ENVIRONMENTAL IMPACT ASSESSMENT

FIRST ADDENDUM

For the Resort Development Project on Randheli Island, Noonu Atoll

Proposed by

I & T Management Pvt. Ltd.

Prepared by

CDE Consulting

July 2010

Contents

Table of Figures

Table of Tables

1 Introduction

The purpose of this document is to assess the potential environmental impacts and mitigation measures for the proposed changes to the resort development concept plan of Randheli. This document has been produced with reference to the original Environmental Impact Assessment (EIA) of the proposed resort (2004) and subsequent monitoring data.

Randheli Island is one of the islands earmarked for tourism development by the government in 2004. The previous developer, Cyprea Pvt Ltd acquired the rights to lease and develop the tourist resort in a public bid. The current developer, I & T Management acquired the rights from Cyprea Pvt Ltd in 2009 under a private agreement.

The primary rationale for the proposed alterations is to address the perceived shortcomings of the initial development concept in accordance with the vision of the new developers, so as to provide an improved tourism product.

This report covers the changes proposed for the concept, current status of the existing environment, potential negative and positive impacts of the proposed changes, potential mitigation measures required to minimize or manage these impacts and changes to the monitoring program.

The baseline conditions of the island are largely based on data obtained from monitoring activities undertaken from 2002 onwards and the original EIA document completed in 2004.

The main alterations proposed to the development concept include changes to the layout of the back-of-house structures and changes to the location of the Dive Center and Specialty Restaurant.

Only additional impacts on the environment that may result from the proposed changes to the original development concept have been discussed. Social impacts are not considered in this assessment as the general impacts of resort development have been addressed in the initial EIA.

This report is produced in accordance to the technical guidelines and EIA regulations prepared by the Environment Protection Authority.

The Terms of Reference (ToR) for this project was issued after scoping meeting held at Environment Protection Agency (EPA) on 23 June 2010. The ToR is attached in Appendix A.

2 Description of Proposed Alterations

2.1 Major Components

The proposed alterations to the project include changes to the layout of back-of-house structures and relocation of the Dive Center and Specialty Restaurant. A detailed site plan with the proposed changes is presented in Appendix B. The site plan for the previous proposal is presented in Appendix C. This section summarizes the proposed changes.

2.1.1 Back-of-House Structures

The layout of the back-of-house structures has been completely changed. However, the general location of the back-of-house structures (in the center of the island) and the total area covered by the structures will remain more-or-less the same. The proposed new layout of the back-of-the-house area is presented in Appendix B and Figure 2.1 below. The previously proposed layout is presented in Appendix C.

Figure 2.1: Site Layout of the Back-of-the-House Area

The following figures show the designs for the revised components of the Back-of-House Structures:

- Administration/ HR/ Housekeeping Departments

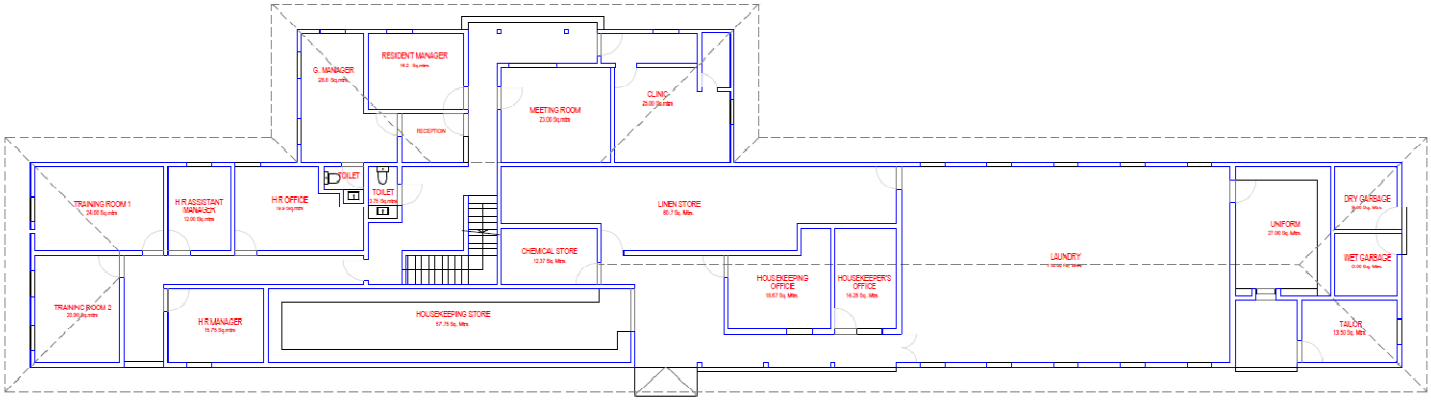

Figure 2.2: Administration/ HR/ Housekeeping Block- Ground floor

- Staff Accommodation

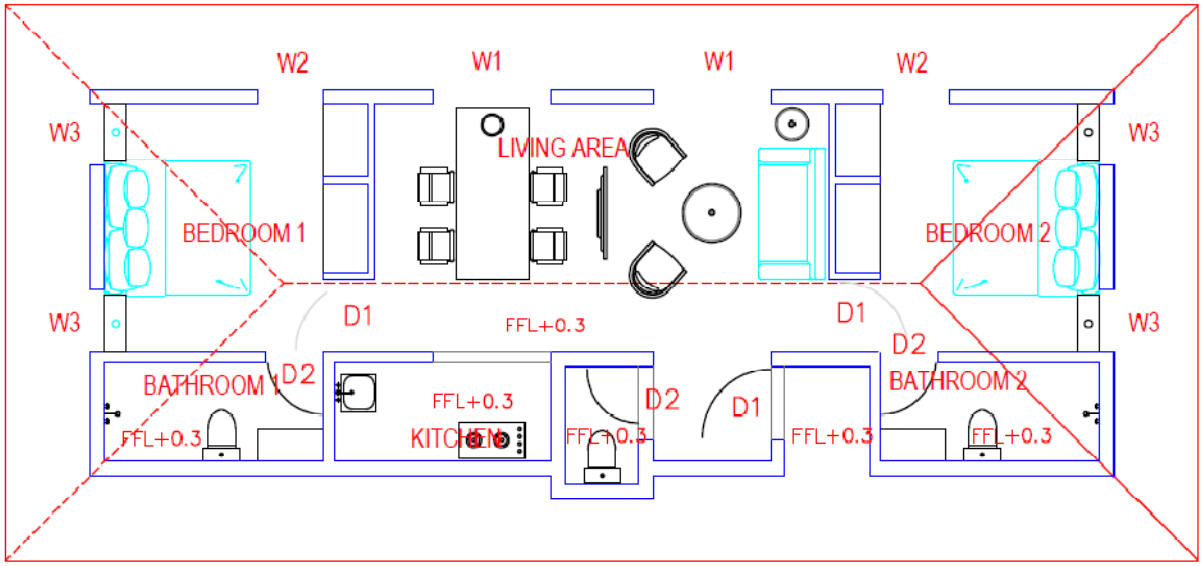

Figure 2.3: Senior Staff Housing, Type 1

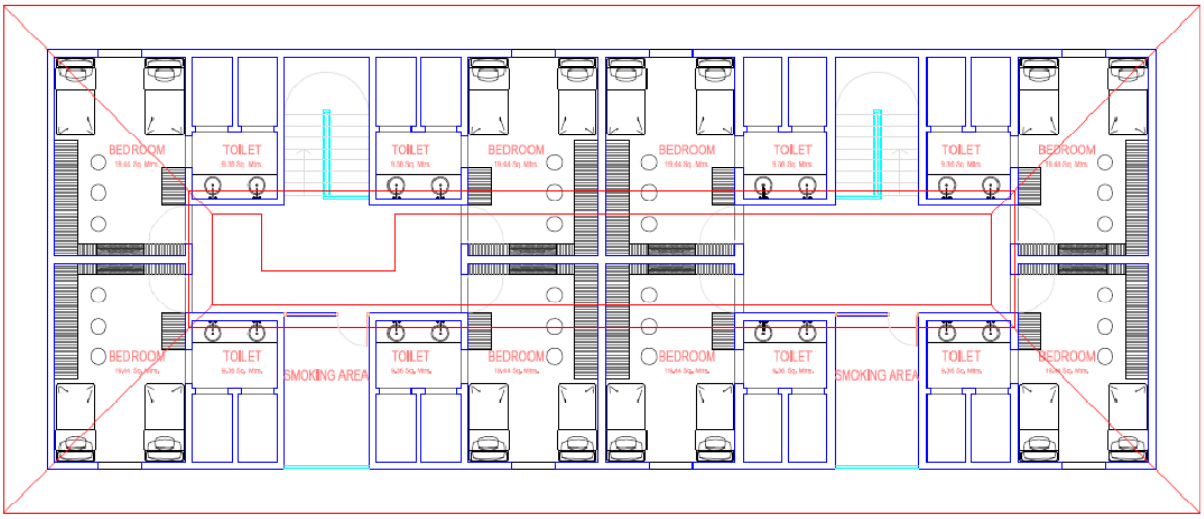

Figure 2.4: Staff Accommodation- Ground floor

- Pool and Bar

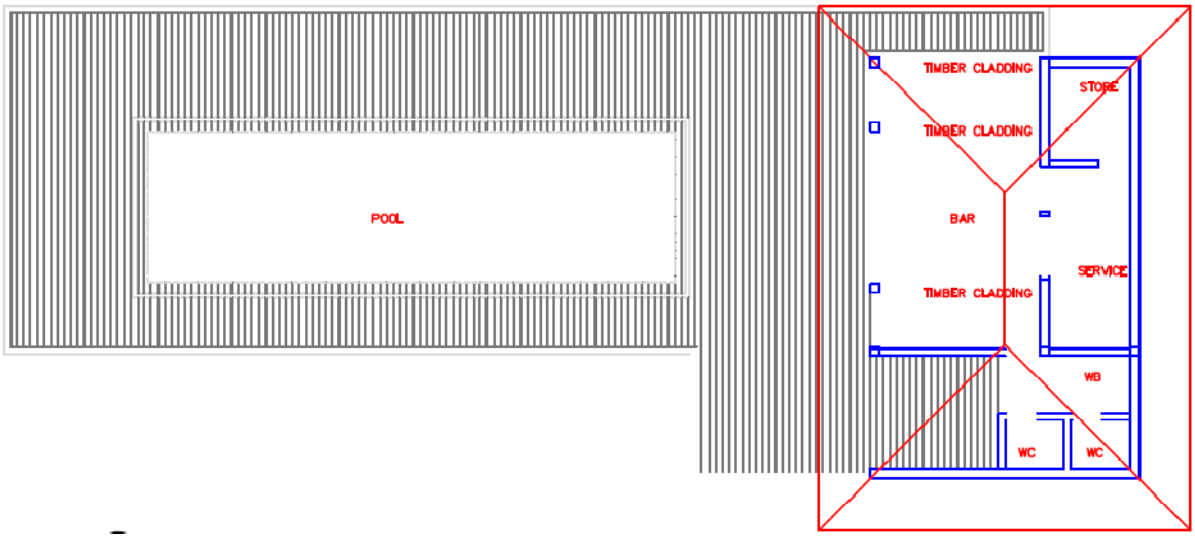

Figure 2.5: Pool and Bar

- Incinerator House

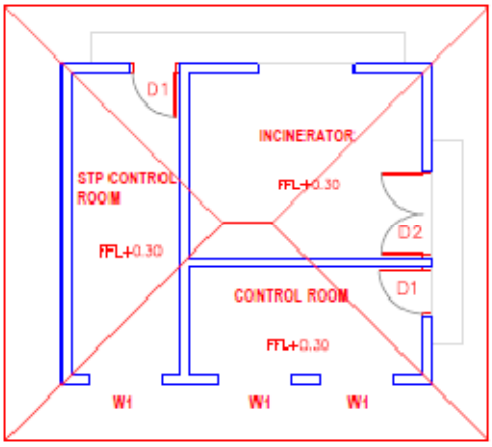

Figure 2.6: Incinerator house

- Power House

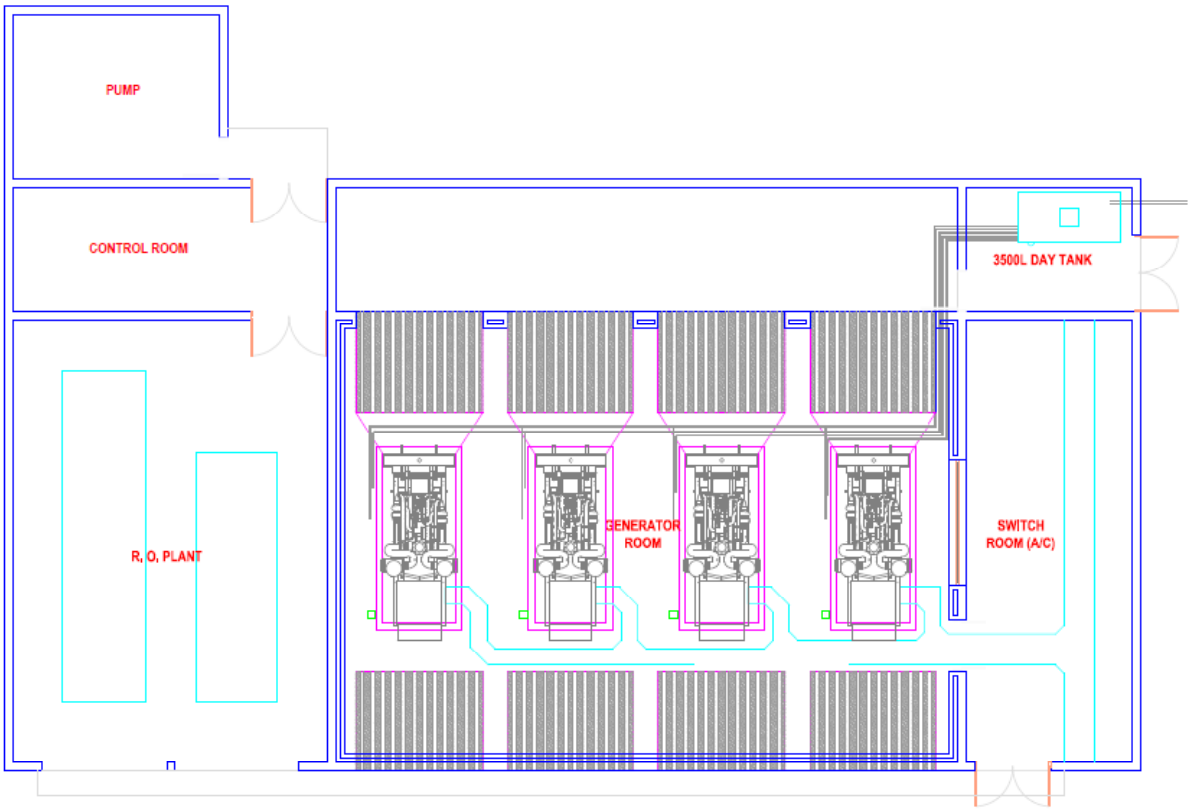

Figure 2.7: Generator Room and R.O Plant

- Kitchen Store and Staff Facilities

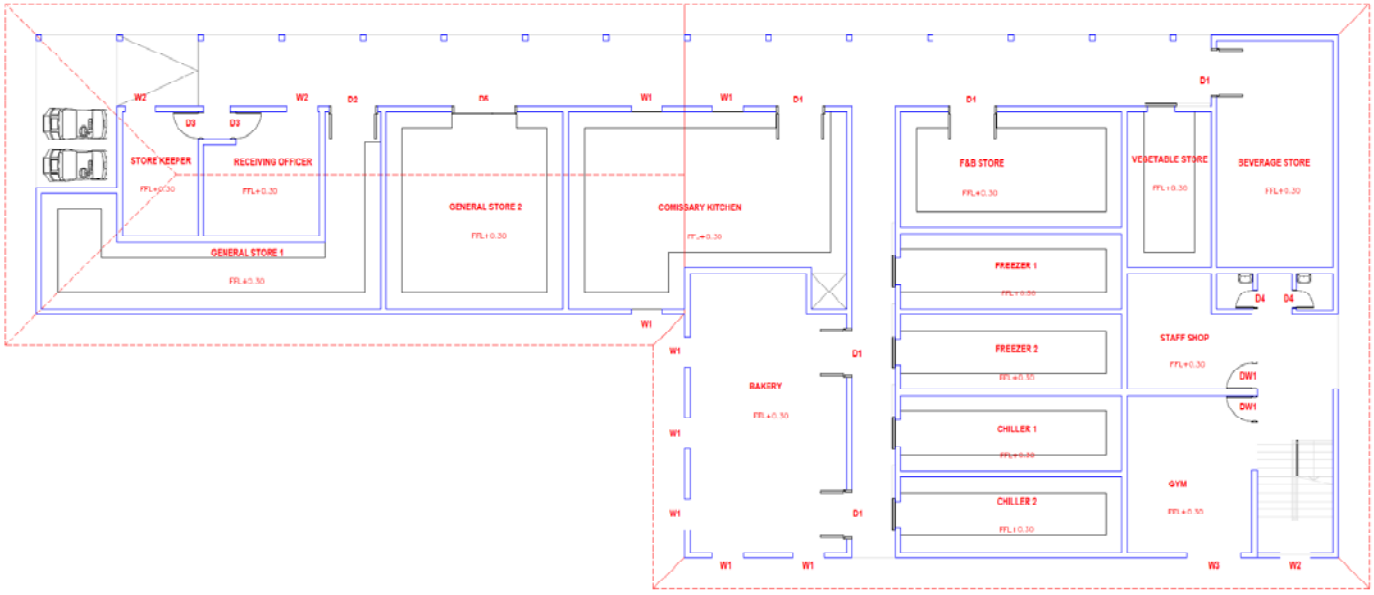

Figure 2.8: Kitchen stores and Staff Facilities- Ground Floor

- Engineering Department

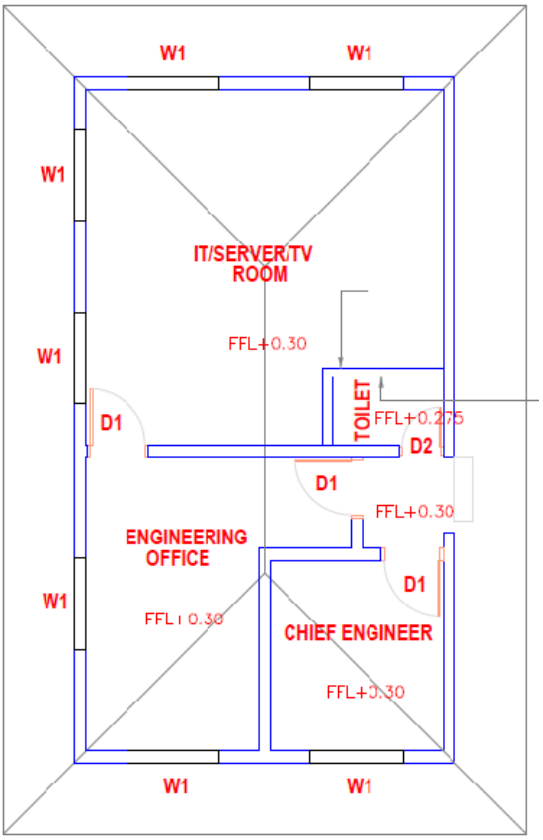

Figure 2.9: Engineers' Office Block

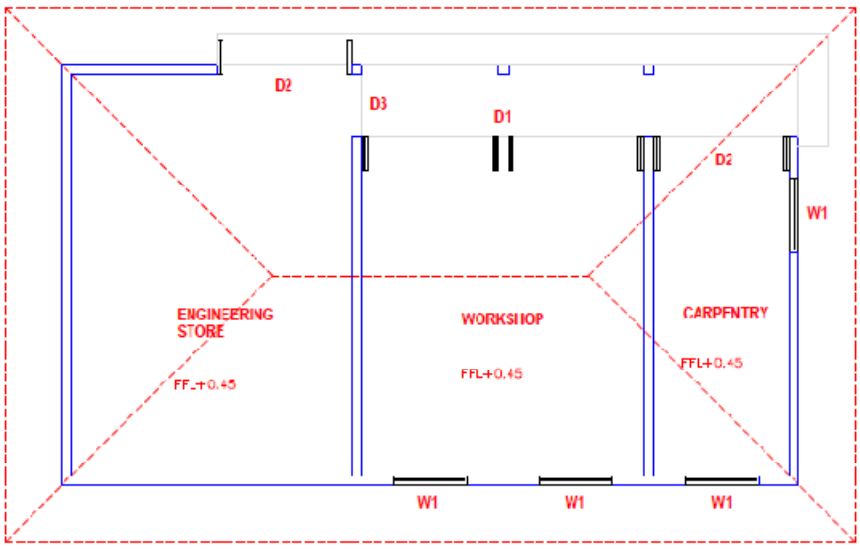

Figure 2.10: Engineering Workshops

2.1.2 Dive Center and Specialty Restaurant

The Dive Center was previously proposed to be located on land, while the Specialty Restaurant was to be an over-water structure. The current proposal is to exchange the locations of these two structures. The Dive Center is now proposed to be built as an over-water structure, in place of the Specialty Restaurant, in order to provide better access to dive facilities. The Specialty Restaurant is proposed to be a relocated to the previously proposed location of the Dive Center, on the beach (see Appendix B and Figure 2.2 – 2.3). The total impact footprint of these structures is still expected to be the same as the previous proposal.

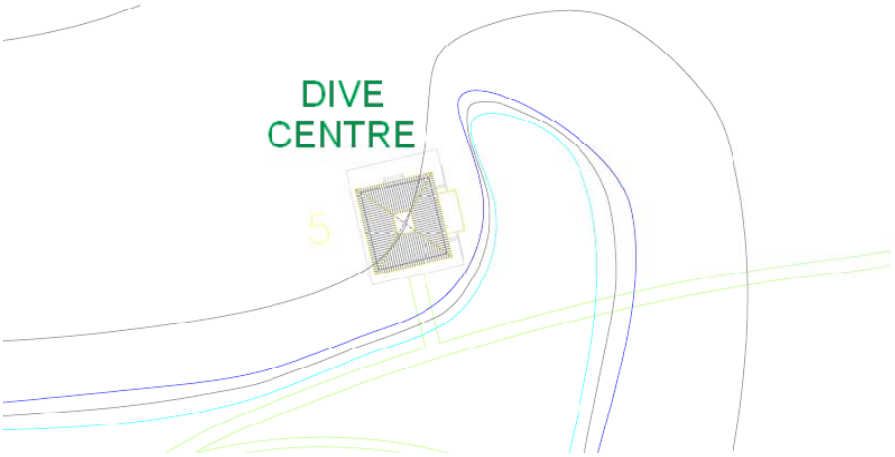

Figure 2.11: Proposed Location of the Dive Centre

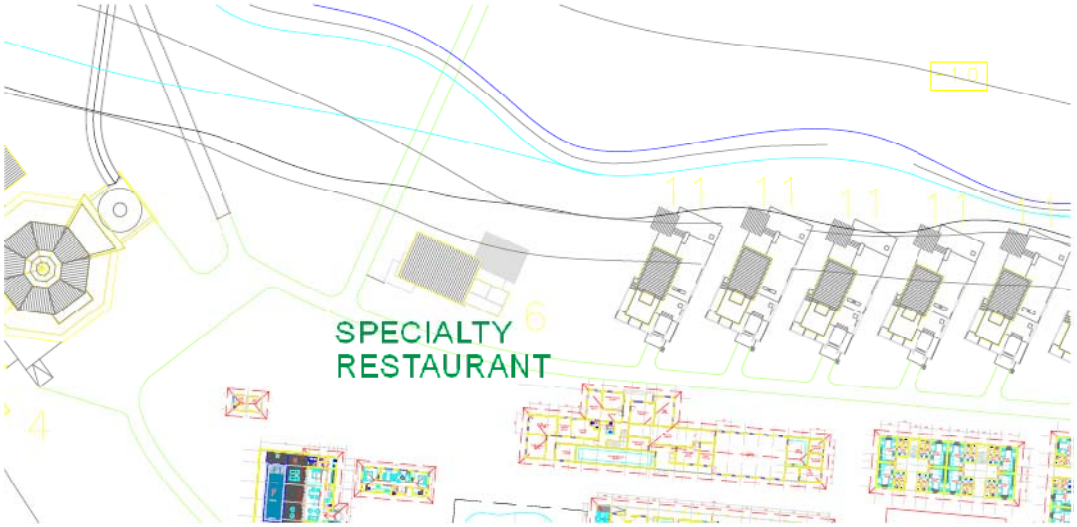

Figure 2.12: Proposed Location of the Specialty Restaurant

2.2 Construction Phase Activities

Construction phase activities such as site clearance, equipment mobilisation, construction waste management and disposal, pollution control, health and safety measures and fire prevention measures will be undertaken as described in the original EIA report, *Section 2.10*. The number of workers and workforce-related infrastructure and services will also be as described in the original report.

2.3 Operational Phase Activities

There will not be any changes to the operational phase activities discussed in the initial EIA report in *Section 2.12*.

2.4 Work Methodology

Work methodology of all components will be undertaken using the construction methods outlined in the initial EIA.

2.5 Project Inputs and Outputs

The types of materials that will go into the development of the resort, methods for obtaining these materials, and the types and amounts of products and waste materials expected to be produced were identified in *Section 2.14* of the original EIA. No changes to the identified inputs and outputs are expected.

3 Existing Environment

3.1 Introduction

This section provides an update on the status of the existing environment at Randheli Island. The aspects of the existing environment described here include:

- *The beach environment*- Historical changes to coastal geomorphology, composition of beach sediments, beach profiles, seasonal changes to coastal geomorphology, and patterns of coastal erosion.
- *The marine environment*- General characteristics of the reef, ecological zonation and changes over time
- *The terrestrial environment*- General characteristics of flora and fauna, and changes to the vegetation cover

3.2 Methodology

The monitoring data obtained between 2002 and 2009, and the data collected for the original EIA in 2007 were used for this assessment.

Methods for beach monitoring include beach profile measurement at 50 m intervals, lagoon currents, high accuracy GPS surveys of vegetation line, low tide line and high tide line, and pictorial monitoring.

Manta tows, Reef line transect surveys, photo quadrats and marine water quality measurement were used to determine the marine environmental conditions.

Broad-scale and temporal assessments of the reef and beach system were done using remote sensing technology (satellite images and aerial photographs).

Vegetation of the island was assessed using remote sensing techniques complemented by ground truthing using GPS.

3.3 Background

3.3.1 Geographic setting

1. Randheli Island located in the southern half of Noonu Atoll at approximately 73° 20' 24" E and 5° 41' 30" N. Randheli is part of the largest atoll in Maldives - Thiladhunmathi Atoll - which spans over 4 administrative atolls. The island is located approximately 170 km from the nation's capital Male' and about 168 km from the nearest airport. It's nearest inhabited islands are Velidhoo (8 km), and Holhudhoo (11 km) Magoodhoo (10 Km) and Atoll Capital Manadhoo (11 km). A location map of the island is presented in Figure 3.1.

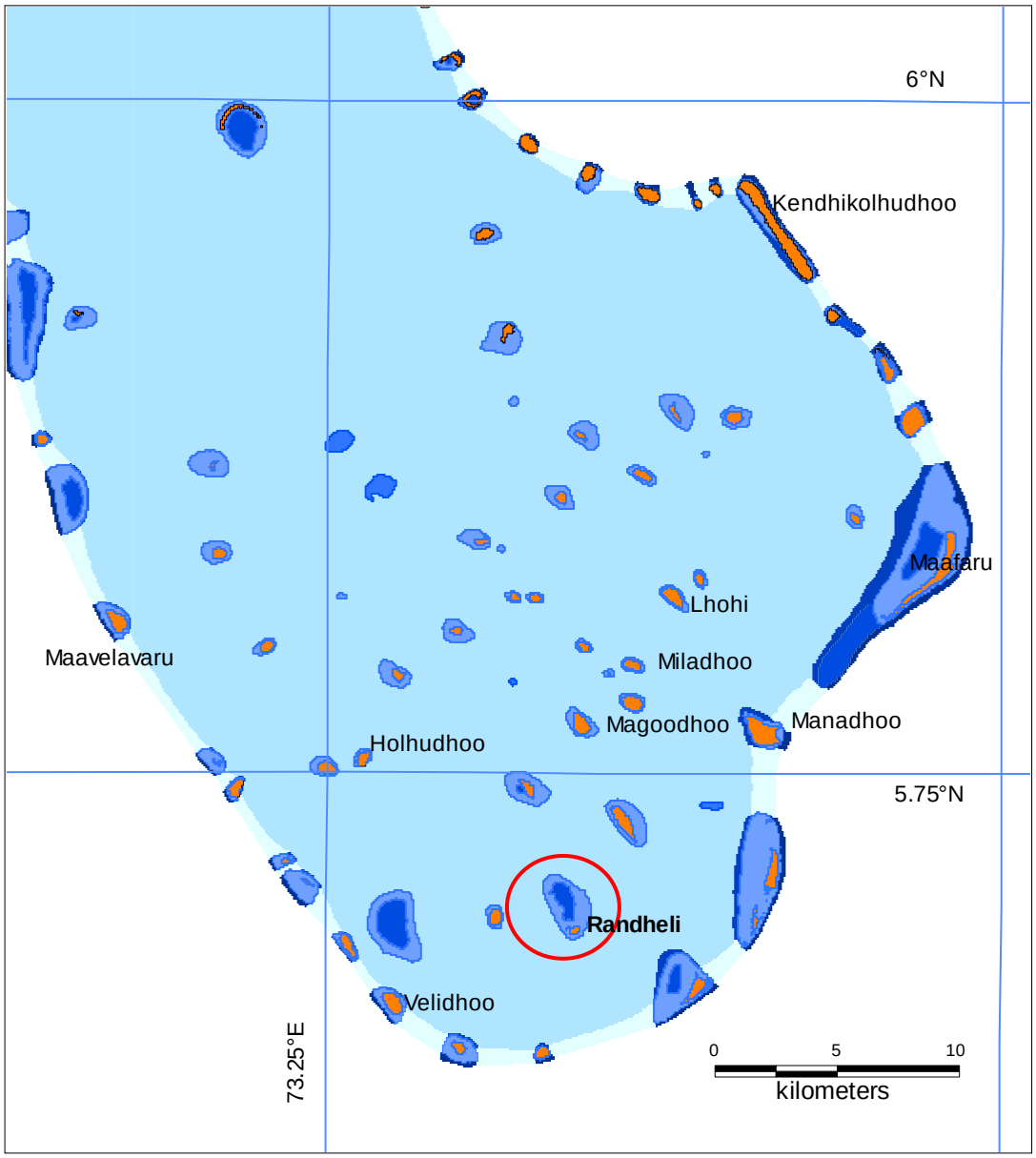

Figure 3.1: Location map of Randheli

3.3.2 Geological Setting

1. Randheli is a fairly small island with a length of 400m and a width of 250 m at its widest point. The total surface area of the island is 9.3 Ha (0.09 km^2) of which only 6.0 (Ha) are vegetated. Much of the beach area is highly mobile and therefore should not be considered permanent land.
2. Randheli should be considered a relatively young island and appears to be constantly shifting its position on the reef system. Over the last 40 years, it has shifted over 100 m southward and has lost 3.3 hectares of vegetated land. It has also gained over 2.9 hectares due to accretion. Randheli Island has to be treated as having a highly volatile beach environment. The seasonal shift in beach is very significant, more so than an average island in the Maldives. In general, the islands inside Noonu Atoll (as opposed to the Atoll rim) are considered as some of the most mobile islands in the Maldives.
3. The influence of Indian Ocean oceanographic and climatic factors on the geologic setting and environment is likely to be less pronounced in Randheli than the islands on the eastern rim of the atoll. Being located inside the atoll lagoon, the environmental forcing is mainly dominated by monsoonal currents.

3.3.3 Marine environment setting

1. The reef of Randheli, with a surface area of 346 Ha (3.46 km^2), is one of the largest reef systems located inside the atoll lagoon of Thiladhunmathi Atoll (see figure 3.1). However, it is still considered a small system compared to similar reef systems around the rest of the country. The reef is characterised by a deep lagoon approximately 94 ha large and -21m deep. Apart from a natural reef entrance on the western side, the depth of the reef flat is shallow averaging less than -2m MSL.
2. Randheli is located at the southern tip of the reef system, approximately 235m from the reef edge. However, the sand spit on the western end during NE monsoon comes to within a few meters of the reef edge. The island is low lying with an average elevation of +1.3m MSL.
3. The marine environment on the outer reef edges and reef flat are generally poor but there are patches of reefs within the deep reef lagoon with substantial live coral cover and fish population.
4. There are no good snorkelling locations in close proximity to the island. Much of the surrounding lagoon areas have undergone significant sedimentation hindering coral diversity and growth. Patches of new coral cover is emerging on the western reef and there is one good spot towards the centre of the western reef slope.

5. The small patches within the reef lagoon are mostly in good condition but those closest ot he island has undergone significant sedimentation.

3.4 Status of the Beach Environment

3.4.1 Changes to beach line over time

Analysing beach changes over time provides an invaluable insight into the geomophological behaviour of the island. Historical aerial photographs from 1969 and 2004, along with satellite imagery from 2002, 2007 and 2008 have been used in this analysis. In addition, high accuracy GPS surveys of the beach and vegetation line undertaken during field surveys in 2007 and 2009 have been used to compile a comprehensive picture of historical changes. The next two sections will summarise the changes between 1969 and 2002 and between 2002 and 2009.

1969 to 2002

Figure 3.2 below summarises the changes to Randheli coastline between 1969 and 2002.

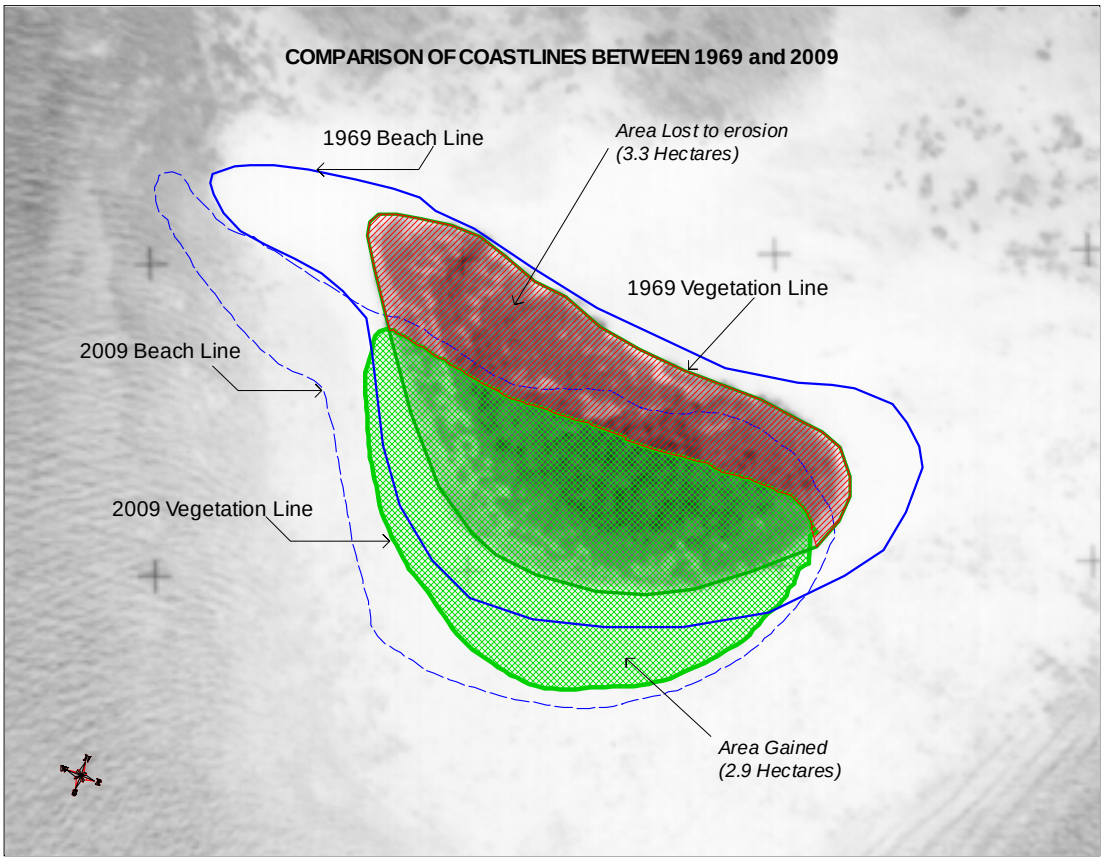

Figure 3.2: Changes to Randheli beach line between 1969 and 2002

1. The shifts in the coastline have been substantial, perhaps, amongst the largest shifts ever recorded amongst the island of Maldives in a 40 year time frame.
2. The shift has generally been southward. Approximately 3.3 Ha of vegetated land has been lost to erosion. Field evidence of this occurrence has been found in the vegetation system, lagoon sediments and from a tomb stone found in the lagoon.
3. The erosion has also been followed by significant accretion (approximately 2.9 Ha). This new land has now stabilised and has a moderately established vegetation system.
4. The total vegetated area of Randheli in 1969 and 2009 are estimated at 6.8 ha and 6.4 Ha. The area within the beach line in 1969 and 2007 are estimated at 10.8 Ha and 10.1 Ha. These figures indicate that despite the significant movement of the island, the net loss of beach material has been insignificant over the last 40 years.
5. The significant change in coastline is most likely to have been associated with changes to the prevailing oceanographic and climatic conditions
6. Smaller islands are generally more exposed to these trends as they are morphologically instable than bigger islands. These trends are expected to continue into the near future and it may be a long time before the island achieves any sort of stability in its coastline. The islands inside Noonu Atoll (as opposed to those on the reef rim) are known to be more mobile.

2002 to 2009

1. The general trend over this period has been: i) erosion in the north and northeast and; ii) accretion in the south (see Figure 3.3 below).
2. **2002 and 2004**: There was significant erosion on the northern side and accretion on the southeast corner.
3. **2004 and 2007**: There was a general shift in the island towards Southwest. Increase erosion was evident along the north and northwestern shoreline. The areas accreted between 2002 and 2004 were stabilised with new (pioneer) vegetation.
4. **2007 and 2009**: The southward shift of the island over the last 7 years appears to be stabilising. There was no observed new land or pioneer vegetation on the southern side. Instead, new growth is evident on the northern side, where 0.5 ha of new land has been stabilising with pioneer vegetation over the last two years. It was reported by the island 'caretaker' that large sand bags were placed near the northern shoreline to stabilise erosion. It is highly likely that the present beach stabilisation has been influenced by the sand bags. It has also been reported by the caretaker, that the sandpit on the western end of the island

did not reach the reef edge during the Northeast monsoon of 2009. The growth of new beach area in the north will invariably be associated with loss of sediments from elsewhere around the island. In this case the net loss was observed from the western and north western side where new land has been forming for the last 7 years.

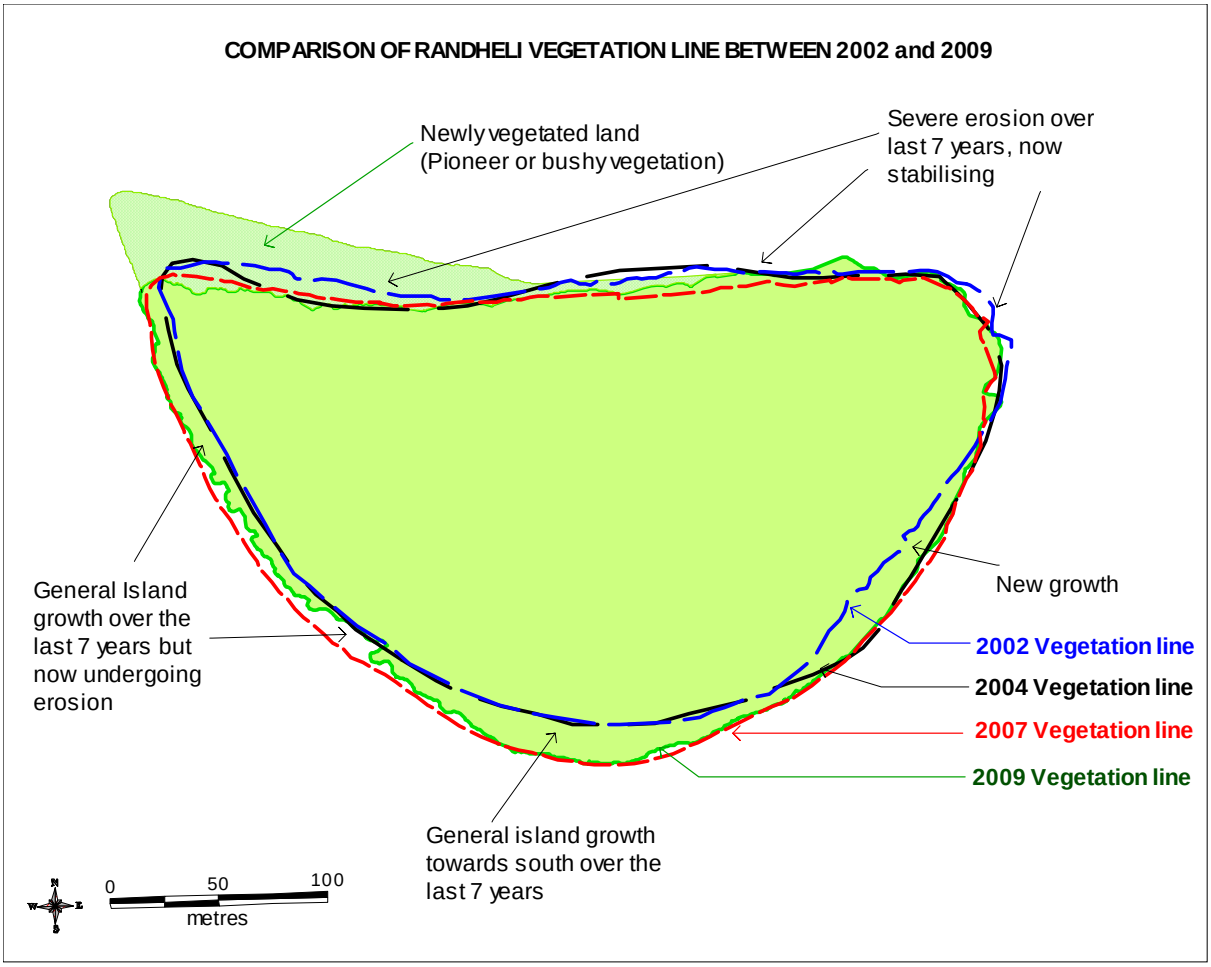

Figure 3.3: Changes to the vegetation line of Randheli between 2002 and 2009

2009 to 2010 – Predicted Beach Changes

1. Based on the changes over the last two years, it could be estimated that atleast 60% of the newly accreted beaches on the northern shoreline will be retained. The volume of sand presently in this area is too high to be moved during a single season.
2. As a consequence, the sand pit which forms on the western end of the island during NE monsoon is likely to be shorter and will have less sand.
3. Moreover, if enough sediment does not reach the western shoreline during the NE monsoon, the coming SW monsoon will cause net erosion on the western shoreline. This area may, simply, not have enough sand to be moved around and will have to 'eat' into the

existing vegetated land. Hence, erosion on the south western corner is inevitable for the next two SW monsoon seasons.

4. It is also highly likely that that erosion on the NE corner of the island will intensify during the coming NE monsoon. The extent of this change needs to be monitored before any realistic predictions could be made.

3.4.2 Beach Characteristics

Beach characteristics could be usefully determined by two main features: i) beach composition; ii) beach profiles.

3.4.2.1 Beach composition

The beach material right around the island comprise of fine sediments. This is expected due to the high mobility of the beach area. Much of the coarse material and coral rubble has been deposited in the lagoon within 100 m of the island. This area could be regarded as the island foot print.

3.4.2.2 Beach Profiles

Beach profiles were surveyed in 21 locations around the island approximately at 50 m intervals. Beach profiles provide invaluable information about the sediment volume, beach slope and changes to volume and slope over time. The table below summarised the key aspects of the profiles.

Table 3.1: Beach profile data for Randheli- Individual profiles

Beach Profile	**Location (see Appendix 2)**	**Distance (Vegetation line to Low tide line)**	**Beach Height (m)**	**Angle**
1	North Side	20	1.7	8
2	North Side	28	2.02	9
3	North Side	30	1.9	11
4	**North West**	**42**	**2.4**	**7**
5	West Side	**5**	1.6	10
6	West Side	**6**	1.9	8
7	West Side	**5.5**	2.0	13
8	West Side	12	2.1	11
9	South Side	9.5	1.9	13
10	South Side	8	1.9	12

11	South Side	16	2.8	11
12	South Side	16	2.3	10
13	South Side	17	1.9	10
14	South Side	14	1.4	10
15	South Side	20	1.7	9
16	East Side	22	2.3	9
17	East Side	28.5	2.2	8
18	**East Side**	**50**	**2.1**	**9**
19	North East	23.5	2.2	8.0
20	North Side	15	2.3	10
21	North Side	13	2.1	15

Table 3.2: Summary beach profile data for Randheli- Regions

Location	**Distance (Vegetation line to Low tide line)**	**Beach Height (m)**	**Angle**
East Side	24.7	2.2	8.3
North Side	28.3	2.1	9.9
South Side	14.4	2.0	10.7
West Side	7.1	1.9	10.5

Some of the key characteristics observed form the beach profiles are summarised below.

1. Much of the beach profile data can be utilised effectively once it is compared with follow-up surveys.
2. During the SW monsoon, the beach is widest on the northern and eastern side, particularly along the sand pits on the northeastern (42 m) and northwestern (50 m) ends of the island. The average width of the beach from the vegetation line is 28.3 m for the northern side and 24.7 for the eastern side. This pattern exists due to the movement of sediments to the eastern side of the island during the SW monsoon.
3. Similarly, the beach is narrowest on the western side and southern side. The average width of 7.1 m reflects the severe erosion being experienced on the western side. A present waves run up to the vegetation line in this area.

4. Beach angle is often an indicator of wave activity. Higher angles often correspond to stronger wave activity. Hence the higher values for west and south side show the exposure of these regions to strong wave activity during SW monsoon. In contrast the eastern side has lower angle reflecting the protected nature of this region to SW monsoon waves. This pattern is expected to reverse with the arrival of the NE monsoon.

3.4.3 Seasonal Movements (Oscillations)

Figure 3.4 shows the generalised variations in beach location in the two seasons. Some of the key aspects of seasonal movements are summarised below.

1. During the NE monsoon the sandpit dramatically enlarged on the western side of the island where it may reach to within few meters of the reef edge. The source of the sediment supply is the material deposited on the eastern coastline during the SW monsoon.
2. During the SW monsoon this process is reversed and beach is reformed on the eastern side. The amount of sediment transported in this manner is very large and hence the beach areas of the island remain very volatile and mobile.
3. Over the last two years, there have been changes to this pattern, whereby a large amount of sediment is deposited on to the northern coastline during SW monsoon. Prior to 2007 this material mainly travelled along the southern coastline. Over the last two years it has been moving along the northern coastline, creating large areas of deposition and temporary stabilisation through pioneer vegetation. These changes may have been assisted by the placement of sand bags along the northern coastline.

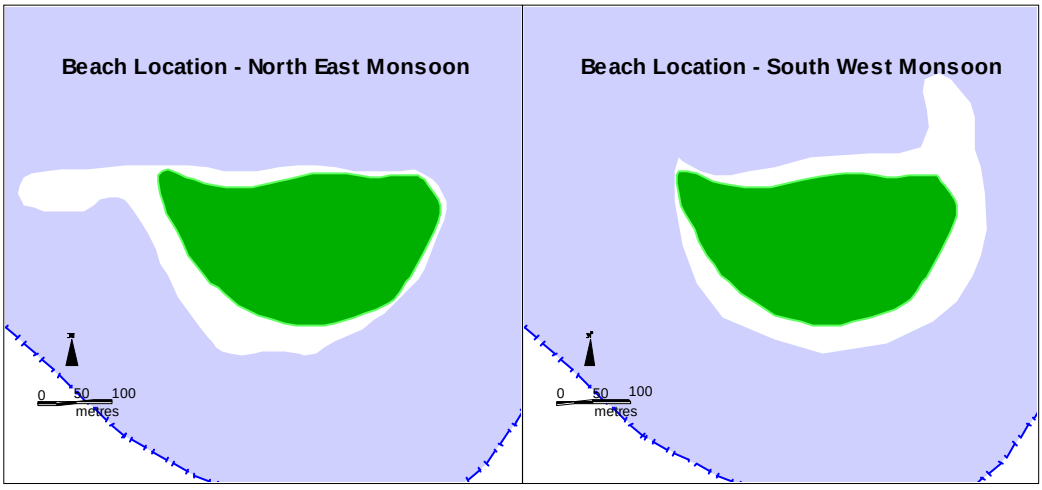

Figure 3.4: Sediment movement pattern in SW monsoon and NE monsoon

4. In 2006 the beach area of Randheli is estimated to be 10.7 Ha in NE monsoon and 9.8 Ha during SW monsoon. During the transition periods some sediment are deposited in the reef flat but remain within the island foot print. They may periodically be deposited on the island but also may remain within the lagoon for considerable number of seasons. However, the sediment budget appears to be quite large for Randheli.

3.4.4 Coastal Erosion

The erosion hot spots around the island vary between seasons (see Figure 3.5 below).

1. During the SW monsoon, western and southwestern shoreline is most at risk with a forecasted retreat of coastline over the next two years.
2. During the NE monsoon, the lack of sediments reaching the eastern side via the southern coastline during SW monsoon is likely to cause net erosion on the eastern side of the island. The extent of erosion may only be determined after a field survey during the peak NE monsoon of 2009/10.

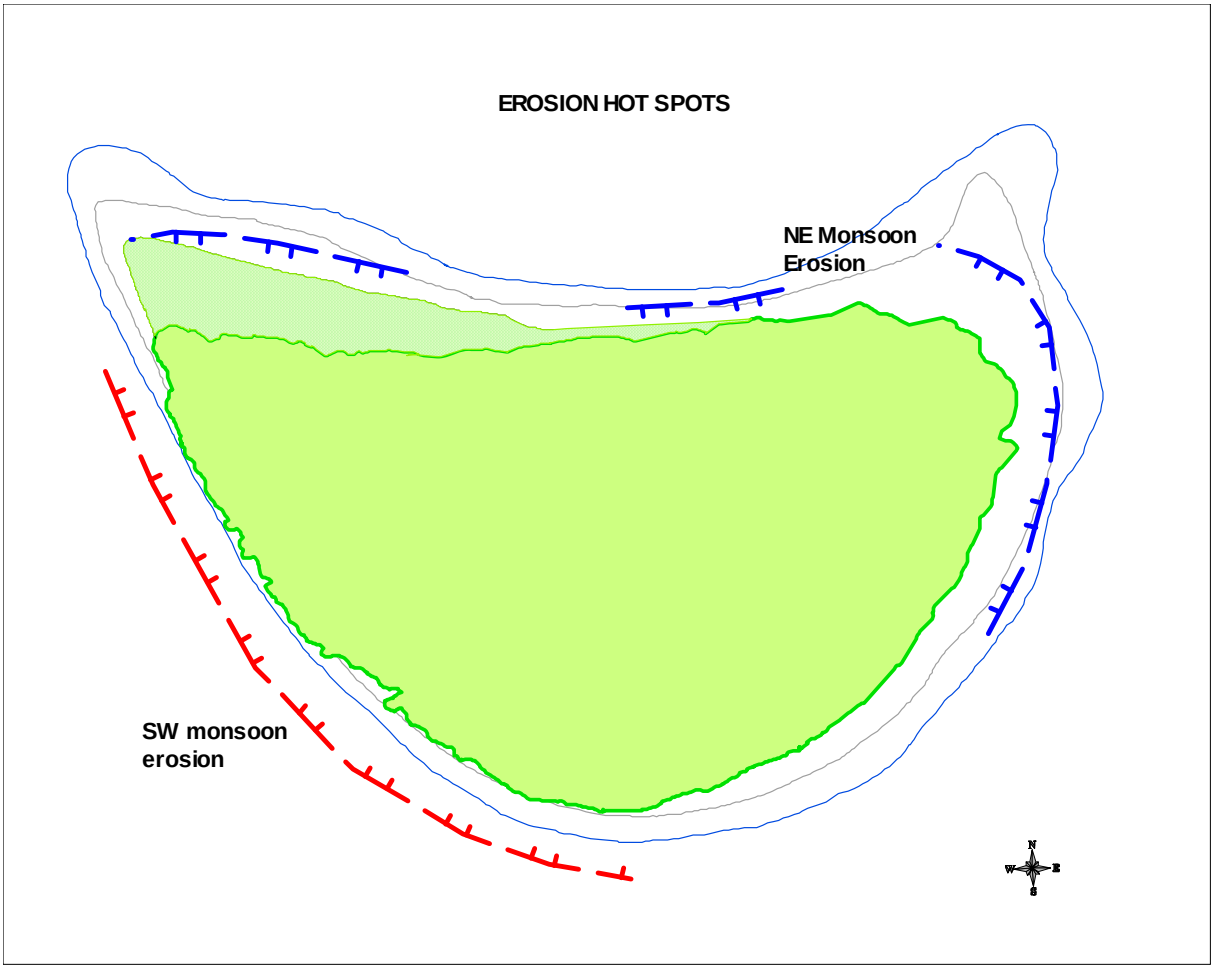

Figure 3.5: Erosion hotspots for Randheli Island estimated for the next 2 years

3.5 Status of the Marine Environment

3.5.1 General Characteristics

1. The reef conditions around Randheli are generally in moderate to poor condition. Years of island instability and migration has caused the lagoon waters to be highly turbid, making the lagoon unsuitable for coral growth.
2. The worst conditions are found on the reef flat within 100 to 150 m from the beach line. This is the area of maximum impact from suspended sediments.
3. The outer reef slopes are also in moderate to poor condition. The reef slopes within close proximity to the island in poor condition. The reef slopes at selected points around the island have large amounts of sand deposits. The most prominent location is located immediate west of the island where the island sand pit would move within a few meters of the reef edge.
4. The best reef areas are found on the northwestern side of the reef system.

5. There are live coral colonies within the deep lagoon system and should be considered the richest source of marine biodiversity in the reef system. These areas are also known to be former bait fishing grounds for fishermen.

3.5.2 Ecological Zonation

The ecological reef zonation map for Randheli is provided in Figure 3.6. Some of the key findings are summarised below.

1. The outer reef slope has two distinctive zones. The outer most zone beyond 7 m depth comprised of a heavily sedimented slope with limited live coral cover. The inner zone contains a mix of live coral cover, dead corals and sandy bottom. This area may be conducive to reef regeneration in the future.
2. The outer edge of the reef flat comprise of a distinctive algal ridge.
3. The inner lagoon between reef edge and southern coastline of the island comprise of a largely dead coral zone and sand bottoms.
4. The deep lagoon comprise of a number of live coral colonies. Most of the colonies close to Randheli have been affected by sedimentation. However, they are potential candidates for coral regeneration.
5. There is an area northeast of the island which was once believed to be a healthy live coral cover zone. The area is now mainly a zone of dead coral rubble with sparsely distributed coral cover. This area could be considered for coral regeneration and as a snorkelling zone.
6. There is an area of coral rubble between the deep lagoon and the northern shoreline of the island. Part of this rubble is believed to have been remnants of previous erosion.

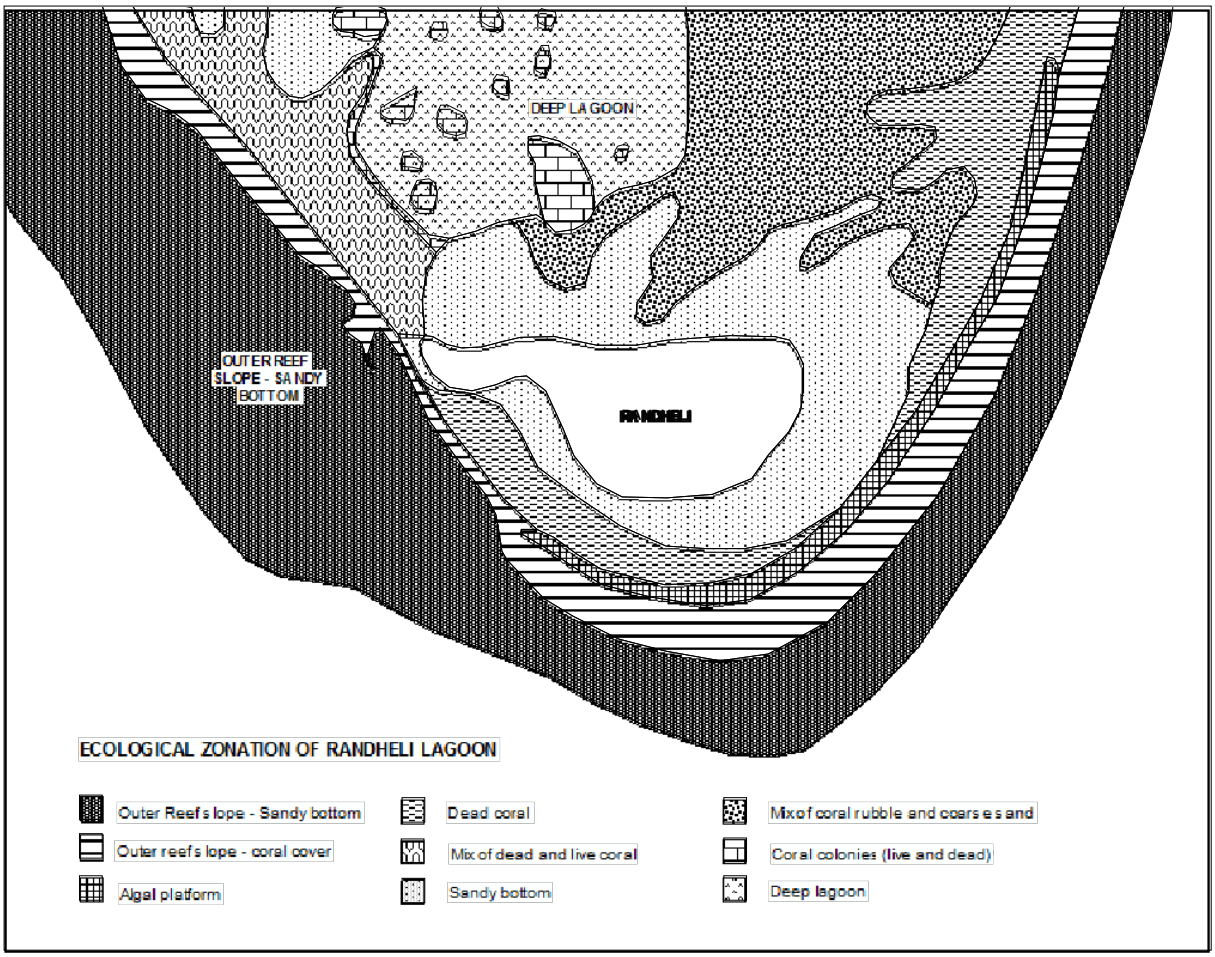

Figure 3.6: Ecological zonation of Randheli lagoon

3.5.3 Changes over time

Changes to the coral reef health and lagoon bottom conditions were observed based on data collected in 2007 and 2009. The main findings are as follows:

1. The ecological zones have changed very little over the period.
2. The reef areas immediately west of the island are showing signs of improvement with new recruitments and comparatively clearer waters. There is a long way to go before the area could regenerate fully.

3.6 Status of the Terrestrial Environment

3.6.1 General Characteristics

Flora

Vegetation of Randheli is predominantly young. The older vegetation (dated more than 50 years) is on the northern half of the island, and is more densely vegetated, with larger species. The younger vegetation occupying the rest of the island is sparsely distributed.

Reminiscent of the vegetation succession patterns in a typical coral island of Maldives, the outer layer of new vegetation is comprised mostly of salt tolerant species- Kuredhi (*Pemphis acidula*) and Magoo (*Scaevola taccada*), followed by sparsely distributed patches of Boa Kashikeyo (*Pandanus Tectorus*), Midhili (*Terminalia catappa*), Dhigga (*Hibiscus tiliaceus*) and Funa, which have overgrown the shorter species such as Magoo. Larger species such as Midhili, Dhigga, Funa and Hirundhu are present in the denser, older section of the island. A large Nika tree (*Ficus benghalensis*) is the largest tree on the island and is located within the center of the older section.

Fauna

Faunal life on Randheli is very limited, with the exception of birds. An unusually large number of bird sightings, including Kaalhu, Valla, Koveli, Dhandifulhu Dhoonu and Kirudhoonu were observed during a field survey in 2007. No signs of breeding were evident on the island, although it is a stopping point for different bird species such as those mentioned above. The island was also reportedly a nesting site for turtles, but numbers have apparently declined over the years, and no evidence of turtle nesting was observed during field visits. Other species of fauna observed include lizards (mostly *Calotes versicolor*), and to a lesser extent, geckos (*Hemidactylus frenatus*) and skinks (*Lygosoma albopunctatum*).

3.6.2 Changes to Vegetation Cover

The vegetation of the island has undergone some changes due to human intervention, apart from the natural succession of vegetation.

The northern side of the island which lacked coastal vegetation prior to 2007 due to the rapid erosion seems to be stabilizing, with pioneer vegetation being observed along the coast. Placement of large sand bags along the northern coastline probably influenced the stabilization of the coastline.

Vegetation was cleared from the interior of the island for the construction of temporary staff quarters, a mess room and a powerhouse. Additional vegetation clearing activities have not been undertaken on the island.

4 Potential Additional Impacts from Proposed Changes and Suggested Mitigation Measures

4.1 Changes to Layout of Back-of-House Structures

Changes to the layout of the back-of-house structures will change the location of the vegetation that needs to be cleared for construction. However, the total area that needs to be cleared is still the same.

Extensive vegetation clearing will be detrimental to the terrestrial biodiversity of the island. Removal of trees can lead to loss of habitat for organisms which use the vegetation for food, shelter etc. Removal of older, larger trees will be especially harmful in this respect. Randheli has been noted for the relatively frequent bird sightings, and could be a key resting point for birds. As the vegetation of Randheli is relatively young and undergoing primary succession, removal of vegetation could also interrupt the natural succession processes.

No changes have been proposed to the operational plan of any aspect of the resort. Therefore, no additional impacts are expected to arise from the operational phase.

Mitigation Measures

- Only plants within the footprint of the building and footpaths will be cleared
- Only narrow footpaths will be developed to avoid clearance of vegetation
- Removal of scrubs and shrubs will be limited to the minimum extent required
- Large trees will be retained
- Trees that are to be retained will be clearly marked and communicated to the construction workers
- Plants and trees that need to be removed from construction sites will be used for landscaping

Similar mitigation measures were included in the mitigation plan presented in the initial EIA (*Section 6* of the initial EIA)

4.2 Relocation of Dive Center and Specialty Restaurant

The Dive Center will be constructed on concrete piles, with piled jetties providing access from the beach. The structure has been designed and located so as to facilitate and withstand sediment mobility. The Specialty Restaurant will be constructed on land. The total footprint of the two structures will remain the same and the impacts arising from their construction and operation are expected to be as discussed in the initial EIA report.

Potential impacts arising from construction of the Dive Center include disturbance to the lagoon environment, accidental spillage of construction materials, scouring effect on the piles, and low levels of sedimentation in the water column. Construction of the Specialty Restaurant has the potential to result in the general impacts of construction on the terrestrial environment such as contamination of groundwater and soil and loss of flora and fauna. These impacts can be minimized or avoided by adopting mitigation measures which have been presented in the initial EIA.

Operation of a Dive Center instead of a restaurant at the over-water location will increase the disturbance to the lagoon environment by vessels, during the operation phase. Leakage of small amounts of oil, as well as littering from the dive vessels will contribute to the contamination of the marine environment. However, the additional impacts due to the operation of the dive center are not expected to be significant if the mitigation measures are properly implemented, especially as the location does not support high marine diversity and sedimentation already occurs due to natural causes.

Suggested mitigation measures include:

- Equipping dive vessels with trash bins within easy reach and with signs
- Making crew members aware of environmentally- friendly practices
- Taking care during refueling and undertaking routine maintenance on vessels to avoid accidental spillage and accidental leakage

These measures have been included in the mitigation plan presented in the initial EIA report.

4.3 Cost of Mitigation Measures

Mitigation measures discussed above have been suggested for impacts identified in the initial EIA. Therefore, mitigation of impacts discussed above will not incur any additional costs. The costs of mitigation measures are presented in *Section 6.9* of the initial EIA report.

5 Environmental Monitoring

The environmental monitoring programme detailed in *Section 8* of the initial EIA report will be followed. No additional aspects require monitoring due to the proposed changes. The major aspects of the original monitoring programme are as follows:

- Monitoring during Construction Phase (from start to end of civil works)
  - *Marine environment*: Percent live coral cover and overall health of the reef, sedimentation rate, water quality
  - *Coastal environment*: Beach profiles, beachline of eroding areas, longshore currents
  - *Terrestrial environment*: Air quality, groundwater quality, waste generation and disposal, etc.

- Monitoring during Operational Phase (upon completion of the construction phase)
  - *Terrestrial environment*: Vegetation cover, soil, groundwater and wastewater effluent quality, faunal populations, erosion, changes to shoreline
  - *Marine environment*: Water quality, reef aesthetics, fish population structure, benthic cover of reef, sedimentation, impacts from diving/ snorkeling
  - *Coastal environment*: Beachlines, beach profiles, currents, water quality
  - *Socio-economic environment*: Employment, trade in local goods, crime rates, social conflict

The methodology, locations, frequency and duration of monitoring for the different aspects identified have been detailed in the original EIA report.

A monitoring report will be submitted to the Environment Ministry annually, as required.

The cost of monitoring and the means of undertaking the monitoring programme have also been discussed in the original report.

The proponent is fully committed to undertake the monitoring requirements detailed in *Section 8* of the initial EIA report (Appendix D).

Appendix A- Terms of Reference

Appendix B- Current Site Plan

Appendix C- Previous Site Plan

Appendix D- Commitment to Monitoring