

# ENVIRONMENTAL IMPACT ASSESSMENT

For the Proposed  
Redevelopment of  
Vaadhoo Island resort, South  
Male' Atoll, Maldives



**Proposed by**

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## **4 Non Technical summary**

This report discusses the findings of an environmental impact study undertaken by Water Solutions Pvt. Ltd. for the redevelopment of Vaadhoo resort in south Male' atoll.

This project is proposed by Unique Resorts Pvt Ltd, to redevelop the island of Vaadhoo. Vaadhoo is located on the northern rim of South Male' atoll and has been operational as a resort since 1995. Vaadhoo is one of the earliest resorts that came in to operation in south Male' atoll. This is one of the reasons why the proponent wishes to redevelop the island in order to compete with other resorts and meet the market demands currently prevailing in the tourism industry. The idea is to renovate the island by upgrading and constructing new facilities in the resort. At present, the island's infrastructure is old, which is a barrier to provide additional and improved quality services without undertaking a redevelopment. Hence, the proponent wishes to redevelop the island with enhanced additional facilities in order to increase the standard of the resort and to market for new clients at a higher rate. The project involves demolition, modification and construction of new structures within the boundary of the island and its lagoon.

The report has identified that the impacts of the redevelopment process will mainly be felt on the marine environment since the redevelopment is mainly focused on the lagoon. Impacts on the marine environment will be felt through sedimentation and siltation caused by the construction activities on the lagoon and the indirect impacts on the coral reef, during this period. Coastal impacts are going to be felt through changes and modification in the long shore sediment transport patterns. Baseline data has, therefore, been collected in order to monitor the changes to the marine and coastal environment which will be identified in periodical monitoring reports.

Although several alternatives to the proposed project were considered, these alternatives cannot be implemented for various reasons. The development concept and objective for this redevelopment is to transform the island in to a high class tourist destination with additional and enhanced services. At the same time, the environmental protection and preservation and operational costs have also been taken in to consideration. Therefore, several design considerations, although initially were considered, it has been avoided due to these reasons. For example, expanding the island by reclaiming land has been rejected as it is expected to be more environmentally damaging than the proposed water villas.

The suggested monitoring programme mainly covers the marine and coastal environmental aspects. These include appropriate areas of the coral reef, marine water quality and beach profiles at designated locations. In addition, groundwater monitoring will be undertaken to assess the improvements to groundwater due to proposed treatment plant.

## **5 Introduction**

This Environmental Impact Assessment report (EIA) has been prepared to fulfil the requirements of the Environmental Protection and Preservation Act, law no. 4/93 for the proposed redevelopment of Vaadhoo island, which is being marketed as Adaaran Prestige Vaadhoo Maldives in South Male' Atoll, Maldives. The project proponent is Unique Resorts Pvt Ltd. At present, the resort has 33 rooms of which 7 are water bungalows.

This report will identify the potential impacts (both positive and negative) of the proposed redevelopment. The report will address 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 in terms of location, construction methods and technologies, design and environmental considerations would be suggested. A mitigation plan and monitoring programme before, during and after the works will also be suggested. This will ensure that the proposed activities are undertaken with caution and appropriate care so as to protect and preserve the natural environment of the island. Figure 1 shows an aerial view of Vaadhoo island taken from the north-west side.

**Figure 1: View of Vaadhoo Island, South Male' Atoll from north-west side. (Photo: April 2007 by Water solutions).**



The major findings of this report are based on qualitative and quantitative assessments undertaken during site visit in March 2008. However, due to unavailability of long term site-specific data, the impact assessment methodology has been restricted to field data collected, consultations, experience and professional judgment. This EIA has been produced in accordance with the EIA Regulations 2007, issued by the Ministry of Environment, Energy and Water on preparing Environmental Impact Assessment studies.

### **5.1 Aims and Objectives of the EIA**

This report addresses the environmental concerns of the proposed redevelopment of Vaadhoo Island Resort. It helps to achieve the following objectives.

- Allow better project planning
- Assist in mitigating impacts caused due to the redevelopment without undertaking EIA
- Promote informed and environmentally sound decision making
- To demonstrate the commitment by the proponent on the importance of environmental protection and preservation.

This EIA is intended to address the potential damage or impacts caused due to the redevelopment and prevent or minimize potentially adverse environmental impacts and enhance the overall quality of the project. This EIA will help stakeholders to make environmentally sound decisions and ensure minimal damage to the environment and minimize future costs of mitigation.

From the perspective of the Proponent, the main objective of the EIA is to fulfil the obligations of the proponent to undertake an EIA under Clause 5 of the Environmental Protection and Preservation Act of the Maldives and requirements of the Tourism Regulations. In addition, it is also the objective of the proponent to undertake the redevelopment with minimum damage to the environment.

### **5.2 Methodologies**

Internationally recognized and accepted methods have been used in this environmental assessment. These are briefly discussed below.

EIA methodologies developed over the years which include screening, scoping and preliminary assessments have been employed. More specifically, the recently enforced EIA regulations 2007 has been followed beginning with the application to undertake an EIA. Due to time constraints, impact assessment has also been based on what is sometimes referred to as "ad hoc" methods which rely on expert opinion. Most EIA methodologies, qualitative or quantitative, rely on expert judgment, based on the experience gained by EIA consultants over the past years.

This EIA is based mainly on data collected during a field visit in early March 2008 by a team from Water Solutions Pvt. Ltd. The data collection methods are described in detail under the sections, "Methodology".

Conditions of the existing environment were analyzed using appropriate scientific methods. Coastal surveys, terrestrial surveys, beach profiles and reef surveys were undertaken. In addition, island's existing shore line and vegetation lines were mapped with high accuracy GPS and compared with available aerial photographs. Additionally, impact predictions have been based on experience gained by the consultants from similar projects. In brief, three environmental components were studied in detail, namely coastal marine and terrestrial environment.

### **5.3 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. Water Solutions engaged a multidisciplinary team of consultants to carry out this assessment and undertake long term monitoring. The team members included local expertise in environmental impact assessment, coastal engineering, marine biology, mapping and GIS and environmental engineering. The team members were:

- Abdul Aleem, BSc, MPH – Mapping and GIS
- Ahmed Jameel, Msc, - Environmental Engineer
- Ahmed Zahid, BSc. – Environment management and Ecotourism Consultant
- Hassan Shah, BSc, - Environmental Science

### **5.4 Terms of Reference**

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

## **6 Project Description**

### **6.1 Project Proponent**

This project is proposed by Unique Resorts Pvt Ltd, to redevelop the island of Vaadhoo. Vaadhoo is located on the northern rim of South Male' atoll and has been operational as a resort since 1995. Vaadhoo is one of the earliest resorts that came in to operation in south Male' atoll..

Unique Resorts Pvt Ltd is registered in Maldives in 2007 to manage and operate tourist resorts with well defined vision to cater holiday makers with different taste. Unique resorts is under the umbrella of the Trade Mark Adaaran which promotes and markets Adaaran Club Bathala opened in 1993, Adaaran Club Rannalhi inaugurated in 1996, Adaaran Select Meedhupparu opened in 2000 that diversify mixed tourism market by branding Ayurveda Village and the Water Villas in 2006 for Luxury, Boutique and Wellness modern tourism in Maldives. Adaaran has completed its newest product Adaaran Select Hudhuranfushi in 2006 and Adaaran Prestige Ocean Villas in 2007.

### **1.1 Project Location and Study Area**

The project takes place in the island of Vaadhoo, located on the northern rim of south Male' atoll (see Figure 3). It is one of the smallest resorts in the Maldives and faces the vaadhoo channel, which is the deepest channel in the Maldives. The island is approximately 1.5 hectares (from the vegetation line).

At present, Vaadhoo Island resort is a 4 star hotel, consisting of 14 land bungalows or rooms and 7 water bungalows. The island is well known among the tourist industry for its exclusive diving experience provided to guests. It is a resort specializing in scuba diving & snorkelling, offering one of the best house reefs in the region with abundance of marine life. This project takes place in the island of Vaadhoo including the boundary of the reef line.

### **1.2 Geography**

Vaadhoo island is small sand cay lying on its own reef system south of the Vaadhoo Channel, on the northern rim of south Male' atoll. The island is located at about latitude of 4° 07'27.27" N and longitude of 73° 27' 15.43"E. The island is formed on an isolated coral reef system, similar to an inverted triangular, with the widest area on the north and narrowing towards the south. The island is roughly 30 to 50 m from inside the eastern rim of the reef system on which it is formed. Towards the south of the island is the atoll lagoon and towards the west of the island is a narrow channel approximately 228 meters in width. Beyond this, on the eastern side, is one of the largest lagoon / reef system in the Maldives. The channel on the eastern side has strong currents varying in direction depending on the tide. On the west of the island's reef system is another channel, measuring approximately 1400 meters. Beyond this, on the western side is another large reef system which contains the island of Velassaru or Laguna Beach resort. This channel on the western side of the island is considerably shallower than the eastern channel as

can be seen from the aerial photo (refer to Figure 2). The eastern side of the island is prone to the effects of currents and oceanic wave activity as there is very narrow lagoon from the shore to the reef extent. As a result, coastal protection measures have been undertaken on this side for several years.

Vaadhoo is directly exposed to Vaadhoo channel as there are no reefs or islands in between this channel and the island. The island is oriented towards north to south direction along its length. The reef on the western side is considerably larger than that on the eastern side. Similarly, the reef edge from the southern side is considerably closer than that on the northern side (refer to Figure 2).

**Figure 2: Aerial view of Vaadhoo and the reef system.**

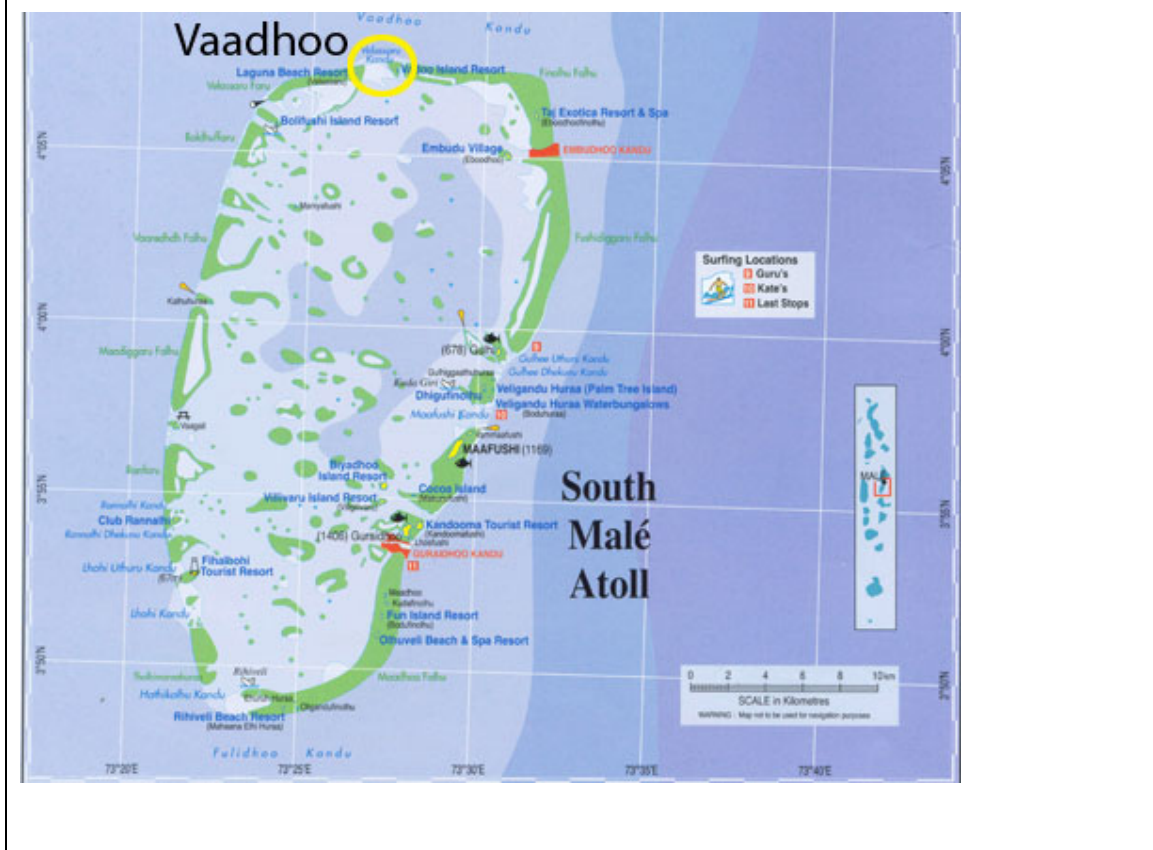


The closest island to Vaadhoo is Velassaru or Laguna Beach resort, which is roughly 2km west of Vaadhoo. The closest inhabited island is Viligili located approximately 5.9 km north. The island is 6.9 km from the capital, Male'.

Vaadhoo has a very beautiful and easily accessible house reef, which is in good condition in terms of diversity and percentage of live coral cover. The reef is easily accessible from the eastern side due to the small reef extent from this side.

In March 2008, the perimeter of the island from the vegetation line measured 441 meters with a total area of the island accounting to 9595 square meters. The island is relatively narrow and the width at the widest point measures 70 meters. The beaches on the island are found on the north, north-east, west and southern side. The average height of the island is 1.5 -1.7 metres above mean sea level.

Figure 3: Location of Vaadhoo in south Male' Atoll



### 1.3 Need and Justification

#### 1.3.1 Need to Redevelop and Upgrade the Resort

Tourism in the Maldives is rapidly expanding with tourist arrivals increasing at about 60% between 1990 and 1995 and about 50% from 1995 to 2000. Following the control of SARS outbreaks and following the aftermath of the terrorist attacks in the United States, the world travel and tourism industry started to show a rapid increase. The tourist arrivals in the Maldives also increased quite rapidly in November 2003 with over bookings diverted to similar destinations such as Seychelles (Haveeru, 7 December 2003). However, the tsunami of December 2004 has left the industry crippled requiring additional infrastructure and investments. Therefore, there is a need to create added capacity to cater for the growing tourism industry in the Maldives.

The growth in the tourism industry of the Maldives has various economic benefits as prescribed in the Second Tourism Master Plan. These include:

- Foreign exchange earnings – over 70% of all foreign exchange earnings is from tourism
- Income generation
- Employment

- Development of entrepreneurial activities
- Improved public facilities

In addition to its contribution to the overall development of the country and growth of the tourism sector, the proposed project will help improve the overall quality of the resort environment.

The island has been operational since 1995 and ever since then; no major renovation has been undertaken in the resort. Due to the small size of the island, it is not feasible and practical to develop additional services on the island. Similarly, additional rooms also cannot be developed on the island. If additional services are to be developed on the island, then there are two options, namely:

1. Reclamation of the relatively large lagoon or
2. Develop all the guest rooms in the lagoon and make space available from the island for staff and public facilities.

Option one has not been considered by the developer as it is environmentally more damaging and it will also destroy the shape and the natural look of the island. The small size, shape and the distinct beaches and coastline of the island has been a selling point ever since the resort began operational. It is anticipated that if the island is modified through reclamation, then it will lose its environmental value and may not be as appealing as it used to be.

The developers therefore opted for option two as it is expected to be environmentally more acceptable. Although considerably a large area of the lagoon will be utilized for over water villas, the impacts would be less than reclaiming a large portion of the lagoon. Furthermore, the impacts on constructing over water villas in the lagoon can be minimized by taking appropriate measures such as transplanting coral to a safe zone. Once the water villas are constructed, the area can be populated with corals and the marine life can be restored. One of the important advantages of option two is that it will create space for public and staff facilities which can be developed with enhanced amenities and facilities, without the need to alter the island's sensitive ecosystem or coastline. The small size of the island contains only limited amount of mature trees and coastal vegetation that is too valuable to be cut, removed or even transplanted. Therefore, any redevelopment should address the sensitive environmental conditions of the island and ensure that the least disruption is caused.

The strategy that would be used for the redevelopment is to create space on the island by demolishing guest rooms and other facilities (details discussed later in this section) on land and develop new and enhanced infrastructure for both staff and guest. Alternatively, all guest rooms will be developed in the lagoon. The end result is that the island will be kept in its natural state at the same time services will be upgraded, both to staff and guest and lastly but not least, the value of the guest rooms will increase thereby increasing the profitability.

## **1.4 Project duration**

The project is expected to take seven (7) months starting May 2008.

## **1.5 Development Objectives and Targets**

The tourism product of the Maldives is almost entirely based on the natural beauty of the island and its reef system. Therefore, protection of the islands natural environment is crucial to maintain the environment quality of the resort and also guarantee the clientele. The basic design concept of this redevelopment is to create a setting as to reflect and blend with the inspirational natural setting of the island without breaking the island's natural integrity. The basic idea is to redevelop the island without destroying its natural beauty and leaving the island in its natural form.

The water villas to be developed on the western side has been proposed to be developed on the lagoon in a harmonizing manner with the natural setting. The sensitive coral reef environment of the island has been considered and the lagoon will not be dredged or excavated in any way to erect these structures in order to ensure that minimal damage occurs to the environment. A considerable distance from the reef flat and slope will be maintained to ensure that the coral reefs are not impacted. Most of the guest rooms on land will be demolished and additional staff and public facilities will be developed. The demolished area will be landscaped using similar vegetation found on the island.

## **1.6 Description of the project components**

This project involves redevelopment of Adaaran Prestige Vaadhoo located on Vaadhoo island in South Male' Atoll, Maldives. See the attached site plan with the proposed new developments in appendix. The island has been in operation since 1995. With the exception of few changes, no major modifications have been brought to the island infrastructure in the past. The proposed redevelopment will have several new components. The proposed redevelopment will consist of three main components namely, demolition of existing structures, construction and development of new additional facilities and refurbishment and enhancement of existing facilities. At present, Adaaran Prestige Vaadoo has 7 water bungalows.

## **1.7 Proposed modifications**

The following modifications are proposed as part of the redevelopment. Refer to new site plan attached as appendix.

### ***1.7.1 Demolition of existing staff quarters***

The existing staff quarters will be demolished. 167 m<sup>3</sup> of construction debris will result. Construction debris will mainly include concrete, masonry, wood and tin roofing. See attached site plan for the location. The executive arrangement for managing the waste is by immediately transporting them to Thilafushi. Once the building is demolished, the debris will be placed within the boundary of the demolished building until transported to Thilafushi. Refer to the site plan attached.

### ***1.7.2 Demolition of existing Manager's Bungalow / Ayurveda***

218 m<sup>3</sup> of construction debris will result from the demolition. Construction debris will mainly include concrete, masonry, wood and tin roofing. See attached site plan for the location. The executive arrangement for managing the waste is by immediately transporting them to Thilafushi. Refer to the site plan attached.

### ***1.7.3 Demolition of existing Water Cottage (Water Bungalows)***

340 m<sup>3</sup> of construction debris will result from the demolition. Construction debris will mainly include concrete, masonry, wood, plumbing, electrical wiring waste and thatched roof. See attached site plan for the location. The executive arrangement for managing the waste is by immediately transporting them to Thilafushi. Once the water bungalows are demolished, the debris will be transported to the island where it will be stockpiled until all the water villas are demolished. Once the process is complete, they will be transported to Thilafushi. Refer to the site plan attached.

### ***1.7.4 Demolition of existing Staff Cafeteria***

60 m<sup>3</sup> of construction debris will result from the demolition. Construction debris will mainly include concrete, masonry, wood, and tin roof. Refer to the site plan attached.

### ***1.7.5 Demolition of existing Individual Cottage (Land Rooms)***

402 m<sup>3</sup> of construction debris will result from the demolition. Construction debris will mainly include concrete, masonry, wood, and tin roofing materials. Refer to the site plan attached.

### ***1.7.6 Modification of Sun Rise Villa***

Half of the building will be demolished resulting in 120m<sup>3</sup> of construction debris. Construction debris will mainly include concrete, masonry, wood, and tin roofing materials. Refer to the site plan attached.

### ***1.7.7 Modification of Big Hut Bar***

The existing over water bar will be extended by extending the Deck (additional Steel Pile, concrete footing, Concrete Column encase with PVC Pipe). Refer to the site plan attached.

### ***1.7.8 Modification of Arrival Jetty***

The present arrival jetty is in not in a good condition and hence it will be extended up to the reef line for easy boat access. (Extension will be done using additional steel Pile, concrete footing and concrete column encase with PVC Pipe). Refer to the site plan attached.

### ***1.7.9 Construction of new 50 Water Bungalows***

The bungalows will be developed on the western side lagoon with an offset of 30 from the reef line. (Refer to the attached site plan and the architectural drawings of the water bungalows attached as an annex). The water villas will be constructed on concrete pile. Piles will be driven using machinery. Once this process is complete, horizontal beams will join the piles and the water villa building will be constructed. Electrical wiring / fitting and plumbing will then be fixed. Refer to the site plan attached.

### **1.7.10 Construction of new Pump Station**

Pump stations are designed to collect sewer from the water bungalows which will be pumped subsequently to the collections tank of Sewerage Treatment Plant for treatment. This station will be constructed on pile drive concrete column with Sulphate Resistant Cement which will be sealed and water proofed accordingly. The pump station will have the capacity to retain the sewage for a period of 24 hours in case of an emergency. The pump station, which will run on a 24 hour sewerage capacity basis will be backed up by a portable generator besides 24-hours electricity provided by the resort.

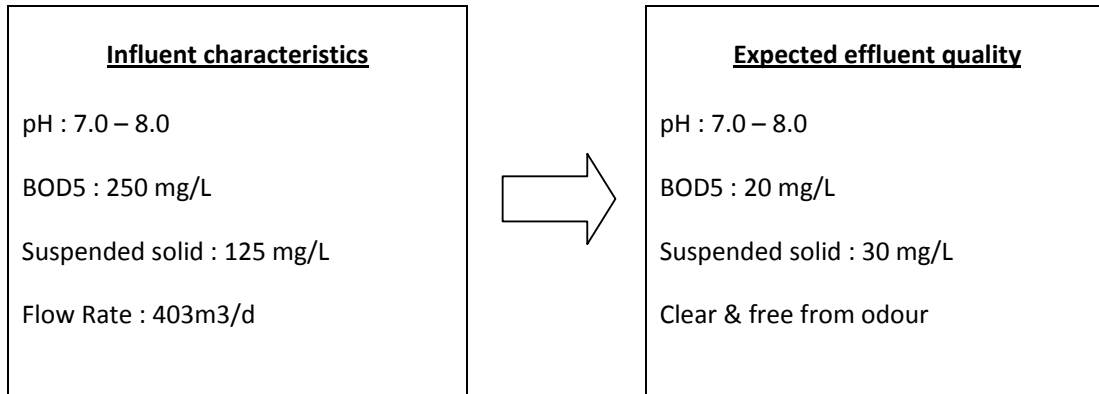
### **1.7.11 Construction of new Sewage System House and Staff Quarters**

Currently, the island's waste water is treated using septic tanks buried underground. With the new redevelopment, a brand new aerobic treatment system, with a capacity of treating 100 m<sup>3</sup> per day will be installed. Existing septic tanks will be sealed and disconnected from existing sewerage system. After completion of New STP plant and its installation, remaining sludge in existing septic tanks will be emptied to the septic tanks of the STP system and will be treated accordingly. The Following treatment method will be used to treat the sewage to the required standard.

- a. Effluent Collection/Equalization
- b. Aerobic Treatment
- c. Clarification
- d. Sludge Treatment
- e. Tertiary Treatment
- f. Disinfection

The process flow diagram is attached as an annex. The sewage network will collect wastewater from the individual rooms and other buildings and transport them to the treatment plant where wastewater will be treated. 50% of the treated water will be recycled for irrigation and toilet flushing. Water, not used for irrigation will be discharged to the sea via the sea outfall. The location of the sea outfall is indicated on the site plan, attached as an annex. A small drying bed will be installed in a garden area with enclosed fence for drying of sludge discharge from the digester. Dried sludge will be discharged to the surrounding vegetation to be used as fertilizer. Refer to the site plan attached.

The following illustrations depict the input and output characteristics of wastewater.



#### **1.7.12 Construction of two new Service Stations.**

A new service station will be constructed. This will be a single storey building. Refer to the site plan attached.

#### **1.7.13 Construction of new Swimming Pool**

A new swimming pool will be constructed on the northern side of the island after demolishing the existing land bungalows in this area. The water capacity of the pool will be 46125 gallon and desalinated water will be used for the pools. Filtration of the water will be achieved using pressure sand filter with quarts and the rate of re-circulation will be 5,765 gls/hr. Refer to the site plan attached for the location of the swimming pool.

#### **1.7.14 Construction of Housekeeping and Butlers Room.**

A new housekeeping and butlers room will be constructed. Refer to the site plan attached.

### **1.8 Construction schedule, process and methodology**

Construction is expected to begin in May 2008. As soon as the EIA is approved and a decision note is issued, the project activities will initiate including finalizing contractors and other issues. Mobilization of the workforce will begin from then onwards (transporting materials and arranging other logistics). Materials such as cement, gravel, timber and other materials will be transported to the island in batches. They will not be stored on the beach. They will be stored in the island and protected from rain. The redevelopment project is expected to be not more than 7 months for construction. The project is expected to begin in May 2008. A detailed construction schedule is attached as an annex.

#### **1.8.1 Construction strategy**

The resort will be redeveloped in the planned time period to reduce cost and also reduce the environmental damage. Both land based and water based construction activities will be done in parallel. Demolition, construction and refurbishment of land based facilities will be undertaken by one group, supervised by the contractor. At the same time, demolition and construction of

over water structures will be undertaken. Construction of over water structures will also be undertaken in parallel with the land based works. This will reduce the construction time period and hence all the work activities can be completed on time.

#### ***1.8.2 Work methods for over water structures***

All water bungalows will be constructed on piles. This method involves driving piles using machinery (excavators and hydraulic hammers). Once the piles are driven to the required depth, they will be evenly cut to connect the supporting horizontal columns. Once these horizontal beams are laid, then construction of the water bungalow structure will be undertaken. Afterwards, plumbing, electrical and fire networking lines will be laid.

#### ***1.8.3 Works methods for land based activities***

Standard construction methods will be used. It is intended to use typical concrete foundations and columns in the construction of structures on land. This methodology involves the use of reinforced concrete to create a foundation joint by horizontally running beams. Together, the beams and the concrete base create a solid foundation on which columns and the building structure will be supported. The walls will be constructed using cement blocks. For the swimming pool, the foundation, flooring and the walls will be constructed using reinforced concrete.

#### ***1.8.4 Demolition strategy***

All demolition work will be undertaken manually and no machinery will be used for demolition.

#### ***1.8.5 Management of demolition waste***

The executive arrangements in place for managing demolition waste is simply by stockpiling the demolished waste for the shortest duration possible, until buildings are demolished and then transport immediately to Thilafushi. All demolished debris from the land structures will be stockpiled within the boundary until the demolition is complete. Once it is complete, they will be transported to Thilafushi. As Thilafushi is very nearby, this operation is not expected to be disrupted and the management of the waste will not be a significant issues. For demolition waste from the water villas, they will be stockpiled to land (not kept in the lagoon or beach) until transported to Thilafushi.

## 1.9 Project Inputs and Outputs

### 1.9.1 Project Inputs

The types of resources that will go into the redevelopment of the resort and from where and how these will be obtained are given in table 1 & 2.

**Table 1: Matrix of major inputs during construction period**

INPUT RESOURCE(S)	SOURCE/TYPE	HOW TO OBTAIN RESOURCES
Construction workers (250+)	Maldivians and foreigners	Open bidding by advertising in local papers/other sources
Water supply (construction period)	Existing Desalination plant in the island	60 m <sup>3</sup> /day desalination plant
Electricity/Energy (construction period)	Existing Diesel generators in the island	400 kVA, generator
Construction machinery	Concrete Mixer and Vibrators	Local suppliers
Telecommunications	Island's Phone Systems, Fax Machines, E-mail and internet facilities	Already this services is available in the island
Transport (sea)	Sea transport by dhoni and speed boats. Materials to be transported in cargo vessels/dhoni or large barges. All construction debris will be transported to thilafushi via cargo vessels/dhoni	Through contractual basis
Food and Beverage during construction period	Mainly imported sources except a few locally available.	local purchase
Fuel, Kerosene and LPG	Light Diesel, LPG Gas, Petrol, Lubricants	Local suppliers

**Table 2: Matrix of major inputs during operational phase**

<b>INPUT RESOURCE(S)</b>	<b>SOURCE/TYPE</b>	<b>HOW TO OBTAIN RESOURCES</b>
Operational Staff (130)	Maldivians and foreigners	Utilize current staffs and also obtain additional staffing through advertising in local newspaper, media.
Electricity / Energy (during operation)	Light diesel (low sulphur content)	600 kVA, generator
Water supply (during operation)	Desalinated water	170 m <sup>3</sup> /day desalination plant
Diving and sports gear	Air Compressor Nitrox Enabled Air Compressor Nitrox Membrane System High Pressured Airbank (for Nitrox Membrane System)	Imported
Electrical appliances/machinery	Energy efficient machinery and lighting; ozone-friendly refrigerators*	Local suppliers
Telecommunications	Hotel Phone Systems, Fax Machines, E-mail and internet facilities	Local telecom company to provide telecom service. Already this service is available. Only expansion is required.
Transport (air and sea)	International air travel, domestic air and sea transport	
Food and Beverage	Mainly imported sources except a few locally available. Preference will be given to locally produced food items	Import/local purchase
Laundry chemicals	Detergent, All Purpose Cleaners, Glass Cleaners, Bathroom Cleaners, Destainer Bleach, Oxygen Bleach, Softener, Alkali Neutraliser, Detergent, DetergentPlus, Starch, Stain Spots Remover, etc. NOTE: All Chemicals are Bio-degradable compounds	Local resort suppliers
Paper Products	Tissue Roll, Tissue Boxes, Hand Tissues, Guest In-room Paper	Import/purchase locally

INPUT RESOURCE(S)	SOURCE/TYPE	HOW TO OBTAIN RESOURCES
	Amenities/ Brochures Office Use Paper Products	
Insecticides, pesticides, etc.	Imported pesticides	Import/local suppliers
Fire fighting equipment	Fire Pumps, Fire Protection System, Smoke Detectors, Carbon Dioxide and Foam Fire Extinguishers, etc.	Import/local suppliers
Fuel, Kerosene and LPG	Light Diesel, LPG Gas, Petrol, Lubricants	Local suppliers

\*Note: Deep freezers, chillers, air conditions and other similar utilities will be ozone friendly and will abide to the Montreal Protocol.

### 1.9.2 Project Outputs

The type of outputs (products and waste streams) and what is expected to happen to the outputs are given in Table 3.

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

PRODUCTS AND WASTE MATERIALS	ANTICIPATED QUANTITIES	METHOD OF DISPOSAL
Sewage and wastewater Grey water/laundry wastewater	Estimated to be at 250 litres/person/day	Treat the wastewater using the existing septic tanks.
Construction waste from construction activities	1307 cubic meters of debris.	Debris from the demolition work will be regularly sent to landfill in Thilafushi
Waste oil and grease	30 to 40 litres per month	Stockpiled and sent to landfill in Thilafushi.
Hazardous waste	Approximately 40 litres of diesel and oils per month	Barrelled and stored until disposal. Final disposal to landfill in Thilafushi
Noise	Only localised to the island environment	-
Air pollution	Limited quantities of dust in only designated areas	Mainly arising as a result of dust emission from the demolition and construction work such as demolition of the buildings, cement mixing, and other processes. Only localised to the island. Environment only.

## **7 Policy, Legal and Administrative Framework**

### **7.1 Overview**

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 2007 of the Maldives by registered consultants. Furthermore, it adheres to the principles underlined in the regulations, action plans, programmes and policies of the following Government Ministries.

- Ministry of Environment, Energy and Water
- Ministry of Tourism and Civil Aviation
- Ministry of Agriculture and Marine Resources

These are discussed in detail in the following sections.

### **7.2 Applicable Policies, Laws and Regulations**

#### ***7.2.1 Environmental Protection and Preservation Act***

The Articles of the Environmental Protection and Preservation Act (Law No. 4/93) addresses the following aspects of environmental management:

- Guidelines and advice on environmental protection shall be provided by the concerned government authorities.
- Formulating policies, rules and regulations for protection and conservation of the environment in areas that do not already have a designated government authority already carrying out such functions shall be carried out by MEEW.
- Identifying and registering protected areas and natural reserves and drawing up of rules and regulations for their protection and preservation.
- An EIA shall be submitted to MEEW before implementing any developing project that may have a potential impact on the environment.
- Projects that have any undesirable impact on the environment can be terminated without compensation.
- Disposal of waste, oil, poisonous substances and other harmful substances within the territory of the Maldives is prohibited. Waste shall be disposed only in the areas designated for the purpose by the government.
- Hazardous / Toxic or Nuclear Wastes shall not be disposed anywhere within the territory of the country. Permission should be obtained for any trans-boundary movement of such wastes through the territory of Maldives.
- The Penalty for Breaking the Law and Damaging the Environment are specified.
- The government of the Maldives reserves the right to claim compensation for all damages that are caused by activities that are detrimental to the environment.
- The proposed redevelopment project will fully abide to the Environmental Preservation and Protection Act. Disposal of oil, chemicals and other hazardous materials will be strictly controlled and managed. Such materials will not be disposed in to the local or the regional environment, but will be transported to designated waste disposal site,

such as Thilafushi.

### **7.3 Second National Environment Action Plan (1999)**

The aim of NEAP II is to protect and preserve the environment of the Maldives and to sustainably manage its resources for the collective benefit and enjoyment of present and future generations.

Main strategies of the NEAP II are:

- Continuous assessment of the state of the environment in the Maldives, including impacts of human activities on land, atmosphere, freshwater, lagoons, reefs and the ocean; and the effects of these activities on human well-being
- Development and implementation of management methods suitable for the natural and social environment of the Maldives, and maintain or enhance environmental quality and protect human health, while at the same time using resources on a sustainable basis
- Consultation and collaboration with all relevant sectors of society to ensure stakeholder participation in the decision making process
- Preparation and implementation of comprehensive national environmental legislation in order to provide for responsible and effective management of the environment
- Adhering to international and regional environmental conventions and agreements and implementation of commitments embodied in such conventions.

NEAP II specifies priority actions in the following areas.

- Climate change and sea level rise; coastal zone management;
- biological diversity conservation; integrated reef resources management;
- integrated water resources management;
- management of solid waste and sewerage;
- Pollution control and management of hazardous waste;
- sustainable tourism development;
- land resources management and sustainable agriculture
- human settlement and urbanisation.

NEAP II contains environmental policies and guidelines that should be adhered to in the implementation of the proposed project activities.

The redevelopment of Vaadhoo will also be in accordance with the main strategies of the NEAP II. The monitoring programme proposed in this report outlines the environmental management strategy and plan. This EIA has also been prepared in consultation with all the key stakeholders. Therefore, these measures address the key strategies outlined in the NEAP II.

#### ***7.3.1 National Biodiversity Strategy and Action Plan***

The goals of the National Biodiversity Strategy and Action Plan are:

- Conserve biological diversity and sustainably utilize biological resources.
- Build capacity for biodiversity conservation through a strong governance framework, and improved knowledge and understanding.

- Foster community participation, ownership and support for biodiversity conservation.

In implementing the proposed project activities due care has to be given to ensure that the national biodiversity strategies are adhered to. The proponent has committed fully on conservation and protection of the environment while undertaking this proposed project. More specifically, the coral reef and generally the marine environment have been assessed in detail in order to assess baseline values. Quantitative and qualitative surveys were undertaken to assess the biological diversity of the coral reef and the lagoon, especially in close proximity and around the proposed development area. Hence, development of the water villas will take in to account the conservation of biological diversity. Practical mitigation measures and solutions have been identified to conserve and protect the biodiversity.

### ***7.3.2 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. At present there are no rules and regulations made available to the public on designation and protection of habitats and heritage areas.

The redevelopment is proposed in the island of Vaadhoo. There are no protected sites or resources such as protected birds and trees in the island environment.

### ***7.3.3 Waste management policy***

The Ministry of Environment, Energy and Water has developed the framework for a national waste management policy. The key elements of the policy include:

- Ensure safe disposal of solid waste and encourage recycling and reduction in waste generated.
- Develop guidelines on waste management and disposal and advocate to enforce these guidelines through inter-sectoral collaboration.
- Ensure safe disposal of chemical, industrial and hazardous waste.

The key objective of the waste management policy would be the formulation and implementation of guidelines and means for solid waste management to maintain a healthy environment.

Waste management for the proposed project has been considered very seriously during the construction stage. Since the island is being redeveloped, measures are already in place to manage the waste during operational period, such as regular transfer of waste to Thilafushi. Due to the small size of the island and the proximity to Thilafushi, construction waste will be immediately transferred to Thilafushi. Similarly, during the redevelopment process, waste management strategies have been developed, details of which are outlined in the report. Therefore, this project will also conform to this policy.

#### **7.3.4 Regulation on sand and aggregate mining**

This regulation addresses sand mining from uninhabited islands that have been leased; sand mining from the coastal zone of other uninhabited islands; and aggregate mining from uninhabited islands that have been leased and from the coastal zone of other uninhabited islands.

Neither sand nor aggregate will be mined for this project. This regulation would not have any implication on the proposed project.

#### **7.3.5 Ban on coral mining**

Coral mining from the house reef and the atoll rim has been banned through a directive from the President's Office dated 26th September 1990. According to these policies,

- coral mining is not to be carried out on island house reefs;
- coral mining cannot be carried out on atoll rim reefs and common bait fishing reefs;
- coral or sand mining is only allowed from designated sites, and approval from the concerned Atoll Office is required prior to the commencement of any mining operation.
- requests for coral or sand mining from residents of inhabited islands are required to be submitted to the Atoll Office through their respective island office
- the island office is required to estimate the quantity of corals required for the applied construction work and hence this ensures that permission is granted to mine just the required amount;
- Every island is required to keep a log book of the amount of corals mined.
- sand mining is not allowed on the beaches of inhabited islands, islands leased for industrial developments and tourist resorts and within the lagoons adjoining these islands.

Coral, aggregate and sand would not be mined in any stage of the project.

#### **7.3.6 Tourism Act (Law no. 2/99)**

This Act provides for the determination of zones and islands for the development of tourism in the Maldives:

- the leasing of islands for development as tourist resorts,
- the leasing of land for development as tourist hotels and tourist guesthouses,
- the leasing of places for development as marinas,
- the management of all such facilities; and
- the operation of tourist vessels, diving centers and travel agencies, and
- the regulation of persons providing such services.

### **7.3.7 Ministry of Tourism Regulations and Circulars**

The Tourism Regulations in the Maldives ensure that carrying capacity of the island and atoll ecosystems are well within limits and the negative effects of the development are minimal. The Ministry also issues circulars on several occasions and when necessary to discourage activities such as sand and coral mining, developing on the coastal environment and waste disposal which may cause harm or damage to the natural environment, which is the main tourism product.

Tourism regulations strictly discourage modifications to the natural movement of sand around the islands. Therefore, Tourism Regulations require that special permission from the Ministry of Tourism and Civil Aviation be sought before commencing any coastal modification works on any tourist resort. It is also stated that hard engineering solutions are not encouraged and construction of solid jetties and groynes be controlled and shall only be undertaken after conducting an Environment Impact Assessment study. Similarly, design of boat piers, jetties and other such structures are required to be in such a way that these shall not obstruct current and sediment circulation patterns of the island.

The Ministry also issues circulars on several occasions and when necessary to discourage activities such as sand and coral mining, developing on the coastal environment and waste disposal which may cause harm or damage to the natural environment, which is the main tourism product.

All over water structures proposed to be developed will conform to this regulation. The conceptual plan and drawings have been approved by the Tourism Ministry. Details of the cross section and other drawings have been attached as an appendix.

### **7.4 Framework for Environmental Assessment**

The enforcement of EIA regulation in the country began with the formulation of the Environmental Protection and Preservation Act (Law 4/93) in April 1993 in order to protect, preserve and safeguard the fragile environment of the country. The Environmental Act gives very high prominence towards safeguarding the environment with regard to all the development activities and is currently being implemented by the Environment Research Center of the Ministry of Environment, Energy and Water. The Ministry has been formed recently and its mandate includes:

- organizing, developing and managing systems for environmental monitoring, including periodically evaluating the actual state of the environment, and forecasting environmental changes;
- evaluating environmental impact assessment reports of new projects and monitoring reports for existing facilities;
- issuing and revoking certificates based on compliance with environmental standards;

According to article 5 (a) of the Act, an Environmental Impact Assessment shall be submitted to the Ministry of Environment, Energy and Water according to guidelines formulated by the Ministry before implementing any activity that may have an adverse impact on the

environment. The Ministry shall determine projects that need such assessment. This umbrella law gives the Ministry the right to terminate projects that have undesirable impacts or claim compensation for damages caused by activities that are detrimental to the environment.

This project fully complies with this law as all necessary permits have been undertaken and this report is submitted in order to obtain the necessary EIA Decision Note.

#### ***7.4.1 Environmental Impact Assessment Regulation 2007***

The Ministry of Environment, Energy and Water has issued new EIA regulation on May 2007, which guides the process of undertaking the Environmental Impact Assessment in the Republic of 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.

#### ***7.4.2 Post EIA Monitoring, Auditing and Evaluation***

The environmental monitoring programme given in EIA reports 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 program. 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 2007.

### **7.5 Relevant International conventions, treaties and protocols**

#### ***7.5.1 The Montreal Protocol on Substances that Deplete the Ozone Layer***

The Montreal Protocol on Substances That Deplete the Ozone Layer is a landmark international agreement designed to protect the stratospheric ozone layer. The treaty was originally signed in 1987 and substantially amended in 1990 and 1992. The Montreal Protocol stipulates that the production and consumption of compounds that deplete ozone in the stratosphere; chlorofluorocarbons (CFCs), halons, carbon tetrachloride, and methyl chloroform--are to be phased out by 2000 (2005 for methyl chloroform). Scientific theory and evidence suggest that, once emitted to the atmosphere, these compounds could significantly deplete the stratospheric ozone layer that shields the planet from damaging UV-B radiation.

Redevelopment of Vaadhoo island will not involve use and consumption of any substances banned in this convention. Even during the operational stage of the resort, compounds or substance that contain ozone depletion will not be imported.

## **8 Methodology**

The section covers methodologies used to collect data on the existing environment.

The key environmental components of the project under consideration are:

- Coral reef areas and the marine environment.
- Terrestrial environment.
- Coastal environment

Data collection was undertaken for the above components. In order to study the existing environment of the island, the following data collection methodologies were used during the field visit undertaken in March 2008.

### **8.1 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. Terrestrial impacts were considered in light of the proposed modifications to be brought on land. The marine environment of the island covered the coral patches, the lagoon and the house reef, especially on the western side which is expected to have the greatest impact as a result of the proposed project.

#### ***8.1.1 Mapping and Location identification***

The island, including shore line, vegetation line and coral areas were mapped for the assessment. Mapping was undertaken using hand held differential GPS. The location of data collection sites were marked using handheld GPS. These data collection points include water sampling locations, beach profile locations and marine survey areas.

#### ***8.1.2 Marine Water Quality***

One of the main environmental components that would be affected by implementing the project would be marine water quality. Water quality was assessed during the field trip in March 2008 by collecting samples and testing them at National Health Laboratory. Water quality was assessed at selected locations. The locations, frequency and parameters to be monitored are given in the monitoring programme outlined later in the EIA report. The sampling locations are illustrated in the section "Existing Marine Environment".

#### ***8.1.3 Coastal processes***

Several beach profiles were taken from designated locations within the project boundary by means of standard levelling techniques. These benchmarks would be used for long term monitoring. The measurement of beach profiles involves standard practice of surveying with a staff and a dumpy level. Combine with GPS shoreline surveys, beach profiles will help to assess the changing beach around the island. Jetties, water villas and other marine structures will have some impact on sediment movement around the island and hence beach profiles will help to assess these changes taking place over time. As this project involves constructing new water

bungalows on the western side lagoon, the beach profiles will provide baseline information about the beaches and a means to compare the changes over time.

#### **8.1.4 Marine Environment**

Marine environmental surveys were conducted to collect data on key environmental components (i.e. the coral reef system), that will be impacted due to the redevelopment. Three methods were primarily used to collect data. Line transects, photo quadrat analysis and visual observations. Purpose of the surveys was to define and establish marine environmental baseline conditions for impact evaluation during and after the proposed project.

Surveys were based on standard marine environmental surveys so that they can be repeatedly carried out to monitor and record changes and assess possible impacts on the marine environment from the proposed work activities. Surveys include quantitative and qualitative surveys. Marine surveys were conducted in the project area where the impacts are likely to occur and. In addition, photos were taken along the length of the lagoon where water villas will be developed.

Photo quadrate coral reef survey method was used to collect quantitative data of coral reef benthic communities i.e. live corals and their types, other benthos, dead corals and other reef substrate. A series of photographs were taken of the quadrat using an underwater camera, which was mounted on a specially designed frame. These photographs were combined to form a photo-composite of the quadrat. Photo-composite of the mapped area of the reef were analysed using computer software. It provided a detail record of individual corals, sandy or rubble area and other benthos to a mapped area. The photographs not only allowed speedy collection of data in the field, but also provided a permanent record of the quadrat, which is useful for long-term monitoring of growth, mortality and recruitment

In addition, qualitative surveys were conducted on the reef and lagoon system. The technique was based on visual observation by snorkelling and then comparing the result with aerial photographs. These surveys were used to assess the general status of the coral reef and the lagoon.

#### **8.1.5 Terrestrial environmental data collection**

Terrestrial environmental assessment was undertaken to assess the level of impacts that will be felt on the terrestrial environment. Tree types were identified and mapped within the island, especially around the northern end of the island where the swimming pool will be constructed. Consultations were also held with the proponent, project engineer and staff stationed in the island to gather information on the extent of land clearing that will be under taken. The surveys were used to prepare a vegetation map illustrated in the "Existing Terrestrial Environment" section.

## 9 Existing Environment

This section will discuss the existing environmental conditions. In doing so, the section will begin with an outline of the general environmental conditions in Maldives, including the climatic settings, tides, wind and wave. As there are no specific such data for individual islands, these data will form the basis for describing the conditions for the islands of the Maldives. The data collection on climate, tide and waves are undertaken from weather stations based strategically throughout the Maldives, including Male', international airport. Vaadhoo island lies close to Male' International airport. Describing and analysing climate and weather information will provide projections and baseline conditions for islands that are close to a specific weather station. Existing terrestrial environment and the marine environments are described later.

### 9.1 Climatic Setting

The Maldives, in general, has a warm and humid tropical climate with average temperatures ranging between 25°C to 30°C (MHAHE, 2001) and relative humidity ranging from 73 per cent to 85 per cent. The country receives an annual average rainfall of 1,948.4mm. There is considerable variation of climate between northern and southern atolls. Table 4 provides a summary of key meteorological findings for Maldives. General studies on climatic conditions of Maldives were taken into account during study as local level time-series data are limited for longer periods at the nearest meteorological station.

**Table 4: Key meteorological information**

Parameter	Data
Average Rainfall	9.1mm/day in May, November 1.1mm/day in February
Maximum Rainfall	184.5 mm/day in October 1994
Average air temperature	30.0 C in November 1973 31.7 C in April
Extreme Air Temperature	34.1 C in April 1973 17.2 C in April 1978
Average wind speed	3.7 m/s in March 5.7 m/s in January, June
Maximum wind speed	W 31.9 m/s in November 1978
Average air pressure	1012 mb in December 1010 mb in April

### 9.2 Monsoons

Monsoons of Indian Ocean govern the climatology of the Maldives. Monsoon wind reversal plays a significant role in weather patterns. Two monsoon seasons are observed: the Northeast (*Iruvai*) and the Southwest (*Hulhangu*) monsoon. Monsoons can be best characterized by wind and rainfall patterns. The southwest monsoon is the rainy season which lasts from May to September and the northeast monsoon is the dry season that occurs from December to

February. The transition period of southwest monsoon occurs between March and April while that of northeast monsoon occurs from October to November.

### **9.3 Rainfall**

Annual average rainfall in Maldives is about 1900mm. There is a marked variation in rainfall across Maldives with an increasing trend towards south. The annual average rainfall in north is 1977mm and for south is 2470mm.

The southwest monsoon is known as the wet season with monthly average rainfall ranging from 125-250mm. The northeast monsoon is known as the dry season with average monthly rainfall of 50-75mm.

Rainfall records indicate an average annual rainfall of 2500mm. The intensity of rainfall is a concern in the Maldives since intensity is high with low frequency. However, excessive rainfall is not a concern for Vaadhoo since the island does not cup towards the middle but rather diverts the runoff towards the shore on all sides especially the easter side where the island has a low elevation.

### **9.4 Temperature**

Daily temperatures of Maldives vary little throughout the year with a mean annual temperature of 28°C. The annual mean maximum temperature recorded for Male' during the period 1967-1995 was 30.4°C and the annual mean minimum temperature for the same period was 25.7°C. The highest recorded temperature for Male' was 34.1°C on 16th and 28th of April 1973. The hottest month recorded was April 1975 with a maximum monthly average temperature of 32.7°C, the next highest being 32.6°C in April 1998. The lowest minimum average temperature of 23.7°C was recorded in July 1992.

### **9.5 Wind**

Wind has been shown to be an important indirect process affecting formation development and seasonal dynamics of the islands in the Maldives. Winds often help to regenerate waves that have been weakened by travelling across the reef and they also cause locally generated waves in lagoons. Therefore winds are important here, as being the dominant influence on the sediment transportation process (waves and currents). With the reversal of winds in the Maldives, NE monsoon period from December to March and a SW monsoon from April to November, over the year, the accompanying wave and current processes respond accordingly too. These aspects have ramification on the seasonal sediment movement pattern on the islands and also the delivery/removal of sediments from the reef platform/island.

The two monsoon seasons have a dominant influence on winds experienced across Maldives. These monsoons are relatively mild due to the country's location close to the equator and strong winds and gales are infrequent. However, storms and line squalls can occur, usually in the period May to July; gusts of up to 60 knots have been recorded at Male' during such storms.

Wind was uniform in speed and direction over the past twenty-plus monsoon seasons in the Maldives (Naseer, 2003). Wind speed is usually higher in central region of Maldives during both monsoons, with a maximum wind speed recorded at 18 m.s-1 for the period 1975 to 2001. Maximum wind speed recorded in the south was 17.5 m.s-1 during the period 1978 to 2001. Mean wind speed was highest during the months January and June in the central region, while wind speed was in general lower and more uniform throughout the year in the southern region. Wind analysis indicated that the monsoon was considerably weaker in the south (Naseer, 2003). During the peak months of the SW monsoon, southern regions have a weak wind blowing from the south and south-eastern sectors.

Table 5 summarises the wind conditions in Vaadhoo throughout the year. Medium term meteorological data from Malé International Airport weather station was used in this analysis.

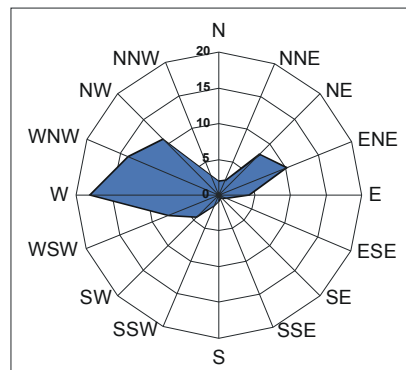
**Table 5: Summary of general wind conditions in Vaadhoo**

Season	Month	Wind
NE - Monsoon	December	Predominantly from NW-NE.
	January	Stronger winds from W
	February	
Transition Period 1	March	From all directions. Mainly W.
	April	Stronger winds from W
SW - Monsoon	May	Mainly from W.
	June	Stronger winds from W
	July	
	August	
	September	
Transition Period 2	October	Mainly from W.
	November	Stronger winds from W

**Table 6: Scatter diagram for Vaadhoo. Wind speed versus wind direction (%). All Year (1999)- (adapted from DHI, 1999)**

Wind speed (m/s)	Wind Direction								
	NE	E	SE	S	SW	W	NW	N	
1	0.94	0.95	0.96	1.19	1.02	0.97	0.82	0.78	
2	2.02	1.95	2.13	1.91	1.81	1.92	1.57	1.46	
3	2.30	2.79	2.98	2.74	2.74	2.99	2.31	2.12	
4	2.04	2.26	2.75	2.91	2.86	2.90	2.15	1.91	
5	1.45	1.97	2.30	2.21	2.98	2.49	1.51	1.27	
6	0.54	0.99	1.42	0.94	1.79	2.36	1.02	0.80	
7	0.10	0.32	0.74	0.28	0.91	2.04	0.43	1.10	
8	0.05	0.06	0.26	0.11	0.52	1.39	0.19	0.04	
9	0.01	0.01	0.16	0.01	0.19	0.94	0.10	0	
10	0	0	0.05	0	0.04	0.75	0.04	0	
11	0	0	0	0	0	0.46	0.01	0	
12	0	0	0	0	0	0.07	0.01	0	
13	0	0	0	0	0	0.02	0	0	

The arrival and service jetties as are concentrated on the eastern side of the island while most of the guest villas face the east and west side. The northern thundi area, is prone to severe weather including the effects of wind-generated waves and oceanic swells from the channel. The reef extent on the western side is considerably large, whereas from the eastern side is very narrow.



**Figure 4: General wind rose diagram for the Maldives (source MEEW 2005).**

### 9.6 Waves

Wave energy is important for sediment movements and settlement, and it is also a crucial factor controlling coral growth and reef development. Waves have been attributed to the diversity and the abundance of coral and algal species. These aspects have implications for the type and perhaps the supply of sediment s into the island.

Studies by Lanka Hydraulics (1988a & 1998b) on Malé reef indicated that two major types of waves on Maldives coasts: wave generated by local monsoon wind and swells generated by distance storms. The local monsoon predominantly generates wind waves which are typically strongest during April-July in the south-west monsoon period. During this season, swells generated north of the equator with heights of 2-3 m with periods of 18-20 seconds have been reported in the region. Local wave periods are generally in the range 2-4 seconds and are easily distinguished from the swell waves.

Distant cyclones and low pressure systems originating from the intense South Indian Ocean storms are reported to generate long distance swells that occasionally cause flooding in Maldives (Goda, 1988). The swell waves that reached Malé and Hulhule in 1987, thought to have originated from a low pressure system of west coast of Australia, had significant wave heights in the order of 3 metres.

In addition, Maldives has recently been subject to earthquake generated tsunami reaching heights of 4.0m on land (UNEP, 2005). Historical wave data from Indian Ocean countries show that tsunamis have occurred in more than one occasion, most notable been the 1883 tsunami resulting from the volcanic explosion of Karakatoa (Choi *et al*, 2003).

Vaadhoo is exposed to waves generated by swells combined with short-wind-generated waves traveling through the channel facing the north eastern side. Waves breaking on the western side may be considered to be less strong because of the wide reef extent on this side. The effect of waves is more prominent on the eastern side, as can be evident from the shore protection measures undertaken.

Waves breaking on the south side may be less strong because it faces the atoll lagoon, therefore it has less influence in island building. General wave conditions in Vaadhoo is summarised in Table 7 (adapted from DHI, 1999).

**Table 7: Summary of wave condition in Vaadhoo.**

Season	Total	Long Period	Short Period
NE - Monsoon	Predominantly from E-S. High Waves from W	From S-SW	Mainly E-NE. High waves from E
Transition Period 1	Mainly from SE-E	From S-SW	Mainly from NE-SE
SW - Monsoon	From SE-SW. Mainly from S. Medium waves also from W	From S-SW	Mainly from SE-S. High waves from E
Transition Period 2	As SW monsoon	From S-SW	From SE-W. Higher waves from E

## 9.7 Tides

Tides affect wave conditions, wave-generated and other reef-top currents. Tide levels are believed to be significant in controlling amount of wave energy reaching an island, as no wave energy crosses the edge of the reef at low tide under normal conditions. In the Maldives where the tidal range is small (1m), tides may have significantly important influence on the formation,

development, and sediment movement process around the island. Tides also may play an important role in lagoon flushing, water circulation within the reef and water residence time within an enclosed reef highly depends on tidal fluctuations.

## **9.8 Currents**

Studies on current flow within a reef flat in Male' Atoll suggests that wave over wash and tides generate currents across the reef platforms, which are also capable of transporting sediments (Binnie Black & Veatch, 2000). However, available information suggests that tidal currents are not strong due to small tidal range.

Generally, current flow through the Maldives is driven by the dominating two-monsoon season winds. Westwardly 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.

Studies on current flow process within a coral atoll have shown that waves and tides generate currents across the reef platforms, which are capable of transporting sediments on them. Currents, like waves are also modified by reef morphology. Under low-input wave conditions (0.5m heights) strong lagoonward surge currents (>60cm/sec) are created by waves breaking at the crest. Studies on current flow across reef platforms have shown that long-period oscillations in water level cause transportation of fine-grained sediments out of the reef-lagoon system, while strong, short duration surge currents (<5sec.) transport coarse sediments from the breaker zone to seaward margin of the backreef lagoon. Always sediment accumulates at the lee of high-speed current zones. Generally zones of high current speed (jets or rips, 50-80cm/sec) are systematically located around islands.

## **9.9 Existing Terrestrial Environment**

### **9.9.1 Section Brief**

This section will look at the terrestrial zone of the island environment which is the area inside the vegetation. As outlined in the Terms of reference, this report will only focus on describing the baseline terrestrial environmental conditions. Therefore, this chapter will cover the following:

- Baseline terrestrial environmental conditions of the island.
- The different proposed components of the project that will impact upon the terrestrial environment

The baseline terrestrial environment of Vaadhoo islands was studied in detail by selecting the areas where the redevelopment activities will be undertaken. A detail account of the terrestrial flora was assessed, identifying the types of flora, maturity and the presence of any endangered or protected species. Terrestrial environment survey was strictly focused on selected areas of the islands vegetation and identifying their abundance and occurrence in the island. At the end, a terrestrial vegetation map as created to identify the baseline conditions.

## **9.10 Existing baseline conditions of the terrestrial environment**

### **9.10.1 Floral Landscape**

The floral landscape of Vaadhoo can be considered of having two major characteristics. The inland vegetation can be considered mature and the coastal vegetation which is more markedly young. Since, the island is very small, there are only limited varieties of plant species than what would be observed in a large island with greater diversity. There are also no terrestrial landscapes of significance nor any threatened species of plants. Hence, the terrestrial flora of Vaadhoo does not have any specific unique characteristics.

There are considerable amount of mature trees on the inside the island. The main types of mature trees in the island is *Cocos nucifera*, (*coconut palms*), *Thespesia populnea* (*Hirundhu*), *Hibiscus tiliaceus* (*Dhiggaa*) and Kaani (*Cordia subcordata*). A summary vegetation map is provided in Figure 5. The vegetation assessment was undertaken by identifying the types of trees and their heights around the areas where project activities will be undertaken. In that regard, the demolition areas and the areas where new developments will take place were assessed, floral types recorded and as a last measure, photographs were taken to illustrate the area that will be impacted.

## 9.11 Result of the vegetation survey

Table 8 outlines the types of vegetation found in Vaadhoo island.

**Table 8: Types of vegetation found in Vaadhoo**

Name
Coconut Palm ( <i>Cocos nucifera</i> )
Dhakan'dhaa ( <i>Premna obtusifolia</i> )
Dhiggaa ( <i>Hibiscus tiliaceus</i> )
Funa ( <i>Calophyllum inophyllum</i> )
Hirundhu ( <i>Thespesia populnea</i> )
Magoo ( <i>Scaevola taccada</i> )
Kaani ( <i>Cordia subcordata</i> )
Uni ( <i>Guettarda speciosa</i> )
Emboo ( <i>Ximenia Americana</i> )

### 9.11.1 Coastal vegetation

The coastal vegetation mainly consist of a mixture of Magoo (*Scaevola taccada*), and Dhiggaa (*Hibiscus tiliaceus*). However, other species such as Boakashikeyo (*Pandanus tectorus*) and Emboo (*Ximenia Americana*) were observed sparsely at various regions. The results of the vegetation survey are summarised in Figure 5.

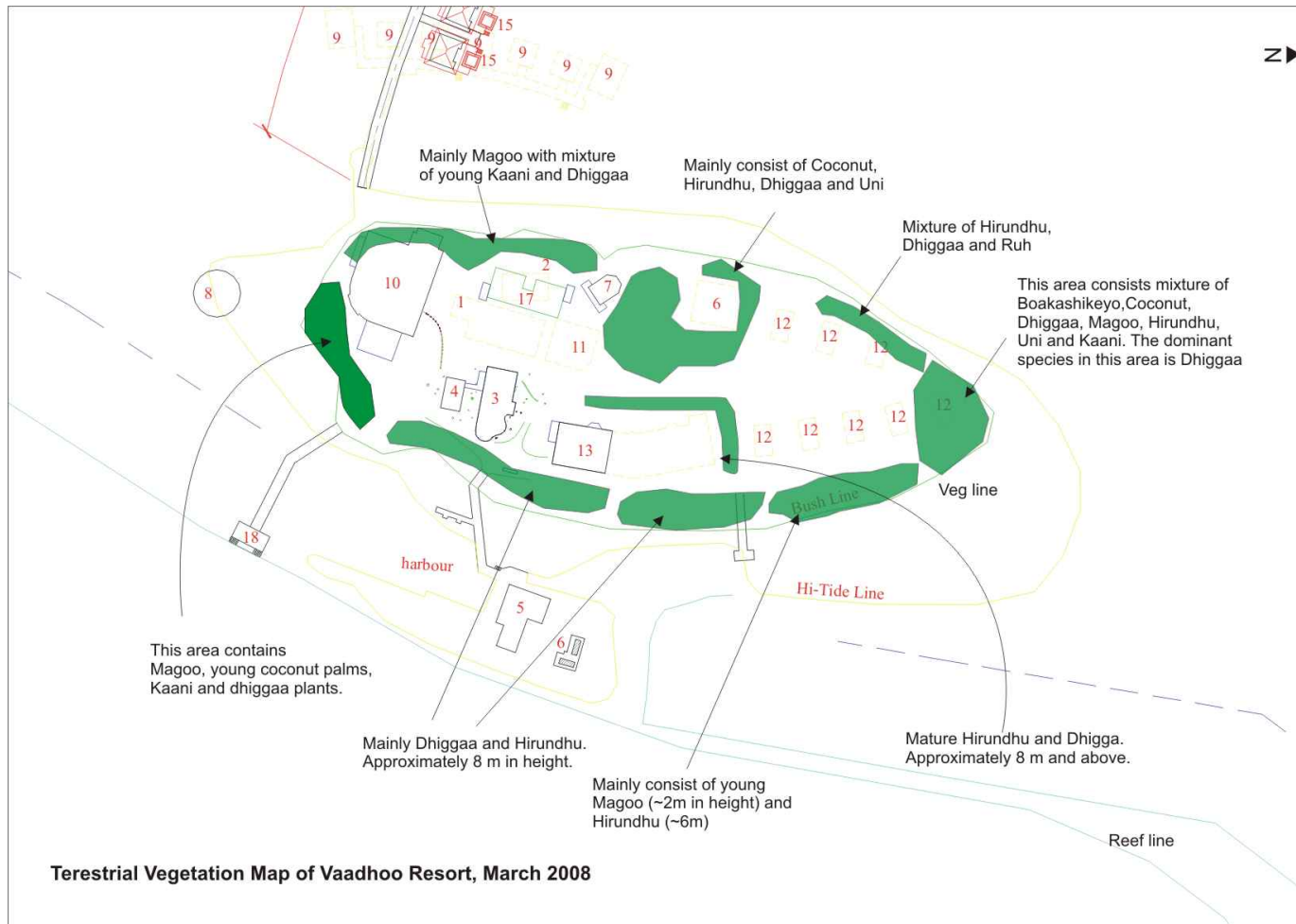
### 9.11.2 Groundwater quality

Groundwater assessment was conducted to assess the ambient conditions of groundwater in Vaadhoo. Methodology used to assess groundwater was to obtain a water sample from a groundwater well. The resort does not use groundwater for any purpose, hence no attempt was made to mark the location of the sampling well. Samples were not taken from the well directly, but using a pump connected to the well. Groundwater of the island was tested for selected parameters outlined below.

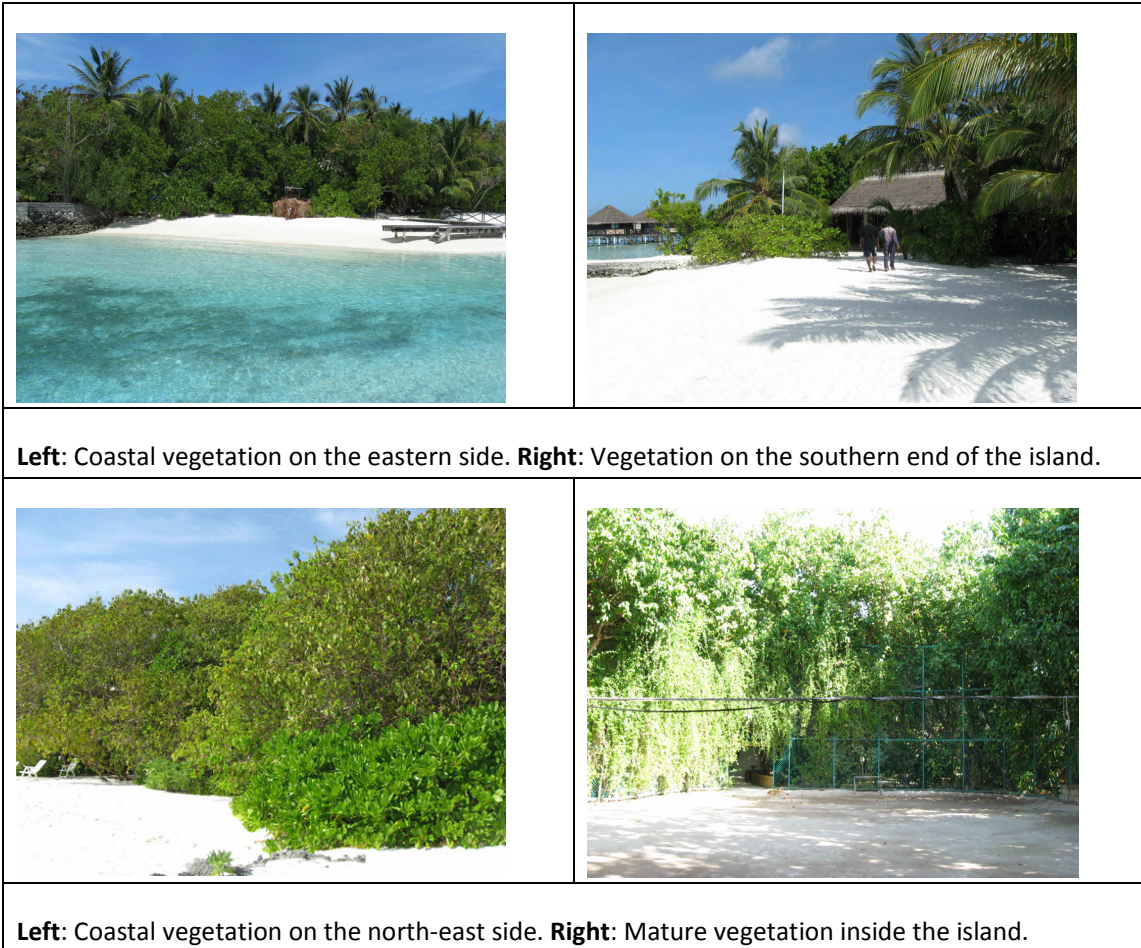
**Table 9: Results of the groundwater quality of Vaadhoo resort.**

Parameter tested	Ground water sample
E-Conductivity	3200 us/cm
Nitrates	2.2 mg/L
Phosphates	0.55 mg/L
pH	7.9

Figure 5: Terrestrial vegetation map



## 9.12 Photographic summary of terrestrial flora



## **9.13 Existing Coastal Environment**

### **9.13.1 Section Brief**

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

- Existing coastal environment, more specifically, the beach and the coastline
- Existing Coastal Environment

### **9.13.2 Island Formation Geological and Setting**

Vaadhoo island is small sand cay lying on its own reef system south of the Vaadhoo Channel, on the northern rim of south Male' atoll. The island is located at about latitude of 4° 07'27.27" N and longitude of 73° 27' 15.43"E. The island is formed on an isolated coral reef system, similar to an inverted triangle, with the widest side on the north and narrowing towards the south. The island is roughly 30 to 50 m from inside the eastern rim of the reef system on which it is formed. Towards the south of the island is the atoll lagoon and towards the east of the island is a narrow channel approximately 228 meters in width. Beyond this, on the eastern side, is one of the largest lagoon / reef system in the Maldives. The channel on the eastern side has strong currents varying in direction depending on the tide and season. On the west of the island's reef system is another channel, measuring approximately 1400 meters. Beyond this, on the western side is another large reef system which contains the island of Velassaru (Laguna Beach resort). This channel on the western side of the island is considerably shallower than the eastern channel as can be seen from the aerial photo (refer to Figure 2). The eastern side of the island is prone to the effects of currents and oceanic waves during north east as there is very narrow lagoon from the shore to the reef extent. This side is exposed to strong winds during north-east monsoon, due to the lack of adequate protection from reefs or islands. As a result, coastal protection measures have been undertaken on this side for several years.

Vaadhoo is directly exposed to Vaadhoo channel as there are no reefs or islands in between this channel and the island. The island is oriented towards north to south direction along its length. The reef on the western side is considerably larger than that on the eastern side. Similarly, the reef edge from the southern side is considerably closer than that on the northern side (refer to Figure 2). Vaadhoo has a very beautiful and easily accessible house reef, which is in good condition in terms of diversity and percentage of live coral cover. The reef is easily accessible from the eastern side due to the small reef extent from this side. In March 2008, the perimeter of the island from the vegetation line measured 441 meters with a total area of the island accounting to 9595 square meters. The island is relatively narrow and the width at the widest point measures 70 meters. The beaches on the island are found on the north, north-east, west and southern side. The average height of the island is 1.5 -1.7 metres above mean sea level.

Analysis of aerial photos and available maps indicate a dynamic sand spit on the north and south of the island. These sand pit or *thundhis* have been observed to move westward during north-east monsoon, when the winds blow predominantly from north-east.

### **9.13.3 Features of the Coastal Environment**

The coastal environment was considered as the main zone of influence from the proposed redevelopment. The existing coastal dynamics were studied briefly during field visits. These include site specific data on the coastal environment including currents and sediment movement patterns and experience of the long term staff stationed in the island. Beach erosion and accretion patterns around the island were studied using aerial photographs available.

The coastline was mapped using a differential GPS. This allowed measurement of the total area of existing beach. The implications of these baseline data are very important for future quantitative measurements as this will aid in the calculation of the beach loss or erosion or accretion patterns.

The coastal environment of Vaadhoo contains mainly white sandy beaches, sea walls at certain sections and shallow lagoon or *falhu*. The coral patches within the lagoon areas are not covered in this chapter as it will be covered in the Marine Environment section. Types of coastal vegetation will also be outlined in the Terrestrial Environment section.

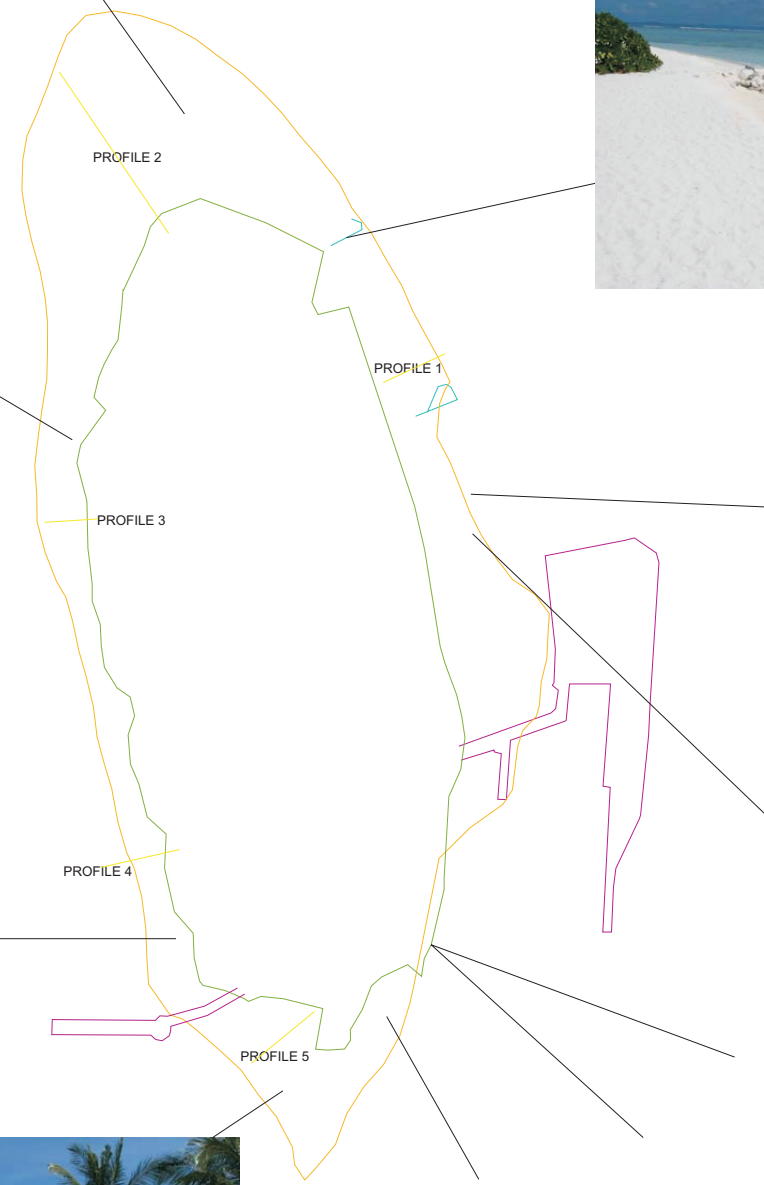
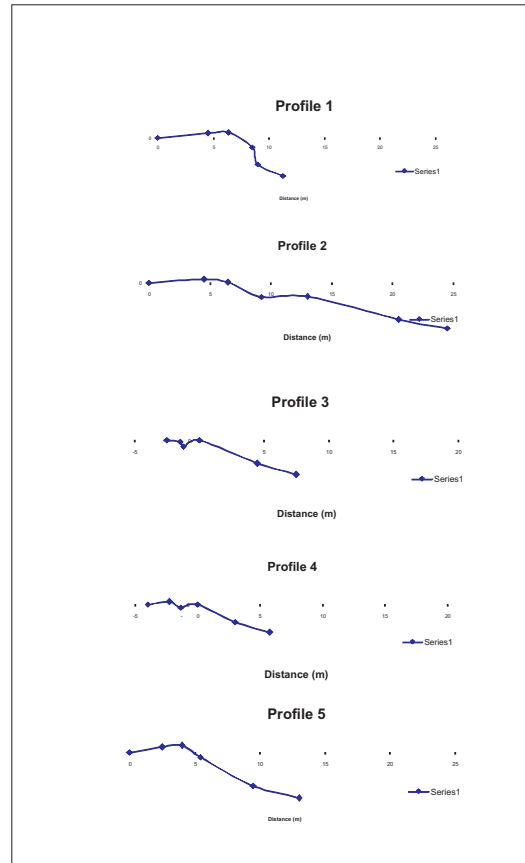
Figure 5 represents the different features of the Vaadhoo island including coastal environment and a description of these different features is given in the following sections.

### **9.13.4 Lagoon**

A considerably large lagoon exists on the north and western side of Vaadhoo. The northern side reef extent is approximately 367 meters from the northern tip of the island. The north-west corner of the reef extent is about 625 meters from the northern tip of the island. The south side also has a lagoon but is narrower than the north and the western lagoon. The southern side reef extent is approximately 210 meters from the southern tip of the island. On the eastern side, the lagoon is very narrow due to the small reef extent on this side (the approximate distance is between 30 and 50 meters varying along the north-south direction of the island). The lagoon around the island is quite shallow. The lagoon consists of medium-fine sandy floor, and scattered patches of coral colonies especially at the western side. The water quality is in a good state with negligible levels of phosphates and nitrates. There is no sign of faecal contamination of the lagoon surrounding Vaadhoo Island.

**Figure 6: Coastal features of the island showing locations from where beach profiles were taken.**

# Coastal features of Vaadhoo



**9.13.5 Beach**

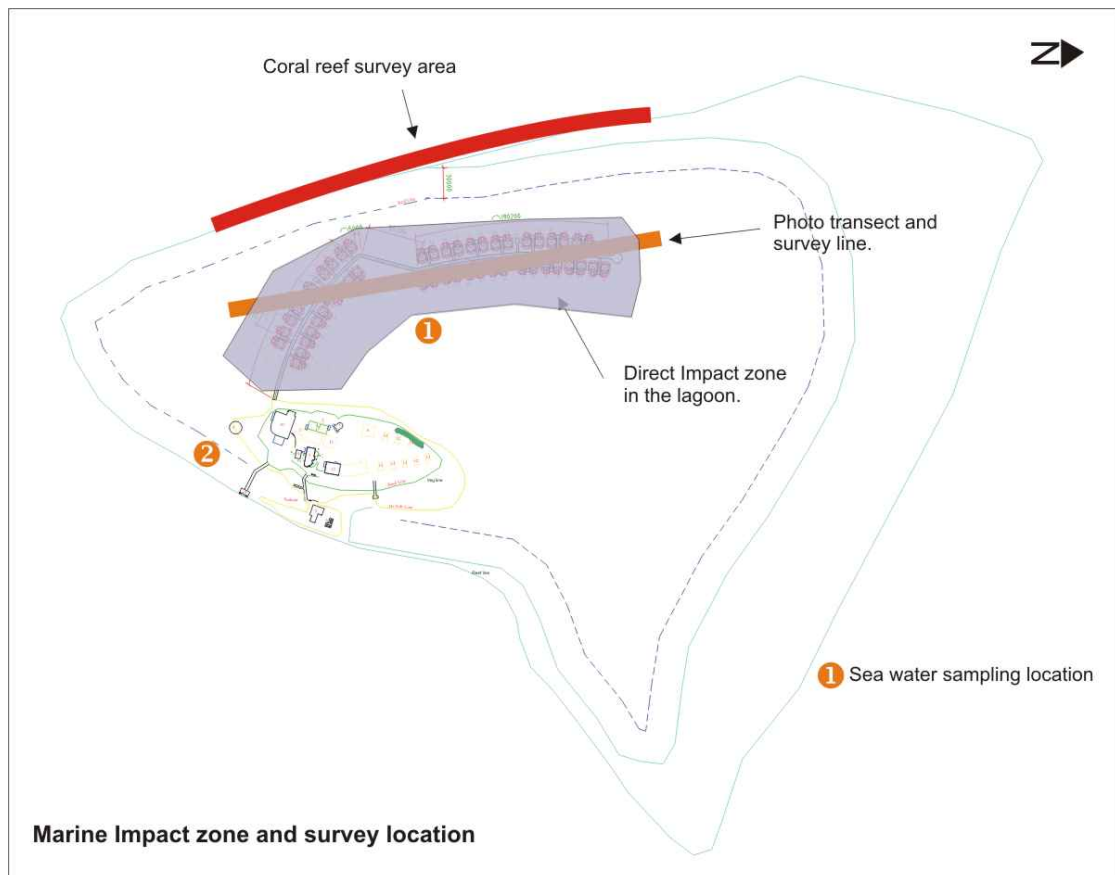
There is no distinctive variation in beach composition around the island. However, the beach extent can be seen to vary from the shoreline survey undertaken in March 2008. The beach consists of mainly fine sand with occasional patches of corals and coral debris on the western side. Beach was observed from all around the island at the time of the survey. However, the coastal environment of the southern and south eastern side has been protected by sea walls and groynes have been placed to trap sediments, indicating that these areas are prone to erosion. The widest beaches are at the north side with a sandspit (*thundi*) slightly oriented to western side. This sand spit has been observed to move to east-west direction in both monsoons, as can be seen from aerial photographs taken at different dates (See Figure 2).

## 9.14 Existing Marine Environment

### 9.15 Section Brief

This section will look at the marine environment of the island with specific emphasis on the western side lagoon.

**Figure 7: Map of Vaadhoo showing marine survey sites and potential impact areas**



### 9.16 Marine water quality

The primary objective of the marine water quality sampling was to determine the baseline conditions of the marine water in the island. Qualitative and quantitative assessments were made on sea water. As the proposed redevelopment activities are mainly concentrated in the western side lagoon, sampling was undertaken in this area. Two sampling locations were selected. The sites were selected based on their location relative to proposed developments. The sea water is clean and clear. To confirm this, water quality tests were done both on site using a water quality logger and at the National Health laboratory. The results indicate no pollution from any human activities nor any other source. Nitrate levels were untraceable in all the two samples. Phosphate levels were also nil in the two samples. These readings indicate negligible nutrient loading. Furthermore, the turbidity levels were also very low. Table 10 illustrates the result of the marine water quality test and Figure 7 illustrates the marine water sampling locations.

**Table 10: Results of the marine water quality tests undertaken in March 2008**

Parameters	Sampling locations	
	Sample 1	Sample 2
GPS Coordinates (UTM)	4 <sup>o</sup> 07'27.14" N 73 <sup>o</sup> 27'20.32" E	4 <sup>o</sup> 07'24.64" N 73 <sup>o</sup> 27'28.14" E
Salinity (ppt)	51	51
Turbidity (NTU)	0	1
Nitrates (mg/L)	0	0
phosphates(mg/L)	0	0

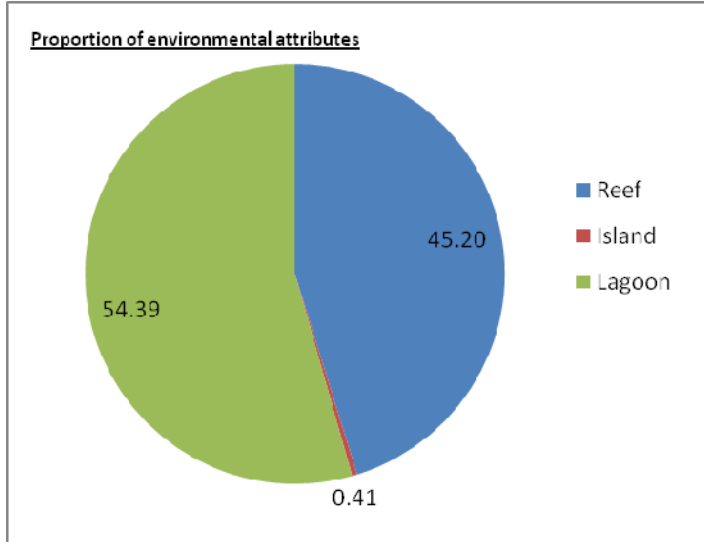
## 9.17 Description of marine environment

### 9.17.1 *Abiotic environment*

The marine environment of Vaadhoo consisted of a relatively large coral reef system, a shallow lagoon system, which is widest on the western side and the various habitats and processes within these systems which collectively function as a small island system. Vaadhoo island system is located on the northern rim of the atoll. As this island system is on the atoll rim and on the mouth of a channel it is very exposed to strong currents. The coral reef system of Vaadhoo is in the shape of an inverted triangle.

### 9.17.2 *Coral reef system*

The width of the reef system from the northern end is 771 m and the length of the system at the southern end was estimated as 167 m. The perimeter of the reef system was estimated to be approximately 2669 m. The total reef area of the system including the reef-flat and reef slope was estimated to be approximately 38,607 m<sup>2</sup>. The following figure shows proportions of the environmental attributes of the island system in terms of area.

**Figure 8: Proportion of environmental attributes of the island**

The coral reef system of Vaadhoo can be considered to be well developed with good coral cover all around the reef system. The reef slope varies along different sections of the reef varying from steep slope to a gentle reef slope. The visibility of the eastern side of the reef was 20 to 25 meters on the day of the survey, mainly resulting from the high currents. A reef-flat measuring a width of approximately 100m is found on the western and north end of the reef system and width of reef-flat on southern end is approximately 70m. The reef-flat on eastern side area is very narrow having approximately 30m in average. The total reef area including the reef-flat and shallow areas of the reef slope was estimated as 383607.00m<sup>2</sup> (Reef area has been calculated as the reef slope and the reef flat, not including the lagoon).

### **9.17.3 Lagoon system**

The lagoon system has been considered as the area from the shore line up to the reef flat. The length of the lagoon system on the north side was estimated as approximately 300 m and on the east side as approximately 20 m. The lagoon total area was estimated as approximately 209,509 m<sup>2</sup>. A large lagoon area is found on the north and north western side of the island, whereas the southern side is comparatively narrow and the eastern side very narrow. The lagoon on northern and southern side of the island is very narrow as the reef system is elongated east-west direction. The bottom substrate of the lagoon consisted of mainly sand and coral rubble, including the western side where water villas have been proposed to be developed. la.

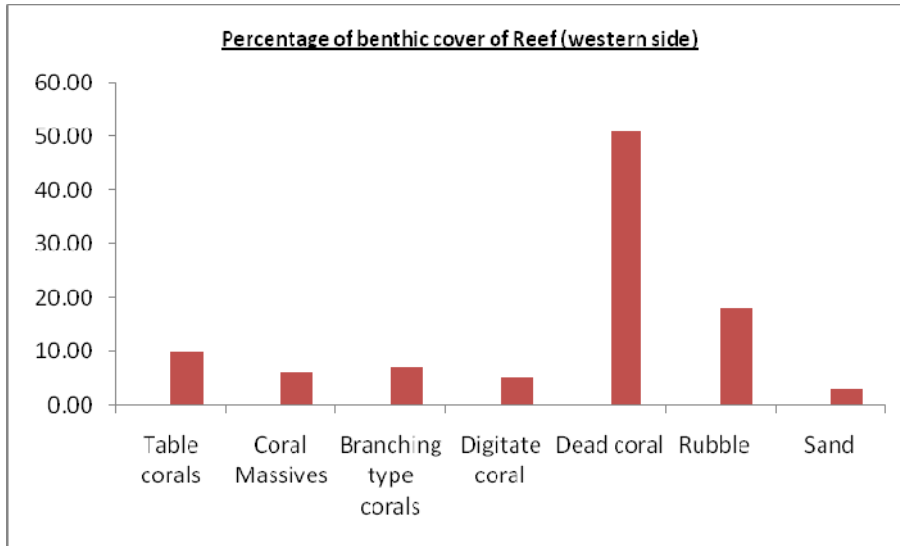
### **9.18 Biotic marine environment**

The biotic marine environment of the system was assessed for the lagoon system, as this was the area that will have the greatest impact. In addition, the coral reef system was also assessed. The two major habitats within the reef system include the reef slope and the reef-flats having distinct biotic marine environments. The major habitat within the lagoon is the lagoon bottom.

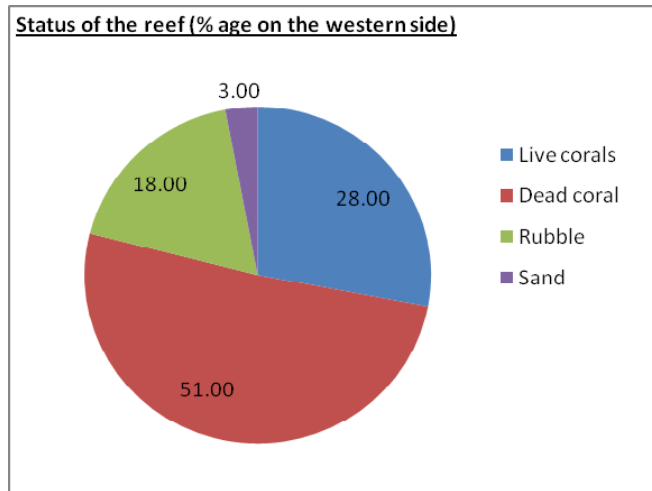
**9.18.1 Coral reef system**

The coral reef system of Vaadhoo island is in good condition in terms of diversity and percentage live coral cover. The photo-quadrant reef survey and visual observations conducted showed that the coral reef of the island had over 28% live coral cover consisting of diverse range coral genera. For the purpose this assessment, coral reef survey was focused on the western side only. The following figure shows the benthic composition the reef in terms of percent cover of different categories of corals genera and other benthos given by the photo-quadrant reef survey at survey site . Standard error for the following estimates is expected to be ±10%.

**Figure 9: Benthic cover of the reef (western side)**



Massive type coral cover was recorded as 4%. These mainly included *Porites*, *Favites*, *Favia*, and *Platygyra* species. Table corals were the most abundant corals type. An estimate 10% of this site consisted of *Acropora* table corals. Other categories of corals recorded were 7% *Acropora* branching corals and 5% *Acropora* digitate corals. Sandy areas of the reef consisted of approximately 3% and dead area of the reef was estimated as 51% of the reef area. Total amount of live coral cover of the reef on the western side was estimated as 28%. The following figure shows the overall status of the reef on this side.

**Figure 10: Status of the western side reef**


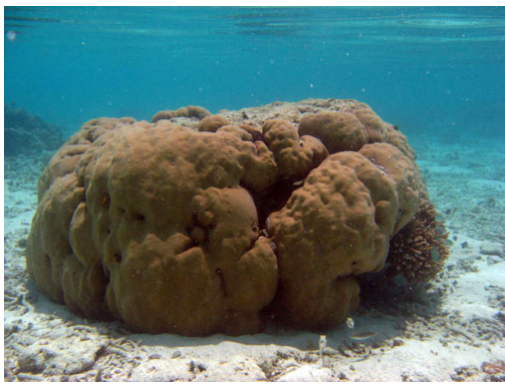


The western side reef had 28% live coral, 3% sand, 18% coral rubble and 51% dead corals. The survey at showed that the reef was in good condition with respect to live coral cover.

#### **9.18.2 Lagoon system**

The lagoon survey was concentrated on west and northwester side of the island where impact of over-water villa construction is going to be the greatest. The lagoon survey showed that lagoon bottom consisted of mainly coarse and fine sand in most areas and unconsolidated rubble in few areas especially in western and eastern sides of the island. Few Isolated individual live coral colonies especially closer to the reef-flat areas was recorded in the lagoon areas. These colonies mostly belong to fast growing *Acropora digitate* corals. In-fauna of the lagoon bottom was not assessed, however lagoon bottom infauna surveys and assessments conducted in similar environments showed that the lagoon bottom environment consisted of mainly burrowing polychaete worms, copepods, amphipods, bivalves and other crustaceans.

The pelagic life of the lagoon in this area consisted of only few species of fishes including trevallies, Family Carangidae, Goatfishes, Family Mullidae and Emperors, Family Lethrinidae. Fish numbers belonging to these families was also limited during the survey as these fishes are not territorial. Rare or endangered species were not observed in the locality. Biotic environment of the lagoon in the locality was found to have no special attribute/characteristic or environmentally sensitive area. See Figure 7 for locations of the lagoon surveys.

Figure 11: Photos of the lagoon showing the composition.

	
<p>Lagoon bottom consisted of mainly sand and coral rubble.</p>	<p>Lagoon bottom with isolated coral massives .</p>
	
<p>Coral rubble and an isolated live coral</p>	<p>Isolated colony of coral massive and coral branching (<i>Acropora Branching</i>).</p>

## **10 Environmental Impacts**

### **10.1 Impact Identification**

Impact identification has been undertaken by considering the proposed developments and modifications and examining the level of impact it will have on the environment. Each area was then examined in detail to identify the construction methods, technology and other factors that would determine the potential impact of the various activities.

The proposed modification is not expected to bring any significant negative impact on the island's existing vegetation. Swimming pool will be developed without cutting any vegetation. Water villas have been proposed to be developed on the lagoon with a buffer of 30 m from the reef line. The footings of the water villas will not be solid structures and will allow sediment movement. Similarly, the extension of the arrival jetty will also be constructed on piles.

### **10.2 Assessing Impacts**

Environmental impacts of the proposed redevelopment work 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.

The impacts of the proposed modifications on the terrestrial environment have been looked into and is considered to be negligible. Whereas, the impacts on the marine environment are going to be moderate as the proposed modifications take place in the lagoon. The impacts are categorized into short-term and long-term. Most of the short-term impacts are related to constructional phase, while the long-term impacts are associated with the operational phase.

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.

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 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 judgement 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.

Positive – the impact is likely to bring a positive change in the sense that it is aimed at further minimizing the impacts as a result of the proposed actions.

### **10.3 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, geomorphological 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.

However, the level of uncertainty, in the case of Vaadhoo is expected to be very low as many similar projects have been undertaken elsewhere in the Maldives. No clearing of trees for the proposed modifications means that there will be negligible impact. In the marine environment, there is a greater degree of uncertainty as the marine environment is more sensitive in extreme cases such as severe weather conditions. Regardless of this, it is important to consider that there will be uncertainties and to undertake voluntary monitoring of natural processes as described in the monitoring programme given in this report.

When infrastructure is developed in coastal environments, it is definitely going to have some impacts as the coastal environments are very dynamic in nature. The nature of the impacts are going to vary as different environments will be very different in their nature. Coastal infrastructure has been known to alter natural sediment transport patterns to some extent resulting in erosion and accretion. This will have its environmental and economic consequences. Similarly, the marine environment will also have its impacts, which will depend on the baseline health of the receiving environment.

Such developments have been undertaken in other parts of the Maldives and their impacts are well known and have been well documented. Therefore, there is very little uncertainty involved in this project with regard to the construction of water villas and extension of the jetty. The marine environment mainly consists of coral rubble and sand with the exception of some isolated coral patches. Therefore, there is a high degree of accuracy in prediction of the impacts.

### **10.4 Impacts on the Coastal environment**

During the initial stages of the redevelopment of Vaadhoo island or during the construction phase will be the major direct short-term impacts and some secondary long-term impacts on the coastal environment. Potential negative impacts on the reef system and beach environment from the proposed work are limited to only few activities such as the extension of the arrival jetty and the construction of the water bungalows on the western side lagoon. The proposed structures in the coastal environment are illustrated in the site pland attached as an annex.

#### **10.4.1 Construction of Proposed Water Villas**

The villas will be located on the western side lagoon. The impact of construction of the water villas on the coastal environment would be resulting from the effect of the columns on the longshore sediment transport. Since the water villa structures are shore connected, there will be some degree of disruption of natural sediment transport patterns at the base of the jetties (where the jetty connects with the shore). The first set of water villas will be roughly 30 from the shore and the second set of water villas will be approximately 130 m from the shore. Therefore, longshore processes and the natural dynamic equilibrium of the lagoon will be affected to some extent. The proposed structures are not expected to affect longshore transport significantly and the impact will be minimal. There may be some sand accretion at the base of the jetty as the shore connects with the first few beams, which would act as nearshore breakwaters, thereby trapping some sediments in between the beam and the shore.

Overall, the construction of proposed water villas would cause some degree of sedimentation (discussed in the Marine Environment section) and potential changes to the long shore transport and littoral regime of the island, as discussed above. This is considered a minor adverse impact if mitigation measures were taken. The impact of sedimentation can also be considered limited and contained if proper construction methods and supervision is undertaken.

### **10.5 Impacts on the terrestrial environment**

#### **10.5.1 Demolition of structures and construction of the swimming pool**

During the construction phase, terrestrial environment will have minor impacts, which will be insignificant and only limited to the construction period. No land clearing has been proposed and therefore, no major terrestrial environmental impacts will be felt. During the demolition of existing buildings and other structures on land, dust and noise will be the significant impact, which will only be localised to the island environment only.

Construction of the swimming pool is not expected to impact the groundwater resources at all. If dewatering is required, it will be done according to the guidelines set by Maldives Water and Sanitation Authority (MWSA). The impacts of dewatering will be short term and would only be felt on the vegetation in the vicinity. Any impact on vegetation would be mitigated as suggested in the mitigation plan. There will not be any impact on the use of groundwater, as groundwater will not be used for any purpose as per Tourism Regulations. The groundwater quality would be deteriorated, however, will get back to a natural equilibrium within a year at the most.

### **10.6 Impacts on the marine environment**

#### **10.6.1 Construction of Proposed Water Villas**

Impacts on the marine environment arising from the proposed project are limited to only the construction of over-water villas.

The surveys and assessment showed that the proposed construction of over-water villas would impact the coral reef indirectly and the lagoon directly and indirectly. Direct impact on coral reef is not expected as the development of the water villas will be undertaken with a buffer of 30 m (see the site plan). Indirect impact on coral reef will be spreading of sediment plumes on the coral reef. This impact will be felt on an estimated 16% of the coral reef system.

Direct impact on lagoon will be disturbance to the lagoon bottom in laying the footings of the over-water structures. This direct impact will be felt on an estimated 7% of the lagoon. Indirect impact on the lagoon will be spreading of low level of sediment in the lagoon water column. This impact will be felt on an estimated 30% of the lagoon. Estimated error of these predictions are  $\pm 10\%$ .

#### 10.6.1.1 Significance of the impacts

Impacts that will arise from activities of the proposed project were categorised into the following characteristics in the table and the significance of impacts was determined based on these characteristics and analysis of the impacts from this project and other analogous projects. These impacts correspond in the worst case scenario and after mitigation measures were taken. The following table shows the main impacts that will arise from the proposed project activities and their significance based on impact characteristics.

**Table 11: Significance of impacts**

Impact characteristic	Project activities
	Over-water villa construction
Nature of impact	cumulative
Magnitude of impact	Major adverse
Geographical range of impact & environmental attribute	Direct impact on 15,466 m <sup>2</sup> of lagoon Indirect impact on 62,852 m <sup>2</sup> of lagoon. Indirect impact on 37,242 m <sup>2</sup> of coral reef
Duration of impact	Short-term on coral reef / Long-term on lagoon
Reversibility of impact	Reversible
Impact significance	Significant

Significant negative impacts from the proposed development will be on the attributes of lagoon bottom and water column due to cumulative impacts of direct and indirect impacts on these attributed. Magnitude of impact is calculated in relation to the total area of the lagoon and the coral reef. Direct geographic range of impact felt will be the immediate proposed development

area and indirect impacts will be felt on a larger area due to spreading of fine sediment. Duration of impact is predicted in terms of severity of impacts. Direct impacts last longer than indirect impacts. Reversibility is predicted based on natural recovery of the habitats impacted. The coral reef naturally takes longer to recover than the lagoon habitats and therefore, in this case, recovery will be much sooner. Significance of the impacts is predicted based on the nature, geographic range where impacts are felt, magnitude, duration and reversibility of the impacts.

#### **10.6.2      *Construction of sewage treatment plant***

Construction and setting up of a sewage treatment plant will benefit the environment positively. First, the use of septic tanks will be abandoned for wastewater treatment. This will eliminate the possibility of sewage leaking in to the groundwater, the effects of which include contaminated soil and groundwater, smelly groundwater and health effects in the long term of hydrogen sulphide accumulation in the groundwater. Secondly, 50% of the treated water will be recycled for irrigation and toilet flushing and the remaining discharged in to the open sea (refer to the appendix for the location of sea outfall). This will reduce the demand for other water sources, which is desalinated water for gardening and toilet flushing (as resorts are not allowed to use groundwater for any purpose). This overall reduction in water demand will reduce the burden on water production, which will be a positive impact on the environment. The discharge of treated wastewater in to the open ocean will have negligible impact as the discharge location has strong currents throughout. Therefore, this component is not expected to have any significant environmental impacts.

**Table 12: Summary of major impacts and mitigation measures**

Environmental Aspect	Potential Impacts to the environment	Mitigation Measures proposed
<p><b>Demolition of some land structures and construction of the swimming pool</b></p>	<p><b><u>Terrestrial environment</u></b></p> <p>Demolition of structures will have temporary impact through the emission of dust which will settle on the vegetation. However, the dust emitted will not be toxic and harmful and the impact is only temporary in nature.</p> <p>The construction of a new swimming pool will not have any impact on terrestrial environment as no trees will be cut. Impacts of dewatering would be short term saline intrusion.</p> <p><b><u>Groundwater and surface water</u></b></p> <p>Excavation for foundations (for swimming pool) may lead to exposure of groundwater and increase the chance of contamination of the groundwater. Only very limited excavation will be undertaken to construct pool foundation and is not anticipated to affect the water lens at all.</p>	<p>Demolish the only required buildings.</p> <p>No cutting of any trees. Cutting may be limited to only branches if they intervene with the demolition.</p> <p>Regularly water spraying the trees to get rid of dust, if they arise too much.</p> <p>Limiting the period of demolition.</p> <p>Watering trees in the vicinity during dewatering for swimming pool construction</p>
<p><b>Construction of over water villas and the extension of the arrival jetty.</b></p>	<p><b><u>Coastal Environment</u></b></p> <p>Primary impact of fine sediment on shallow lagoon and long shore sediment transport. Bottom biota affected and water quality will be reduced (short term) due to fines in the water column.</p> <p><b><u>Marine Environment</u></b></p> <p>The construction of over-water villas would impact the coral reef indirectly and the lagoon directly and indirectly. Direct impact on coral reef is not expected as the development of the water villas will be undertaken with a buffer of 30 m (see the site plan). Indirect impact on coral reef will result through the spreading of sediment plumes on the coral reef. Direct impact on lagoon will be disturbance to the lagoon bottom in laying the footings of the over-water</p>	<p>The following mitigation measures will help minimize the impacts.</p> <ul style="list-style-type: none"> <li>- The water villas will be built on columns. STRICTLY no solid structures on which they will be constructed.</li> <li>- Ensure appropriate supervision and monitoring during works</li> <li>- Carry out the work in low tide hours during calm weather</li> <li>- Complete the work in as short a time period as possible</li> <li>- Use manual methods as much as possible</li> <li>- Create awareness and brief the workforce on how to minimize impacts</li> <li>- limiting the working area within the boundary of the construction zone and avoiding disturbing other areas. An ideal method would be to mark the area with tape to indicate the construction zone.</li> </ul>

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Environmental Aspect	Potential Impacts to the environment	Mitigation Measures proposed
	structures.	<p>- Early planning is one of the most important steps in reducing and eliminating any adverse impact from the proposed project. Environmental concerns are considered concurrently with technical planning of the project and precautions will be applied from the outset of the planning process through all phases of the project activities.</p> <p>Minimum and most appropriate area for the development of the over-water structures was selected to minimise negative impacts through prior planning and consultations. Environmental surveys were conducted to identify these and means of impact mitigations.</p> <p>Proposed development work will be carried out to coincide with low tide. Proposed development work will be carried out in calm weather and sea condition.</p> <p>Machinery, equipment and vessels used in the project activities will be maintained in good condition and operated in a manner that they do not pose a risk of the environmental degradation.</p> <p>All work activities will be kept to the minimum period of time to reduce impacts on the environment.</p> <p>Work will be inspected and supervised in whole lifecycle of the proposed project. Supervision of work will be carried out by a competent and independent party with experience of similar work and its possible impacts to the environment. Supervising party will carry out compliance monitoring and reporting to ensure that the predicted impacts are not exceeded. If predicted impacts were exceeded, the work will be halted and impacts re-assessed and</p>

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Environmental Aspect	Potential Impacts to the environment	Mitigation Measures proposed
		<p>reported.</p> <p>The monitoring programme specified in this report will be followed and reported in both work phase and operation phase.</p>
<b>Noise and air pollution</b>	<p>Vaadhoo is an isolated island. Noise impacts are therefore going to be localized to the Island only.</p>	<p>Noise is not expected to be a concern due to the intermittent nature of noise sources such as excavators. However construction workers, who are prone to high noise levels such as machinery operators, will be provided with proper personal protection equipments (PPE) such as ear muffs.</p> <p>Demolition will also be done using manual methods and not with the use of any machinery</p>
<b>Generation of construction debris</b>	<p>Construction waste will impact the environment as they have to be managed and disposed using proper methods. This component is not expected to have any significant impact as the debris will be regularly transferred to Thilafushi. Temporary stockpiling of waste in the island will not have any significant impact as it will only be short term/temporary.</p> <p>Additional burden on Thilafushi resulting from the construction waste is not considerable.</p>	<ul style="list-style-type: none"> <li>- Sort the construction debris in to concrete, wood and metal waste before transporting them to Thilafushi.</li> <li>- Temporary stockpiling to be done on land and to avoid the beach and the marine environment.</li> <li>- Debris from the water villa to be immediately taken to the island and minimizing their contact with the marine environment.</li> </ul>
<b>Construction of the sewage treatment plant</b>	<p>Eliminates the dependence on septic tanks, thereby avoiding sewage leakage to the ground. Helps to protect the groundwater resources.</p> <p>Reduce the water demand for flushing and gardening, thereby reducing the overall energy consumption for these uses.</p> <p>Sludge is a by product of the process which can be used to enrich the soil and condition the soil, which helps plant growth and landscaping.</p>	<ul style="list-style-type: none"> <li>-Ensure that the treatment standards are met and undertake regular testing of the effluent.</li> <li>-Undertake regular servicing of the treatment plant to make sure their function is not affected.</li> <li>-Buffer the drying bed location with partition or screens to make sure that the smell / foul odour is contained from the reach of</li> </ul>

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<b>Environmental Aspect</b>	<b>Potential Impacts to the environment</b>	<b>Mitigation Measures proposed</b>
	Smell from the drying beds could become a potential problem if the bed is not managed.	tourists.

**Table 13: Summary of the impacts and their characterization**

<b>Environmental Aspect</b>	<b>Nature of impact</b>	<b>Magnitude of impacts (negligible/minor adverse/moderate adverse/major adverse/ positive)</b>	<b>Significance of the impact (low/moderate/high)</b>	<b>Duration of Impact</b>	<b>Reversibility</b>
<b>Demolition of land structures and construction of the swimming pool</b>	Cumulative	negligible	Low	Short term	reversible
<b>Construction of over water villas and the extension of the arrival jetty.</b>	Cumulative	Moderate adverse	Low to moderate	Medium to long term	irreversible
<b>Noise and air pollution</b>	Cumulative	negligible	Low	Short term	reversible
<b>Generation of construction debris</b>	Cumulative	Minor adverse	Low	Short term	reversible
<b>Construction of the sewage treatment plant</b>	Cumulative	positive	high	Long term	-

## **11 Public Consultations**

For the purpose of this project, public consultations were limited to relevant government agencies, the proponent and the designer / Architects. As the project is a redevelopment of an existing resort, these key stake holders were identified relevant to undertake public consultations. Methodology for undertaking these discussions was through interviews and discussions.

### **11.1 Consultation with the proponent / staff**

In general, discussions were held with the proponent to obtain information about the need for this redevelopment and to justify the project. The major outcome of these consultations is outlined below.

- The proponent wishes to develop the resort to a higher standard with additional rooms and facilities thereby generating more profit by providing more options and services for the clients. The need was felt as the current setting does not allow any profit increase without upgrading. Since the island is limited in area, without expansion in to the lagoon, any new concept would not simply be feasible.
- The proponent does not want to alter the island and hence, reclamation has not been considered as it will result in the loss of natural features and beauty of the island.
- There is also the issue of refurbishments for the existing facilities on the resort. The current design and facilities do not match the current market conditions where new and up market clients can be attracted to the island. The existing rooms and other facilities are old and require major upgrading.
- Increase profitability does not mean that it is only beneficial for the proponent. Naturally, it will increase the government's revenue.
- Discussions were also held with the long term staff of the resort. They also felt that the island is too old and does not fit the current market conditions.
- Most of the guest rooms and public facilities are old fashioned and require upgrading.

## **11.2 Consultations with the Ministry of Tourism and Civil Aviation**

Consultations were held with Mr. Mohamed Adhlee, Assistant Director-General of Ministry of Tourism and Civil Aviation over the phone. Following are the main outcome.

- Tourism Ministry's policy is very clear on such redevelopments and all such projects are required to undertake an EIA prior to commencement. Before undertaking and EIA, the proponent also have to obtain the approval of the concept design from Tourism Ministry.
- The Ministry is generally very positive about such redevelopments and welcomes new redevelopment projects.
- This project has been given the approval to continue and hence, the next stage would be the EIA, which will determine the final outcome of the project.

## **11.3 Consultations with Ministry of Environment, Energy and Water**

Consultations were held with senior officials. Following are the main outcome.

- Feels that EIA should be undertaken for such projects.
- All over water structures should have a safe minimum distance from the reef flat, on which they can be developed.
- Environment Ministry's interest lies in protection of the environment at the same time allowing development to take place. This means, that developers should implement all mitigation measures and also undertake regular monitoring.

## **11.4 Consultations with the Architect/Designers**

Consultations were held with Mr. Mohamed Saahil /Chief Architect, Abel Architects regarding the proposed redevelopment. Following are the main outcome.

- The design concept has been developed after considering similar projects elsewhere in Maldives.
- Several alternative designs were considered, including locating the water villas on the northern side. However, this side would be rough during the peak tourist season, which is during the north-east monsoon. Hence, it was decided to relocate to the western side.
- Various shapes and orientations of the water villas were also explored, but the current design was adopted.

### 11.5 List of persons consulted

Following are the names and designation of persons consulted.

Name	Designation	Office
Mr. Mohamed Adhlee	Assistant Director	Ministry of Tourism and Civil Aviation
Mr. Amjad Abdulla	Director-General	Ministry of Environment, Energy and Water
Mr. Mohamed Saahil	Chief Architect	Abel Architects
Mr. Hussein Hilmy	Accountant, Special projects	Adaaran
Mr. Mohamed Salih Hassan	General Manager, Projects	Adaaran

## 12 Alternatives

There are a few alternatives that can be suggested. Since the EIA Regulations require two alternatives to be suggested, two alternatives have been suggested in addition to the no project alternative. These alternatives are discussed below:

### 12.1 No Project Option

The no project option takes the following into account.

- The existing infrastructure continues to deteriorate in quality.
- No additional infrastructures/services are introduced, therefore, price cannot change and profit margin will decrease year by year

The main advantages and disadvantages of these are given in Table 14.

**Table 14: Advantages and disadvantages of the no project option**

Strategy	Advantages	Disadvantages
Allow the existing infrastructure to deteriorate in quality	Environmental problems related to upgrading can be avoided  No upgrading costs to the Proponent, short term benefit	Guest complaints resulting in dissatisfied clients and eventually negative publicity and low occupancy  Low occupancy would mean lower returns and therefore reduced bed tax, therefore, reduced national revenue
Existing water villas would be left as they are	Environmental problems related to demolition and construction of new water villas can be avoided	Value of the tourism product may deteriorate  Guest complaints would arise

### 12.2 Design Alternatives

As the island is very limited in space (1,595 m<sup>2</sup>), it was not practical to increase room capacity without developing additional facilities on water. Therefore, at the design stage, the option of constructing additional facilities in the island environment were abandoned due to limited space. Hence, it would violate the Tourism regulation on maximum space usage on resort islands. The only possibility was to develop double story buildings with rooms on ground and the first floor. Secondly, the island could be increased in size through reclamation. Some of the options that could be considered are discussed below.

#### 12.2.1 *No jetties for the water villa*

The water villas could have been built in the lagoon without a shore connecting jetty. However, this means that access to these structures would have to be provided by float or

mechanised or non-mechanised dinghy. This will involve lot of inconveniences to tourists in addition to the logistic difficulties and high operational cost. Therefore, this option has been rejected. However, there is a small environmental benefit in that there will be less influence on the longshore sediment transport. The impact of the structures would be similar, which mainly includes some degree of siltation/sedimentation. Therefore, there is only little environmental advantage in this option while there are several economic and logistical disadvantages.

## **12.3 Alternative locations**

### **12.3.1 *Location of the Water villas***

The only alternative location for the water villas are on the northern side lagoon. However, this side will receive strong winds and experience rough conditions during the peak season, which is the north-east monsoon. There will also be the issue of constructing access jetty where it will have to be connected via the northern sand spit or *Thundhi*. Constructing any structures at the island tip (sand spit) is not environmentally recommended as this is a highly dynamic area of the coastline and hence, any structures will have significant impacts. The only way to connect the jetty would be to extend it from the west side.

### **12.3.2 *Location of the swimming pool***

The swimming pool has been located on the northern side of the island, after demolition of the existing beach bungalows. There is no alternative location for the swimming pool in the island due to its limited size.

## **12.4 Alternatives to construction technologies**

The foundations or the footings of the water villas and spa will be constructed using concrete piles. The villas will then be constructed using pre-fabricated materials. During the concept development stage, drilling the sea bed to a depth of 6 m to erect the columns were considered in order to ensure that water villas will be structurally strong. However, the cost of this operation would be much more than piling.

Similar water villas have been constructed in other resorts in Maldives, using concrete pads but this method was rejected as the concrete pads are more expensive. Furthermore, the concrete pads when placed on the lagoon bottom may act as submerged breakwaters and hence, the long shore sediment transport patterns will be much disrupted than if they were not placed. The foundation pad will also increase the contact area with the lagoon, thereby increasing the directly impacted area. Therefore, this alternative has not been considered due to cost as well as the environmental benefit.

## **12.5 Preferred alternative**

Several alternatives have been preferred including alternative locations for the proposed new over water structures and construction technologies. The locations have been selected as there are very limited options for developing them elsewhere. Therefore, the selected location is the preferred.

Constructing water villas on concrete columns on pads have been selected as alternative construction method for the supporting columns. This method will provide more structural support and strength for the over water structures and although it may be expensive, it may be justifiable in the long term.

**12.5.1 Mitigation measures for the proposed alternative**

Following mitigation measures are proposed for pad foundation.

- Construct the concrete foot pads and columns on land and then place them once their location is fixed.
- Construct the foot pads only to the minimum required area.
- Undertake the construction in the shortest possible time to minimize sedimentation as well as any disturbances to the sea bed and the marine environment.

## **13 Environmental Monitoring**

### **13.1 Introduction**

Environmental monitoring is essential to ensure that potential impacts are minimized and to mitigate unanticipated impacts. Monitoring will be carried out as part of the environmental impact assessment and monitoring requirements addressed in this EIA report.

Table 15 summarizes the various aspects of the monitoring program and the costs.

### **13.2 Cost of Monitoring**

The proponent has committed fully for the monitoring programme outlined in this report. A commitment letter is attached as an annex.

The cost indicated below is for monitoring the project during the construction stage and for an additional two years during the operational stage. Monitoring will be undertaken by subcontracting the work to an independent consultant or a consulting firm.

The amount indicated is the total cost of monitoring during the construction and operational phase (2 years after the construction). Monitoring will include marine and coastal environmental aspects. Summary monitoring reports will be provided every two months and final report will be provided at the end of the construction stage and will adhere to Schedule M of the EIA Regulations, 2007.

### **13.3 Methods of monitoring**

Environmental monitoring will be undertaken using standard methods described in the Methodology section. Monitoring is only recommended for marine and coastal environment. No terrestrial environmental monitoring is considered necessary for these proposed modifications.

**Table 15: Aspects of the environmental monitoring program with cost breakdown**

Monitoring Attribute	Indicator	Methodology	Monitoring Frequency	Estimated Cost
Marine water visibility	Visibility	Secchi Disc & Tow line distance	Every other day during work. Every 3 month thereafter	-
Coral cover	Percentage live cover	Qualitative & Quantitative	Once during the construction stage. Once a year thereafter.	US\$ 300 per survey
Coral recruitment	Recruit/m <sup>2</sup>	Qualitative & Quantitative using quadrat	Once a year	US\$ 300 per survey
Marine water quality	DO, nitrates and turbidity from the lagoon and faecal coliforms from the outfall discharge location.	Onsite or Lab analysis	Every two months during work; thrice a year thereafter.  Faecal coliforms to be tested during the operation stage only.	US\$ 50 per test performed
Siltation	Sediment deposited on reef substrate	Qualitative & Quantitative	Every other day during work. Every 3 month thereafter	-
Beachline changes and beach profiles from baseline benchmark locations.	Beach length and profile changes	Using auto levels and staff for beach profiles and GPS for shifts in beachline	Once during construction and twice a year thereafter	US\$ 200 per survey
Ground water	Nitrates and Phosphates	Quantitative	Twice a year after construction	US\$ 50 per survey

**Table 16: Detail cost of monitoring during construction period and for two years.**

DESCRIPTION	UNIT COST (US\$)	TOTAL (US\$)
<b>Logistics</b> (A total of 2 trips to be made during the construction stage and during the 2 years monitoring period)		
Transport to Vaadhoo.	Client to provide	
Food, accommodation and logistics	Client to provide	
<b>Survey costs</b>		
Cost of undertaking the environmental surveys during the project construction stage.	650.00	<b>650.00</b>
Cost of undertaking the environmental surveys after the construction stage	1150.00 (per year)	<b>2300.00</b>
<b>Sub Total</b>		<b>2,950.00</b>
<b>30 % contingency (to account for variation in transport costs)</b>		<b>885.00</b>
<b>Grand total for monitoring during construction stage and for two years (three thousand eight hundred and thirty five US Dollars only)</b>		<b>3,835.00</b>

### 13.4 Monitoring responsibility

Monitoring responsibility will be with the client and financial provisions will be made in the project to undertake the monitoring.

### 13.5 Monitoring Report

A detailed monitoring report will be compiled after the completion of the civil works. This report will be based on the baseline data collected for monitoring the parameters included in the monitoring program. This report will be submitted to the relevant government agencies for compliance.

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

## 14 Conclusion

This EIA report has identified the major impacts of the proposed redevelopment. The project will only have its environmental impact on the project boundaries which is confined mainly to the marine environment of Vaadhoo. Mitigation measures have been proposed to these anticipated impacts including a detailed environmental monitoring programme. It has been assessed that the most significant negative impacts from the proposed development will be on the lagoon bottom, water column and indirect impacts on the coral reef system as a result of developing water villas. More specifically, the most significant impact period will be during construction stage. Mitigation measures to reduce the impact on the marine environment have been proposed. They include measures such as appropriate retention method to reduce spreading of sediment in order to minimize the damage on the marine environment during construction period. In addition, several other mitigation measures including limiting the time frame of construction and proper supervision are also proposed. Although the social impacts of the project were not assessed in detail, public consultations were undertaken with key stakeholders. The project will also have positive impacts. This includes the prevention of groundwater pollution and the reduction on water demand for flushing and gardening as a result of reusing part of the treated wastewater. Other positive benefits will be gained through the creation of more employment opportunities and increasing the government's revenue from the expansion of the resort. There will also be indirect positive economic benefits with the expansion by creating more demand for local food produce, goods and services.

Although several alternatives to the proposed project were considered, these alternatives cannot be implemented for various reasons. The development concept and objective for this redevelopment is to transform the island in to a high class tourist destination with additional and enhanced services. At the same time, the environmental protection and preservation and operational costs have also been taken in to consideration. Therefore, several design considerations, although initially were considered, it has been avoided due to these reasons. For example, expanding the island by reclaiming land has been rejected as it is expected to be more environmentally damaging than the proposed water villas.

The monitoring programme for this project will mainly focus coastal and marine components and for this reason, sedimentation levels on the reef, water quality and visibility and the coral cover has been considered in the monitoring programme. Monitoring of coastal aspects will include beachline and beach profiles to asses the changes in beach profiles and measure the changes occurring in the coastline.

## **15 Declaration of the consultants**

This EIA has been prepared according to the EIA Regulations 2007, issued by the Ministry of Environment, Energy and Water. The EIA was carried out by a multidisciplinary consulting team representing Water Solutions Private Ltd. In preparing this report, no data has been manipulated. All data has been collected by field visits.

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

Name: Hassan Shah ( EIAT 02/07 )

Signature:

Name: Abdul Aleem ( EIA 09/07 )

Signature:

Name: Ahmed Jameel ( EIA 07/07 )

Signature:

Name: Ahmed Zahid ( EIA 08/07 )

Signature:

## 16 References

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## **17 Annex: Terms of reference**

**Environment Research Centre  
Ministry of Environment, Energy & Water  
Male', Republic of Maldives**

## **Terms of Reference for Environmental Impact Assessment**

The following is the TOR is based on the points discussed in the scoping meeting held on the 21 February 2008 for undertaking the EIA of the proposed redevelopment of Vaadhoo Island Resort, Kaafu Atoll, Maldives.

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
2. **Study Area** - Specify the boundaries of the study area for the assessment.
3. **Scope of Work** - The following tasks will be performed:

**Task 1. Description of the Proposed Project** Provide a full description of the relevant part and nature of the project, using maps at appropriate scales where necessary. This is to include: brief description of the proponent; justification of the proposed project; a clearly labeled site location plan and architectural drawings; a detailed description of how the project activities will be undertaken including work method for constructing structures; how wastes and emissions will be managed during the project; including a waste management plan for construction phase, a matrix of project inputs and outputs during the construction and operational phase; detail of coastal modifications, vegetation clearing for land structures (a vegetation map should be present, including a plan to relocate the matured trees), a detailed project schedule; and life span. Specify the boundaries of the study area for the EIA assessment. Sketches of foundation pads and columns of over-water structures shall be included.

**Task 2. Description of the Environment** - Assemble, evaluate and present baseline data on the relevant environmental characteristics of the study area, including the following

- a) **Physical environment:** geomorphology, meteorology (rainfall, wind, waves and tides) and sea currents, surface hydrology, deep lagoon, shallow lagoon and marine water quality at reef survey site and effluent disposal sites. (The seawater quality parameters shall specifically include. The data of waves and current may be avoided or spot readings; Dissolved oxygen, salinity, suspended solids, pH, temperature and turbidity, phosphates, nitrates COD and BOD (same parameters should be used as sea water, among other chemical parameters). The locations of these sampling points should be clearly provided with geographical coordinates. All water samples shall be taken at mid depth. Ground water quality should be tested and provided.
- b) **Biological environment:** terrestrial and marine vegetation and fauna, vegetation map showing areas of vegetation clearance, rare or endangered species, and coral reef status (status of the coral community, fish community) at reference location to establish baseline data on significant environment

TOA for the proposed project of the redevelopment of Vaadhoo Resort, Kaafu Atoll



- c) *Hazard vulnerability; vulnerability of area to flooding, and storm surge.*
- d) *At least four beach profiles at different locations should be provided to establish the baseline statistics giving GPS positions of each site*

*Characterize the extent and quality of the available data, indicating significant information deficiencies and any uncertainties associate. All survey locations shall be referenced with Geographic Positioning System (GPS). The EIA also need to describe the sensitive ecosystems within the project site*

*The report should also outline the detail methodology of data collection utilized to describe the existing environment. A proper bathymetric conditions of the project site should be undertaken including local hydrodynamics.*

*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 the impacts for both construction and operational phase. Distinguish between significant impacts that are positive and negative, direct and indirect, and short and long term. Identify impacts that are cumulative, unavoidable or irreversible. Identify any information gaps and evaluate their importance for decision-making. The EIA report needs to contain the most practical method of controlling the sediments. Impacts of the proposed structures in the coastal zone especially those in the beach line and beyond must be given specific emphasis. Impacts of demolition waste must also be considered. Provide a brief indication about the house reef of water villa structures based on the EIA report or any further observations or studies undertaken in the affected area(s). The report should outline a detail account of the demolition waste and how they will be managed. This section should also include the impacts that could be caused due to the installation of the new proposed desalination plant.*

*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 includes alternative construction methodologies; alternative technologies, material, demolition methods, locations and mitigation options. Distinguish the most environmentally friendly alternatives.*

*Task 6. Mitigation Measures Identify possible measures to prevent or reduce significant negative impacts to acceptable levels 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. The environmental management plan needs to be provided including the following*

- *Sewerage system*
- *Mode of power Generation*
- *Methods of Waste Management*
- *Construction materials (quantity and how the materials will be obtained)*
- *Vegetation clearance*
- *Water generation and usage*



***Task 7. Development of a Monitoring Plan** – a reasonable time frame should be outlined for monitoring during construction and operational phase. Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan for dredging/disposal operations. The report should also provide a detailed cost breakdown for implementing the monitoring plan. Provide commitment of the proponent to conduct the monitoring programme.*

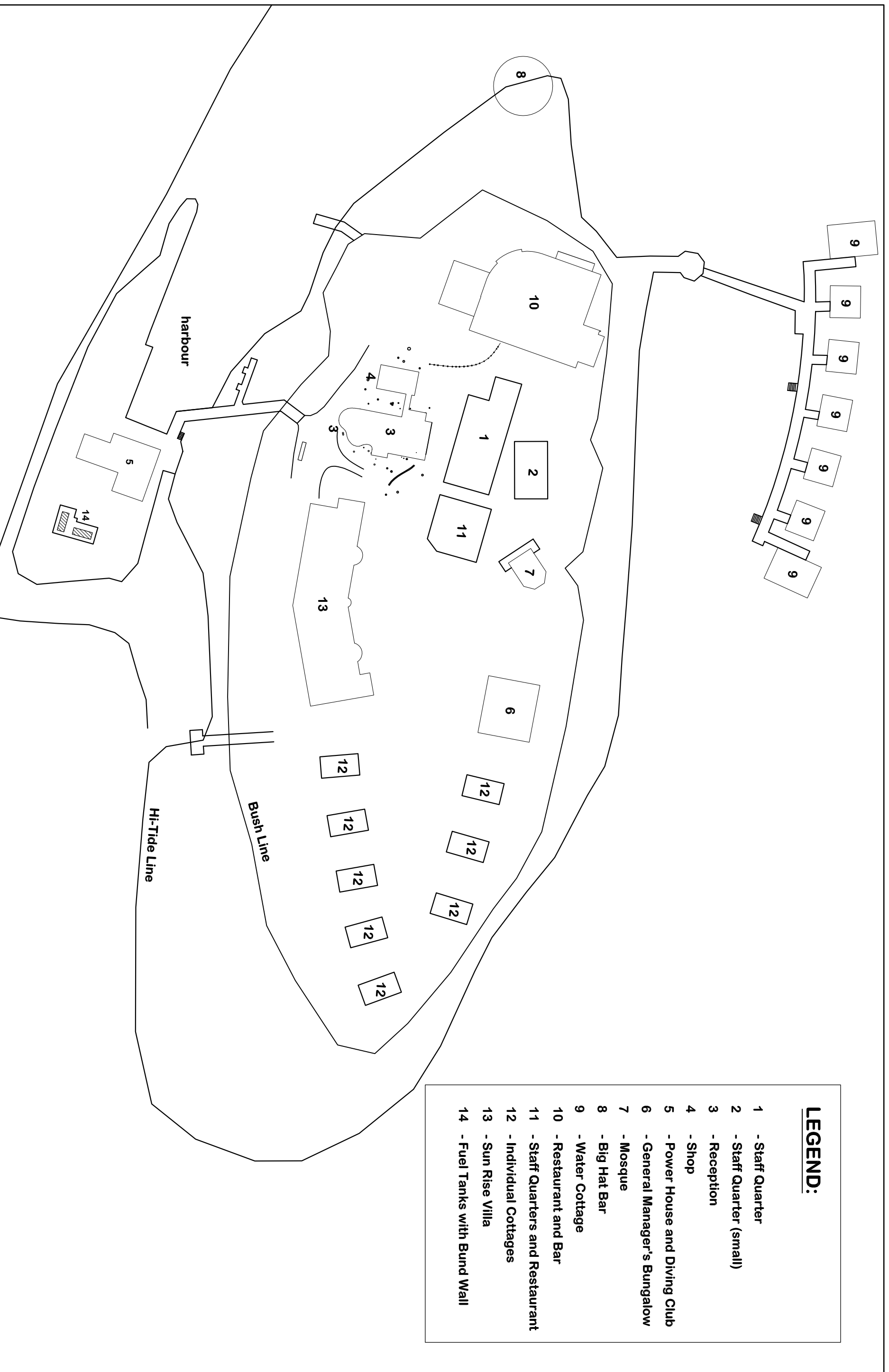
***Task 8. Stakeholder Consultation** – major stakeholder consultation to include Ministry of Tourism and Civil Aviation, Ministry of Environment, Energy and Water and Ministry Tourism and Civil Aviation location from and any other relevant stakeholders. Consultation should also be done with staff who has been on the island for a long time and the project engineers/designers.*

***Presentation** - The environmental impact assessment report, to be presented in 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 Report, 2007.*

.....  
26 February 2008



**18 Annex: Annex: Existing Site plan of the resort**

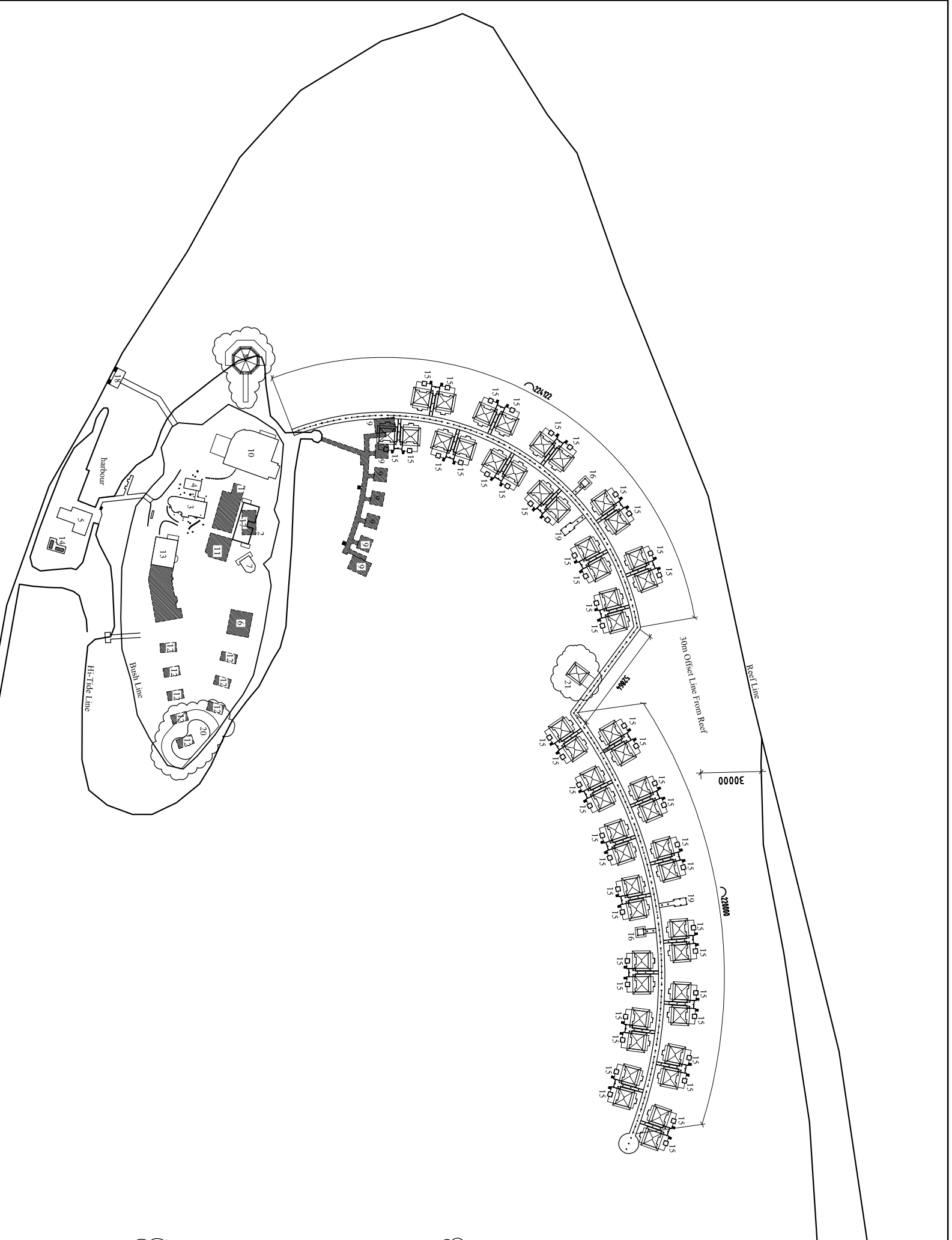


**LEGEND:**

- 1 - Staff Quarter
- 2 - Staff Quarter (small)
- 3 - Reception
- 4 - Shop
- 5 - Power House and Diving Club
- 6 - General Manager's Bungalow
- 7 - Mosque
- 8 - Big Hat Bar
- 9 - Water Cottage
- 10 - Restaurant and Bar
- 11 - Staff Quarters and Restaurant
- 12 - Individual Cottages
- 13 - Sun Rise Villa
- 14 - Fuel Tanks with Bund Wall

REV	DESCRIPTION	DATE			DRAWING TITLE:		
					<b>EXISTING SITE LAYOUT</b>		
					PROJECT TITLE:		
					<b>PROPOSED WATER BUNGALOWS</b>		
					<b>VADOO ISLAND - REFURBISHMENT</b>		
			CODE	<b>ENV-ASS</b>			
			DWG NO	<b>A2_ENV/001</b>			
			SCALE	1 : 500 (A2)			
			DATE	01.03.2008			
			DRAWN	---			
JEAN MICHEL FRAGNAY INTERIOR DESIGNER NO: 10, HORTON PLACE, COLOMBO 7, SRI LANKA Tel: 0094 11 2666970, Fax: 0094 11 2697564 Email: jfbco@jfrnet.lk			1st floor, dhurttin villa <b>abel</b> design galiolu, neelofaru maqu, male' maldives. phone: +960326007, fax: +960326008 email: abel@abel.com.mv www.abel.com.mv			MANO PONNIAH & ASSOCIATES (Pvt) Ltd CHARTERED ARCHITECTS & ENGINEERS NO: 10, FLOWER TERRACE, COLOMBO 7, SRI LANKA Tel: 0094 11 2573221, Fax: 0094 11 2467504 Email: mano@stl.lk	

**19 Annex: New Site plan indicating the proposed  
redevelopment to the resort**



NO	DESCRIPTION	AREA(m <sup>2</sup> )
1	- Staff Quarter (To Be Demolished)	X
2	- Staff Quarter (To Be Demolished)	X
3	- Reception	14,398
4	- Shop	4,087
5	- Power House and Diving Club	136,85
6	- General Manager's Bungalow (To Be Demolished)	X
7	- Mosque	39,71
8	- Big Hat Bar (To be replaced with New)	105,05
9	- Water Cottage (To Be Demolished)	X
10	- Restaurant and Bar	420,53
11	- Staff Quarters and Restaurant (To Be Demolished)	X
12	- Individual Cottages (To Be Demolished)	X
13	- Sun Rise Villa (To Be Modified)	156,00
14	- Fuel Tanks with Bund Wall	
15	- Proposed Water Bungalows (50x4,45 Sqm)	2322,5
16	- Proposed Pump Station	
17	- Proposed Ground Floor Services & STP : Upper Floor Staff Quarters	14,667
18	- Proposed Arrival Jetty	X
19	- Service Room (2x9 Sqm)	18,00
20	- New Swimming Pool & Sun Deck	X
21	- House Keeping & Butler's Room	
Total Building Area		3530,59
Total Land Area		17759,38
Beach Length (m)		781,03
Built - Up Area %		19,98%

**Note:**

- Original Survey was done by Densu Engineering (Pvt) Ltd
- Original Survey was modified by Cadon Architecture Pvt Ltd
- Modified Survey was digitized by Tekon Design Associates Pvt Ltd - 14.03.2008
- Reef, Beach & Bush Line Survey was done & updated by (LESA) Land & Environmental Survey Associates Pvt Ltd - 27.07.2007

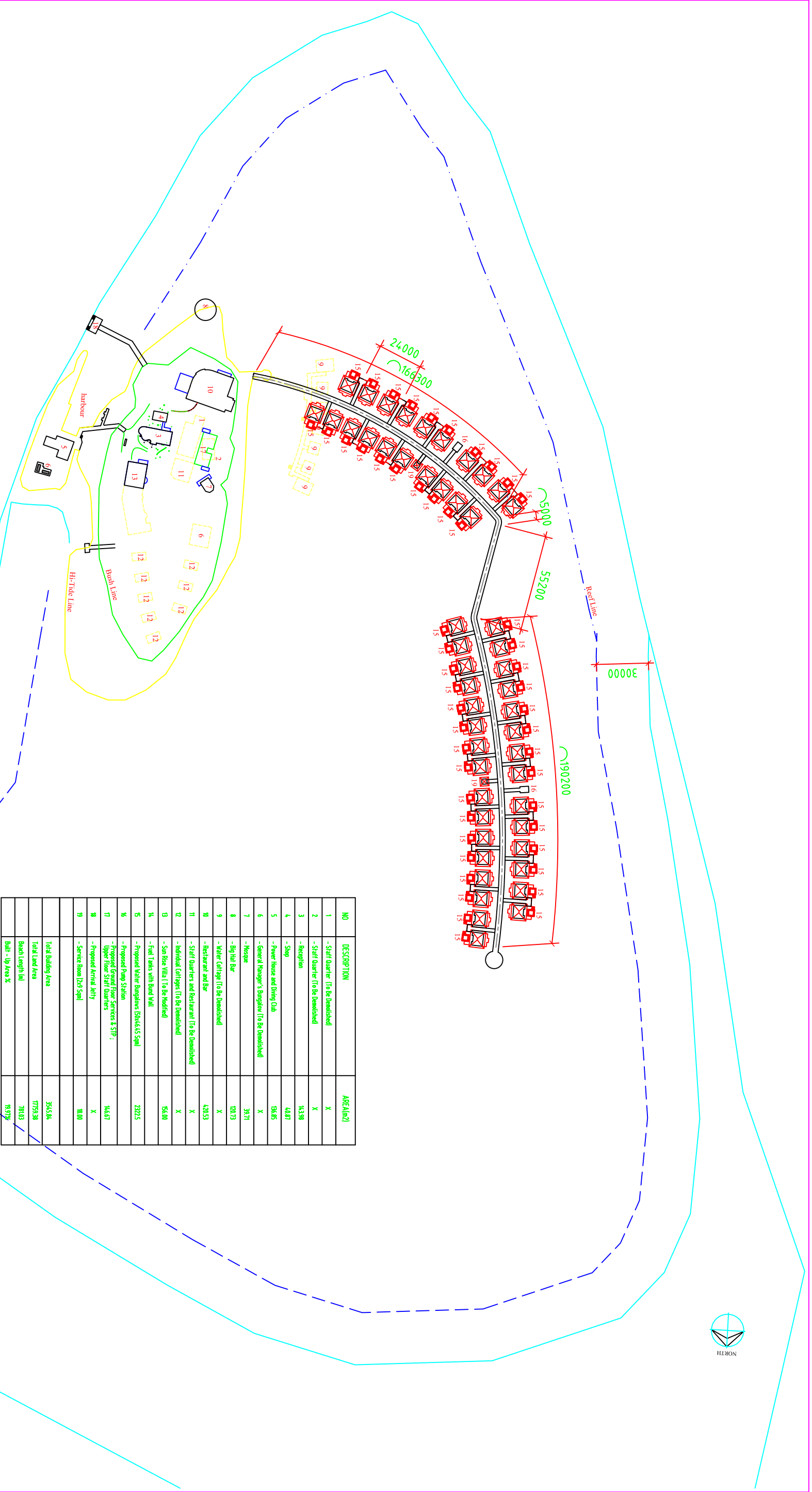
REV	DESCRIPTION	DATE
A	New Bar, Swimming pool & Butler's Room added	30.01.06

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DRAWING TITLE:		<b>SITE LAYOUT</b>	
PROJECT TITLE:		<b>PROPOSED WATER BUNGALOWS</b>	
DRAWING TITLE:		<b>VADOO ISLAND - REFURBISHMENT</b>	
CODE	<b>ENV-ASS</b>	DWG NO	<b>A2 ENV/002</b>
SCALE	1 : 1500 (A2)	DATE	01.03.2008
DRAWN	---		



NO	DESCRIPTION	AREA(m <sup>2</sup> )
1	- Staff Quarter (To be Demolished)	X
2	- Staff Quarter (To be Demolished)	X
3	- Reception	14,398
4	- Shop	4,487
5	- Power House and Dining Club	18,485
6	- General Manager's Bungalow (To be Demolished)	X
7	- Mosque	39,371
8	- Big Fish Bar	10,073
9	- Water Carriage (To be Demolished)	X
10	- Restaurant and Bar	420,153
11	- Staff Quarters and Restaurant (To be Demolished)	X
12	- Individual Cottages (To be Demolished)	X
13	- Sun Bar Villa (To be Modified)	85,400
14	- Fuel Tanks with Bund Wall	22,225
15	- Proposed Water Bungalows (50x44.5 Spm)	X
16	- Proposed Pump Station	X
17	- Proposed Ground Floor Services & STP : Upper Floor Staff Quarters	14,667
18	- Proposed Arrival Jetty	X
19	- Service Room (2x9 Spm)	8,100
Total Building Area		354,584
Total Land Area		775,938
Beach Length (m)		781.03
Bund - Up Area %		19.97%

**Note:**

- Original Survey was done by Densu Engineering (Pvt) Ltd
- Original Survey was modified by Cadar Architecture Pvt Ltd
- Modified Survey was digitized by Tekton Design Associates Pvt Ltd - 14.03.2000
- Reef, Beach & Bush Line Survey was done & updated by (LESA) Land & Environmental Survey Associates Pvt Ltd - 27.07.2007

REV	DESCRIPTION	DATE

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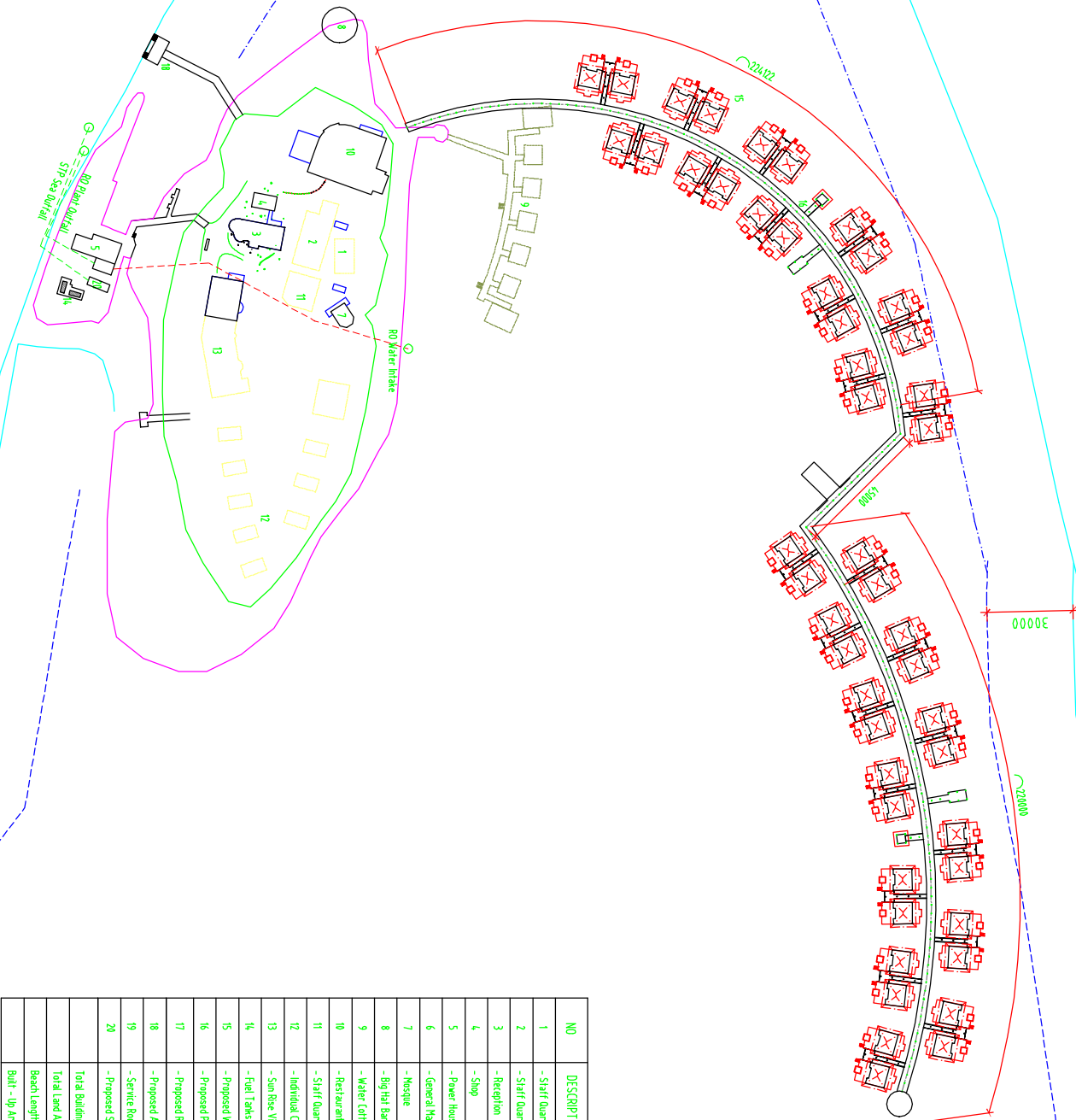
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DRAWING TITLE:  
**SITE PLAN**  
 PROJECT TITLE:  
**PROPOSED WATER BUNGALOWS**  
**VADDOO ISLAND - REFURBISHMENT**

CODE	
DWG NO	<b>A2. ARC/100</b>
SCALE	1 : 1500 (A2)
DATE	06.11.2007
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**WATER BUNGALOWS**

**20 Annex: New Site plan indicating the proposed sea outfall location**



NO	DESCRIPTION	AREA(m <sup>2</sup> )
1	- Staff Quarter (To be Demolished)	700
2	- Staff Quarter (To be Modified)	X
3	- Reception	14,398
4	- Shop	4,487
5	- Power house and Dining Club	39,85
6	- General Manager's Bungalow (To be Demolished)	X
7	- Mosque	39,71
8	- Big Hall Bar	20,773
9	- Water Cottage (To be Demolished)	X
10	- Restaurant and Bar	42,953
11	- Staff Quarters and Restaurant (To be Demolished)	X
12	- Individual Cottages (To be Demolished)	X
13	- Sun Rise Villa (To be Modified)	156,08
14	- Fuel Tanks with Bond Wall	
15	- Proposed Water Bungalows (50x64.5 Sqm)	23,225
16	- Proposed Pump Station	
17	- Proposed RO Water plant	14,657
18	- Proposed Arrival Jetty	X
19	- Service Boat (209 Sqm)	18,00
20	- Proposed SIP	
Total Building Area		354,584
Total Land Area		779,938
Beach Length (m)		781.03
Bath - Up Area %		19.97%

**WATER BUNGALOWS LAYOUT**

REV	DESCRIPTION	DATE

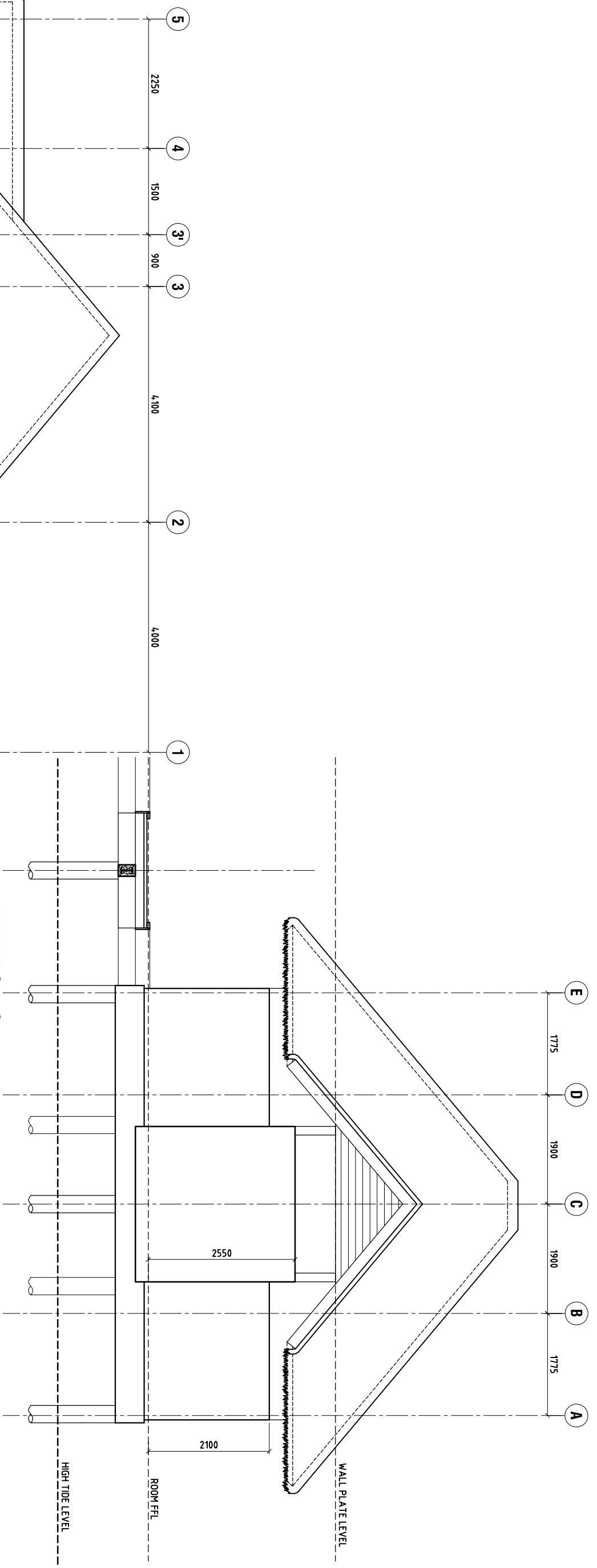
**JEAN MICHEL FRAGNAY**  
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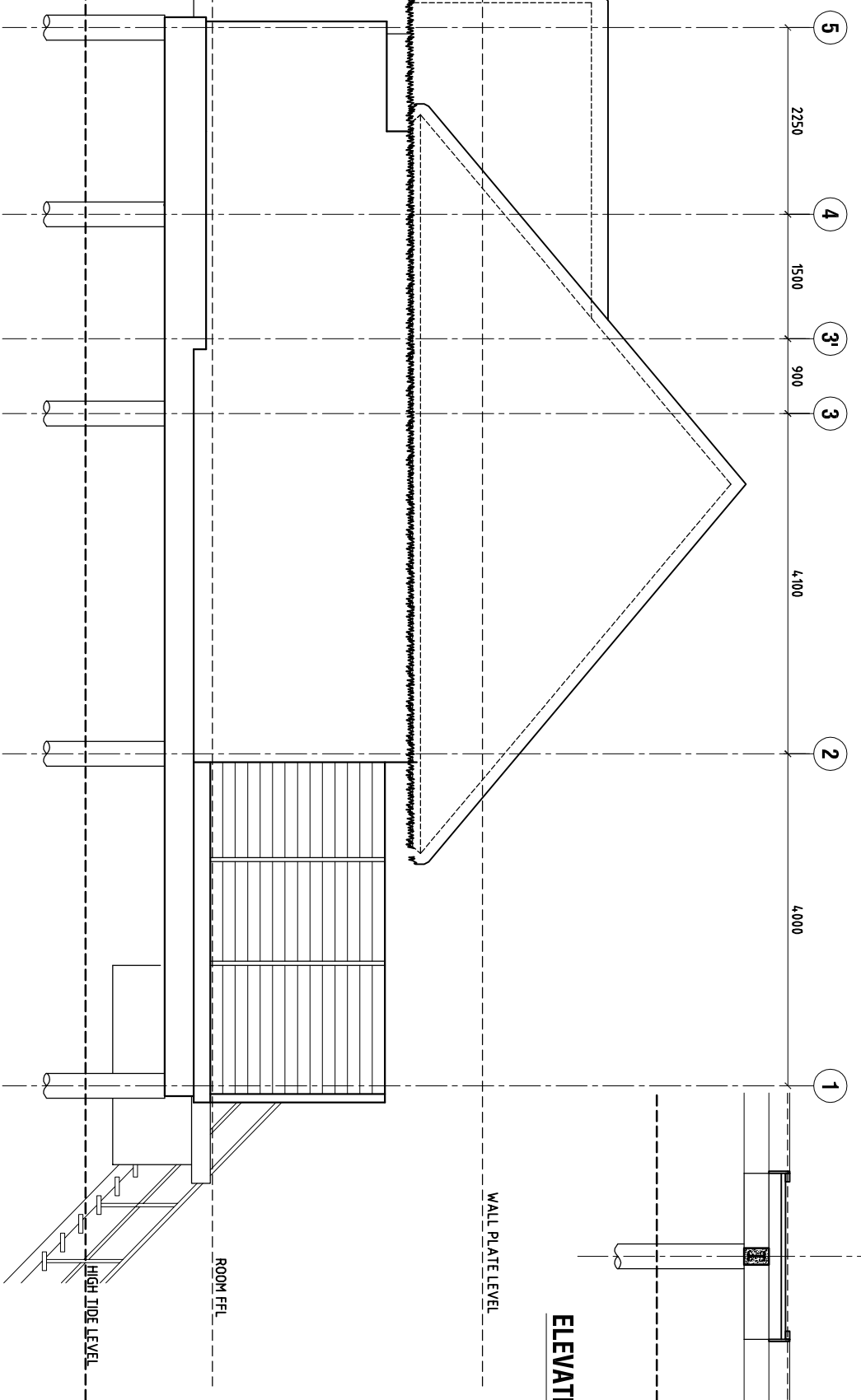
**MANO PONNIAH & ASSOCIATES (Pvt) Ltd**  
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DRAWING TITLE:		CODE
SITE LAYOUT		WDAR
PROJECT TITLE:		DWG NO
PROPOSED WATER BUNGALOWS		A2 ARC/100
VADDOO ISLAND - REFURBISHMENT		SCALE
		1 : 1500 (A2)
DATE		DRAWN
08.03.2008		CRISHANTHI

## **21 Annex: Cross section details of water bungalows**



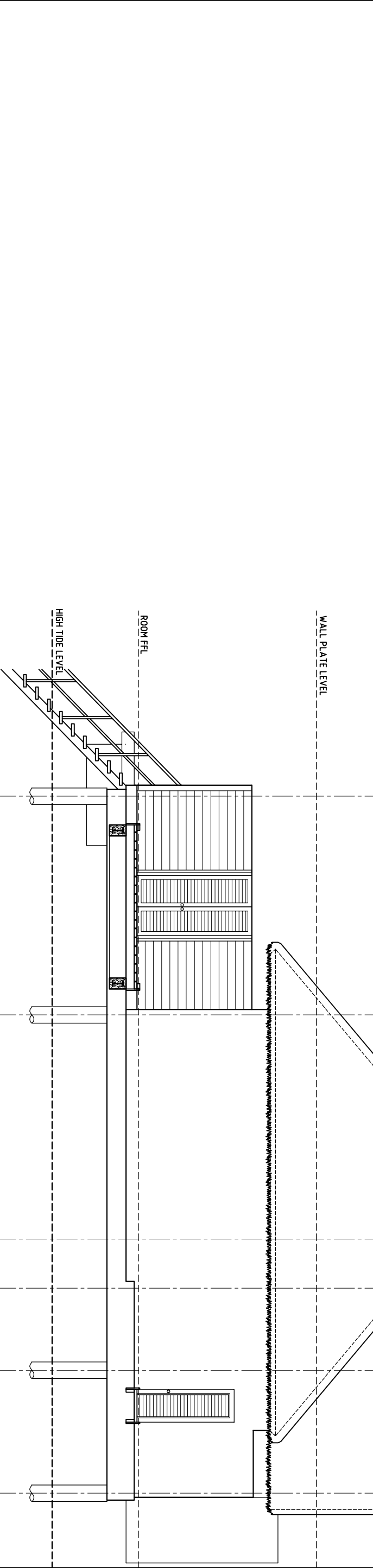
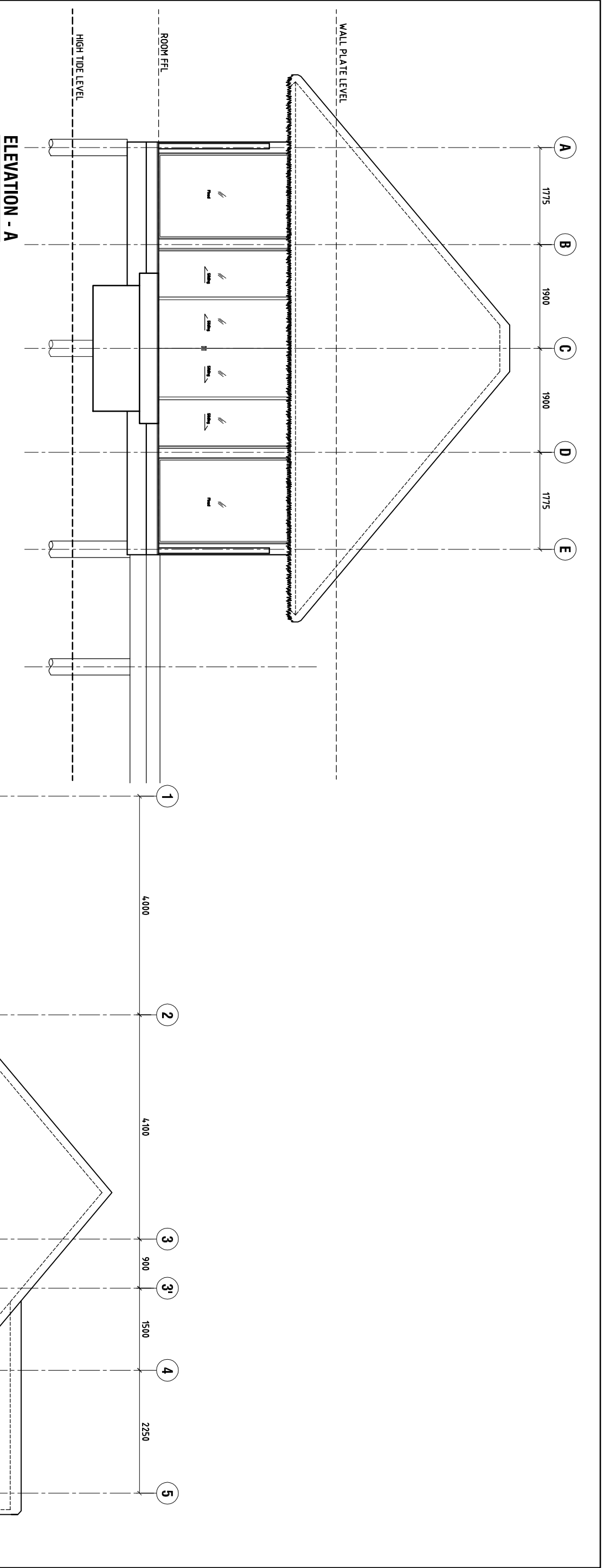
ELEVATION - C



ELEVATION - D

REV	DESCRIPTION	DATE

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<b>DRAWING TITLE:</b> <b>WATER BUNGALOW ELEVATIONS</b> PROJECT TITLE: <b>PROPOSED WATER BUNGALOWS</b> <b>VADDOO ISLAND - REFURBISHMENT</b>		
<b>CODE</b> DWG NO SCALE DATE DRAWN	<b>ENV-ASS</b> <b>A2 ENV/0035</b> 1 : 50.25 (A2) 01.03.2008 ---	<b>WATER BUNGALOWS</b>



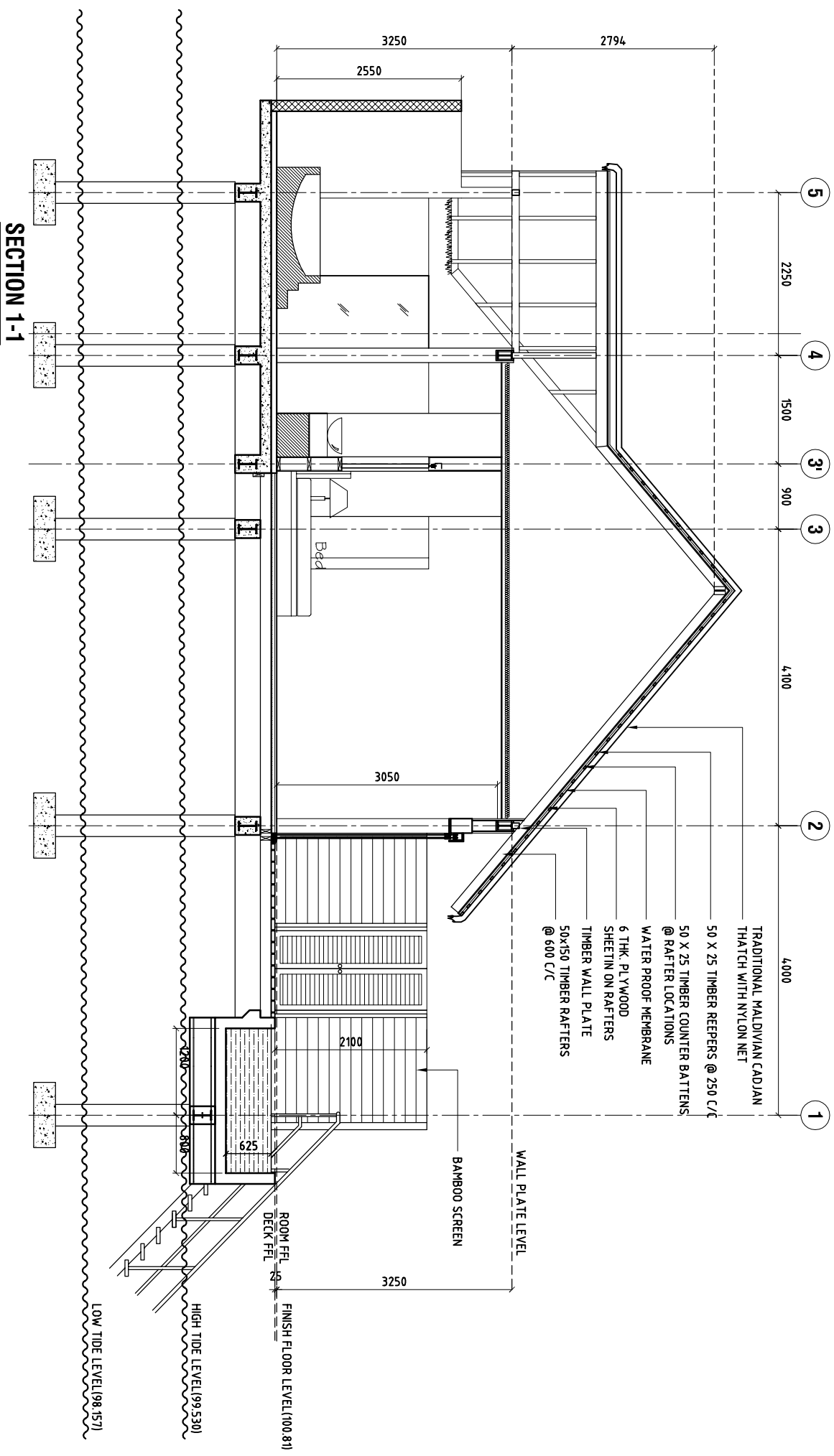
**WATER BUNGALOWS**

REV	DESCRIPTION	DATE

<p><b>JEAN MICHEL FRAGNAY</b>          INTERIOR DESIGNER          NO: 10, HORTON PLACE, COLOMBO 7, SRI LANKA          Tel: 0094 11 2666970, Fax: 0094 11 2697564          Email: jfbco@stinet.lk</p>	<p><b>abel design</b>          1st floor, dhurttin villa          galolhu, neelofaru maqu, male' maldives          phone: +960326007, fax: +960326008          email: abel@abel.com.mv          www.abel.com.mv</p>	<p><b>MANO PONNIAH &amp; ASSOCIATES (Pvt) Ltd</b>          CHARTERED ARCHITECTS &amp; ENGINEERS          NO: 10, FLOWER TERRACE, COLOMBO 7, SRI LANKA          Tel: 0094 11 2573221, Fax: 0094 11 2467504          Email: manopon@st.lk</p>
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DRAWING TITLE:	<b>WATER BUNGALOW ELEVATIONS</b>
PROJECT TITLE:	<b>PROPOSED WATER BUNGALOWS</b>
	<b>VADDOO ISLAND - REFURBISHMENT</b>

CODE	<b>EW-ASS</b>
DWG NO	<b>A2 EW/003.4</b>
SCALE	1 : 50.25 (A2)
DATE	01.03.2008
DRAWN	---



SECTION 1-1

REV	DESCRIPTION	DATE

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DRAWING TITLE:  
**WATER BUNGALOW SECTION**  
 PROJECT TITLE:  
**PROPOSED WATER BUNGALOWS**  
**VADDOO ISLAND - REFURBISHMENT**

CODE	ENV-ASS
DWG NO	<b>A2 ENV/0033</b>
SCALE	1 : 50.25 (A2)
DATE	01.03.2008
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**WATER BUNGALOWS**

## **22 Annex: Construction Schedule**

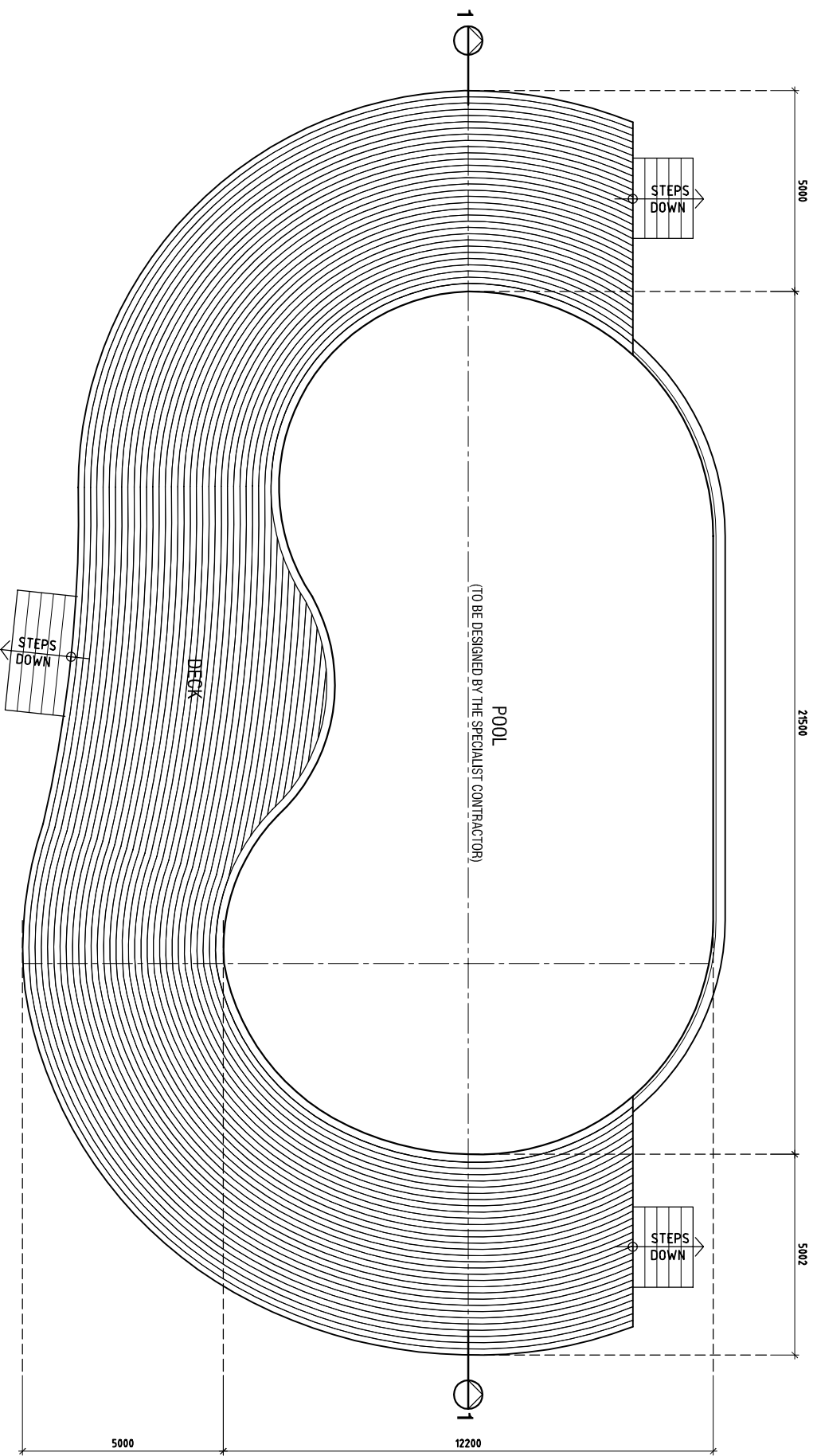
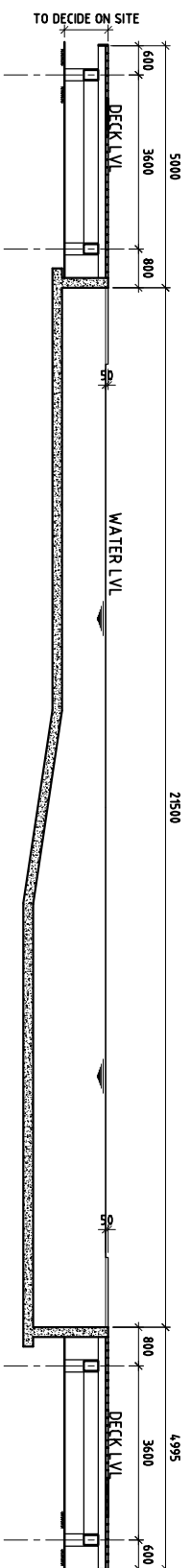
## WORK SCHEDULE OF PROPOSED VADOO ISLAND REFURBISHMENT – REPUBLIC OF MALDIVES

ID	Task Name	Duration	Start	Finish	April	May	June	July	August	September	October	November	December				
1	<b>Water Bungalows</b>	<b>195 days</b>	<b>Thu 10/04/08</b>	<b>Sun 23/11/08</b>	▶												
2	<b>Piling of Bungalows</b>	<b>78 days</b>	<b>Thu 10/04/08</b>	<b>Wed 09/07/08</b>	▶												
3	Pile Driving and placing of column base	60 days	Thu 10/04/08	Wed 18/06/08	▶												
4	Pile Column shuttering	60 days	Thu 24/04/08	Wed 02/07/08	▶												
5	Pile Column concreting	60 days	Thu 01/05/08	Wed 09/07/08	▶												
6	<b>Sub structure welding and concreting</b>	<b>124 days</b>	<b>Thu 01/05/08</b>	<b>Mon 22/09/08</b>	▶												
7	Platform frame work and H iron welding	60 days	Thu 01/05/08	Wed 09/07/08	▶												
8	Bar bending and shuttering of beams	60 days	Thu 15/05/08	Wed 23/07/08	▶												
9	Beam concreting	60 days	Thu 29/05/08	Wed 06/08/08	▶												
10	Fabrication and fixing of Floor joist	45 days	Sat 02/08/08	Mon 22/09/08	▶												
11	Floor planking and reepering	30 days	Sun 10/08/08	Sat 13/09/08	▶												
12	Floor decking with wood	30 days	Sun 17/08/08	Sat 20/09/08	▶												
13	<b>Super structure</b>	<b>147 days</b>	<b>Sat 10/05/08</b>	<b>Mon 27/10/08</b>	▶												
14	Welding of columns and roof beams	60 days	Sat 10/05/08	Thu 17/07/08	▶												
15	Roof carpentry work	75 days	Sat 02/08/08	Mon 27/10/08	▶												
16	Bungalow periphereral block work	65 days	Mon 02/06/08	Sat 16/08/08	▶												
17	Hand rails fixing and stairs	30 days	Sun 24/08/08	Sat 27/09/08	▶												
18	Fall ceiling work	60 days	Sun 29/06/08	Sat 06/09/08	▶												
19	Fixing door and window	45 days	Mon 01/09/08	Wed 22/10/08	▶												
20	<b>Services</b>	<b>104 days</b>	<b>Sun 20/07/08</b>	<b>Mon 17/11/08</b>	▶												
21	Plumping	90 days	Sun 20/07/08	Sat 01/11/08	▶												
22	Electrical work-wiring	60 days	Sun 10/08/08	Sat 18/10/08	▶												
23	Electrical work-fittings	45 days	Sat 27/09/08	Mon 17/11/08	▶												
24	Installation of transformer room	21 days	Sun 12/10/08	Tue 04/11/08	▶												
25	<b>Finishing</b>	<b>75 days</b>	<b>Thu 28/08/08</b>	<b>Sun 23/11/08</b>	▶												
26	Toilet finishing and tiling	45 days	Mon 15/09/08	Wed 05/11/08	▶												
27	Painting	75 days	Thu 28/08/08	Sun 23/11/08	▶												
28	<b>Walk way</b>	<b>157 days</b>	<b>Tue 29/04/08</b>	<b>Tue 28/10/08</b>	▶												
29	Piling of Walk way	50 days	Tue 13/05/08	Wed 09/07/08	▶												
30	Walk way Substructure welding and concreting	50 days	Tue 29/04/08	Wed 25/06/08	▶												
31	Fixing of Timber	60 days	Wed 20/08/08	Tue 28/10/08	▶												
32	<b>Service stations</b>	<b>166 days</b>	<b>Wed 21/05/08</b>	<b>Sun 30/11/08</b>	▶												
33	Piling of service stations	20 days	Wed 21/05/08	Thu 12/06/08	▶												
34	Sub structure welding and concreting	25 days	Sat 28/06/08	Sat 26/07/08	▶												
35	super structure	20 days	Sat 19/07/08	Sun 10/08/08	▶												
36	Service(Plumping & Electrical)	15 days	Thu 13/11/08	Sun 30/11/08	▶												
37	<b>Refurbishment</b>	<b>121 days</b>	<b>Sat 10/05/08</b>	<b>Sat 27/09/08</b>	▶												
38	Demolishing of existing land bungalows and transporting	45 days	Sat 10/05/08	Mon 30/06/08	▶												
39	Construction of Staff Quarters, staff cafeteria	45 days	Sun 01/06/08	Tue 22/07/08	▶												
40	Refurbishment of administrative block	60 days	Mon 30/06/08	Sun 07/09/08	▶												
41	Construction of swimming pool	45 days	Thu 17/07/08	Sun 07/09/08	▶												
42	Refurbishment of Main bar	25 days	Mon 04/08/08	Mon 01/09/08	▶												
43	Construction of STP	30 days	Sat 16/08/08	Thu 18/09/08	▶												
44	Refurbishment of restaurant and bar	30 days	Sun 24/08/08	Sat 27/09/08	▶												
45	Testing and handing over	15 days	Mon 24/11/08	Wed 10/12/08	▶												

Project: Work schedule  
Date: Thu 27/03/08

Task		Progress		Summary		External Tasks		Deadline	
Split		Milestone		Project Summary		External Milestone			

## **23 Annex: Architectural drawings of Swimming pool and deck**



**PLAN - SWIMMING POOL & DECK**  
SCALE : 1:100

**SECTION 1-1**  
SCALE : 1:100

REV	DESCRIPTION	DATE

**JEAN MICHEL FRAGNAY**  
INTERIOR DESIGNER  
NO: 10, HORTON PLACE, COLOMBO 7, SRI LANKA  
Tel: 0094 11 2666970, Fax: 0094 11 2697564  
Email: jfbco@stinet.lk

**abel design**  
1st floor, neelofaru dhurttin villa  
galolhu, neelofaru maqu, male' maldives.  
phone: +960326007, fax: +960326008  
email: abel@abel.com.mv  
www.abel.com.mv

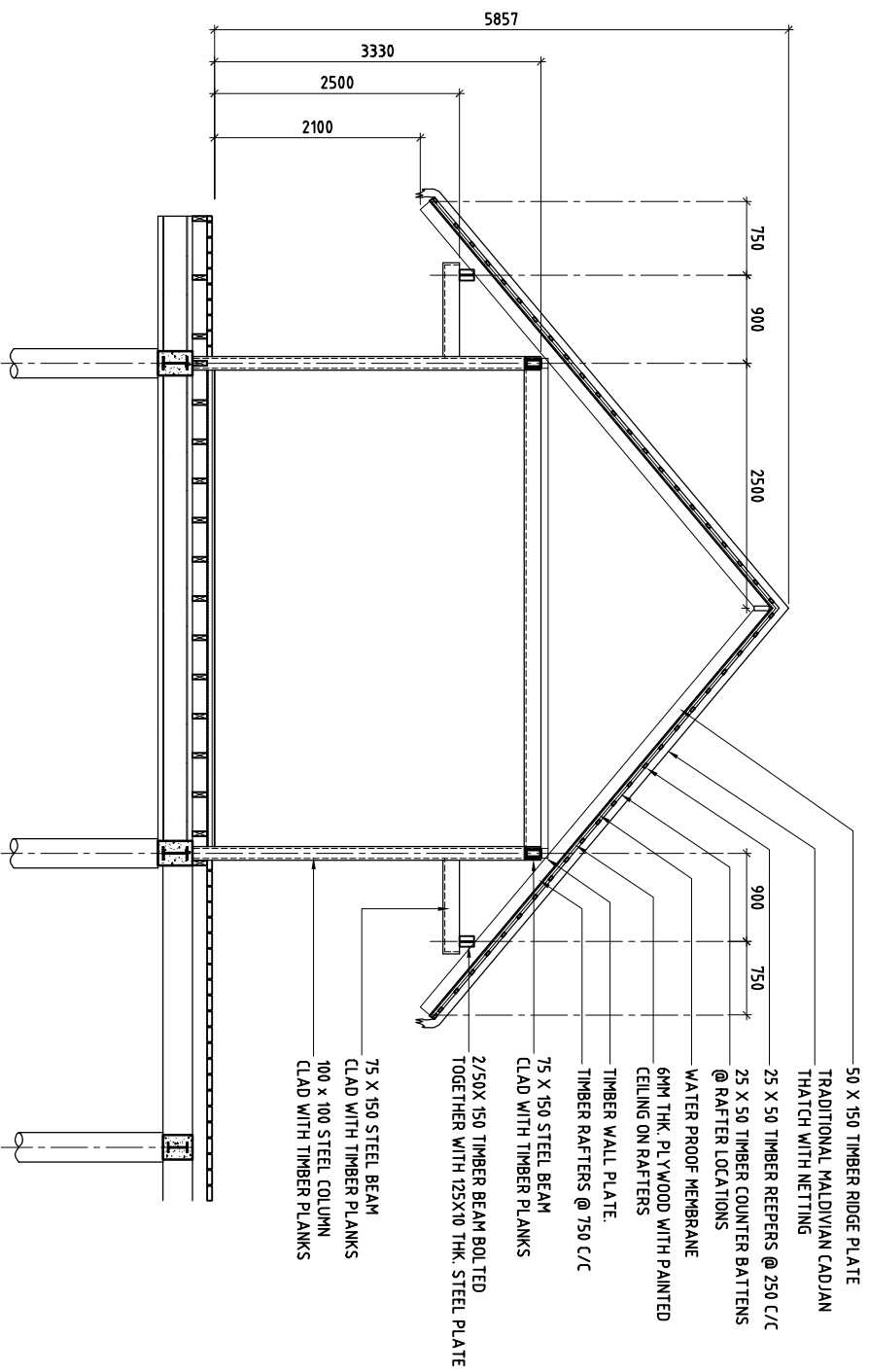
**MANO PONNIAH & ASSOCIATES (Pvt) Ltd**  
CHARTERED ARCHITECTS & ENGINEERS  
NO: 10, FLOWER TERRACE, COLOMBO 7, SRI LANKA  
Tel: 0094 11 2573221, Fax: 0094 11 2467504  
Email: manopon@st.lk

DRAWING TITLE:  
**PROPOSED SWIMMING POOL & DECK  
PLAN & SECTION**  
PROJECT TITLE:  
**PROPOSED WATER BUNGALOWS  
VADDOO ISLAND - REFURBISHMENT**

CODE	ENV-ASS
DWG NO	<b>A2 ENV/008</b>
SCALE	1 : 100 (A2)
DATE	01.03.2008
DRAWN	CJW

**SWIMMING POOL & DECK**

**24 Annex: Architectural Drawings and cross sectional details of the arrival jetty**



SECTION 1-1

REV	DESCRIPTION	DATE

**JEAN MICHEL FRAGNAY**  
 INTERIOR DESIGNER  
 NO: 10, HORTON PLACE, COLOMBO 7, SRI LANKA  
 Tel: 0094 11 2666970, Fax: 0094 11 2697264  
 Email: jfbco@jfrnet.lk

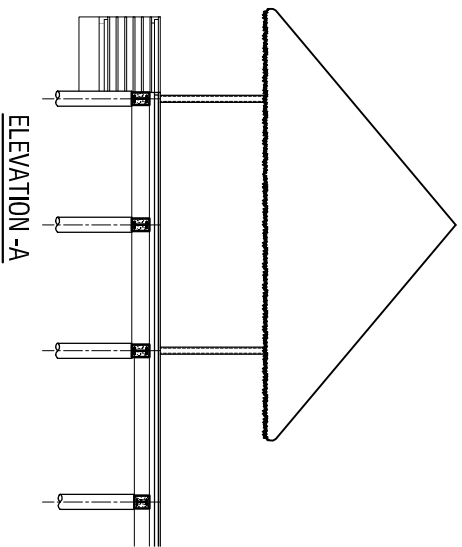
**abel design**  
 1st floor, dhurttin villa  
 galolhu, neelofaru maqu, male' maldives  
 phone: +960326007, fax: +960326008  
 email: abel@abel.com.mv  
 www.abel.com.mv

**MANO PONNIAH & ASSOCIATES (Pvt) Ltd**  
 CHARTERED ARCHITECTS & ENGINEERS  
 NO: 10, FLOWER TERRACE, COLOMBO 7, SRI LANKA  
 Tel: 0094 11 2573221, Fax: 0094 11 2467504  
 Email: manopon@sl.lk

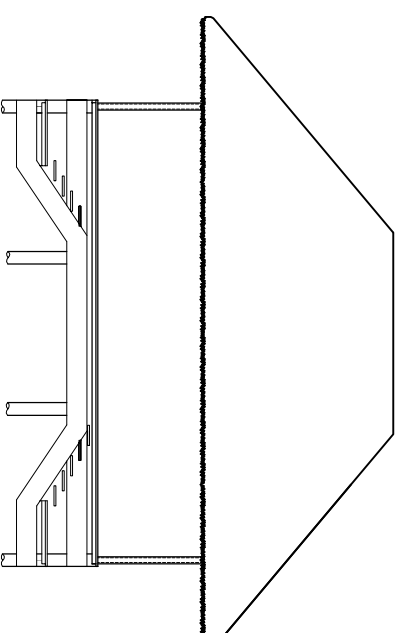
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**ARRIVALS JETTY BUILDING-SECTION**  
 PROJECT TITLE:  
**PROPOSED WATER BUNGALOWS**  
**VADDOO ISLAND - REFURBISHMENT**

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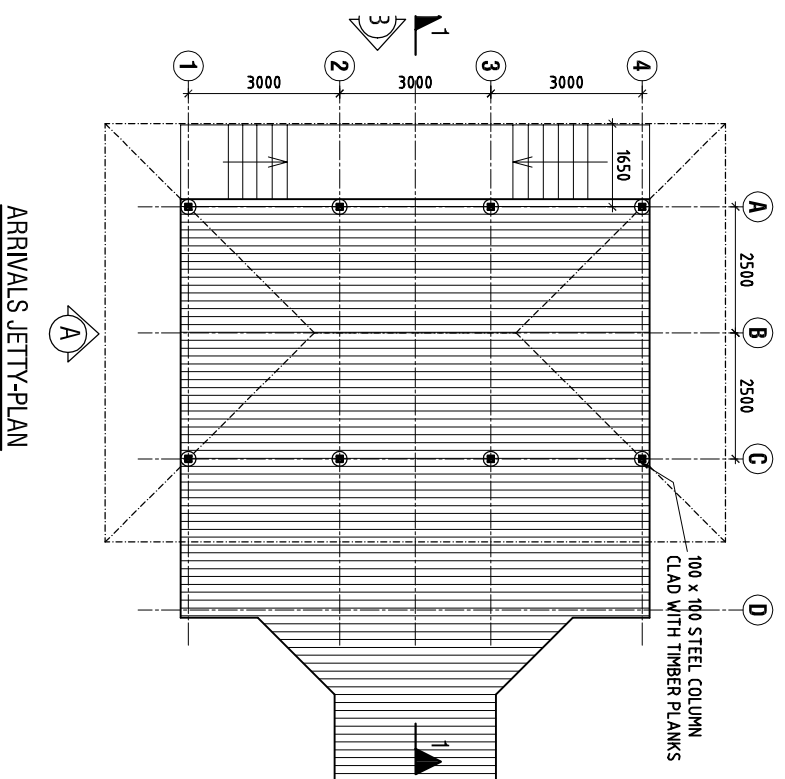
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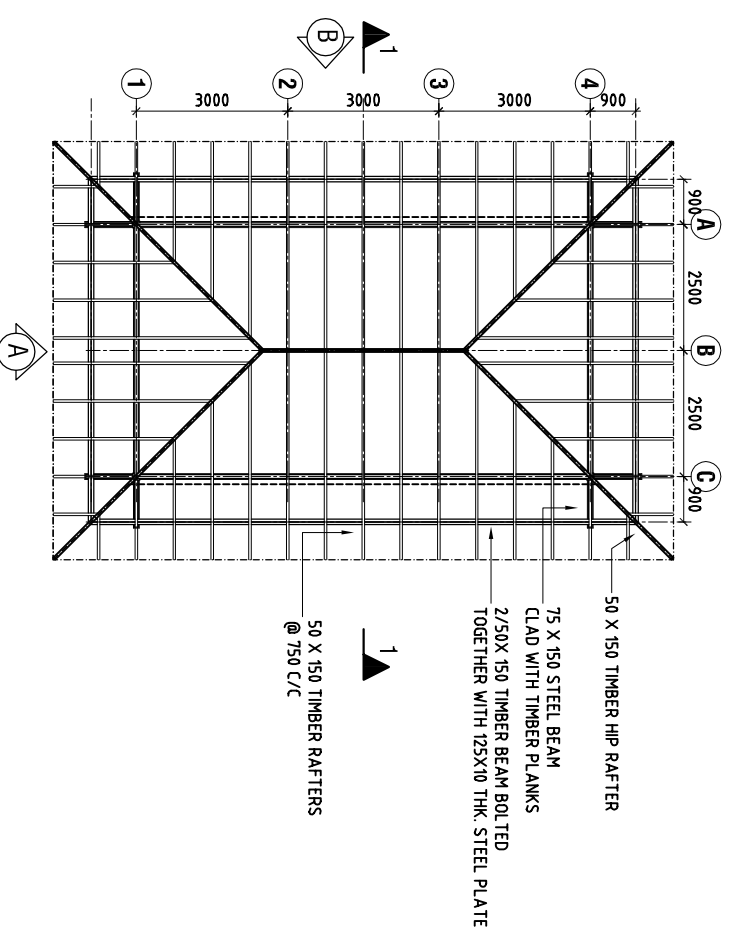
ELEVATION -A



ELEVATION -B



ARRIVALS JETTY-PLAN



ROOF PLAN

REV	DESCRIPTION	DATE

**JEAN MICHEL FRAGNAY**  
 INTERIOR DESIGNER  
 NO: 10, HORTON PLACE, COLOMBO 7, SRI LANKA  
 Tel: 0094 11 2666970, Fax: 0094 11 2697564  
 Email: jfbcoc@stinet.lk

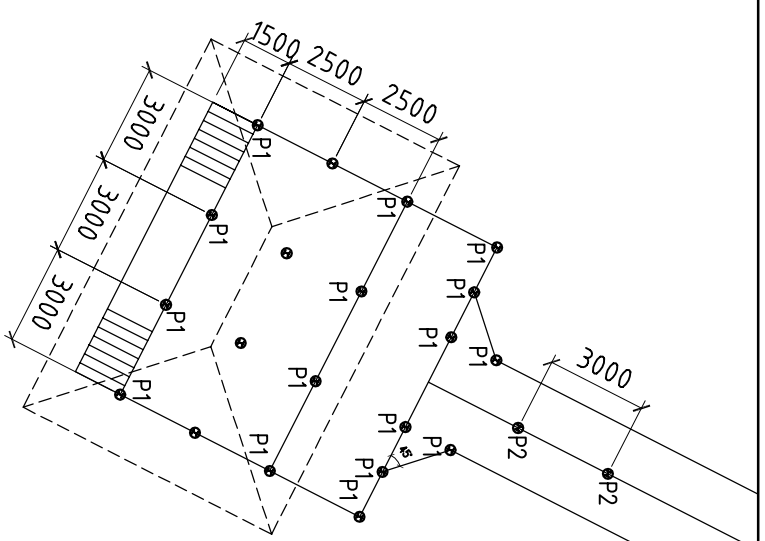
**abel design**  
 1st floor, dhurttin villa  
 galolhu, neelofaru maqu, male' maldives.  
 phone: +960326007, fax: +960326008  
 email: abel@abel.com.mv  
 www.abel.com.mv

**MANO PONNIAH & ASSOCIATES (Pvt) Ltd**  
 CHARTERED ARCHITECTS & ENGINEERS  
 NO: 10, FLOWER TERRACE, COLOMBO 7, SRI LANKA  
 Tel: 0094 11 2573221, Fax: 0094 11 2467504  
 Email: mano.ponni@stl.lk

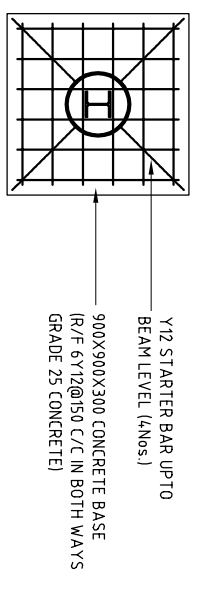
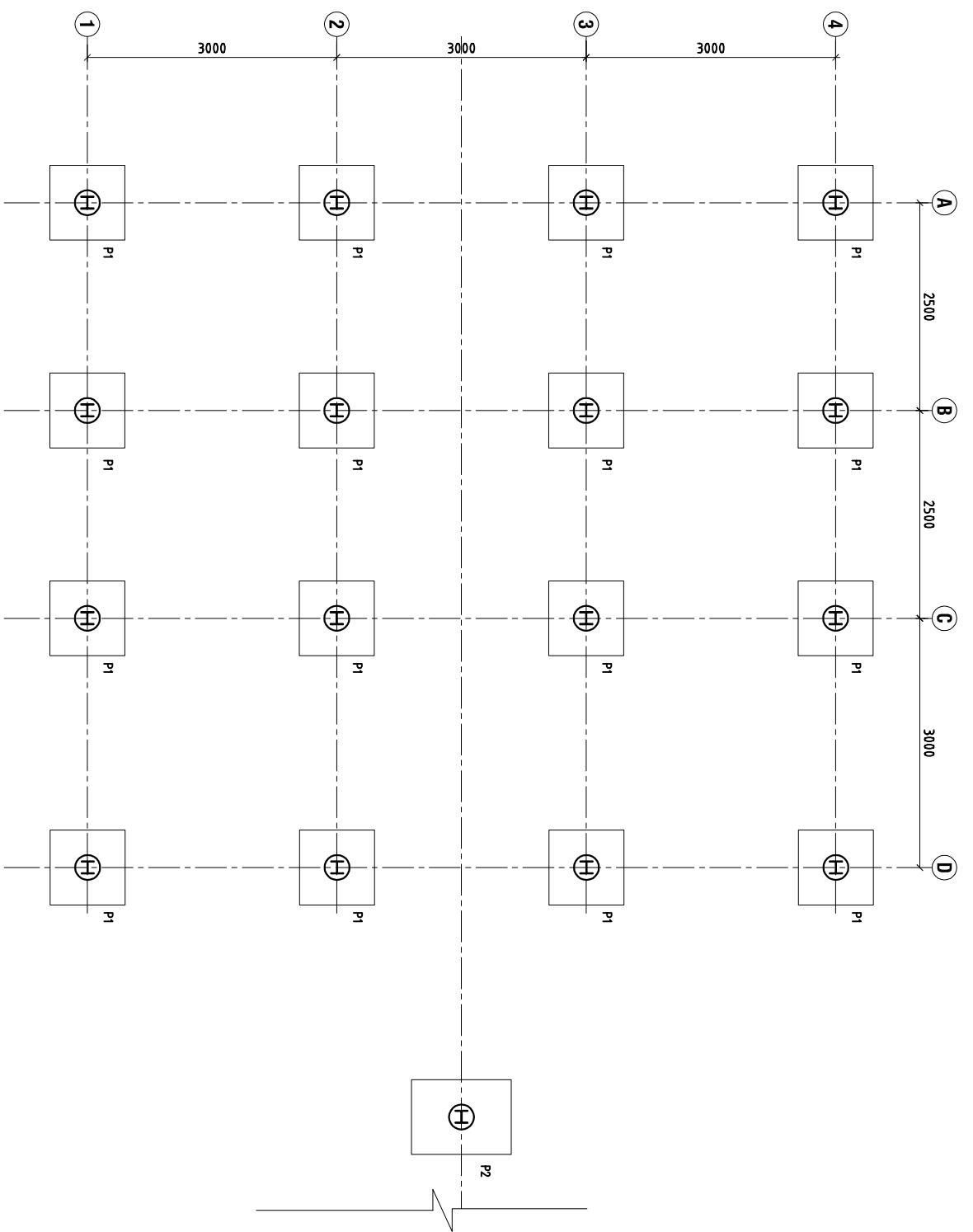
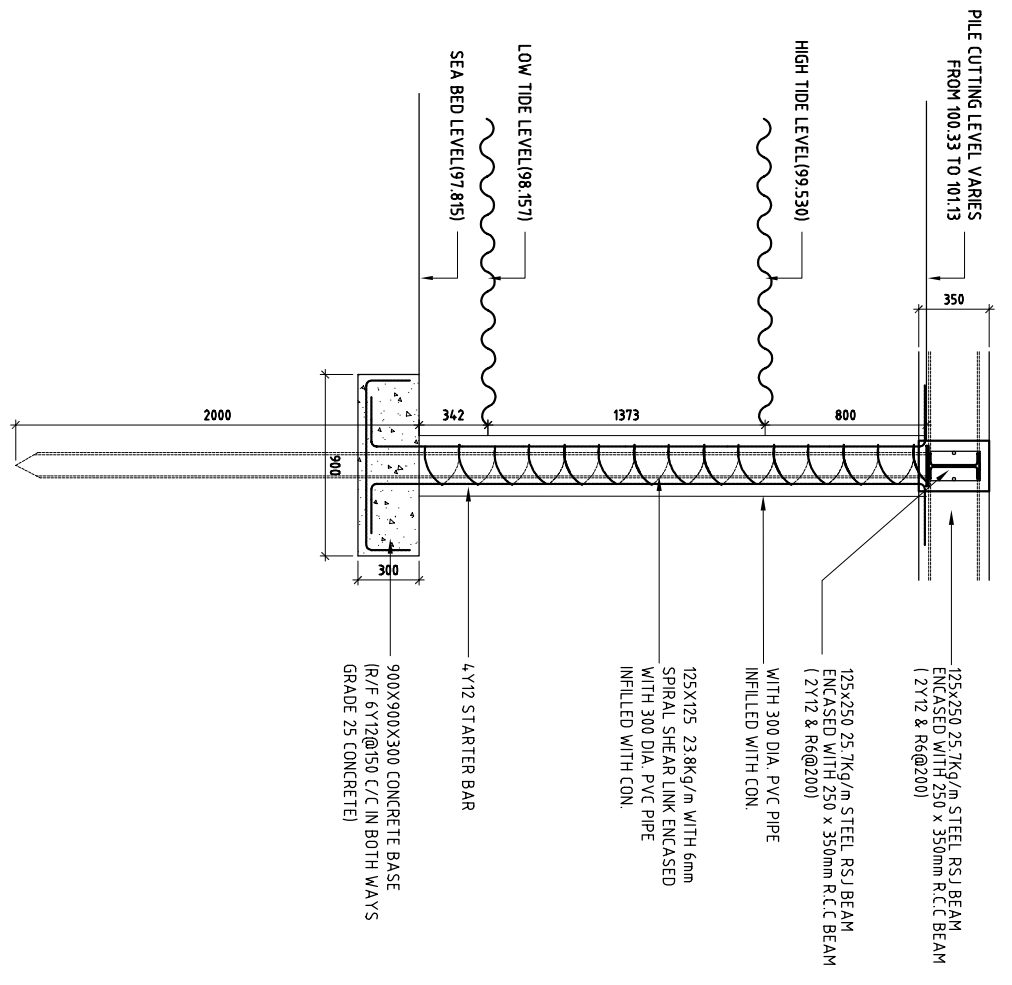
DRAWING TITLE:  
**ARRIVALS JETTY BUILDING**  
 PROJECT TITLE:  
**PROPOSED WATER BUNGALOWS**  
**VADDOO ISLAND - REFURBISHMENT**

CODE	ENV-ASS
DWG NO	<b>A2 ENV/0081</b>
SCALE	1 : 100,50 (A2)
DATE	01.03.2008
DRAWN	---

**ARRIVALS JETTY**



**ENTRANCE JETTY SITE PLAN**  
SCALE 1:150



**PILE BASE PLAN**

**SECTION**

**PILE DETAILS-P1**

**SECTION**

REV	DESCRIPTION	DATE

**JEAN MICHEL FRAGNAY**  
INTERIOR DESIGNER  
NO: 10, HORTON PLACE, COLOMBO 7, SRI LANKA  
Tel: 0094 11 2666970, Fax: 0094 11 2697564  
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Tel: 0094 11 2573221, Fax: 0094 11 2467504  
Email: manopon@sl.lk

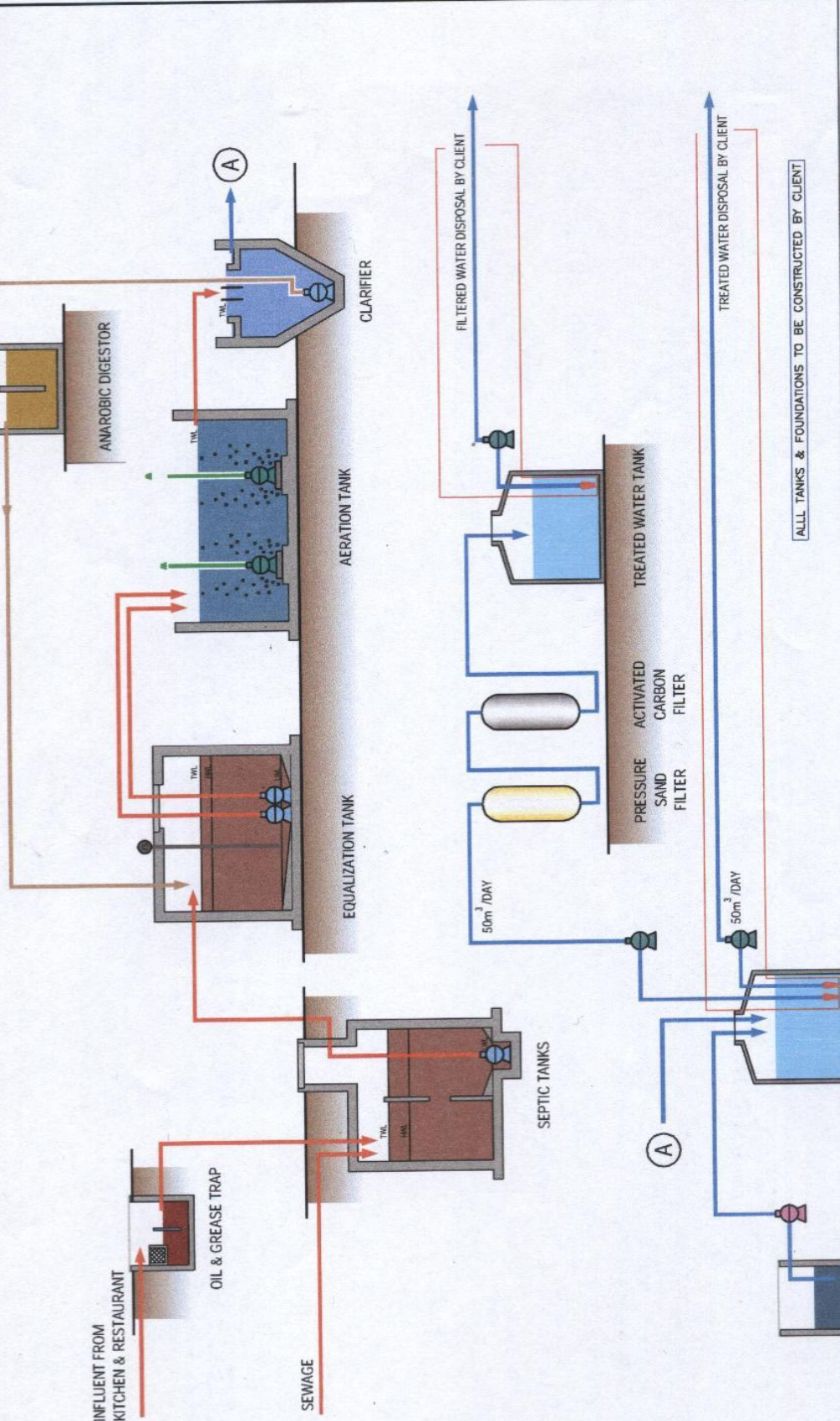
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**ARRIVALS JETTY BUILDING**  
PROJECT TITLE:  
**PROPOSED WATER BUNGALOWS**  
**VADDOO ISLAND - REFURBISHMENT**

CODE	EW-ASS
DWG NO	<b>A2.EW/009.3</b>
SCALE	1:50.25 (A2)
DATE	01.03.2008
DRAWN	---

**ARRIVALS JETTY**

## **25 Annex: Sewerage treatment plant flow process**

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[ALL TANKS & FOUNDATIONS TO BE CONSTRUCTED BY CLIENT]

PART NO		DESCRIPTION		REF. DRAWING NO.	
REV. NO	ITEM	DESCRIPTION	DATE	07.01.2008	
UNITS		mm	DESIGN/DRAWN	YW/YCJ	
SCALE		N/S	CHECKED	YW	
GENERAL TOLERANCE			APPROVED	YW	
SAVE NAME		WAD_PFD_20_00			
MATERIAL LIST					
PART NO	DESCRIPTION	SPECIFICATIONS	QTY		
<b>PURITAS LTD</b> 25, FOSTER LANE, COLOMBO 10.					
TITLE			PROCESS FLOW DIAGRAM - STP		
PROJECT			WADOO RESORT -- MALDIVES		
DWG. No			WAD_PFD_20_00		
REV.			00		

**26 Commitment letter from the proponent to undertake monitoring**

# UNIQUE RESORTS PRIVATE LTD

#7-A, STO Aifaanu Building, Boduthakurufaanu Magu, Malè 20026, Republic of Maldives.

Tel: (960) 332 3323, 331 5238 Fax: (960) 331 5237

E-mail: gm@adaaran.com.mv

C-643/2007

DIRECTORS:

K.A.A.C. Perera (Managing)

J.M.S. Brito

S. Jayawickrama

Thursday, March 27, 2008

Mr. Ahmed Saleem  
Director General  
Environmental Research Centre  
Male', Maldives

Dear Mr. Saleem,

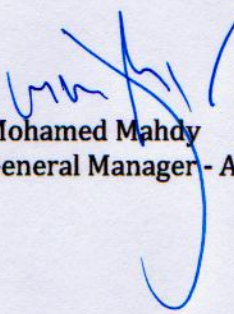
**Sub: Commitment to undertake the environmental monitoring programme proposed in the EIA for the re-development of Vadoo Island Resort**

Vadoo Island Resort has been proposed for redevelopment beginning May 2008.

Hence we would like to confirm our commitment to the proposed mitigation and monitoring programme that has been outlined in the EIA report that has been specifically prepared for the proposed redevelopment project.

Thanking you,

Yours Sincerely

  
Mohamed Mahdy  
General Manager - Administration



---

**AITKEN SPENCE HOTELS (INTERNATIONAL) LIMITED**

305 Vauxhall Street, Colombo 2, Sri Lanka

Tel: +94 11 2308308 Fax: +94 11 2446838

E-Mail: ashmres@aitkenspence.lk

  
**ADAARAN**  
Luxury Boutique Wellness Resorts

## **27 Names and Registration Certificate numbers of the EIA consultants**

Abdul Aleem – EIA Registration no: EIA09/07

Ahmed Zahid – EIA Registration no: EIA08/07

Ahmed Jameel – EIA Registration no: EIA07/07

Hassan Shah - – EIA Registration no: EIAT02/07