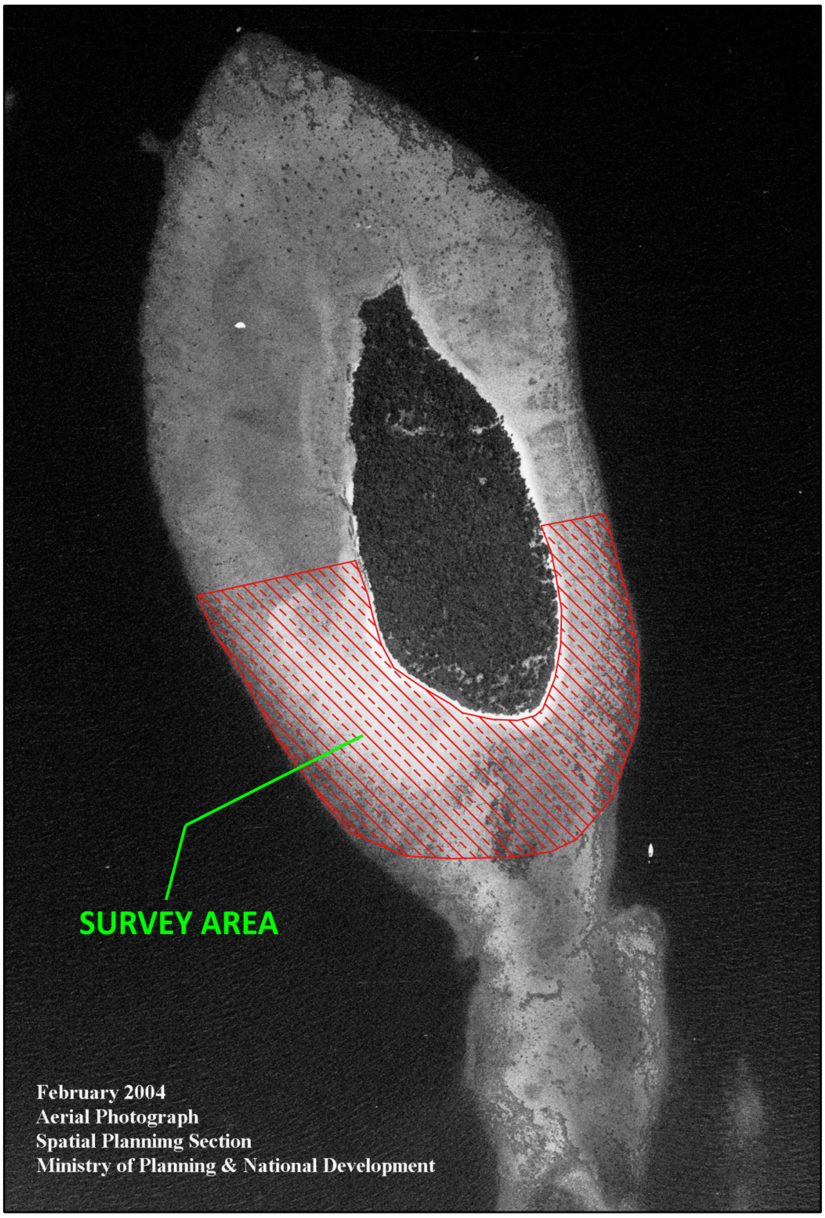

Figure 2: Survey Boundary Area

2. THE PROJECT

2.1. *Site Plan*

The following site plan shows the 250 m long portion of the coastline requiring the implementation of a revetment as well as the revetment itself (Fig. 3).

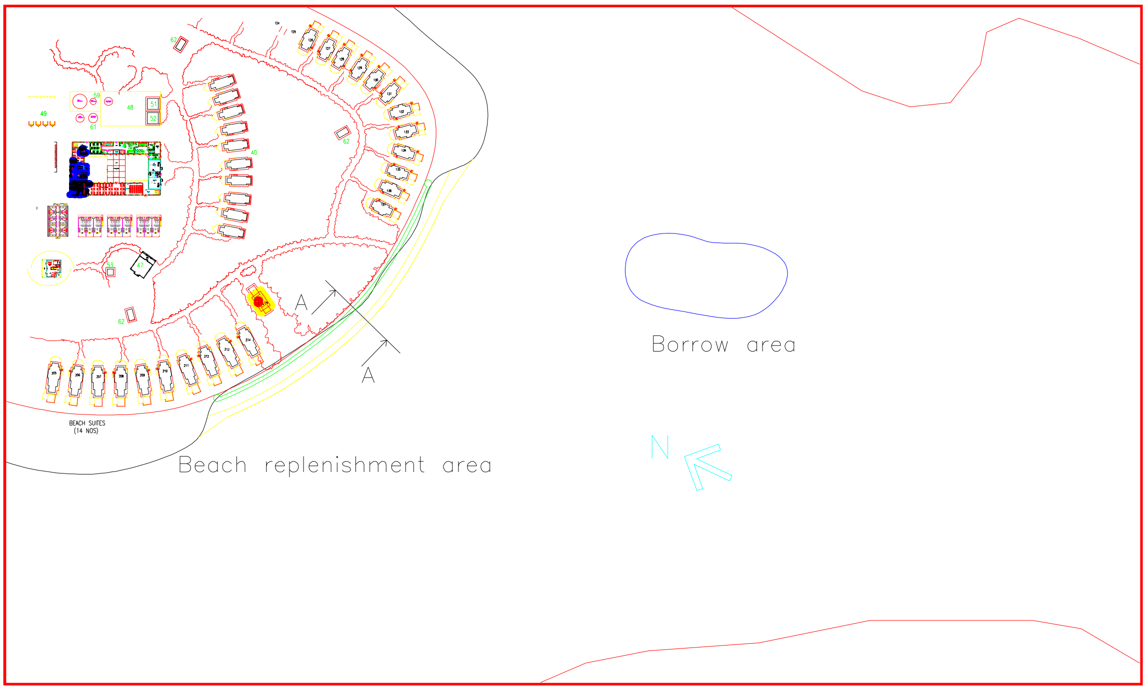

Figure 3: Beach Replenishment Area

The following figure shows the section of the protection required.

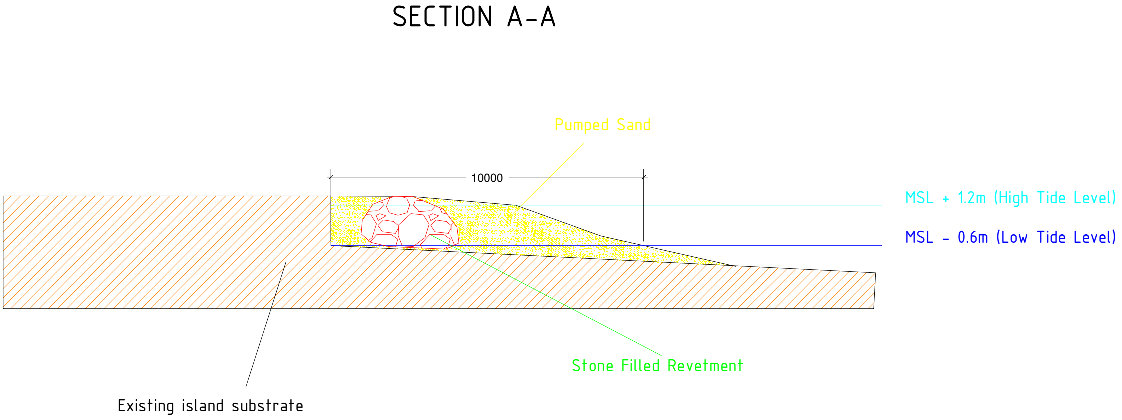

Figure 4: Section drawing of beach replenishment area

2.2. *Processes and methods used*

Previously a number of different options have been adopted in a hurry, which have proved not very long lasting; these included in particular sand filled jumbo bags and retaining planks of plywood (Fig. 5).

Figure 5: Ad hoc solutions to counter erosion on Magudhdhuvaa

The present project is looking at more permanent solutions to ensure the aesthetics of the beach and the satisfaction of the guests. Based on previous observations, shore parallel protective structures have been opted for (Fig. 5).

The new structures will be made of rocks which will be excavated during the harbour basin excavation.

2.3. *Duration*

It is expected the project will be finished one month after the approval of the EIA.

2.4. *Machinery*

The project will make use of an excavator, a back hoe loader, as well as a sand pump mounted on a barge.

3. LEGISLATIVE AND REGULATORY CONSIDERATIONS

This section outlines the relevant environmental legislation, existing plans, policies and guidelines and international conventions pertaining to the development under study.

3.1. *Environment Protection and Preservation Act of Maldives (Law no. 4/ 93)*

The Environment Protection and Preservation Act of the Maldives (EPPA; Law no. 4/ 93) provide the legal basis for environmental protection, preservation and conservation in the country. Being an umbrella law, it gives extensive power to Ministry of Housing and Environment (MHE) in matters concerning the environment.

The following articles are addressed in the EPPA:

- The guidelines and advice on environmental protection in accordance with the prevailing needs and conditions of the country shall be provided by the concerned government authorities.
- In areas of environmental protection and preservation that do not already have a designated government authority, MHE shall be the responsible authority to formulate policies, rules and regulations.
- MHE shall be responsible for identifying and drawing up legislation for conservation of protected areas and natural reserves.
- An environmental impact assessment has to be submitted to MHE before implementation of any project that may have an impact on the environment. MHE shall formulate the guidelines and determine the projects that require such an assessment.
- MHE has the authority to terminate any project that has an unfavourable impact on the environment without compensation.
- Disposal of waste, oil, poisonous gases or other substances harmful to the environment is prohibited within the territory of the Maldives. In the event that disposal of such substances become necessary, they shall be

disposed of within the area designated for the purpose by the government.

- Disposal of hazardous, toxic or nuclear waste is prohibited within the territory of Maldives and a permit shall be obtained before any transboundary movement through the Maldivian territory.
- The penalty for defying the law is stated in the Law.
- The government of Maldives has the right to claim compensation for any damages caused by activities that are detrimental to the environment.

3.2. *The EIA Process*

Under Article 5 (a) of the EPPA, an Environmental Impact Assessment has to be submitted by the developer of a project which may have potential impacts on the environment, to MHE for approval before commencement of the project.

The EIA process is coordinated by the Environment Protection Agency of the MHE with consultation from other relevant government agencies and the National Commission for the Protection of the Environment (NCPE). The EIA process is initiated when the proponent submits a Screening Form to the Ministry. This stage identifies if the project requires an Initial Environmental Examination (IEE) or a full Environmental Impact Assessment. Subsequently, the scope of the EIA will be discussed in a Scoping Meeting attended by representatives from the Ministry and the proponent. Once the scope is identified, baseline surveys will be carried out and a report submitted to the Ministry according to the guidelines provided in the EIA Regulation. The main components of the report are project description, existing environment, public consultation, impact assessment, alternatives, mitigation and monitoring. A decision statement is then issued by the Ministry stating whether the project is approved, needs further information or is rejected. The EIA process is schematically shown on Figure 2.1. The development of all new resorts is included in the list of activities requiring an EIA (Schedule D) of the EIA Regulations. Thus, this project need not go through the screening process but can go directly to the scoping stage.

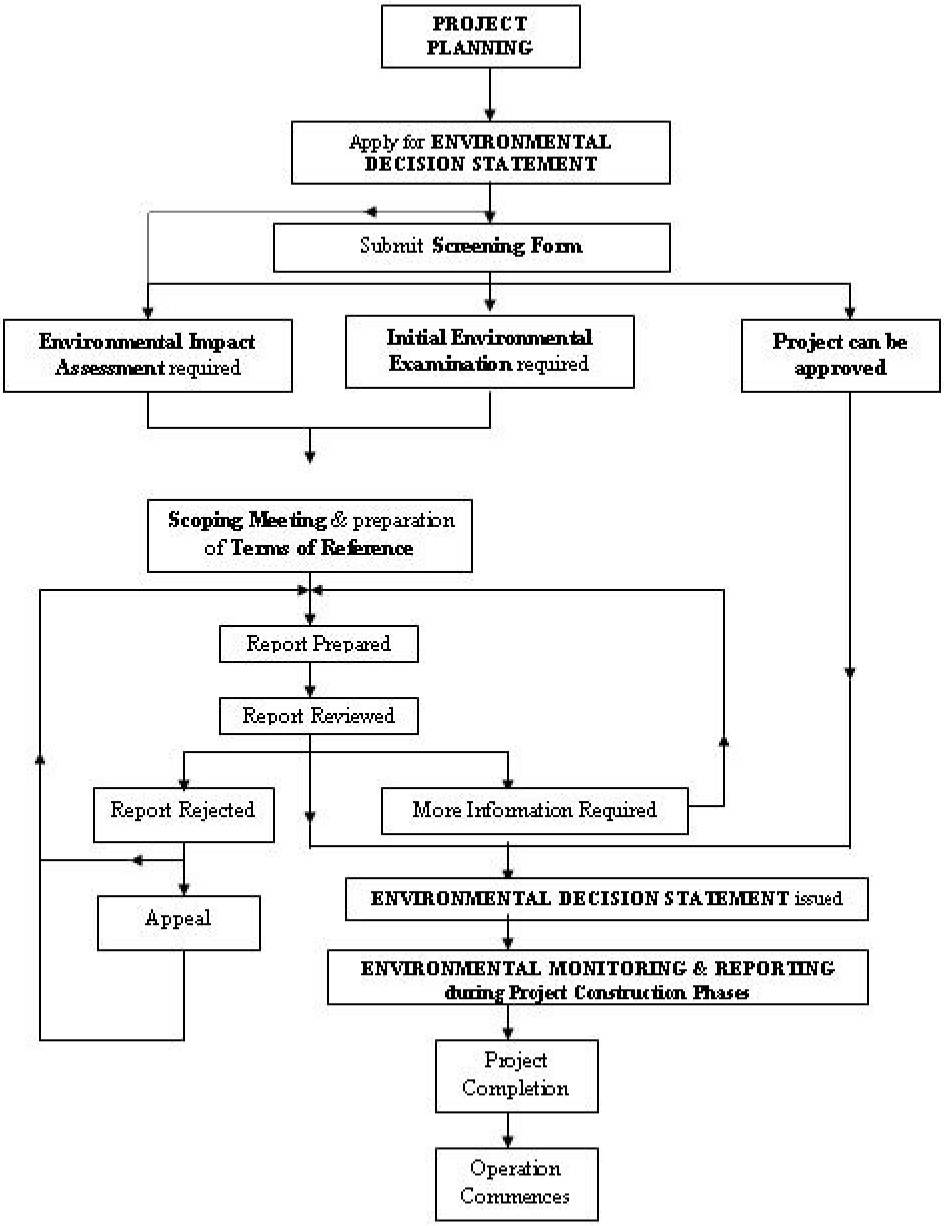

Figure 6: The EIA process in the Maldives

3.3. *Maldives Tourism Act (Law no. 2/99)*

This act encompasses the issues related to the development of tourism in the Maldives. It came into effect on the November, 1999, repealing the Law on Tourism in the Maldives (Act No. 15/79) and the Law on Leasing of Uninhabited Islands for the Development of Tourist Resorts (Act No. 3/94). Act No. 15/79 was the primary legislation that was passed by the Citizen’s Majlis in November of 1979 and the main aim was to provide for the collection of a bed tax from the visiting tourists and to control their movement in the Maldives. While this Act only dealt with tourist resorts, hotels and guest houses, the amended act (Act No. 2/99) incorporates the determination of zones where tourism development can occur, as well as the development and management of marinas and the operation of tourist vessels, diving centres and travel agencies. This is evidence that the tourism industry has expanded since the enactment of the initial laws, both in magnitude and in the diversity of facilities that are provided for the visiting tourists.

The environmental legislation that directly applies to the development is outlined under article 15 (a) and (b). Article 15 (a) provides for the felling of *Ruh'*s and trees, dredging of lagoons, reclamation of land or any other activity that may cause permanent change to the natural environment of an island leased as a tourist resort. It states that the activities mentioned above can only be carried out after obtaining written permission from the Ministry of Tourism, Arts and Culture and in accordance with the relevant regulations.

Under Article 15 (b), a justification has to be provided for such an activity, as well as an environmental impact assessment, which has to be submitted to and approved by the Ministry of Housing and Environment.

There are several regulations under the Maldives Tourism Act (Law No. 2/99) and those pertaining to the environment are presented below.

3.4. *Regulations under Maldives Tourism Act*

3.4.1. Development of Tourist Resorts

Under article 4 of this regulation, permission is required from the Ministry of Tourism, Arts and Culture before felling of trees.

3.4.2. Carrying Capacity for Islands to be Developed as Tourist Resorts

A set of standards has been imposed under this regulation to ensure preservation of the natural beauty and the environment of the islands as well as the consumer's image of the islands. As such, the following guidelines are provided:

- The felling of trees has to be carried out evenly throughout the island with the intention of conserving the natural façade and the beauty of the island.
- Sufficient trees have to be left untouched when clearing trees for construction in order that they block the view of the buildings. All buildings, including two storey buildings are to be constructed below the highest canopy level so that they are not visible above the treetops.
- The maximum number of buildings to be constructed on the island should be dependent on how much space can be cleared of vegetation, with consideration of the above factors.
- The maximum area utilized for the construction of buildings should not exceed 20% of the total land area.
- All buildings should be located at least 5m landwards from the vegetation line of the island. In the event that over water bungalows are built on the reef flat or lagoon, an equal area has to be left free on the island.
- To provide the visiting guests with sufficient beach area, the guest rooms should face the beach with a minimum of 5m of beach allocated for each room.

3.4.3. Disposal of Garbage

- Garbage from the resorts should be disposed of appropriately to avoid impacts on the environment. Waste disposed of at sea should be thrown away far out to sea, ensuring that it does not get washed back on the beach of any islands.
- All resorts are required to have incinerators and compactors to be utilized for burning all flammable material and compact the cans respectively. Glass is to be broken into small pieces and plastic and polythene bags burnt.
- A fine between Rf100 and Rf2000 is to be charged if the regulation is breached, and the sum doubled for those who violate it a second time.

In addition to the Maldives Tourism Act and the relevant Regulations, there are Circulars issued by the Ministry of Tourism, Arts and Culture, advising the Tourism industry of their new policies or strengthening the existing ones.

- Circular no. 21/90 (21.04.1990) advices all resorts having filled jetties to be modified so that they allow free flow of currents through them or new jetties composed of reinforced concerted stilts to be built in their place by the end of June 1991.
- Circular no. CIR-ES/98/07 issued on the 27th of January 1998 states that all resorts have to obtain permission from the Ministry of Tourism, Arts and Culture before commencing any coastal modifications. Hard engineering solutions are discouraged while environmentally friendly structures are supported.
- Circular no. 88-ES/CIR/2002/12 (05.05.2002) deals with the proper disposal of garbage from the resorts in response to concerns that floating garbage from resort islands were washing up on beaches of nearby islands.

3.4.4. Maldives Third Tourism Master Plan

The Maldives Third Tourism Master Plan (TTMP) was launched in August 2007. The planning horizon is from 2006 to 2010. The strategies recommended will integrate with the policies and strategies for tourism, air and sea transport proposed in the 7th National Development Plan which is also being developed.

The TTMP will focus on the following areas:

- Identification of potential product expansion and diversification and Maldives tourism product review.
- Increasing the share of Maldivians working in the tourism industry.
- Greater community involvement in the tourism sector.
- Improvements in the retention of economic benefits of tourism within the Maldives economy.
- Improvements to the tourism related infrastructure and support services.

- Protecting, preserving and promoting the natural resource base, heritage and culture in relation to tourism development.
- Strengthening the institutional capacity of Ministry for Tourism, Arts and Culture.
- Developing domestic tourism.
- Improving the legislative framework in relation to the tourism industry.

3.4.5. Fisheries Regulation of the Maldives

Under Article 1 (d) of this regulation, it is an offence to carry out any fishing activity on the house reef or the lagoon of a tourist resort without prior approval from the management of that resort.

3.4.6. Regulation on Sand and Coral Mining

Under Article 7 (c) of the Regulation on Sand and Coral Mining issued by the Ministry of Fisheries, Agriculture and Marine Resources (MOFA) on the 13th of March 2000, it is an offence to mine sand or coral from the beach, lagoon or reef of any island leased for the purpose of building a tourist resort. Mining of coral or sand for the construction of resorts and associated facilities is discouraged under the policy of the Ministry of Tourism, Arts and Culture, and utilization of alternative construction material is encouraged. As an incentive, import duty is exempted under Sub clause 3, Article 9 of Law No. 31/79 for the import of cement, iron, steel, roofing sheets and timber for the construction of tourist resorts. However, sand mining is allowed for beach replenishment projects, predominantly from the immediate lagoon of the resort and in the case of a lack of sand on the island, from an area that is decided by MOFAMR.

3.5. *International Conventions*

3.5.1. United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol

UNFCCC is the first binding international legal instrument that deals directly with the threat of climate change. It was enacted at the 1992 Earth Summit in Rio de Janeiro and came into force on the 21st of March 1994.

Signatory countries have agreed to take action to achieve the goal outlined in Article 2 of the Convention which addresses the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous Anthropogenic interference with the climate system," Thus all Parties to the Convention are committed under Article 4 to adopt national programs for mitigating climate change, promote sustainable management and conservation of green house gas (GHG) sinks such as coral reefs, to develop adaptation strategies, to address climate change in relevant social, economic and environmental policies, to cooperate in technical, scientific and educational matters and to promote scientific research and exchange of information.

The Kyoto Protocol entered into force on the 16th of February 2005 and is an international and legally binding agreement to reduce GHG emissions globally. It strengthens the Convention by committing Annex I Parties to individual, legally-binding targets to achieve limitations or reductions in their GHG emissions.

Maldives has signed and ratified both the Convention and the Protocol.

3.5.2. United Nations Convention on Biological Diversity (UNCBD)

The objectives of the UNCBD are "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." The Convention entered into force on the 29th of December 1993. Maldives has ratified the Convention and has prepared the National Biodiversity Strategy and Action Plan in 2002.

3.5.3. United Nations Convention to Combat Desertification (UNCCD)

The objective of the UNCCD is to “combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, particularly in Africa, through effective action at all levels, supported by international cooperation and partnership arrangements, in the framework of an integrated approach, which is consistent with Agenda 21, with a view to contributing to the achievement of sustainable development in affected areas (article 2).” To achieve this goal the Convention focuses on improving land productivity, rehabilitation of land, conservation and sustainable management of land and water resources.

The Convention was adopted in Paris on 17th June 1994 entered into force on 26th December 1996. Maldives has acceded to the Convention in 2002.

3.5.4. United Nations Convention on the Law of the Sea (UNCLOS)

UNCLOS refers to several United Nations events and one treaty. This treaty provided new universal legal controls for the management of marine natural resources and the control of pollution. UNCLOS provides a legal order for the seas and oceans which will facilitate international communication, and will promote the peaceful uses of the seas and oceans, the equitable and efficient utilization of their resources, the conservation of their living resources, and the study, protection and preservation of the marine environment

3.6. *Role of Stakeholders*

There are many parties that can affect or can be affected by development projects. Various national agencies are responsible for environmental management and protection. At the same time, the project proponent has a duty to do their share of conserving the environment by minimising and mitigating impacts arising from the project. The environmental consultants also play a major role in informed decision making by providing the proponent with the information required for this purpose.

3.7. *Government Agencies*

Ministry of Housing and Environment (MHE) and Environment Protection Agency (EPA) are the lead government agency that has the responsibility to implement the Environmental Impact Assessment process. It has the task of ensuring all development projects anticipated to have impacts on the environment undergo the process before implementation. This involves screening the projects and providing approvals and recommendations related to the EIA. MHE is also responsible for ensuring proper implementation of the environmental measures proposed in the EIA including the Environmental Monitoring Plan.

The EIAs and any related documents for resort development are required to be submitted to the MHE through the Ministry of Tourism, Arts and Culture (MTAC). MTAC is the authority that determines the zones where tourism development can occur, as well as the development and management of marinas and the operation of tourist vessels, diving centres and travel agencies. It has the mandate to develop tourism in the Maldives in a sustainable manner and is responsible for ensuring that resort construction and operation abide by the Maldives Tourism Act of Maldives and the associated regulations. MTAC also has the responsibility to provide authorisation for operation of aerodromes.

Other government agencies having a role in the project include:

- Ministry of Housing and Environment has the authority to allocate the land on inhabited islands, including area approval and implementing “no development” buffer zones as well as enforcing planning regulations. The Ministry provides a planning permit to Ministry of Tourism, Arts and Culture which then allows the development of a resort on the island.
- Pertinent legislation, regulations and standards and responsible authority jurisdiction

4. Project Environment

4.1. *Coastal configuration of the project location*

4.1.1. General description

The resort is based on the island of G. Dh. Magudhdhuvaa, with the geo-coordinates 0º 16’ 35” N, 73º 21’ 25” E. Magudhdhuvaa is the only island located on its reef system, and is situated slightly inside the atoll facing a channel between two bigger reef systems (Figure 4.1). The island is rather on the north of the reef system and it is inferred that important wave energy is sometimes experienced from the lagoon.

Figure 7: Aerial picture of G. Dh. Magudhdhuvaa and the surrounding reefs.

A shallow and rocky reef flat surrounds the island; it is 450 m wide in the north and decrease to 100 m on the east side and 250 m on the west side. The reef extends in length in the south, creating a 750 m long and deep channel enclosed in 2 shallow crests. This provides a natural shelter area where deeper drafted boats can anchor. On the south-west side, there is a large sand bank, extending to the reef crest and separated from the island by a shallow channel. All parts of the reef appear healthy even though some colonies have been damaged during construction and due to the recent bleaching event.

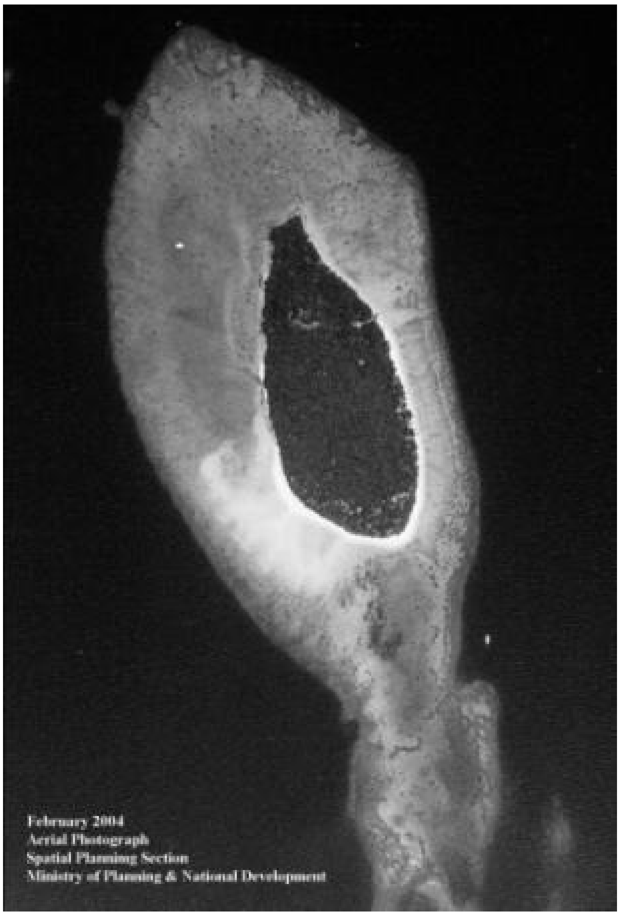

Figure 8: The island of Magudhdhuvaa with surrounding reef in 2004

4.2. Hydrodynamic regime

There are three main factors influencing the current regime and sediment transport around Magudhdhuvaa, and these have the particularity of being quite localized in this case. These three factors are the oceanic swell, which progresses along the channel and inside the internal southern lagoon and hits the southern side of the island, the southwest monsoon, creating wind waves from the west, and the northeast monsoon, creating wind waves form the northeast. Note that the morphology of the nearby reefs has a great influence on the prevailing wave directions.

The southern side of the island is very particular in the way the three forces interact. The erosion noticed is mostly due to the swell waves. They hit the southern side of the island and tend to push the sand on either side of the island, where two sandy bulges, called here southeast and southwest bulges are present year round, even though they vary in shape and overall volume. This is illustrated in figure x, where the two sandy bulges are visible on either side of the island with the eroded coastline in between. In the forefront, the low sand bank is also visible.

Figure 9: Bird eye view of the southern coastline

During the southwest monsoon, the southwest bulge tends to flatten and sand is moved towards the southern part where the erosion is noticed and north towards the semi-water villas. As the flow of water divides, the southern part counteracts the flow of water from the oceanic swell, which tends to push it off shore. Thus the sand accumulates on the sand bank, slightly off the island. When the swell is not strong or the wind waves very strong, the sand from the sand bank tends to be transported back to the island. The south-eastern bulge is being pushed northward by the wind waves, but these don't get the sand to migrate all the way north and soon the beach is thin again.

During the northeast monsoon, the wind waves tend to push the sand back to more southern directions. The sand moves from the semi-water villa areas and the eastern shores back to a more southern position. When the swell is less strong, the sand may move towards the south as well.

In this respect, the shifting of the sand and beaches at the southern side of the island can seem quite erratic, as it is more determined by a balance between the oceanic swell influence and the wind waves rather than a typical monsoonal pattern as is frequent in the north of the Maldives. The monsoons are usually less defined in the south of the Maldives as well.

4.3. Beach profiles

All the beach profiles were taken from the areas, where the current project is predicted to have most effect.

Figure 10: Showing different beach survey profiles

The following table (table 1) is giving the geo-coordinates of the different profiles.

Table 1: Geo-coordinate values of the transects

Dive transects	Latitude (° N)	Longitude (° E)
Profile 1	0°16'28.70"	73°21'24.41"
Profile 2	0°16'28.30"	73°21'27.46"
Profile 3	0°16'29.01"	73°21'29.55"

Figure 11: Profile 1

The profile was taken from the south eastern corner of the island. The profile starts from where some sand bags are currently deployed (Fig. 14). The steep drop in the profile is where the bags end and the rise in the graph at 100 m shows that there is sand accumulation in this area. When observed from the aerial photo, a sand bank can be seen in this area. Some beach rock was observed along the profile line.

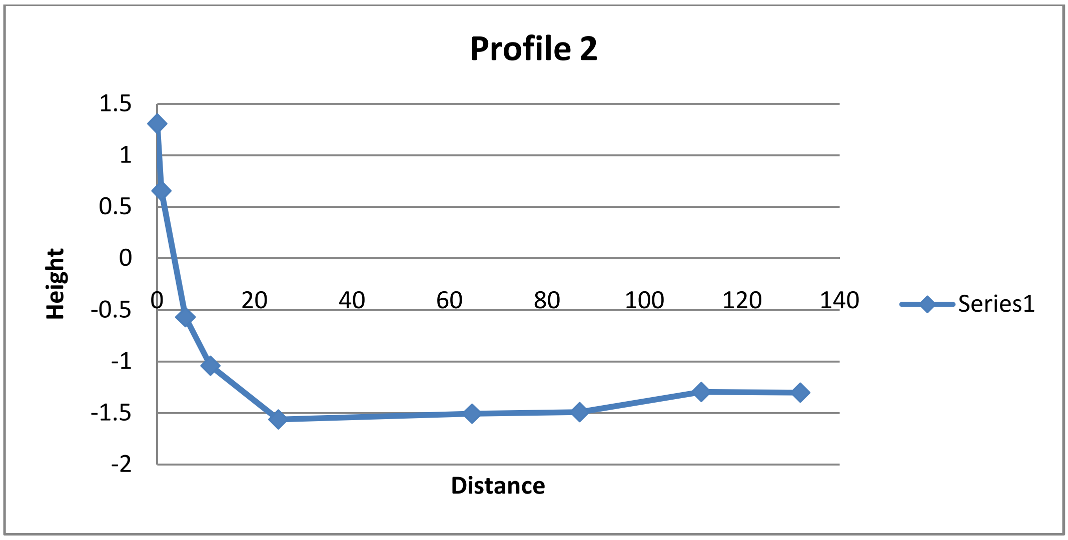

Figure 12: Profile 2

The profile has the same characteristics as of profile 1. The profile gets shallow again at about 100 m. The depth is quite consistent in the profile and it was all sand with very few coral along the profile line.

Figure 13: Profile 3

The island is lower in the area where the profile was taken compared to the other profiles. From the profile we can see that this area is deeper and is very consistent. The sand which will be pumped on to the beach will be possibly taken from this area.

Figure 14: Sand bags deployed to retain the beach. The picture was taken during low tide.

4.4. Reef status

4.4.1. Survey plan

The coral reef environment was surveyed on 5th May 2010. To assess the benthic cover 5 photographic transects were carried out on the reef. The areas surveyed have been chosen to serve as a baseline to assess anticipated impacts occurring during the construction and operational stage. The fish life was visually assessed during the survey.

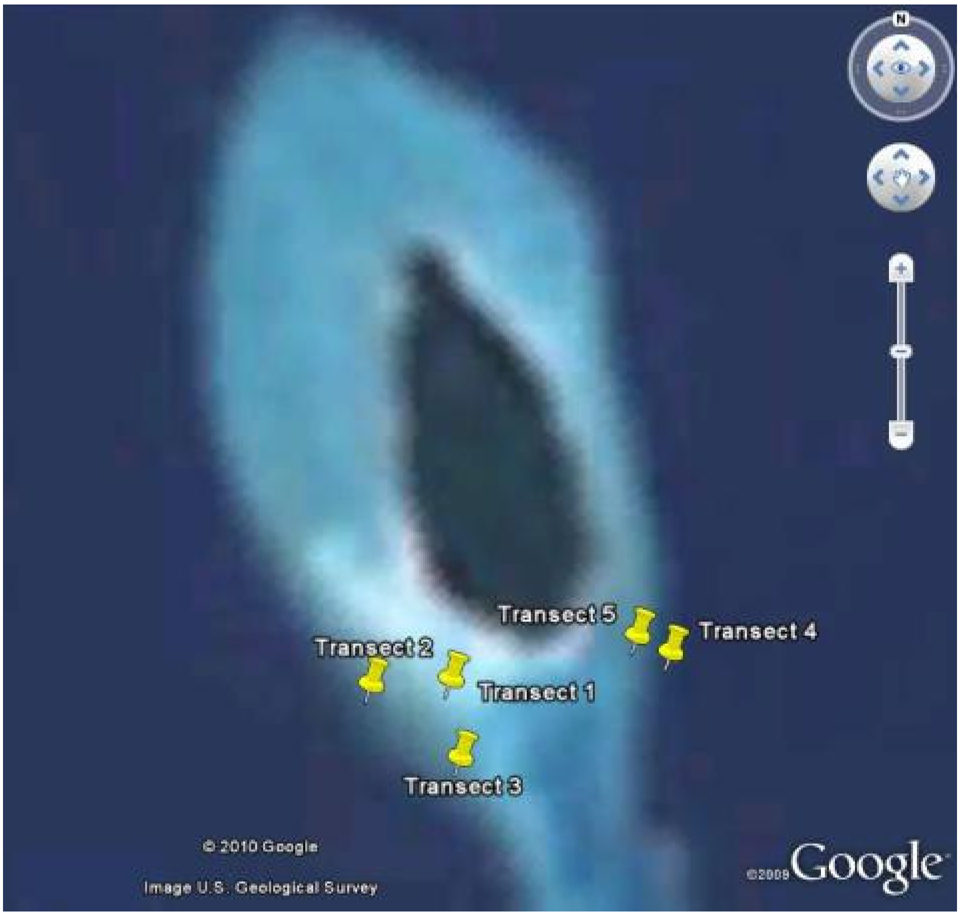

Figure 15: Reef survey site plan showing the different transects around the island

The following table (table 1) displays the geo-coordinates of the different transects.

Table 2: the geo-coordinates of the transect carried out to assess the benthic substrate

Dive transects	Latitude (° N)	Longitude (° E)	Description
Transect 1	0.2741	73.3563	Shallow reef flat
Transect 2	0.2740	73.3552	Edge of reef slope
Transect 3	0.2729	73.3565	Edge of reef slope
Transect 4	0.2745	73.3595	Edge of reef slope
Transect 5	0.2747	73.3590	Lee side reef

4.4.2. Results

The results obtained on the different transect with the subdivisions of the abiotic substrate is shown in the table below (Table 3) and in graphic form without the separation of the abiotic substrate (Fig 16).

Table 3: results of the transect into major categories

MAJOR CATEGORY	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	MEAN	STDEV
CORAL	12.8	67.2	61.3	69.9	50.8	52.4	23.3
OTHERS	0.0	0.0	0.8	0.0	0.0	0.2	0.4
ALGAE	13.6	8.8	7.3	8.1	34.7	14.5	11.5
SAND, PAVEMENT, RUBBLE	70.4	19.2	13.7	17.9	12.9	26.8	24.5
DEAD CORAL	3.2	4.8	16.9	4.1	1.6	6.1	6.2
TAPE, WAND, SHADOW	0.0	0.0	0.8	1.6	0.8	0.6	0.7
Bleached coral point (%)	68.8	67.9	65.8	24.4	63.5	58.1	18.9

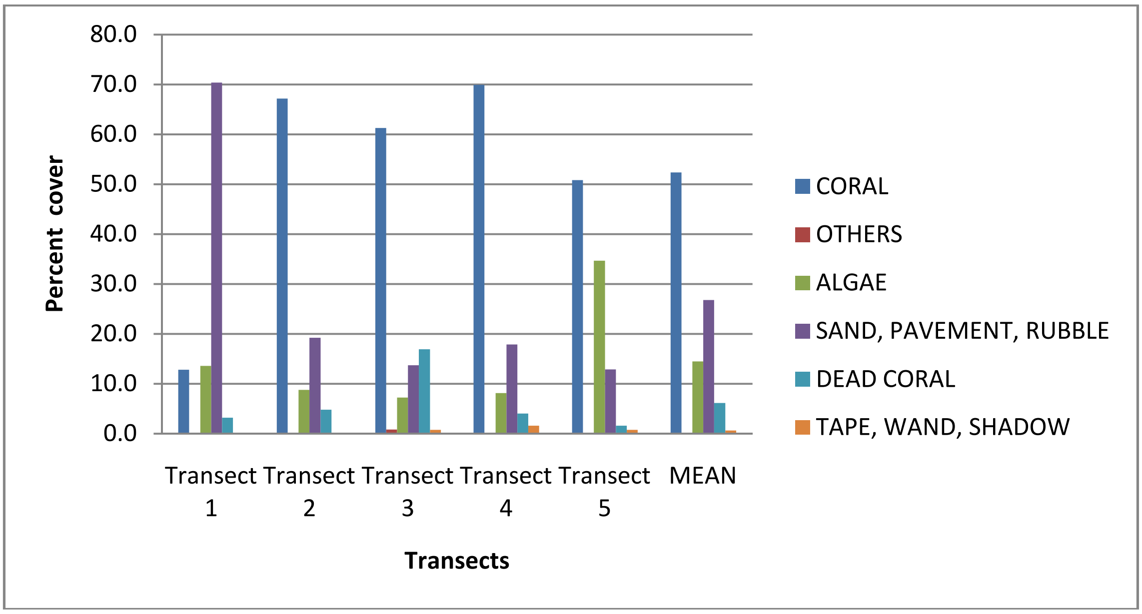

Figure 16: Bar chart of substrate composition

With an average of 52 %, the reef exhibits a good live coral cover. The places sampled are not the ones which show the best coral cover around the island, especially the slightly inshore ones, and therefore the average is reduced.

The present survey carried out during the bleaching event of 2010 also shows that close to 60 % of the corals present were bleached on the transects (Fig 17).

Figure 17: The May-June high sea surface temperature event caused coral bleaching around the island

Site 1 is a low lying inshore coral area with a coral cover of 13 % (table 3) dominated by massives but where digitates are also present (Fig 18). These coral colonies grow close to their upper limit relative to the water column and massives are often flat topped. This is on the outer side of the sand bank and abiotic substrate, in particular, sand dominates the area, forming a mat with the turf algae that covers the pavement.

Figure 18: shallow coral area on the outer side of the sand bank

On the outer reef, transect 2, 3 and 4 have a live coral cover between 60 and 70 %. The 1998 bleaching event did not affect this part of the Maldives majorly, which explains the high live coral cover in these areas. Transect 4, which was in slightly deeper waters already shows a decrease in the percentage of bleached corals. The western side seems to have more tabular forms than the eastern one, which exhibited a lot of branching life forms. Some of the table corals have been affected by bleaching and sedimentation and have died. Dead corals account for 17 % on transect 3.

Figure 19: Near transect 3, branching corals and dead tabular life forms.

Transect 5 is slightly inside the reef crest. In this area, the reef is also high and colonies are predominantly digitates (Figure 20), before descending into the internal lagoon. The wave action and turbidity from the island result in a slightly lower coral cover (51 %) than on the reef edge. A high density of small colonies is present at the site (Fig. 20), and the coral cover may improve in the next few years if these colonies can survive.

Figure 20: the reef crest near transect 5

4.5. *Methodology*

4.5.1. Water Quality

For testing of physical and chemical parameters, empty plastic water bottles are flushed with the water and then filled with the same, collected at mid depth. The bottles were then promptly stored in ice boxes. At the time of the study, no laboratories could carry out the required tests in Male'.

4.5.2. Topographic Survey

A survey of the area concerned was carried out using a total station and a prism. Levels were recorded as well as horizontal positions relative to fixed benchmarks on the island. During the survey, remarks on the substrate types at each point were also taken for further analysis. All the survey data was analyzed using Microsoft Excel and AutoCAD.

4.5.3. Marine Environment

4.5.3.1. *Photographic transects*

Photographic transects were carried out to assess benthic cover of the six reef slope sites. Map observation prior to field survey enabled to determine the areas to characterise, and emphasis has been given to areas the most likely to be impacted as well as a control site which is situated away from the construction areas. However the exact site locations were chosen only during field observations in order to adapt the survey to the reef patterns.

Observation of the entire area was necessary prior to carrying out transects because the operator had to choose a survey site with a representative pattern in terms of species and homogeneity. Once chosen, the operator randomly took 10 photos in line at a depth between 1 and 3 metres to avoid any bias.

For each site, pictures have been analyzed using CPCe software. It enables to randomize 25 points per picture and attribute benthic data for a quantitative and qualitative survey. Each photo result is automatically grouped in a table presenting the means and standard deviation of each benthic substrate groups.

4.5.4. Impact Identification Methodology

Impacts on the environment are divided into two main categories: impacts during construction and impacts during operations.

4.5.5. Impacts during construction

The impact prediction methodology for constructional impacts starts with the identification of the potential impact area from the development. There is, in this category a difference made between direct physical damage and indirect impacts, for example, the direct and indirect impact which could arise from turbidity plumes. Therefore, the extent of the damage area very often follows natural features, such as shoreline and streamline of hydrodynamic patterns.

Once the location was defined, the activities taking place at the site were listed and their impacts on the environment were identified. The impacts were predicted using the following:

- The results of field surveys, along with consultations with project manager and engineers
- Impact prediction was also based on experience from similar projects carried out previously.

Finally, the magnitude of the impact was inferred based on the conditions at the site and experience from previous projects.

4.5.6. Impacts during operations

For the operational impacts, the process starts with the identification of the factors, which potentially differ from the existing conditions before the works, and the situation once the works are completed. The impacts are mostly linked to the Shore line and to the coastal dynamics of the island; however the guests’ activities can also significantly impact the environment.

4.5.7. Impacts ratings

The results from the survey presenting the natural environment in the considered area were then used to assess how the changing conditions will affect the existing environment. The significance of the impacts were predicted based on the experience gathered over years of observations, the magnitude and the duration of the exposure to changing condition as well as the long lasting changes caused to the natural processes. The negative impacts on the environment have been considered in the worst-case scenario in order to emphasize the need for mitigation and try to minimize the impacts. The importance of each impact was rated along a scale from very negative (---) to very positive (+++). When the impact is not very significant, it is stated as negligible.

4.5.8. Limitations in impact prediction

Even though a thorough brainstorming takes place when assessing the impacts, there is always a possibility for some of the impacts to have been disregarded, either that they have not been noticed in the past or that the effects and causes have not been related. Therefore there is an intrinsic limitation due to the limitation of our knowledge itself.

The lack of previous studies or careful monitoring creates a lack of information as to the extent and magnitude of the impacts encountered in other similar cases. Therefore, in many cases it is difficult to ascertain the significance of impacts, which remains subjective to the field experience of the consultant and observations of the proponent.

There is often a discrepancy between the understanding of the consultant and the work methods carried on site by the contractor. Even though the environmental follow up of the project is supposed to reduce these discrepancies, it is clear that there is an inherent risk of misunderstanding.

Furthermore, there is always a possibility that uncertainties about related decisions such as planning, negotiation, coordination, etc., affect the accuracy of prediction in EIA process.

5. ASSESSMENT OF THE SIGNIFICANT EFFECTS

5.1. *Description of Impacts on the Natural Environment*

5.1.1. Disturbance of sea bed

The top layers of the sea bed will be disturbed in the project area. It is colonized by an array of living organisms such as worms, shells and echinoderms etc. These will be exposed and suspended into the water column when the excavator and the sand pump operate. Most of these will be eaten by the fish, in particular wrasses, which are not hindered by the turbid conditions. On the other hand some fish, such as gobies, will lose their habitat and could fall prey to other fish when they move away in search of a new habitat. The concerned species usually have very short life cycles, and colonization of the area after the end of the disturbance will be rapid.

5.1.2. Alteration to water flow and sediment transport

The current sediment transport even though mostly natural to the island is resulting in the erosion problems and island instability mentioned in this report, and therefore the project is looking at modifying them slightly to improve the situation. In addition to providing direct protection to the affected areas, the project will aim to alter wave and current patterns to prevent the southern coast from eroding and if possible accumulate sand in a more southern position. It is therefore expected that the impact from the project will be positive for the island stability.

5.1.3. More durable structures without jumbo bags

Previously the structures have been made with jumbo bags and plywood planks. The bags, whether put in these structures or at the top of the beach face have a tendancy to break apart, especially under the high UV radiation present. The sand then spills and often the empty bags arewashed away by the tides and waves. These unfortunately can be later entangled in the corals or eaten by fish, resulting in the death of marine life and loss of habitat.

5.1.4. Noise, smell and other disturbances to habitat

When excavating, some material will have to be carried to the disposal area using different machinery. These will usually emit a fair amount of black smoke which will disturb the habitat. Also the noise pollution from the machinery will scare the wildlife and birds in particular will not be able to roost in these areas during construction. Given the short time scale of the project, and the fact that the area has already been built, this does not represent a significant threat.

5.1.5. Green house gas emissions

The green house gases that are emitted increase the global world emission, which contributes to the increase in the global warming effect. The overall amount, of course, is very limited compared to the general fuel consumption in the world, and even at the scale of the result will only represent a few percent of the resort output. The principal source of fuel consumption during this operation will be the machinery, which will use up to 1500 l of fuel.

5.1.6. Increased aesthetic and structural stability

The area considered will be a major recreation area for the guests and the entire work will directly affect the beach quality. It is expected that the presence of a wider beach in that area will increase the aesthetics enabling the guests to relax on beach by the sea.

6. PROJECT ALTERNATIVES

6.1. *No-project scenario*

If the project does not take place, the island will continue to lose its shoreline and face operational hindrances, when resorts strive to provide the best possible standards to their guests.

In addition, the management will have to continue with the previous ad hoc methods which have a bad environmental impact as mentioned previously.

The maintenance costs will continue to be high, not allowing for the resort to devote means to other important areas.

6.2. *Alternative material*

An alternative solution would be to use sand filled containers made of perforated geotextile allowing the sediment to stay inside the container, while the water is drained through the small openings. Once filled, the smaller bags (2 tons or 5 tons) will be placed using excavator. Geotubes, made with the same fabric can also be used. They are then placed *in situ* and sand pumped from the sandbarge directly. These are very durable and will be installed to create the revetment as highlighted in the photo (Fig 21).

Figure 21: A beach protection revetment installed in R. Maduvvari using Elcorock containers

6.3. *Alternative borrow area*

Different sandy areas are present around the island, where sand could be taken to carry out the beach reclamation and filling of elcorock bags. The *vilu* on the southern side has finer sand, which will be better suited for the beach. It is also closer the project area and will therefore more effort and fuel consumption to be transported to the site.

An alternative would be to sieve the material coming from the harbour basin and use it for these purposes, but this appears unpractical. The sand will be of lesser quality, and the transportation will also be a problem.

6.4. *Alternative structure design*

Another solution to the problem would be to design offshore structures (Fig. 22) in an attempt to reduce the influence of the swell from the south. This is expected to prevent the flow of water from the south towards the shore, making the water flow along the shore and not offshore where the sand bank is present. If the flow is reduced, it is expected that the sand bank will migrate towards the shore, providing more sand for the beach of the island. This could also be beneficial for the coral life where transect 1 was taken as the area will have less sand and could recruit more corals.

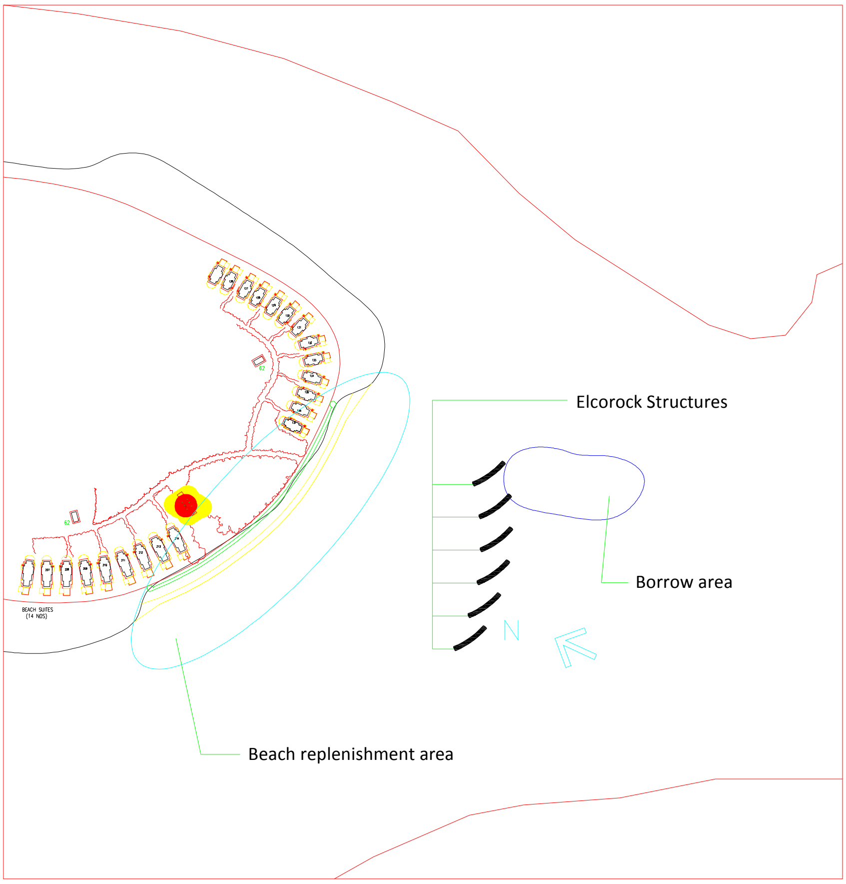

Figure 22: Alternative beach protection structures

It is expected that this solution, even though it offers less guarantee of a stable coastline would benefit the aesthetics of the beach as no rocks would then be placed on it and the sand quality will not be impaired.

6.5. *Removal of existing temporary structures*

The temporary structures present will be removed and the jumbo bags either recycled when possible or considered solid wastes.

7. MITIGATION MEASURES

The practical actions to mitigate or compensate for the significant effects are discussed in the following paragraphs.

7.1. Sediment plumes creation and sedimentation

The revetment, whether made with rocks or sand filed container will be placed first. The sand will thereafter be pumped in between the revetment and the shoreline. The revetment will act as a bundh when the sand is pumped, preventing much of the finer sediment to leave in the water column.

When replenishing the beach, sand will be taken from that area and spread on the outer side of the revetment, so that the pumping can still occur inside the bundh.

7.2. Summary table of impacts and ratings

Table 4: Direct Impacts expected to arise from the project during the construction phase

Activity	Site of Impact	Component	Impacts	Rating	Mitigation	Final rating
Transport of rocks from harbour areal	Eastern coast	Machinery	Green house gas emissions	negligible		negligible
		Unloading and dispatching	Solid waste from the construction material can be released into the environment	-	Waste management practices have to be strictly implemented	negligible
Fill Elcorock bags	Filling area	Storage of solid wastes	Wastes can be dispersed in the environment	-	Waste management practices have to be strictly implemented	negligible
		Transport and disposal	Release of solid wastes in the environment	-		
Removal of jumbo bags and plywood	Southern coastline	Site preparation	Release of solid wastes in the environment	-	Waste management practices have to be strictly implemented	negligible
Sand Pumping	Southern tip of the island	Beach replenishment	Sedimentation and silt plumes will be created	--	Revetment will act as a bundh. More environmentally friendly materials used (Elcorock)	-
Machinery Operation	Project site	Machinery Used	Disturbances to the wild life	-	Speed operations	negligible

Table 5: Indirect Impacts expected to arise from project during the operation phase

Activity	Site of Impact	Component	Impacts	Rating	Mitigation	Final rating
Beach maintenance	Island coastline	Coastal modification	Changes to former water flow and sediment transport. Accumulation of sand on the southern side and erosion controlled at all time.	++		++
	Southern coastline	Sand pumping	Small scale turbidity plume	-	It is expected that sand pumping will not be required very frequently	Negligible

8. MONITORING PROGRAM

Monitoring is the systematic collection of information over a long period of time. It involves the measuring and recording of environmental, social and economic variables associated with the development impacts. Monitoring is needed to;

- Compare predicted and actual impacts
- Test the efficiency of mitigation measures
- Obtain information about responses of receptors to impacts
- Enforce conditions and standards associated with approvals
- Prevent environmental problems resulting from inaccurate predictions
- Minimize errors in future assessments and impact predictions
- Make future assessments more efficient
- Provide ongoing management information
- Improve EIA and monitoring process

The before-impact data collection at Magudhdhuva was carried out during baseline surveys in June 2007. Baseline survey is carried out to quantify ranges of natural variation and/ or directions and rates of change that are relevant to impact prediction and mitigation. A set of reference data was obtained from these surveys, which can be used during the construction and operation phases to evaluate whether the predicted impacts occurred and to test the efficiency of the mitigation measures that will be implemented.

To compare predicted and actual impacts occurring from project activities and to determine the efficiency of the mitigation measures, environmental impact monitoring and a mitigation monitoring are carried out. This type of monitoring is targeted at assessing human impacts on the natural environment. By monitoring the actual impacts, the environmental risks associated with the project can be reduced. Impact monitoring is supported by an expectation that at some level, anthropogenic impacts become unacceptable and action will be taken to either prevent further impacts or re-mediate affected systems. Mitigation and monitoring, aims to compare predicted and actual (residual) impacts, and hence to determine the effectiveness of mitigation measures.

In summary, environmental monitoring can:

- Illustrate the extent of environmental effects and resource losses
- Provide scientific information on the response of the environment to human activities and mitigation measures
- Provide data that can be used in the environmental auditing for management purposes.

All monitoring activities will be carried out under the supervision of the environmental consultants. The details of the monitoring program are given in Table 6.

Table 6: Environmental Monitoring Plan for Magudhdhuva

Monitoring Parameter	Phase	Methodology	Indicators	Sampling Frequency	Estimated Cost
Coastline	Construction/ Operational	Beach level survey	• Erosion or accretion • Changes to the beach profile • Sand movement around island	Every 6 months	USD 1000/ survey
Coastline	Construction/ Operational	Photography	• Erosion or accretion • Changes to the beach profile • Sand movement around island	Every 6 months	USD 200/ survey
Benthic substrate	Construction/ Operational	Photo transects	• Percentage live coral cover and other benthic substrates	Just after construction and every 6 months following that	USD 1000/ survey
Seawater quality	Operational	Test of the seawater parameters	• Salinity, Turbidity, COD, pH, nitrate, suspended solids	Just after construction and every 6 months following that	USD 500/ survey

Summary reports will be submitted to the Ministry of Tourism, Arts and Culture according to the requirements of the Ministry and the Ministry of Housing, Transport and Environment. This report will include the results of the monitoring carried out on G. Dh. Magudhdhuva according to the monitoring plan.

9. Declaration of the Consultant

I certify that the statements made in this Environmental Impact Assessment study are true, complete and correct.

Name: Mariyam Rozlyn Saleem

Signature:

Date: 21/08/2010

APPENDICES

Ahmet Aydeniz Construction Co. Inc.
Maldives Branch

Aydeniz Group

Ref. No : AA-MB/2010/M98
Date : August 18th, 2010
Subject : Environmental Impact Assessment for Coastal Works

Mr. Mohamed Aslam

Minister of Housing and Environment

Ministry of Housing and Environment

Republic of Maldives

Dear Sir,

Re: Environmental Impact Assessment for Coastal Works at G. Dh. Magudhdhuvaa

As per the requirements of the EIA, we hereby confirm our commitment to act accordingly as proposed in the EIA report attached herewith.

Yours Sincerely

Murat Dilici
Project manager

18/08

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بسم الله الرحمن الرحيم

Environmental Protection Agency
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Environmental Protection Agency
Male', Republic of Maldives

Terms of Reference for Environmental Impact Assessment for the proposed beach replenishment at Magudhdhuvaa, G.Dh. Atoll

The following is the TOR based on the points discussed in the scoping meeting held on the 06th April 2010, for undertaking the Environmental Impact Assessment for the proposed beach replenishment at Magudhdhuvaa Resort, G.Dh. Atoll.

This document is a legally binding document prepared after consultation with relevant stakeholders and the EIA report must follow the activities under this ToR while it should not be limited to only the matters identified.

1. Introduction - Identify the development project to be assessed and explain the executing arrangements for the environmental assessment. Describe the rationale for the development and its objectives. Provide the background information on the project and its costs. Justification should be given into consideration purpose and objectives of the project.

2. Study Area - Specify the boundaries o f the study area for the assessment as well as any adjacent or remote areas that should be considered with respect to the project

3. Scope of Work - The following tasks will be performed:

Task 1. Description of the Proposed Project –The description of the project should consider the following.

a) Provide a brief description of the proponent, project justification, full description of how the project activities will be undertaken including work methods,
b) A scaled site plan showing the location of proposed activity, and the project schedule.
c) Quantified project outputs (e.g. length of protection, quantity of sediment pumped) and inputs (e.g. manpower, machineries, energy and materials)

Task 2. Description of the Environment - Where baseline data is to be collected, careful consideration must be given to the design of the methodology and sampling programme. Data collection must focus on key issues needing to be examined for the EIA. Consideration of likely monitoring requirements should be borne in mind during survey planning, so that the data collected is suitable for use as a baseline to monitoring impacts.

Assemble, evaluate and present baseline data on the relevant environmental characteristics of the study area (and disposal sites), including the changes to the existing environment in light of monitoring conducted after the commencement of the initial project.

a) Physical environment: including wind, wave and currents based on available secondary data and primary data collected at the site.

b) *Biological environment: Detail coastal and marine environmental conditions of the impacted area. Marine environment shall include baseline reef status (the benthic flora and fauna) at selected sites with seawater quality. (The seawater quality parameters shall be; temperature, turbidity, dissolved oxygen, salinity, total suspended solids, pH, Nitrate, nitrite, phosphate, and BOD).*

c) *The coastal environment shall include erosion and accretion patterns of the island with minimum of 4 beach profiles and existing shoreline map*

Provide description of the work methodology for collection and compilation of report, approach to specific assumptions and predictions made identification of information and data gaps and discussions of major limitations.

All survey locations shall be referenced with Geographic Positioning System (GPS) including sampling points, reef transects, vegetation transects, manta tows and soil sampling sites. All water samples shall be taken at a depth of 1m from the mean sea level or mid water depth for shallow areas. At least two benchmarks shall be used when undertaking the baseline assessments. The report should outline the detailed methodology of data collection utilized to describe the existing environment.

Characterize the extent and quality of the available data, indicating significant information deficiencies and any uncertainties associated with the prediction of impacts. All available data from previous studies of the island, if available should be presented. Geographical coordinates of all sampling locations should be provided. All water samples shall be taken at a depth of 1m from the mean sea level or mid water depth for shallow areas. The report should outline the detailed methodology of data collection utilized to describe the existing environment. Baseline conditions should be presented for the marine environment.

Task 3. Legislative and Regulatory Considerations - Describe 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.

Task 4. Determine the Potential Impacts of the Proposed Project – Identify impacts related to the whole project. Distinguish between significant impacts that are positive and negative, direct and indirect, and short and long term both during construction phase and operational phase. Identify impacts that are cumulative, unavoidable or irreversible. Particular attention shall be given to impacts associated with:

- *Impacts on marine environment*
- *Impacts to the coastal dynamics of the island*

Task 5. Analysis of Alternatives to the Proposed Project. – Describe the alternatives examined for the proposed project that would achieve the same objective including the "no action alternative. This should include; alternative technologies, material, locations to the proposed components of the project with economic, environmental and social factors taken into consideration. Distinguish the most environmentally friendly alternatives. Suggest alternatives with justifications in particular in terms of borrow area

Task 6. Mitigation and Management of Negative Impacts – Identify possible measures to prevent or reduce significant negative impacts to acceptable levels with particular attention paid to dispersal/sedimentation control during beach replenishment activities. Mitigation measures should be *identified for both construction and operational phase. Cost of the mitigation measures, equipment and resources required to implement those measures. A commitment regarding the mitigation measures should be submitted by the responsible person.*

Task 7. Environmental Management Plan and Monitoring – A reasonable time frame should be outlined for monitoring focused on the construction and operational phase. Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan for waste disposal operations. Detail of the monitoring programme including the physical and biological parameters for monitoring, frequency, duration and cost as well as commitment from responsible person, detailed reporting time table and ways and means of undertaking the monitoring programme must be provided.

Task8. Methodology: Explain clearly the methodologies used for data collection, making predictions and data gaps and the information on the uncertainties and assumptions involved in interpreting the data.

Task 8. Stakeholder Consultation – Major stakeholder consultation to include Ministry of Tourism Arts and Culture, Environment Section of Ministry of Housing, Transport and Environment, Ministry of Civi lAviation and communication (regarding seaplan anchor area), Ministry of Fisheries (regarding burrow areas if outside the resort boundary) and any other relevant stakeholder including the engineers/designers and management and staffs of the resort. EIA report should include a list of people/groups consulted and the methodology of consultation.

Presentation - The Environmental Impact Assessment report, to be presented in print and digital format, will be concise and focus on significant environmental issues. It will 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 will be organized according to, but not necessarily limited by, the outline given in the Environmental Impact Assessment Regulations, 2007.

Timeframe for submitting the EIA report - The developer must submit the completed EIA report within 3 months from the date of this Term of Reference.

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14th April 2010

Environmental Protection Agency
Malé, Republic of Maldives

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Miller, M.W. & Sluka, R. D., 1999. Patterns of seagrass and sediment nutrient distribution suggest anthropogenic enrichment in Laamu Atoll, Republic of Maldives. Marine Pollution Bulletin, 38 (12) : 1152-1156.

Bers,A.V., 2005. Biodiversity assessment for Maldives' Baa Atoll. Baseline information for UNDP's Atoll ecosystem-based conservation programme. UNDP Maldives – Ministry of Environment, Energy and Water Maldives. 47 pp.

Environmental Impact Assessment Team

The EIA for the development of the Resort was carried out by Seamarc Pvt. Ltd. with an experienced professional team lead by Ms Mariyam Saleem (EIA Consultant No. EIA05/07). Following are the Curriculum Vitae of the team members:

CURRICULUM VITAE of MARIYAM SALEEM

PERSONAL DETAILS

Name: Mariyam Rozlyn Saleem

Nationality: Maldivian

Gender: Female

Date of Birth: 1st of September 1974

Marital Status: Married with two children

Languages: Dhivehi, English and French Present address
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Fax: (960) 336575
Email: marie@seamarc.com

EDUCATIONAL QUALIFICATION

SECONDARY EDUCATION: 1991-1993 Woodstock School, Mussoorie, U.P, India
High School Diploma

May 1993 - **Advanced Placement**
1981-1991 Aminiya School, Malé
Republic of Maldives
GCE O' level

TERTIARY EDUCATION: **Bachelor of Science** (Marine Biology)
July 1996 - June 1997 - University of the South Pacific, Fiji
July 1997 - July 1999 - James Cook University, Australia
Conferred in August 1999

Master of Applied Science (Protected Area Management)
James Cook University February 2002 – April 2004

Conferred in May 2004

EMPLOYMENT HISTORY

28.06.00 – ongoing	Environmental Manager	Seamarc Pvt. Ltd.
08.05.04 – ongoing	Senior Research Officer	Marine Research Centre Min. of Fish, Agri. & Mar. Res.
28.07.99 – 08.05.04	Research Officer (Grade 3)	Marine Research Centre Min. of Fish, Agri. & Mar. Res.
29.11.94 - 30.06.96	Research Assistant	Marine Research Section Min. of Fish, Agri. & Mar. Res.
23.08.93 - 28.11.94	Marine Biology Trainee	Marine Research Section Min. of Fish, Agri. & Mar. Res.

WORKSHOPS AND SEMINARS ATTENDED

Workshop held on the "Introduction of Reef Resources Management Handbook", Vaavu & Meemu Atoll, 1994

Involved in the International Coral Reef Initiative Workshop 1995, Bandos Island Resort.

Workshop on Integrated Reef Resources Management 1996, MCSE, Malé.

CORDIO Workshop on Survey Design and Data Analysis 23-30 January 2000, MRC, Malé'.

Workshop on Monitoring the Social, Economic and Environmental Impacts of Tourism in the Maldives 27 January 2000, Nasandhura Palace Hotel, Malé.

Introduction and demonstration of Marine GIS to conduct the spatial analysis for fisheries and oceanographic data 27 March 2000, MRC, Malé.

Training Workshop on Climate Change Vulnerability and Adaptation Assessment 17-27 April 2000, Bandos Island Resort, Maldives.

GCRMN Training Workshop on Coral Reef Survey Design and Data Analysis 1-8 May 2000, Chennai, India

First Regional Workshop on Conservation of Biodiversity 15-18 July 2000, AA. Mahibadhoo, Maldives

Third Regional Workshop on Conservation of Biodiversity 25-26 August 2000, Seenu Gan, Maldives

Fourth Regional Workshop on Conservation of Biodiversity 15-16 September 2000, Baa Eydhafushi, Maldives

Fifth Regional Workshop on Conservation of Biodiversity 13-14 October 2000, Meemu Muli, Maldives

9th International Coral Reef Symposium 23-27 October 2000. Bali, Indonesia

Sectoral Workshop on Conservation of Biodiversity 6-7 November 2000, Hulhulé, Maldives

GCRMN Evaluation Meeting Phase II March 2001, Male', Maldives

GCRMN Database Evaluation Meeting June 2001, Colombo, Sri Lanka

National Workshop on Conservation of Biodiversity September 2001, Male', Maldives

Workshop on Protected Areas: IUCN categories November 2001, Male', Maldives

Workshop on Code of Conduct for Responsible Fisheries January 2004, Male', Maldives

10th International Coral Reef Symposium 28 June – 2 July 2004, Okinawa, Japan

Technology Needs Assessment for Climate Change: First Workshop on Technology Needs Assessment Methodology 22 – 24 November 2004, Hulhule', Maldives

Inception workshop on the "Preparation of National Adaptation Plan of Action" (NAPA) Project 25 November 2004, Hulhule', Maldives

Inception workshop on AEC – AEC Baa Atoll Project July 2005, Hulhule', Maldives

First Workshop on the Development of a National Waste Management Strategy December 2005, Hulhule' Island Hotel, Maldives

Second Workshop on the Development of a National Waste Management Strategy May 2006, STELCO Seminar Room, Male', Maldives

National Biodiversity Strategy and Action Plan (NBSAP) and National Development Plan 7 Review Retreat – Atoll Ecosystem Conservation Project and National Climate Change Project, July 2006, Paradise Island, Maldives

NAPA Workshop on Identifying and Prioritisation of Adaptation Measures, September 2006, Bandos Island Resort, Maldives

Roundtable on Coastal Erosion and Disaster Risk and Vulnerability, September 21, 2006 - Male, Maldives

Regional Resource Coordination and Mobilisation Workshop for the Long-term Management and Conservation of MCPAs in South Asia, September 2006, Colombo, Sri Lanka

Environment and Disaster Risk Assessment of Islands in the Maldives, December 2006, Hulhule' Island Hotel, Maldives

SAARC Expert Group Consultation on Coastal Zone Management, April 2007, Dharubaaruge, Male', Maldives

Workshop on the Development of a Grouper Management Plan, April 2007, Dharubaaruge, Male', Maldives

National Consultation on the Fisheries Sector Master Plan, May, Islamic Centre Conference Hall, Male', Maldives

WORK EXPERIENCE

Was involved in the Integrated Reef Resources Management Programme, MRS & BOBP. This project was carried out in Vaavu, Meemu, Faafu and Dhaalu atolls and was focused on working with the communities to develop sustainable reef resource management. Importance was given to environmental awareness and community involvement in the process of management.

Was involved in the National Turtle Conservation Program and my main task was to liaise with the researchers at the turtle hatchery at Vaadhoo resort, Male' Atoll.

Was involved in setting up a system for regulating and monitoring coral and sand mining in the Maldives. My task was to give expert advice on the coral reef environment in the development of the Regulations.

Carried out the environmental component of two bids for resort development at Hudhufushi Island, Lhaviyani Atoll. The emphasis of my work was on Ecological values and relationships as well as conservation.

Carried out the environmental component of the Proposed Information Technology Project in the Maldives for ADB. My task was to analyse and discuss the existing marine environment and the predicted impacts from the proposed development as well as mitigation measures and monitoring.

Annual monitoring for resorts: Velavaru Island and Reethi Beach Resort where my main responsibility is to carry out the monitoring of the marine environment including field work and report writing.

Carried out the Environmental Impact Statement for Thari Village Resort for the Harbour enhancement Project and my area was to assess the marine environment as well as the terrestrial environment and associated impacts.

Project Manager, GCRMN Socio-economic Monitoring Project, MRC, Maldives. My main task was to carry out the field work including interviews with the community and coordinating the project.

GCRMN Coral Reef Database Development Project, Seamarc Pvt. Ltd., Maldives. My main tasks were testing the database, preliminary data entry, developing the help file and the data entry guide.

National Coral Reef Monitoring Program (Global Coral Reef Monitoring Network) team member. My main task within this project was to collect field data which contributes to the National Coral Reef Database.

CORDIO (Coral Reef Degradation in the Indian Ocean) Project team member. My main responsibility was to collect field data on coral reef recovery and compile it. I was also in charge of data collection for the project carried out to assess the impacts of the 1998 Coral Bleaching on Tourism in the Maldives. This involved questionnaire based interviews with departing tourists at the airport.

Maldives Climate Change Vulnerability and Adaptation team member. My area was to give expert advice on coral reef related issues.

Focal point for GEF Conservation of Coral Reefs in the Maldives Project, PDF B. My task was to give expert advice on coral reefs at the community workshops held in the atolls as well as report writing. I was also involved in the field data collection carried out in Baa Atoll.

Focal Point for TNA Climate Change Project. My task was to give expert advice on the marine environment associated with climate change issues.

Worked on the preparation of a report on the Status of the Shark Fishery in Maldives. This involved field trips to the northern and southern atolls of Maldives to collect socio-economic data on the fishery.

Worked on the preparation of a report on the Aquarium Fishery of Maldives. This involved compilation and analysis of export data and interviews with exporters.

Preparation of report on Cost Estimation and Willingness to pay for waste management in Baa Atoll as National Consultant for AEC project.

Presently working on the Management of the Aquarium Fishery of the Maldives.. It involves working closely with the exporters and Maldives Customs Services to develop tools and guidelines for monitoring and management.

ADDITIONAL SKILLS

Computer literate - Fluent in Microsoft Windows
Languages spoken - Fluent in Dhivehi (mother tongue) and English
French (intermediate)

REPORTS & PUBLICATIONS

Anderson, R.C. & M.R. Saleem. (1994). Seasonal and Regional Variation in Livebait Utilization in the Maldives. In: *Rasain,* M. H. Maniku (ed.), Vol 14. Ministry of Fisheries and Agriculture. pp: 162-182.

Anderson, R.C. & M.R. Saleem. (1995). Inter-annual Variations in Livebait Utilization in the Maldives. In: *Rasain*, M. H. Manik (ed.), Vol 15. Ministry of Fisheries & Agriculture. pp: 194-216.

Ahmed, H., Mohamed, S. & M.R. Saleem. (1996). Exploitation of Reef Resources - Beche-der-mer, Reef Sharks, Giant Clams, Lobsters and Others. In: Workshop on Integrated Reef Resources Management in the Maldives, D.J. Nickerson and M.H. Maniku (eds.), Bay of Bengal Programme, Madras. pp: 137-165.

Ahmed, H. & M.R. Saleem. (1999). *Marine Flora and Fauna of the Maldives*. Biodiversity theme paper prepared for the Ministry of Home Affairs, Housing and Environment. Unpublished manuscript.

Ahmed, H., Le Berre, T. & M.R. Saleem. (2000). Environmental statement for Thari Village Beach reclamation and associated harbour development project. Unpublished report.

Ahmed, H., Le Berre, T. & M.R. Saleem. (2000). Annual environmental monitoring report – Velavaru Island Resort, Maldives. Unpublished report.

Ahmed, H., Le Berre, T. & M.R. Saleem. (2000). Annual environmental monitoring report – Reethi Beach Resort, Maldives. Unpublished report.

Cesar, H., Waheed, A., Saleem, M. & D. Wilhelmsson. (2000). Assessing the impacts of the 1998 Coral Bleaching on Tourism in the Maldives and Sri Lanka. Report prepared for CORDIO Programme.

Ahmed, H., Le Berre, T. & M.R. Saleem. (2001). Initial Environmental Examination for Proposed Information Technology Project in the Maldives. Report prepared for ADB.

Jameel, A., Hameed, F., Shakeel, H., Ahmed, H., Shareef, H.A., Shareef, M., Saleem, M., Aslam, M., Faiz, M., Zuhair, M., Hassan, M.Z. and S. Saeed. (2002). *National Biodiversity Strategy and Action Plan of the Maldives*. Ministry of Home Affairs, Housing and Environment, Male', Maldives.

Zahir, H., Clark, S., Rasheed, A. and M.R. Saleem. (2002). Spatial and temporal patterns of coral recruitment following a severe bleaching event in the Maldives. In: O. Linden, D. Souter, D. Wilhelmsson and D. Obura (eds.) *Coral Reef Degradation in the Indian Ocean: Status report 2002*. CORDIO, Sweden. 125-134 pp.

Saleem, M.R. (2004). Monitoring management effectiveness of Kuda Huraa Dive Site, North Male' Atoll, Maldives. Report submitted for the degree of Master of Applied Science in TESAG, James Cook University, Australia.

Saleem, M.R. and M.S. Adam. (2004). Review of the Aquarium Fishery of the Maldives. Unpublished report.

Saleem, M.R. and M.S. Adam. (2004). Status of the Shark Fishery of Maldives. Dhivehi report prepared for the Fisheries Advisory Board of Maldives.

Saleem, M. R. and M. Hameed. (2006). Willingness to Pay for Waste Management in Baa Atoll. Report prepared by Seamarc for the AEC Baa Atoll Project.

REFEREES

Dr. Abdulla Naseer
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Tropical Environmental Studies and Geography
James Cook University
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Australia
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CURRICULUM VITAE of THOMAS LE BERRE

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Kulhidhoshu Magu
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Mobile: 778 76 42
E-mail : thomas@seamarc.com

32 y. o

Married

2 children

Main Compétences

- **Trilingual** (french (mother tongue) / english (fluent) / divehi (maldivian)), **bicultural** french-maldivian.
- Environmental consultant, coastal oceanography, Programming (Delphi)
- Worked overseas (Maldives, Australia).

Education

1995 -1998 **Engineering Diploma (ENSTA, Paris),** a 3 year-formation, admission after preparatory classes, ending Baccalaureat + 5 years. Participated in two exchange programs with KTH, Stockholm, Sweden (6 months in second year), studies in groundwater management and fluid mechanics, and JCU, Townsville, Australia (1 year in third year), studies in environmental engineering, coral reef geology and fluid mechanics.

1992 -1995 **Mathematic superior and special : Preparatory classes for selective examination to the french engineering schools (major in Physics and Chemistry)** Lycée Chateaubriant, Rennes. This is to prepare the selective examination to enter the french "Grandes Ecoles".

1992 **Baccalauréat C (Math-Physics, distinctions)**. Lycée Lesage, Vannes. French equivalent to A-levels

Professionnal experience

1999 - 2008 **Setup and run an Environmental Consultancy in the Maldives - Seamarc Pvt. Ltd.** (Systems Engineering and Marine Consulting)

The major contracts in which I was involved were:

- Environmental Impact assessment and design for coastal development of Vabboa Huraa (Four Seasons Resort, HPL)
- Coral Monitoring of T. Vilufushi, which was undergoing major dredging operations, dredging works and consultancy for Boskalis International.

- Environmental Impact Assessment for the development of a fisheries project in Addu Atoll, for MIFCO (Maldives Industrial Fisheries Company)
- Environmental Impact Assessments for the development of Herethere as a tourist resort, for MTDC (Maldives Tourism Development Corporation).
- Work as national consultant for the development of the Integrated Climate Change Strategy. Includes GEF (Global Environmental Facility) NAPA (National Adaptation Plan of Action) project, NCSA (National Capacity Self Assessment) project and TNA (Technology Need Assessment) project. Remains member of the National Climate Change Technical Team.
- Environmental Impact assessment and design for coastal redevelopment of Kuda Huraa (Four Seasons Resort, HPL)
- Environmental Impact Assessment and coastal designs for the redevelopment of K. Kandooma. redevelopment works not yet started (Leisure Hollidays, HPL Maldives)
- Erosion control at Baa Landaa Giraavaru (upcoming Four Seasons resort, LGPL) (on going).
- Coral translocation as a mitigation measures for development impacts at Baa Landaa Giraavaru (upcoming Four Seasons resort) (on going).
- Setting up of a fish laboratory to breed *Amphiprion nigripes* and other ornamental species at Baa Landaa Giraavaru (upcoming Four Seasons resort) (on going).
- Supervising clearing of 45 hectares plot in L. Gan for the French Red Cross utilizing man power from the IDP camps and villages in L. Gan.
- Constructed a 50 feet boat in the Maldives in order to carry out research and tourism activities. Subsequently managed this activity (on going).
- Bid documents for a number of resort islands, regularly obtained among top ranking for environmental concepts.
- Local Environmental counterpart for BCL (Bangladesh Consultant Limited) for a IDB funded project for the government of Maldives about Focus Development Islands.

- Research on *Amphiprion nigripes* (Maldives clownfish for aquarists) and export of 500 individuals maricultured by the Marine Research Center of the Government of Maldives.
- Bid document and Environmental Impact Assessment for the development of a hotel/marina in H.A. Dhonakulhi for Turquoise Pvt. Ltd.
- Environmental and research programs for restoration and rejuvenation of reefs affected by global warming and bleaching using Reef Balls, for Four Seasons Resort (on going).
- Consultancies for the dredging operations and coastal works at Medhufinolhu (One and Only at Reethi Rah).
- Database design and programming for coral reef resources management for the governments of India, Sri Lanka, and the Maldives, for IOC/UNESCO through the GCRMN (Global Coral Reef Monitoring Network)
- Analysis of salinity and temperature profile data at the mouth of the Herbert and Burdekin River in North Queensland, Australia, for James Cook University.
- Environmental auditing of tourist resorts for Velavaru (Turtle Island Resort) and Fonimagoodhoo (Reethi Beach Resort) since 2000.
- Feasibility study for power generation with wind mills in the Maldives.
- Translation into French of books pertaining to the Maldives (Marine Life of the Maldives, by Neville Coleman, Dive Maldives, by Tim Godfrey).

Moosa Athfal (CV).

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C. Address: H. Sandhubarakaage

Dhilleemagu, Malé, Maldives

Tel: +9609666676, +9607730443

E-Mail: athfal@gmail.com

Summary

Able to handle work in a cooperate environment; manage projects with ease, good knowledge of the environment and a friendly attitude.

Experience

2008 – 2010 - TENNSSOR HOLDINGS PVT.LTD

Tennssor Surveying and Design Solutions (Manager)

Tennssor Holdings Pvt. Ltd is a premier company building its reputation of Quality, Trust, Craftsmanship and Expertise throughout Maldives. A team of Motivated Professionals, understanding your development needs requirements to meet and cater to your utmost needs. Tennssor Holdings Pvt. Ltd is in the business of building and realizing your dreams. Always in tune with the latest market trends and supported by our impeccable service and excellent quality of work.

Responsibilities

- Manage a team of 7 staff's developing technical solutions for the clients.
- Manage and worked on a number of RFP's.
- Liaised with the implementation team once RFP won.
- Followed up with client post sales to ensure satisfaction and on-going business.
- Manage Survey trips and coordinate the project whilst handling the finance.
- Supervise the technical drawings and assist in staff development.

Achievements

- Surveyed and Manage the Data for the project of "Establishment of three Airport Islands in Dh. Kudahuvadhoo, Th. Thimarafushi and Sh. Funadhoo".

- Attend COP15 as a member of the youth delegate which represented Maldives at COP15.

Experience

2008- To present – Development Technologies

Architectural Designer & Drafter (Part time)

The Company is a small company mainly specialized in problems related to sewerage and water. Also the company has been expanding their spectrum of work and has been working on small real estate projects.

Responsibilities

- Design and Draft Houses according to government regulations.
- Follow up with client post sales to ensure satisfaction and on-going business.
- Manage all the administrative works regarding the job title.

Experience

2010 – Present - System Engineering and Marine Consultancy (SEAMARC Pvt.Ltd)

Surveyor

The aim of the company is to provide quality advice on dealing with environmental problems arising from the rapid developments in infrastructure taking place in the Maldives.

Responsibilities

- Coastal geomorphology and research consultancy.
- Coastal engineering and hydro graphic analysis and carry out research and feasibility studies in aquaculture.
- Environmental impact assessment.
- Surveying, Beach monitoring as well as creating awareness programs.

Achievements

- Participate in the National Environmental Guidelines convention.
- Analyze 30 yrs of National Meteorological Data and implement it on the EIA's.

Experience

2002-2005 – Environment Research Centre (ERC)

Research Assistant

A Centre Created by the Government to do Research and Find mitigation and sustainable methods to protect the vulnerable environment of the Maldives.

Responsibilities

Area of work included:

- Coastal geomorphology and research.
- Coastal engineering and hydrographic analysis and research.
- Integrated coastal zone management.
- Environmental impact assessment.
- Geophysical information assessment.
- Surveying, Beach monitoring as well as creating awareness programs.

Education

Completed Advanced Certificate in AutoCAD – 2004

Completed A' Levels Jan 2002 – Centre for Higher Secondary Education

Completed O' Levels Jan 1998 – Majeedhiya School

Technical Skills

- Good Knowledge of Microsoft Office Package.
- Excellent Knowledge and Practice of AutoCAD.
- Fairly Good in Written and Spoken English.

Interests

Cooking, Swimming, Music and National Geographic Channel

Referee

Mohamed Zahir, Director General

Ministry of Housing, Transport and Environment

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