ENVIRONMENTAL IMPACT ASSESSMENT

For the Proposed Refurbishment of Adaaran Club Rannaalhi, South Male' Atoll, Maldives

Proposed by

Jetan Travel Services Co. Pvt Ltd

Signature:

Prepared by

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For Water Solutions Pvt. Ltd., Maldives

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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 Adaaran Club Rannaalhi located in Rannaalhi island in south Male' atoll.

- This project is proposed by Jetan Travel Services Co. Pvt Ltd , to refurbish the resort. The resort will be refurbished without shutting down the operations.

- Rannaalhi is located on the south-western rim of South Male' atoll and is operated under the name, Adaaran Club Rannaalhi

- At present, some of the island infrastructure is old and requires refurbishment 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. Hence, the project involves removal of two structures on land, construction of a swimming pool, construction of new water bungalows and internal modifications to the existing water bungalows.

- The report has identified that the major impacts of the project will be felt on the marine environment since new water villa construction will take place in the lagoon. Impacts on the marine environment will be felt through sedimentation and siltation caused by the construction activities on the lagoon and the associated indirect impacts on the coral reef, during this period. Baseline data has, therefore, been collected in order to monitor the changes to the marine environment which will be identified in periodical monitoring reports.

- Alternatives to the project have also been considered in detail and several alternatives to the proposed project were considered. Due to various reasons, these alternatives have not been considered. The advantages and disadvantages of these alternatives have been discussed and they include environmental as well as financial reasons. Therefore, several design considerations, although initially were considered, has been rejected due to these reasons.

- Towards, the end of the report, a monitoring programme has been suggested which mainly covers the marine environment. These include coral cover and marine water quality among many other parameters.

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 refurbishment of Adaaran Club Rannalhi located on the island of Rannaalhi. The project proponent is Jetan Travel Services Co. Pvt Ltd. At present, the resort has 100 rooms on land and 16 rooms over water, developed in two storey chalets (at present, 8 chalets over water). The project is expected to take 20 months starting from May with a budget of 3.5 million dollars.

5.1 Extent of the EIA

This EIA is only limited to the proposed refurbishment work as outline in the terms of reference. Therefore the environmental impacts that are of concern to this project have been considered.

5.2 Structure of the EIA

The report has been structured to meet the requirements of the EIA regulations 2007 issued by the Ministry of Environment, Energy and Water. Hence, the report will provide an executive summary as a starting point. What will then follow will be 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.

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.

5.3 Aims and Objectives of the EIA

The objective of the report is to:

- Assist in mitigating impacts caused due to the refurbishment 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.
- To fulfill 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.
- Undertake the project work with minimum damage to the environment.

5.4 EIA Implementation

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

- Abdul Aleem, BSc, MPH – Mapping and GIS
- Ahmed Zahid, BSc. – Environment management and Ecotourism Consultant
- Hassan Shah, BSc, - Environmental Science
- Mohamed Riyaz, - Surveying assistant

5.5 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 Jetan Travel Services Co. Pvt Ltd , for the refurbishment of Adaaran Club Rannalhi based on the island of Rannaalhi island. Rannaalhi is located on the south-west rim of South Male' atoll.

Jetan Travel Services Co. 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. Jetan Travel Services Co. (Pvt) Ltd 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.

6.2 Project Location and Study Area

The project takes place in the island of Rannaalhi, located on the south-west rim of south Male' atoll (see Figure 2). The island is approximately 4.9 hectares (from the shore line). At present, Rannaalhi Island resort consists of 100 land rooms and 16 bungalows.

6.3 Geography

Rannalhi is a small isolated island formed on its own reef system on the sout-western rim of south Male' atoll. The island is located at about latitude of 3^{o} 54'10.42" N and longitude of 73^{o} 24' 21.53"E. The island is formed on an isolated coral reef system, shape that of an "L", with the widest area on the south and narrowest portion on the north.

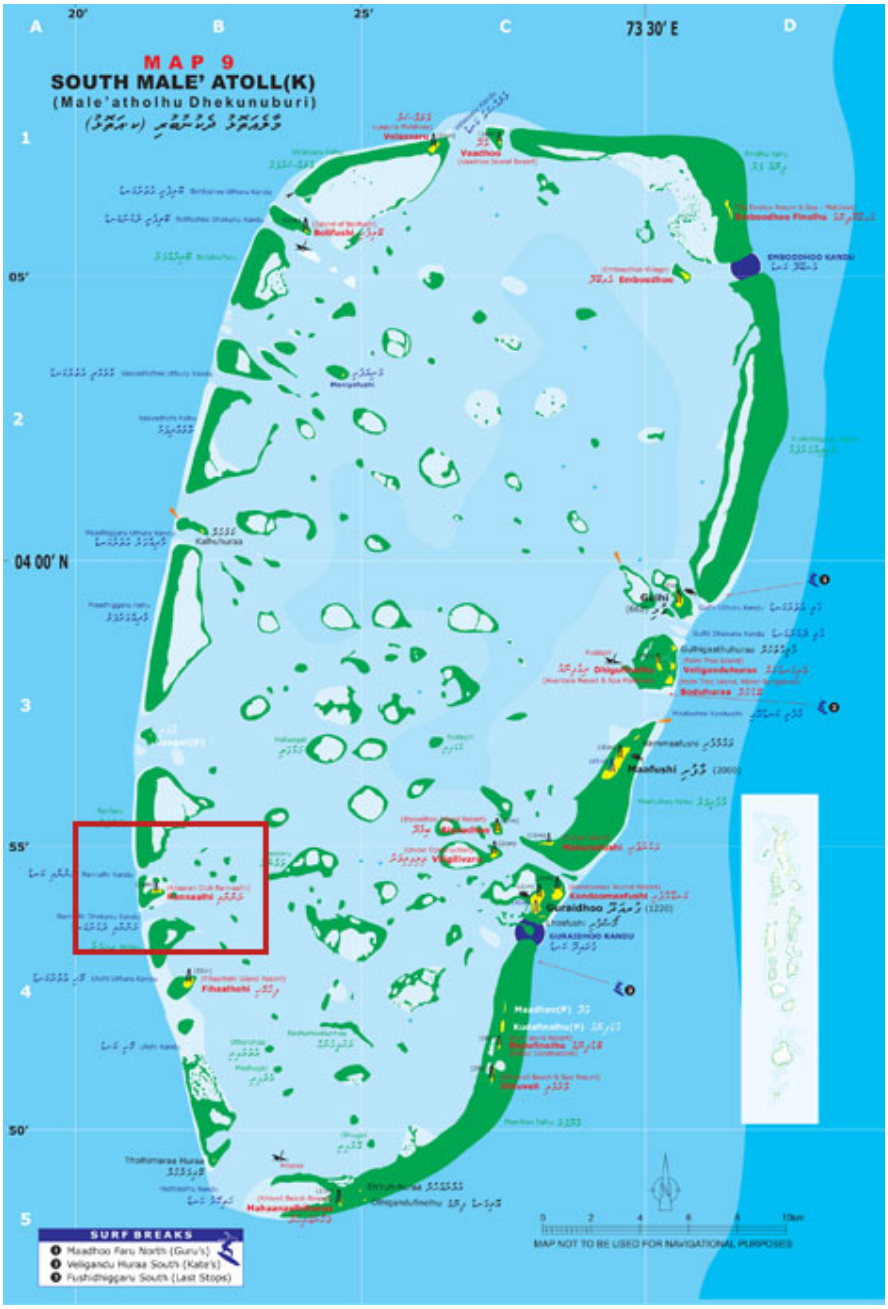
The island is roughly 45 m from the eastern rim of the reef system on which it is formed. Towards the east of the island is the atoll lagoon and towards the west of the island is the channel between Male atoll and Alif atoll. The southern shore line is approximately 150 m from the southern reef extent. The southern side of the island is prone to the effects of currents and oceanic wave activity during the south-west monsoon. As a result, coastal protection measures (groynes) have been constructed on this side for several years. The island is oriented towards east to west direction along its length. The reef on the western side is considerably larger than that on the eastern side (refer to figure 1).

Figure 1: Aerial view of Rannaalhi and the reef system.

The closest island to Rannaalhi is Fihalohi island resort, which is roughly 3 km south of Rannaalhi. The closest inhabited island is Guraidhoo located approximately 12 km east. The island is 34 km from the capital, Male'. Rannaalhi has a beautiful and easily accessible house reef, which can be considered in a moderately good condition in terms of diversity and percentage of live coral cover. The reef is easily accessible from the north and east side due to the small reef extent from this side.

In March 2008, the perimeter of the island from the vegetation line measured 899 meters with a total area of the island accounting to 36563 square meters. The length of the shore line in March 2008 measured 993 meters with an area of 49763 square meters. The island is shaped like a kidney bean and the beaches on the island are found on the north, north-east and south east side. The average height of the island is 1.2 -1.4 metres above mean sea level.

Figure 2: Location of Rannaalhi in south Male' Atoll (Map by Water Solutions)



6.4 Need and Justification

6.4.1 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.

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 and services provided.

The strategy that would be used for the redevelopment is to create additional water bungalows and upgrade some of the existing facilities such as the spa and beach bar. In order to be competitive in the market, diversifying the services available in the island is urgently required. Therefore, diversifying the product from exclusive Italian Club concept resort to an internationally marketable resort having different levels of accommodation and facilities to offer is required. Having additional beds in the resort will be economically feasible to invest for upgrading the property to be competitive in the market. In addition Maldives Tourism Industry will be benefited in terms of bed capacity and its income.

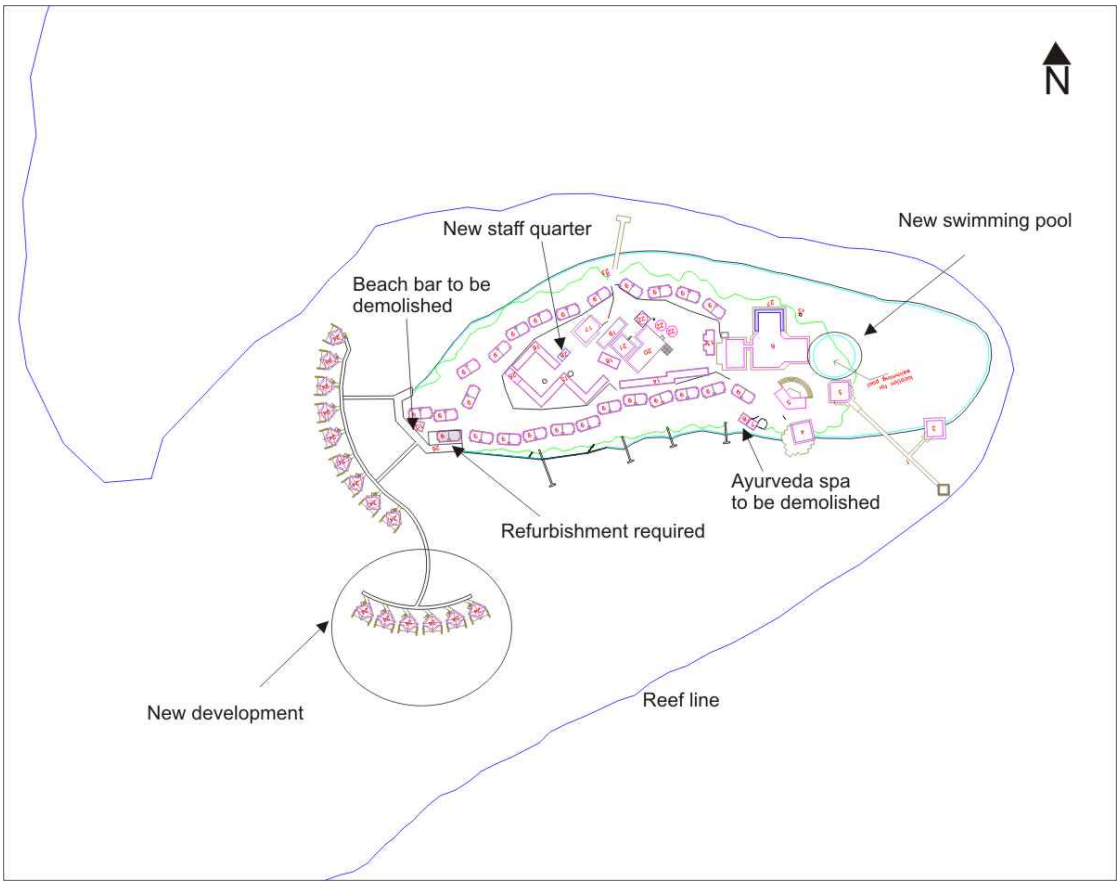
6.5 Project duration

The project is expected to take seven (10) months starting 01/05/2008. A schedule is attached as an annex.

6.6 Project boundary

This refurbishment is only limited to certain areas of the island illustrated below.

Figure 3: Project boundary



6.7 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 refurbishment 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 refurbish the island without destroying its natural beauty and leaving the island in its natural form. In addition, the refurbishment will be done with minimal environmental impact.

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 and to a similar manner as the existing water bungalows. 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. The location of the water villas on the lagoon has been planned in such that they don't overlap any live coral patches. Hence, the location of the new water villas will be developed on clear lagoon.

All refurbishment on land will not require cutting of any mature trees. The construction of swimming pool will not require cutting of any mature trees, but will involve cutting of young few trees (details are discussed later in the report). No other proposed refurbishment will require cutting of any trees or involve any serious land contamination of pollution.

6.8 Existing facilities in the island

Being a fully operational resort, the resort has several facilities on the island namely, main jetty, diving school, reception, main bar, restaurants and kitchen, shops and entertainment, spa, water sports centre, on land guest rooms, beach bar, water bungalows, small beach hut, executive staff bungalow, general staff bungalow, staff canteen, mosque, workshop, laundry and desalination plant, power house and fuel storage, storage tanks, security checkpost

6.9 Description of the project components

This project involves refurbishment of Adaaran Club Rannaalhi located in Rannaalhi Island in South Male' Atoll, Maldives. See the attached site plan with the proposed new developments in appendix. The proposed refurbishment will have new components and upgrading of some existing facilities. The refurbishment will consist of three main components namely:

- Refurbishment of existing structures
- Construction of new water bungalows
- Demolition of structures (these structures are made from coconut thatch. These are not made from concrete or masonry)

6.10 Proposed refurbishment

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

6.10.1 Modification of 4 guest rooms (1 chalet)

Refurbishment will include conversion of the chalet in to a bar and Spa. This component will not involve any demolition. The refurbishment will include mainly interior decoration and painting works. Please refer to the site plan attached as an annex. The photo below illustrates the existing chalet which will be modified. No trees will be cut for this component.

6.10.2 Demolition of existing beach bar

The beach bar on the western side of the island is made from coconut thatch roof and wood. Demolition will result in 20 m2 of debris which will mainly be coconut thatch and wood. Please refer to the site plan attached as an annex. The photo below illustrates the existing beach bar which will be demolished. No trees will be cut for this component.

6.10.3 Demolition of existing Ayurveda

The existing Ayurveda spa is also made from wood and coconut thatch. Hence, this will also be demolished. The new spa will be developed after refurbishing the Chalet discussed earlier. Demolition will result in 20 m2 of debris which will mainly be coconut thatch and wood. Please

refer to the site plan attached as an annex. The photo below illustrates the existing Ayurveda spa which will be demolished. No trees will be cut for this component.

6.10.4 Construction of new bar and Spa

The new bar and spa will be developed by refurbishing the existing Chalet (4 rooms). Refer 6.10.1 and annex.

6.10.5 Construction of new staff quarters

A new staff quarter will be constructed within the boundary of the existing staff quarters. The new development will take place on empty land and no cutting of trees of clearing of vegetation is required.

6.10.6 Construction of new water bungalows, 06 Rooms (2 by 2 storey chalet)

Water bungalows will be constructed south of the existing water bungalow. The new bungalows will be connected to the existing bungalows via a jetty. Villa footings will be driven using steel piles encased with concrete in columns and beams and the concrete footings will be laid in steel moulds in situ. See annex for location.

6.10.7 Construction of new water bungalows, 1 Room (2 by2 single storey chalet)

An additional single bungalow (2 storey) will be constructed to the north of the existing water bungalow set. This will make the total number of bungalows in this set to nine (9). The new bungalow will also be connected to the existing bungalows via a jetty. Villa footings will be driven using steel piles encased with concrete in columns and beams and the concrete footings will be laid in steel moulds in situ. See annex for location.

6.10.8 Refurbishment of existing water bungalows, 8 Room (2 by single storey chalet)

All the existing water bungalows will be refurbished. Refurbishment will be upgrading the interior and decoration. See annex.

6.10.9 Construction of new swimming pool.

A new swimming pool will be constructed on the east side of the island in the available empty space. 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.

6.10.10 Extension to the Existing Restaurant

This is not a major extension and only the roof will be extended to increase the facade. No tree clearing will be required for this component. Refer to the attached plan as annex.

6.11 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. They will not be stored on the beach. They will be stored inside the island away from the guest areas and protected from rain.

6.11.1 Construction strategy

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

6.11.2 Work methods for over water structures

All water bungalows will be constructed on piles. This method involves man driven steel piles encased with concrete in columns and bean. 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.

6.11.3 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 staff quarters. 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.

6.11.4 Demolition strategy

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

6.11.5 Management of waste

The executive arrangements in place for managing demolition waste is simply by stockpiling the demolished waste for the shortest duration possible, in the staff area and then transport immediately to Thilafushi. As Thilafushi is in close proximity to Rannaalhi (approximately 35 km), this operation is not expected to be disrupted and the management of the waste will not be a significant issues. Waste will be transferred twice a week.

6.11.6 Expected environmental conditions during the project implementation period

Since the project will take place in south-west monsoon, environmental conditions can at times influence the work. June and July, being the worst period of south-west monsoon, working conditions can become difficult. Therefore, the strategy would be do complete the water villa columns as soon as possible, preferably before June. This would give more window for construction workers to undertake other works rather than causing delays due to bad weather.

6.11.7 Risks associated with the project

There are few risk factors associated with this project that could possibly have more financial implications than environmental. The most significant risk is associated as a result of keeping the resort operational during the construction period. This may cause and is expected to generate guest complains and cancellations. Although the tour operators and guests will be informed of the construction, their perception will heavily be influenced when they come to the resort to find out that it is under construction. A similar case have already created havoc and lawsuits in Maldives. The inaugural guests to Herathere resort in seenu atoll experienced that their holiday destination was in fact a construction site and hence they had to be diverted to other resorts. This case is still ongoing.

There is also the risk of project delays caused by bad weather as the construction period falls within the south-west monsoon. This risk can be minimized if the footings of the water villas could be completed before June-July, which is the worst period of the south-west monsoon. However, this risk can be minimized as the construction will be awarded to experienced contractors with experience in working in similar situations. Therefore, work delays will be least impacted.

6.12 Project Inputs and Outputs

6.12.1 Project Inputs

The types of resources that will go into the refurbishment 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 (60 to 100)	Maldivians and foreigners	Open bidding by advertising in local papers/other sources
Water supply (construction period)	Existing Desalination plant in the island	120 m^3/day desalination plant
Electricity/Energy (construction period)	Existing Diesel generators in the island	3 by 400 kVA, generator
Construction machinery	Concrete Mixer and general construction tool	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	Already established.
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

6.12.2 Project Outputs

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

Table 2.

Table 2: 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	Utilize the existing disposal system
Construction waste from construction activities	50 cubic meters of debris and general construction waste.	Debris twice a week sent to landfill in Thilafushi
Waste oil and grease	10 to 20 litres per month	Stockpiled and sent to landfill in Thilafushi.
Noise	Localised to the island environment	Fencing the construction area and barricading the boundary.
Air pollution	Limited quantities of dust .	Mainly arising as a result of dust emission from the construction work such as cement mixing, and other processes. Only localised to the island environment only.

7 Policy, Legal and Administrative Framework

7.1 Overview

This section outlines the relevant environmental legislation pertaining to this project.

7.2 Applicable Policies, Laws and Regulations

7.2.1 Environmental Protection and Preservation Act

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

7.2.2 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.

There are no protected sites or resources such as protected birds and trees in the island environment.

7.2.3 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.

7.2.4 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.

7.2.5 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.

7.2.6 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.

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. However, the terrestrial environment around the newly to be constructed swimming pool was assessed. 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 almost negligible in light of the scale of the project component on land. The marine environment of the island covered the coral reef and the lagoon, especially on the southern and northern side which is expected to have the greatest impact as a result of the proposed project.

8.2 Mapping and Location identification

The island, including shore line, vegetation line and reef lines 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, marine survey locations, existing groynes, sea walls and the location for construction of the swimming pool.

8.3 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".

8.4 Marine Environment surveys

Marine environmental surveys were conducted to collect data on key environmental components (i.e. the coral reef system and the lagoon), that will be impacted due to the construction works. Three methods were primarily used to collect data, namely:

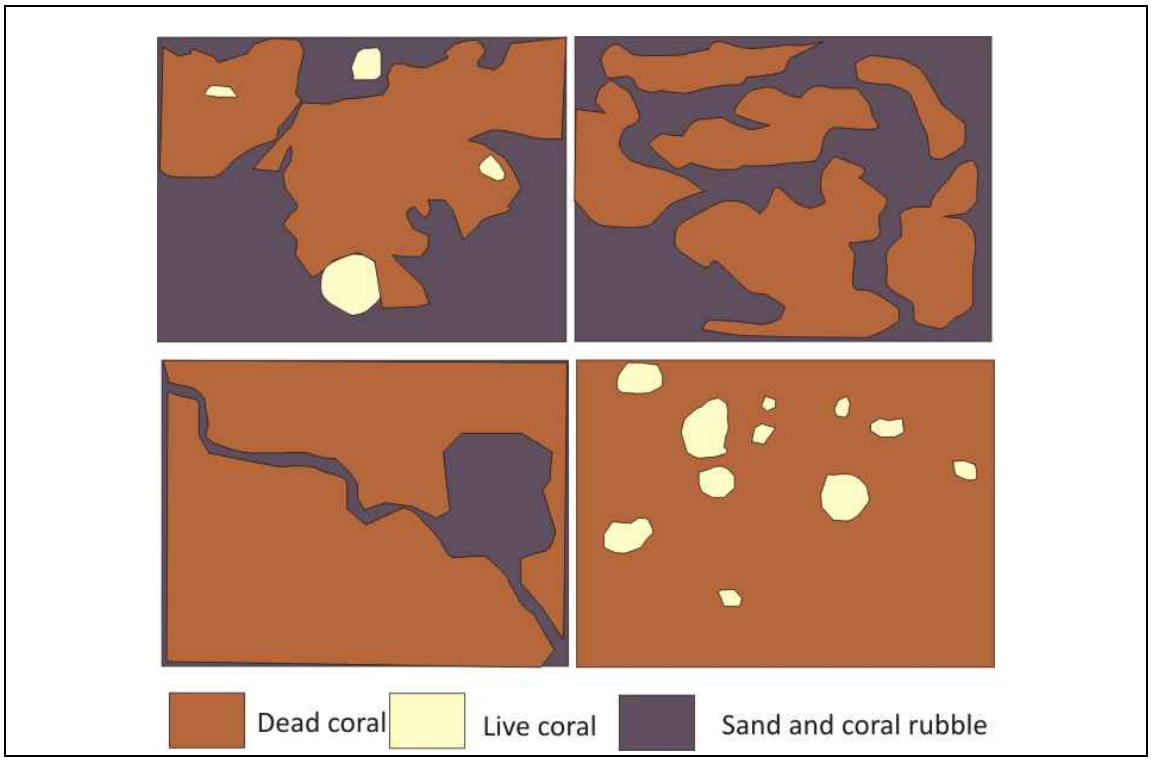
- Detail photo transect analysis,
- Fish census and
- Visual observations.

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 methods. In addition, photos were taken along the reef survey sites and the length of the lagoon where water villas will be developed.

8.4.1 Photo transect analysis

Photo transect coral reef survey method was used to quantify the 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 along the transect line (40 m each) using an underwater camera. These photographs were combined to form a photo-composite. Photo-composite of the mapped area of the reef were analysed using a 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 transect line, which is useful for long-term monitoring of growth, mortality and recruitment.

Figure 4: Photo quadrate analysis from site 1



In addition, qualitative and quantitative surveys were conducted on the reef and lagoon system. Qualitative assessment was based on visual observation by snorkelling and then comparing the result with aerial photographs. Quantitative method involved photo transect analysis described in the previous paragraph.

These surveys were used to assess the general status of the coral reef and the lagoon.

8.4.2 Reef fish Visual Census

Underwater counts of reef fishes or underwater visual census (UVC) method was used to assess the fish population at the surveyed sites. Visual counts appear to give reasonably reliable results provided that they are applied to fish that are non-cryptic and either diurnally active or at least evident by day. In this method, the surveyor swims along the transect paths above the reef, counting fish that were observed within 5m either side of the transect and above up to the water column. The same transects line for the photo transect were utilized to carry out the fish census. Fish was counted along the 40 m transect path (that is in a belt of 5 m on either side and up to the water surface). To count the fish, the surveyor swam slowly along, counting fishes that was seen within the defined band transect, 40m long by 10m wide (i.e. one with a total area of 400m^2). Each individual fish or group of fish was noted on the underwater slate immediately after it was seen, and the totals obtained by adding up these figures following the end of the swim. Counting any fish more than once was avoided by training and experience. Only the families belonging to one or two closely similar families and groups were counted at any one time. This improved accuracy, because on most reefs there were far too many for all to be counted at the same time. Measures were taken to improve the accuracy. Speed at which the path was swum was controlled so as to standardize the efficiency of search. If the surveyor swims too fast it is easy to miss fish, especially of smaller species, that may be temporarily obscured by corals or rock or be taking shelter. Experience shows that the slower the surveyor swims, more fish that is recorded up to a point. However, the highest number recorded by moving along very slowly may actually be an over estimate of fish density. Hence it is necessary to standardize swimming speed to a slow but not too slow pace. The standard speed of swimming practiced was at a mean rate of 10m a minute.

8.4.3 Terrestrial environmental data collection

Since this project has very limited components on land, terrestrial environmental assessment was limited to the location where the swimming pool will be developed. This location was assessed for the presence of any mature or protected trees and the extent of clearing required.

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. Rannaalhi island lies in proximity 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 3 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 3: 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 Rannaalhi 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 4 summarises the wind conditions expected for Rannaalhi throughout the year. Medium term meteorological data from Malé International Airport weather station was used in this analysis.

Table 4: Summary of general wind conditions expected for Rannaalhi

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

Table 5: Scatter diagram for Rannaalhi. 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 jetty –east is located on the south-east side and the service jetty on the north side of the island. The eastern side sand spit or *thundi* area, is prone to severe weather including the effects of wind and currents during the north-east monsoon. The reef extent on the western side is considerably large, whereas from the north and eastern side is very narrow.

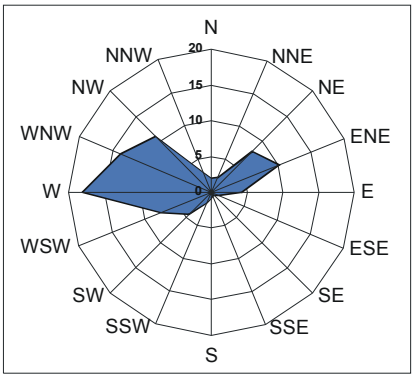


Figure 5: General wind rose diagram for the Maldives (source MEEW 2005).

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).

Rannaalhi is exposed to waves generated by swells combined with short-wind-generated waves travelling from the west. Waves breaking on the western side may be considered to be strong as can be evident from the shore protection measures undertaken. Similarly, the southern side is also protected by sea wall (to some extent) and multiple groyns.

Waves breaking on the north side may be less strong because it faces the atoll lagoon, therefore it has less influence in island building. General wave conditions in Rannaalhi is summarised in Table 6 (adapted from DHI, 1999).

Table 6: Summary of wave condition in Rannaalhi.

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 lagoon ward 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 back reef 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

This section will look at the terrestrial environment, but only limited to the area where new development will take place. No transects were done as there were only very few trees.

9.9.1 Floral Landscape

The floral landscape was assessed for two locations. There are:

1- The location, where the swimming pool will be constructed

2- The location, where the new staff building will be constructed.

The location for the swimming pool is an empty area with limited young trees. The photo below illustrates the baseline condition of this area.

Figure 6: Floral landscape at the location for the swimming gpool

9.9.2 Groundwater quality

Groundwater assessment was conducted to assess the ambient conditions of groundwater in Rannaalhi. 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 tap connected to the well. Groundwater of the island was tested for selected parameters outlined below.

Table 7: Results of the groundwater quality of Rannalhi resort.

Parameters tested	Results
Physical appearance	clear
Nitrates (mg/L)	0.00
pH	7.3
Temp (C)	27
Phosphates (mg/L)	0.01
COD	Tests not available from the lab
BOD	Tests not available from the lab

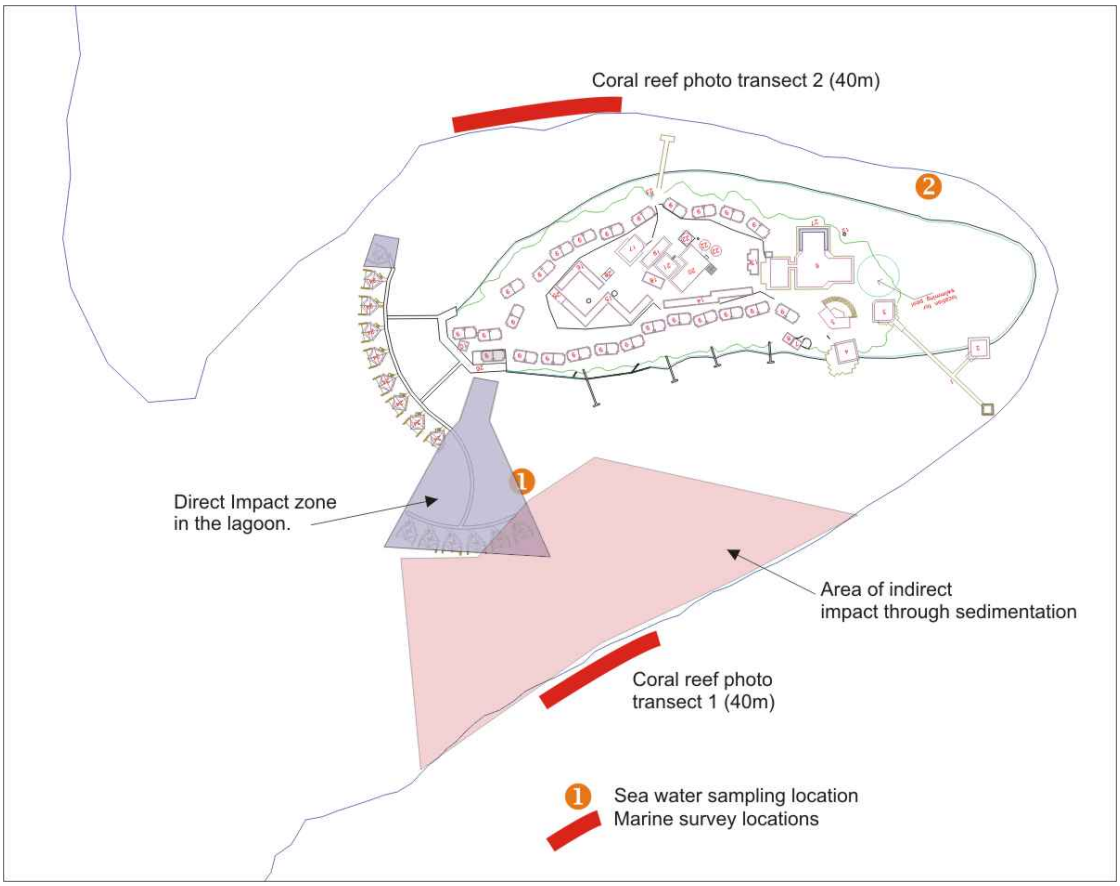
Ref: National Health Laboratory Report no: NHL/RE/WC 460

9.10 Existing Marine Environment

9.10.1 Section Brief

This section will look at the marine environment of the island with specific emphasis on the development area. Marine environmental survey was conducted in three locations as outlined in Figure 7.

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



9.10.2 Marine water quality and bathymetry

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 new water bungalows are concentrated in the western side lagoon, sampling was undertaken in this area. The qualitative assessment indicates that the sea water is clean and clear. To confirm this, water quality tests were done at the National Health laboratory. The results indicate no pollution from any human activities nor any other source.

The bathymetry of the proposed water villa construction area indicates that the average depth is between 0.7 to 1. 2 m. A bathymetric map is illustrated in Figure 8. Table 8 illustrates the result of the marine water quality test and Figure 7 illustrates the marine water sampling locations.

Table 8: Results of the marine water quality tests undertaken in March 2008

Parameters	Sample 1	Sample 2
GPS Coordinates	3055'10.14" N 73021'19.68" E	3054'13.11" N 73021'31.64" E
Turbidity (NTU)	3	0
Nitrates (mg/L)	0	0
phosphates(mg/L)	0.09	0.03
pH	7.4	7.0
DO (mg/l)	5.2	6.0

NHL: Lab report no: NHL/RE/WC459

Figure 8: Bathymetryof the project location.

9.11 Description of marine environment

9.11.1 Abiotic environment

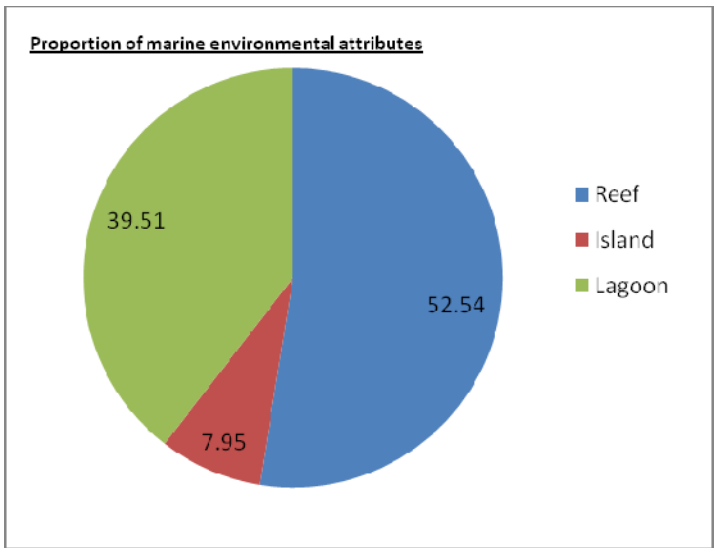
The marine environment of Rannaalhi consisted of a relatively large coral reef system, a lagoon system, and the various habitats and processes within these systems which collectively function as a small island system. Rannaalhi island system is located on the south-west rim of the atoll. As this island system is on the atoll rim it is exposed to waves generated by south-west winds. The coral reef system of Rannaalhi is in the shape of an "L".

9.11.1.1 Coral reef system

The width of the reef system from the northern end is 455 m and the width of the system at the southern end was estimated as 960 m. The perimeter of the reef system was estimated to be approximately 4146 m. The total reef area of the system including the reef-flat, reef slope and the lagoon was estimated to be approximately 576292 m². The total area of the reef (reef slope and

reef flat was estimated as 328919 m^2. The following figure shows proportions of the environmental attributes of the island system in terms of area.

Figure 9: Proportion of marine environmental attributes of the island



The coral reef system of Rannaalhi can be considered to be in a state of recovery with emerging new coral growth around the areas where the surveys were undertaken. The reef slope at site 1 varies along different sections of the reef varying from steep slope to a gentle reef slope. The reef slope on this side was observed to have a drop in 8 metes and then with a flat reef bed of about 3 to 4 meters, before sloping again. The reef flat on the first 8 meters cannot be considered as a very healthy reef as most of the corals are dead. However, between 5 to 8 meters, numerous new coral growth was observed, mainly branching type.

The visibility at site 1 was roughly 20 meters on the day of the survey. A reef-flat measuring a width of approximately 50 m is found on the southern side (site 1). The reef-flat on the northern side area is very narrow having approximately 5 to 10m in average. The total reef area including the reef-flat and shallow areas of the reef slope was estimated as 328,919.73 m^2 (Reef area has been calculated as the reef slope and the reef flat, not including the lagoon).

9.11.1.2 Lagoon system

The lagoon system has been considered as the area from the shore line up to the reef flat. Distinguishing the exact boundary of a reef flat is very difficult as there are no guidelines and criteria's developed for this. Hence, the surveys together with aerial photos were used to determine this. The total area of the lagoon was estimated as 247,373.00 m^2. A large lagoon area is found on the southern and western side of the island, whereas the northern and eastern side is very narrow. 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.

9.11.2 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. Marine surveys were undertaken from three sites, two from the coral reef and one in the lagoon.

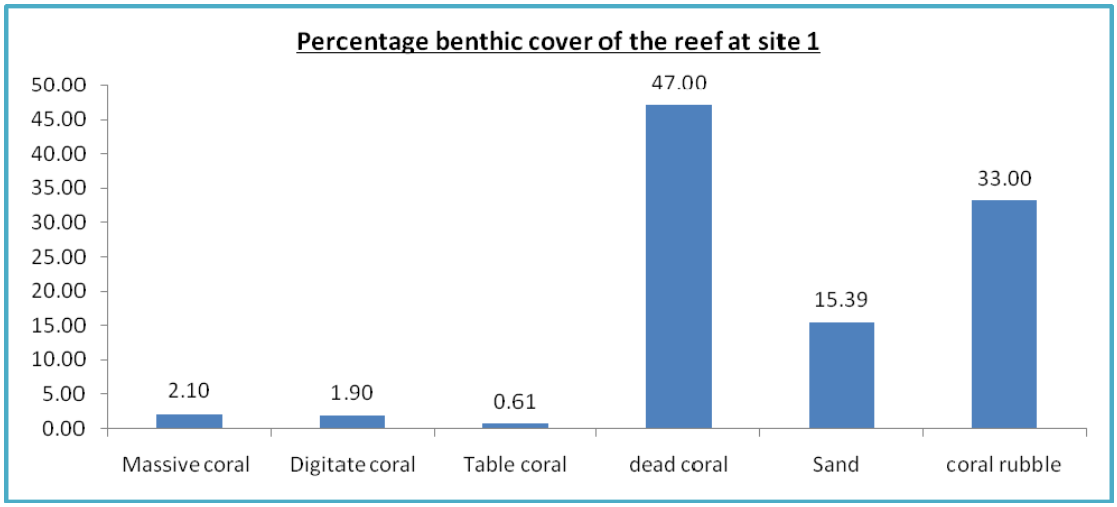
9.11.2.1 Coral reef system and amount of live corals

Amount of different categories of live corals and other benthos in the reef slope/reef edge was quantitatively estimated by Photo-Quadrate survey described in the methodology section. Two representative sites of the reef were assessed using Photo-Quadrate method. Site 1 is the southern side and Site 2 is the northern side of the island. See Figure 7for the locations of Photo-quadrate (PQ) reef survey sites.

The coral reef system of Rannaalhi cannot be considered as healthy as the percentage of live coral coverage is very less. However, the reef was observed to be recovering and new emerging and young corals were observed indicating that the reef is in a state of growth.

The following figure shows the results of the Photo-Quadrate survey at site 1.

Figure 10 Percentage benthic cover of the reef at Site 1



The photo-quadrate reef survey and visual observations conducted showed that the coral reef at site 1 had 4.6% live coral cover consisting of corals mainly belonging to the *Acropora* group. The survey showed that site 1 consisted of 2.10 % massive corals, 1.9 % digitate coral and 0.61% table corals. This area is dominated by dead corals accounting for 47%, coral rubble accounting for 33% and 15% sand. Standard error for these estimates is within ±10%.

The following figure shows the results of the Photo-Quadrate survey at site 2.

The photo-quadrate reef survey and visual observations conducted showed that the coral reef at site 2 had 4.10% live coral cover. The survey showed that site 2 consisted of 3 % massive corals, 0.9 % digitate coral and 0.20% table corals. This area is dominated by dead corals accounting for 60 %, coral rubble accounting for 30% and 5% sand. Standard error for these estimates is within ±10%.

Figure 11: Benthic cover of the reef (site 2)

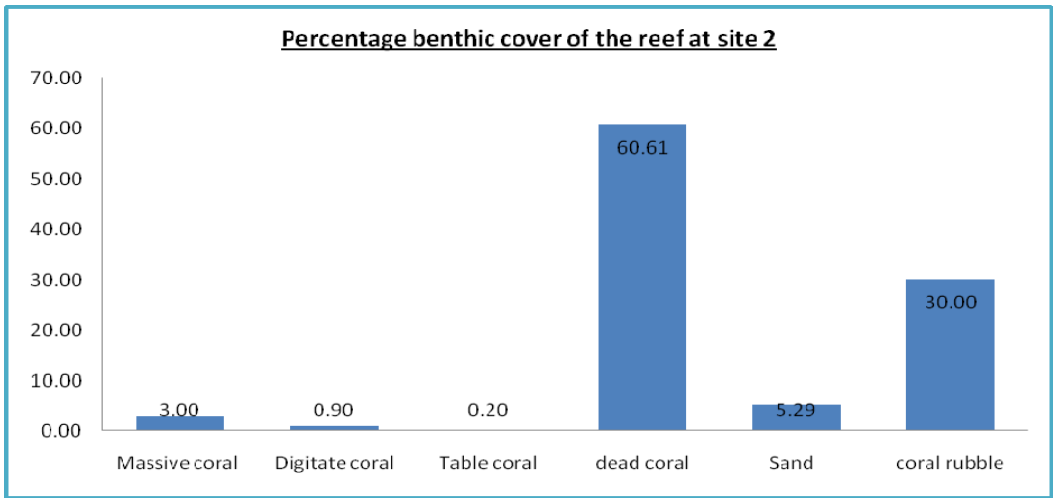
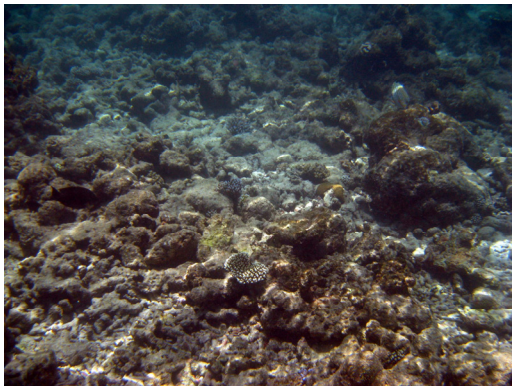


Figure 12: Photos from site (site 1)

	
Isolated live coral at site 1 (*Acropora Digitate*)	Dead coral and coral rubble at side 1
	
Dead coral at site 2	Dead coral with some live coral massives

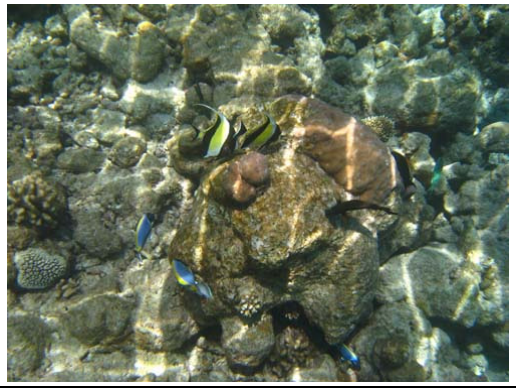
9.11.2.2 Coral reef system and fish communities.

Fish population structure can be used as in idicator of status of the marine environment. Increases grazers is generally a sign of increased nutrients in the area thus decreased coral and other increased algae.The result of 10 minute swim for fish count on the survey reveals that the abundance and diversity of fish is low to moderate at site 1 (see Figure 13).

The table below represents the results of the fish encounter survey (Sites 1 & 2).

Family	Species	Site1	Site2
Acanthuridae	*Acanthurus triostegus*	2	4
Acanthuridae	*Ctenochaetus* sp.	6	2
Balistidae	*Rhinecanthus* sp.	2	2
Kyphosidae	*Kyphosus* sp.	-	8
Labridae	*Helichoeres scapularis*	4	3
Labridae	*Helichoeres hortulanus*	-	1
Labridae	*Labroides dimidiatus*	2	-
Labridae	*Thalassoma lunare*	-	2
Labridae	*Thalassoma hardwicke*	-	1
Labridae	*Novaculicthys taeniourus*	1	-
Labridae	*Stethojulis albovittata*	-	1
Labridae	*Coris* sp.	-	-
Labridae	Labrid spp.	-	7
Mullidae	*Parupeneus barberinus*	-	4
Mullidae	*Parupeneus bifasciatus*	-	1
Penguipedidae	*Parapercis* sp.	4	-
Pomacanthidae	*Centropyge flavicauda*	4	-
Pomacentridae	*Pomacentrus nagasakiensis*	-	6
Pomacentridae	*Pomacentrus indicus*	2	5
Pomacentridae	*Chrysiptera brownriggii*	6	3
Pomacentridae	*Pomacentrus chrysurus*	2	4
Scaridae	*Scarus* sp.	-	3
Serranidea	*Epinephelus merra*	1	3
Sygnathidae	*Corythoicthys* sp.	1	4
Zanclidae	*Zanclus cornutus*	-	-

Figure 13: Fish encountered from site 1

	
Blue Surgeon fish	Schooling banner fish (*Heniochus diphreutes*)

9.11.2.3 Lagoon system

The lagoon survey was concentrated on the western side lagoon where impact of over-water villa construction is going to be the greatest. The lagoon survey showed that lagoon bottom consisted of mainly coral rubble and fine sand. The area had a high percentage of sand and rubble which combined with elevated levels of turbidity (3 NTU) makes the proposed site very unfavourable for coral recruitment as coral spat need a hard substrate to settle and grow. Absence of live corals along the transect line is a good indication of the absence of suitable substrate in this area. In this area, 65 % were rubble and 35% sand.

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 can be considered poor as no fishes were encountered during the survey. This could be due to lack of any live corals in this area. Hence, the biotic environment of the lagoon in the proposed construction area was found to have no special attribute/characteristic or environmentally sensitive area. See Figure 7 for locations of the lagoon surveys.

Figure 14: Substrate cover on the proposed site for water villas.

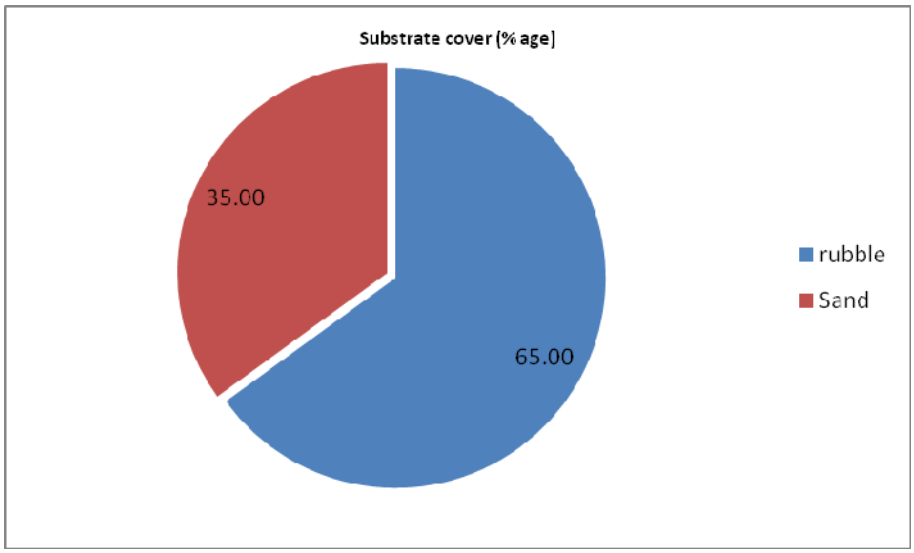
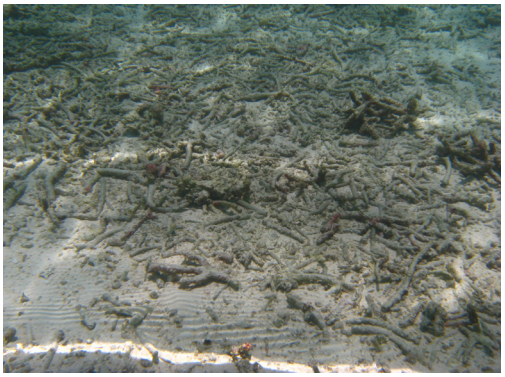


Figure 15: Photos of the lagoon showing the substrate cover



Lagoon bottom consisted of mainly sand and coral rubble.

10 Environmental Impacts

10.1 Impact Identification

Impact identification has been undertaken by considering the proposed activities and modifications and examining the level of impact it will have on the environment. Each activity 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. New staff quarter will be developed on empty land and therefore, no cutting of trees will be required. New water villas have been proposed to be constructed on the lagoon which does not have any live corals. The footings of the water villas will not be solid structures and will allow sediment movement.

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. For example, the anticipated impacts on the coral reef has been exaggerated to account for uncertainties.

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

Negligible – the impact is too small to be of any significance;

Minor– the impact is minor;

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 Ranaalhi 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 slightly elevated degree of uncertainty as the marine environment is more sensitive in extreme cases such as severe weather conditions. Water villas have already been developed on the island and therefore, the impact of constructing additional water villas can be fairly accurately predicted.

Such developments have been undertaken in Rannaalhi and also 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. The marine environment also contains very small percentage of live corals. Therefore, there is a high degree of accuracy in prediction of the impacts.

10.4 Impacts on the Coastal environment

The impacts on the coastal environment is expected to be minor. The major impacts would be felt through diffraction of waves by the water villa columns and changes in the current speed in this area. Therefore, the additional columns of the new water villas will affect the sediment movement patterns in the lagoon to some extent. This changes in the sediment pattern is not expected to affect the beaches significantly as the coastline on the west and southern side is protected by a sea wall and groynes respectively. Furthermore, the new water villas will be connected to the existing water villas and no additional jetty will connect the new villas and shore. This will reduce the number of columns on water.

10.5 Impacts on the terrestrial environment

10.5.1 Demolition of structures and construction of the swimming pool and new staff quarter

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 Ayurveda and beach bar, visual intrusion and noise will be the significant impact to the guests as the resort will be operational during the refurbishment period.

Construction of the swimming pool and new staff quarter 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 on the lagoon (see the site plan). Indirect impact on coral reef will be spreading of sediment fines on the coral reef. This impact will be felt on an estimated 10% of the coral reef system. The construction period falls in south west monsoon and therefore, the winds and the winds generated currents will likely distribute the sediment towards the south, south east.

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 6% 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 22% of the lagoon. Estimated error of these predictions are ±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 9: Significance of impacts

Impact characteristic	**Project activities**
	Water bungalow construction
Nature of impact	cumulative
Magnitude of impact	Moderate adverse
Geographical range of impact & environmental attribute	Direct impact on 3,512 m² of lagoon Indirect impact on 5,6671 m² of lagoon. Indirect impact on 33,835 m² 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 construction 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.

The direct impact area has been calculated based on the area of the new construction that is to be undertaken. An estimate has been made taking in to account with a buffer of 3 to 4 meters from the boundary of the new water villa construction, where direct impacts will be felt during the construction stage.

Table 10: Summary of major impacts and mitigation measures

Environmental Aspect	Potential Impacts to the environment	Mitigation Measures proposed
Construction of the swimming pool and the new staff quarters	**Terrestrial environment** The construction of a new swimming pool will not have any significant impact on terrestrial environment as no mature trees will be cut. Very few young trees will be relocated elsewhere. Impacts of dewatering would be short term saline intrusion. Noise impacts to guests are likely to arise, but will be in the short term. No cutting of trees will be undertaken for the construction of new staff quarter; therefore flora will not be affected. Temporary impacts will be through emission of dust and noise. **Groundwater and surface water** 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.	Only excavating the required depth for the foundations (both for swimming pool and staff quarter). Undertake dewatering as per the guidelines set by MWSA. Fencing the swimming pool area during construction period. For the construction of swimming pool, relocate the young coconut palms elsewhere in the island. If tree trimming is required, trimming should be kept to only to the required amount. Regularly spray the sorrouding trees with water (in the vicinity of the new staff area).
Construction of over water villas.	**Coastal Environment** 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. The beaches on the south and western side will have negligible impact as there are sea walls and groynes constructed on this side. **Marine Environment** The construction of over-water villas would impact the coral reef indirectly and	The following mitigation measures will help minimize the impacts. - The water villas will be built on columns. STRICTLY no solid structures on which they will be constructed. - Ensure appropriate supervision and monitoring during works - Carry out the work in low tide hours during calm weather - Complete the work in as short a time period as possible - Use manual methods as much as possible - Create awareness and brief the workforce on how to minimize impacts - limiting the working area within the boundary of the construction

Environmental Aspect	Potential Impacts to the environment	Mitigation Measures proposed
	the lagoon directly and indirectly. Direct impact on coral reef is not expected to be very significant as the live coral cover of the coral reef is very less (approximately 4%). Indirect impacts on coral reef will result through the spreading of sediment fines on the coral reef. Direct impact on lagoon will be disturbance to the lagoon bottom during the construction of the footings of the water villas.	zone and avoiding disturbing other areas. An ideal method would be to mark the area with tape to indicate the construction zone. - 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. 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. Proposed development work will be carried out in calm weather and sea condition. 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. 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 reported.

Environmental Aspect	Potential Impacts to the environment	Mitigation Measures proposed
		The monitoring programme specified in this report will be followed and reported in both work phase and operation phase.
Noise and air pollution	Rannalhi is an isolated island. Noise impacts are therefore going to be localized to the Island only. Noise impacts will be an issue during the construction period for the guests.	Noise is expected to be a concern as the resort will be operational during the refurbishment works. Guests will be informed about the construction at the time booking by the tour operator concerned. Construction area will be fenced and manual methods will be used as much as possible to avoid machinery use. Demolition will also be done using manual methods and not with the use of any machinery. Working platform for construction of over water villas will be located away from occupied rooms
Generation of construction debris	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 and stockpiled away from the guest areas. Indirect impact on Thilafushi through dditional burden on Thilafushi resulting from the construction waste is not considerable.	- Sort the construction debris in to concrete, wood and metal waste before transporting them to Thilafushi. - Temporary stockpiling to be done on land and to avoid the beach and the marine environment. - recycle any wood or other material if possible in order to reduce the volume of debris reaching the landfill.
Demolition of the beach bar and Ayurveda	No significant impacts are expected as the structures are made from coconut thatch and wood. No machineries will be used. Structures will be dismantled	- confine the boundary by fencing the area. - use manual labour and not machinery

Environmental Aspect	Potential Impacts to the environment	Mitigation Measures proposed
	using manual labour. No tree cutting will be required. Guest complains are anticipated as a result of visual disturbance	- inform the tour operator and guests before they arrive the resort. - complete the work in the shortest possible time.

Table 11: Summary of the impacts and their characterization

Environmental Aspect	Nature of impact	Magnitude of impacts (negligible/minor /minor adverse/moderate adverse/major adverse/ positive)	Significance of the impact (low/moderate/high)	Duration of Impact	Reversibility
Construction of the swimming pool and the new staff quarters	Cumulative	minor	Low	Short term	reversible
Construction of over water villas	Cumulative	Moderate adverse	High	Short to long term	irreversible
Noise and air pollution	Cumulative	Moderate adverse	High	Short term	reversible
Generation of construction debris	Cumulative	Minor	Low	Short term	reversible
Demolition of the beach bar and Ayurveda	Cumulative	Minor adverse	Medium to high	Short term	reversible

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 only involves refurbishment, 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

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 existing facilities are old, without expansion and refurbishment, it would be difficult to compete in the market.

- The proponent does not want to alter the island too much as they would like to undertake the refurbishment works by operating the resort at the same time. Shutting down the resort will be financially unfeasible through loss of revenue.

- New staff quarter is required in order to accommodate the staff increase and also provide better accommodation facilities.

- 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 and management. They also felt that the island requires 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.

- This project has been approved by the ministry including all the concepts.

- The Ministry is generally very positive about such refurbishments.

- 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. They should also be developed at a considerable distance from the shore line in order to avoid the sediment movement around the island as much as possible.
- 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 developing the water villas elsewhere. However, the present location was chosen
- Several alternative ways of constructing the water villas were also considered, details of which are discussed under alternatives. .

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. Ahmed Jameel	Assistant 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

EIA Regulation requires two alternatives to be suggested for such developments and therefore 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 12.

Table 12: Advantages and disadvantages of the no project option

Strategy	Advantages	Disadvantages
Allow the resort to operate as it is.	Environmental problems related to refurbishment 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. With the limited facilities, the resort can only be marketed to certain markets.
Existing water villas would be left as it is and not constructing new water villas.	Environmental problems related construction of new water villas can be avoided No upgrading costs to the Proponent, short term benefit	Value of the tourism product may deteriorate. Services cannot be diversified and hence profit generation will be limited.
Not constructing the swimming pool	Space can be conserved in the island. No No upgrading costs to the Proponent, short term benefit.	Value of the island and the service cannot be increased. Services cannot be diversified and hence profit generation will be limited.
Leave the existing spa and beach bar as it is	No upgrading cost.	Unable to diversify the market. Unable to increase space on the island.

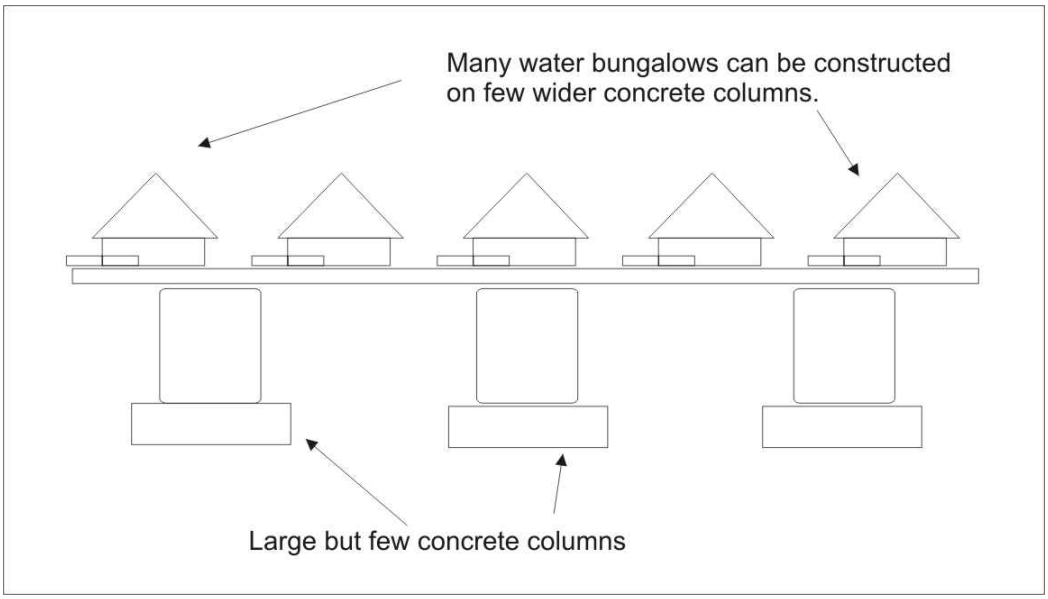
12.2 Design Alternatives

During the planning stage, few design alternatives were considered, mainly for the construction of the water villas. They are discussed below.

12.2.1 Construct multiple water villas on few large columns

An alternative method of water villa construction were considered at the planning stage. This method involves constructing large, but few concrete columns on the lagoon and then building multiple water villas on them. This method is illustrated in Figure 16. This method was rejected for several reason. First, this is a very new concept for Maldives and hence require a greater degree of uncertainty. Secondly, the large columns would be very unattractive and will not blend with the existing water villa columns. There would be lot of negative visual perception. Thirdly and very importantly, the large surface area of the columns will disrupt the sediment movement greatly than if it was constructed sing standard column sizes. Hence, there would be a greater degree of sediment disruption and at present, there is very limited information and experience within Maldives as far as this method is considered.

Figure 16: Alternative construction method for water villas.



12.3 Alternative locations

12.3.1 Location of the Water villas

The only alternative location for the water villas are on the north-west side lagoon. However, this side will receive strong winds and experience rough conditions during the peak season, which is the north-east monsoon. The proposed location is in the lee of the island during the NE monsoon. It is not possible to locate the water villas on the southern side as it will obstruct the view of guests using the southern side beach.

12.3.2 Location of the swimming pool

The swimming pool has been proposed to be constructed on the north-east side. This is the most appropriate location as the island is presently saturated. The proposed location is also suitable in the sense that it is adjacent to the eastern side sand spit which is a very attractive feature of the island. There is no alternative location for the swimming pool in the island due to its limited size and existing facility.

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 on them. 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. In addition, foundation pads will have to be constructed on land which will have to be done in the island. This will increase the construction activity in the island which will be a disadvantage as the island will be operational. The objective would be to minimize construction activities as much as possible. 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 outside the island, transport them to the resort and then place them once their location is fixed. Alternatively, construct the foundation footings inside the staff area, which is at present isolated and also fenced to limit construction activities.

- 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.
- Undertake the construction during low tide hours.

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.

13.3 Aspects of monitoring

Monitoring will include marine aspects only. 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.

13.4 Methods of monitoring

Environmental monitoring will be undertaken using standard methods described in the Methodology section. Monitoring is only recommended for marine environment. No terrestrial environmental monitoring is considered necessary for this project.

Table 13: Aspects of the environmental monitoring program with cost breakdown

Monitoring Attribute	Indicator	Methodology	Monitoring Frequency	Estimated Cost (construction and operational phase
Marine water visibility in the lagoon	Visibility	Secchi Disc & Tow line distance	Every other day during work. Every 3 month thereafter	No cost. Contractor to undertake this during construction period.
Coral cover at survey sites	Percentage live cover	Qualitative & Quantitative	Once during the construction stage. Once a year thereafter (US $ 500 per survey).	Total US$ 1500
Coral recruitment at survey sites	Recruit/m^2	Qualitative & Quantitative using photo quadrat	Once a year (US $ 500 per survey).	Total US$ 500
Marine water quality	DO, nitrates, phosphates and turbidity.	Onsite or Lab analysis	Every two months during work; twice a year thereafter (US $ 50 per test).	Total US$ 400
Siltation	Sediment deposited on reef substrate	Qualitative & Quantitative	Every other day during work. Every 3 month thereafter	No cost. Contractor to undertake this.

Table 14: Detail cost of monitoring during construction period and for two years.

DESCRIPTION	UNIT COST (US$)	TOTAL (US$)
Logistics		
Transport to Rannaalhi.	Client to provide	
Food, accommodation and logistics	Client to provide	
Survey costs		
Cost of undertaking the environmental surveys during the project construction stage and operational stage	2400.00	**2400.00**
Sub Total		**2400.00**
30 % contingency		**720.00**
Grand total for monitoring during construction stage and for two years (three thousand one hundred and twenty US Dollars only)		**3,120.00**

13.5 Monitoring responsibility

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

13.6 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 refurbishment. Due to the small scale of the project, the environmental impacts are anticipated to be limited. Although, limited in nature, every practicable mitigation measures have been proposed in addition to a detail environmental monitoring programme.

It has been assessed that the most significant negative impacts from the proposed development will be on the lagoon bottom and indirect impacts on the coral reef system as a result of constructing new water villas. The most significant impact period will be during construction stage as a result, several mitigation measures to reduce the impact on the marine environment have been proposed during the construction stage.

They include measures such as undertaking work during low tide hours and also limiting the construction duration as much as possible. In addition, several other mitigation measures such as proper supervision have also been proposed.

Although the social impacts of the project were not assessed in detail, public consultations were undertaken with key stakeholders to obtain their views and opinion about the project. The project is also expected to have positive impacts, including the diversification of the services and increased revenue to the resort and to the country as a whole.Other positive benefits will be gained through the creation of more employment opportunities.

The monitoring programme for this project will mainly focus on marine environment and for this reason, specific parameters have been outlined for monitoring. It therefore, appears justified to undertake this refurbishment.

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 Zahid (EIA 08/07)

Signature:

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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 11th March 2008, for undertaking the EIA of the proposed **redevelopment work at Adaaran Club Rannaalhi, K 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. Provide the background information on the project and it costs. Justification should be given into consideration purpose and objectives of the project. Submit the proponents and their experience with similar projects. Project settings should indicate how the project conforms to existing plans, policies, guidelines, regulations, laws and International Conventions.*

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 –The description of the project should consider the following.

- *Project proponent's information clearly indicating the owner's consent to the project.*
- *A scaled site plan (A3 size) showing the location of proposed activity, site plan and architectural drawings and a separate site plan indicating all existing structures.*
- *Details of the major activities of the project and schedules.*
- *Details of the existing facilities on the island.*
- *Details of the processes and methods used.*
- *Quantified project outputs (e.g. jetties, bungalows, infrastructure) and inputs (e.g. manpower, machineries, energy and materials including their source)*
- *Description of the expected environmental conditions at the time of probable project implementation and associated constraints (e.g. season, tidal regime etc)*
- *Descriptions of how waste and emissions will be managed.*
- *Sketches of foundation pads and columns of over water structures.*
- *Reference to previous IEE and EIA studies relating to similar projects on the area.*
- *Discussion of the risks associated with the project.*

Task 2. Description of the Environment - Assemble, evaluate and present baseline data on the relevant environmental characteristics of the study area (and disposal sites), including the following:

a) *Description of the site, existing terrestrial environment specific to the proposed renovation area including details of any vegetation clearing activities needed and ground water quality.*

b) *Physical environment including wind, wave and currents based on available secondary data and primary data collected at the site, marine environment to include baseline reef status with seawater quality. (The seawater quality parameters would specifically include; turbidity, dissolved oxygen, salinity, suspended solids, pH, Nitrate, nitrite, phosphate, COD, BOD, among other chemical parameters.)*

c) *A proper assessment of the bathymetric conditions of the project site should be undertaken, including local hydrodynamics and sediment transport of the reef flat and coastal dynamics around the island.*

All survey locations shall be referenced with Geographic Positioning System (GPS). All water samples shall be taken at mid depth. The report should outline the detailed methodology of data collection utilized to describe the existing environment.

Task 3. Legislative and Regulatory Considerations - Describe the pertinent legislation, regulations and standards, and environmental policies that are relevant and applicable to the proposed project, and identify the appropriate authority jurisdictions that will specifically apply to the project.

Task 4. Determine the Potential Impacts of the Proposed Project –Identify the impacts for both construction and operational phase. Distinguish between significant impacts that are positive and negative, direct and indirect (= triggering), and short and long term. Identify impacts that are cumulative, unavoidable or irreversible. Identify any information gaps and evaluate their importance for decision-making. Special attention will be paid to:

- *Impacts on marine environment or the location of the proposed water bungalows.*
- *Impacts on coral reef, reef flora and fauna due to turbidity and sedimentation.*
- *Impacts on the reef flat due to hydrodynamics and sediment transport.*
- *Impacts to the coastal dynamics of the island*
- *Impacts on the terrestrial environment related to all proposed activities on land.*
- *Impacts on resort operation IF proposed construction activities are to be carried out when resort is in operation.*
- *Impacts due to construction and demolition waste.*

*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, locations for water bungalows and mitigation options. Distinguish the most environmentally friendly alternatives.*

Task 6. Mitigation and Management of Negative Impacts – Identify possible measures to prevent or reduce significant negative impacts to acceptable levels with particular attention paid to waste management during construction, dispersal/sedimentation control during construction of coastal structures. Cost the mitigation measures, commitment, equipment and resources required to implement these measures.

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. Identify appropriate mechanisms for providing information on dredging activities and progress of project to stakeholders. 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 any other relevant stakeholders.

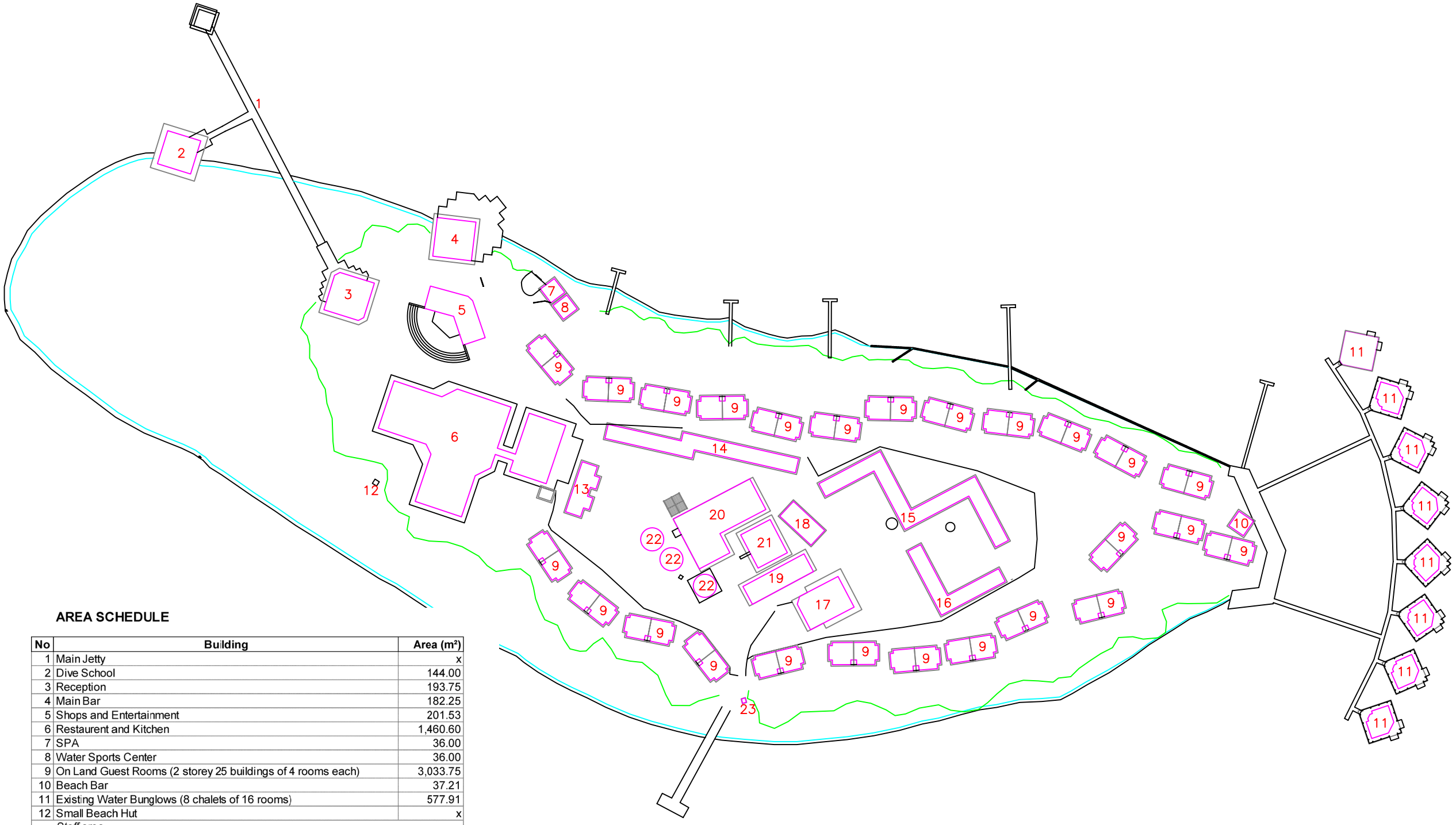
Task9, Methodology Explain clearly the methodologies used for data collections, making predictions and data gaps and also the information on the uncertainties and assumptions involved in interpreting the data.

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.

.....

12th March 2008

18 Annex: Annex: Existing Site plan of the resort

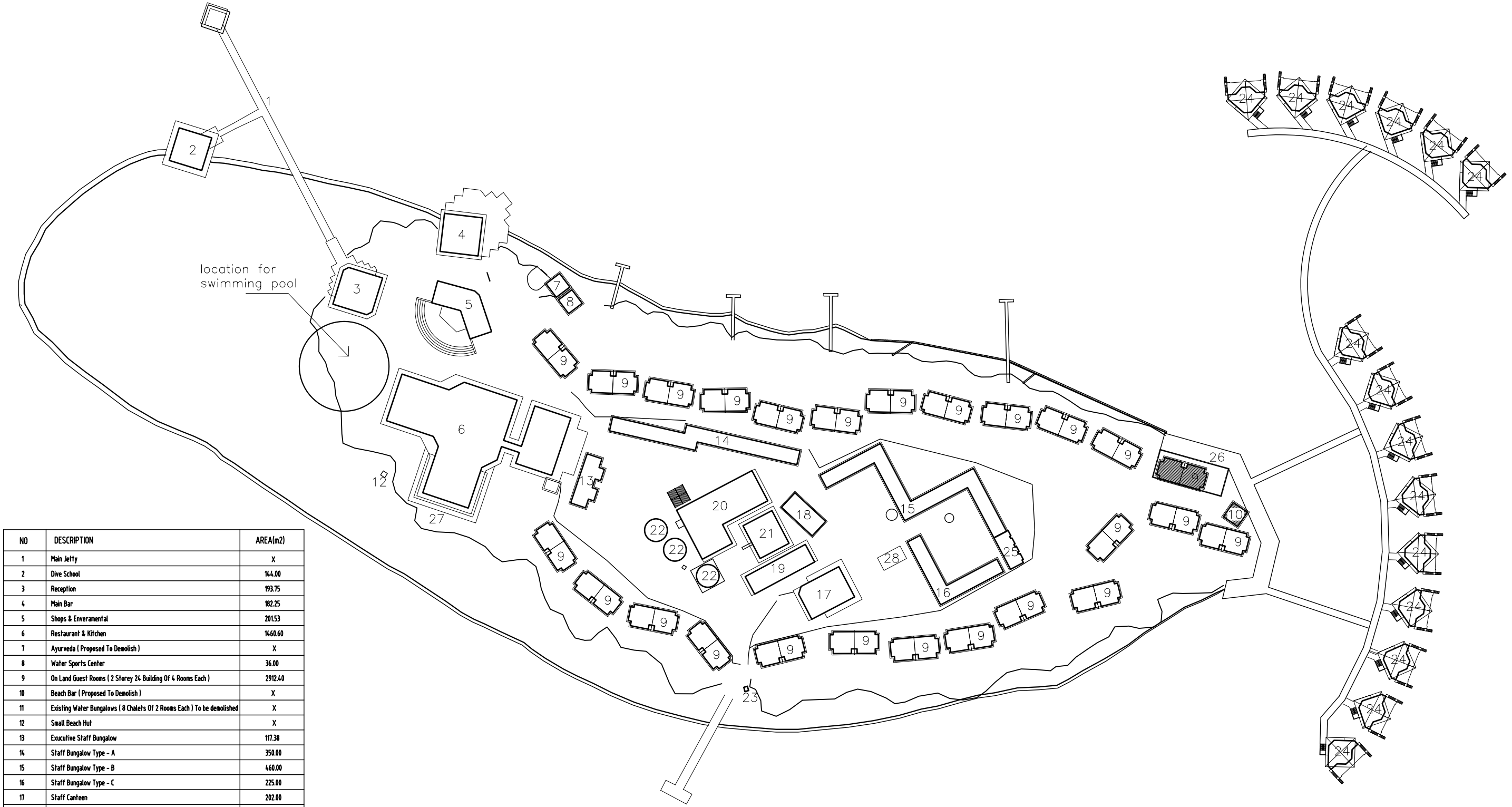


AREA SCHEDULE

No	Building	Area (m²)
1	Main Jetty	x
2	Dive School	144.00
3	Reception	193.75
4	Main Bar	182.25
5	Shops and Entertainment	201.53
6	Restaurent and Kitchen	1,460.60
7	SPA	36.00
8	Water Sports Center	36.00
9	On Land Guest Rooms (2 storey 25 buildings of 4 rooms each)	3,033.75
10	Beach Bar	37.21
11	Existing Water Bunglows (8 chalets of 16 rooms)	577.91
12	Small Beach Hut	x
	Staff area	
13	Executive Staff Bungalow	117.38
14	Staff Bungalow type A	350.00
15	Staff Bungalow type B	460.00
16	Staff Bungalow type C	225.00
17	Staff Canteen	202.00
18	Mosque	103.51
19	Workshop	168.00
20	Laundry and D. water plant	450.00
21	Power house and Fuel Store	149.50
22	Storage Tanks	150.80
23	Security Checkpost	x
	Grand Totals	**8,279.19**

Area of island - as of initial construction	**43,522.00**
% age of built up area	**19.02%**
Area of island - survey Nov 2004 high tide line	48,681.34
Area of island - survey Nov 2004 low tide line	49,721.63
Area of island - survey Nov 2004 vegetation line	32,786.00

19 Annex: New Site plan indicating the proposed refurbishment to the resort



NO	DESCRIPTION	AREA(m2)
1	Main Jetty	X
2	Dive School	144.00
3	Reception	193.75
4	Main Bar	182.25
5	Shops & Enveramental	201.53
6	Restaurant & Kitchen	1460.60
7	Ayurveda (Proposed To Demolish)	X
8	Water Sports Center	36.00
9	On Land Guest Rooms (2 Storey 24 Building Of 4 Rooms Each)	2912.40
10	Beach Bar (Proposed To Demolish)	X
11	Existing Water Bungalows (8 Chalets Of 2 Rooms Each) To be demolished	X
12	Small Beach Hut	X
13	Exucutive Staff Bungalow	117.38
14	Staff Bungalow Type - A	350.00
15	Staff Bungalow Type - B	460.00
16	Staff Bungalow Type - C	225.00
17	Staff Canteen	202.00
18	Mosque	103.51
19	Workshop	168.00
20	Laundry & Dessalination Water Plant	450.00
21	Power House & Fuel Store	149.50
22	Storage Tanks	150.80
23	Security Checkposts	X
24	Proposed Water Bungalows (15 X 2 Storey Chalets Of 4 Rooms Each)	1071.75
25	Proposed Staff Quarter Extension (Approved By Ministry)	68.44
26	Proposed Bar & Spa	250.00
27	Proposed Restaurant Extension	123.69
28	Proposed Staff Quarter Extension (New)	45.00
	Total Building Area	9,065.60
	Total Land Area (Registered On 27th Oct 2005)	48,668.00
	Beach Length (m)	1010.13
	Built - Up Area %	18.63%

NEW WATER BUNGLOWS, SPA & BAR

SW plus
CHARTERED ARCHITECTS
NO: 23, GUNESEKERE GARDENS, NAWALA, SRI LANKA
Tel: 0094 11 5523559, Fax: 0094 11 5523358
Email: manopon@slt.lk

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

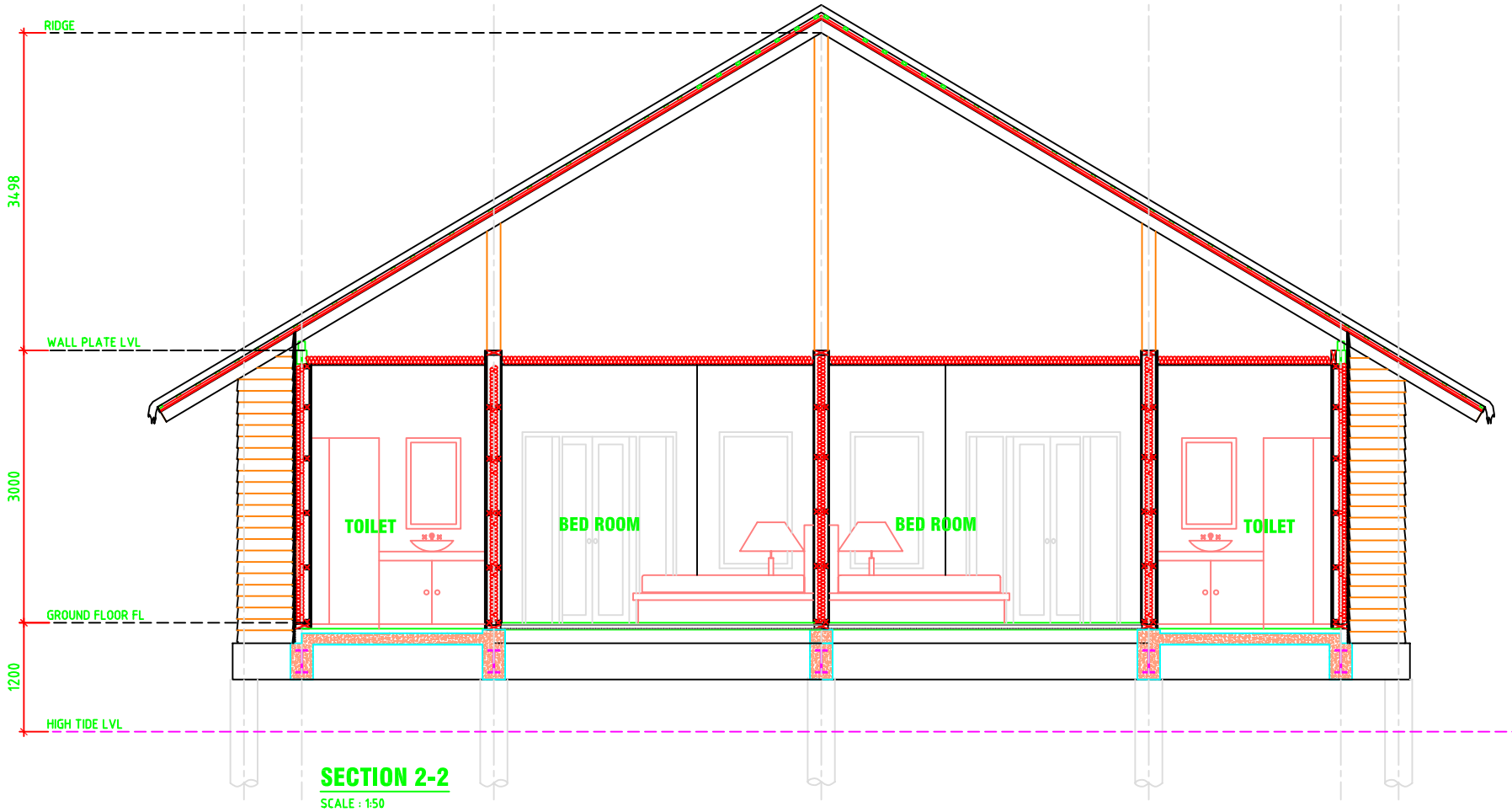
MANO PONNIAH & ASSOCIATES (Pvt) Ltd
CHARTERED ARCHITECTS & ENGINEERS
NO: 10, FLOWER TERRACE, COLOMBO 7, SRI LANKA
Tel: 0094 11 2573221, Fax: 0094 11 2467604
Email: manopon@slt.lk

DRAWING TITLE: **SITE PLAN**

PROJECT TITLE: **PROPOSED WATER BUNGALOWS, SPA & BAR**
RANALI ISLAND - REFURBISHMENT

CODE	
DWG NO	**A2. ARC/100**
SCALE	1:1000 (A2)
DATE	03.09.2007
DRAWN	Chamara

20 Annex: Architectural drawings of water bungalows



SECTION 2-2

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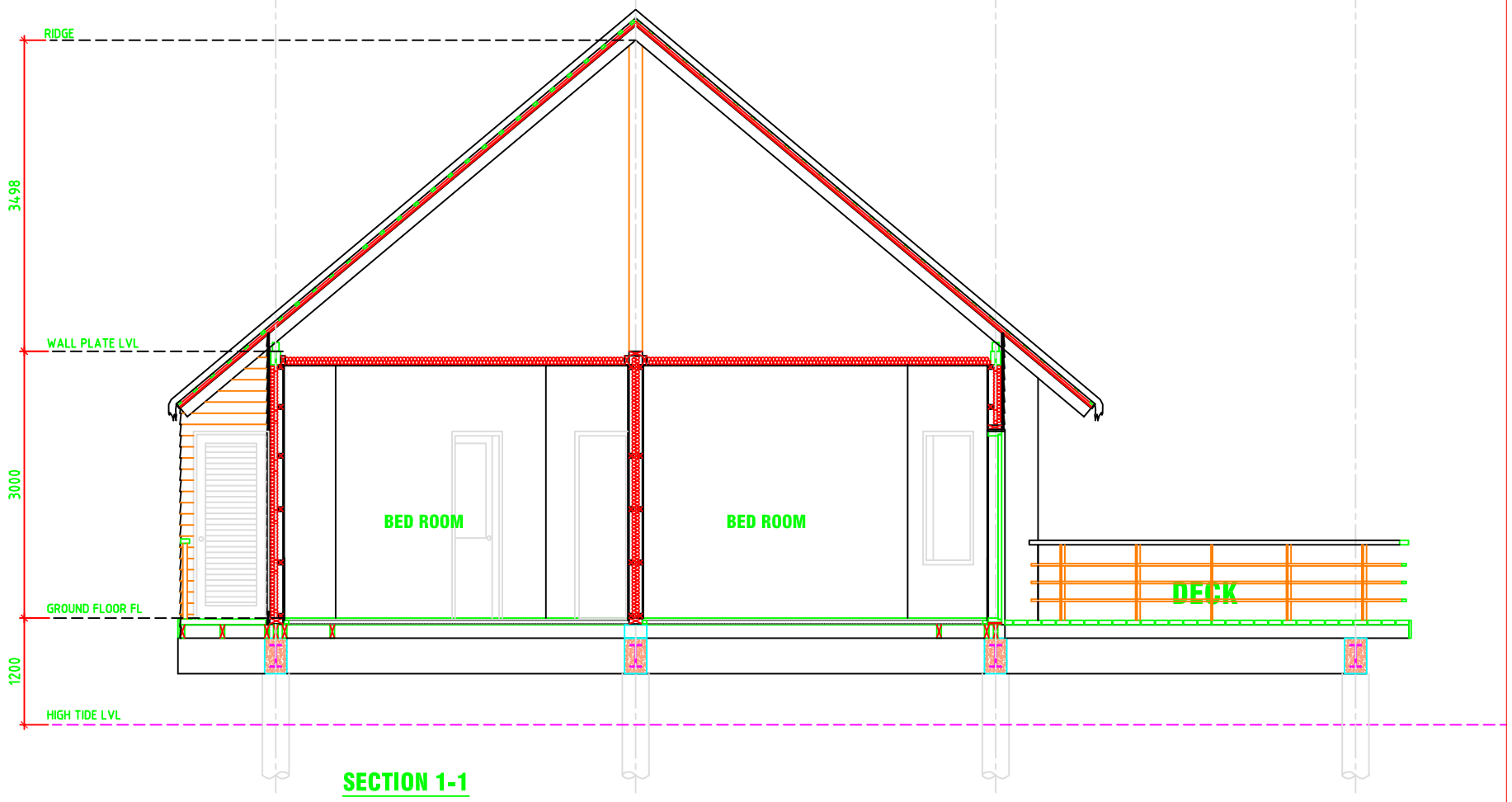

SECTION 1-1

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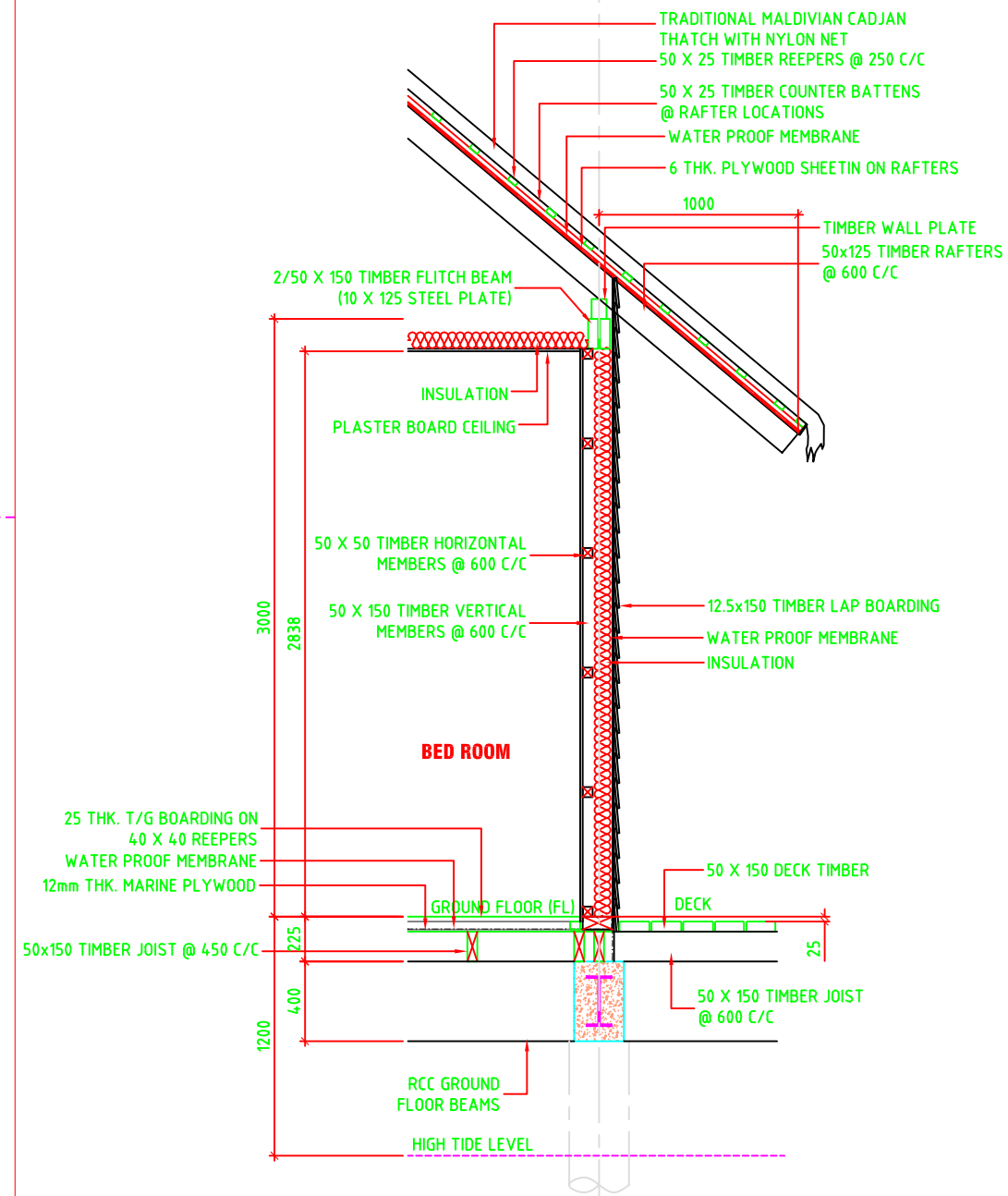


TYPICAL DETAIL SECTION

SCALE : 1:25

STANDARD WATER BUNGALOWS

REV	DESCRIPTION	DATE

SW plus
CHARTERED ARCHITECTS
NO: 23, GUNESEKERE GARDENS, NAWALA, SRI LANKA
Tel: 0094 11 5523559, Fax: 0094 11 5523358

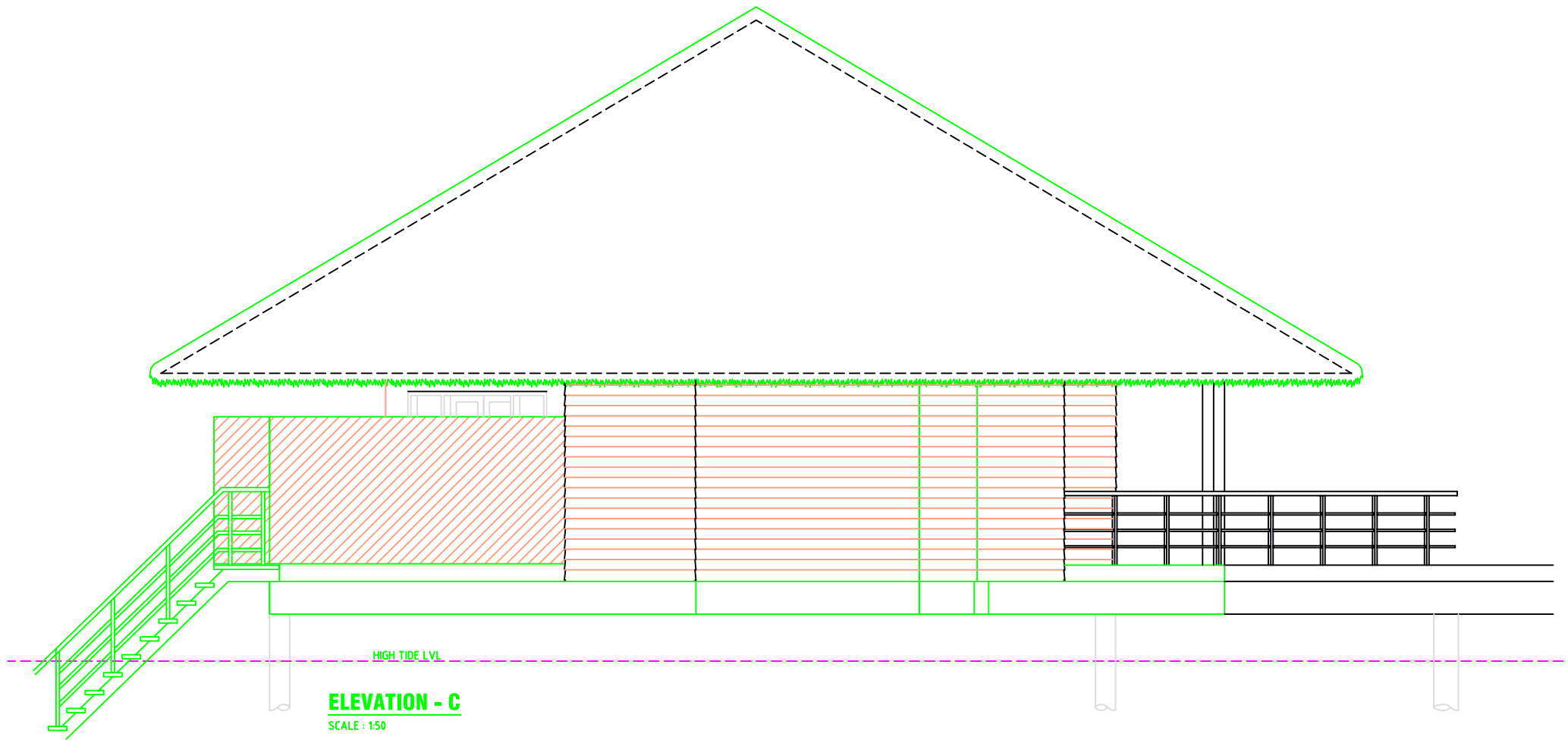
abel
design
1st floor, dhunfini villa
galolhu, neelofaru magu,male' maldives
phone: +960326007, fax: +960326008
email: abel@abel.com.mv
www.abel.com.mv

MAIN CONSULTANT
MANO PONNIAH & ASSOCIATES (Pvt) Ltd
CHARTERED ARCHITECTS & ENGINEERS
NO: 10, FLOWER TERRACE, COLOMBO 7, SRI LANKA
Tel: 0094 11 2573221, Fax: 0094 11 2467604
Email: manopon@slt.lk

DRAWING TITLE: **SECTIONS**

PROJECT TITLE: **PROPOSED WATER BUNGALOWS, SPA & BAR RANALI ISLAND - REFURBISHMENT**

CODE	WDAR
DWG NO	A2. ARC/302
SCALE	1 : 50
DATE	09.09.2007
DRAWN	Chamara



ELEVATION - C

SCALE : 1:50

STANDARD WATER BUNGALOWS

REV	DESCRIPTION	DATE

SW plus
CHARTERED ARCHITECTS
NO: 23, GUNESEKERE GARDENS, NAWALA, SRI LANKA
Tel: 0094 11 5523559, Fax: 0094 11 5523358

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

MAIN CONSULTANT
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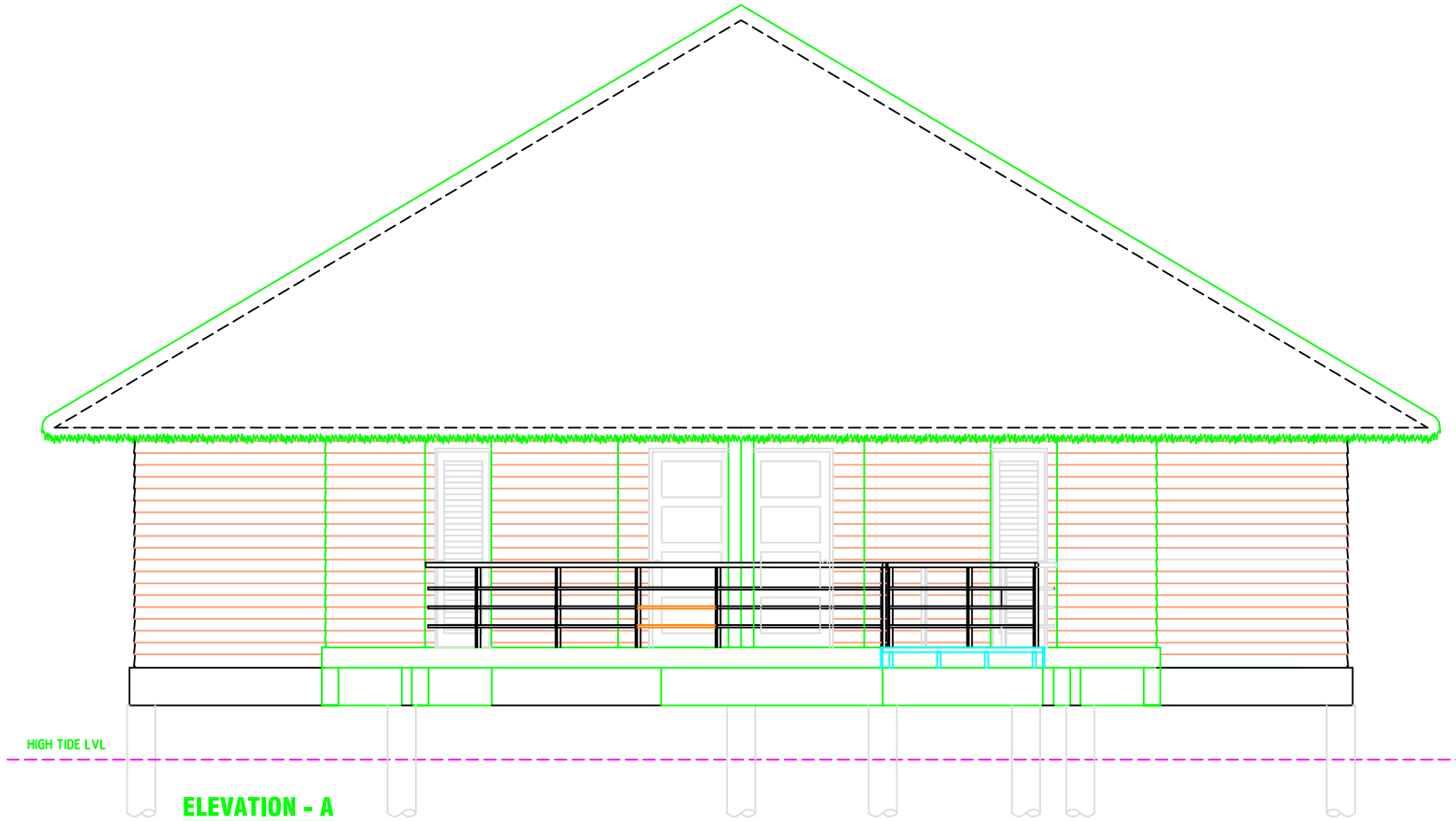
CHARTERED ARCHITECTS & ENGINEERS
NO: 10, FLOWER TERRACE, COLOMBO 7, SRI LANKA
Tel: 0094 11 2573221, Fax: 0094 11 2467604
Email: manopon@slt.lk

DRAWING TITLE:
ELEVATION - C

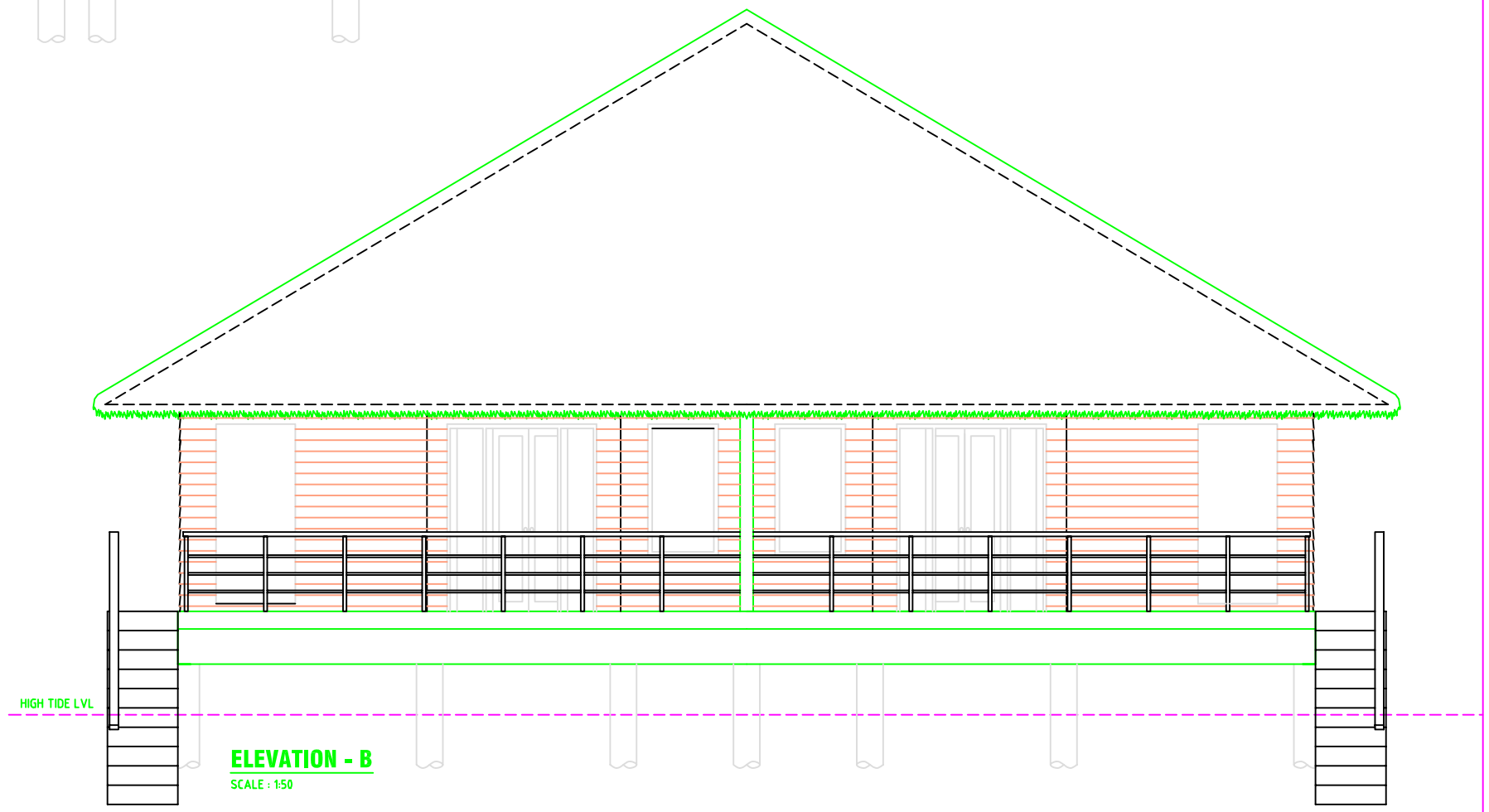
PROJECT TITLE:
PROPOSED WATER BUNGALOWS, SPA & BAR
RANALI ISLAND - REFURBISHMENT

CODE	**WDAR**
DWG NO	**A2. ARC/304**
SCALE	1 : 50
DATE	09.09.2007
DRAWN	Chamara



ELEVATION - A

SCALE : 1:50



ELEVATION - B

SCALE : 1:50

STANDARD WATER BUNGALOWS

REV	DESCRIPTION	DATE

SW plus
CHARTERED ARCHITECTS
NO: 23, GUNESEKERE GARDENS, NAWALA, SRI LANKA
Tel: 0094 11 5523559, Fax: 0094 11 5523358

abel
design
1st floor, dhunfini villa
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Tel: 0094 11 2573221, Fax: 0094 11 2467604
Email: manopon@slt.lk

DRAWING TITLE:
ELEVATION A & B

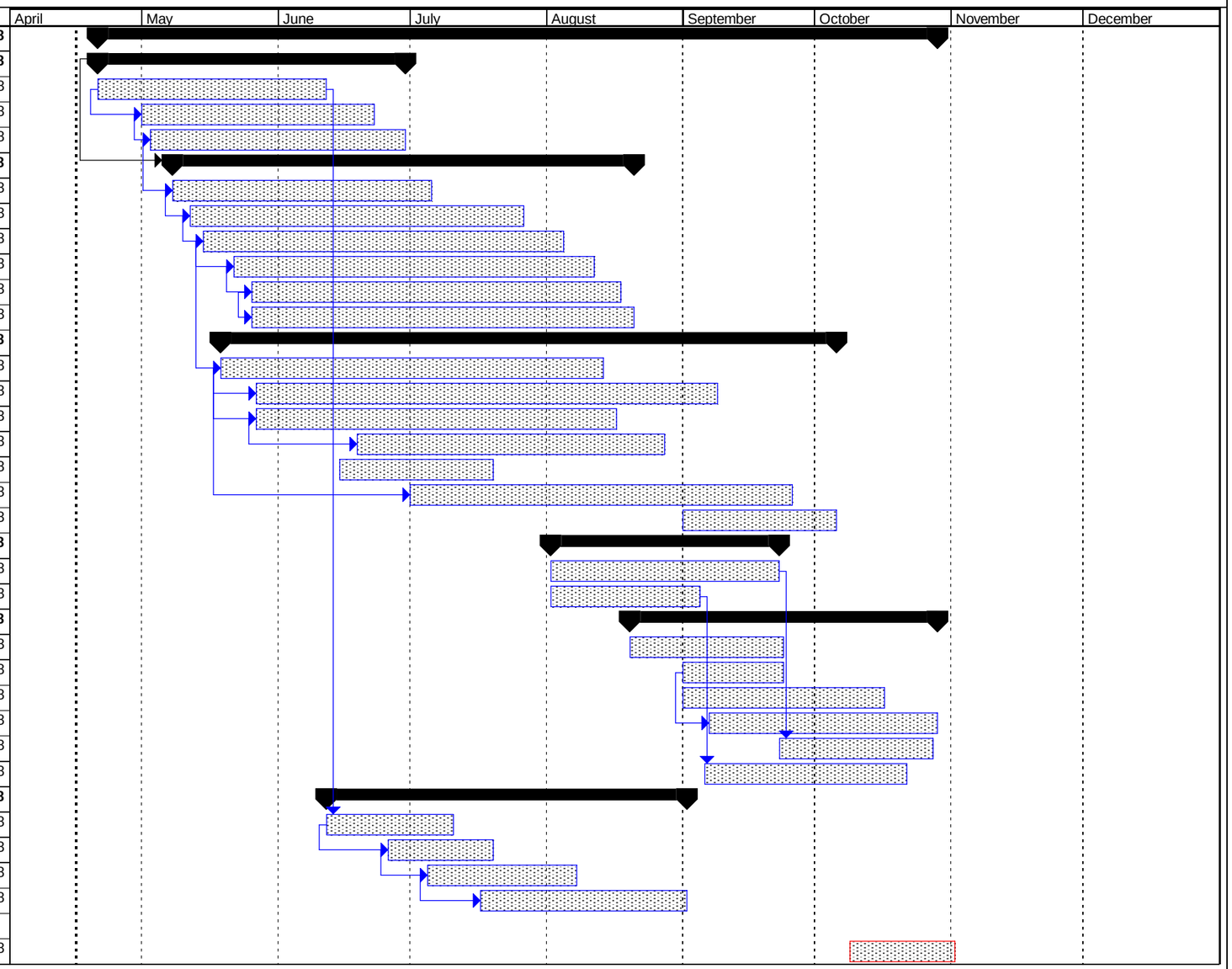
PROJECT TITLE:
PROPOSED WATER BUNGALOWS, SPA & BAR
RANALI ISLAND - REFURBISHMENT

CODE	**WDAR**
DWG NO	**A2. ARC/303**
SCALE	1 : 50
DATE	09.09.2007
DRAWN	Chamara

21 Annex: Construction Schedule

WORK SCHEDULE FOR CONSTRUCTION OF PROPOSED WATER BUNGALOWS AT RANALHI ISLAND – REPUBLIC OF MALDIVES

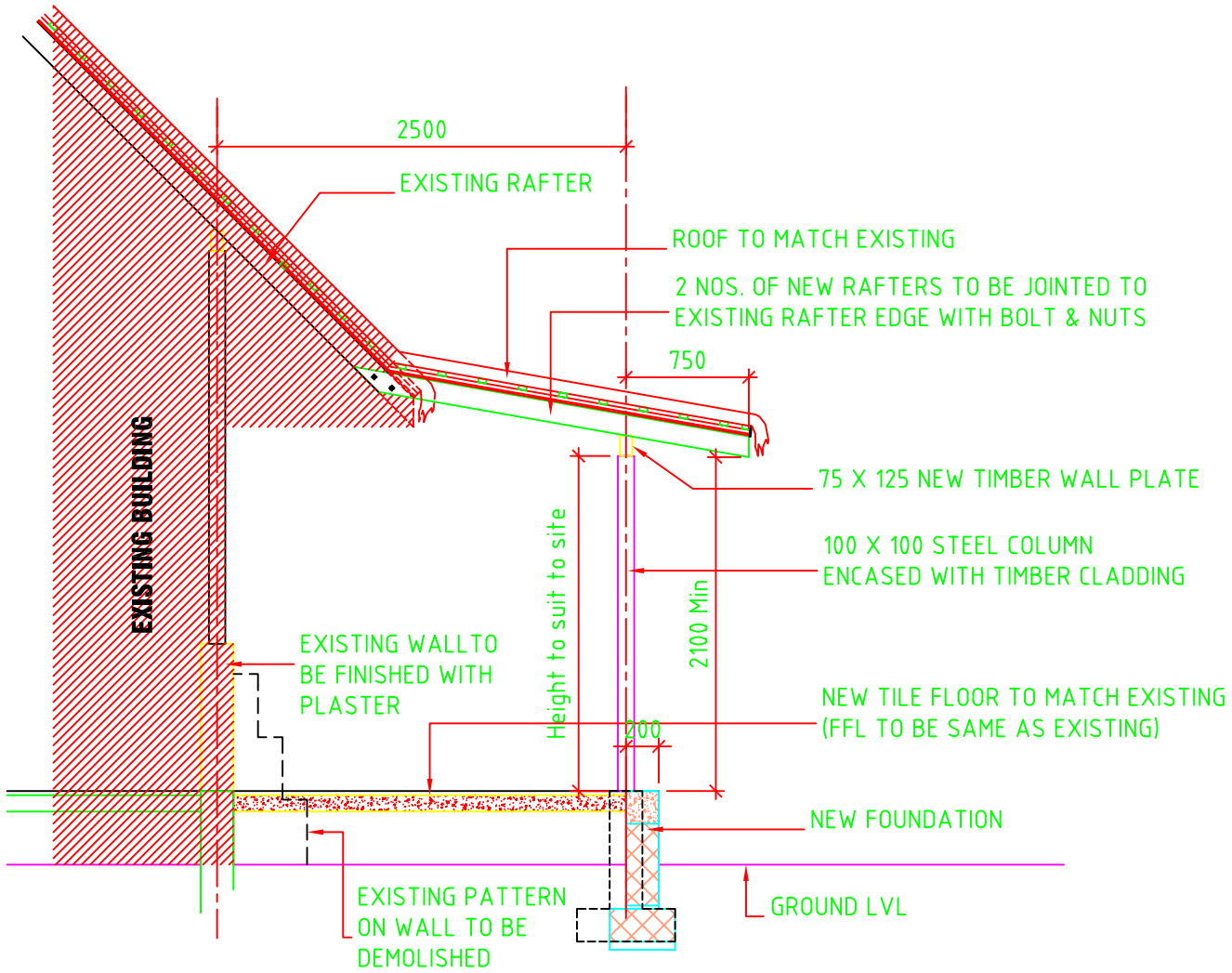
ID	Task Name	Duration	Start	Finish
1	**Water Bungalows**	**164 days**	**Mon 4/21/08**	**Tue 10/28/08**
2	**Piling Foundation**	**60 days**	**Mon 4/21/08**	**Sun 6/29/08**
3	Pile Driving and placing of column base	45 days	Mon 4/21/08	Wed 6/11/08
4	Pile Column shuttering	45 days	Thu 5/1/08	Sun 6/22/08
5	Pile Column concreting	50 days	Sat 5/3/08	Sun 6/29/08
6	**Sub structure welding and concreting**	**90 days**	**Thu 5/8/08**	**Wed 8/20/08**
7	Platform frame work and H beam welding	50 days	Thu 5/8/08	Sat 7/5/08
8	Bar bending and shuttering of beams & slab	65 days	Mon 5/12/08	Sat 7/26/08
9	Beam & slab concreting	70 days	Thu 5/15/08	Mon 8/4/08
10	Fabrication and fixing of Floor joist	70 days	Thu 5/22/08	Mon 8/11/08
11	Fixing of Marine plywood	72 days	Mon 5/26/08	Sun 8/17/08
12	Timber planks for sundeck	75 days	Mon 5/26/08	Wed 8/20/08
13	**Super structure**	**120 days**	**Mon 5/19/08**	**Sun 10/5/08**
14	Welding of columns and roof beams	75 days	Mon 5/19/08	Wed 8/13/08
15	Roof carpentry work	90 days	Tue 5/27/08	Mon 9/8/08
16	Bungalow peripheral block work	70 days	Tue 5/27/08	Sat 8/16/08
17	Plastering of wall	60 days	Thu 6/19/08	Wed 8/27/08
18	Hand rails fixing and stairs	30 days	Sun 6/15/08	Sat 7/19/08
19	Fall ceiling work	75 days	Tue 7/1/08	Thu 9/25/08
20	Fixing door and window	30 days	Mon 9/1/08	Sun 10/5/08
21	**Services**	**45 days**	**Sat 8/2/08**	**Mon 9/22/08**
22	Plumping	45 days	Sat 8/2/08	Mon 9/22/08
23	Electrical work-wiring	30 days	Sat 8/2/08	Thu 9/4/08
24	**Finishing**	**60 days**	**Wed 8/20/08**	**Tue 10/28/08**
25	Floor reapers and T/G boarding	30 days	Wed 8/20/08	Tue 9/23/08
26	Block work finished with wall putty	20 days	Mon 9/1/08	Tue 9/23/08
27	Toilet finishing and tiling	40 days	Mon 9/1/08	Thu 10/16/08
28	Painting	45 days	Sun 9/7/08	Tue 10/28/08
29	Toilet fittings	30 days	Tue 9/23/08	Mon 10/27/08
30	Electrical work-fittings	40 days	Sat 9/6/08	Tue 10/21/08
31	**Walk way**	**70 days**	**Thu 6/12/08**	**Mon 9/1/08**
32	Piling of Walk way	25 days	Thu 6/12/08	Thu 7/10/08
33	Footing base concreting	20 days	Thu 6/26/08	Sat 7/19/08
34	Walk way Substructure welding and concreting	30 days	Sat 7/5/08	Thu 8/7/08
35	Fixing of Timber	40 days	Thu 7/17/08	Mon 9/1/08
36				
37	Testing and handing over	20 days	Thu 10/9/08	Sat 11/1/08



Project: Work schedule
Date: Wed 4/16/08

Task
Critical Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Critical Task
Rolled Up Milestone
Rolled Up Progress
Split
External Tasks
Project Summary
Group By Summary
Deadline

22 Annex: Restaurant roof extension plan



TYPICAL SECTION

23 Annex: Commitment letter from the proponent to undertake monitoring

DIRECTORS:
J.M.S. Brito (Chairman)
K.A.A.C. Perera (Managing)
H. Mohamed
M. Mahdy

JETAN TRAVEL SERVICES COMPANY PRIVATE LIMITED.

#7-A, STO Aifaanu Building, Boduthakurufaanu Magu, Malè, Republic of Maldives.
Tel: (960) 332 3323, 331 5238 Fax: (960) 331 5237
E-mail: gm@adaaran.com.mv

C-252/97

Saturday, April 19, 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 refurbishment of Adaaran Club Rannalhi

Adaaran Club Rannalhi on Rannalhi Island has been proposed for refurbishment in 2008. An EIA has been undertaken to obtain the required permit to undertake the works. Protection of the environment is one of our key policy and we are committed for protecting the environment.

Hence we would like to confirm our commitment to the proposed mitigation and monitoring programe that has been outlined in the EIA report which has been specifically prepared for the proposed refurbishment works.

Thanking you

Yours Sincerely

Mohamed Mahdy
General Manager - Administration

24 Annex: Names and Registration Certificate numbers of the EIA consultants

Abdul Aleem – EIA Registration no: EIA09/07

Ahmed Zahid – EIA Registration no: EIA08/07

Hassan Shah - – EIA Registration no: EIAT02/07