ENVIRONMENTAL IMPACT ASSESSMENT

Proposed 10 Storey Building in M. Dhoonifushi, Male'

Proponent:

Jawad Shakeel (A078331)

Consultant:

Amir Musthafa (EIA01/13)

May 2017

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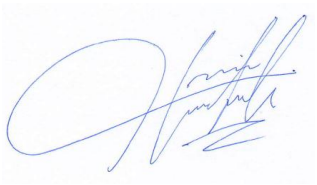
Consultants Declaration

This EIA has been prepared according to the EIA Regulations 2012. I certify that the statements in this Environmental Impact Assessment study are true, complete and correct to the best of my knowledge and abilities



Amir Musthafa (EIA 01/13)

7th June 2017

Proponents Declaration

(attached in the following page)

Ibrahim Naeem
Director General
Environmental Protection Agency
Ministry of Environment and Energy
Male', Maldives

7th June 2017

Dear Mr. Ibrahim Naeem,

Project: EIA for the proposed 10 Storey Building in M. Dhoonifushi, Male'

Sub: Proponents Declaration

As the proponent of the project, we guarantee that we have read this EIA report and to the best of our knowledge, all non-technical information provided here are accurate and complete. We are aware that this report has been prepared in accordance with the EIA regulations.

Thanking you

Yours Sincerely

Jawad Shakeel

ID NO A078331
7901633
M. Dhoonifushi

Non Technical Summary

This report is based on the proposed 10 storey building construction at the residence, M. Dhoonifushi in the capital city, Male'. The building is being constructed by Seven Weeks Construction Pvt. Ltd. The proponent of the project is Mr. Jawad Shakeel.

An Environmental Impact Assessment was necessary for the works outlined in this report as they fall under 'Jadhuvalu R' of the Environmental Impact Assessment Regulations 2012 of the Maldives. In addition to meeting the regulatory requirements, the report would further assist the proponent and important stakeholders to make decisions based on favourable environmental conditions with the main focus on sustainability. The project also adheres to several other rules and regulations in the Maldives and has obtained permit from the Ministry of Housing and Infrastructure for the project to proceed.

The area the project is proposed to be undertaken is a moderately built area in Orchid Magu, Male'. There is no natural terrestrial environment at site, although there are some roadside vegetation in the area. The existing environment therefore was focussed on the regional climate of Male', and the traffic distribution, and noise pollution in the area. As could be seen from the data, this area has moderate traffic. A general exterior overview of the existing structures in the area was also observed. It was found that most of the buildings in the area were in general conditions with few masonry cracks as is the case in most of buildings. Older buildings were mostly single storey structures. Therefore, serious structural defects are expected to be at a minimum, especially considering the standard foundation protection methods.

The overall environmental impacts of the project have been assessed using frameworks found in literature. Since the development is undertaken in a moderately built area, the results indicate that the proposed project has neutral impact. However, there are some significant impacts on the environment during the construction phase of the project and these needs to be mitigated to avoid any significant damage to the environment. Significance of the impacts and mitigation measures have been provided based on previous similar projects undertaken in the Maldivian environment and based on literature.

The main cause for concern regarding this project is the impact it will have on neighbours residing in this area. As such, several short-term impacts are envisaged including air pollution, noise pollution, aesthetic impacts, traffic issues and safety concerns. As there are numerous high storey building projects being undertaken in Male', there is no particular long term impact associated with this project. The impacts that do occur however can be easily mitigated to minimise and/or completely nullify them. Mitigation measure proposed includes creating awareness among the construction staff and neighbours regarding the

scope of the project. Other measures include taking protective measures to ensure people residing and utilising the vicinity will not have to endure the impacts during the construction stage. Foundation protection measures are recommended and are provided as part of the project to prevent impact on neighbouring structures in addition to a 1m offset from the adjacent building. Dewatering procedure also needs to be undertaken with care, details of which are given in the report. Care should also be taken to prevent any damage to the road during transport of machinery and equipment.

Alternatives, including the no project option and alternatives for some project components are also discussed. No project option is not viable at this stage of the project. Regarding construction methodology, a few alternatives are recommended. Regarding the design, there are recommendations to make the development greener. These include interior landscaping to incorporate plants, use of LED lights, rooftop solar panels, etc.

An environmental monitoring program is provided at the end of the report, which provides details on the parameters to monitor on site, and the frequency in which it needs to be done. Estimated costs for the monitoring works are given. Implementation of the program is essential for the sustainable development of the project.

In conclusion, it is discussed the impact such major housing projects have for the increasing population density in Male', and how it can be prevented at a policy level. However, taking this project as a standalone development project in an already heavily built island city, it can be concluded that no significant long-term impacts are predicted. There are numerous such projects being undertaken currently in Male'. Therefore, it is recommended that the project go ahead as proposed with precautions and mitigation measures in place.

ސާރާ ޚުލާސާ

މި ރިޕޯޓަކީ މާލެ، މާފަންނު އޯކިޑް މަގު ދޫނިފުށި ގޯތިގައި 10 ބުރިގެ އިމާރާތެއް ހެދުމުގެ މަޝްރޫޢަށް ބިނާކޮށް ތައްޔާރު ކުރެވިފައިވާ ރިޕޯޓެކެވެ. ތިމާވެށްޓަށް އަސަރު ފޯރާނެ މިންވަރު ބަޔާންކުރާ ރިޕޯޓް ނުވަތަ 'އީ.އައި.އޭ' މި މަޝްރޫޢު ހަދަން ޖެހިފައިވާ މިމަޝްރޫޢަކީ ތިމާވެށްޓަށް އަސަރު ފޯރާނެ މިންވަރު ބަޔާންކުރާ ރިޕޯޓް ހެދުމާ ބެހޭ ގަވާއިދު 2012 ގެ 'ޖަދުވަލު ރ'ގައި މިފަދަ ރިޕޯޓު ހަދަންޖެހޭ މަޝްރޫޢުގެ ލިސްޓުގައި މިމަޝްރޫޢުގައި ހިމެނޭ މަސައްކަތެއް އެކުލެވިފައިވާތީއެވެ. މިމަޝްރޫޢު ތިމާވެށްޓާއިބެހޭ ގަވާއިދުގެ ޝަރުތުތައް ފުއްދުމުގެ އިތުރުން، މި އީ.އައި.އޭގެ ސަބަބުން މިމަޝްރޫޢުގެ އިދާރާތަކާއި ކަމާބެހޭ އެހެން ފަރާތްތަކަށް މަޝްރޫޢާއި ބެހޭ ނިންމުންތައް ނިންމުމަށް އެހީ އަކަށް ވެގެންދާނެއެވެ. އަދި [illegible] މިމަޝްރޫޢު ކުރިއަށް ގެންދިއުމަށް އޮތް ވަސީލަތްތަކަށް ވެގެންދާނެއެވެ.

މި ރިޕޯޓުގެ ހޯދުންތައް ބިނާކުރެވިފައިވަނީ މާރިޗު - ޖުލައި 2017 ގައި މަޝްރޫޢުގެ ކަންސަލްޓަންޓް، އާދިލު މުސްތަފާގެ ޓީމުން މި މަޝްރޫޢުގެ ސަރަހައްދުގެ ތިމާވެށި ދިރާސާކުރުމަށް ކުރެވުނު ތަޙުޤީޤުތަކުން ބިނާކޮށްގެންނެވެ. މީގެ އިތުރުން މިފަދަ މަޝްރޫޢުތަކަށް ކުރިން މާލޭގައި ދިވެހިރާއްޖޭގައި ކުރެވިފައިވާ ތަޙުޤީޤުތަކަށް ވެސް ރިޢާޔަތް ކުރެވިފައެވެ. އަދި މަޝްރޫޢުގެ ކޮންޓްރެކްޓަރ ސިވަން ވީއެސް ކޮންސްޓްރަކްޝަން ޕްރައިވެޓް ލިމިޓެޑް ވެސް ޖެނެރަލް މަނޭޖަރ ފޯރުކޮށްދީފައެވެ.

މިމަޝްރޫޢު ކުރިއަށްގެންދަން ހަމަޖެހިފައިވާ ސަރަހައްދަކީ ގޯތީގެ ބޮޑުކަން 800 އަކަފޫޓު ސަރަހައްދެކެވެ. މާލޭގެ އެހެނިހެން ސަރަހައްދު ތަކަކަށްވެސް އެއްފަދައިން މިސަރަހައްދަކީވެސް ވަރަށް ބޮޑަށް އިމާރާތް ކުރެވިފައިވާ ސަރަހައްދެކެވެ. އަދި ޒުދުނަކީ ބިމާފުރިވެސް ވަރަށް ބޮޑަށް ކުރެވިފައިވެއެވެ. މާހައުލު ދިރުމުގެ ގޮތުން މާލެ ސަރަހައްދުގެ މާސާލާއި، މަޝްރޫޢު ކުރިއަށްދާ ސަރަހައްދާ އެކުގައިވެސް ހިމެނޭގޮތަށް، ބޮޑުމިން ފޫޓް، އަދި ފެންގެ ކަނޑުގެ މި ތަފާސްހިސާބުތައް ކުރެވިފައެވެ. މީގެ އިތުރުން މިސަރަހައްދުގައި އިމާރާތްކުރެވިފައިވާ އެހެނިހެން އިމާރާތްތަކަށް އަޑިއަށްވާލާފައިވާނެއެވެ.

މި މަޝްރޫޢުގެ ސަބަބުން ތިމާވެށްޓަށް ކޮންފަދަ އަސަރުތަކެއް ފޯރާގޮތުގައި އަންނަނިވި ކަންކަން ފާހަގަ ކުރެވިފައެވެ. އެސަރަހައްދުގެ ޖިއޮލޮޖީއަށް ބަދަލުއައުން، ކޮންސްޓްރަކްޝަން މަރުހަލާ އަދި އެއަށް ފަހުވެސް އެސަރަހައްދުގައި އުފެދޭ ކުނި އުފެދުން، މަސައްކަތު ކުރަމުންދާއިރު އަޑުގަދަވުން، ފެންފަރުއަށް ބަދަލުއައުން، ކަރަންޓާއި އިމާރާތްތަކަށް ގެއްލުންވުން، މަގުމަތީ ރައްކާތެރިކަމާއި ހުރި ގަސްގަހަށް ގެއްލުންލިބުން، މިކަންކަން ހިމެނެއެވެ. ނަމަވެސް މިމަޝްރޫޢުގެ ތެރެއިން ރަނގަޅު ފައިދާތަކުގެ ޕްރޮޖެކްޓުތަކަށް ބޭނުން ކުރެވިދާނެ، އެންމެ ކާރީގައި ހުރި އިމާރާތްތަކުގެ 1

މިބިނާގެ އޮޕަރޭޝަނަލް ފޭޒުގައި އިމާރާތް ކުރަން ފެށުމާއި، އަދި މިފަދަ އެހެނިހެން ރައްކާތެރި ފިޔަވަޅުތަކުގެ ސަބަބުން އިމާރާތަކަށް ގެއްލުމެއް ނުވާނެކަމަށް ނިންމެވިދާނެއެވެ. އަދި ހަމައެހެންމެ ދެންނެވިފަދައިން ތިމާވެށްޓަށް ކޮށްފާނެ އަސަރުތަކެއް ކުޑަކުރަން މިޕްރޮޖެކްޓުގައި ހުށަހަޅާފައިވާ ފިޔަވަޅުތަކާ ރިޢާޔަތްކޮށް މަޝްރޫޢު ކުރިއަށްގެންދިއުމުން، މަޝްރޫޢުގެ ސަބަބުން ތިމާވެށްޓަށް ކުރާނެ އަސަރު ވަރަށް ބޮޑު ނޫން ކަމަށް ލަފާކުރެވެއެވެ. މި ފިޔަވަޅުތަކުގެ ތެރޭގައި ކުނި މެނޭޖު ކުރުމާއި، ޖެނެރޭޓަރ ކުރުމުގައި ވިސްނަންޖެހޭ ކަންކަމާއި، ކޮންސްޓްރަކްޝަން މަސައްކަތް ކުރަން ބޭނުން ކުރާ މެޝިނަރީ ތަކެތި ކުރުމުގައި ބަލަންޖެހޭ ކަންކަމާއި، ޕްރޮޖެކްޓް ސައިޓުގެ ސޭފްޓީ ސްޓޭންޑަރޑްސް ދެމެހެއްޓުން ހިމެނެއެވެ.

މިޕްރޮޖެކްޓުގައި ތިމާވެށްޓަށް އަސަރުކުރާ މިންވަރު ޗެކްކުރުމަށް ހުށަހެޅިފައިވާ 'އެންވަޔަރަމަންޓަލް މޮނިޓަރިންގ ޕްރޮގްރާމް' އެކުލެވިގެންވެއެވެ. މި ޕްރޮގްރާމް ބެހިގެންދަނީ ކޮންސްޓްރަކްޝަން މަސައްކަތް ކުރެވޭއިރާއި މަސައްކަތް ނިމުމަށްފަހު 5 އަހަރު ވަންދެނެވެ. މޮނިޓަރިންގެ މަސައްކަތަކީ ދިރާސާކުރުމުގެ ޑޭޓާގައި މިމަޝްރޫޢު ތަރައްޤީ ކުރުމަށް އެއް ވަރަށް މުހިއްމު މަސައްކަތެކެވެ.

މި މަޝްރޫޢުގެ ސަބަބުން ތިމާވެށްޓަށް ފޯރާނެ ނެގެޓިވް އަސަރުތައް ލިބޭ ކުރުގޮތަކަށް، މަސައްކަތުގެ ސަބަބުން ލިބޭނެ އިޤްތިޞާދީ އަދި އިޖްތިމާޢީ ފައިދާތަކުގެ ބޮޑުމިނުގެ ސަބަބުން މިޕްރޮޖެކްޓަށް ތާއީދު ކުރެވެއެވެ. މިފަދަ އިމާރާތްތަކުގެ ސަބަބުން މާލޭގެ ބޮޑުވަމުންދާ ހިޔާވަހިކަމުގެ ބޭނުން ކުޑަކުރުމަށް އެހީތެރިވެދޭނެއެވެ. ނަމަވެސް މިކަމަށް މިމަޝްރޫޢު ބައްޓަން ކޮށްފައިވާ ގޮތާއި ސަރަހައްދުގެ ތިމާވެށިން ބަލާއިރު ދިމާވެދާނެ މައްސަލަތަކެވެ. މިޕްރޮޖެކްޓުގެ ކަންކަން ރަނގަޅަށް ހިންގުމާއި ހިފެހެއްޓުމާއި، ރަނގަޅު ފިޔަވަޅުތައް އެޅުމަށް ޕްރޮޕޯނަންޓާއި އެކު ކުރިއަށް ގެންދިއުމަކީ މި މަޝްރޫޢުގެ މިމަސައްކަތްތަކުގެ ނަތީޖާ ކުރިއަށް ދާނެ ގޮތް މަސައްކަތް ކުރުމަށް އެދެނީ ރަނގަޅު ފިޔަވަޅުތަކެއް ޖެހިދާނެއެވެ. އެހެންކަމުން މިޕްރޮޖެކްޓަށް ހުށަހެޅުނީ މި މަޝްރޫޢު މިޕްރޮޖެކްޓް ފެށުމުގެ ކުރިން، ތިމާވެށްޓަށް ލިބޭނެ ގެއްލުން އެކުލަވާލެވި ކުރިއަށް ގެންދިއުމަށެވެ.

1. Introduction

1.1 Background

This Environmental Impact Assessment (EIA) report has been prepared in order to meet the requirements of Clause 5 of the Environmental Protection and Preservation Act of the Maldives to assess the impacts of the proposed 10 storey building construction in M. Dhoonifushi, Male'.

The report will look at the justifications for undertaking the proposed project components and it will identify and determine the significance of the potential impacts of the proposed works. Alternatives to proposed components or activities in terms of location, design and environmental considerations would be suggested along with measures to mitigate any negative impact on the environment. Environmental monitoring programme is vital in order to demonstrate the long-term sustainability of the proposed project as well as to undertake mitigation measures before any impact leads to long-term significant effects. Long term monitoring helps to understand uncertainties in impact analysis improving future impact predictions and project implementation. Therefore, a building monitoring and management plan would be suggested.

The major findings of this report are based on qualitative and quantitative assessments undertaken during site visits on March 2017. Available long-term data were collected from available sources, such as long-term data on meteorology and climate from local and global databases. Long-term data on the project site is lacking. However, to compensate for this, data collected over the years in Male' for similar projects will be used.

1.2 Aims and Objectives of the EIA

This report addresses the environmental concerns of the building construction works and also those that will occur during the operational stage of the development. The report attempts to achieve the following objectives.

- Describe the project components to the relevant authorities and to the public
- Allow better project planning and decision-making based on the sustainable development.
- Identify environmental impacts that will occur and gauge their significance for such a project undertaken in the particular location.
- Mitigating impacts caused due to the works outlined in the project

- Promote informed and environmentally sound decision making
- To demonstrate the commitment by the proponent on the importance of environmental protection and preservation.

1.3 Methodologies

This EIA has been prepared by Amir Musthafa, a registered permanent EIA consultant with a few years of experience in Environmental Impact Assessment in the Maldives and has been actively involved in numerous building construction projects and coastal protection projects undertaken in the country. The consultant was assisted by the developer's staff throughout the project.

Internationally recognized and accepted methods have been used in this environmental evaluation and assessment. This EIA is based mainly on data collected during field investigation missions on March 2017. The data collection methods are described in detail under the following Section.

1.4 Methods of data collection

Conditions of the existing environment of the study area were analysed by using various surveying techniques and scientific methods. Field surveys were carried out to get a further understanding of the existing conditions at the project location, and were carried out during March 2017 to collect baseline data.

The following investigations were carried out on site.

- Groundwater quality parameters
- Existing noise pollution on site
- Traffic flow at the project site
- Socio-economic conditions in the area
- Visual exterior inspection of existing structural defects in nearby high rise structures

1.4.1 Groundwater quality

Groundwater quality was measured at the project location. Groundwater was collected by dipping into groundwater wells using 700ml glass bottles and sterilised water collection

bags. The containers were filled and taken for testing at the MWSC laboratory within 3 hours for testing.

1.4.2 Noise Pollution

Noise pollution at the project area was measured using a handheld noise measurement device using 'Science Journal' software. Noise measurements were undertaken at the locations shown under Existing Environment section.

1.4.3 Traffic flow

Traffic flow was measured by visual observation of traffic within a predetermined area at the project location within a specified period of time using a stop-watch. The no. of heavy duty vehicles, cars, motor-cycles, and pedestrians at the area in a 15 minute period were noted down by visual inspection. The data was extrapolated to a 60 minute period. Previous studies undertaken were also referred to.

1.4.4 Stakeholder consultations

Stakeholder consultations were mainly carried out in the EIA scoping meeting between the regular, and developer/contractor. The EIA scoping meeting gave the opportunity to consult with the Environmental Protection Agency, project developer and contractor in one sitting. Additionally consultation with the Ministry of Housing and Infrastructure, MWSC and Project engineer, were carried out throughout this study, both via mail and in person.

1.4.5 Built Environment

An overview of the built environment around the project site was undertaken by visual inspection with the aid of photographs. It is advisable to undertake a thorough defects inspection of neighbouring structures by a civil engineer.

Once the EIA has been submitted it is expected that the review process will not take more than 2 weeks. The review process may result in the request for additional information before issuing a decision statement. However, all efforts have been made to ensure that adequate information has been provided with specific attention paid to meet all requirements of the Terms of Reference (TOR). The TOR for this EIA is given in Annex 1.

1.5 References to similar studies

As there have been several muti-storey building projects undertaken in Male' City recently by various consultants, several of them were studied. These include the following:

- EIA for 14 Storey building construction in G. Hudhukoka, (Musthafa 2015)
- EIA for the proposed 11 storey building construction at MA. Andhalus, Male' (Musthafa 2015)
- EIA for 14 Storey building construction in Ma. Manaage, (Musthafa 2015)
- EIA for Hulhumale' mixed use residence, 2015 (Zuhair 2015)
- EIA for 11 Storey building construction in M. Thulhaadhooge, 2015 (Zuhair 2015)
- EIA for 14 Storey building construction in G. Hudhukoka, 2014 (Musthafa 2014)
- EIA for the proposed 10-storey building in Plot No. D6-2C, Hulhumale' – Renaatus Ithaamuiy Musthafa, A. (2016)
- EIA for the proposed 10-storey apartment building construction at G. Hiyaaa, Male'

1.6 The Proponent

The project is being proposed by Jawad Shakeel. Construction works have been handed over to Seven Weeks Construction Pvt. Ltd. Seven Weeks have engaged in numerous construction projects in Male'

1.7 The Project Location

The project is based at Dhoonifushi residence in the Maafannu district in Male', the capital city of Maldives. Location coordinates are at 4°10'34.52"N, 73°30'23.64"E. The road in which the site is located is Orchid Magu. The road is not generally known to attract a lot of traffic compared to the busier roads of Male', especially compared to Majeedhee Magu.

The precise location is shown in the following satellite image (Figure 1) taken from Google Earth and Map image from www.raajjemap.com. A more detailed site plan is given in Annex.

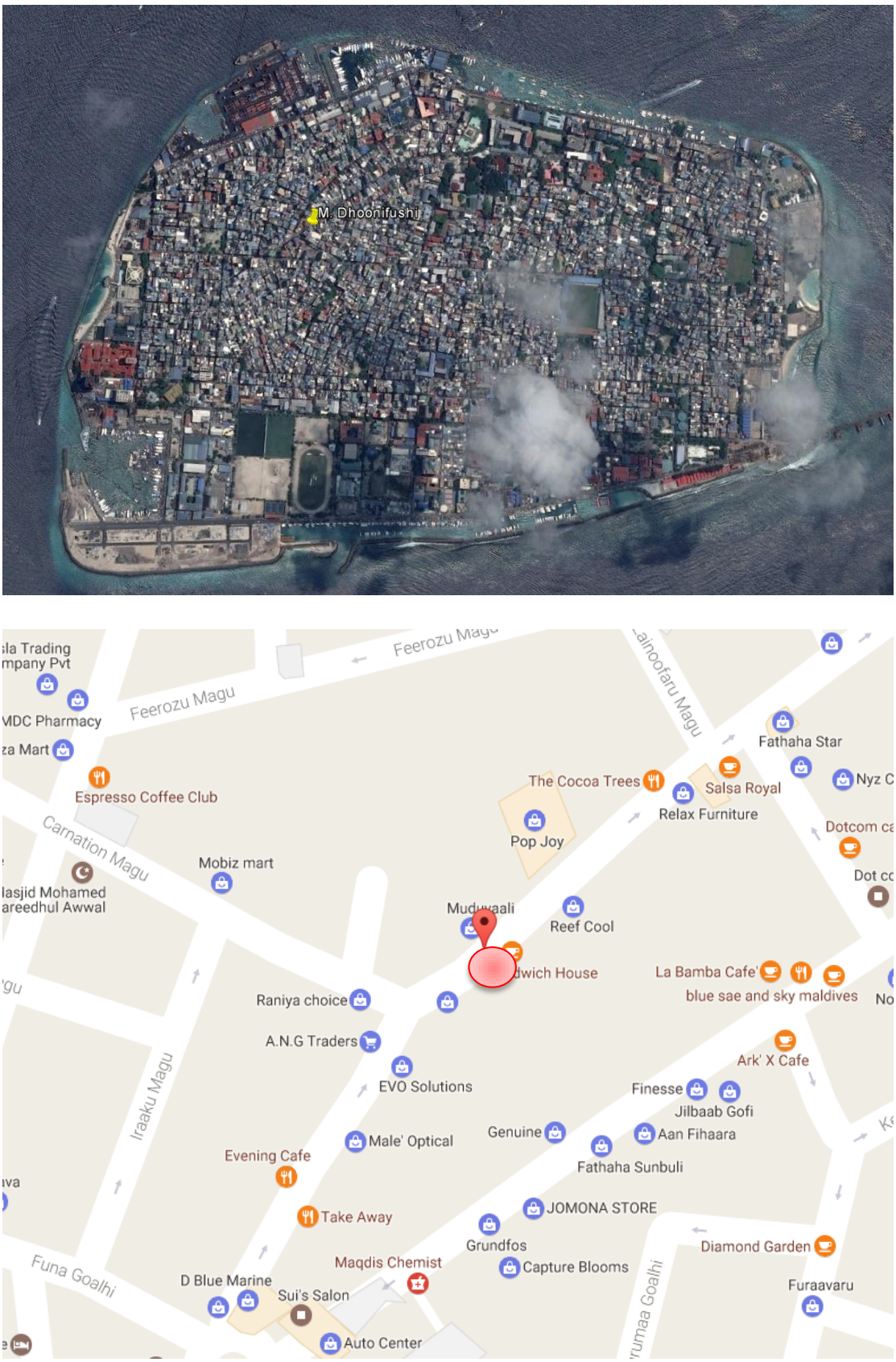


Figure 1 Location of M. Dhoonifushi in Male' and Study area highlighted in red (source: Google Earth and http://www.raajjemap.com)

1.8 Need and Justification

The capital city Male', where the project is located is among the most densely populated island cities in the world. With a land area of 5.8km^2 accommodating a population of 103,693 (Census, 2006), land scarcity is felt throughout the already vastly dense concrete island. With such a population concentration, and the need to continue living in the island, the solution had been to develop high-rise building to accommodate increasing no. of people. With no land for horizontal development, the result had been to develop vertically.

This current project is also part of this continuing trend of vertical development to mitigate the issue of land scarcity. Upon development, the building would provide 3 apartments in each floor, which would in turn provide housing accommodation to about 30 families. The site will also provide much needed commercial space in the ground floor for shops.

Since this project is a commercial project, constructing the building in the landlords privately owned land which the developer has attained, the project will be entirely commercial. It is not a government based social housing project, and the units will be rented as real estate developments. Nevertheless, more housing units in Male' would lead to more residential opportunities to the citizens living in the island and would assist in alleviating the housing issues currently faced at the capital. The proposed project is expected to increase the housing units and commercial floor area available in Malé.

2. Project Description

M. Dhoonifushi is an almost 800 sqft plot located along Orchid Magu. Currently the site has been demolished and there are no structures or vegetation on the plot itself; there is only bare land. Regarding public facilities, there are so significant structures within relative close proximity, considering the size of Male' There are commercial units around the site, as is the case anywhere in Male'.

The project site area is given in more detail in Section 3 'Existing Environment. The building drawings are given in the annex.

2.1 Design Details

Important design details for the project are given below:

- Plot Area: 800 sqft
- Elevation: 30 m
- Foundation depth: ~2.65 m
- Foundation type: raft foundation

- Foundation thickness: 500mm
- Terrace use: Open area
- Basement use: Godown facilities with service room and Parking
- Ground floor use: Commercial shops
- First and Second floor use: Commercial office
- Remaining floor use: residential apartments

2.2 Demolition of existing structure

Demolition of existing structure has already been undertaken with the approval from Aanmu Hidhumaiythakaa Behey Bai (AHBB) from the Ministry of Housing and Infrastructure (MHI)

The area has been demarked and all debris contained within the site. Most of the building and construction waste have now been removed. The works were carried out with proper safety precautions, and workers use safety equipment and clothing at all times. Demolition works were carried out using Excavator and Demolition hammer. During demolition, care was taken not to cause any damage to nearby structures. It can be observed that there had not been any such damage.

2.3 Excavation works

It has been established that the depth of foundation will be 2.65m below the existing ground level. Therefore maximum depth of excavation will be up to 2.2m. The estimated depth of water table in the area is 1.4m from ground level. As the ground water table is 1.3m above the proposed foundation depth at nearly all tide levels, dewatering will have to be continuous throughout the period of casting the foundation. Excavation will be undertaken with a backhoe excavator. When all the necessary excavation is complete, a 50 mm thick lean concrete (Grade C15) layer will be laid to provide a level surface to assemble the reinforcement of foundation raft slab and beams.

2.4 Foundation Protection

There will an offset of 1m from the nearest adjacent building in the same block. MS sheets, 9mm thick, are proposed to be hammered into the ground between the proposed and the existing adjacent building wall and 50 x 50 mm MS angle shall be fixed vertically and horizontally at 600 mm intervals. Scaffolding GI pipes, 48mm diameter shall be used at 600 mm spacing to prop the MS sheet wall and the wall shall be braced from all directions. A stepped excavation at 600mm centres shall be done to prevent destabilising of the soil from underneath the adjacent existing foundation.

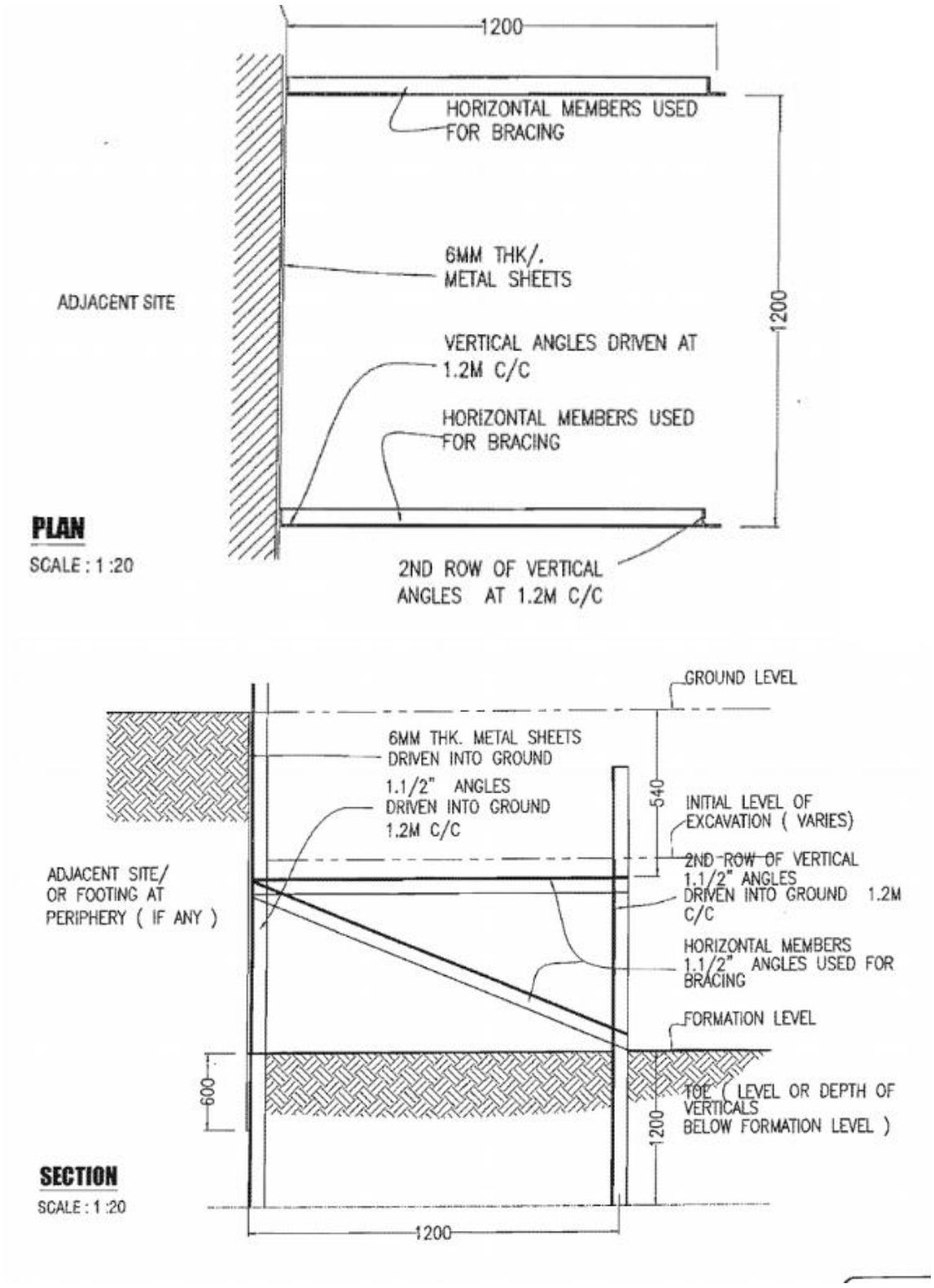


Figure 2 Schematic showing typical Foundation Protection method in place.

2.5 Dewatering

Dewatering is the localized lowering of the ground water table from its natural level, in order to create a dry environment for construction works. This is a critical process for creating the correct working conditions to establish the building substructures.

Dewatering will be a continuous process and will be on-going simultaneously while excavation is being undertaken. The process will be continued throughout until casting of the foundation. It is envisaged that 5 or 6 pumps each with the flow rate of 30 litres per second will be located at specific locations to pump out the water. It was initially planned to use the existing MWSC pump stations. However, currently due to overloading the stations, this has been temporarily stopped and contractors own pumps and pipe network has to be used to pump out water to the sea. Alternatively, pipes that are already placed in the area for other similar projects can be used.

MHI has informed the contractor that pipe network should be placed by contractor, and that pipe can be placed above ground with a steel casing speed breaker ramp,

2.6 Building Foundation

For the foundation works, a raft foundation be used. This is currently the most commonly adopted method of construction in Maldives. It enables to spread the load from a structure over a large area, minimizing the pressure exerted on the base. Beams will then be incorporated into the structure to stiffen the foundation.

Excavation in loose sand requires continuous support, and therefore supports will be placed immediately as excavation commences. Sheets would be closely spaced and horizontal support bracings provided as excavation progresses. Supports and bracings will be placed concurrently with excavation, moving along the periphery of the plot successively. The concrete works for the raft foundation will be done using C30 Grade concrete. An anti-separation additive would be used to promote bonding of the concrete mix, since the concrete works will be done underwater.

2.7 Structure of the building

Once the main substructure casting is over, the site will be backfilled up to the basement floor slab bottom level.

One 1300 mm diameter well will be constructed underground along with a 3.3m x 2.8m water tank. Water tank is required to store water for fire extinguishing purposes.

A basement will be constructed 1.1m below ground level reaching an elevation of 2.65m. The structure will be entirely a reinforced concrete structure.

2.8 Construction materials and machinery

The construction materials to be used are detailed in Table 1. All the materials such as cement, Aggregate and Sand will be delivered to site based on consumption. Steel and Plywood will be stored at the contractor's warehouse. Barb bending and carpentry work will be prefabricated at company work yard and transported to site.

2.9 Utilities

Water and sewerage facilities will be provided by the MWSC water and sewerage network. Therefore water will be desalinated water from the main supply. And sewage will be disposed untreated along the main water outfall

Electricity will be provided by STELCO. Backup generator will be placed on site by the house owners. A Perkins Sound Proof Diesel Generator, with specifications of 100 KW, 125/140 kva will be in place.

It is anticipated that the project site will require approximately 30 kW of power during the construction phase, while 25 m3 per day of desalinated water in anticipated during the construction stage of the development

During the construction, the amount of wastewater generated would be relatively low compared to its generation during the operation phase of the development.

2.10 Project Management

The project is managed by the contractor, Nalahiya Construction Pvt. Ltd. Construction works is undertaken entirely in house using company staff, most of which are made up of expatriates.

All labourers will be accommodated at Company Labour Quarters. All operations, work planning for the on-going construction work will be done at Site Office; Major operations will be done at company head office. Heavy machinery such as Excavator, Dump Truck, and Crane will be used during excavation and casting. Some of the machineries are rented while most equipment and machinery are owned by the company.

2.11 Waste Management

Construction debris generated during the demolition work will be cleared from the site and disposed at the Building and Construction waste land fill in Male'. Sand excavated during

foundation work will also be transported to this landfill site. Upon completion of foundation works, sand will be purchased from same land-fill for back filling.

It is estimated that during the construction phase, the project will generate wastes around 2 – 4 tons per day which will be collected on site, transported to the waste collection centre at Male' and finally disposed at Thilafushi. None of the waste will be placed outside the project boundary at any time. Temporary waste storage will be within the project-demarcated area.

All waste generated during concrete works phase and finishing phase will be collected at the end of each work day and temporarily stored in the ground floor. Construction solid waste will be transported to land fill site once a week or on a needs basis. Hazardous waste such as empty oil-cans (lube-oil), paint cans or strainers will be kept separate and disposed according to the standards established by relevant government authority.

For waste generated during operations, waste collection bins will be kept at ground floor garage area. Garbage chutes will be placed in each floor. On a daily basis waste will be dumped at Male waste yard.

2.12 Road closure and traffic re-routing

The proposed building is located at Orchid Magu. Access for the building is from the main road. The road is a one way from west to east.

Prior to casting of foundation or slabs; permit will be taken from Male' City Council or *Aanmu Hidhumaiythakaa Behey Bai* (AHBB) under Ministry of Housing and Infrastructure for road blocks in Orchid magu. The expected location is shown in following figure.

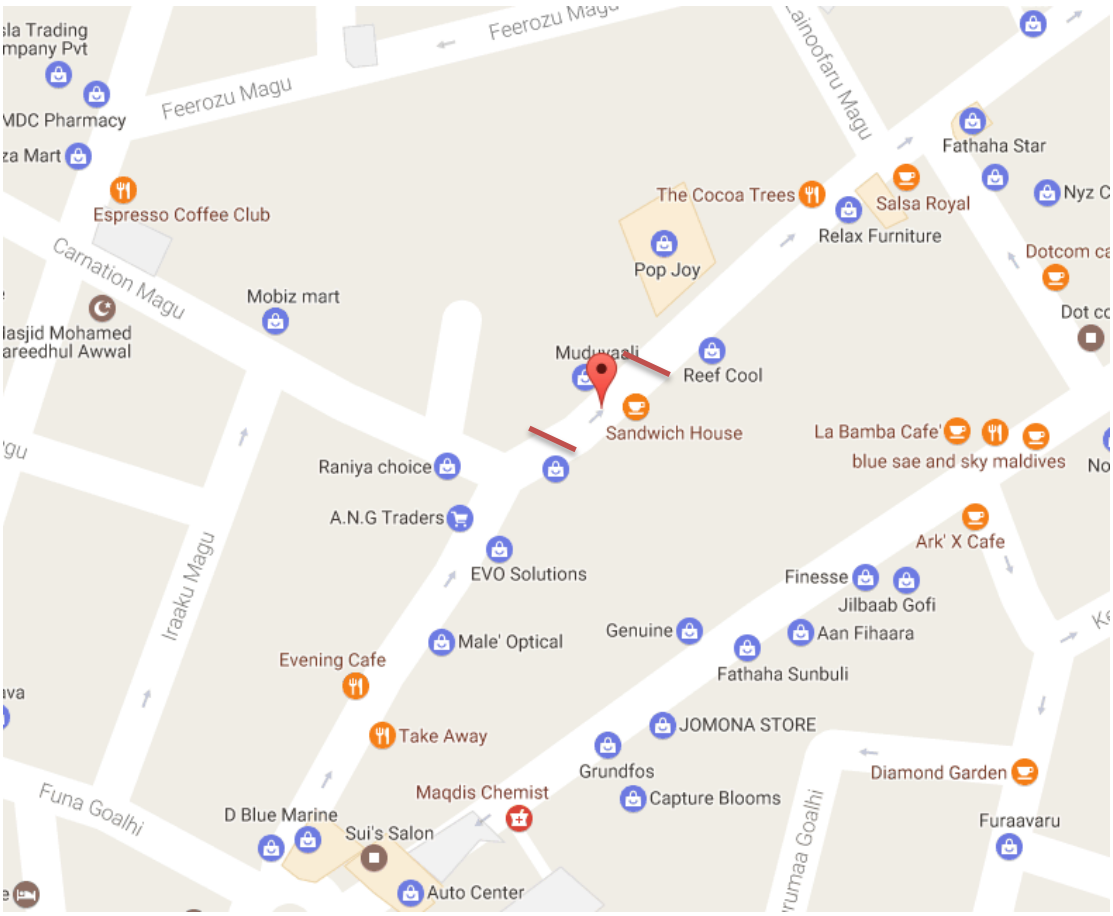


Figure 3 Proposed road closure location shown in red.

Road closing will be based on guidelines set by AHBB. In all cases the time will be minimized and for major construction works the Road will be closed at low traffic hours, mostly likely to be during late at night.

Road closures need to be undertaken for 2 major project components: foundation work and casting slabs. Maximum no of hours for foundation work will be 14- 15 hours. For each slab casting it will be 8- 10 hours.

2.13 Work Schedule

The project is expected to commence soon after the approval of this EIA report, which should take approximately 2-3 weeks from submission.

Initially the architectural and structural design works had been completed and approved before undertaking the EIA. Once the EIA is completed, demolition of the existing structure will take place. Dewatering is scheduled to commence next, which will be carried out by MWSC. Upon completion of dewatering, foundation works will begin and soon thereafter

structural works will be carried out. Masonry work and interior works will commence afterwards. The total project duration is expected to be about 400 days.

The detailed project work scheduled is attached in Annex 5.

2.14 Safety on site

All precautions will be taken for safety of workers during the construction stage. Barricades, warning signs or devices will be placed on the road during casting or road works (connection of water lines and sewer lines) for safety of pedestrians and vehicles.

All workers are given instructions about the health and safety at Site. The Site Engineers and Supervisors will give a brief on daily basis before the work starts to all workers and all proper health and safety precautions will be implemented on site. Safety signs will be used on site, some of which are shown in the following Figure.

Personal protective equipment will be available for all the workers, for falling objects, hazardous dust or chemicals, or high working areas. Emergency first aid kit will be at site for minor injuries. First aid kit will be provided in the temporary office on the ground floor, after completion of ground and first floor slab where all safety clothing and equipment will be held. All workers and personnel entering the premises will be given hard hats and safety shoes.

Figure 4 Some safety signboards to be used on site

2.15 Accident and hazard scenarios

Assessment for accident and Hazard is given below.

The following hazard and accident assessment is based on the following 3 stages of the building lifecycle, including construction, use and maintenance of building. Risk levels & probability are qualitatively assessed based on the following parameters; High, Moderate and Low.

Table 1 Accident and Hazard Risks

Performance Consideration	**Risk Level**	**Risk Probability**	**Responsible Personnel**
Presence of hazardous substances, which impact on construction work eg: asbestos, SMF, hydrogen chloride, etc.	High	Low	Project manager, Site Supervisor
Sufficient access / space around new section or building for use of cranes,	Moderate	Moderate	Project Engineer

scaffolding during construction			
Construction workers will be protected from / proximity to HV electrical, high risk energy sources	High	Moderate	Site Supervisor
Traffic / pedestrian risks are minimised for planned loading & unloading for construction vehicles	High	Moderate	Site Supervisor, Project Manager
Neighbourhood construction considerations e.g:, school vicinity, site location	Moderate	Low	Project Manager, City Council
Roof design will reduce /eliminate the risk of falls from height during construction	Moderate	Moderate	Project Engineer
Sufficient space is planned for access & to install / major fixed plant or equipment or specialised equipment, plant rooms	Low	Moderate	Project Engineer
Floor loading design has been assessed by engineer to be able to accommodate heavy equipment / plant to be installed in future	Moderate	Moderate	Project Engineer
Floor surfaces – even level with no sudden changes in levels – floor coverings non slip, suitable for levels of traffic use and suitable for type of tasks to be done	Moderate	High	Project Engineer
Stairs and balcony – edge delineation, slip resistant (SR) stair nosing, construction / design suitable for intended use, handrails, non-horizontal railings in balcony	Moderate	High	Project Engineer

Window positioning and solar glare	Low	High	Project Engineer
Safe Access to lighting fixtures to change fitting, bulbs	Low	Moderate	Project Engineer
Safe Access to plant rooms – locked, lighting.	Low	High	Project Engineer
Access to roof tops – safe access to within safety zone, minimised manual handling of material, equipment tools.	Low	Moderate	Project Engineer
Accessible window cleaning methods	Low	High	Project Engineer
Accessible gutter cleaning methods	Low	High	Project Engineer
Accessible dirt or rubbish collection points	Moderate	Moderate	Project Engineer Maintenance Officer

2.16 Project Inputs and Outputs

Each component of the project has inputs and outputs based on human resources, economics, and the environment. However, since the operation is carried out in house, project inputs and outputs are greatly conserved and limited.

The major inputs and outputs associated with the project encompassing all the components, are tabulated below. Table 1 highlights the main inputs, while Table 2 highlights the major outputs.

Table 2 Main inputs from the proposed project

Input resource(s)	**Estimated Quantity**	**Main sources of resource**
Construction workers	01 Project Manager 01 Project Engineer 01 Consultant	Contractor's permanent staff. Project staff. Labourers mostly registered workers from Bangladesh.

	Engineer 02 Local Supervisors 20 Skilled Foreign Laborers 10 Non Skilled Laborers 03 Security Staff (24 Hours security)	
Machinery and equipment	Excavator Concrete Mixer Dump Truck Crane	Contractor's own equipment.
Energy supply (during construction)	30kW	From STELCO mains
Backup energy supply (during operations)	100 kW	Procured from abroad
Cement (Ordinary Portland cement)	14,000 bags	Procured from local supplier
Sand	35,000 bags	Imported from abroad
Aggregates	45,000 bags	Imported from abroad
Ply wood (12mm thick),	3,000 No.	Procured from local supplier
Timber (Hard wood)	19,000 No.	Procured from local supplier

Steel	200 tons	Imported from abroad
Painting Exterior (Seamaster, or Equivalent Emulsion) Interior (Seamaster or Equivalent Emulsion)	Not yet determined	Procured from local supplier
Masonry Blocks (300x150x150)	+100,000 No.	Imported from abroad
Hydraulics and Drainages	All the UPVC pipes and fittings shall be used high pressure pipes.	Procured from local supplier
Tiling materials	General Floor - 600x600mm Homogeneous tile. Toilet floor - 200x200mm Non slip Ceramic tile. Toilet wall - 200x300mm Ceramic tile.	Imported from abroad

Table 3 Major outputs from the proposed project

Products and waste materials	**Anticipated quantities**	**Method of disposal**
Waste generated during construction	2-4 tons per day	Collected and sorted ground floor, and taken to Male' Waste collection area.
Waste water (dewatering)	30 litres/second	Water flow to junction provided by MWSC and to the lagoon via storm water drainage pipes
Waste oil and grease	Minute quantities	Collected in used containers and transported to waste site
Air pollution	Debris in minute quantities	External influence minimised by site demarcation temporary boundary walls.
Noise pollution	>80 db(A)	Minimised by site demarcation barriers. Ear muffs and safety equipment for workers on site.
Waste generated during operations	1 – 2 tons per day	Collected on site and transported to waste collection site in Male'
Waste water generated during operations	150 tons per day	Via MWSC sewerage network

3 Description of the Existing Environment

This section covers the existing environmental conditions of the project site. Since this is a housing project, the key components with respect to the project under consideration are described below.

- Climate
- Existing structures
- Vegetation
- Traffic flow
- Noise pollution
- Water quality
- Hazard vulnerability

Data was collected using methods discussed in Section 1.4.

3.1 Climate

This section deals with the regional and local climate of the study area. Since the Maldives does not experience relatively highly varying climate patterns throughout the country, utilising the climate conditions on a regional scale provides good indicator for the local environment, albeit with some errors.

Therefore data has been taken from the weather station at Hulhule', the island which accommodates the International Airport. Long-term meteorological data for Hulhulé is available and being only 1 km away from the capital city, the station is at an ideal location.

The Maldives, has a warm and humid tropical climate with average temperatures ranging between 25°C to 30°C and relative humidity ranging from 73 per cent to 85 per cent. The country receives an annual average rainfall of 1,924.7mm in the central parts of Maldives, where Male' is located. (Department of Meteorology, 2012).

The climate of the Maldives is dependent upon the Indian Ocean Monsoons. Monsoon wind reversal plays a significant role in weather patterns.

The two monsoon seasons observed in the Maldives include the Northeast (Iruvai) and the Southwest (Hulhangu) monsoon. The northeast monsoon is the dry season that occurs from

December to February and the southwest monsoon is the rainy season, which lasts from May to September. The transition period of northeast monsoon occurs from October to November while that of southwest monsoon occurs between March and April. The 'four seasons' of the Maldives is highlighted in the following Table 4.

Table 4 Four Seasons of the Maldives

Seasons	Duration
South West Transition	March to April
South West	May to September
North East Transition	October to November
South West Transition	December to February

3.1.1 Wind

Wind is an important indirect process affecting formation, development and seasonal dynamics 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 an important factor, as being the dominant influence on the hydrodynamics in most coastal areas. However, for this project, the impact of wind on the is negligible.

The two monsoon seasons have a dominant influence on winds experienced across Maldives. Since Maldivian islands are spread across the equator, monsoons are relatively moderate while strong winds and gales are rare. However, during South West monsoon gusts of up to 60 knots have been recorded at Male'. Wind is an important indirect process affecting the formation, development and seasonal dynamics of the Maldivian islands. Reversal of winds in the Maldives means change of seasons from North East monsoon to South West or vice versa.

General wind surface wind pattern over the country during North East monsoon is north-easterly direction whereas during South West monsoon mean wind flow is westerly.

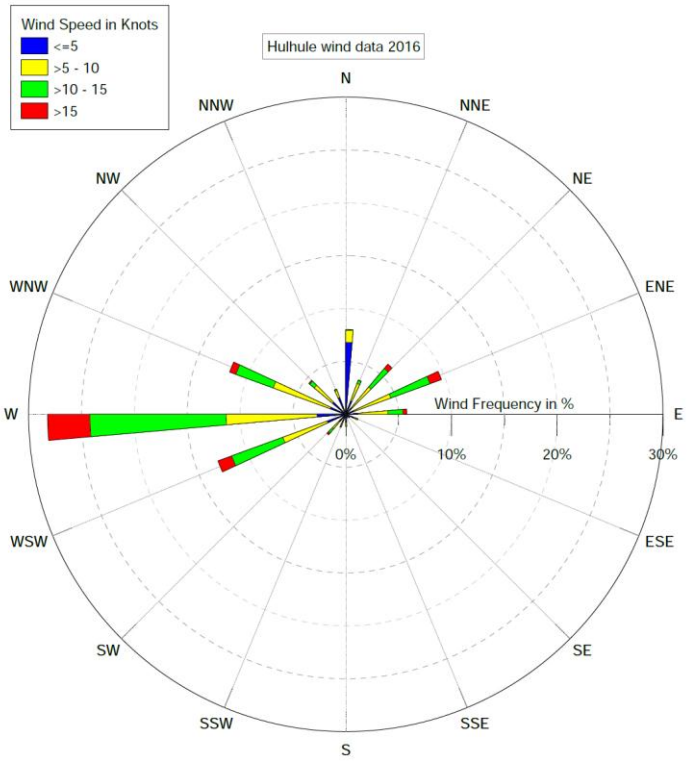


Figure 5 General wind rose diagram (MEEW, 2016)

3.1.2 Waves

Wave climate is not as important for a structure in the middle of the island. Therefore, for the purpose of the EIA, there were no measurements carried out for the wave generation on a local scale. However, regional data has been studied and visual observation on site was used to analyse the environment, as even though direct wave impact will not occur at the project site, inundation due to larger swells is possible for the entire island.

Two major types of waves are formed on the 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 May-July in the aforementioned southwest monsoon period. During this period, 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.

Swell waves are the main cause of concern. There is virtually no reef flat currently available which provides a natural breakwater and protection from large waves. However, the coast around Male' is heavily built and protected using tetrapod blocks and concrete sea walls.

3.1.3 Rainfall

The average annual rainfall for the archipelago is 1,937mm. There are regional variations in average annual rainfall. Southern atolls receive more rain compared to the northern atolls (MEC, 2004). Mean monthly rainfall also varies substantially throughout the year with the dry season getting considerably less rainfall. The north east monsoon is known as the dry season and the south west monsoon the rainy season.

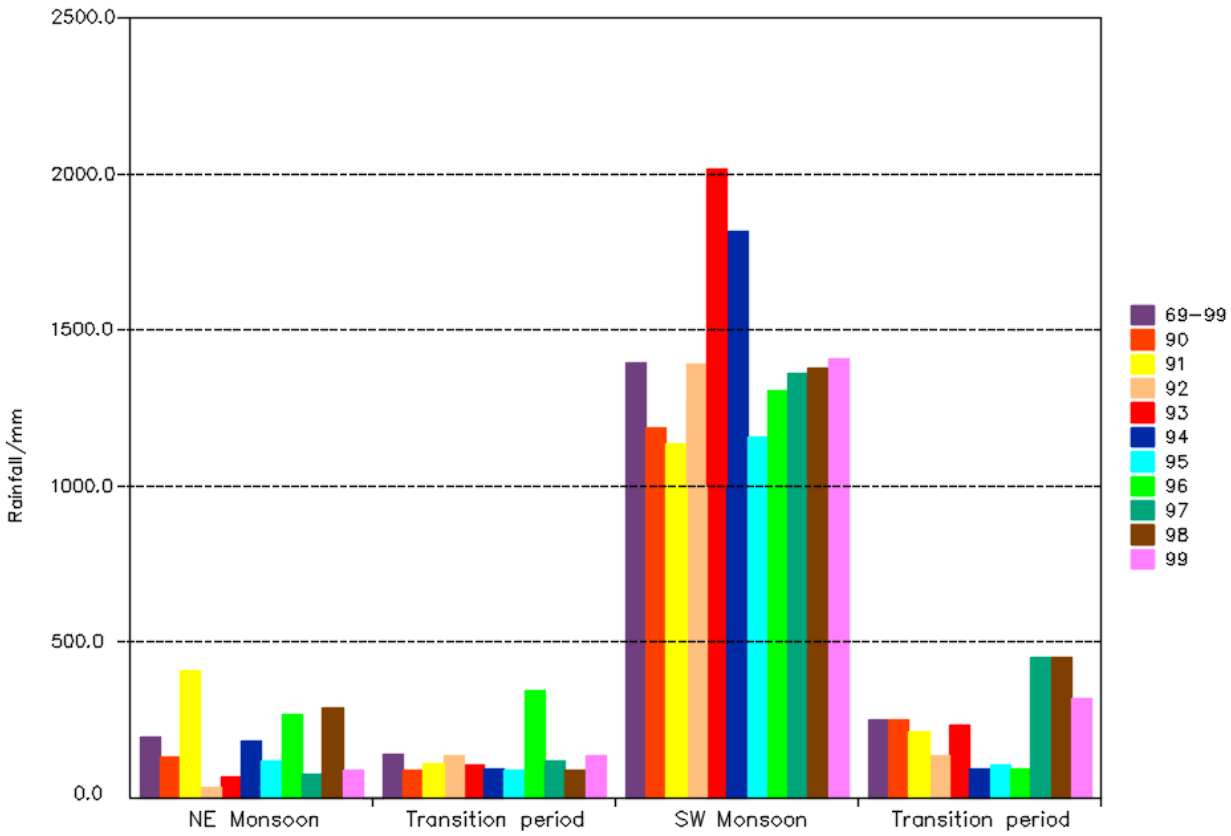


Figure 6 Annual Seasonal rainfall variation in Male'

For this project, it is important to commence the project soon during the north eastern monsoon, as the project works may get delayed, especially initial dewatering and foundation works during the rainy season.

3.2 Existing structures

There are very few other buildings on the same block as M. Dhooniushi, none of which are that significant in terms of public use, and height of structure. There are no schools or mosques nearby. An audit of the existing structure with details is given below. It has been identified that most of the buildings are old, single-storey or two-storey buildings and have

several cracks due to ageing and settlement (mainly on the ground and first floor in most of the high rise buildings) but could not have been subjected to any vibration impacts in the past. There is little or no structural damage in the existing multi-storey buildings. Surrounding roads are all paved with a narrow pavement and both side pavement on Orchid magu where Dhoonifushi is located. The roads including the pavements are paved with concrete pavement blocks. These blocks are tightly packed but can be removed for repairs and utilities works.

Table 5 Status of existing structures near project site

	Structure	Social and Environmental
M. Dhoonifushi	• Previous building demolished and site ready for excavation and foundation works	• No trees inside or outside the plot • Groundwater was used for flushing previously
M. Orchid leaf	• Existing 3-storey building • Several visible cracks on masonry walls	• All floors are occupied • Groundwater supplied for flushing • Ground Floor and First floor use as shop
M. Arooma	• Existing single storey old building use for cold storage. • Few cracks on masonry were found.	• No trees inside or outside the plot
M. Ochird Flower	• Existing single storey building. • Few cracks on masonry walls, interior and exterior with plaster applied on some cracks	• No trees inside or outside the plot • House is occupied • Groundwater supplied for flushing
M. Muleege	• Existing 6-storey building • Some cracks on masonry walls, interior and exterior with plaster applied on some cracks • Quite new building	• No trees • All floors are occupied • Ground floor use as a shop and café • Groundwater supplied for flushing
M. Guleyseemuge	• Single-storey building opposite of Dhoonifushi • Few visible cracks on the exterior • Old building	• Some trees inside the plot • House is occupied • Groundwater supplied for flushing
M. Ranika	• Existing 2-storey building • Quite old building • Ground Floor use for godown	• No trees • House is occupied
M. Hulhuvehi	• Under Construction	• Foundation works on progress

3.3 Vegetation

The site has been used as a residential area and therefore there is no vegetation to be found at the site. Moreover, the site has been already cleared.

3.4 Traffic Survey

Traffic load at Orchid Magu was expected to be moderate relative to the busier roads of Male'. As the road does not accommodate many public facilities and has been designated as a one way, traffic generally flows rather smoothly. However, still there was moderate traffic in the area as can be seen from the survey results.

Traffic increases on a regular basis based on the traffic congestion in Majeedhee Magu. Every 5 minutes, there is a spike in motorcycle, cars, and heavy vehicles passing the project area.

In this regard traffic counts were carried out on March 2017 in the morning, noon, evening, and night. Summary of data recorded is provided in the following figure.

Table 6 Traffic flow at project site

Time	Motor Cycle	Car	Pedestrian	Bicycle	Truck/ Lorry	Van	TOTAL
08:00 to 08:15	479	33	253	23	15	5	808
12:15 to 12:30	593	43	324	15	21	7	1003
16:30 to 16:45	667	38	412	22	35	10	1184
20:15 to 20:30	634	44	612	19	16	9	1334

Any potential road closures have to take into account the traffic that enters before commencing works on site. The traffic can be diverted through Carnation Magu, which is the road the traffic encounters on the western side right before the project site area. However, due to the current oneways setup near the area, access to the neighbourhood will be difficult with any road closure.

3.5 Noise Pollution

Noise pollution can be an environmental and health hazard. However, there are no currently no guidelines for noise levels at residential areas in general. Examples of guidelines with regard to noise for residential areas as set World Bank Environmental Health and Safety guidelines for noise at residential areas are: Daytime reference value for noise as set by the bank is 55 dBA while night time value is set at 45 dBA. For industrial area the noise reference level is set at 70dBA.

The following figure gives the noise levels measured at the selected sites near the project area. As stated in the traffic flow section, this area undergoes moderate traffic throughout the day and therefore noise pollution is reasonably high. When the traffic noise is included, the measurements exceeded the reference levels.

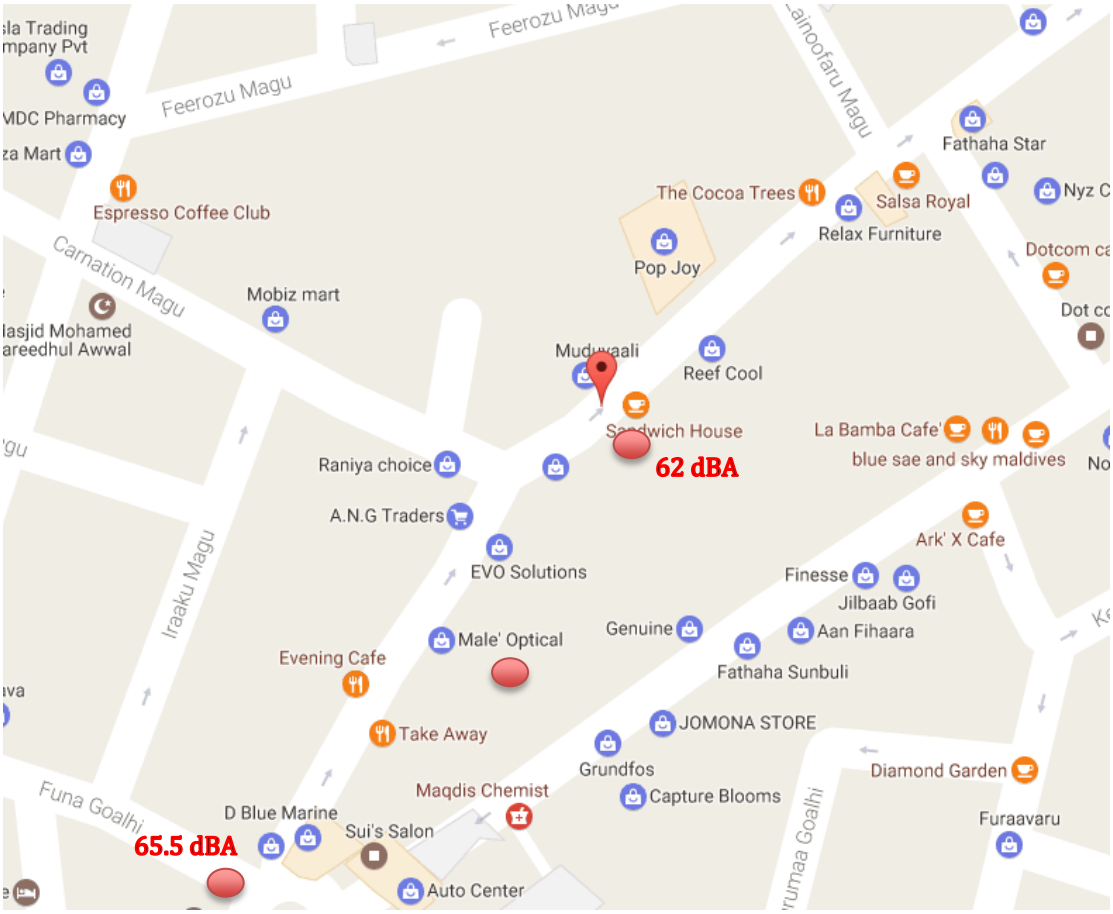


Figure 7 Noise pollution measured at specified locations shown.

Noise levels in the project area

Parameter	**Time**	**Minimum level, dB(A)**	**Maximum level, dB(A)**	**Average level, dB(A)**
At M. Dhoonifushi	16:15 – 16:30	53	71	62
Near Male Optical	16:35- 16:45	51	80	65.5
In front of Dhaanaage	16:50 – 17:00	52	77	64.4

3.6 Water quality

Ground water in the location was sampled and sent for testing to MWSC, on 20th February 2017. Results of this test are shown in Table 5 below (see Annex 4 for results sheet).

It is noted that the groundwater quality of Male' has deteriorated over the past several decades due to extraction of groundwater for several development projects such as water and sewerage and road construction projects, along with major building infrastructure project.

Due to overcrowding and congestion of Male' there is virtually no land to physically sink the water to the ground that is extracted from the dewatering process. It is expected that the dewatered water would disposed to the sea.

Table 7 Groundwater quality

	Unit	**Project Site**
GPS Location	-	4°10'32.95"N, 73°30'43.40"E
Conductivity	µs/cm	8440
pH	-	7.67
Nitrogen Ammonia	mg/L	3.0
Sulphide	µg/L	10400
Salinity	‰	4.69
Dissolved Oxygen	mg/L	2.1
Temperature	oC	22.1
Total Dissolved Solids	mg/L	4220
Turbidity	NTU	60.6

As seen from the results, the parameters from the project site show poor water quality. The EC and salinity values are very high as well as TDS. The water cannot be used for any meaningful purpose without treatment.

3.7 Socio economic status

As is the situation in Malé, especially in Henveiru and Maafannu wards, the project location is congested with mainly single storey or 2-storey buildings but with increasing number of multi-storey buildings in the area. There are few multi-storey buildings above 3-storeys in the same block as Dhoonifushi. On the corner of the block on the south of Dhoonifushi is a recently built 10-storey building.

There is hardly any vegetation in the area with a few trees grown in the Guleyseemuge yard.

In terms of living conditions in the vicinity of the project site, most of the houses have congested living conditions except for some of the multi-storey buildings. Groundwater is quite commonly used in all households for washing, flushing and other non-potable uses, as discussed earlier.

3.8 Hazard Vulnerability

Maldives in general does not experience natural disasters and hazards on a frequent basis. However, the Indian Ocean Tsunami in 2004 was a momentous reminder on potential hazardous threats the country faces. The islands across Maldives face similar type of threats and hazards to varying degrees and magnitude depending on several factors.

The vulnerability of islands to natural hazards depends on geological and more importantly geographic aspects of the island. As such, the location of the island, with respect to the country and atoll is quite important. Likewise, the level of protection the island is offered from neighbouring islands, and the house reef, shape and orientation of the island are also important factors.

Based on the UNDP Disaster Risk Assessment Report of Maldives in 2006, Male' is located in an area that has been designated as a low-risk hazard zone. However, as stated in the report, sea level rise due to climate change is a uniform hazard throughout the country, and will have high impact on Male as well. Figure profiling the Maldives based on the hazard zones are given in following figure

Local data on the hazard vulnerability of Male' cannot be taken within such a short period as has been for this EIA report. Long-term data on a local and regional scale is required to deduce such probabilities.

Dhoonifushi being located virtually at the centre of the island, any impact at the project site will be minimum compared to those at the island coast. However, in an event of a disaster

such as a tsunami, where the impact will be felt throughout the island, the project site will also be vulnerable. It is worthwhile to note that the project area did not have any significant impact during 2004 Indian Ocean Tsunami.

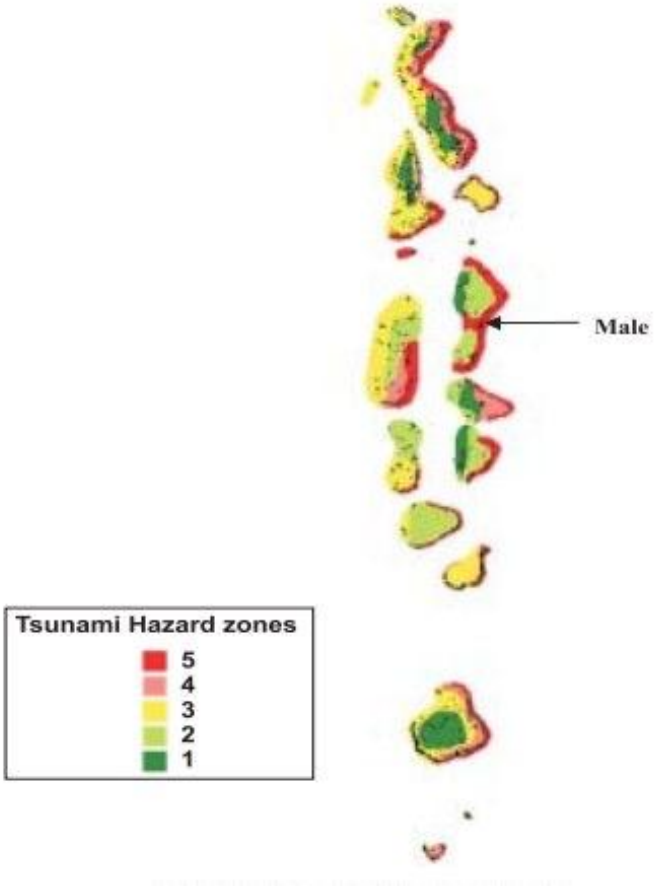


Figure 8 Disaster risk profile of the Maldives (UNDP, 2006)

4 Legislative and Regulatory Considerations

The legislative and regulatory consideration the project adheres to is mostly at a national level, since it takes place on a local scale within the Maldivian environment. The extent to which the project conforms to existing plans, policies, guidelines, regulations and laws of the Maldives are considered in this Section. Some of the more important regulations are stated within the context of this project scope. The regulatory context in which the project activities take place and the legal and policy aspects relevant to those activities will be discussed in the Section.

4.1 Environmental Protection and Preservation Act (Law No. 4/93)

There are few environmental policies; regulations and standards of specific relevance to coastal protection or environmental protection related to coastal protection activities. The major legal instrument relating to environmental protection is the Environmental Protection and Preservation Act (Law No. 4/93) of the Maldives passed by the Citizen's Majlis in April 1993. This Act provides the Ministry of Environment with wide statutory powers of environmental regulation and enforcement. This umbrella law covers issues such as environmental impact assessment, protected areas management and pollution prevention. The following clauses of the Environmental Protection and Preservation Act (Law No. 4/93) are relevant to the project:

Clause 5a: An impact assessment study shall be submitted to the Ministry of Environment, Energy and Water before implementing any development project that may have a potentially detrimental impact on the environment.

Clause 5b: The Ministry of Environment, Energy and Water shall formulate the guidelines for EIA and shall determine the projects that need such assessment as mentioned in paragraph (a) of this clause.

Clause 6: The Ministry of Environment, Energy and Water has the authority to terminate any project that has an undesirable impact on the environment. A project so terminated shall not receive any compensation.

Clause 9a: The penalty for minor offences in breach of this law or any regulations made under this law, shall be a fine ranging between Rf5.00 (five Rufiyaa) and Rf500.00 (five hundred Rufiyaa), depending on the actual gravity of the offence. The fine shall be levied by the Ministry of Environment, Energy and Water or by any other government authority designated by that Ministry.

Clause 9b: Except for those offences that are stated in (a) of this clause, all major offences under this law shall carry a fine of not more than Rf100,000,000.00 (one hundred million Rufiyaa), depending on the seriousness of the offence. The fine shall be levied by the Ministry of Environment, Energy and Water.

Clause 10: The government of the Maldives reserves the right to claim compensation for all damages that are caused by activities that are detrimental to the environment. This includes all activities mentioned in Clause No. 7 of this law as well as those activities that take place outside the projects that are identified here as environmentally damaging.

4.2 Regulation on Aggregate and Sand 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.

Coral mining from the house reef and the atoll rim has been banned through a directive from the President's Office dated 26th September 1990. Under Article 7 (c) of the Regulation on Sand and Coral Mining issued by the Ministry of Fisheries, Agriculture and Marine Resources (MOFAMR) on the 13th of March 2000, it is an offence to mine sand or coral from the beach, lagoon or reef of any inhabited island and islands leased for the purpose of building a tourist resort.

This regulation would not have any implication on the project, as manufactured sand will be used for the construction works.

4.3 EIA Regulations

The EIA Regulations, which initially came into force in May 2007 has been amended and re-published in May 2012 by the powers vested by the Environmental Protection and Preservation Act. The EIA Regulations have been the basis for Environmental Impact Assessment in the Maldives and since its inception; it had helped to improve the quality of EIAs undertaken in the country. Today, registered consultants are required to sign EIAs and the reports are subsequently reviewed by two independent reviewers and a final decision is

made by EPA based on the reviews. Likewise, this EIA report would also be subject to these requirements and review criteria.

'Jadhuvalu Raa' of the new EIA Regulations lists the different environmental projects that require an Environmental Impact Assessment study. High rise building construction works is among this list and thus a full Environmental Impact Assessment was needed to be carried out for this project. The EIA Regulations sets out the requirements for the contents of Environmental Impact Assessment reports in 'Jadhuvalu Baa' and format for monitoring reports have been given in 'Jadhuvalu Laamu'. Therefore, these requirements have been taken into consideration in preparing this EIA report.

On 9th April 2013, a further amendment to the EIA Regulation 2012 has been published, which deals with repeated offenders of the regulation. Under Clause 20 of the regulation, the amendment proposes a new Schedule. 'Jadhuvalu Taviyani, which lists penalties for repeated offenders. Under 'Jadhuvalu Taviyani', repeated offenders of the regulation will be fined based on the following criteria

- For Initial offence: 20,000 MVR
- If an offence is repeated for the 2nd time: 60,000 MVR
- If an offence is repeated for the 3rd time: 120,000 MVR
- If an offence is repeated for more than 3 times: 200, 000 MVR for each offence.

On 11th August 2016, a third amendment was published, which mainly deals with revised criteria for EIA evaluators, environmental consultants and their performance evaluations.

On 19th January 2017, a 4th amendment to the EIA regulation was published. The amendment lists additional types of project which can be implemented without the need of an EIA, with only a confirmation/assurance from the developer/proponent affirming that mitigation measures required for the project will be undertaken during project implementation. These types of projects include the following

1. Harbour and entrance channel maintenance dredging.

2. Removal of vegetation in plots allocated for housing development by the owner of the plot

3. Removal of vegetation from roads in areas allocated for housing development.

4. Making boreholes for water intake

5. Projects that are undertaken within 3 years in newly reclaimed areas in which the reclamation has been alongside existing natural island.

6. Projects that are undertaken within 5 years in newly reclaimed areas in which the reclamation has been in a lagoon separate from existing island.

The amendment gives an exemption to the types of projects mentioned in 5 and 6, if the project has the following characteristics

1. use of hazardous chemicals

2. any type of fuel storage

3. use of an incinerator

4. release of poisonous emissions

5. involves fibre work

Moreover, it states that if a residential population is established in the reclaimed land, then the exemptions granted for the type of projects as stated in Clause 5 will not be applicable.

This amendment does not have much impact for this particular project due to the following factors

- The project does not involve any significant vegetation removal.

- The project does not involve construction of boreholes

- Male' is not a newly reclaimed island.

4.4 Maldives National Building Act 2010

The Maldives National Building Act (4/2017) has been published in the gazette on 23rd April 2017. The building Act discusses compliances issues and procedures, providing disability access, details of procedures for building consent, supervision of buildings, roles and duties of all parties concerned with developments including the regulatory authority, building owners, developers and contractors, occupation of the buildings, licensing of building practitioners, and refers to the Building Code for more detailed guidance on construction procedures and best practice.

The Act also establishes the "Maldives Building and Construction Board" which is responsible for advising the Minister and other relevant actors on matters specified in the

Act. The Board is comprised of 7 appointees, from both private and, public sector, who can sit on the board for 2 consecutive 2 year terms.

Some other key areas covered by the Act include the creation of a standardised building code, a fine regime for persons who do not comply with the Act and subsequent Regulations, giving priority to Maldivian workers in the construction sector and, guaranteeing compensation for services rendered. The Act also provides a dispute resolution mechanism for parties who seek to contest fines and other actions taken against them under this Act. The dispute must be lodged within 14 days of the action and a response to the disputed action must be given within 1 month.

The Act also stresses on the importance of engaging locals in building construction projects and also highlights fines for non compliance of the various clauses given within the Act.

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4.5 Maldives National Building Code 2008 draft

Maldives National Building Code is also still at a draft stage, and is awaiting the Building Act to come in place. The Code intends to regulates on the duties of the contractors, It recommends best practices, in addition to regulations to be adhered to during construction work. It covers aspects such as structural stability, fire safety, access, moisture control, durability, services and facilities, and energy efficiency. Once the building act is published, the Coder will be enforced and all contractors will need to adhere to the regulations provided. Currently the contents are followed as a guideline. The proposed development will conform to the guidelines provided in the Building Code draft.

4.6 Waste Management Regulation, 2013

Waste Management Regulation (No. 2013/R-58) came into effect on 6 February 2014. The Regulation was gazetted on 05 August 2013. The regulation provides a set of comprehensive guidelines and on collecting, storing, transporting and managing waste as well as management of hazardous waste. The waste management regulation prohibits dumping of waste on to parks and roads; protected areas under the Environmental Protection and Preservation Act. Moreover, waste management regulation states that those involved in waste management must be permitted by the Environmental Protection Agency.

Clause 11 of the regulation deals with terrestrial wastes and states that waste should be deposited and managed only at sites allocated by the relevant authority.

Clause 26 of the regulation deals with the transportation of wastes.

Clause 34 of the regulation states the procedure for penalties for those that do not abide by the regulation.

Jadhuvalu (annex) Haa 1.1 states the regulation applicable to household wastes.

- Waste should be stored within the household in a container with a lid, such that there is no opening for any leakage. This is the responsibility of the household dwellers.
- There should not be any leakage of waste from waste storage to waste transport vehicle
- Any waste that can potentially leak out liquid should be properly sealed
- Waste should be sealed such that no insect or animal will be able to access the contents of the stored wastes

Jadhuvalu (annex) Haa 1.4 of the regulation states the conditions applicable to building and construction waste. From the clause, the notable points are as given below:

- Construction projects should be planned and managed in such a way to ensure minimum amount of waste is produced.
- Steps should be in place to ensure minimum waste generation during building and construction
- Building and construction waste generated from demolition should be reused as much as possible
- Building and construction waste should be within the site boundary of the project and should not cause any disturbance to the public
- All building and demolition works shall be arranged in such a way to ensure that during the course of the project, there shouldn't be any disturbances to the neighbouring entities and public due to the generation of wastes

It should be noted that demolition is not part of this project, as there is no structure in the area currently. Moreover, the way the site is setup, it is virtually guaranteed that waste will be contained within the site and will not pose any nuisance to the public or any potentil neighbour.

Jadhuvalu (annex) Haa 2.1 states the conditions applicable to land transport of waste.

- Waste should be properly concealed during transportation such that any waste or smell of waste will not be exposed to the surrounding environment
- Waste transporting vehicle should be properly washed and cleaned regularly
- If waste is to be transported on a wheel burrow, it has to still be ensured that the burrow is able to handle the entire content of the waste and that there is no chance for waste to spill out
- If waste is transported by individuals personally, still the condition as stated in this clause is applicable.

During the operational stage of the project, waste management of the building will likely be handled by the tenants.

4.7 Dewatering Regulation,2013

A Dewatering Regulation (No. 2013/1697) came into effect in December 2013. The main purpose of the regulation is to protect groundwater resources found in the islands from impacts of dewatering, pollution and protect the environment from release of groundwater by dewatering. As per the regulation, a dewatering permit shall be obtained from EPA prior to any dewatering operations required for all development projects.

Further, the regulation states that 30m radius boundary shall be considered as impact area from all dewatering operations and any entities within the boundary shall be informed 24hrs before the dewatering operation. EPA approved dewatering signage must be placed during the process of dewatering. There are no structures or any development within a 30m radius from the project site.

Dewatering can only be to be carried out, after gaining approval by submitting "the dewatering approval form" in the annex 1 of the Regulation to the enforcing body for approval with all the required documents expressed and with an administrative fee of 500 MVR. Water quality tests results also have to be submitted as one of the required component.

The regulation also guides on where and how the extracted water shall be disposed of, and how it has to be handled. According to the regulation, permission can be granted for dewatering at a stretch for a maximum of 28 days, for which a sum of 500 MVR should be paid per day. This amount is liable to be increased with the number of days increased.

4.8 Management, Use and Control of HCFC Substances Regulation, 2010

The HCFC Regulation is developed under the Environmental Protection and Preservation Act (4/93) towards regulating phasing out of import, use, selling of HCFC substances by 2011 and completely eliminating use of HCFC substances in the Maldives by 2020 through controlling importers, registering importers, establishment of a quota system, control mechanisms for selling, maintenance of import, selling, purchase and service providers statistics. This regulation is more relevant to the operational stage of the project

4.9 Maldivian Land Act, 2002

The Act governs the allocation of Maldivian land for different purposes and uses and other issues regarding the issuing of land, issuing of state dwellings for residential purposes, conduct regarding state dwellings or private dwellings constructed for residential purposes and the sale, transfer and lease of Maldivian Land.

In accordance with section 3 of this Act, land shall be allocated for the following purposes and uses: for the construction of households and buildings for residential purposes, for commercial use, for social use, for environmental protection and for government use.

4.10 Land Use Plan and Implementation Regulation

Under the Maldivian Land Act of 2002, all lands in the islands under the lands development policy, a Land Use Plan shall be developed and approved from Ministry of Housing and Infrastructure prior to use of the lands. The regulation outlines key aspects that need to considered while preparing land use plans as well as describes guidelines on developing and allocating lands for various purposes. In this regard, various categories of lands are identified under which a government agency shall implement the land use plan. However, for Male' the regulation has not been adhered to. There is no approved LUP for the island, by which land allocations are made and approvals given for land use.

4.11 Condominium Law 2006

Condominium Law or 'Emmedhu Imaaraathaa behey Qavaaidhu' came into effect on 21st May 2006. The law states that a Condominium is defined by buildings in which in different

tenants own floor areas/apartments in the same building, as would be the case in this project. Although this is not a mixed residential condominium development project as such, it will follow the same principles.

Clause 18 of the law states that Public Spaces and Services in Condominiums will have to be maintained by the tenants

Clause 19 of the law states that It has to be stated in the contract on how Public Spaces and Services in Condominiums will be monitored and maintained.

Clasue 20 of the law states that apartments in condominiums can only be owned by local citizens of the Maldives.

The tenants would need to be contractually obliged to maintain the building.

The law is very brief and is in need up revision considering the many upcoming condominiums projects.

4.12 Mosquito Control Regulation 2007

Ministry of Health published a mosquito control regulation in 2007.

Clause 3 of the regulation provides responsibilities of landlords and developers on prevention of mosquito growth in households and buildings. These include prevention of open water logged areas, cleaning gutters, and pipes

Clause 4 is on prevention of mosquito growth during building construction and repair/maintenance works.

These are the clauses most relevant to this project. The penalties for not adhering to the Clauses of the regulation as stated by the regulation very small, and is almost negligible. Heavier penalties may be imposed by HPA if mosquito breeding becomes a persistent issue in the building area, and if not controlled after several inspections and warnings. As such Clause 9.3 states HPA can take legal action against developers under such a scenario.

4.13 Permits required for the Project

4.13.1 Design Approval

The floor plans and design has to be currently approved by the Ministry of Housing and Infrastructure (MHI). The approval has been obtained and the approved drawings are provided in the Annex.

4.13.2 Dewatering Permit

A dewatering permit shall be obtained from EPA prior to undertaking any dewatering works. Before dewatering approval is given, an EIA would need to be done if the project falls under 'Jadhuvalu R' of the EIA regulations.

4.13.3 EIA Decision Statement

A decision regarding this EIA from the Environmental Protection Agency (EPA) need to be obtained before construction commences. The EIA Decision Statement, as it is referred to, shall govern the manner in which the project activities must be undertaken. This EIA report assists decision makers in understanding the existing environment and potential impacts of the project. Therefore, the Decision Statement may only be given to the Proponent after a review of this document following which the EPA may request for further information or provide a decision if further information is not required.

5 Identification of Impacts & Significance

This section is based on the potential environmental impacts due to the project components including:

- Demolition
- Excavation and Dewatering
- Material sourcing, transport and storage
- Construction of the foundation
- Super structure construction and masonry works
- Waste management
- Establishment of utilities
- Building operation
- Building maintenance

The section describes the mitigation measures for each identified impact. Since the components are all building related some impacts are general to all the components of the project, and some are specific. Likewise, the same applies for the mitigation measures. Methods of identification of potential impacts and assessing the significance of the impacts are described in the following sections.

5.1 Identification of Impacts and their Significance

Impacts on the environment from various activities of the proposed project have been identified through:

- Public consultation with important stakeholders. Including during the scoping of the project and formulation of the Terms of Reference for the EIA.
- Using decision frameworks for assigning significance to impacts
- Existing environmental studies carried out similar developments in other similar environments
- Research data that has been accumulated specific to the Maldivian context.
- Baseline environmental conditions collected.
- Past experience of the consultants with similar projects.

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 the implementation phase.

The impacts highlighted in the TOR for this EIA has been used as a guideline in identifying important impacts. However, this was not used as a strict instruction for the identification. Once new impacts not highlighted in the TOR were foreseen, they were given equal importance.

Following are the major types of negative impacts foreseen due to the implementation of building construction projects in Male'

- Loss of visual amenity during demolition and construction
- Loss of vegetation and impact on terrestrial habitats
- Groundwater degradation
- Mosquito growth
- Noise Pollution
- Air Pollution
- Traffic disruption leading to congestion
- Generation of building and construction waste
- Impact on adjacent structures
- Health and safety of workers and neighbours

5.2 Description of Impacts

5.2.1 Loss of visual amenity during demolition and construction

The existing building has already been demolished. There are few high-rise buildings in the area, and the demolition works does not appear to have had any impact on these. Moreover, the site has been cleared and it seems demolition had taken place in a very orderly manner. Waste has been removed save for some few concrete blocks still in the land.

Orchid Magu in general provides some tranquillity and a classic outlook of Male' and the public has come to expect it in this area of the city. However, this outlook will be altered when construction commences in the area. Moreover, it would create some disturbances to the public to witness a construction site and the nuisances that arises due to it.

There is also the issue of whether construction of this site will hinder the visual impact of a cultural site or a site of national significance nearby. However, such a structure is not found within the project vicinity.

5.2.2 Loss of vegetation and impact on terrestrial habitats

The area surrounding the project site is a heavily built area much like the rest of Male'. There are no parks nearby. Therefore there is no significant natural vegetation found on site.

5.2.3 Groundwater degradation

The major cause for concern with regards to groundwater is the water extraction process to lay the foundation, which is generally known as dewatering. Dewatering would remove a significant volume of water from the project site. This water will not be disposed anywhere on land and will not be used for groundwater recharge. It will be discharged to the lagoon using the pipelines. The impacts of the operation are however short term.

The short-term impacts due to dewatering is mainly the impact on the groundwater lens due to saline intrusion resulting from coning and the impact of such sudden increase in salinity on the freshwater lens in the vicinity of the site. As stated previously, there are no mature trees that will undergo an impact from this. It is not expected that the impact will be significant on the surrounding infrastructure in accordance with the permit given by Environmental Protection Agency. In any case, dewatering is an unavoidable component of the project. Likewise, the possibility of groundwater recharge also does not exist within a heavily built area with poor drainage. Therefore the best existing option is to dispose the water to the sea/lagoon.

5.2.4 Mosquito growth

Mosquito growth has become a significant issue at all major construction sites, mostly due to negligence. After foundation is laid, and construction takes place at ground floor and beyond, the elevator pit is usually left without any such construction. As a result, water gets accumulated in the area; and if left untouched, provides a favourable environment for mosquito growth.

5.2.5 Noise Pollution

As stated previously under Description of the Environment, ambient noise pollution in the area is moderate - high due to relatively moderate traffic, with very high peaks. Construction activities will nevertheless increase the amount of noise, especially during the demolition and concrete mixing operations. Also, there will be consistent noise emitted from Stationary equipment such as air compressors, cranes, and generators. They generally run continuously at relatively constant power and speed, although sound levels may vary according to the work cycle (e.g., loading). These types of noises are temporary and are

relatively intermittent. Due to the high peaks already endured in the neighbourhood and the common occurrence of construction projects throughout the capital, it is not anticipated noise from this particular project will be perceived as an impact on the community.

5.2.6 Air Pollution

Air pollution is an issue during demolition when debris maybe seen accumulating in the project area. Impact of debris on human health is significant. Pollutants will include dust from demolition, excavation, movement of transportation vehicles, loading and unloading of materials, earthwork and during concrete mixing work. Dusts may also be transported to surrounding areas by wind, affecting residents and workers of surrounding areas.

In addition to dusts and debris, harmful gases released by heavy machineries and vehicles and other construction work include carbon monoxide, carbon dioxide, hydrocarbons, and nitrogen oxides. Other harmful gases can be released from vapors of oils, glues, thinners, paints and wood treatment during construction and interior finishing. These are all atmospheric pollutants and can also cause respiratory problems and other detrimental health issues upon repeated inhalation.

5.2.7 Traffic Congestion

From the nos. obtained during the observation of traffic, it can be seen that this project will have a significant impact on traffic in the area. There will inevitably be road closures at different times of the project, which would lead to worsening of the traffic issue. In addition to road closures, the movement of heavy-duty vehicles such as cranes and excavators would also disrupt the traffic not only at the project site. Therefore, efficient traffic diversion is important for this project. From Section 2.9, it can be seen where road closures are going to take place. Due to the no. of vehicles using the area consistently, there will be congestion no matter which method is in place.

5.2.8 Generation of building and construction waste

There will be a significant volume of building and construction waste generated from a near 4000 sqft land area. Since the structure is quite old, no material from the existing structure will be used for the new building. This would result in a negative input to the environment and can be a nuisance to the neighbourhood. Construction waste such as wood, concrete, metals, bricks, plastic and domestic waste will be generated in addition to excavated waste and municipal waste. This impact will be felt especially during and straight after the demolition stage and is therefore short-tem.

5.2.9 Impact on adjacent structures

Male', being overcrowded as it is, structures are constructed side by side. This project site is no different as numerous structures are all around M. Dhoonifushi, with no significant high rise building nearby. There is some probability that there will be some impact on these structures especially during the dewatering process and foundation construction works. The impact will certainly not be as high as construction with deep piling. After the issues faced due to the construction of Holiday Inn building in Male' using this method, it is not currently practiced. Also, since the construction is taking place in Orchid Magu it is observed that adequate parking for mobile cranes will be available to an extent, and the boom of the crane could be moved at varying degrees without overlapping into adjacent properties.

The best way to avoid any claims in the future is to ensure the current status of the facilities. This can be done by carefully and properly investigating the structures before construction commences so that any potential defects can be compared to the pre-existing defects of the respective buildings. Although this is not strictly a mitigation measure, it is a necessary process to identify potential impacts. A visual defects inspection by a Civil Engineer is therefore highly recommended before project commencement. Such an assessment is important in order to establish the conditions of the buildings for structural monitoring purposes, in case if there is any failure as a result of undertaking this project. Avoiding all impact to neighbouring sites may not be possible, and under such circumstances compensation will need to be paid to the relevant landowners. It is worthwhile to note that the proponent declared that 3rd party insurance will be taken for the project with respect to any damage that may occur from this project.

The site offset, foundation protection methods and shoring methods proposed for the project will ensure that the surrounding buildings will not be affected during construction of M. Dhoonifushi, especially since similar methods have been used on numerous occasions in Male' with success. Therefore, with the effective mitigation measures in place, the impact on adjacent structures is expected to be low.

5.2.10 Health and Safety of workers and neighbours

Health and safety of workers and neighbours have been discussed to some extent under noise pollution and air pollution. As stated in the preceding sections, the construction site will indeed be a health hazard and care must be taken at all times while at or near the site. Moreover, in addition to impacts arising from noise and air pollution, there is also the significant possibility of direct impact from accidents from the work area. This could occur

due to falling objects, misplaced equipment and materials, temporary structures not properly fixed, etc.

Awareness of the works on site is the first and foremost mitigation measure that can be taken to reduce any risk of accidents and other minor health impacts. For awareness, the commonly used method is to put up warning signs around the project area. These include

- 'Caution: Construction works in progress".
- "Warning: No entry beyond this point".
- "Wear Safety Hats", etc.

Further to this, it is also recommended to send leaflets to neighbouring houses and shops to inform them of the construction work schedule and warn neighbours to stay away from the site while construction is in progress for their safety. Aside from awareness, second method is to encourage wearing safety cloths and equipment at the construction site at all times. This applies more to construction workers. As such, they should be instructed to wear safety helmets at all times, dust masks during sensitive work, conspicuous fluorescent cloths, earmuffs, etc.

5.2.11 Contribution to congestion in Male'

Male' is already among the most densely populated island cities in the world. Based on the 2006 census, the population density of Male' is 18,000/km^2. Currently over one third of the total population lives in Male'. It is a widely held belief that projects of these types contribute to the ever increasing population in Male'. More housing has traditionally resulted in more migration to the capital city, and the process has continued to grow exponentially. While it is not the intention of the developer to encourage more migration to the city, it is very much an indirect impact from projects such as these.

Since there is no policy in place discouraging migration to Male', the process looks to continue for the foreseeable future. However, decentralisation is a key policy for all the major government stakeholders and policy makers and this has resulted in reducing the increase in the population density. One of the key actions for this has been the development of Hulhumale', a reclaimed island nearby, which has resulted in people moving to the island from Male'. From the developer's side, there is no measure that can be taken to mitigate this issue, and is really beyond the interests and abilities of the client.

5.3 Impact Significance Assessment

This section provides a summation of the impacts of the project components discussed above. The impacts of the project have been evaluated according to the criteria proposed by Posford Haskoning (2004). The decision framework is given in the following figure

In order to make the evaluation quantitative, the framework proposed by Haskoning has been modified. Spatial distribution of impact is also added in order to make the significance of the impacts more realistic. Scores are given for each impact once it is identified that the resource is vulnerable to the impact. Scores are based on the following factors.

- Sensitivity of Receptor
- Recoverability of Receptor
- Importance of Receptor
- Spatial Distribution of impact

The scales associated with the above criteria are given in the Table 6.

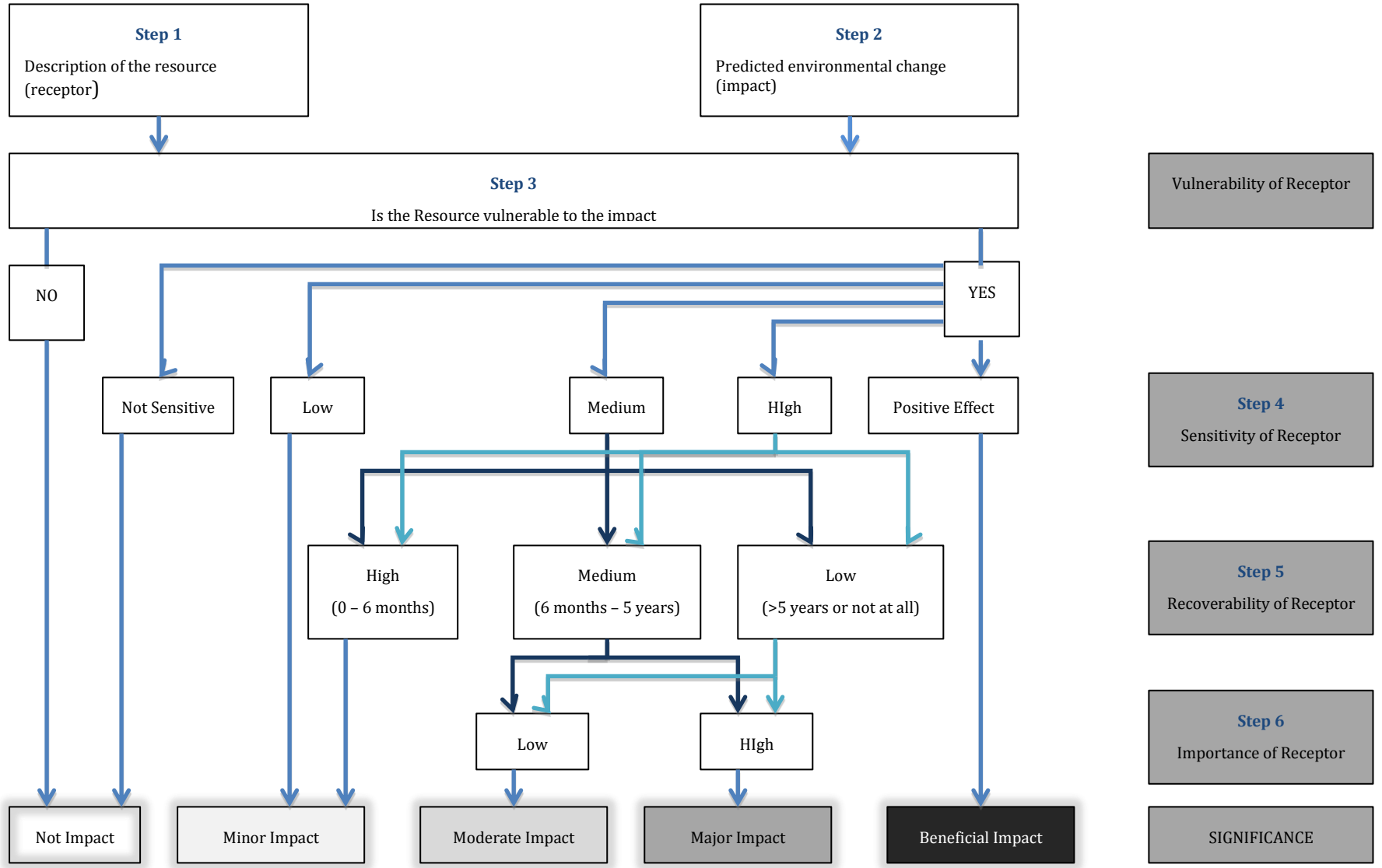

Step 1
Description of the resource (receptor)
Step 2
Predicted environmental change (impact)
Step 3
Is the Resource vulnerable to the impact
Vulnerability of Receptor
NO
YES
Not Sensitive
Low
Medium
HIgh
Positive Effect
Step 4
Sensitivity of Receptor
High
(0 – 6 months)
Medium
(6 months – 5 years)
Low
(>5 years or not at all)
Step 5
Recoverability of Receptor
Low
HIgh
Step 6
Importance of Receptor
Not Impact
Minor Impact
Moderate Impact
Major Impact
Beneficial Impact
SIGNIFICANCE

Table 8 Impact Evaluation Criteria

Criteria	Scale	Attribute
Sensitivity *How sensitive the receptor is to the impact*	-1	Positive Effect
	0	Not sensitive
	1	Low
	2	Medium
	3	High
Recoverability *How long it would take for the receptor to recover from the impact*	1	Short
	2	Medium
	3	Non-recoverable
Importance *The importance of the receptor to the environment*	1	Low
	2	Medium
	3	High
Spatial Distribution *Distribution of impact*	1	local scale
	2	regional scale
	3	global scale

If the impact receives a -1, it deems the impact to have a positive effect on the receptor and the other criteria is then not applied. The impact is referred to as a Beneficial impact as is done by the Haskoning framework.

The significance of the negative impacts will be given based on the following range:

- 1 – 5 : Minor Impact
- 6 – 9 : Moderate Impact
- 10 – 12: Major Impact

Table 9 Analysis of potential impacts and their significance

Potential Impact	**Sensitivity**	**Recoverability**	**Importance**	**Spatial Distribution**	**Significance**
Loss of visual amenity during demolition and construction	2	1	1	1	5 (Minor)
Air pollution during demolition and construction	3	1	2	2	8 (Moderate)
Groundwater degradation during dewatering.	1	1	2	1	5 (Minor)
Mosquito growth during dewatering stage, and at locations where structural construction is scheduled at a later stage	1	2	1	2	6 (Moderate)
Noise pollution during construction.	1	1	1	2	5 (Minor)
Disruption of regular traffic and traffic congestion	2	1	2	2	7 (Moderate)

Generation of waste oil and building and construction wastes	1	1	2	1	5 (Minor)
Structural impact on adjacent structures	1	1	3	1	7 (Moderate)
Health and safety of workers	2	3	2	1	6 (Moderate)
Health and safety of neighbours	2	3	2	2	9 (Moderate)
Indirect contribution to congestion in Male'	3	3	3	2	11 (Major)
Waste Generation during the operational stage of the project	3	2	2	1	8 (Moderate)
Indirect Economic impact on the community	-1				Beneficial
Alleviate housing issue currently faced in Male'	-1				Beneficial

In conclusion, the project will have minor to moderate impacts on the environment. While some moderate impacts are important, probability of these impacts occurring is rather low including significant structural impact on adjacent structures.

The major negative impact the project would have on the environment is the project's indirect impact on contributing to the worsening congestion issue in the capital city. However, mitigating this impact is beyond the scope of the project and mitigation can only come from on a planning level by government authorities.

5.4 Uncertainties in Impact Prediction

The impact prediction has been carried out based on literature and tested methods. However, the prediction relies heavily on the judgement of the consultant, and would therefore lead to uncertainties. Alternatively, such projects as has been described in this report have been carried out on numerous occasions in Male'. Therefore, observing past literature on a local context, the uncertainty would be severely reduced. Based on this, the level of uncertainty in the case of the proposed project in M. Dhoonifushi may be expected to be low as similar projects in similar settings have been carried out.

Uncertainties will be further reduced by undertaking the monitoring program and re-analysing impacts, after comparing the monitoring data with the baseline data in this report and previous recent environmental studies done for Male'.

6 Environmental Management and Mitigation Measures

Mitigation measures are proposed where significant impacts are expected. Once an impact is identified to have 'moderate' or 'major' impact, appropriate mitigation measures are given for the project, if possible. Impacts such as the project contributing to the congestion in Male' will have no mitigation under the scope of this project.

Successful implementation of the measures given would lead to a major reduction and/or nullification of the impacts on the environment and thereby ensuring that the project is environmentally sustainable.

6.1 Loss of visual amenity during demolition and construction

Major impacts from the demolition generally arises due to poor project planning. To avoid loss of visual amenity and also other such minor impacts, it is recommended that the project site be hidden to the public by means of a temporary boundary wall straight after demolition. Warning signs should be placed which states that only staff is allowed within the boundary wall. The wall height should not be less than 10ft, and it could be made of wood or roofing materials.

6.2 Mosquito growth

As a mitigation measure, some project managers put an oil layer on top to make the area inaccessible for mosquito growth. However, this also leads to groundwater contamination. It is recommended to put a wax layer on top of the area instead of an oil film. This practice is already carried out by some contractors and results have been positive. Any significant negative impact due to the wax layer is not currently known.

6.3 Noise Pollution

Noise protection gears such as ear muffs are to be used by workers on site. Components that require heavy vehicles such as casting of the slabs and columns are scheduled to be undertaken on weekends, during morning or at noon as to minimize the impact of noise to the shops, offices mosques. Works emitting noise at high decibels are not to be undertaken during night time. Furthermore, the boundary wall should be able to contain some amount of noise within the project site.

6.4 Air Pollution

For mitigation, dust screens and regular water spraying and dampening should also be practiced to reduce the spread of dust to surrounding areas. All heavy machineries should be inspected and fine-tuned to make sure the harmful gases released to the atmosphere do not exceed allowed standards. Building materials should be covered or contained during loading, unloading and storage. The boundary wall or fence should also be able to restrict the movement of dusts and debris within the project site. Construction workers should wear dust masks during dust sensitive work.

6.5 Traffic Congestion

Permission will be obtained from the authorities before works commence in order to arrange road blocks and place relevant signboards and notices for pedestrians and drivers. The relative width of roads leading to site would accommodate movement of large vehicles at times of day, as vehicles can take Majeedhee Magu. Transport of

such vehicles should also be undertaken during off peak hours. This would mitigate congestion during peak hours.

6.6 Generation of building and construction waste

It is recommended to re-use as much construction waste as possible, although this may be difficult to manage. The reusable waste includes wood and blocks. Metals can be recycled, and a recycling group such as Secure Bag can be contacted to remove such materials. All such recyclable or reusable wastes should be segregated on site. Waste that cannot be reused or recycled (which will be in the majority) are to be taken away from site for disposal. Such waste will be taken straight to the building and construction waste, landfill in Male'. Male' City council will later transport the waste to Thilafushi. Reusing formwork material as much as possible is another measure that can be taken to reduce waste.

6.7 Impact on adjacent structures

For mitigation, soft/silent piling can be used, which would be approximately 6m of piles at regular intervals around the land plot for retaining the earth to a depth of 10 metres below the ground level. The piles would be driven into the ground to hold the boundary wall that would be constructed for the shoring of the foundation. As added horizontal protection, the compacted soil should be placed along the periphery of the construction area, preferably in gunny bags, to minimize stress and risk of overturning. The construction methodology adopted for the proposed project has been decided in order to minimise the impact on the adjacent buildings. Unlike the deep pile foundation, the raft foundation is shallow and does not require deep piling.

Furthermore, it is recommended that dewatering will be timed when rainfall is less or there is no rainfall (NE monsoon). This is to avoid rainwater percolating into the soil beneath the foundations of adjacent buildings. If rain does occur, measures should be taken to reduce the amount of water to the site, as the water particles may loosen the soil reducing its shear strength.

6.8 Health and Safety of workers and neighbours

Awareness of the works on site is the first and foremost mitigation measure that can be taken to reduce any risk of accidents and other minor health impacts. For awareness, the commonly used method is to put up warning signs around the project area. These include:

'Caution: Construction works in progress".

"Warning: No entry beyond this point".

"Wear Safety Hats", etc.

Further to this, it is also recommended to send leaflets to neighbouring houses and shops to inform them of the construction work schedule and warn neighbours to stay away from the site while construction is in progress for their safety. Aside from awareness, second method is to encourage wearing safety cloths and equipment at the construction site at all times. This applies more to construction workers. As such, they should be instructed to wear safety helmets at all times, dust masks during sensitive work, conspicuous fluorescent cloths, earmuffs, etc.

6.9 Waste Management

Waste management is the main issue during the operational stage of the project. A large number of wastes will be generated from the apartments in a concentrated area. Currently the proponent has proposed a chute system for all wastes including recyclables and non-recyclables. Waste will be collected in ground floor and arrangements will be made with a waste transporter to transport waste to Male' waste yard.

In addition to the general waste management method, it is recommended to separate recyclables from non-recyclables. This will reduce the total no. of waste produced and the system will be easier to manage ensuring sustainability.

Furthermore, it is recommended for the developer to put in place a system for hazardous wastes and large waste collection. It is recommended to collect such large wastes on a quarterly basis.

Table 10 Mitigation management plan summary

Mitigation measures	Implementing Responsibility	Implementing Stage	Cost
Demolition			
Site is to be demarcated and boundary walls of approximately 6ft high are to be put in place straight after demolition	Project Manager	Demolition	~35,000
Ensure no material gets deposited outside project boundary	Project Manager	Demolition	0

All waste to be removed from site on a daily basis	Project Engineer	Demolition	~25,000
Ground water degradation			
Dispose water to the sea or lagoon due to lack of other practical options for groundwater recharge in Male'.	MWSC	Construction	na
Regular monitoring of groundwater condition on site	Project Engineer	Construction	1000/test
Mosquito Growth			
Ensure still water does not remain on site	Site Supervisor	Construction	na
Place a lid layer of wax on top of area in which water is prone to accumulate.	Site Supervisor	Construction	na
Noise Pollution			
For workers, use of earmuffs at construction site.	Project Manager	Design	In project cost
Construction to be scheduled in such a way that noise pollution will be at a minimum to the public. As such, works such as casting of slab and column are scheduled to be undertaken on weekends, during morning or at noon to minimize impact on the numerous shops nearby and mosques. Such works are not to be undertaken during night time after 8pm under any condition.	Project Manager & Site supervisor	Design and Construction	In Project cost
Ensure proper site demarcation and boundary wall condition before commencing such work	Site supervisor	Construction	In Project cost
Air Pollution			
Workers should be made to wear dust marks during dust sensitive work.	Project Manager	Construction	In Project cost
Place dust screens demarking the concrete mixer	Project Manager	Construction	In project cost
Daily water spraying and dampening to reduce spread of dust to surrounding areas.	Site Supervisor	Construction	In Project cost
Inspect and fine-tune all machinery and vehicles before work commencement to ensure harmful gases released to atmosphere are at a minimum.	Site Engineer	Construction	In Project cost
Cover building materials such as cement and sand, and should be contained during loading, unloading and storage.	Site Engineer	Construction	In project cost
Traffic Congestion			
Schedule transport of heavy-duty vehicles to site during off peak hours such as the morning.	Project Manager	Construction	0
Upon closure of the road, divert the traffic through so that vehicles can go around the project area.	AHBB	Construction	0
Generation of building and construction waste			

Re-use construction waste where possible. Reusable waste could potentially be wood and blocks found on site.	Project Engineer	Construction	0
Metals are to be collected separately and handed over or sold to a metal recycling group.	Site supervisor	Construction	0
All waste should be segregated on site.	Site supervisor	Construction	5,000
During and straight after demolition works, all waste that cannot be recycled or reused, are to be transported daily to the waste disposal site in Male'	Site supervisor	Construction	In Project cost
Reusing formwork material as much as possible.	Site supervisor	Construction	**0**
Impact on adjacent structures			
Undertake a defects inspection survey of structures above 2 storeys within the same block to verify the existing condition of these structures.	Project Engineer	Construction	30,000
Prepare and establish a budget of 10% of the project value before project commencement to provide compensation to neighbors in the event of damage to a nearby structure or take 3rd party insurance.	Project Manager	Construction	In Project cost
Soft/silent piling is recommended to be used as foundation protection, which would be approximately 6m of piles at regular intervals around the land plot for retaining the earth to a depth of 10 metres below the ground level. The piles would be driven into the ground to hold the boundary wall that would be constructed for the shoring of the foundation.	Project Engineer	Construction	In Project cost
Compacted soil should be placed along the periphery of the construction area, preferably in gunny bags, to minimize stress and risk of overturning of nearby boundary walls.	Site Supervisor	Construction	In Project cost
Dewatering will be timed when rainfall is less or there is no rainfall (NE monsoon). This is to avoid rainwater percolating into the soil beneath the foundations of adjacent buildings.	Project Manager	Construction	In Project cost
If rain does occur, measures should be taken to reduce the amount of water to the site, as the water particles may loosen the soil reducing its shear strength	Site Supervisor	Construction	0
Health and safety of workers and neighbors			
Undertake health and safety training for workers before project commencement.	**Project Manager**	**Pre-Construction**	In Project cost
Put up warning signs around the project area including signs indicating ongoing works, and restricting entry into the project area, and signs reminding the use of safety gear at site.	**Project Manager**	**Construction**	In Project cost
Encourage use of safety cloth and equipment at the site at all times. These include safety helmets, dust masks, conspicuous fluorescent cloths, earmuffs, safety shoes, etc.	**Project Manager**	**Construction**	In Project cost
Generation of household wastes			
Separate collection of recyclables and non-recyclables at the building and transport the waste	**Site Supervisor**	**Operation**	In Project cost

Collect hazardous wastes on a separate schedule.	**Site Supervisor**	**Operation**	In Project cost
Have a quarterly large waste collection schedule in place	**Site Supervisor**	**Operation**	In Project cost

7 Alternatives

This section looks at different alternatives for the proposed project. The main alternative is the no project option. After extensive discussion of this alternative, then options for the project components are investigated. Alternatives are given for each component based on location and design. Each alternative is discussed based on economic, social, and environmental factors. Finally, the recommended alternatives are suggested to assist in the project decision-making process.

These alternatives are not as intensively investigated as the original scope of the project. However, investigating and discussing alternatives is important so that it is ensured that the best available option(s) is/are chosen to solve the issues/problems of the project.

7.1 No project option

Initially the no project option is discussed in order to hypothesise whether the project should be taking place first of all. Sometimes, projects are proposed without much thought given to the socio-economic motivation of such development and the unnecessary impacts it may have on the environment, especially those that are long term. Therefore carrying out this exercise is important to avoid such a scenario and to ensure that undertaking this project at this stage makes good socio-economic sense without any significant impact on the environment.

The advantages and disadvantages of not undertaking each project component is given below.

Table 11 Advantages and Disadvantages of the no project option

Advantages	Disadvantages
Will not contribute to groundwater degradation	Will be a missed opportunity for the developers to develop their land and increase the value of their land
Will not lead to health and safety concerns at project site	Will not be able to alleviate the issue of people living in small crowded places in Male'
Will not contribute to structural issues of	Will lead to residents of the existing

neighboring buildings.	structure to continue living in an old structure prone to accidents
Will not cause any noise and air pollution at project location	Will decrease economic opportunities for construction companies and their employees
Will not cause any traffic disruptions	
Will not have any contribution to the increasing population in Male'	

A comparison of the no project option with the project going ahead as proposed, indicate that the no-project option is practicable, and environmentally favourable but involves massive losses to the developers. The other major disadvantage of the no project option is that in such a case, there won't be further housing options for people living in crowded areas in Male'. However, on the other side, it may also discourage more people migrating to Male', thereby increasing the population of the already dense city. However, this is a very indirect effect, the scope of which is outside this project, as the developers cannot in any way influence this socio-economic behaviour.

There are a few advantages of the no project option from an environmental perspective. However, local environmental impact from this project is small in nature, and the advantages stated is not significant, since most of the environmental impacts can be properly mitigated. Alternatives for components of the project are discussed further.

7.2 Project Alternatives

The Proponent initially decided that the best option not encompassing excessive costs would be adopted after evaluating different options. Therefore, the different alternatives for the project components were considered before finalising a particular option. Alternative options; mainly based on design and methodology for the construction are given below.

7.2.1 Project Location

Alternative locations are not as important for this project, as the location cannot be changed under any circumstances. The government could provide the developers with

an alternative land of similar size from a similarly lucrative location in Maldives. However, there is currently no such program and the practicality of such a shift in location is questionable. Proceeding with the construction in this exact location will be the most favourable for the developers.

7.2.2 Project design

Several component of the project design can be changed, taking the community more into consideration, such as:

Making space for a mini mall for the first 4 or 5 floors so that it would provided more vertical shopping space for Male'. Vertical development is important since it would encourage shop goers to get concentrated to particular areas, rather than spread out into the streets in Male' making them crowded & disrupting traffic.

Provide a larger parking space within the building, as the area is currently very congested with plenty of vehicles parked illegally due to virtually non-existent parking space available. Providing such a space in the building will be an important service to the community, and assisting to alleviate the crowding issue. .

Design for a rooftop garden area, alongside the swimming pool, instead of an empty terrace, which will contribute to making the city greener, while continuing with the infrastructure development in the given area.

These project designs are given as suggestions, the feasibility of which the developer should take into consideration before implementation.

7.2.3 Foundation

A deep pile foundation can be constructed, which will likely provide more stability to the 14 storey structure in the long term. However, the city have had to endure some negative experiences with deep piled structures, most notably that of the Traders building (formerly Holiday Inn) at Athireege Aage. For the structure, metal load bearing piles were driven to depths of 30 to 40 metres. The deep piling, lead to several neighbours complaining of tremors and cracks in their walls. Due to the close proximity of buildings structures, use of deep pile technology may not be ideal for high rise buildings in Male'.

8 Stakeholder Consultations

Stakeholder consultations were carried out with the construction management team of Seven Weeks Pvt. Ltd. Officials from the Environmental Protection Agency were also met for consultation. The EIA scoping meeting held at Environmental Protection Agency provided a good opportunity to discuss issues with all the major stakeholders present and thus a significant portion of the consultation was carried out at the meeting. Further consultations were carried out with the Project Engineer and Project Manager for the project, and Assistant Engineer from Ministry of Housing and Infrastructure.

Table 12 Important stakeholders met during the consultation process

Name	Office	Phone No.	Designation
Ahmed Mujah	Seven Weeks Pvt. Ltd.	7778026	Contractor
Jawad Shakeel	-	7901633	Land lord
Momamed Niyaz	STELCO	7787021	Senior Engineer
Ubaid	WAMCO		Facilities Manager
Zeeniya Ahmed Hazeem	Ministry of Housing and Infrastructure	3004340	Deputy Director General

8.1 Consultations with the Contractor

Discussions with the contractor initially commenced on 3rd May 2017

Consultations were undertaken with the developer to ensure the details of the project components. Consultations were also important in order to identify the most environmentally sensitive components and discuss potential mitigation measures. The developer ensured that the well-being of the surrounding environment will be given priority and as such an effective waste management system will be place. Moreover, they have plans to further improve the waste management of the building after observing the tenants practices during operation.

In addition to waste management the developer also informed on the importance they give to the health and safety procedures for both staff and general public.

The concerns raised by the developer included the time delays for project component approvals from the government and discussed on the need to expedite bureaucratic processes. As such, Environmental Impact Assessment approvals were also discussed.

The contractor also raised concerns on the difficult setup to undertake dewatering currently in Male'

8.2 State Electric Company Limited (STELCO)

STELCO was met in the scoping meeting held on 22nd May 2017

STELCO raised a concern with regards to the main board placed in areas difficult to access by the utility company staff. They instructed that the main board should be accessible at all times.

They did not raise any further concerns or have any further inquiry.

8.3 Ministry of Housing and Infrastructure (MHI)

The Ministry was met before the scoping meeting in 10th May 2017.

The Ministry informed that under recent changes, Male' City Council currently has no role to play in developments in Male'. The unit that was undertaking building and land approvals now come under the Land and Building Department under the Ministry of Housing and Infrastructure.

With regards to safety on site the Ministry informed that they are getting more strict with site supervisions to ensure the safety of the public both during construction and operations of the project.

The structure and architectural works for the project are to be undertaken by consultants registered at the Ministry. The foundation protection method along with other structures will need to be certified by these registered licenced consultants.

The Ministry informed that they do not have any further concerns if the necessary approvals for the project have been obtained.

MHI further informed that this area will not have any impact from the on-going road works in Male'

8.4 Waste Management Corporation Ltd. (WAMCO)

WAMCO staff was consulted via email. They responded on 5th June 2017 with the following information.

WAMCO had informed that as per current procedure they charge 200 MVR per ton as waste transfer fee. The vehicles must adhere to the transport and waste regulations whilst transporting the CND waste. During building and construction. the columns etc. must be broken down to manageable pieces, each piece must weigh less than 200 kg.

During the operation phase, there must be a designated area (keep bins) inside the building for waste management. This area must be accessible for the waste collection staff.

9 Environmental Monitoring

This section deals with the Environmental Management and Monitoring plan for M. Dhoonifushi building construction project with respect to the developments proposed in this EIA. The proposed monitoring plan is for the construction and operation phase of the project. The data collected for this assessment will be used as baseline data while undertaking the monitoring plan. Undertaking environmental monitoring is essential for several reasons including:

- To ensure that potential impacts are minimized and to mitigate unanticipated impacts.
- To aid in impact management,
- To improve impact prediction and mitigation methods.
- To gather long term data to minimise uncertainty
- To ensure sustainable development

Environmental monitoring has traditionally been a component that has been overlooked by most proponents.

The proposed monitoring programme will yield beneficial results if it is undertaken for a long period. As required in the TOR, the monitoring is to take place during the construction phase once every 3 months up to 1 year, and then on an annual basis for 5 years during operations. The operational stage monitoring can be undertaken at a

broader level by the regulatory authority which includes all such developments. The monitoring can perhaps be more effective then. Nonetheless, the monitoring program given in this report is based on this project alone.

The proponent expressed their full commitment to carry out the monitoring program outlined in this report. The proponent's commitment to undertake the environmental monitoring and mitigation measures is given in the Annex

9.1 Monitoring Methodology and Costs

The methodology used for monitoring will be similar if not the same as those used in this environmental assessment. However, field water quality testing equipment can be employed to decrease the uncertainties of the results as they can be compared to those obtained from the Laboratory from MWSC.

Cost estimates for environmental monitoring were usually given in previous EIAs based on the components that require monitoring. However, this was not seen as an efficient method and it tended to give high overall cost estimates to proponents and how much the proponent would need to spend to generate an annual monitoring report was not clear. As a result, more often than not, it discourages the proponent from attending to the monitoring program. Generally, the components that require monitoring can be done simultaneously and therefore estimated costs are given based on the activities that need to be carried out to compile an effective monitoring report.

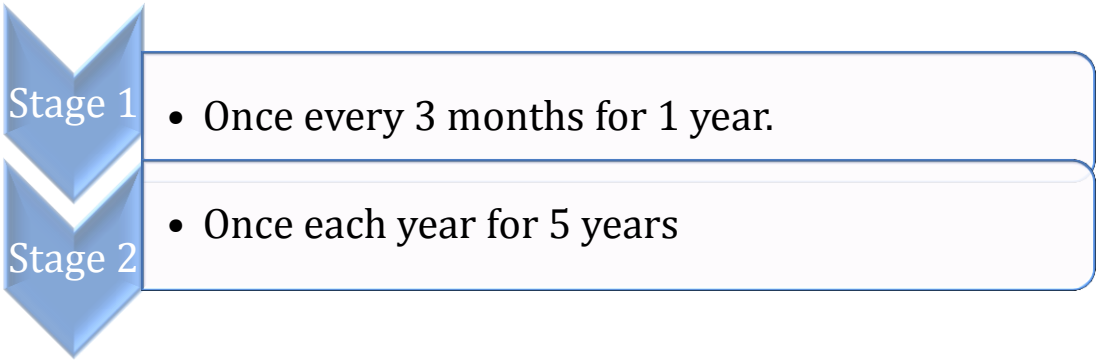
The costs given in the following tables are calculated for monitoring to be undertaken by hiring environmental consultants for each monitoring program. However, field data collected for the proposed environmental monitoring program can be carried out by an in house team of engineers and/or technical assistants since most of the parameters are to be investigated monthly and quarterly, and therefore hiring a consultant for each occasion may not be feasible. Nevertheless, if the contractor does not employ environmental experts among its staff, it is highly recommended that an arrangement is made with an environmental consultant on a long term basis to carry out and supervise the execution of the monitoring program. Additionally, it is an EPA requirement that the annual environmental monitoring report needs to be compiled and formulated by a registered environmental consultant with a **permanent** EIA consultant license.

The parameters that are most relevant for monitoring the impacts that may arise from the project are included in the monitoring plan. Therefore, the monitoring programme will cover the following aspects of the project:

- Ground water quality
- Defects in neighbouring structures
- Generation of wastes
- Noise pollution
- Traffic congestion

9.2 Recommended Monitoring Programme

As instructed in the TOR, the monitoring programme will be divided into 2 stages.



Stage 1

- Ground water quality for pH, temperature, EC, and salinity at project site
- Determine number, type and respective quantity of waste produced
- Noise measurement
- Survey the traffic within the same area as undertaken for this EIA
- Visual inspection of structure exterior of nearby buildings.

Stage 2

- Ground water quality for pH, temperature, EC, and salinity at project site
- Determine number, type and respective quantity of waste produced
- Noise measurement

- Determine quantity of accidents if any had occurred
- Survey the traffic within the same area as undertaken for this EIA

9.3 Cost of monitoring

The following tables outline the cost estimate for each stage of the monitoring plan given. The costs are calculated assuming the monitoring will be undertaken by hiring environmental consultants on a project basis. Since this monitoring is in Male' and does not involve expensive surveying equipment, and most are based on visual observation and consultation, the overall cost is low relative to most monitoring programs.

Table 13 Estimated costs of Stage 1 Monitoring Programme

Item No.	Details	Unit cost (US$)	Frequency	Total (US$)
1	Field allowance for 1 consultants for 1 day	75.0	4	300.00
2	Surveying and monitoring equipment depreciation	50.00	4	200.00
3	Laboratory charges	110.00	4	440.00
4	Compliance reporting (annual report)	800.00	1	800.00
	Total			**1740.00**

The monitoring is for a period of 1 year, where data is collected quarterly.

Table 14 Estimated costs of Stage 2 Monitoring Programme

Item No.	Details	Unit cost (US$)	Frequency	Total (US$)
1	Field allowance for 1 consultants for 1 day	75.00	5	375.00

2	Surveying and monitoring equipment depreciation	50.00	5	250.00
3	Laboratory charges	110.00	5	550.00
4	Compliance reporting (annual report)	800.00	5	4000.00
	Total for 5 years			**5175.00**

This monitoring is for a period of 5 years, where a data is collected annually. Therefore for each year the cost will be approximately USD 1035.00, not taking into account any effects of inflation and other such economic scenarios. Considering the 2 stages of monitoring, monitoring costs in the first year would be approximately **USD 1740.00**. The proponent has to endure the greatest cost during the first year, as frequency of monitoring is greater. However, in the following years the frequency considerably decreases.

Please note that the costs are subjective. It may vary depending on the consultant and also due to changes in price with time. Also, in the case that a long term arrangement is made with a consultant, the price may considerably decrease and may be more feasible for the proponent.

9.4 Monitoring Report

Monitoring report should be compiled based on the baseline data collected. This report should be submitted to the EPA and any other relevant government agencies for compliance, if requested. The report structure may include but not limited to;

- Introduction
- Details of the site at the time of investigation,
- Data collection and analysis,
- Details of methodologies and protocols followed
- Quality control measures,
- Sampling frequency and monitoring analysis
- Conclusion and recommendations

10 Conclusion

With the continued problem of land scarcity faced in the capital city, Male', projects of this nature is now inevitable in the capital island. The question on more high-rise buildings is not of if, but when, as more and more developers focus on vertical development. This land scarcity issue had also exponentially increased the cost of land in Male', and therefore it is very financially attractive for developers to invest huge sums to construct such large structures. Approval for the construction is obtained without any significant issues if the land area and neighbouring sites are favourable for development, as in the case with M. Dhoonifushi

From a regional environmental perspective, Male' is in quite a poor state. From a land use perspective, more parks and empty areas is what is required to make the city more liveable and less crowded. However, specific developments such as these cannot be stopped or altered on this basis. Such restrictions would need to come at a policy level. Looking at the norms and trend of development in Male', it can be argued that this project alone will contribute little to an already bad situation. From this projects perspective alone, the environmental impacts from the project is minor to moderate and can be easily mitigated. Apart from an indirect contribution to congestion at ground level, the only real concern is the impact on neighbouring building due to the construction of this new building. However, the probability of any significant impact occurring is low, while this can be mitigated by providing adequate foundation protection and other such measures as provided in this report and as already planned to be undertaken as part of the project

All the impacts as highlighted in the project can be mitigated. The socio economic benefits to the developer and also to the area are reasonably high. It also provides additional housing opportunities, which would contribute to alleviating the housing issues in Male'. Therefore, after consideration of all these perspectives and the fact that numerous such developments are continuously being undertaken, it is recommended that this project proceed as planned.

It is also recommended that restrictions for such developments in Male' come at a policy level in the near future, and especially government funded big apartment buildings are located elsewhere other than the capital city to decrease the worsening congestion issue. It is recommended for the project to proceed as planned after incorporating the mitigation measures given in this study with the commitment to implementing the monitoring plan given.

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Annex 1 – Terms of Reference

بسم الله الرحمن الرحيم

No: 203-EIARES/PRIV/2017/467

Terms of Reference for Environmental Impact Assessment for Development of 10- Storey building at M. Dhoonifushi

The following is the Terms of Reference (ToR) following the scoping meeting held on 22nd May 2017 for undertaking the EIA of the Proposed 10 Storey Building in Male' – M. Dhoonifushi. The proponent of the project is Jawad Shakeel (A 078331).

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

1. **Introduction to the project** – Describe the purpose of the project and, if applicable, the background of the project and the tasks already completed. Clearly identify the rationale and objectives to enable the formulation of alternatives. Define the arrangements required for the environmental assessment and if relevant, including how work carried out under this contract is linked and sequenced with other projects executed by other consultants, and how coordination between other consultants, contractors and government institutions will be carried out. List the donors and the institutions the consultant will be coordinating with and the methodologies used.

2. **Study area** – Submit an A3 size scaled plan with indications of all the proposed land infrastructures. Specify the boundaries of the study area for the environmental impact assessment highlighting the location and size of the proposed construction. The study area should include nearby environmentally sensitive areas. Justification for site selection is required. Relevant developments in the areas must also be addressed including residential areas, all economic ventures and cultural sites.

3. **Scope of work** – Identify and number tasks of the project including site preparation, construction and decommissioning phases.

   Task 1. Description of the proposed project – Provide a full description and justification of the relevant parts of the project, using maps at appropriate scales where necessary. All inputs and outputs related to the proposed activities shall be justified.

   1. Provide a clearly labeled concept design and scaled site plan of the project boundary.
   2. Submit a detailed description of the components of the project and how the project activities will be undertaken.
   3. A project schedule should be included.
   4. A matrix of inputs and outputs related to the proposed activities shall be included
   5. Need and justification for the proposed project
   6. Waste management during construction period including construction waste, demolition waste, and green waste where applicable.
   7. Dewatering plan

8. Description of any underground structures such as basement or wells.
9. Plans for road closures during construction
10. Details of vegetation clearance if any
11. Use of any energy conserving utilities
12. Details of the back-up generator to be installed
13. Estimated consumption of water and electricity and their sources
14. Fire Emergency Evacuation plan

Project management: Include communication of construction details, progress, target dates and duration of works, construction/operation/closure of labor camps, access to site, safety, equipment and material storage, water supply, waste management from construction operations, power and fuel supply for backup generators;

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

The baseline data will be collected before construction and from at least two benchmarks. All survey locations shall be referenced including water-sampling points.

Physical and Biological Environment
Noise levels in the vicinity of the site including any noise sensitive location
Traffic flow (size and direction) around the project site
Vegetation in the project site and major trees around it, if any
Water quality of groundwater wells in project site. Following parameters are to be tested: Conductivity, pH, Salinity, Temperature, TDS, and Turbidity

Built Environment
Nature of adjacent buildings if any
Condition of the surrounding roads
Existing structure/uses of the proposed site
Public facilities nearby

Socio-economic Environment
Demographic data for greater Male' area.
Brief description of social environment of Male' in general and adjacent residential units in particular
Identify types of vehicles and peak traffic hours in or near the project site

Task 3. Legislative and regulatory considerations – Identify the pertinent legislation, regulations and standards, and environmental policies that are relevant and applicable to the proposed project, and identify the appropriate authority jurisdictions that will specifically apply to the project. Legal requirements:

- Approval from the Ministry of Housing and Infrastructure

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

- Loss of vegetation if any
- Loss of visual amenity
- Land preparation and piling works if any
- Impacts on ground water table and water quality
- Impacts related to construction works on land including materials sourcing, transport and storage, building construction methodology and piling.
- Mosquito growth
- Noise, fugitive dust, traffic obstruction and other impacts related to traffic due to the project
- Impacts due to generation of waste
- Potential impacts of the development on adjacent properties and residential areas, especially sensitive areas like schools, pre-schools and mosques.
- Safety and security of the building
- Risk of accidents to workers and public
- Impacts on employment and income such as job opportunities
- Disturbances to residents and public facilities/activities nearby

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

Task 5. Alternatives to proposed project – Describe alternatives including the *"no action option"* should be presented. Determine the best practical environmental options. Alternatives examined for the proposed project that would achieve the same objective including the "no action alternative". All alternatives must be compared according to international standards and commonly accepted standards as much as possible. The comparison should yield the preferred alternative for implementation. Mitigation options should be specified for each component of the proposed project.

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

Task 7. Development of monitoring plan (see appendix)– Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan for ground water as well as defects in neighbouring structures. Detail of the monitoring program including the physical and biological parameters for monitoring, cost commitment from responsible person to conduct monitoring in the form of a commitment letter, detailed reporting scheduling, costs and methods of undertaking the monitoring program must be provided.

Task 7. Stakeholder consultation, Inter-Agency coordination and public/NGO participation – The EIA report should include a list of people/groups consulted and summary of the major outcomes and concerns raised. The following parties should be consulted.

a) MWSC
b) STELCO
c) HPA
d) WAMCO

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 f or any references used in interpreting those data. The environmental assessment report will be organized according to, but not necessarily limited by, the outline given in the Environmental Impact Assessment Regulations, 2012

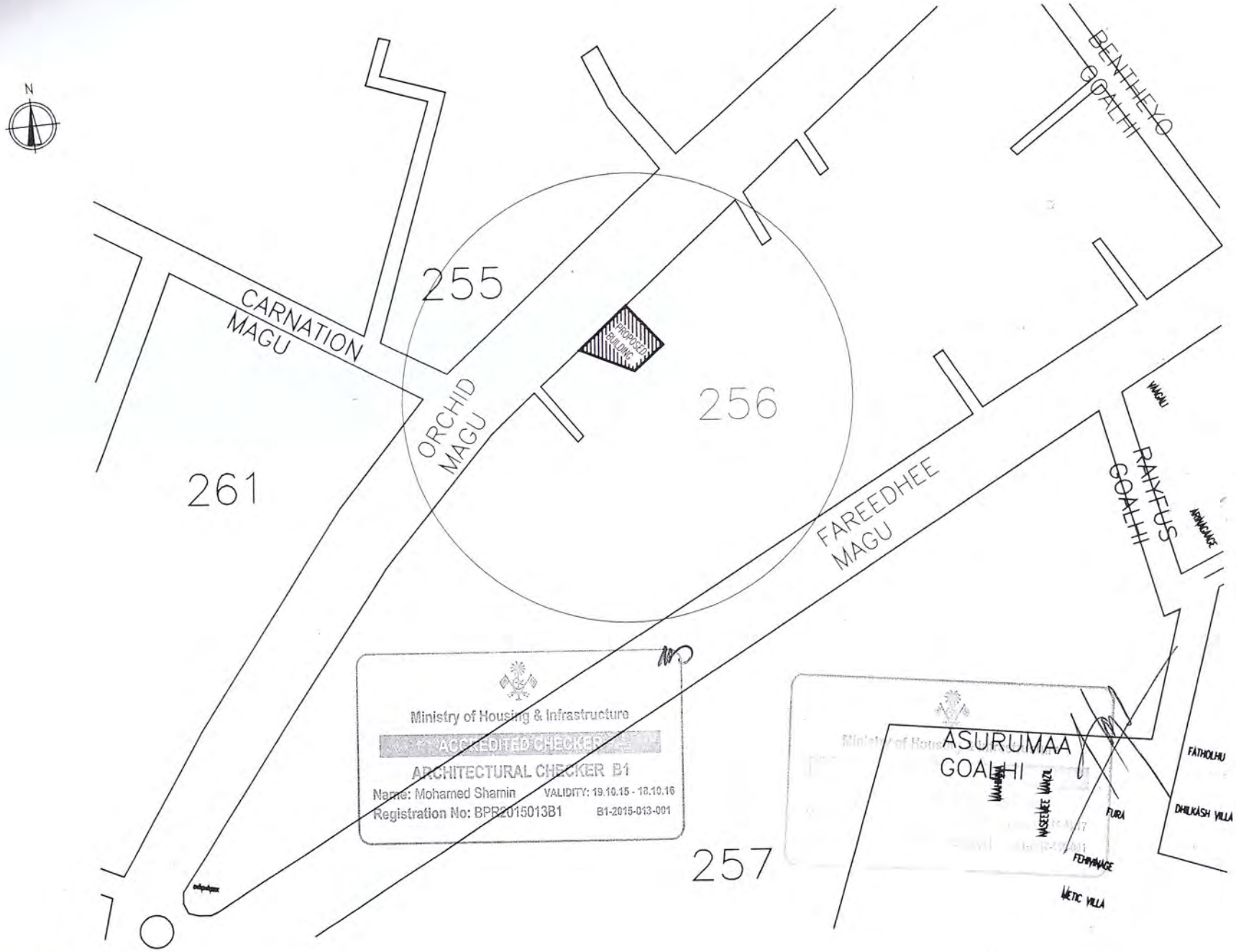
Timeframe for submitting the EIA report – The developer must submit the completed EIA report within 3 months from the date of this Term of Reference.

22nd May 2017

ENVIRONMENTAL PROTECTION AGENCY
Male', Rep of Maldives

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

Annex 2 –Site layout



LOCATION PLAN

NOT TO SCALE

PROJECT TITLE:	DHOONIFUSHI, MALE', MALDIVIES
	SUBMISSION DRAWING
CLIENT :	MR. ISHAN MAHMOOD
ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-
DWG NO :	A-01/13

Annex 3 – Approved Design

ARCHITECTURAL CHECKER'S CERTIFCATE

for architectural design compliance - category B1

1. I, Mohamed Shamin being a registered checker, hereby certifies that I have in accordance with Male' Planning Regulation and other applicable regulations relevant to planning, design and construction of buildings set out by the Government Authorities, have carried out an evaluation and review of the drawings of the building works attached and to the best of my knowledge and belief the drawings do not show any incompliance in the design of the building to be erected or by the works carried out in accordance with those drawings.
2. In arriving at my conclusion, I confirm that I have reviewed and checked the design in accordance with the relevant regulations using the following criteria: -

    a. rules and regulations set out by the authorities in relation to building design and construction;

    b. codes of practice adopted in the design;

    c. standards and specifications of materials;

    d. architectural design concept;

    e. architectural detailing;

    f. appropriate checklists set out by the authorities (included with this Certificate);

    g. others specify.....

Plot Name/No: M. Dhoonifushi

City/Atoll/Island: K. Male'

Type of Building (use): Residential

Plot Owner's Name: Ajwad Shakeel
Jawad Shakeel

Name of Architect: Mohamed Shamin

Date: 16-10-2016

Reg. Number: BPR2015013B1

Signature: .....

Ministry of Housing & Infrastructure

ARCHITECTURAL CHECKER: B1

Official Stamp of the
Registered Architectural Checker

FOR OFFICIAL USE ONLY

Building Permit No.:	Local Authority's Stamp
.....	APPROVED PERMIT No: 1-2007/333 DATE: 20-11-2016 SIGNATURE MINISTRY OF HOUSING AND INFRASTRUCTURE MALE', REPUBLIC OF MALDIVES

STRUCTURAL CHECKER'S CERTIFCATE

for structural design compliance - category A1

1. I *Ashraf Hameed* being a registered checker, hereby certifies that I have in accordance with Male' Planning Regulation and other applicable regulations relevant to planning, design and construction of buildings set out by the Government Authorities, have carried out an evaluation and review of the drawings of the building works attached and to the best of my knowledge and belief the drawings do not show any incompliance in the design of the building to be erected or by the works carried out in accordance with those drawings.
2. In arriving at my conclusion, I confirm that I have reviewed and checked the design in accordance with the building regulations using the following criteria:-

    a. Codes of practice adopted in the design;

    b. Including wind load, construction load or dynamic load, (if applicable) checked;

    c. Standards and specifications of structural elements;

    d. Structural design concept and identification of the key structural elements;

    e. Structural analysis and design of all key structural elements including foundation systems;

    f. Stability of structural frame;

    g. Structural detailing;

    h. Others specify.....

Plot Name/No: ~~*H. Dhiyadhooge*~~ *M. Dhoonifushi*

City/Atoll/Island: *Male'*

Type of Building (use): *Residential*

Plot Owner's Name: *Mr. Ajwad Shakeel*
Mr. Jawad Shakeel

Name of Engineer: *Ashraf Hameed*

Date: *16th October 2016*

Checker's Reg. Number: *BPR2016006A1*

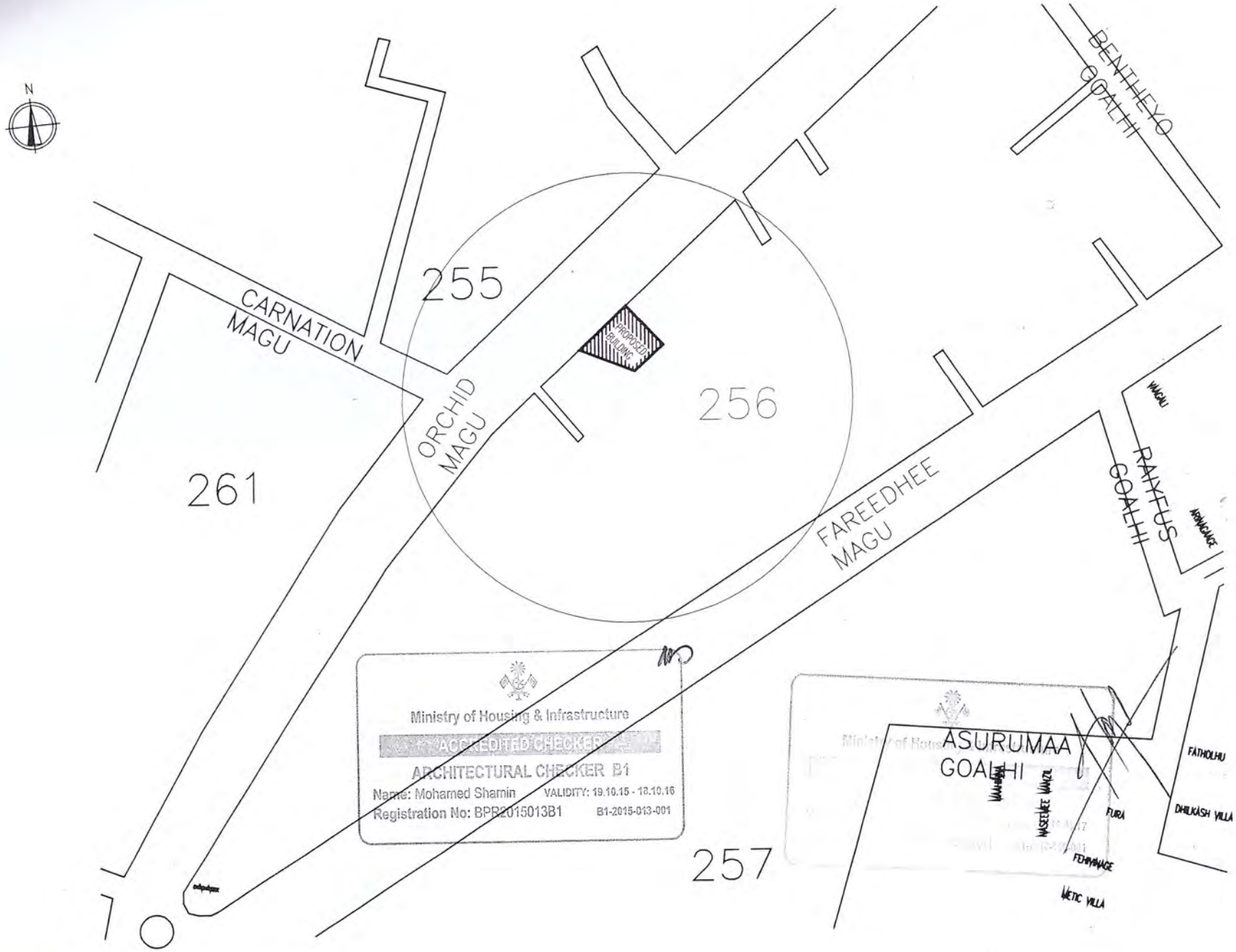
Checker's Signature: .....

Ministry of Housing & Infrastructure
STRUCTURAL CHECKER - A1
Name: Ashraf Hameed
Registration No: BPR2016006A1

Official Stamp of the Registered Structural Checker

FOR OFFICIAL USE ONLY

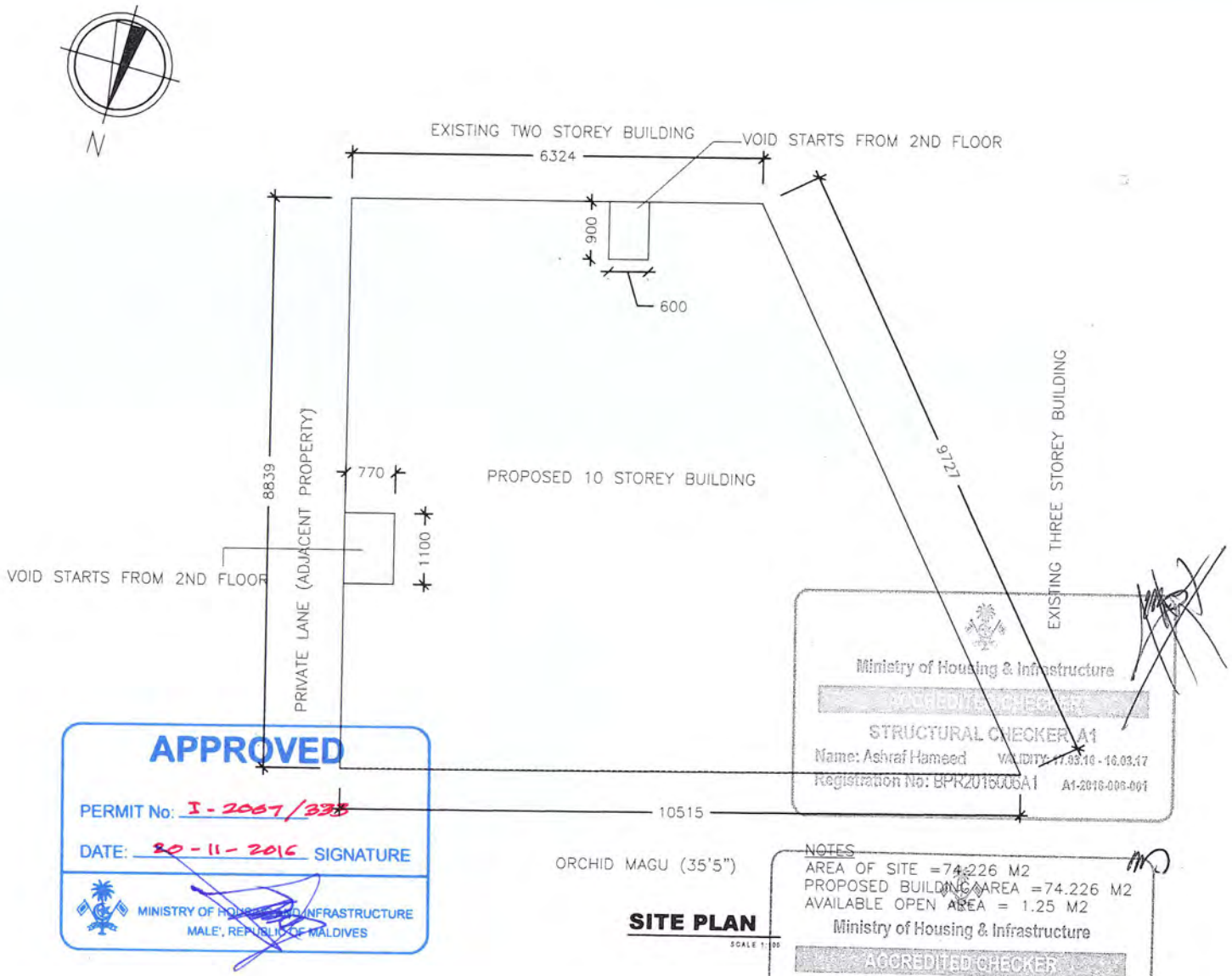
Building Permit No.:	Local Authority's Stamp
.....	APPROVED PERMIT No: I - 2007/333 DATE: 30 - 11 - 2016 SIGNATURE MINISTRY OF HOUSING AND INFRASTRUCTURE MALE', REPUBLIC OF MALDIVES



LOCATION PLAN

NOT TO SCALE

PROJECT TITLE:	DHOONIFUSHI, MALE', MALDIVIES
	SUBMISSION DRAWING
CLIENT :	MR. ISHAN MAHMOOD
ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-
DWG NO :	A-01/13



SITE PLAN

SCALE 1:100

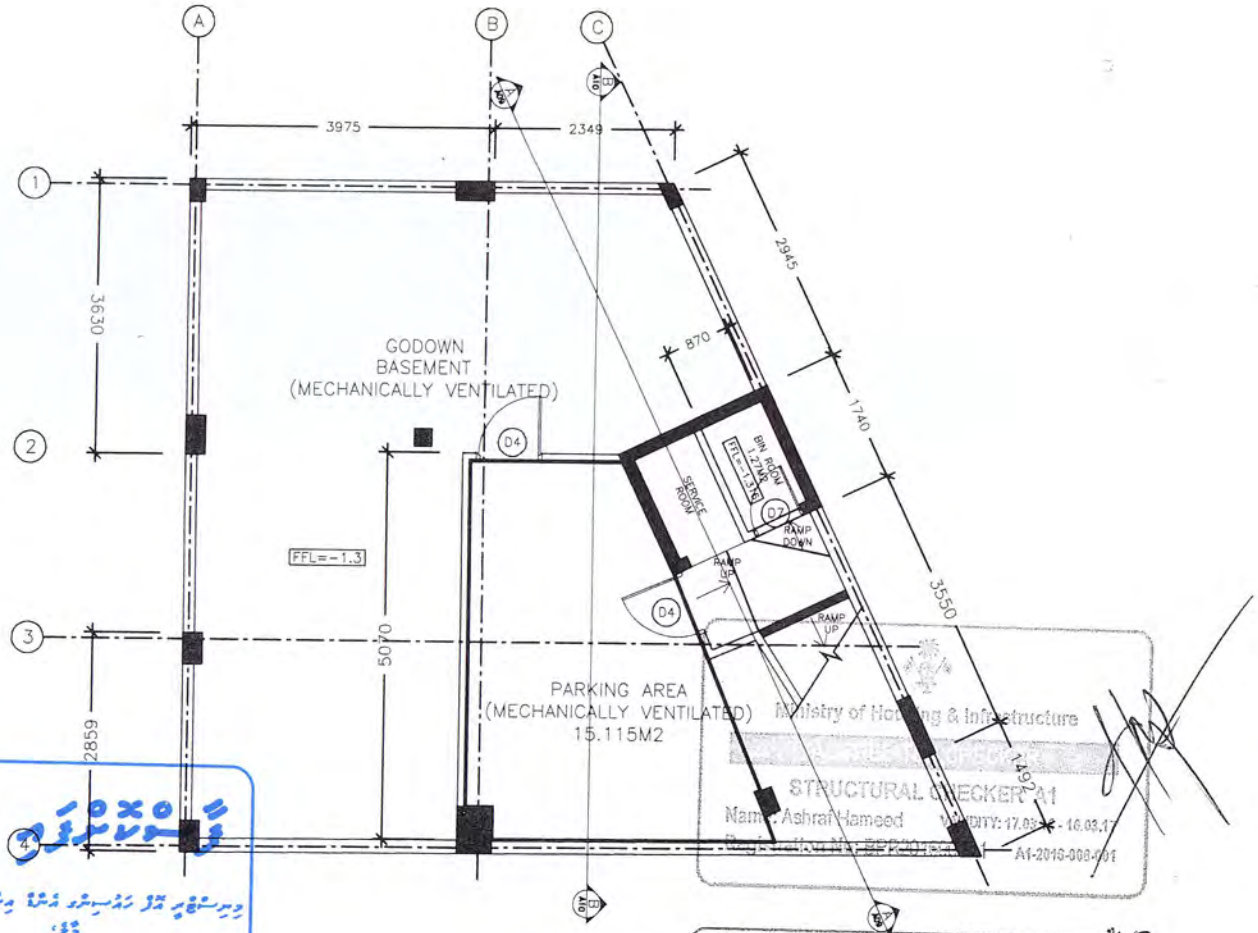
PROJECT TITLE:
DHOONIFUSHI
MALE', MALDIVES

SUBMISSION DRAWING

CLIENT :
MR. ISHAN MAHMOOD

ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-

DWG NO :
A-02/13



NOTE: RAMP SLOPE NOT FOR RIDING IN OR OUT BUT FOR PUSHING THE BIKE

BASEMENT FLOOR PLAN

SCALE 1:100

Ministry of Housing & Infrastructure
ACCREDITED CHECKER
ARCHITECTURAL CHECKER B1
Name: Mohamed Shamin VALIDITY: 19.10.15 - 18.10.16
Registration No: BPR201501 3B1 B1-2015-013-001

Ministry of Housing & Infrastructure
STRUCTURAL CHECKER A1
Name: Ashraf Hameed VALIDITY: 17.03 - 16.03.17
A1-2016-008-001

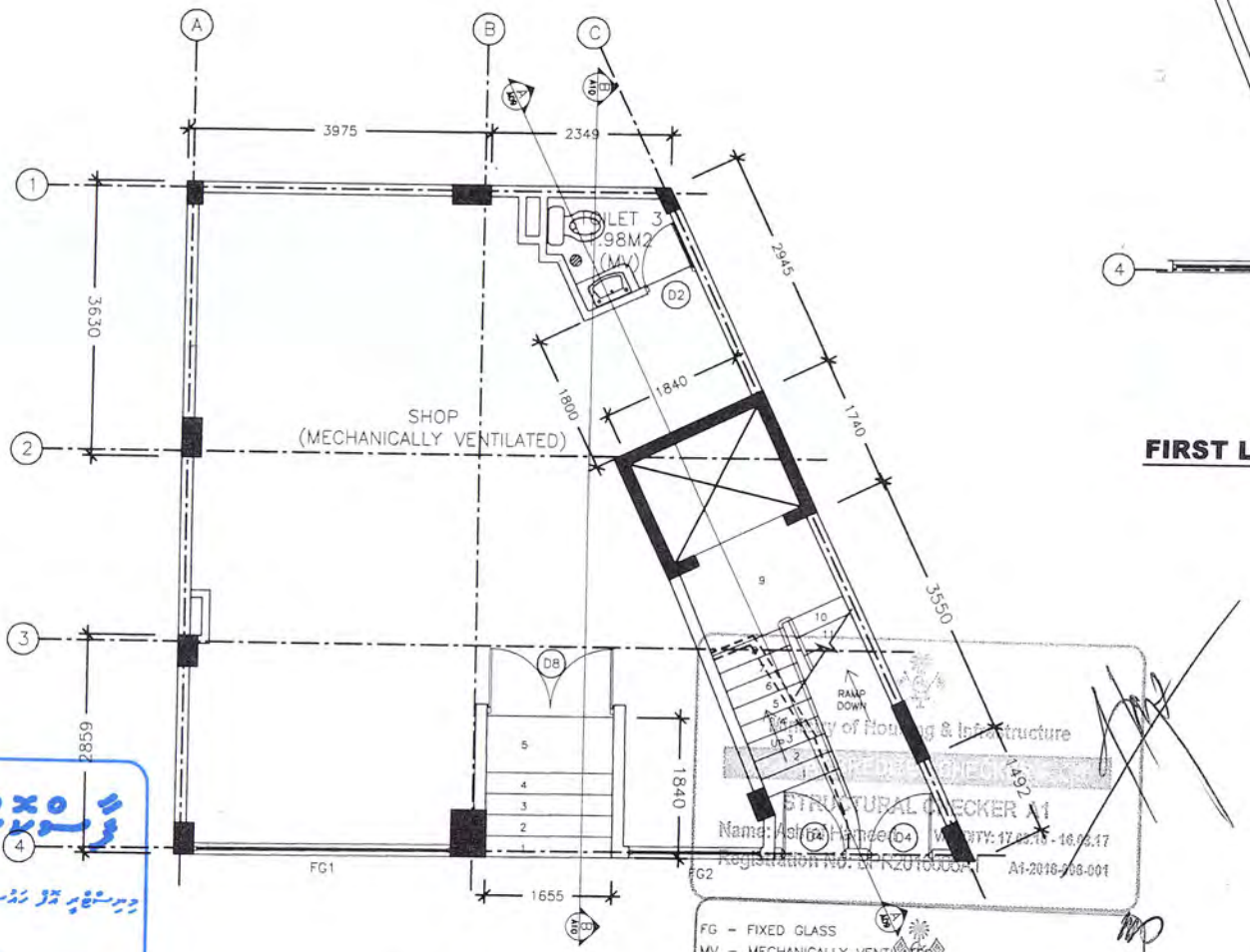
PROJECT TITLE:
DHOONIFUSHI
MALE', MALDIVES

SUBMISSION DRAWING

CLIENT :
MR. ISHAN MAHMOOD

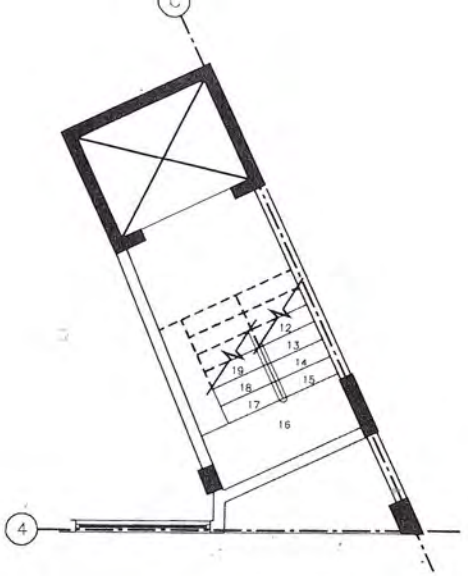
ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-

DWG NO :
A-03/13



GROUND FLOOR PLAN

SCALE 1:100



FIRST LANDING PLAN

SCALE 1:100

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ފަރާތް،

ދިރާސާ ކުރުވުނު

Ministry of Housing & Infrastructure
ACCREDITED CHECKER
STRUCTURAL CHECKER A1
Name: Ashraf Hameed VALIDITY: 17.03.15 - 16.03.17
Registration No: BR KZ0160003A1 A1-2016-008-001

FG - FIXED GLASS
MV - MECHANICALLY VENTILATED

Ministry of Housing & Infrastructure
ACCREDITED CHECKER
ARCHITECTURAL CHECKER B1
Name: Mohamed Shamin VALIDITY: 19.10.15 - 18.10.16
Registration No: BPR201501 3B1 B1-2015-013-001

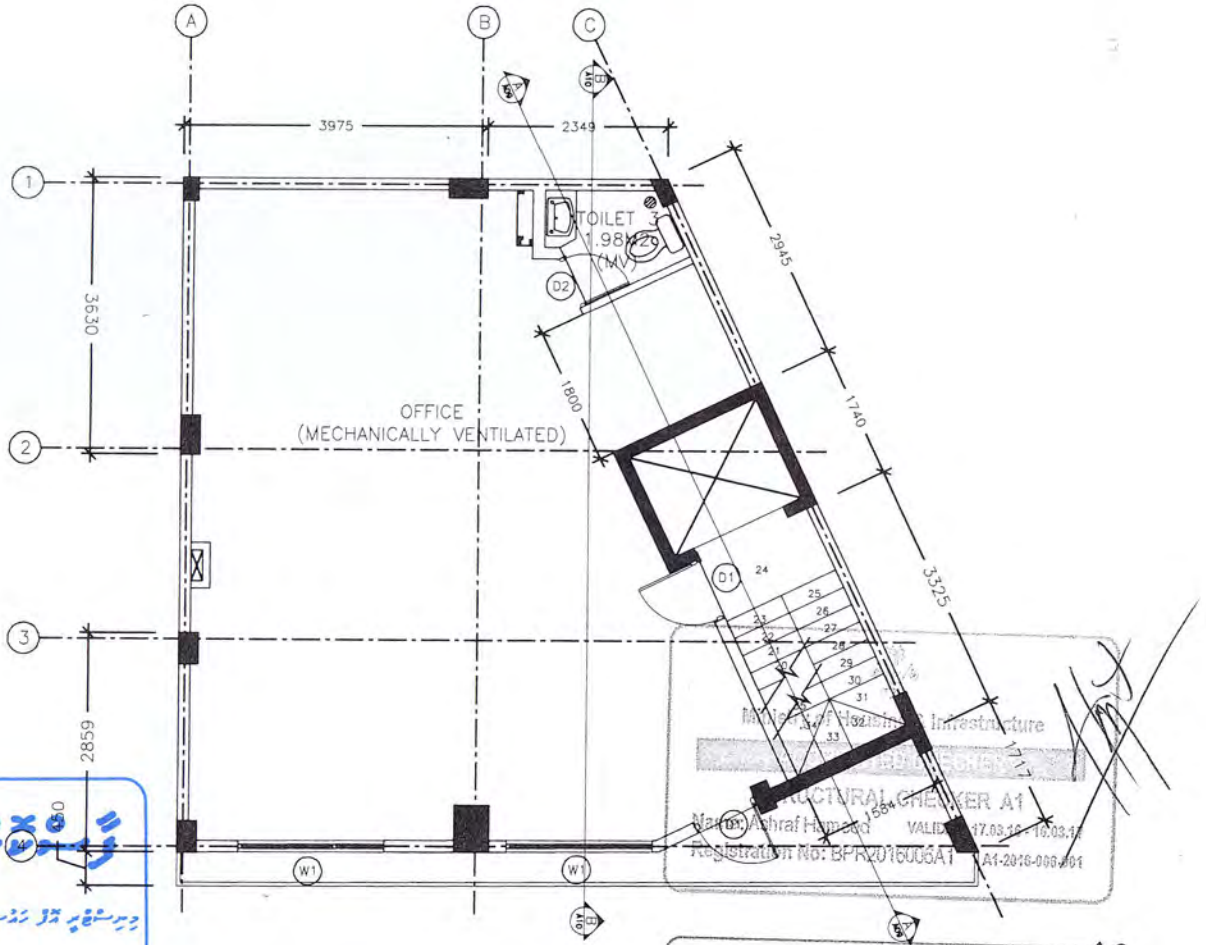
PROJECT TITLE:
DHOONIFUSHI
MALE', MALDIVES

SUBMISSION DRAWING

CLIENT :
MR. ISHAN MAHMOOD

ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-

DWG NO : A-04/13



FIRST FLOOR PLAN

SCALE 1:100

MV – MECHANICALLY VENTILATED

Ministry of Housing & Infrastructure

ACCREDITED CHECKER

ARCHITECTURAL CHECKER B1

Name: Mohamed Shamin VALIDITY: 19.10.15 - 18.10.16

Registration No: BPR2015013B1 B1-2015-013-001

Ministry of Housing & Infrastructure

ACCREDITED CHECKER

ARCHITECTURAL CHECKER A1

Name: Ashraf Hameed VALIDITY: 17.03.16 - 16.03.17

Registration No: BPR2016006A1 A1-2016-006-001

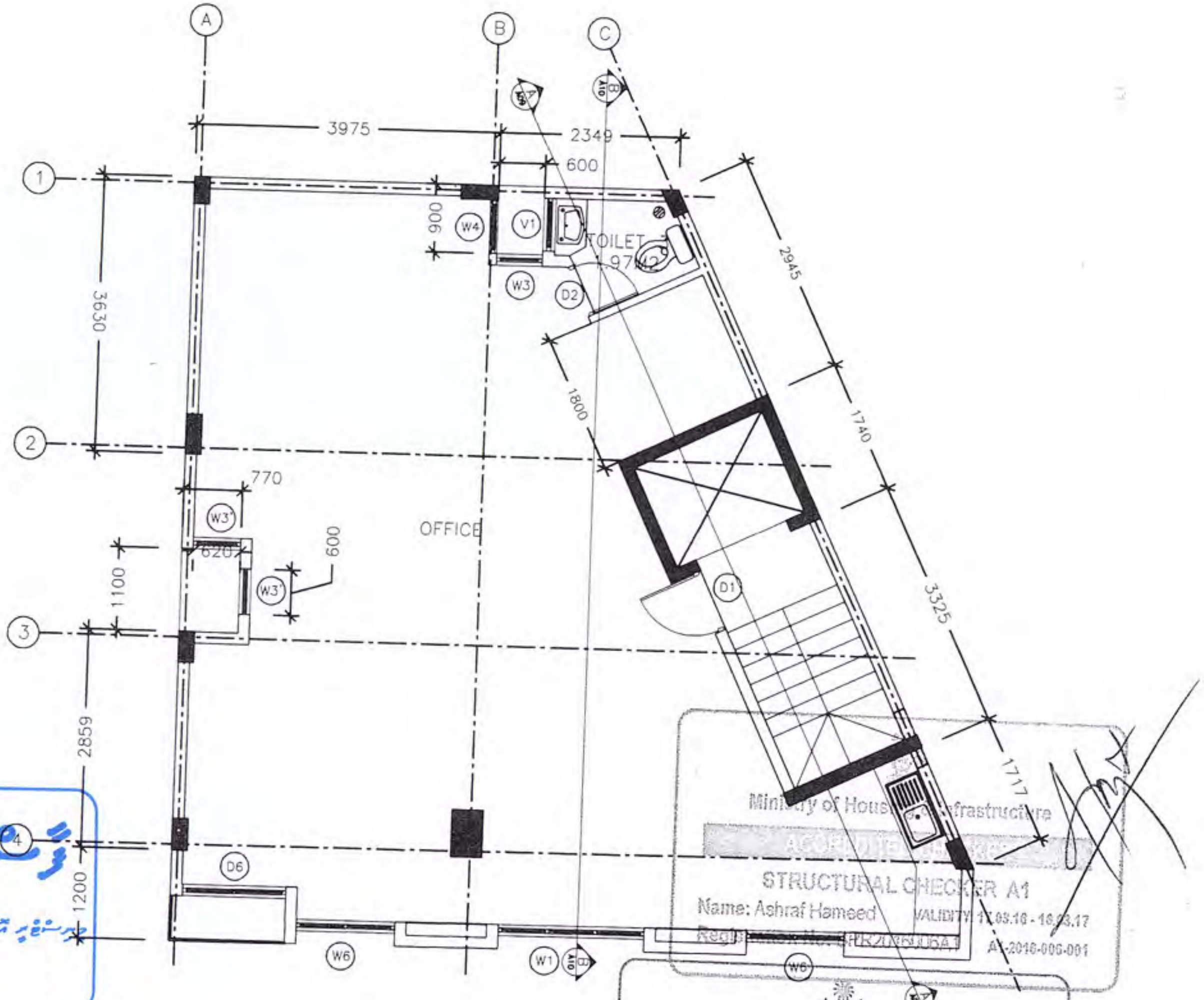
PROJECT TITLE:
DHOONIFUSHI
MALE', MALDIVIES

SUBMISSION DRAWING

CLIENT :
MR. ISHAN MAHMOOD

ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-

DWG NO :
A-05/13

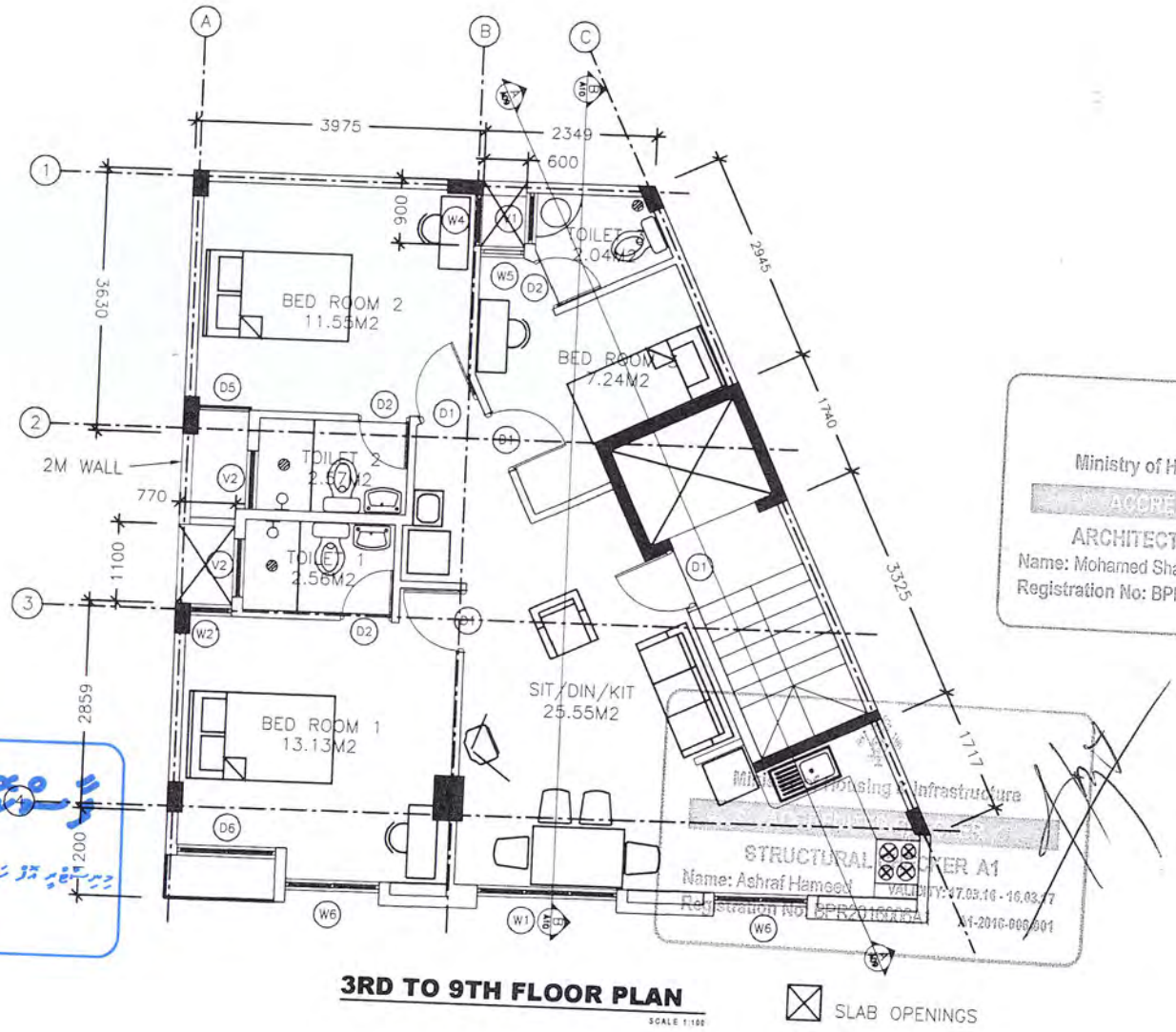


SECOND FLOOR PLAN
SCALE 1:100

Ministry of Housing & Infrastructure
ACCREDITED CHECKER
STRUCTURAL CHECKER A1
Name: Ashraf Hameed VALIDITY: 19.03.16 - 18.03.17
Registration No: BPR2016006A1 A1-2016-006-001

Ministry of Housing & Infrastructure
ACCREDITED CHECKER
ARCHITECTURAL CHECKER B1
Name: Mohamed Shamin VALIDITY: 19.10.15 - 18.10.16
Registration No: BPR2015013B1 B1-2015-013-001

PROJECT TITLE:	DHOONIFUSHI MALE', MALDIVIES
	SUBMISSION DRAWING
CLIENT :	MR. ISHAN MAHMOOD
ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-
DWG NO :	A-06/13



3RD TO 9TH FLOOR PLAN

SCALE 1:100

SLAB OPENINGS

Ministry of Housing & Infrastructure

ACCREDITED CHECKER

ARCHITECTURAL CHECKER B1

Name: Mohamed Shamin VALIDITY: 19.10.15 - 18.10.16

Registration No: BPR2015013B1 B1-2015-013-001

Ministry of Housing & Infrastructure

ACCREDITED CHECKER

STRUCTURAL CHECKER A1

Name: Ashraf Hameed VALIDITY: 17.03.16 - 16.03.17

Registration No: BPR2016002A A1-2016-002-001

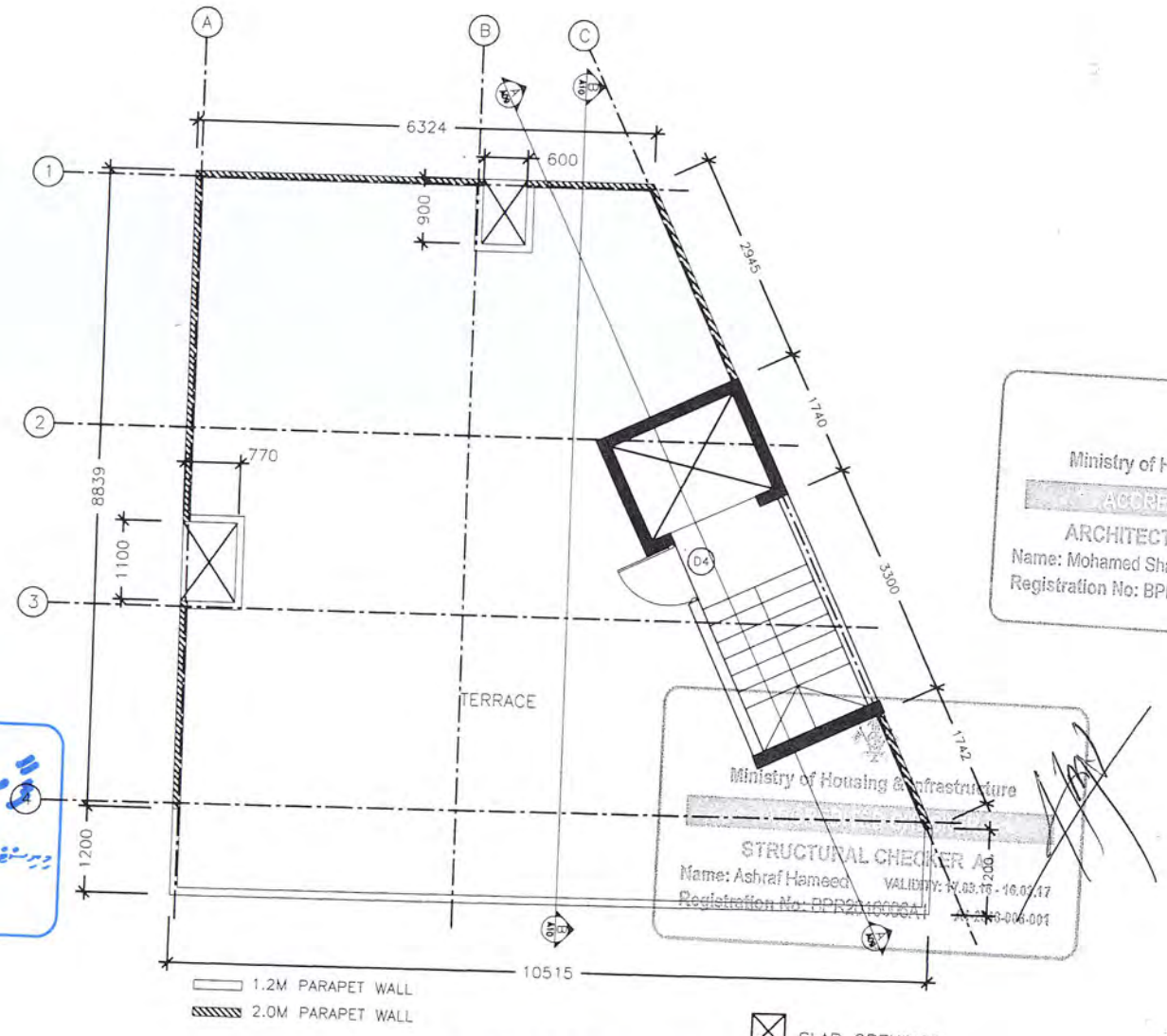
PROJECT TITLE:
DHOONIFUSHI
MALE', MALDIVES

SUBMISSION DRAWING

CLIENT :
MR. ISHAN MAHMOOD

ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-

DWG NO :
A-07/13



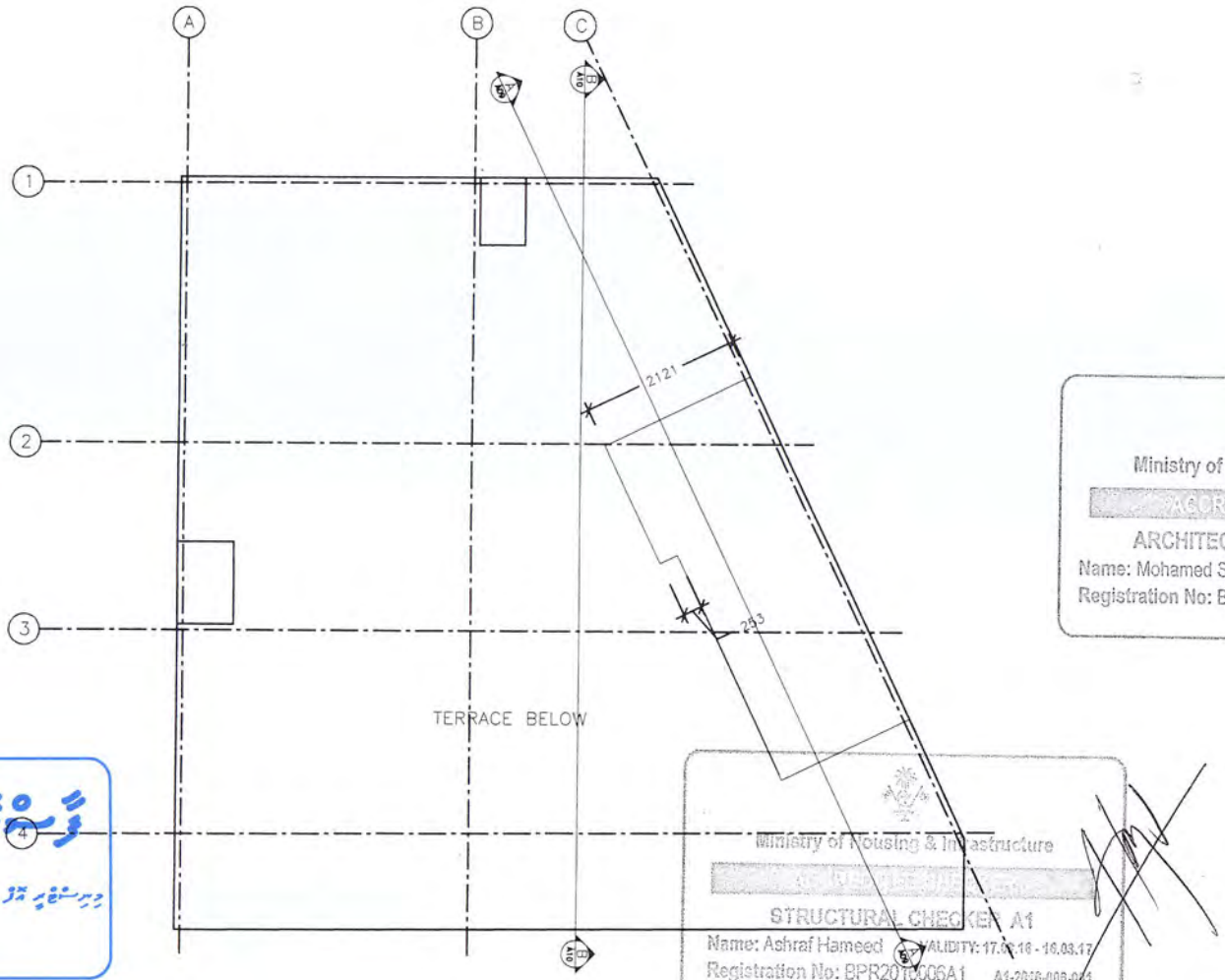
TERRACE PLAN

SCALE 1:100

Ministry of Housing & Infrastructure
ACCREDITED CHECKER
ARCHITECTURAL CHECKER B1
Name: Mohamed Shamin VALIDITY: 19.10.15 - 18.10.16
Registration No: BPR2015013B1 B1-2015-013-001

Ministry of Housing & Infrastructure
ACCREDITED CHECKER
STRUCTURAL CHECKER A2
Name: Ashraf Hameed VALIDITY: 17.03.16 - 16.03.17
Registration No: BPR2016008A1 A2-2016-008-001

PROJECT TITLE:	DHOONIFUSHI MALE', MALDIVES
	SUBMISSION DRAWING
CLIENT :	MR. ISHAN MAHMOOD
ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-
DWG NO :	A-08/13



Ministry of Housing & Infrastructure
ACCREDITED CHECKER
ARCHITECTURAL CHECKER B1
Name: Mohamed Shamin VALIDITY: 19.10.15 - 18.10.16
Registration No: BPR2015013B1 B1-2015-013-001

Ministry of Housing & Infrastructure
ACCREDITED CHECKER
STRUCTURAL CHECKER A1
Name: Ashraf Hameed VALIDITY: 17.0[illegible]16 - 16.03.17
Registration No: BPR2016006A1 A1-2016-006-001

ދާއިރާ ކައުންސިލް
ދިރާސާ ކުރެވިފައިވާ ތަކެއް ކަމަށް ތަކެއް ކަމަށް
ދާއިރާ
ތާރީޚް

ROOF SLAB PLAN
SCALE 1:100

PROJECT TITLE:
DHOONIFUSHI
MALE', MALDIVES

SUBMISSION DRAWING

CLIENT :
MR. ISHAN MAHMOOD

ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-

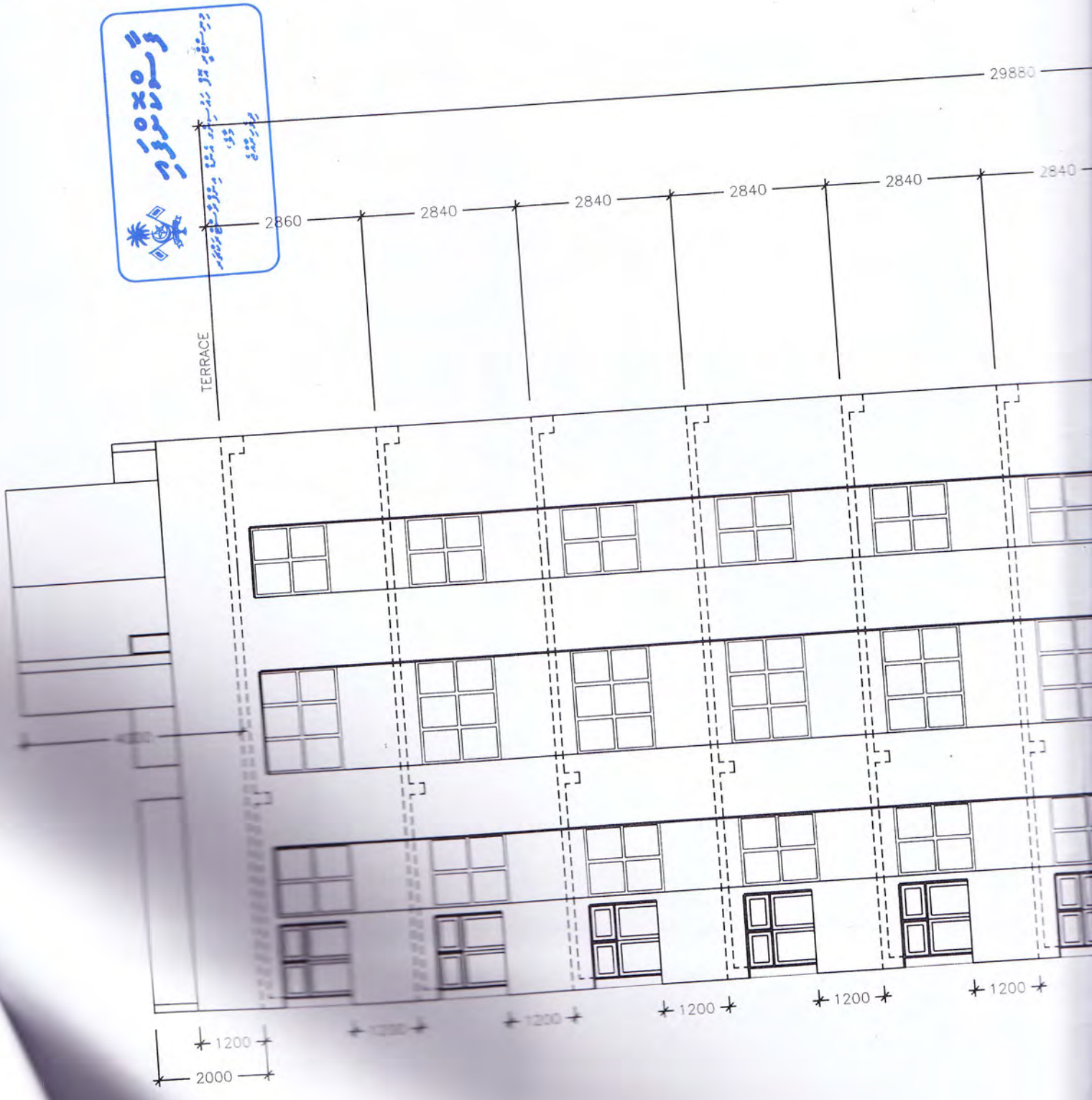
DWG NO : A-09/13

4000
2000
2000
1200
2860
2710
2840
2710
2840
2710
2840
2710
2840
2710
TERRACE
NINETH FLOOR
EIGHTH FLOOR
SEVENTH FLOOR
SIXTH FLOOR
FIFTH FLOOR

SECTION BB

SCALE 1:100

PROJECT TITLE:	DHOONIFUSHI MALE', MALDIVES
	SUBMISSION DRAWING
CLIENT :	MR. ISHAN MAHMOOD
ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-
DWG NO :	A-10/17


29880
2860
2840
2840
2840
2840
2840
TERRACE
1200
1200
1200
1200
1200
2000

FRONT ELEVATION

SCALE 1:100

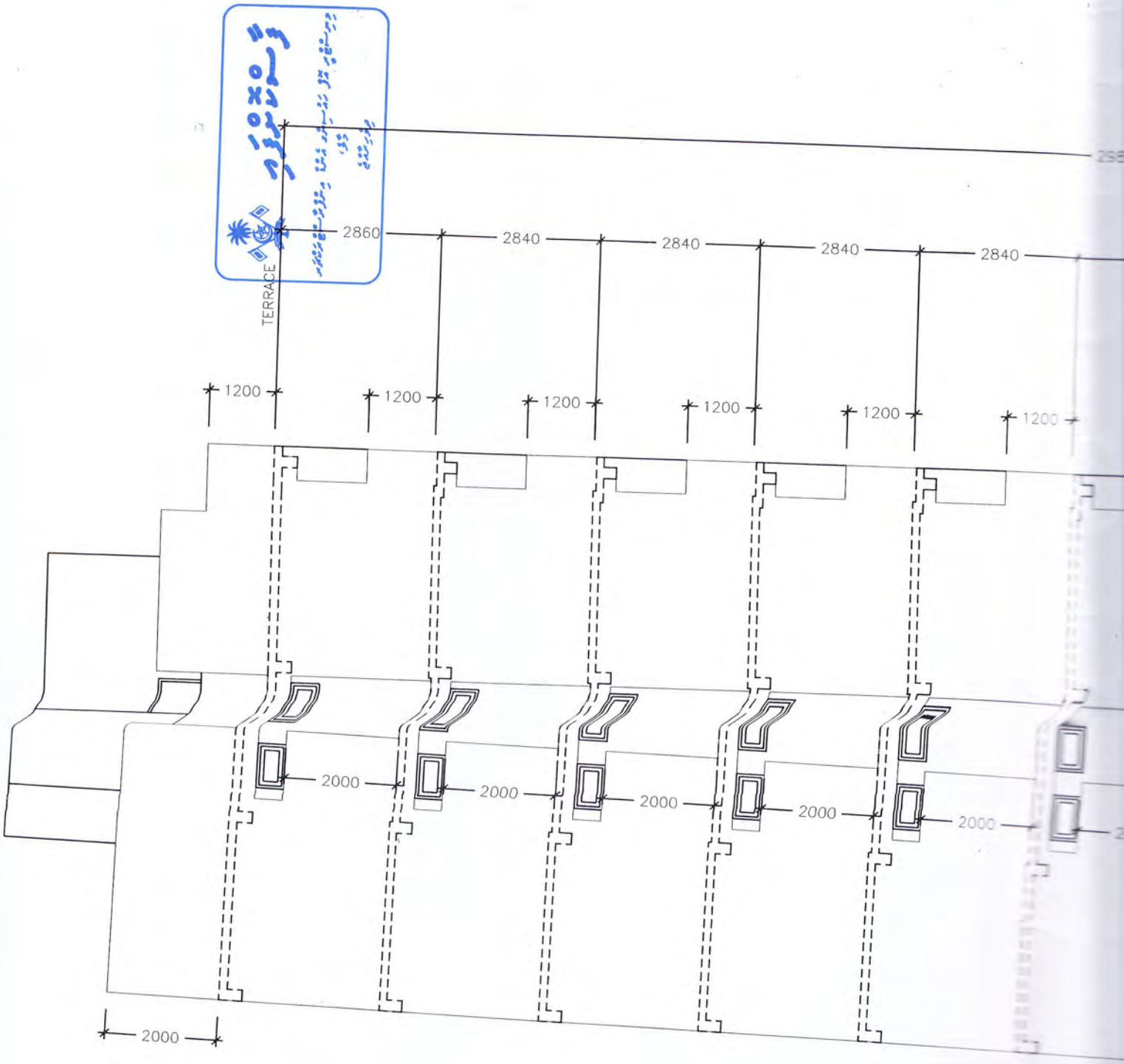
PROJECT TITLE:
DHOONIFUSHI
MALE', MALDIVES

SUBMISSION DRAWING

CLIENT :
MR. ISHAN MAHMOOD

ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-

DWG NO : A-12/17


TERRACE
2860
2840
2840
2840
2840
1200
1200
1200
1200
1200
1200
2000
2000
2000
2000
2000
2000

SIDE ELEVATION

SCALE 1:100

PROJECT TITLE:
DHOONIFUSHI
MALE', MALDIVES

SUBMISSION DRAWING

CLIENT :
MR. ISHAN MAHMOOD

ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-

DWG NO : A-13/17

VENTILATION TABLE

ROOM NUMBER	AREA	WINDOOR NUMBER	REQUIRED OPEN AREA	DESIGNED OPEN AREA
GODOWN (BASEMENT)	40.19msq	MECHANICALLY VENTILATED		
SHOP (GRND)	50.10msq	MECHANICALLY VENTILATED		
OFFICE (1ST FLR)	53.52 msq	MECHANICALLY VENTILATED		
OFFICE (2ND FLR)	66.122 msq	W1,W3,W3',W3',W4,W6, W6,D6	6.612msq	8.22msq
BEDROOM 1	13.13 msq	D6, W6, W2'	1.313msq	3.22msq
BEDROOM 2	11.55 msq	D5, W4	1.155 msq	2.27msq
BEDROOM 3	7.24 msq	W5	0.724 msq	0.81msq
TOILETS 1 & 2	2.567msq	V2 / MV	0.257 msq	0.28msq
TOILETS 3 (GROUND,1st)	2.04 msq	MV	0.204 msq	MV
TOILETS 3 (2nd and above)	2.04 msq	V1/ MV	0.204 msq	0.24msq
SIT/DIN/KIT	25.55 msq	W1, W6	2.555 msq	2.577msq

MV= MECHANICALLY VENTILATED

ދިވެހިރާއްޖެ ގެ ހައުސިންގ ހަދާ ބިނާ ތަރައްޤީ ވަޒާރާ

ދ.ގ.

ލައިސަންސް

Ministry of Housing & Infrastructure
ACCREDITED CHECKER
ARCHITECTURAL CHECKER B1
Name: Mohamed Shamin VALIDITY: 19.10.15 - 18.10.16
Registration No: BPR2015013B1 B1-2015-013-001

Ministry of Housing & Infrastructure
STRUCTURAL CHECKER A1
Name: Ashraf Hameed VALIDITY: 17.03.16 - 16.03.17
Registration No: BPR2016006A1 A1-2016-006-A1

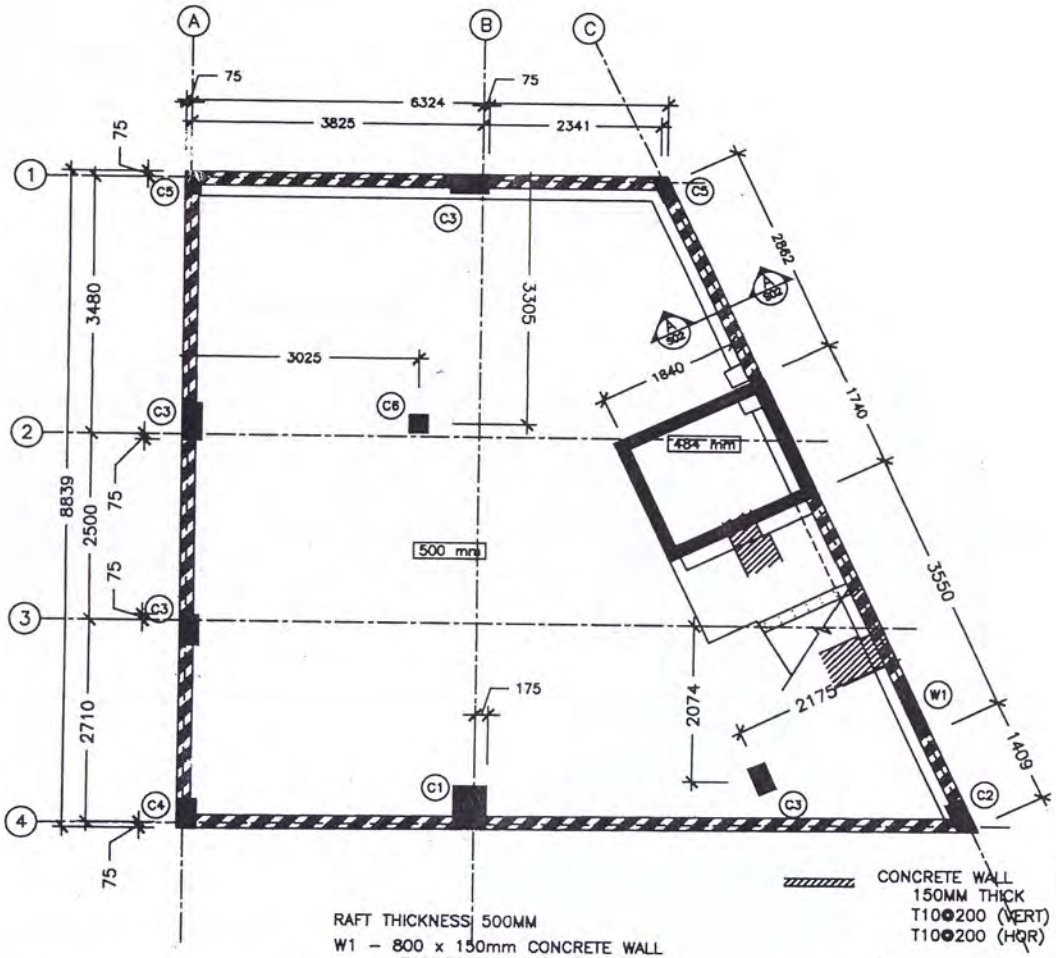
PROJECT TITLE:
DHOONIFUSHI
MALE', MALDIVES

SUBMISSION DRAWING

CLIENT :
MR. ISHAN MAHMOOD

ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-

DWG NO :
A-14/17



RAFT THICKNESS 500MM
W1 – 800 x 150mm CONCRETE WALL
T12@250 VERTICAL (CENTRAL)
T12@250 HORIZONTAL (CENTRAL)

CONCRETE WALL
150MM THICK
T10@200 (VERT)
T10@200 (HOR)

CONCRETE WALL
175MM THICK
REFER TO SECTION
FOR REINFORCEMENT

RAFT GENERAL ARRANGEMENT PLAN

SCALE 1:100

Ministry of Housing & Infrastructure
ACCREDITED CHECKER
ARCHITECTURAL CHECKER B1
Name: Mohamed Shamin VALIDITY: 19.10.16 - 18.10.17
Registration No: BPR2016013B1 B1-2016-013-001

GENERAL CONSTRUCTION NOTES

1. FLOOR LIVE LOADS USED IN THE DESIGN ARE:
   a) STORAGE 10.0kPa
   b) STAIRS 4.0kPa
   c) OFFICE AREA 3.0kPa
   d) LIVING AREAS 2.0kPa
   e) TERRACE 12.0kPa
   NO LIVE LOAD REDUCTION IS USED IN THE CALCULATIONS

CONCRETE WORK

1. THE CONTRACTOR SHALL ENSURE THAT BARS SHALL AT ALL TIMES BE PLACED IN THE EXTREME CORNERS OF LIGATURES TO BEAMS AND COLUMNS. SPACING OF ADJACENT BARS IN BEAMS AND COLUMNS SHALL BE 30mm AND 40mm RESPECTIVELY.
2. UNLESS OTHERWISE NOTED THE MINIMUM COVER TO REINFORCEMENT, INCLUDING LIGATURES SHALL BE:
   COLUMNS :-30 INTERNAL; 60 EXTERNAL EXPOSURE
   WALLS :-40 INTERNAL; 60 EXTERNAL EXPOSURE
   BEAMS :-30 INTERNAL; 60 EXTERNAL EXPOSURE
   RAFT :-70 BOTTOM & SIDES; 30 TOP
   FOUNDATION BEAMS :-70 BOTTOM & OUTER FACE; 60 ELSE WHERE
   SUSP. SLABS :-25 SHELTERED; 35 EXPOSED
3. ALL LAP LENGTHS SHALL BE 40 x SMALLER BAR DIAMETER.
4. THE CONTRACTOR SHALL ENSURE BLOCKWORK PALLETS STACKED ON ANY FLOOR SLAB, TOGETHER WITH CONSTRUCTION LIVE LOAD, DOES NOT EXCEED THE DESIGN LIVE LOAD AT ANY TIME.
5. THE CONTRACTOR SHALL CO-ORDINATE THE INSTALLATION OF IN-GROUND PLUMBING AND ELECTRICAL SERVICES. PIPES AND CONDUITS SHALL NOT PASS THROUGH FOOTINGS WITHOUT THE ENGINEERS SPECIFIC APPROVAL. WHERE NECESSARY, SET DOWN OR STEP DOWN FOOTINGS TO PERMIT PIPES AND CONDUITS TO PASS OVER FOOTINGS.
6. FOR SUSPENDED SLABS RUN CONDUITS BETWEEN THE TOP AND BOTTOM REINFORCEMENT. AVOID CONGESTION OF PIPES AND CONDUITS. ENSURE 75MM MINIMUM CLEAR SPACING BETWEEN CONDUITS.
7. DO NOT INSTALL PIPES OR CONDUITS IN STRUCTURAL BEAMS WITHOUT SPECIFIC APPROVAL OF THE ENGINEER.
8. DO NOT INSTALL PENETRATIONS IN SUSPENDED SLABS WITHOUT THE APPROVAL OF THE ENGINEER.
9. AN INTEGRATED WATER PROOFING ADMIXTURE SUCH AS SIKA PLASTOCRETE PLUS SHALL BE INCORPORATED IN THE FOUNDATION, WALL AND COLUMN CONCRETE.

Ministry of Housing & Infrastructure
ACCREDITED CHECKER
STRUCTURAL CHECKER A1
Name: Ashraf Hameed VALIDITY: 17.03.16 - 16.03.17
Registration No: BPR2016006A1 A1-2016-006-001

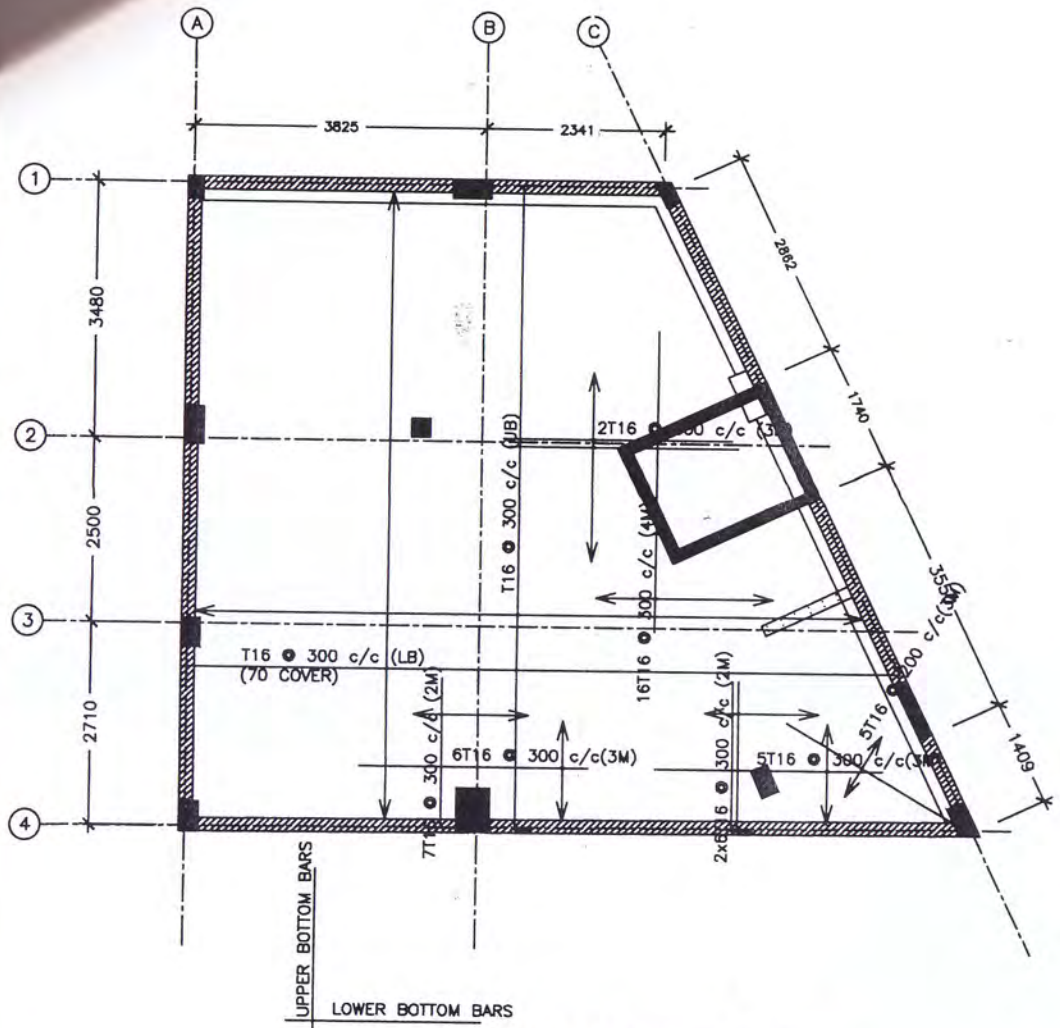
PROJECT TITLE:
DHOONIFUSHI
MALE', MALDIVES

SUBMISSION DRAWING

CLIENT :
MR. ISHAN MAHMOOD

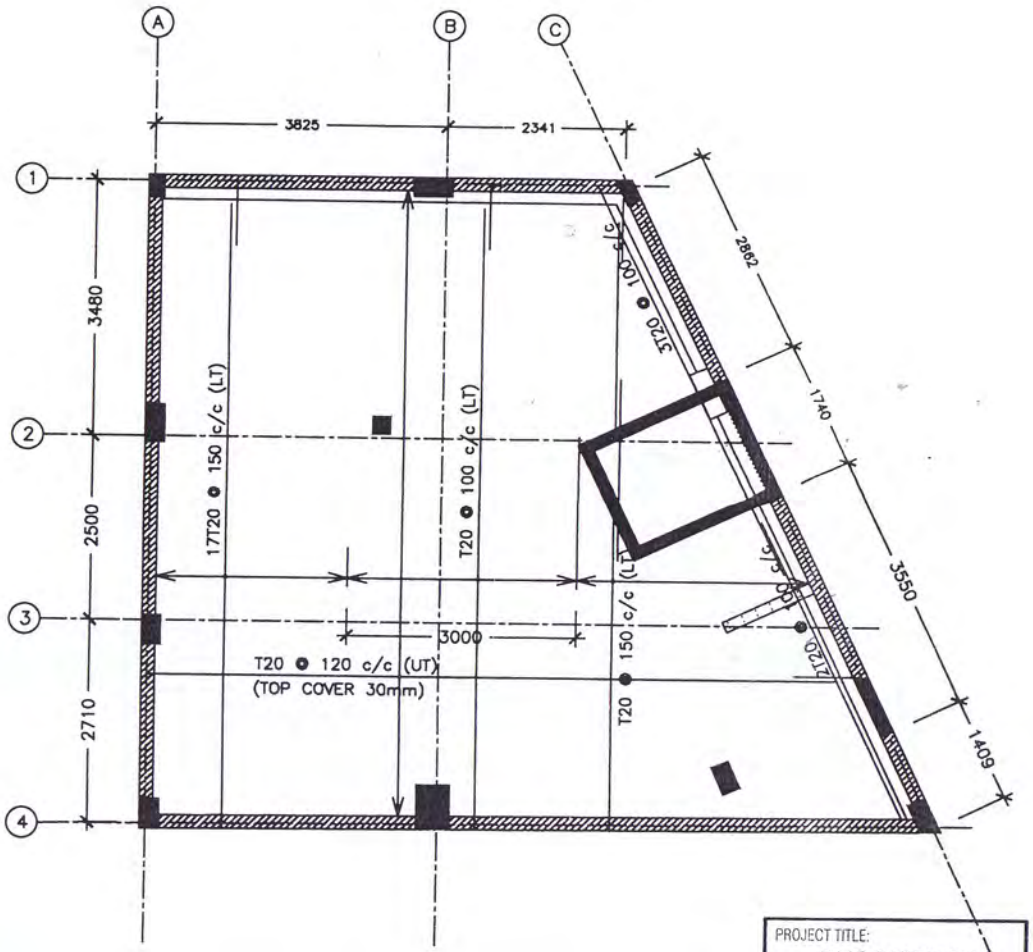
ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-

DWG NO : S-01/19



RAFT BOTTOM REINFORCEMENT PLAN

SCALE 1:100



RAFT TOP REINFORCEMENT PLAN

SCALE 1:100

Ministry of Housing & Infrastructure

ACCREDITED CHECKER

ARCHITECTURAL CHECKER B1

Name: Mohamed Shamin VALIDITY: 19.10.16 - 18.10.17

Registration No: BPR2016013B1 B1-2016-013-001

Ministry of Housing & Infrastructure

ACCREDITED CHECKER

STRUCTURAL CHECKER A1

Name: Ashraf Hameed VALIDITY: 17.03.16 - 16.03.17

Registration No: BPR2016006A1 A1-2016-006-001

PROJECT TITLE:

DHOONIFUSHI

MALE', MALDIVES

SUBMISSION DRAWING

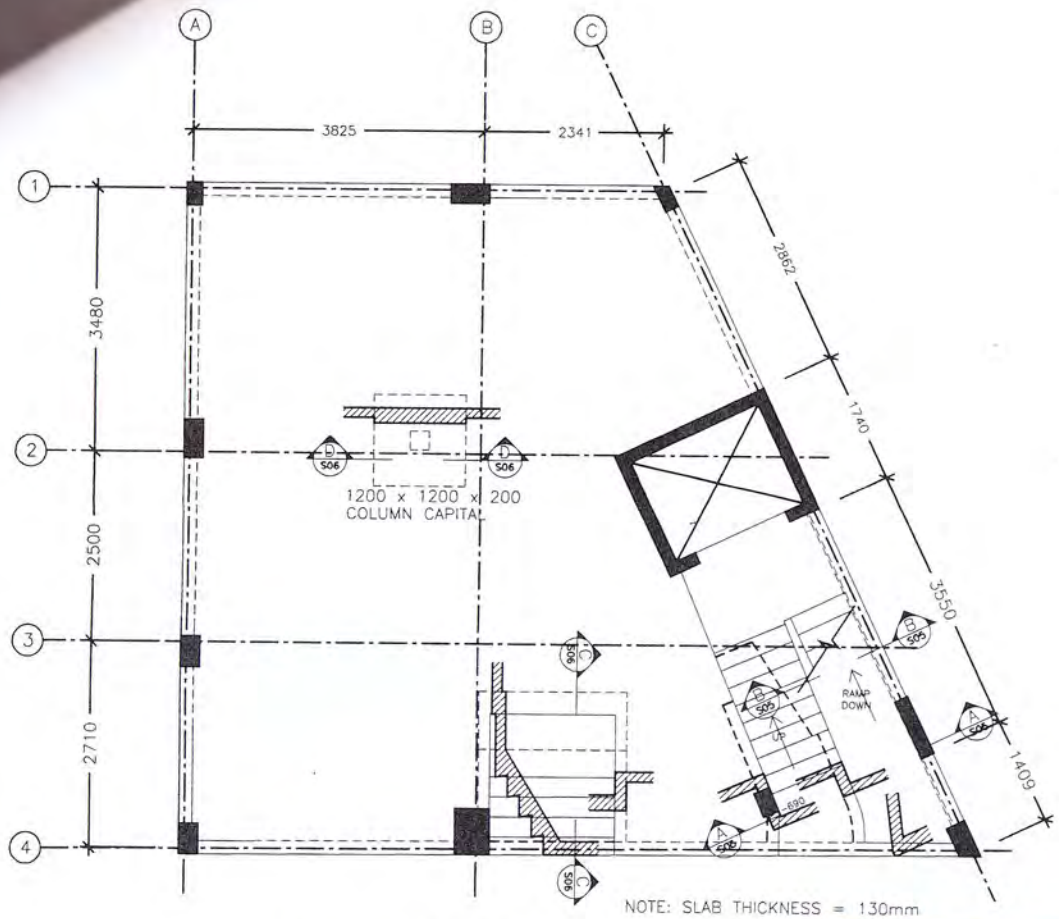
CLIENT :

MR. ISHAN MAHMOOD

ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-

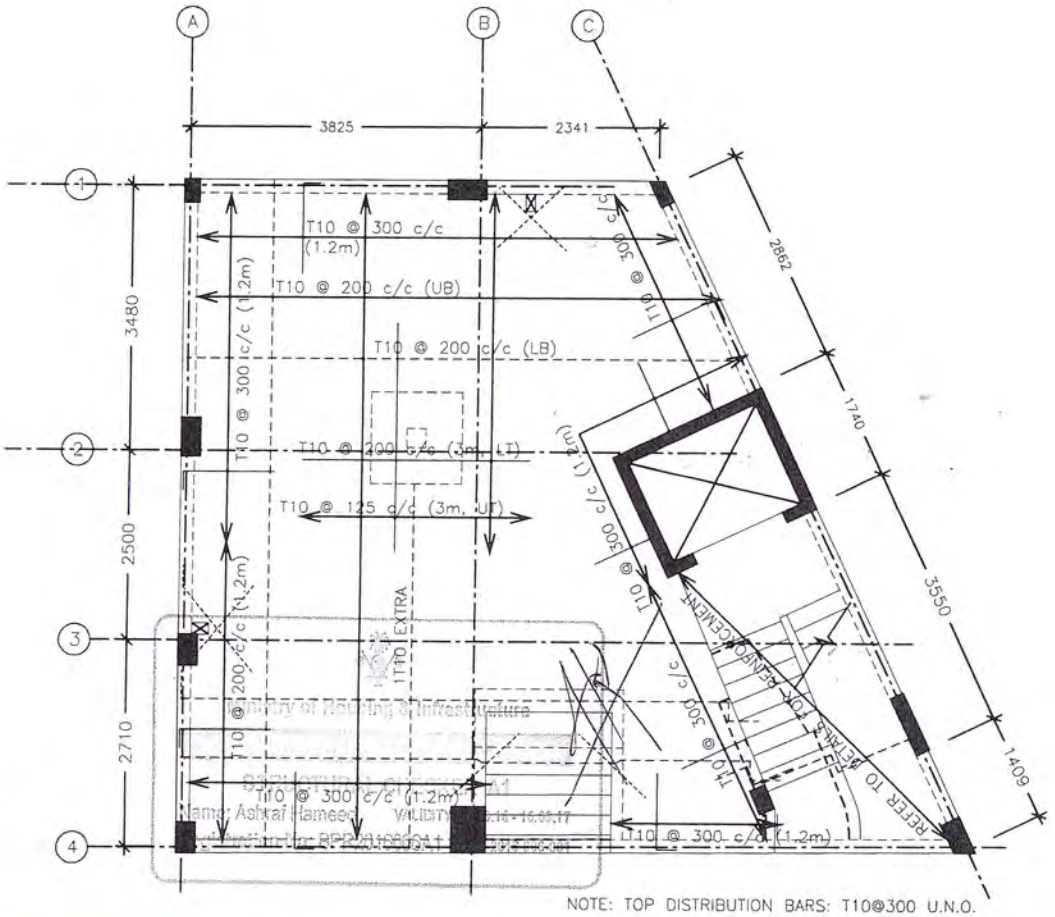
DWG NO :

S-02/19



NOTE: SLAB THICKNESS = 130mm

GROUND FLOOR GENERAL ARRANGEMENT PLAN



NOTE: TOP DISTRIBUTION BARS: T10@300 U.N.O.

GROUND FLOOR REINFORCEMENT PLAN

SCALE 1:100

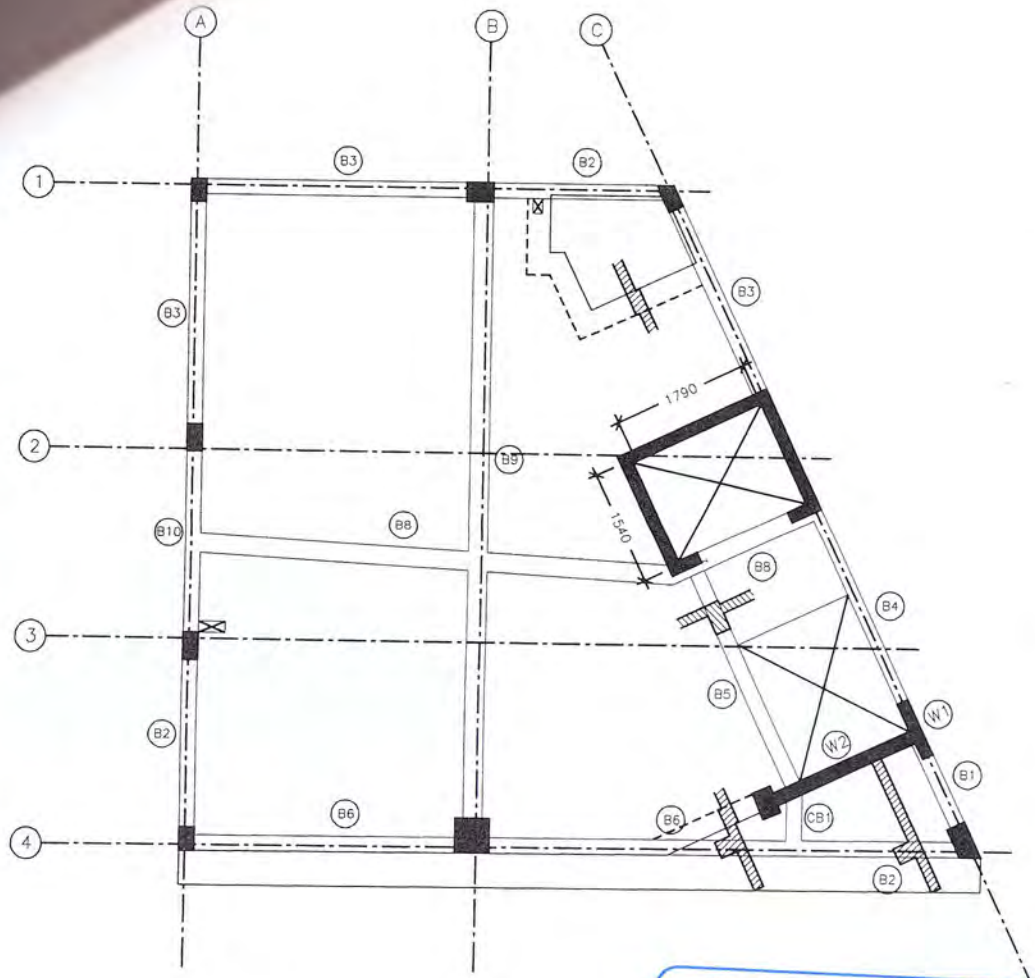
Ministry of Housing & Infrastructure

ARCHITECTURAL CHECKER B1

Name: Mohamed Shamin VALIDITY: 19.10.15 - 18.10.16

Registration No: BPR2015013B1 B1-2015-013-001

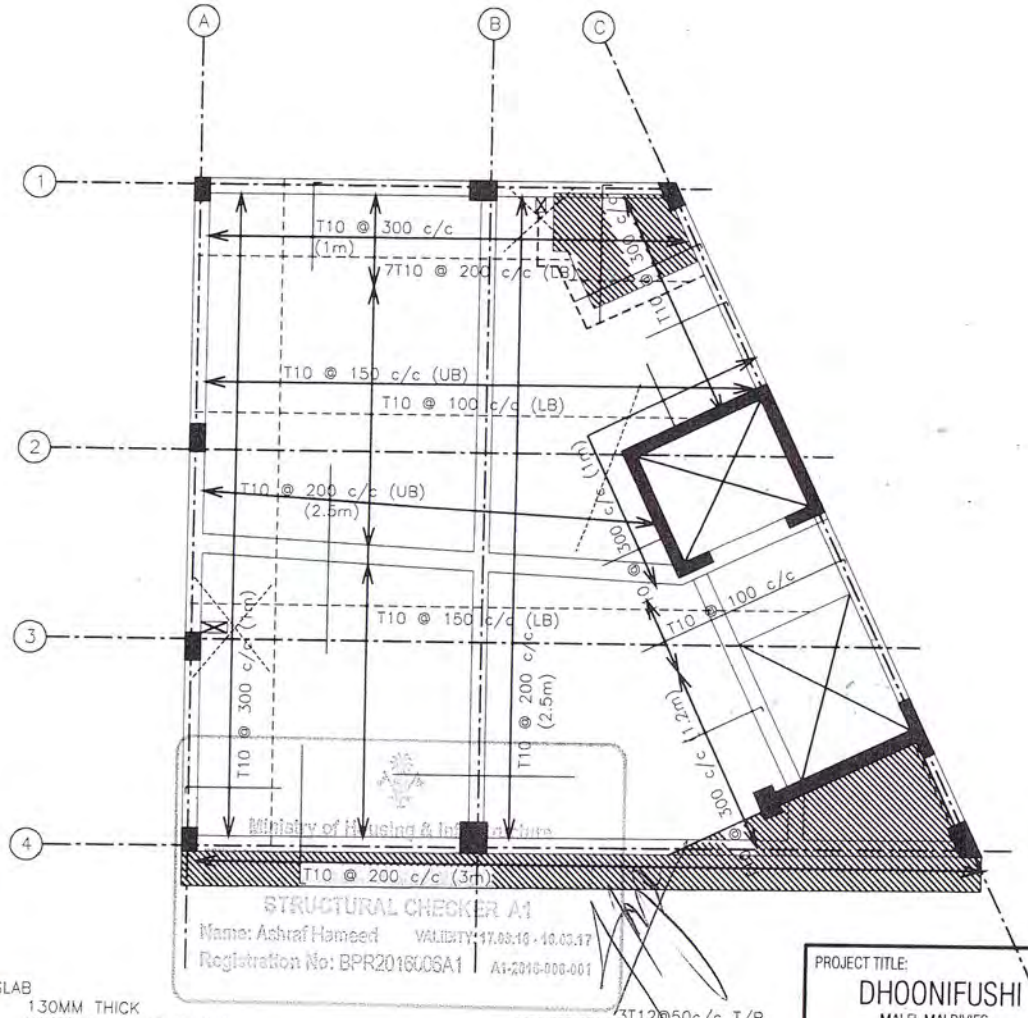
PROJECT TITLE:	DHOONIFUSHI MALÉ, MALDIVES
	SUBMISSION DRAWING
CLIENT :	MR. ISHAN MAHMOOD
ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-
DWG NO :	S-03/19



W1 – 800 x 150mm CONCRETE WALL
T12@250 VERTICAL (CENTRAL)
T12@250 HORIZONTAL (CENTRAL)
W2 – 150mm CONCRETE WALL FROM FIRST FLOOR SLAB LEVEL
T12@250 VERTICAL (CENTRAL)
T12@250 HORIZONTAL (CENTRAL)

FIRST FLOOR LEVEL BEAM PLAN

SCALE 1:100



SLAB
130MM THICK
BOTTOM AS SHOWN --------
TOP AS SHOWN ——
DISTRIBUTION BARS T10 @ 300
WET AREAS T10 @ 250 BW
COVER 25mm
PROVIDE 50mm SETDOWN AT BALCONY

3T12@50c/c T/B

50mm SETDOWN

FIRST FLOOR SLAB REINFORCEMENT PLAN

SCALE 1:100

Ministry of Housing & Infrastructure
STRUCTURAL CHECKER A1
Name: Ashraf Hameed VALIDITY: 17.03.16 - 16.03.17
Registration No: BPR20160OSA1 A1-2016-008-001

Ministry of Housing & Infrastructure
ARCHITECTURAL CHECKER B1
Name: Mohamed Shamin VALIDITY: 19.10.15 - 18.10.16
Registration No: BPR2015013B1 B1-2015-013-001

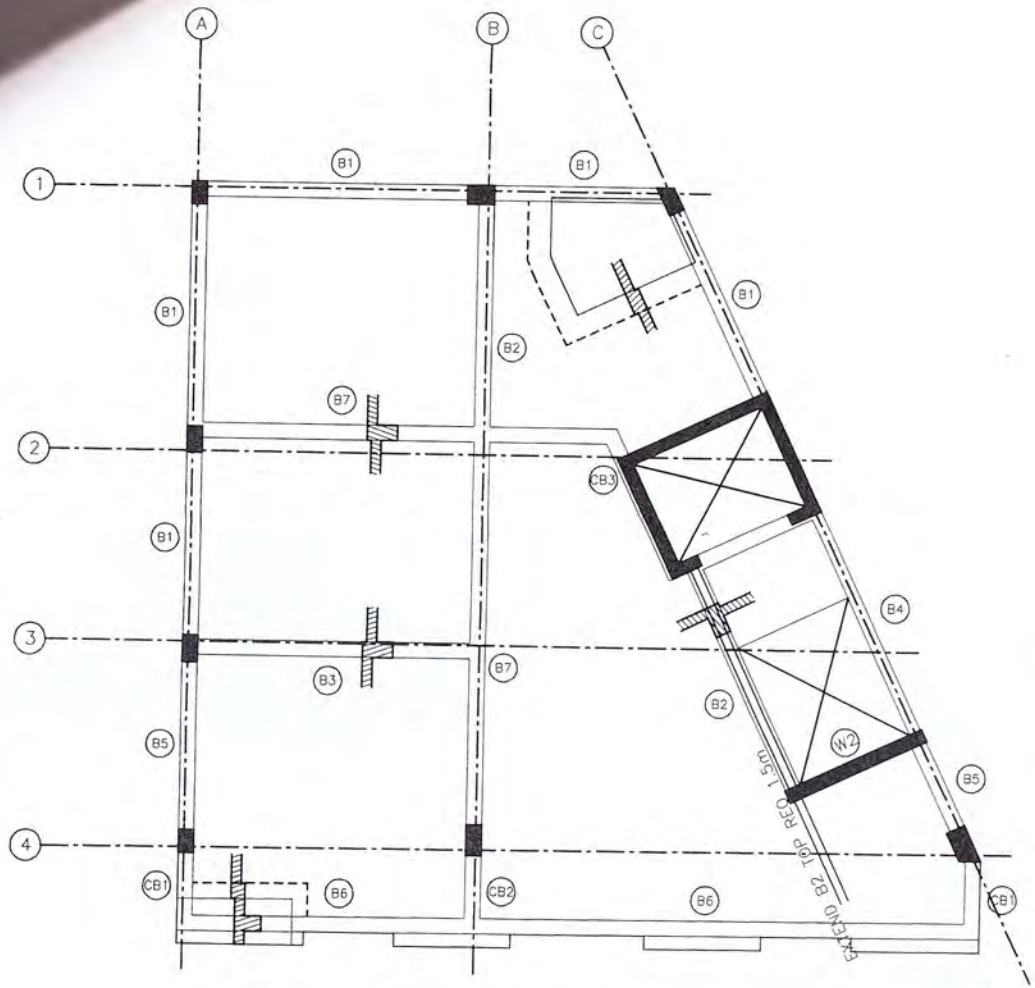
PROJECT TITLE:
DHOONIFUSHI
MALE', MALDIVES

SUBMISSION DRAWING

CLIENT :
MR. ISHAN MAHMOOD

ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-

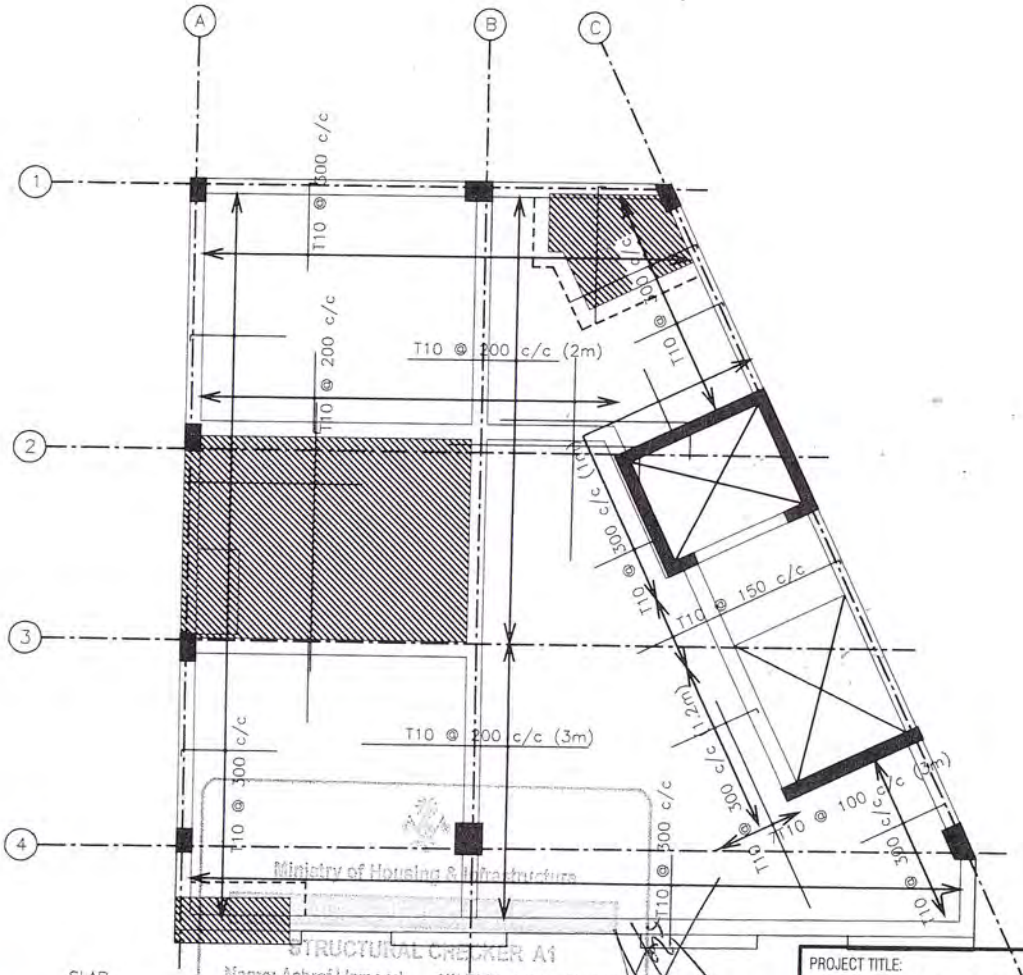
DWG NO : S-04/19



W2 – 150mm CONCRETE WALL
T12@250 VERTICAL (CENTRAL)
T12@250 HORIZONTAL (CENTRAL)

2ND FLOOR BEAM PLAN

SCALE 1:100



SLAB
130MM THICK
BOTTOM T10 @ 250 BW NOT SHOWN
TOP AS SHOWN
DISTRIBUTION BARS T10 @ 300
WET AREAS T10 @ 250 BW
COVER 25mm
PROVIDE 50mm SETDOWN AT BALCONY

T10@50c/c T/B

50mm SETDOWN

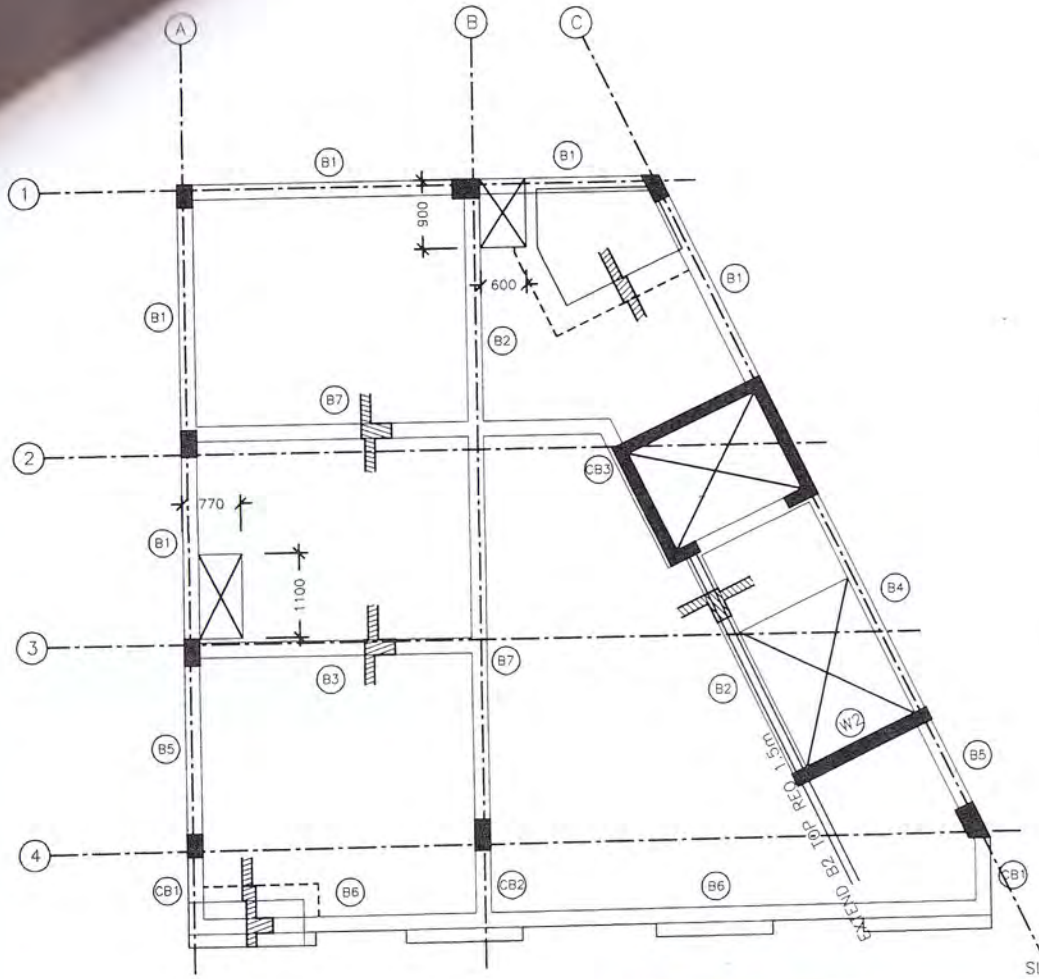
2ND FLOOR SLAB REINFORCEMENT PLAN

SCALE 1:100

Ministry of Housing & Infrastructure
ARCHITECTURAL CHECKER B1
Name: Mohamed Shamin VALIDITY: 19.10.15 - 18.10.16
Registration No: BPR2015013B1 B1-2015-013-001

Ministry of Housing & Infrastructure
STRUCTURAL CHECKER A1
Name: Ashraf Hameed VALIDITY: 17.03.16 - 16.03.17
Registration No: BPR2016003A1 A1-2016-003-001

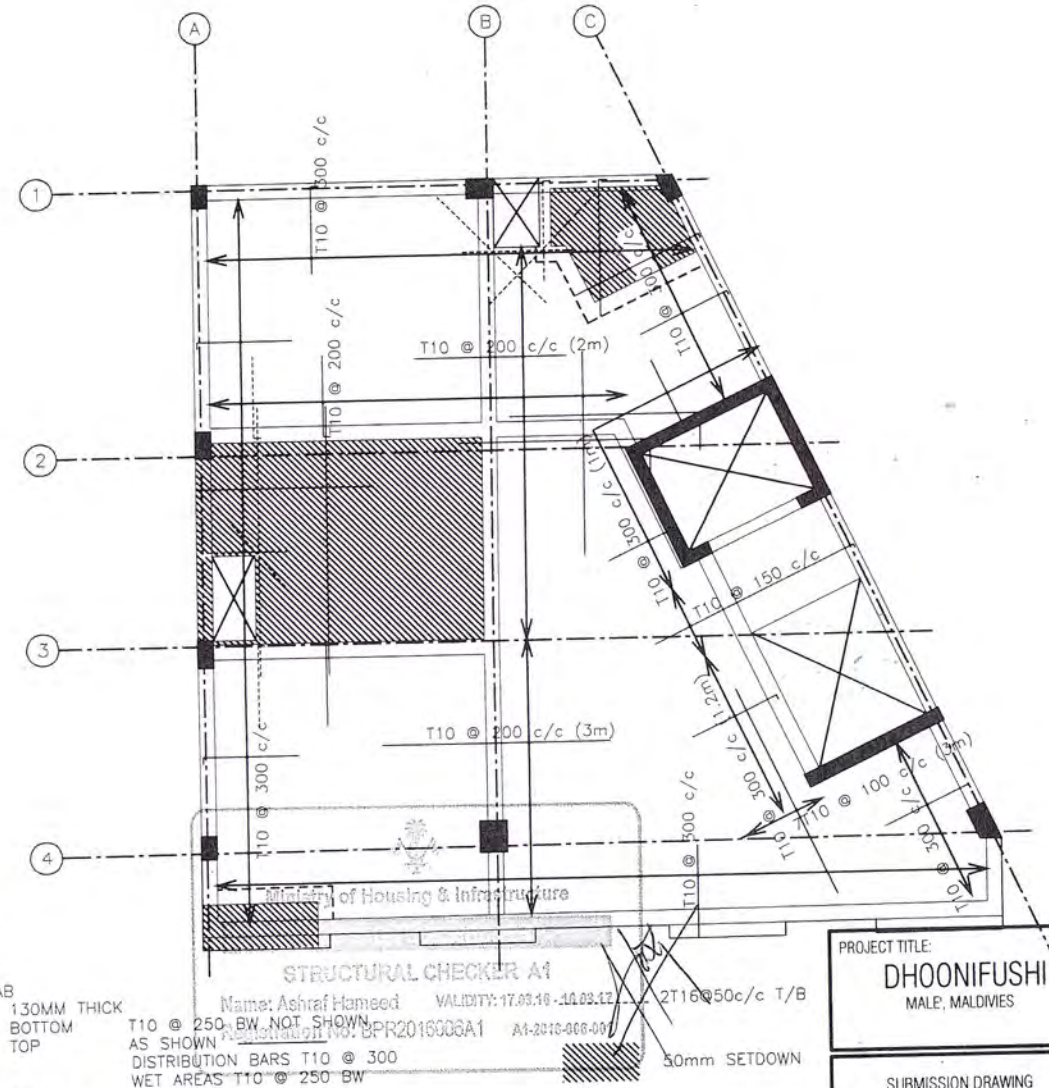
PROJECT TITLE:	DHOONIFUSHI, MALE', MALDIVIES
	SUBMISSION DRAWING
CLIENT :	MR. ISHAN MAHMOOD
ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-
DWG NO :	S-05/19



W2 – 150mm CONCRETE WALL
T12@250 VERTICAL (CENTRAL)
T12@250 HORIZONTAL (CENTRAL)

3RD TO 9TH FLOOR BEAM PLAN

SCALE 1:100



SLAB
130MM THICK
BOTTOM T10 @ 250 BW NOT SHOWN
TOP AS SHOWN
DISTRIBUTION BARS T10 @ 300
WET AREAS T10 @ 250 BW
COVER 25mm
PROVIDE 50mm SETDOWN AT BALCONY

3RD TO 9TH FLOOR SLAB REINFORCEMENT PLAN

SCALE 1:100

Ministry of Housing & Infrastructure
STRUCTURAL CHECKER A1
Name: Ashraf Hameed VALIDITY: 17.03.16 - 16.03.17
Registration No: BPR2016003A1 A1-2016-003-001

Ministry of Housing & Infrastructure
ARCHITECTURAL CHECKER B1
Name: Mohamed Shamin VALIDITY: 19.10.15 - 18.10.16
Registration No: BPR2015013B1 B1-2015-013-001

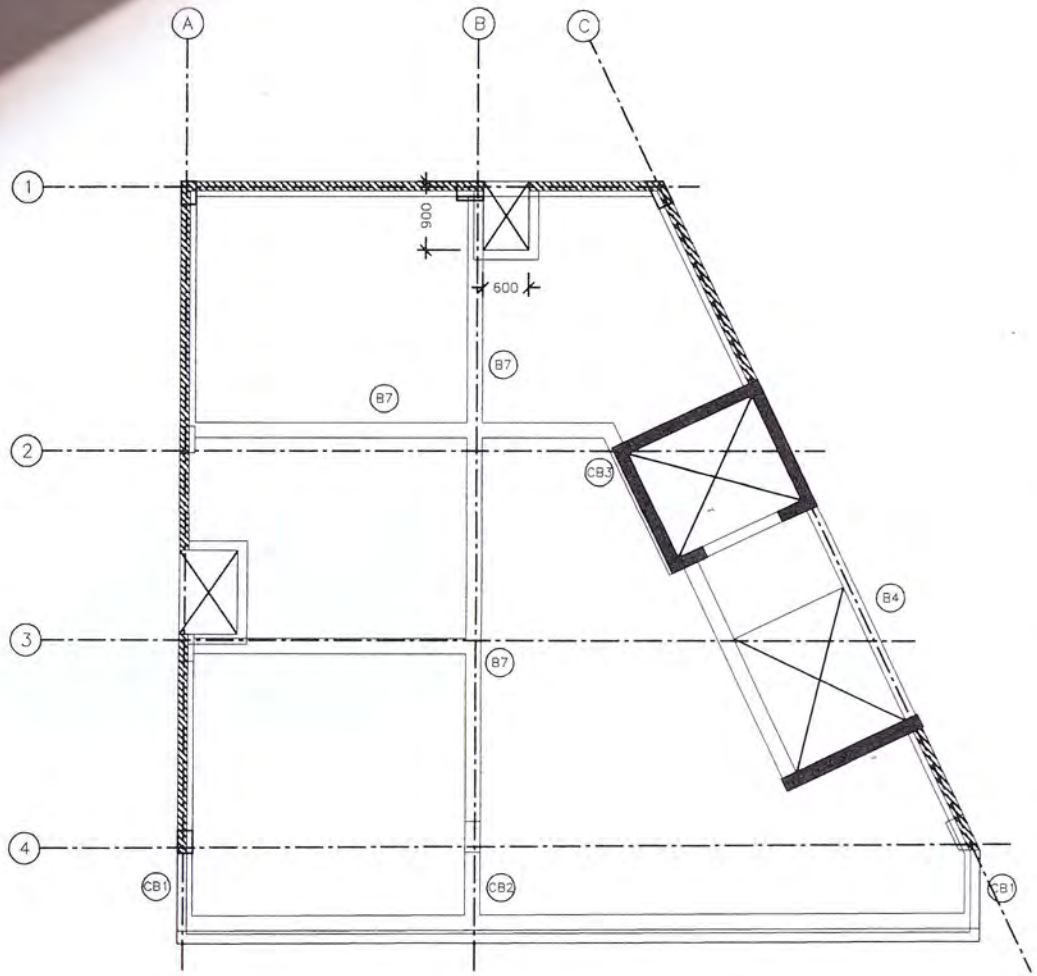
PROJECT TITLE:
DHOONIFUSHI
MALE', MALDIVES

SUBMISSION DRAWING

CLIENT :
MR. ISHAN MAHMOOD

ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-

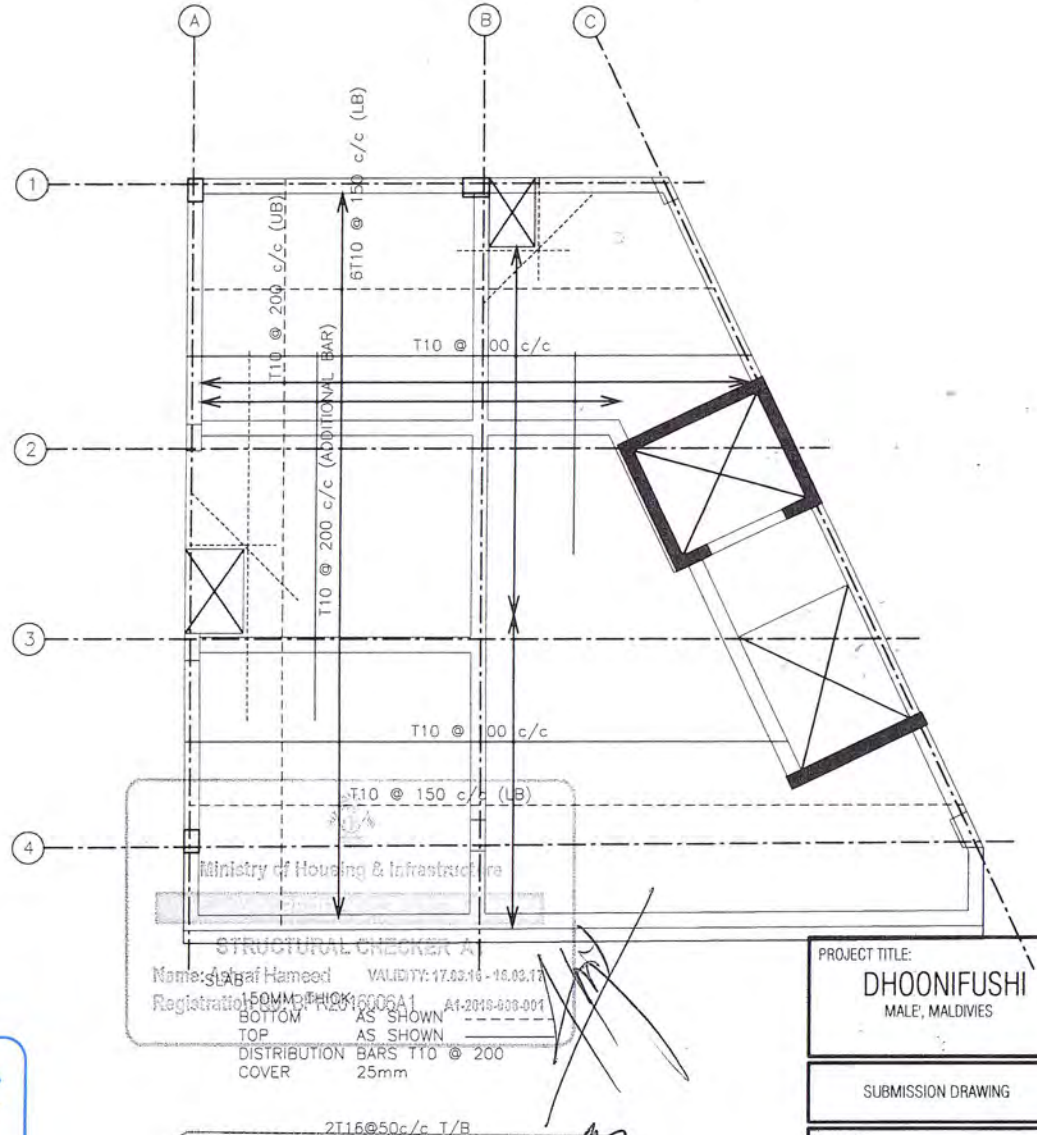
DWG NO : S-06/19



2M HIGH RC WALL – 125mm THICK T10@200 BW

TERRACE FLOOR BEAM PLAN

SCALE 1:100



Ministry of Housing & Infrastructure

STRUCTURAL CHECKER A1

Name: Ashraf Hameed VALIDITY: 17.03.16 - 16.03.17

Registration No: BPR2016006A1 A1-2016-003-001

SLAB	150MM THICK
BOTTOM	AS SHOWN
TOP	AS SHOWN
DISTRIBUTION	BARS T10 @ 200
COVER	25mm

2T16@50c/c T/B

TERRACE FLOOR SLAB REINFORCEMENT PLAN

SCALE 1:100

Ministry of Housing & Infrastructure

ARCHITECTURAL CHECKER B1

Name: Mohamed Shamin VALIDITY: 19.10.15 - 18.10.16

Registration No: BPR2015013B1 B1-2015-013-001

PROJECT TITLE:

DHOONIFUSHI

MALE', MALDIVES

SUBMISSION DRAWING

CLIENT :

MR. ISHAN MAHMOOD

ARCH:	SHAMIN
ENG:	ASHRAF
DRAWN:	
DATE	SEP 2016
SCALE:	AS GIVEN
PN:	-

DWG NO : S-07/19

Annex 4 – Water test results

' Water & Sewerage Company Pvt Ltd
Quality Assurance Laboratory
lding 5th Floor, Machangoalhi, Ameenee Magu, Male', Maldives
03323200, Fax: +9603324306, Email: wqa@mwsc.com.mv

MWSC

WATER QUALITY TEST REPORT

Report No: 500173644

ıer Information:
Weeks Pvt Ltd

IEE MAGU
)-01

Report date: **04/05/2017**
Test Requisition Form No: **900175523**
Sample(s) Recieved Date: **02/05/2017**
Date of Analysis: **02/05/2017 - 03/05/2017**

Description	M.Dhoonifushi	TEST METHOD	UNIT
Type	Ground Water		
No	83186346		
d Date	02/05/2017		
ETER	**ANALYSIS RESULT**		
l Appearance	Cloudy with particles		
tivity	8440	Method 2510 B. (adapted from Standard methods for the examintation of water and waste water, 21st edition)	µS/cm
	7.67	Method 4500-H+ B. (adapted from Standard methods for the examintation of water and waste water, 21st edition)	-
	4.69	Method 2520 B. (adapted from Standard methods for the examintation of water and waste water, 21st edition)	‰
ıture	22.1	Electrometry	°C
ssolved Solids	4220	Electrometry	mg/L
/	60.6	HACH Nephelometric Method (adapted from HACH 2100N Turbidimeter User Manual)	NTU
	2.1	Method 8039 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
ı Ammonia	3.0	Method 8038 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
	10400	Method 8131 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	µg/L
ıte	0.69	Method 8048 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L

/cm : Micro Seimen per Centimeter, ‰ : Parts Per Thousand, **°C** : Degree Celcius, **mg/L** : Milligram Per Liter, **NTU** : Nephelometric Turbidity Unit, **µg/L** : Microgram Per Liter, **MPN/100ml** : Most Probable Number

Checked by

Nashath Ali
Senior Laboratory Technician

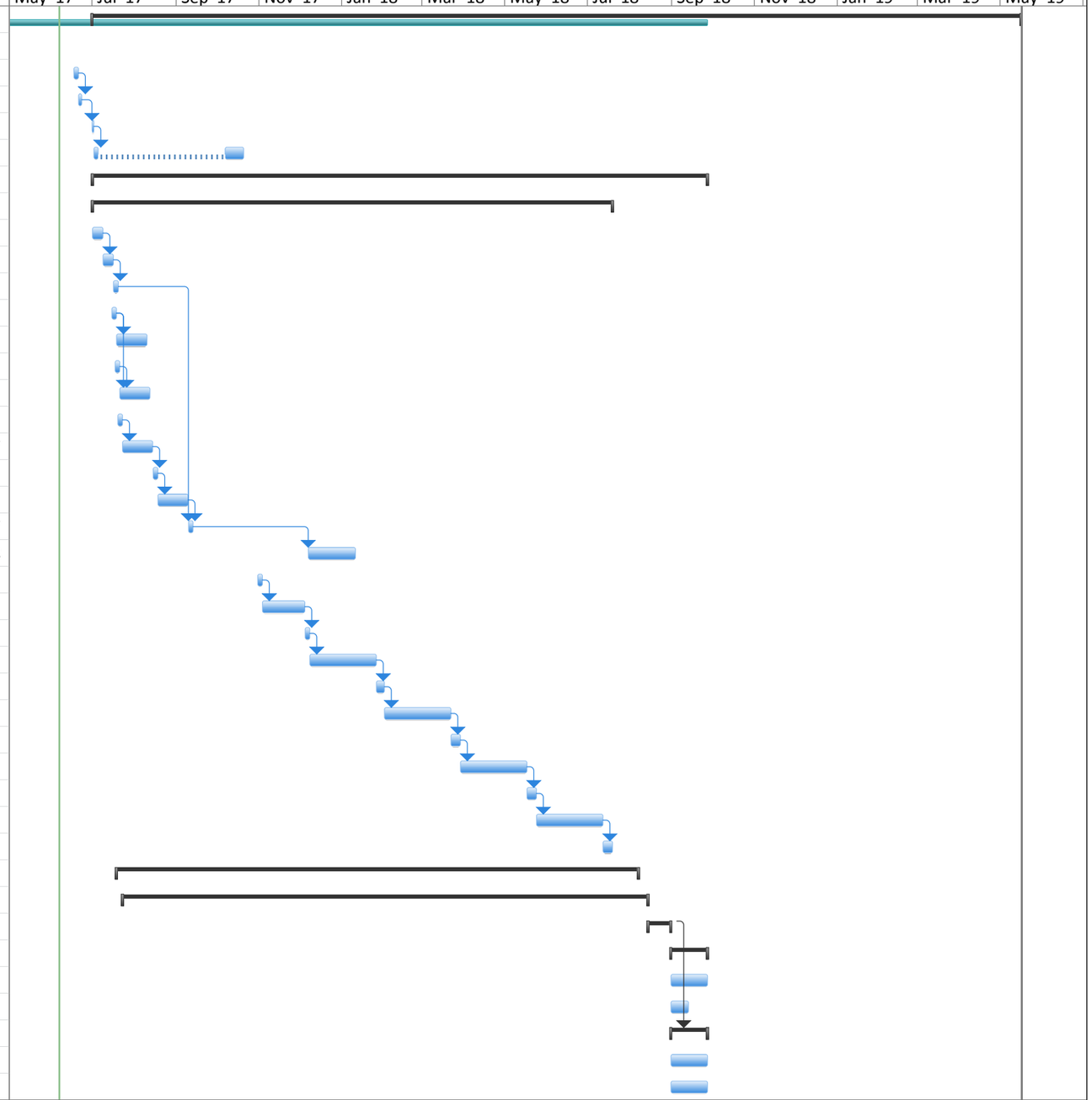
Approved by

Afnan Farooq
Laboratory Executive Gr.1

ımpling Authority: Sampling was not done by MWSC Laboratory
rt shall not be reproduced except in full, without written approval of MWSC
report is ONLY FOR THE SAMPLES TESTED.
tion provided by the customer

Annex 5 – Work schedule

ID	Task	Task Name	Duration	Start	Finish
1		**Project- M. Dhoonifushi**	**441.2 days**	**Sat 1 07 17**	**Thu 16 05 19**
2		SITE Demolition Excavation	9 days	Wed 1 02 17	Sat 11 02 17
3		Boundary Wall Bellow Ground	3 days	Sat 17 06 17	Tue 20 06 17
4		Excavation & Dewatering	2 days	Wed 21 06 17	Fri 23 06 17
5		Lean Concrete	1 day?	Sat 1 07 17	Sun 2 07 17
6		Well Concrete	15.4 days	Sun 2 07 17	Fri 20 10 17
7		**Super Structure**	**309 days**	**Sat 1 07 17**	**Thu 27 09 18**
8		**Concrete Works**	**269 days**	**Sat 1 07 17**	**Thu 19 07 18**
9		Foundation Concrete Formwork	7 days	Sat 1 07 17	Sat 8 07 17
10		foundation Concrete Steel Bar Frame	7 days	Sun 9 07 17	Sun 16 07 17
11		Foundation & Walls Concrete	3 days	Sun 16 07 17	Thu 20 07 17
12		Ground Floor Collumns	3 days	Sat 15 07 17	Tue 18 07 17
13		Ground Floor Slabs	20 days	Wed 19 07 17	Thu 10 08 17
14		1st Floor Columns	3 days	Tue 18 07 17	Fri 21 07 17
15		1st Floor Slabs	20 days	Fri 21 07 17	Sat 12 08 17
16		2nd Floor Columns	3 days	Thu 20 07 17	Sun 23 07 17
17		2nd Floor Slabs	20 days	Sun 23 07 17	Mon 14 08 17
18		3rd Floor Columns	3 days	Tue 15 08 17	Fri 18 08 17
19		3rd Floor Slabs	20 days	Fri 18 08 17	Sat 9 09 17
20		Collumns upto 4th level slab beam	3 days	Sun 10 09 17	Wed 13 09 17
21		4th Level Slab	20 days	Thu 7 12 17	Wed 10 01 18
22		Collumns upto 5th level slab beam	3 days	Tue 31 10 17	Fri 3 11 17
23		5th Level Slab	28 days	Fri 3 11 17	Mon 4 12 17
24		Collumns upto 6th level slab beam	3 days	Tue 5 12 17	Fri 8 12 17
25		6th Level Slab	28 days	Fri 8 12 17	Fri 26 01 18
26		Collumns upto 7th level slab beam	3 days	Fri 26 01 18	Thu 1 02 18
27		7th Level Slab	28 days	Thu 1 02 18	Thu 22 03 18
28		Collumns upto 8th level slab beam	4 days	Thu 22 03 18	Thu 29 03 18
29		8th Level Slab	28 days	Thu 29 03 18	Thu 17 05 18
30		Collumns upto 9th level slab beam	4 days	Thu 17 05 18	Thu 24 05 18
31		9th Level Slab	28 days	Thu 24 05 18	Thu 12 07 18
32		Collumns upto roof beam & Roof beam	4 days	Thu 12 07 18	Thu 19 07 18
33		**Masonry Works & MEP Provisions**	**264.1 days**	**Wed 19 07 17**	**Tue 7 08 18**
45		**Plastering Floor Screed Tiling**	**264.1 days**	**Sun 23 07 17**	**Tue 14 08 18**
57		**Roof & Terrace Construction**	**10 days**	**Tue 14 08 18**	**Fri 31 08 18**
61		**Ceiling Works**	**15 days**	**Fri 31 08 18**	**Thu 27 09 18**
62		Timber Framing	15 days	Fri 31 08 18	Thu 27 09 18
63		Electrical Wiring Over the Ceiling	7 days	Fri 31 08 18	Thu 13 09 18
64		**Site Cleaning & Hand Over**	**15 days**	**Fri 31 08 18**	**Thu 27 09 18**
65		Remove external scufolding	15 days	Fri 31 08 18	Thu 27 09 18
66		Cleaning of related debri	15 days	Fri 31 08 18	Thu 27 09 18



Annex 6 – Proponents Commitment for Monitoring and Mitigation

Ibrahim Naeem
Director General
Environmental Protection Agency
Ministry of Environment and Energy
Male', Maldives

7th June 2017

Dear Mr. Ibrahim Naeem,

Project: Project: EIA for the proposed 10 Storey Building in M. Dhoonifushi, Male'

Sub: Proponents Commitment for Monitoring and Mitigation

As the proponent of the project, we confirm our commitment to undertake all mitigation measures and carry out the monitoring program as specified in the report.

Thanking you

Yours Sincerely

Jawad Shakeel

ID NO A078331
7901633
M. Dhoonifushi