

## Environmental Impact Assessment for Development of new Power House at G.Dh. Thinadhoo



**June 2016**

**Proponent: FENAKA Corporation Limited**

**Prepared by;**

**Mahfooz Abdull Wahhab**

**Mohamed Ibrahim Jaleel**

**Ali Shareef**

**Table of Contents**

**1.0 INTRODUCTION** .....17

**1.1 Purpose of this EIA** .....17

**1.2 Project background** .....17

**1.3 Project Objectives** .....17

**1.4 Proponent**.....17

**1.4.1 Power generation services** .....17

**1.4.2 Water and Waste water services** .....18

**1.5 Consultants** .....19

**2.0 STUDY AREA** .....20

**2.1 Relevant development in the area** .....22

**3.0 PROJECT DESCRIPTION**.....23

**3.1 Proposed Works** .....23

**3.1.1 Construction of new power house**.....26

**3.1.1 Construction of Admin building** .....26

**3.1.2 Transfer of generators and panel boards**.....26

**3.2 Generators** .....26

**3.3 Powerhouse**.....27

**3.3.1 Design** .....27

**3.3.2 Fabrication**.....27

**3.3.3 Delivery and Handling** .....27

**3.3.4 Erection** .....28

**3.3.6 Doors and Windows** .....28

**3.3.7 Roof and Wall Cladding system**.....29

**3.3.8 Lighting, small power, air conditioner and fans** .....29

**3.3.9 Safety Precautions** .....30

3.3.10 Depth of foundation .....30

3.3.10 Emergency power mechanism.....30

3.2.11 Measures to increase power efficiency .....30

3.2.12 Safety components.....30

3.2.13 Fuel Management .....31

3.4 Admin building.....34

3.5 Project inputs and outputs .....36

3.6 Construction method .....37

    3.6.1 Workforce .....37

    3.6.2 Materials and machinery required for construction .....37

    3.6.3 Mobilization .....38

    3.6.5 Proposed timeline for project activities.....40

3.7 Decommissioning.....42

4.0 EXISTING ENVIRONMENT .....43

    4.1 General Climate .....43

    4.2 Temperature .....43

    4.3 Rainfall.....44

        4.3.1 Specific rainfall data at G.Dh Thinadhoo .....45

    4.4 Insolation .....47

    4.5 Wind .....48

    4.6 Waves .....49

    4.7 Hazard Vulnerability.....50

    4.8 Water Quality.....52

        4.8.1 Sampling method.....52

        4.8.2 Sampling location .....53

        4.8.3 Results .....55

4.9 Vegetation .....56

    4.9.1 Method.....56

    4.9.2 Results .....56

    4.9.1 Dhivehi names for the vegetation.....58

4.10 Noise level .....59

    4.10.1 Method.....59

    4.10.2 Results .....61

4.11 Socioeconomic environment.....62

4.12 Air quality.....67

    4.12.1 Method.....67

    4.12.2 Results .....67

4.13 Data gaps.....68

5.0 LEGISLATIVE AND REGULATORY CONSIDERATIONS .....69

    5.1 Law on general public services (4/96) .....69

    5.2 Law on Environmental Protection and Preservation of the Maldives (4/93) .....69

    5.3 1<sup>st</sup> addendum to Environmental Protection and Preservation of the Maldives (4/93) law no 12/2014 .....71

    5.4 Environmental Impact Assessment Regulation 2012 .....71

    5.5 Waste management regulation .....72

    5.6 Regulation on provision of electricity to Male’ and islands .....78

    5.7 Guideline for power system approval .....84

6.0 POTENTIAL IMPACTS AND MITIGATION .....88

    6.1 Impact identification methodology .....88

    6.2 Limitations in impact prediction .....89

    6.3 Impacts during Construction.....89

        6.3.1 Impacts on Air quality .....90

6.3.2 Noise Pollution .....91

6.3.3 Impacts on water quality .....91

6.3.4 Impacts from Waste .....92

6.3.5 Impacts on terrestrial environment .....92

6.4 Impacts summary .....92

6.5 Impacts during operation .....94

6.5.1 Impacts on water quality .....95

6.5.2 Impacts on air quality .....96

6.5.3 Noise disturbance .....96

6.5.4 Socio-economic impacts .....97

6.5.5 Health .....97

6.5.6 Impacts from Waste .....98

6.5.7 Fire hazard risk and safety .....98

6.5.8 Vibration Impacts .....98

6.6 Impacts summary .....99

7.0 ALTERNATIVES .....102

7.1 No project scenario .....102

7.2 Alternative locations for powerhouse .....102

8.0 MONITORING .....104

8.1 Monitoring schedule .....105

9.0 STAKEHOLDER CONSULTATIONS .....106

9.1 Public Consultation .....106

9.2 Meeting with the island council .....107

9.3 Consultations with working staff on site .....108

9.4 EPA air quality section .....109

9.5 MEA .....109

**9.6 Scoping Meeting** .....110

**10.0 CONCLUSION** .....111

**11.0 REFEERENCES** .....112

**Introduction**.....141

**Purpose**.....141

**Fuel use** .....141

**Delivering and dispensing of fuel**.....141

**Current delivering and fuel dispensing procedure** .....141

**Additional fuel delivery/dispensing requirements at berth**.....142

**Fuel transporter vehicles** .....142

**Fuel dispensing** .....143

**Spills** .....144

**Fuel storage**.....144

**Refueling of day tanks** .....146

**Posting of procedure** .....146

**References**.....147

**Appendix A - Spill response equipment to be available at all the powerhouses**.....148

**Appendix B- Sample floor plan of a bunded storage tank**.....149

**List of Figures**

Figure 1: location of Thinadhoo, G.Dh Atoll .....20

Figure 2: study area .....21

Figure 3: location of kafenaa, powerhouse and wetland on Thinadhoo. ....22

Figure 4. project location.....24

Figure 5: site plan of the project .....25

Figure 6. Fuel transfer route from fuel unloading area to the new powerhouse at Thinadhoo .....33

Figure 7: location of proposed temporary site setup location .....39

Figure 8: proposed timeline for project activities.....41

Figure 9: monthly maximum and minimum temperatures(<sup>0</sup>C) for Maldives throughout the year. Data since 2000, adopted from the National Meterological Centre. ....44

Figure 10: rainfall (mm) data since 2000, adopted from the National Meterological Centre .....45

Figure 11: monthly rainfall variations at G.Dh Thinadhoo .....46

Figure 12: annual variations in rainfall at G.Dh Thinadhoo.....47

Figure 13: average daily insolation (hours) for different areas .....48

Figure 14: wind vectors from 2003 to 2008. ....49

Figure 15: Ten year mean monthly wave height and direction for the central Maldives. Source: Young (1999).....50

Figure 16: erosion at the corner of the desalination plant premise walls .....51

Figure 17: flooding during rainy season at powerhouse area.....52

Figure 18: water sample location.....54

Figure 19: vegetation near proposed powerhouse .....57

Figure 20: noise level measurement locations.....60

Figure 21: population census of G.DH Atoll.....63

Figure 22. Residential areas at Thinadhoo (blue highlight) .....66

Figure 23: impact zone during construction. Orange; is primary impact zone and yellow; is secondary impact zone.....90

Figure 24: impact zone during operations. Orange; primary impact zone and green; secondary impact zone.....95

Figure 25: floor plan of powerhouse .....125

Figure 26: sectional elevation of powerhouse .....126

Figure 27: front and side elevation of powerhouse .....127

Figure 28: floor plan for admin building .....128

Figure 29: sectional elevation of admin building .....129

Figure 30: front elevation of admin building.....130

**List of Tables**

Table 1: details of generators proposed to be installed.....26

Table 2. Major inputs for required for the construction of a powerhouse at GDh. Thinadhoo .....36

Table 3. Project outputs anticipated to be generated from the proposed project.....37

Table 4: geocordinates for proposed temporary site setup .....38

Table 5: geocordinates of water sample location .....53

Table 6: water sample results .....55

Table 7: geocordinates for proposed powerhouse location .....56

Table 8: Dhivehi and scientific names for plants .....58

Table 9: geocordinates of noise level measurement locations .....59

Table 10: results of noise level measurements .....61

Table 11: population details of Thinadhoo (Data from 1985 to 2013 adopted from MEE, 2013)62

Table 12: geocordinates of air quality measurement locations .....67

Table 13: air quality results .....67

Table 14: impact characteristics, where 5 is of highest significance.....88

Table 15: summary of impacts during construction .....93

Table 16: summary of impacts during operation.....99

Table 17: environmental monitoring plan .....104

Table 18: monitoring schedule .....105

Table 19: details of individuals consulted .....106

Table 20: attendees of council meeting .....107

Table 21: details of staffs that were consulted. ....108

Table 22: attendees of meeting with EPA air quality section.....109

Table 23: attendees of scoping meeting .....110

## LETTER OF COMMITMENT

FNK-F/203/2016/

Environmental Protection Agency  
Male'  
Republic of Maldives

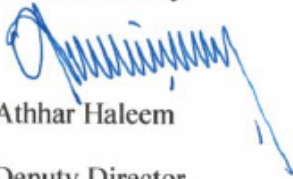
25<sup>th</sup> April 2016

Dear Mr. Ibrahim Naeem,

**Re: Environmental Impact Assessment for Powerhouse Development in G.Dh. Thinadhoo**

As per the requirements of the EIA regulation, we hereby confirm our commitment to implement the mitigation measures according to what is proposed in the EIA report attached herewith.

Yours Sincerely



Athhar Haleem

Deputy Director

## DECLARATION OF PROPONENT

### Declaration of the proponent

As the representative of the proponent of the proposed project I assure that I have read the report thoroughly and that to the best of my knowledge all information provided here is accurate and complete. In addition, I confirm our commitment to making sure that the contractor implements all mitigation measures proposed in the present report and adhere to the monitoring schedule given.

Name: Athhar Haleem

Date: 25<sup>th</sup> April 2016

Signature:



## DECLARATION OF CONSULTANTS

We hereby confirm that the information in this report is accurate to the fullest of our understanding.



Ali Shareef (EIA 19/11)



Mahfooz Abdul Wahhab (Registration no: EIA TA03/15)





## EXECUTIVE SUMMARY

1. The purpose of this EIA is to critically analyse and assess the potential environmental impacts associated with the development of new powerhouse at G.DH Thinadhoo and expose the solutions and preferred alternatives as well as mitigation measures to minimize any negative impacts whilst trying to derive the maximum positive impacts from the project.
2. The powerhouse in Thinadhoo was recently burned down by an accidental fire. The powerhouse was burned to the extent that the building can no longer be used. The fire has greatly reduced the strength of the walls and concrete beams of the building, considering the health and safety of the staff that work in the powerhouse it is not advisable to repair the building and continue operations. Therefore, a new powerhouse is proposed to be developed in Thinadhoo.
3. In this powerhouse development project, a new powerhouse is proposed to be constructed within the FENAKA premise. The powerhouse will be constructed from pre-fabricated sheets and blocks. The project will also involve the construction of admin building, fuel storages and the transfer of generators from the existing temporary powerhouse to the new powerhouse. The generator beds will be rolled over metal rollers to the new powerhouse. All the components of the powerhouse will be constructed according to BS standards complying to both MEA and EPA regulations.
4. Thinadhoo is located on the western edge of Huvadhoo Atoll. Thinadhoo is the most densely populated island in G.DH atoll. According to census 2014 the total population of Thinadhoo is 5268.
5. A full baseline of air quality, water quality and noise level was established. It was found that the water at the powerhouse location had very high conductivity which may be due to its close proximity to the coast. Noise level within the vicinity of the temporary generators is very high, it was concluded that the noise level is high because the generators were not inside a sound attenuated powerhouse. Air quality measurements at the existing temporary powerhouse and proposed powerhouse revealed that only air pollutant Nitrogen dioxide was found at 2 ppm concentration near the exhaust chimney of the existing temporary powerhouse.

6. The construction works of new powerhouse presented in this report are not expected to adversely impact the environment if the mitigation measures mentioned in the report are followed. The most important mitigation measures are to do daily maintenance of machinery, following chemical handling procedures, waste segregation and storage in closed labelled containers until disposal to Thilafushi and most importantly following the fuel handling plan
7. It is expected that the newly established powerhouse will ensure reliable electricity services to Thinadhoo. And also will greatly reduce any smoke and noise disturbance to the community and the environment.
8. The major potential negative impact for this project is groundwater contamination from chemical spills and oil spills during fuel handling. Therefore, handling of fuel or other chemical substances has to be done according to the fuel handling plan. The major potential positive impact from the project is the reliable supply of electricity services to Thinadhoo.
9. Monitoring is essential to ensure that environmental thresholds are not exceeded and mitigation measures proposed are working. Water quality and air quality monitoring will be done according to the monitoring schedule.
10. The no project scenario will mean that the new powerhouse will not be developed in Thinadhoo and would lead to reduced reliability of electricity services to Thinadhoo. One alternative location, west side of island along with the proposed project location was analysed. It was found that the proposed project location is the preferred alternative based on socioeconomic and environmental factors.

## 1.0 INTRODUCTION

### 1.1 Purpose of this EIA

The aim of this EIA is to critically analyze the environmental and socio-economic impacts which may arise due to the development of power house in G.DH Thinadhoo. After analyzing the impacts, it would be then possible to suggest proper mitigation measures to prevent or reduce any negative impacts and to enhance any positive impacts.

### 1.2 Project background

The powerhouse in Thinadhoo was burned down by an accidental fire on 26th January 2016. The powerhouse was burned to the extent that the building can no longer be used. The fire has greatly reduced the strength of the walls and concrete beams of the building, considering the health and safety of the staff who work at the powerhouse and it is not advisable to repair the building and continue operations. Therefore, a new powerhouse is proposed to be developed at Thinadhoo.

### 1.3 Project Objectives

The objective of the project is to build a power house to provide power in a sustainable manner to the people of Thinadhoo with minimum disturbance to residents.

### 1.4 Proponent

The proponent, Fenaka Corporation Limited was established on 18th June 2012 by a presidential decree under the companies Act of 10/96, as a limited liability company. The company is registered on 1st of August 2012 and it is 100% Government owned utility company with a mandate to provide island communities with electricity, water and sewerage. Today, FENAKA is a multi-disciplinary engineering organization, dealing contracts involved in civil, mechanical, electrical, water and waste water engineering.

#### 1.4.1 Power generation services

Out of a total of 196 inhabited islands in the country, FENAKA Corporation provides electricity services to 152 islands. 24 / 7 sustainable electricity provision was not achieved to outer islands until recently FENAKA corporation started providing the services to the islands. In its short history the company has carried out numerous projects for the betterment of the service provision, one such example is the 77 Genset project which aided in the sustainable service provision. Furthermore, as electricity services were provided by the island communities themselves in the

past, the location, infrastructure and operations were not ideal. This causes negative impacts and disturbance to the communities and the environment. Therefore, every year the company carries out a number of projects in power house relocation, refurbishment and generated set upgrading throughout the country.

Electricity is mainly generated through diesel, however the Company is now slowly shifting towards renewable energy as a form of power generation. The company is also an important implementing partner in the mega projects of the Governments renewable energy. Some of these projects include;

- Preparation of outer islands for Sustainable energy development (POISED), funded by Asian Development Bank
- Accelerating Sustainable Private Investments in Renewable Energy (ASPIRE), funded by the World Bank

### 1.4.2 Water and Waste water services

At FENAKA Corporation, safe water is provided to the public after desalinating sea water into potable drinking water through the process of reverse osmosis. Water produced and distributed by the Company adheres to the standards set by Environment Protection Agency (EPA) in the Maldives. Currently the company operates fully fledged system with complete RO plants, distribution networks and pipe distribution to households in 4 islands, which includes; GDh. Thinadhoo, GDh. Gahdhoo, Ha.Ihavandhoo and Ha.Thuraakunu. Out of the 3 islands, two of them are operated on the principles of Integrated Water Resource Management (IWRM) where conjunctive use of water is practised, whereby 25% of the total demand is catered by rainwater by catchment from public roof tops. This is in line with the countries global commitments of the Sustainable Development Goals where the adaptation of IWRM principles is a specified goal. Other than the fully fledged systems, the company also have standalone RO plants, some with community tap bay systems where services are mainly to the fishing vessels and any other need of the community.

Other than service provision, the company also implements one of the largest water projects of the nation, which is the provision of water supply services to the Allied islands of Addu City. The project is nearing completion and is expected to be completed within this year.

FENAKA operates the sewerage system of around 28 islands by means of a gravity collection system and effluent is discharged to the open ocean by means of pump stations and sea outfalls.

Furthermore, the company has recently successfully completed the design and construction of sewer systems in TH.Buruni and Th.Madifushi and the sewer project for L.Maamendhoo is ongoing. Moreover, the construction of sewer services of Hithadhoo central area is also carried out by Fenaka Corporation.

### 1.5 Consultants

This EIA report has been compiled by Mahfooz Abdull Wahhab and Mohamed Ibrahim Jaleel who are registered temporary EIA Consultants. The report was reviewed and edited by Ali Shareef, who is a registered EIA consultant with a number of years of experience and has been involved in numerous projects in the Maldives such as resort development project, sewerage system, RO plants, reclamation, shore protection and harbour projects.

## 2.0 STUDY AREA

Thinadhoo with an area of 184 Ha (isles, 2016) is located in the western edge of Huvadhoon Atoll, hence the island is exposed to strong swell waves during the South-West monsoon.

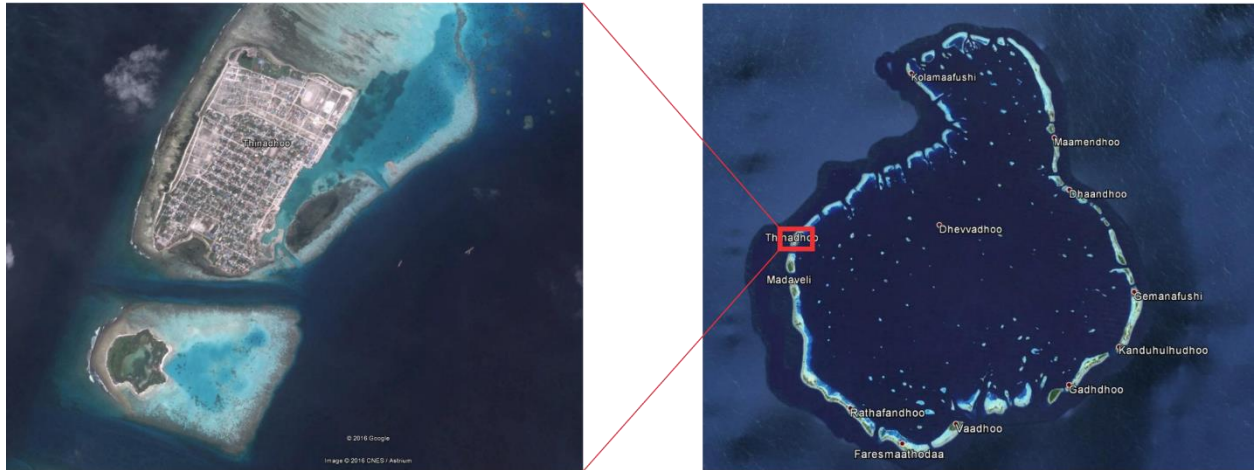


Figure 1: location of Thinadhoo, G.Dh Atoll

To the North of Thinadhoo lies an extensive reef flat measuring about 6 km in length and 1 km in width. To the South lies an uninhabited island *Kafanaa* on a separate reef flat system. Between the reef flat systems there is a small channel no wider than 140 m.

The study area for this proposed project consist of the entire Thinadhoo Island. Figure below shows the study area boundaries. Although the construction work is not going to impact the whole island, once the powerhouse is established, the benefits from the project will extend to the entire population of Thinadhoo.



Figure 2: study area

There is an environmentally sensitive area on the NE corner of the island, a small wetland less than 250 feet in length. Further, there is an environmentally sensitive area beyond the study area boundary; *Kafanaa*, a wetland on the neighboring island to the south 760 meters from the project site. Both of these environmentally sensitive areas are quite far away from where the development of this powerhouse is going to take place and the location of them on the North and West side of the powerhouse means that it is very unlikely that any smoke from the powerhouse will impact them in any way.



Figure 3: location of kafenaa, powerhouse and wetland on Thinadhoo.

## 2.1 Relevant development in the area

Construction of housing units are ongoing and is expected to be completed in the near future.

Road development ongoing by MRDC. The project involves the paving the main roads of Thinadhoo. The project is expected to be completed in the near future.

A coastal protection project is proposed to be carried out in the Southern side of the island. The project involves reclamation of the embayment area at the southern side of the island according to the EIA report for the proposed coastal protection on the south side of Thinadhoo island, G.Dh Atoll, Maldives (Water Solutions Pvt.Ltd, 2016). Reclamation works are currently ongoing and it is expected that the project will be completed in the near future.

Installation of a desalination plant is proposed to undertake during April 2016. The project involves construction of one new borehole and installation of a 300 m<sup>3</sup>/day desalination plant (FENAKA Corporation Limited, 2016).

### 3.0 PROJECT DESCRIPTION

#### 3.1 Proposed Works

The current project is looking at the development of a new power house at the existing Fenaka premises. The location of the new proposed powerhouse is shown on the figure below. The powerhouse will be constructed from pre-fabricated sheets and blocks. The project also involves transfer of the existing temporary generators to the new powerhouse.

Figures 4 and 5 below show the project location and detailed drawings of the new powerhouse.



Figure 4. project location

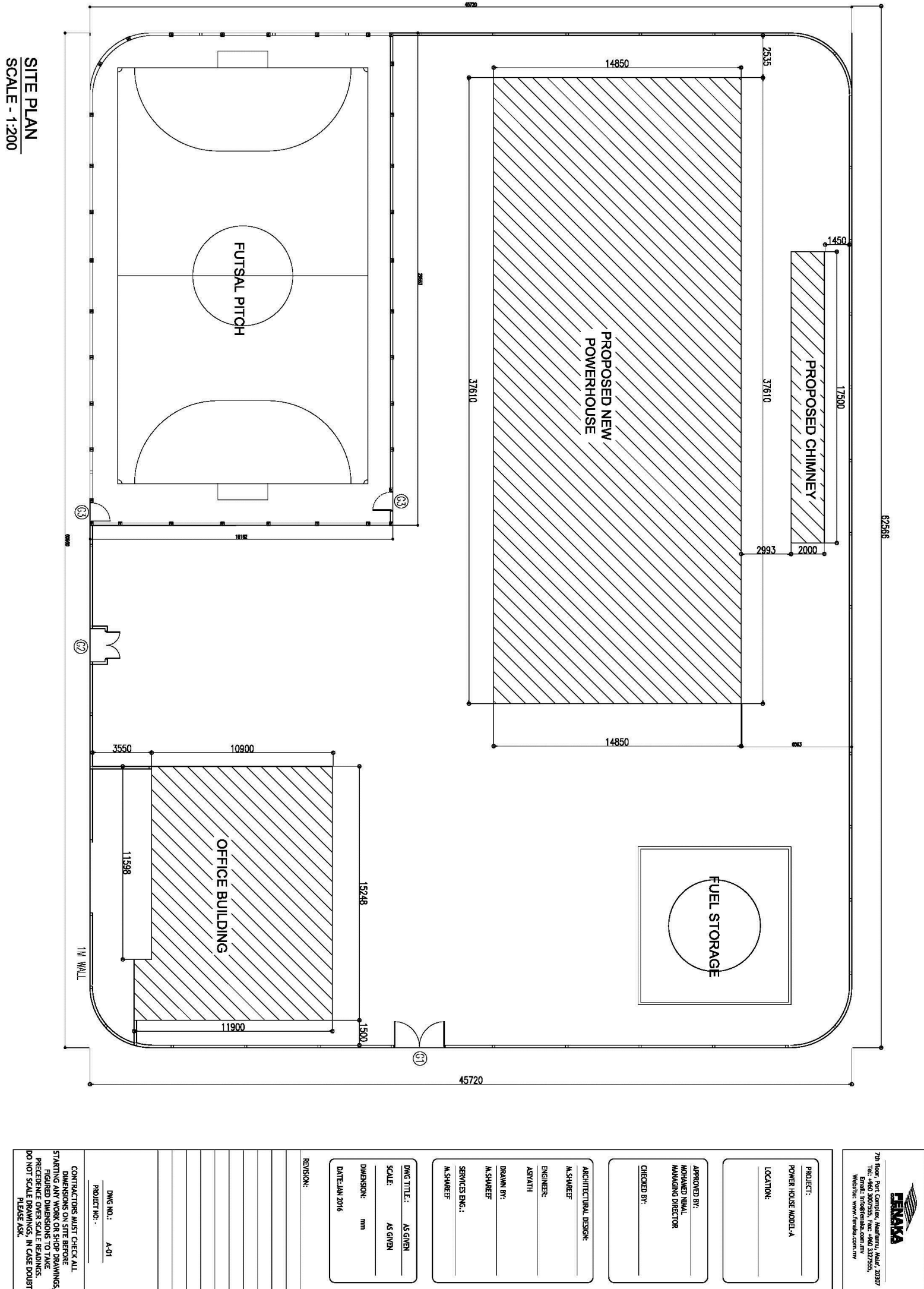


Figure 5: site plan of the project



### 3.3 Powerhouse

The powerhouse is designed in accordance with MEA and EPA standards details of which summarized in the following sections. The components of the powerhouse and the admin buildings will all comply with the BS (British Standards). The BS standard is a standardization made by the United Kingdom which sets out internationally agreed specifications for manufacturers. The BS standards for electrical components is agreed in the Maldives which is mentioned in the MEA regulations.

#### 3.3.1 Design

The design of all steel structures will be performed in accordance with BS 449 and BS 5950. Grade 43C steel will be used or similar approved. Bolts, nuts and washers will comply with BS 4190, BS 4320 / BS 4395. All welding consumables such as electrodes, filler rods, fluxes will comply with BS 5135.

Structures will be designed for the most critical combinations of dead loads, imposed loads, equipment loads, wind loads, seismic loads and temperature loads.

All walls and roof at the power house building will have galvanized profiled sandwich steel sheet cladding with paint system applied for marine environment.

It is expected that the design will mitigate the noise propagation outside the building. All walls and roof will provide delta 35 dB noise reduction.

The height of the chimney will be 9998 mm. The height is in accordance with EPA and MEA standards. The estimated height of Thinadhoo canopy is 7620 mm. Hence the chimney will be above the canopy of the island. Chimney will be fitted with particulate filter to filter out particulate matter.

#### 3.3.2 Fabrication

Cutting, holing, assembly, and bolting will be carried out in accordance with BS 5950. All structural steel will be pre-assembled in the workshop to such an extent to ensure proper site erection.

#### 3.3.3 Delivery and Handling

All structural steel works will be protected from damage during handling, transport, unloading and storage. Particular attention will be given to stiffen free ends and to prevent any permanent

distortion. All bolts, nuts, washers and small articles will be suitably packed and identified. All structural steel will be stored on thick timbers to prevent any dirt or accumulation of water under the steel.

While delivering and handling works, the necessary safety sign boards will be put up in working areas. Further, safety gears would be used by laborers, for instance safety boots and hard hats.

### 3.3.4 Erection

In general erection of the steel structures will comply with BS 5950.

Steel packing plates will be provided where necessary to ensure that the total remaining gap between the connected parts does not exceed 2 mm. All non-matching holes required for new connections will be formed by drilling and in no case will be done by burning.

Welding will be used only for shop fabrication and bolting which will be used for field connections. Welding on site will be done in exceptional circumstances. Metal arc welding will be carried out in accordance with BS 5135.

Non-shrink grout will be used between the column plates and the concrete foundation. The minimum distance between the base plate and the concrete (thickness of grout) will be 35 mm. The surface of the concrete base will be free from oil, grease or any loose material. Pouring of grout will be continuous operation to maintain the hydrostatic head and to ensure the flow of the grout is not stop and to eliminate any air becoming trapped under the base plate.

### 3.3.6 Doors and Windows

Aluminium doors, windows and glass walls as well as aluminium frames will be anodized in accordance with BS 1615 or BS 3987. Sections of aluminium profiles will not be less than 50 mm deep and 2 mm thick. Door and window elements will be fixed to the structure by means of separate rectangular hollow galvanized steel or aluminium frame.

For air conditioning rooms, the aluminium windows will have double glazing. Glass wall on the wall, between the control room and Gen set room will have triple glazed.

All doors will have design to mitigate noise and heat by using necessary insulation material or techniques.

**3.3.7 Roof and Wall Cladding system**

All the wall and roofs will have insulated sandwich cladding. The roof and wall cladding will be multi-layered protected metal system consisting of a galvanized steel substrate, heavy epoxy base coat and high build exterior weather coat of polyurethane.

It is expected that the design will mitigate the noise propagation outside the building. All walls and roof will provide delta 35 dBA noise reduction.

The cladding will be sealed with a non-drying, non-corrosive permanently elastic preformed metal sealing tape capable of performing in a temperature up to 100 deg C.

The external weathering sheet will be secured to the galvanized sub-girths or structural support with stainless steel hexagon headed self-tapping screws, each with an integral EPDM (Ethylene Propylene Die Memonoma) washer bonded to a dished aluminium washer.

Flashings required in connection with the external weather skin will be formed from > 0.5mm thick material similar as claddings material.

Profiled filler pieces will be provided at all terminal positions on the roof and side wall areas. The fillers will be of polyethylene form and be immune to birds and insect attack.

**3.3.8 Lighting, small power, air conditioner and fans**

All electrical installation at the building will comply with BS Standards. All electrical equipment, appliances and fittings and cable use will meet the standards. Furthermore, the electrical design of the building will be in accordance with MEA standards.

Lights and sockets used for gen set hall will be industrial type, design for hot and harsh environment. For outdoor application, on gable end walls and corridors, only outdoor lights will be used. For all the rooms except gen set hall, lights design for office application can be used.

Control room and Technical staff room will be fitted with air conditioners and ceiling fans. Store room and tool room will be fitted with air conditioners. Workshop will have ceiling fans.

Power sockets will be available on all walls of the rooms including gen set hall.

The mean illumination level will be as follows;

- Inside the Gen set hall: 300 Lux
- Control room / SWG room: 350 Lux
- All other room: 250 Lux
- Corridors / walls: 200 Lux

### 3.3.9 Safety Precautions

The safety precautions to be applied during the erection of the steel structures will be in accordance with BS 5531. All necessary precautions will be taken to protect personal and property from hazards due to falls, injuries, toxic fumes, or other harm. During construction works the necessary safety sign boards will be put up in working areas. Further, safety gears would be used by laborers, for instance safety boots and hard hats. All painting and corrosion protection work, including inside the building will be performed under strict safety conditions.

### 3.3.10 Depth of foundation

The powerhouse is a single storey building (only ground floor) and hence does not require a deep foundation and the depth of foundation according to the details is 750 mm which does not require dewatering.

### 3.3.10 Emergency power mechanism

- Movable Backup gen-sets with containerized generator and control panel.

### 3.2.11 Measures to increase power efficiency

- Efficient diesel generator governor system and running time
- Scheduled maintenances (de-carbonizing, top overhaul, full overhaul and filter changes) at manufacturer recommended running intervals

### 3.2.12 Safety components

- Safety boards
- Fire safety system
- Security camera system
- Lightning protection system

Pre fab powerhouse designers will propose all the safety systems. It will be ensured that the measures meet the minimum requirements once the supplier submits the final designs.

### 3.2.13 Fuel Management

- 60,000 Liters (30,000 x 2) fuel storage tanks, with reinforce concrete retaining wall is proposed to be constructed which will contain the volume of fuel during emergency spills. The detailed drawings of fuel storage tanks are shown in the appendix.
- Day tanks will be equipped with flow-meters and level detection. Tank will be installed with 150mm concrete base
- Fuel pipe line: GI Pipelines conforming to international standards. Pipes will be laid 300mm above ground level. Leak detection and echo-sounding in main tanks and lines will be equipped with flow-meter
- Fuel to be transferred directly from transport vessel (from harbor) to fuel tank at power house by bowser. Bowser will be loaded at the harbor using a horse from the barge. Fuel transfer horses must be checked for any damages prior to fuel transfer.
- Lubricant oil consumption: average 800 Liters per month. Waste lubricant oil shall be stored in the store room in a closed labelled container over concrete floor. Waste lubricant oil will be transported to Thilafushi for disposal on a monthly basis.

Figure 6 below shows the proposed fuel transfer route from the unloading area to the new powerhouse at Thinadhoo.



Figure 6. Fuel transfer route from fuel unloading area to the new powerhouse at Thinadhoo

### 3.4 Admin building

#### 3.4.1 Design

The design of all steel structures will be performed in accordance with BS 449 and BS 5950. Grade 43C steel will be used. Bolts, nuts and washers will comply with BS 4190, BS 4320 / BS 4395. All welding consumables such as electrodes, filler rods, fluxes will comply with BS 5135.

Structures will be designed for the most critical combinations of dead loads, imposed loads, equipment loads, wind loads, seismic loads and temperature loads.

All walls and roof at the admin building will have galvanized profiled sandwich steel sheet cladding with paint system applied for marine environment.

It is essential that the design will mitigate the noise propagation outside the building. All walls and roof will provide delta 20 dB noise reduction.

#### 3.4.2 Fabrication

Cutting, holing, assembly, and bolting will be carried out in accordance with BS 5950. All structural steel will be pre-assembled in the workshop to such an extent to ensure proper site erection.

#### 3.4.3 Delivery and Handling

All structural steel works will be protected from damage during handling, transport, unloading and storage. Particular attention will be given to stiffen free ends and to prevent any permanent distortion. All bolts, nuts, washers and small articles will be suitably packed and identified. All structural steel will be stored on thick timbers to prevent any dirt or accumulation of water under the steel.

#### 3.4.4 Erection

In general erection of the steel structures will comply with BS 5950.

Steel packing plates will be provided where necessary to ensure that the total remaining gap between the connected parts does not exceed 2 mm. All non-matching holes required for new connections will be formed by drilling.

Welding will be used only for shop fabrication and bolting will be used for field connections. Welding on site will be done in exceptional circumstances. Metal arc welding will be carried out in accordance with BS 5135.

Non-shrink grout will be used between the column plates and the concrete foundation. The minimum distance between the base plate and the concrete (thickness of grout) will be 35 mm. The surface of the concrete base will be free from oil, grease or any loose material. Pouring of grout will be continuous operation to maintain the hydrostatic head and to ensure the flow of the grout is not stop and to eliminate any air becoming trapped under the base plate.

### 3.4.6 Door and Windows

Aluminium doors, windows and glass walls as well as aluminium frames will be anodized in accordance with BS 1615 or BS 3987. Sections of aluminium profiles will not be less than 50 mm deep and 2 mm thick. Door and window elements will be fixed to the structure by means of separate rectangular hollow galvanized steel or aluminium frame.

For air conditioning rooms, the aluminium windows will have double glazing. All doors will have design to mitigate noise and heat by using necessary insulation material and techniques.

### 3.4.7 Roof and Wall Cladding system

All the wall and roofs will have insulated sandwich cladding. The roof and wall cladding will be multi-layered protected metal system consisting of a galvanized steel substrate, heavy epoxy base coat and high build exterior weather coat of polyurethane.

The cladding will be sealed with a non-drying, non-corrosive permanently elastic preformed metal sealing tape capable of performing in a temperature up to 100 deg C.

The external weathering sheet will be secured to the galvanized sub-girths or structural support with stainless steel hexagon headed self-tapping screws, each with an integral EPDM (Ethylene Propylene Die Memonoma) washer bonded to a dished aluminium washer.

Flashings required in connection with the external weather skin will be formed from > 0.5mm thick material similar as claddings material.

Profiled filler pieces will be provided at all terminal positions on the roof and side wall areas. The fillers will be of polyethylene form and be immune to birds and insect attack.

### 3.4.8 Lighting, small power, air conditioners and fans

All electrical installation at the building will comply with BS Standards. All electrical equipment, appliances and fittings and cable use will meet the standards. Furthermore, the electrical design of the building will be in accordance with MEA standards.

Sockets will be installed on all the walls of each room at office building. The desired illumination will be made by installing many light fixtures in each room. For outdoor application, on walls and corridors, only outdoor lights will be used. Air conditioners and fans will be installed in all rooms including main hall.

The mean illumination level will be as follows;

- Inside the rooms / hall : 300 Lux
- Corridors / outside walls : 200 Lux

### 3.4.9 Safety Precautions

The safety precautions to be applied during the erection of the steel structures will be in accordance with BS 5531. All necessary precautions will be taken to protect personal and property from hazards due to falls, injuries, toxic fumes, or other harm. All painting and corrosion protection work, including inside the building will be performed under strict safety conditions.

### 3.5 Project inputs and outputs

The major inputs required for the construction of a powerhouse at GDh. Thinadhoo are outlined in Table 2 below.

Table 2. Major inputs for required for the construction of a powerhouse at GDh. Thinadhoo

Input resource(s)	Source/ type	Qty/Volume	Source of resource
Machinery and equipment	Generators	1	Contractor
	Crane	1	Contractor
	Pre-fab house	1	Imported
	Excavator	1	Locally available
	Metal rollers	10	Contractor

Fuel for operation	Petrol	80 L/day	Local purchase
Power	Electricity for operation	-	Obtained from existing grid

Main output of the project is a new powerhouse constructed from pre-fabricated material. Other outputs anticipated to be generated from the project are outlined in Table 3 below.

Table 3. Project outputs anticipated to be generated from the proposed project.

Project outputs	Method of generation/Qty	Method of control
New powerhouse	To be built from pre-fab material	NA
Construction wastes	Demolition wastes Waste oils Green waste Wastewater Greenhouse gases, effluents	Demolition and green waste gathered for one month and transferred to Thilafushi for disposal  Connection made to sewer system of the island to dispose waste water
Wastes generated from workforce	1.2 m <sup>3</sup> per day	Managed according to the existing waste and sewerage scheme of island
Noise	Localized to the project site	Unavoidable, but could be minimized by limiting working hours to daytime only and completing the project within the earliest possible duration.

### 3.6 Construction method

#### 3.6.1 Workforce

The workforce required for the construction shall be stationed within the island in existing houses. G.Dh.Thinadhoo has all the utility services such as water, sewer and electricity networks, therefore there is no requirement to do additional work to provide the services to the workforce.

#### 3.6.2 Materials and machinery required for construction

The material required for construction which is not available locally, shall be imported and shipped from Male' to the site. The prefab materials will be imported by the contractor.

The equipment's required for the project are a crane and general construction tools. Some of these are available at the company and others would be sourced from available shops.

### 3.6.3 Mobilization

The cranes required for the project will be carried to Thinadhoo via a barge. Other materials and workforce will be transported in a ferry. The outer roads of Thinadhoo (fuel transfer route shown in figure 6) are wide enough for access of machinery.

### 3.6.4 Establishment of temporary project facilities

No temporary project housing facilities will be required to build as the required housing for the workforce will be provided from the residential houses in Thinadhoo.

Project site setup will be done within FENAKA premise, the proposed location is shown in figure 7. The proposed temporary project site setup would include a small hut constructed from metal pipes joined together by brackets, with tin roofing. Waste generated will be temporarily stored and transferred to Thilafushi on a monthly basis.

Table 4: geocoordinates for proposed temporary site setup

Location	Longitude	Latitude
Powerhouse	72.99319753451118	0.524738681774777



Figure 7: location of proposed temporary site setup location

### 3.6.5 Proposed timeline for project activities

Figure 8 below shows the proposed timeline for project activities.

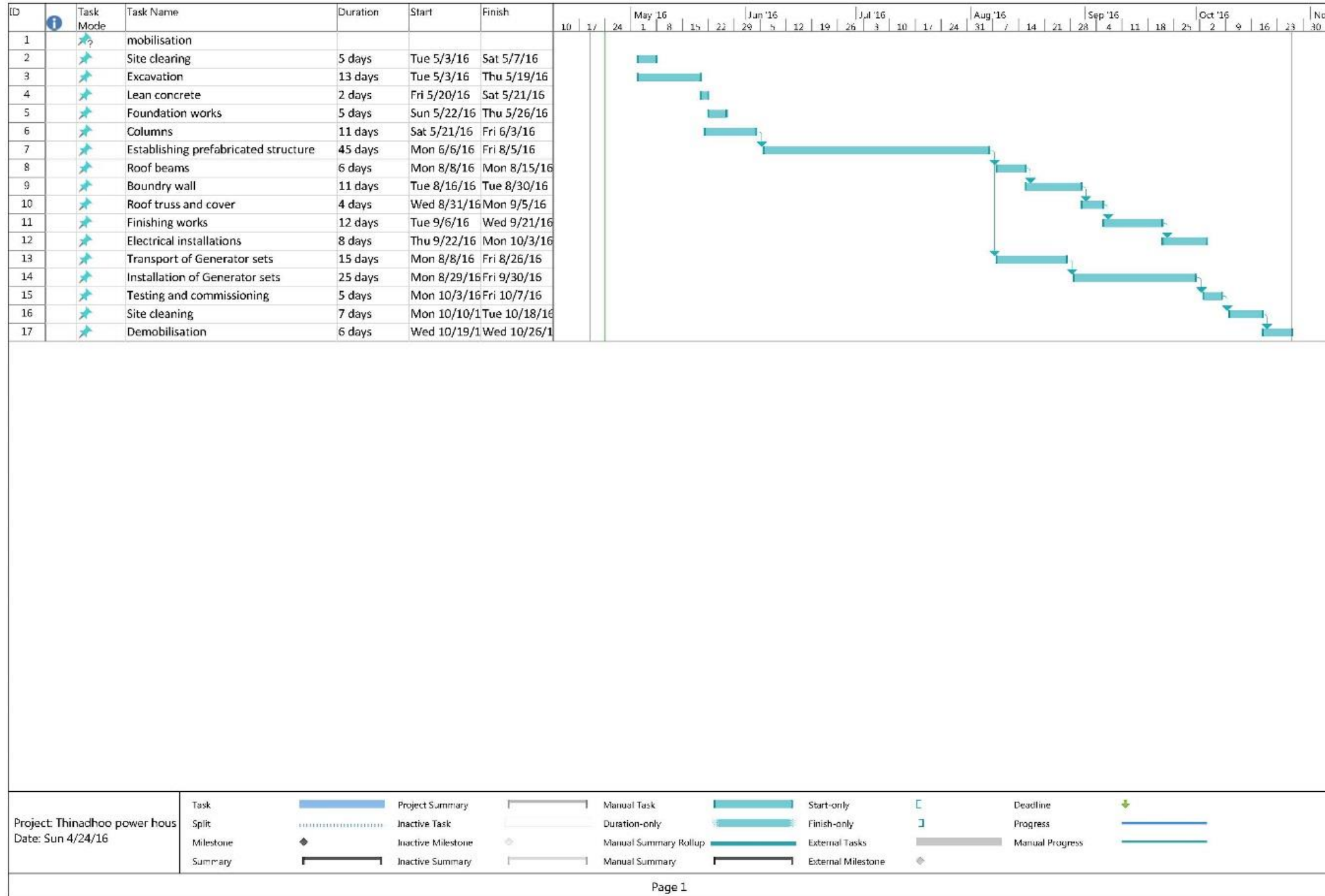


Figure 8: proposed timeline for project activities

### 3.7 Decommissioning

Once the project has been completed, the contractor leaves the site after performing the required site clearance and levelling works. Any temporary project facilities will be demolished and the waste will be transported to Thilafushi for disposal. All heavy machinery brought in by the contractor will be demobilized via barge.

Once the powerhouse is handed over to FENAKA, the registration of the powerhouse in MEA will commence.

## 4.0 EXISTING ENVIRONMENT

### 4.1 General Climate

As most islands of the Maldives are located within and in very close proximity to the equator, all islands experience monsoonal climate. Towards the North, the effect of Seasons are more apparent and hence experience infrequent torrential rain, while towards the South the effect of seasons are negligible and experience frequent rain.

Maldives experiences two distinctive monsoons; the North-East Monsoon or dry monsoon which last from January to March and the South-West monsoon or wet monsoon which lasts from May to November. In both seasons, the temperature varies slightly despite the huge difference in rainfall.

### 4.2 Temperature

As the Maldives consists of small islands surrounded by sea, even hot days are tempered by cooling sea breezes and mild evening temperatures. Therefore, throughout the year there is little change in temperature. However the daily temperatures fluctuate between 31 °C in daytime and 23 °C at night. However there were rare temperature anomalies recorded; on 19<sup>th</sup> May 1991 the highest temperature ever recorded in Maldives was recorded at Kahdhoo Meteorological office - 36.8 °C and on 11<sup>th</sup> April 1978 the lowest temperature was recorded in National Meteorological Center- 17.2 °C.

Looking closely at the monthly maximum and minimum temperatures from four different meteorological centers, it becomes clear that there is a very small fluctuation in the maximum and minimum temperatures throughout the year. However, as expected there is a considerably huge variation in the maximum and minimum temperature for Hanimadhoo. From February to May, the minimum temperature for Hanimaadhoo rose from 24.5 °C to 26.5 °C.

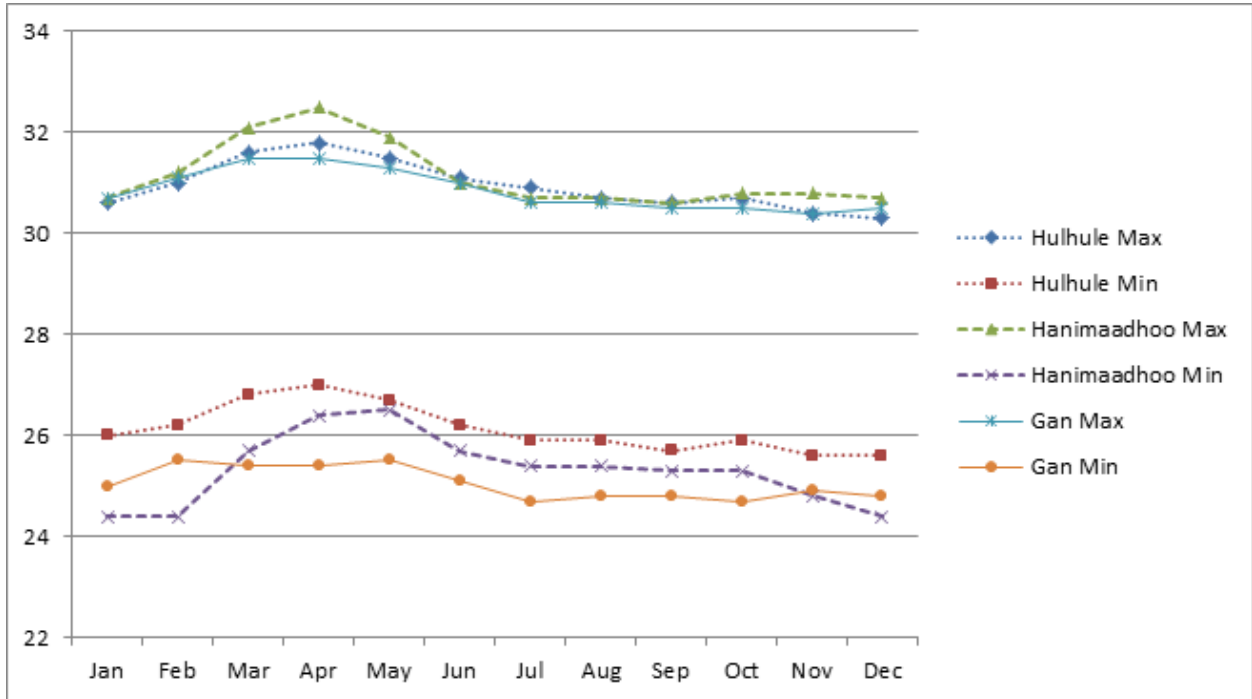


Figure 9: monthly maximum and minimum temperatures(°C) for Maldives throughout the year. Data since 2000, adopted from the National Meterological Centre.

### 4.3 Rainfall

During the South-West monsoon, from mid-May to December heavy rainfall is experienced to all atolls. The highest rainfall ever recorded during a 24 hour period was on 9<sup>th</sup> July 2002 at Kaadedhdhoo Meteorological office, which was 219.8 mm of rainfall.

Looking at rainfall data since 2000, heavy rainfall is experienced (between 200mm and 250mm of rainfall) from May to December. Lowest rainfall is between February and March, where rainfall is between 25mm and 80mm.

There is a considerable difference in the rainfall pattern between the North and the rest of Maldives during May to July and October to December. For North rainfall is higher during May to July which is at 250mm while for other areas 170mm of rainfall, during October to December rainfall for North declines from 225mm to 100mm while rainfall for other areas remains between 210mm and 240mm.

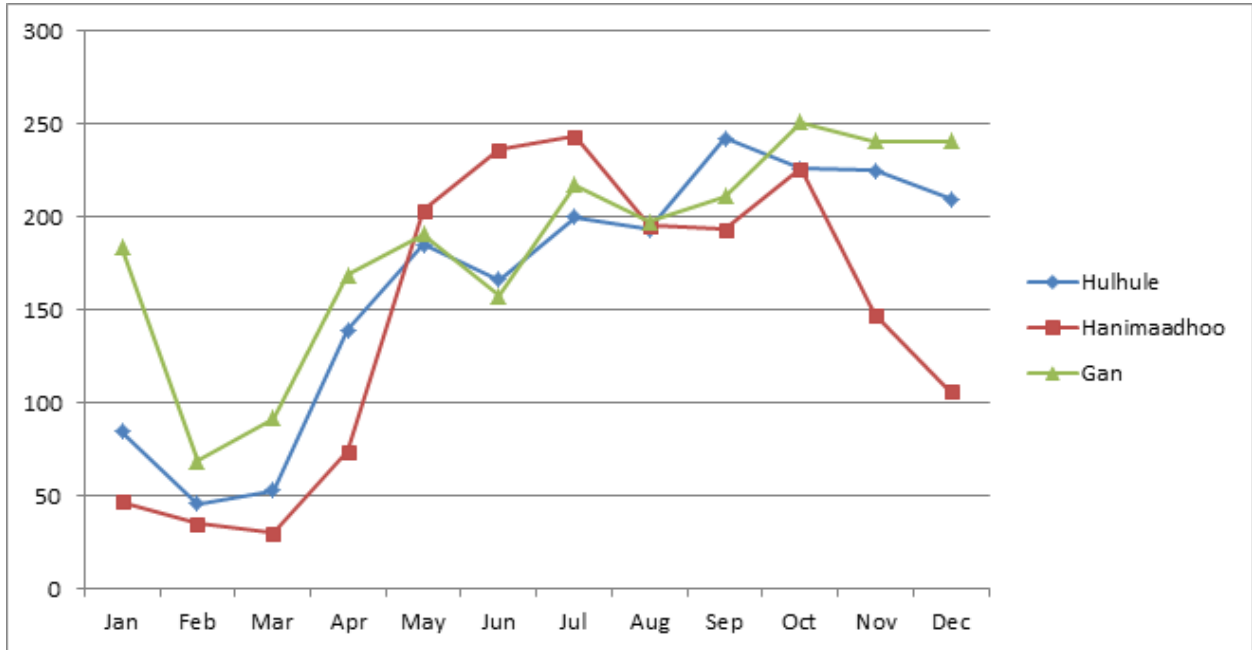


Figure 10: rainfall (mm) data since 2000, adopted from the National Meteorological Centre

### 4.3.1 Specific rainfall data at G.Dh Thinadhoo

Since Thinadhoo is in very close proximity to Kaadedhdhoo, the rainfall data for Kaadedhdhoo would be almost the same for Thinadhoo.

Monthly rainfall variations in Thinadhoo follows the same pattern as of the Southern atolls. Highest rainfall is in May and November.

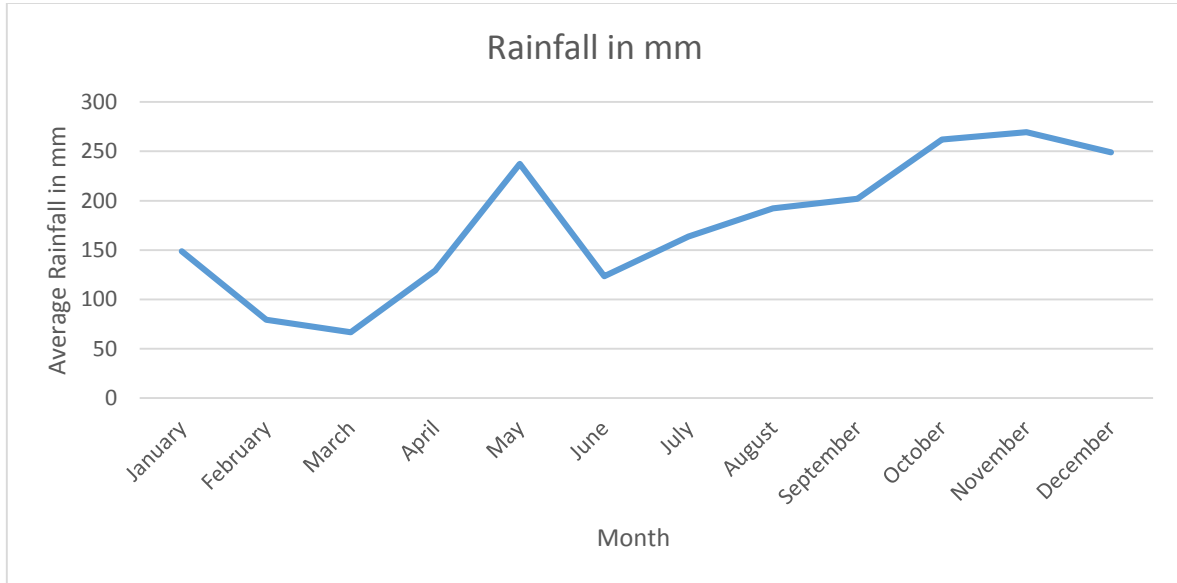


Figure 11: monthly rainfall variations at G.Dh Thinadhoo

The yearly rainfall for Thinadhoo seems to be in a cyclic manner like the rest of the Maldives. The cycle is about 10 years where average rainfall increases from 2000mm/year reaches a peak of 2500mm/year and decreases up to 1500mm/year, and again increasing up to 2500mm/year.

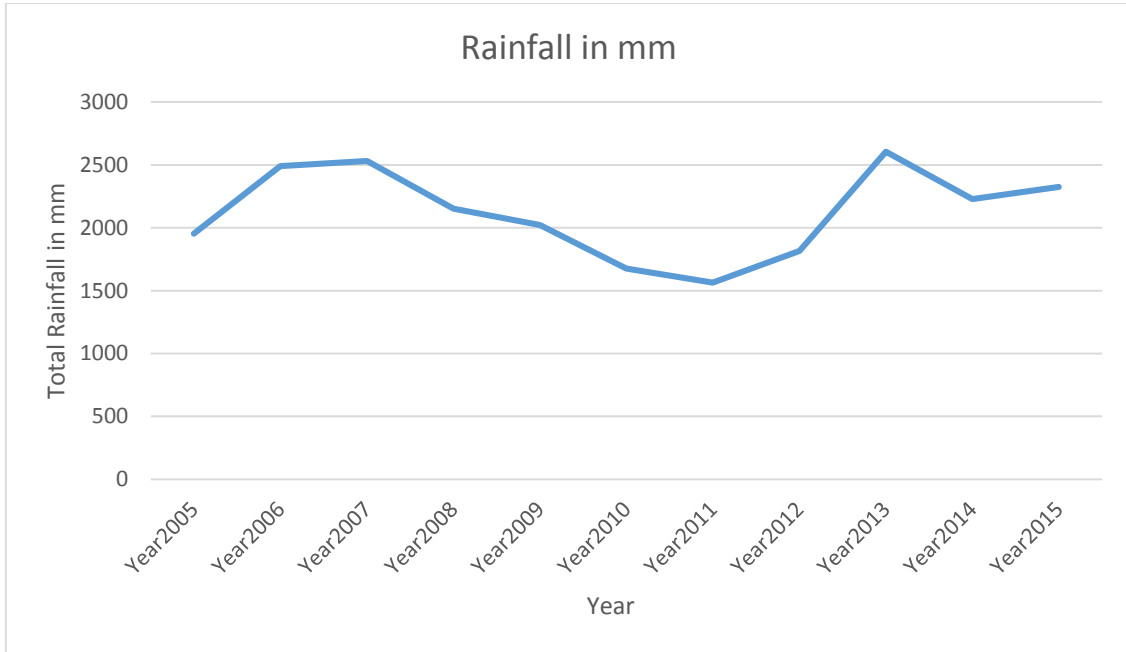


Figure 12: annual variations in rainfall at G.Dh Thinadhoo

#### 4.4 Insolation

As the Maldives lie within the equator, it received plentiful of sunlight everyday throughout the year. Highest insolation is received between February and April with a peak of 12 hours of daylight. For North, insolation is lower than for the other areas between May and July; 7 hours of insolation for North while for other areas the lowest sunshine was 8.5 hours.

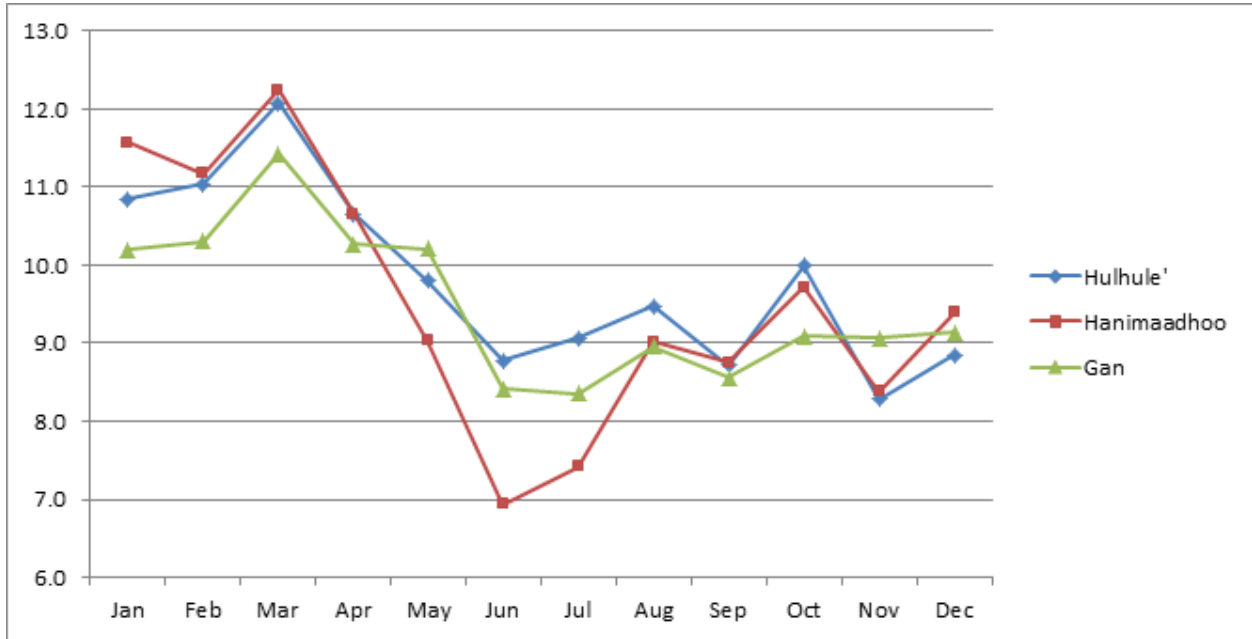


Figure 13: average daily insolation (hours) for different areas

#### 4.5 Wind

The following figure shows wind pattern from year 2003 to 2008, adopted from EIA report for development of B. Voavah as a luxury tourist resort (2015). The blue vectors represent wind direction in the NE monsoon and green vectors represent wind direction in the SW monsoon. As can be seen from the vectors during the SW monsoon wind predominately blows from the SW and during NE from the NE.

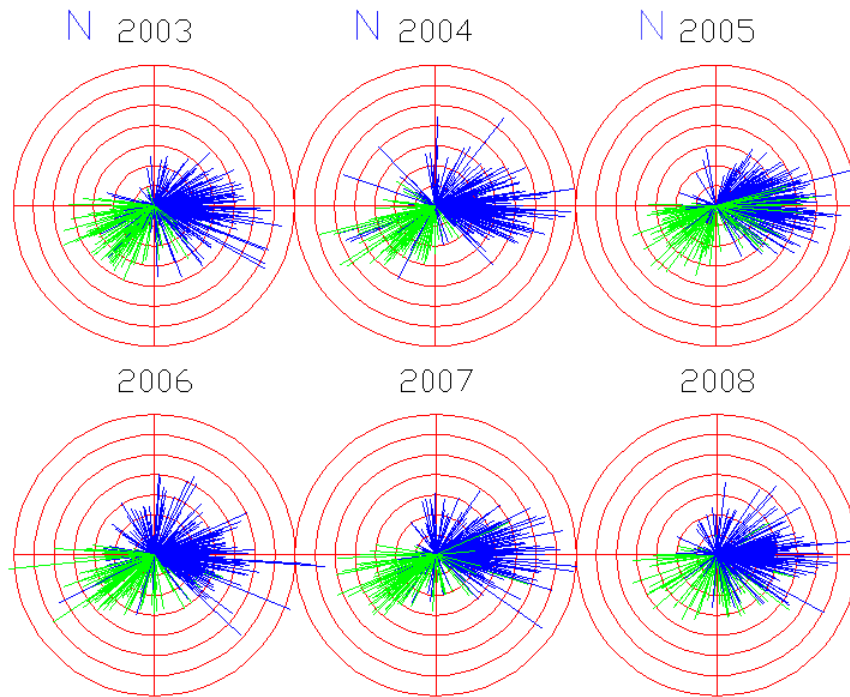


Figure 14: wind vectors from 2003 to 2008.

#### 4.6 Waves

The following figure shows waves data gathered by Young (1999) for a ten year period for each world regional zone. This data was adopted from EIA report for development of B. Voavah as a luxury tourist resort (2015). In this research by Young Wave height was measured by satellite (Radar Altimeter), whereas a global wave model was used to precise wave directions. It indicates that dominant swell waves during the SW monsoon comes from SW and during NE monsoon from the NE. The peak wave height according to this model is in June with 1.8 meters. This corresponds with the roughest weather days for Maldives, which is roughly June and July.

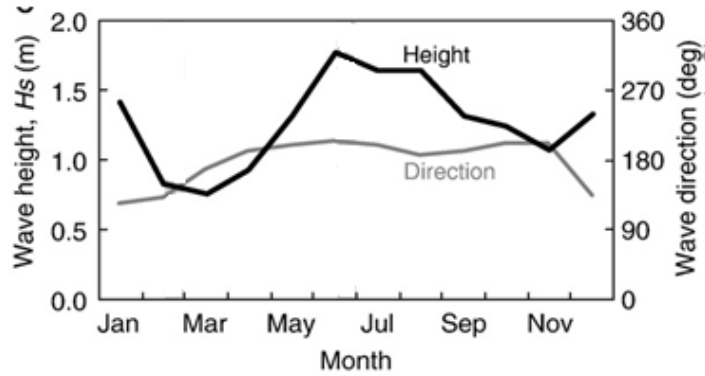


Figure 15: Ten year mean monthly wave height and direction for the central Maldives. Source: Young (1999).

#### 4.7 Hazard Vulnerability

The coastal area near the powerhouse is subjected strong wave action during monsoon season. There has been severe flooding and erosion of the area in the recent past during rough weather. In some instances, desalination plant premise was inundated. Further, the outer wall of the FENAKA premise has been greatly damaged due to the result of being battered by strong waves.



Figure 16: erosion at the corner of the desalination plant premise walls

During rainy season the road to powerhouse get flooded. However, the flooding is not so severe that the water enters the powerhouse as the inside of the powerhouse premise is slightly elevated. Inundation due to storm surges will not be an issue as the coastal protection measure to Thinadhoo will be completed in the near future. However, as mitigation for flooding, the floor of the powerhouse shall be constructed slightly elevated.



Figure 17: flooding during rainy season at powerhouse area

## 4.8 Water Quality

### 4.8.1 Sampling method

One water sample was taken from an existing well within the powerhouse premise. Water from the well was collected by dipping a bucket into the well. Water sampling bottle was rinsed 3 times from the well water.

Water sample was collected in a 1.5 mL plastic bottle on 04<sup>th</sup> April 2016. The bottle was chilled and transferred to Male', which was later tested at MWSC laboratory.

### 4.8.2 Sampling location

Table 5 below shows the locations from which water samples were taken.

Table 5: geocoordinates of water sample location

Location	Longitude	Latitude
Powerhouse	72.99261255027722	0.5244835145853928



Figure 18: water sample location

### 4.8.3 Results

Table 6: water sample results

Location	Powerhouse	Optimal Range	Reference
Conductivity(μs/cm)	6420	<1500 μs/cm	EPA
pH	7.34	6.5-8.5	EPA
Salinity (‰)	3.5	NA	EPA
Temperature(°C)	23.4	NA	EPA
Turbidity (NTU)	0.401	<5NTU	EPA
Total Petroleum Hydrocarbon (mg/L)	0.07	NA	EPA

Only pH and Turbidity is within the optimal range. Conductivity is beyond the optimal range. This high conductivity is possibility due to the close proximity to the coast. Further, hydrocarbons are present at a concentration of 0.07 mg/L.

#### Previous data on water quality

In a study done on 2010 during the EIA surveys for the G.Dh Thinadhoo wastewater collection, treatment and disposal system (Ministry of Housing and Environment, 2010), it was reported that ammonium was present in 90% of the wells with an average concentration of 4.3mg/L. Nitrate was found in 60% of the wells with an average value of 7.2mg/L. Phosphate was detected in 95% of the wells with an average of 0.68 mg/L.

During the EIA surveys for G.Dh Thinadhoo 300m<sup>3</sup>/day Desalination plant (FENAKA Corporation Limited, 2016) it was found that the conductivity of water in the reclaimed area was

higher than the EPA recommended range (1702 microSiemens/cm). Further, Sulphate (108 mg/L) and Nitrates (17.2 mg/L) were also found to be in high concentrations.

## 4.9 Vegetation

### 4.9.1 Method

The vegetation cover at the proposed powerhouse location was determined visually. All the trees within the site were counted. The geo-coordinates of the proposed powerhouse location is shown on Table 7.

### 4.9.2 Results

There are 57 *Cocos nucifera L.* within the vicinity of the proposed powerhouse location, out of which an estimated 20 *Cocos nucifera L.* will have to be removed. There is a considerable cover of *Panicum maximum*, *Lippia nudiflora* and on the ground with a few *Launaea sarmentosa*. Further, one *Casaurina equisetifolia*, *Hibiscus tiliaceus* and *Terminalia catappa* tree needs to be removed.

The estimated canopy height is 25 feet.

Table 7: geocoordinates for proposed powerhouse location

Location	Longitude	Latitude
Proposed powerhouse	72.99260325262722	0.5246153982880835

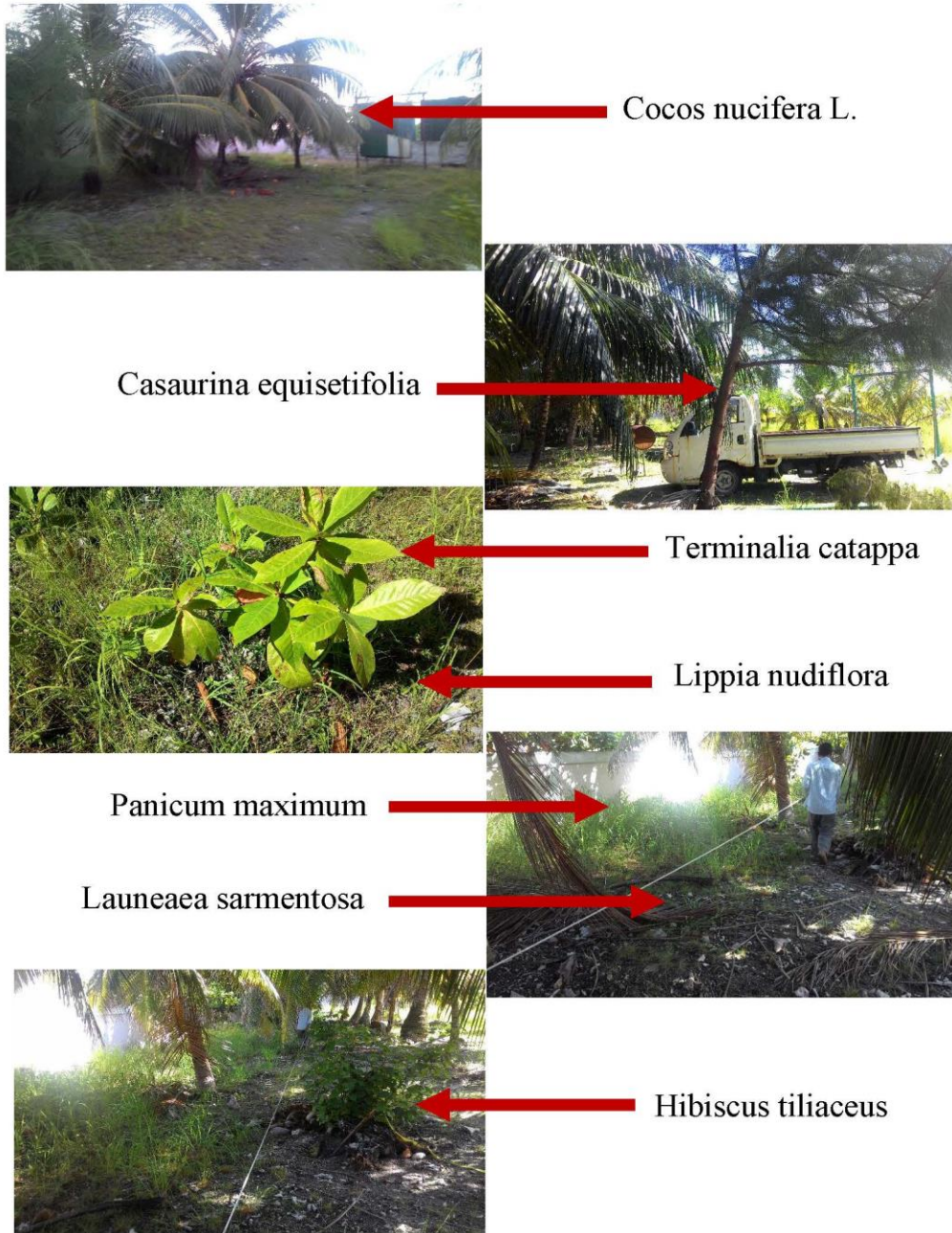


Figure 19: vegetation near proposed powerhouse

#### 4.9.1 Dhivehi names for the vegetation

Table 8: Dhivehi and scientific names for plants

Scientific Name	Dhivehi Name
<i>Panicum maximum</i>	<i>Onuhui</i>
<i>Casaurina equisetifolia</i>	<i>Fithuroanu</i>
<i>Cocos nucifera</i> L.	<i>Ruh</i>
<i>Terminalia catappa</i>	<i>Midhili</i>
<i>Hibiscus tiliaceus</i>	<i>Dhiggaa</i>
<i>Launea sarmentosa</i>	<i>Kulhlhaa filaa</i>
<i>Lippia nudiflora</i>	<i>Huni gondi</i>

#### 4.10 Noise level

##### 4.10.1 Method

Noise level was measured using a hand held decibel meter. The maximum and minimum readings were recorded at the powerhouse and near the closest residential area. The geo coordinates of the locations are shown below.

Table 9: geocoordinates of noise level measurement locations

Location	Longitude	Latitude
Powerhouse 1	72.99278461679171	0.525053582048661
Powerhouse 2	72.99254778715314	0.525053582048661
Powerhouse 3	72.99307523687308	0.5243081178376194
Powerhouse 4	72.99319753451118	0.524738681774777
Haashge 5	72.99349857747193	0.5253819028107845
Fathihugali 6	72.99311964503562	0.5254930096518305
Malasge 7	72.9929625057601	0.525561366819073



Figure 20: noise level measurement locations

#### 4.10.2 Results

Table 10: results of noise level measurements

Location	Noise level (db)	
	Minimum	Maximum
Powerhouse 1	58.4	60.2
Powerhouse 2	58.7	60.3
Powerhouse 3	68.2	70.5
Powerhouse 4	76.7	77.8
Haashge 5	58.2	59.4
Fathihugali 6	48.0	49.7
Malasge 7	53.9	54.7

Noise level within the vicinity of the temporary generators was very high. This is because the generators are not inside a sound attenuated powerhouse that the noise level within the nearest residential area are also considerably high.

## 4.11 Socioeconomic environment

### 4.11.1 Demography

#### Population

Over the past years the population of Thinadhoo has shown quite an interesting pattern. Although typically there has been a gradual increase in the population, the island experienced a drop in population in the year 2006 as well as on 2014 (MEE, 2013). The island population as of census data from 2014 is 5268 (Table 11), which is a negative growth rate of -36.9 %. The reason for this decrease could be attributed to emigration to the greater Male’ region for employment, education and health reasons.

Table 11: population details of Thinadhoo (Data from 1985 to 2013 adopted from MEE, 2013)

	1985	1990	1995	2000	2006	2012	2013	2014
<b>Total</b>	3030	3636	4408	4893	4442	7108	7210	5268
<b>Male</b>	1436	1775	2174	2387	2168	3625	3546	2889
<b>Female</b>	1594	1861	2234	2506	2274	3483	3664	2379

Thinadhoo is the most densely populated island in G.DH Atoll. The following figure shows the population of islands of G.DH atoll from the 2014 census.

Table P21 : POPULATION, SEX RATIO AND ANNUAL POPULATION GROWTH BY ISLANDS- GDH ATOLL, 2006 & 2014

Locality	Population 2014									Maldivian Population 2006			Maldivian Population 2014			Total
	Total			Maldivians			Foreigners			Both Sexes	Male	Female	SEX RATIO 100 Males per 100 Female	INTER-CENSAL AVERAGE ANNUAL GROWTH RATE 2006-2014	% SHARE OF POPULATION IN LOCALITY	
	Both Sexes	Male	Female	Both Sexes	Male	Female	Both Sexes	Male	Female							
<b>Total</b>	<b>13,152</b>	<b>7,240</b>	<b>5,912</b>	<b>11,765</b>	<b>6,052</b>	<b>5,713</b>	<b>1,387</b>	<b>1,188</b>	<b>199</b>	<b>11,013</b>	<b>5,395</b>	<b>5,618</b>	<b>106</b>	<b>0.78</b>	<b>100.00</b>	
<b>Administrative Islands</b>	<b>12,715</b>	<b>6,874</b>	<b>5,841</b>	<b>11,663</b>	<b>5,951</b>	<b>5,712</b>	<b>1,052</b>	<b>923</b>	<b>129</b>	<b>10,991</b>	<b>5,373</b>	<b>5,618</b>	<b>104</b>	<b>0.70</b>	<b>99.13</b>	
Madaveii	1,259	643	616	1,190	585	605	69	58	11	1,065	508	557	97	1.31	10.11	
Hoadedhdhoo	796	411	385	757	383	374	39	28	11	668	324	344	102	1.47	6.43	
Nadallaa	725	388	337	692	364	328	33	24	9	614	289	325	111	1.41	5.88	
Gadhdhoo	1,489	809	680	1,375	706	669	114	103	11	1,439	729	710	106	-0.54	11.69	
Rathafandhoo	553	301	252	517	273	244	36	28	8	492	249	243	112	0.58	4.39	
Vaadhoo	741	393	348	694	351	343	47	42	5	662	319	343	102	0.56	5.90	
Fiyoori	825	455	370	737	382	355	88	73	15	673	316	357	108	1.07	6.26	
Faresmaathodaa	1,059	585	474	994	528	466	65	57	8	936	471	465	113	0.71	8.45	
Thinadhoo	5,268	2,889	2,379	4,707	2,379	2,328	561	510	51	4,442	2,168	2,274	102	0.68	40.01	
Resorts, Industrial Islands and Others	437	366	71	102	101	1	335	265	70	22	22	0	10,100	18.05	0.87	

Figure 21: population census of G.DH Atoll

### Sex ratio

102 males per 100 females.

### Density

39.3 per hectare (isles, 2016)

### Growth

Inter-Censal average annual growth rate 2006 to 2014 is 0.68.

#### 4.11.2 Community needs

According to the council and locals, the most important needs right now for the island is road development.

#### 4.11.3 Pressure on resources

Groundwater is saline due to over-extraction and hence most locals has to rely on desalinated water. There is not enough land for housing, however a reclamation project is currently underway hence it is expected that this issue will be resolved in the near future.

#### 4.11.4 Main economic activities

The main income generating activity for the locals are from public administration. Other income generating sectors where people work are manufacturing, wholesale and retailing, transport and construction, fisheries and tourism sector.

#### 4.11.5 Economic ventures of the island

Development	Number
Auditorium/theater	1
Automobile repair garage	5
Carwash - garage	3
Bakery	2
Cafeteria	4
Mosque	8
Community centre	2
Health facility	1
Hospital	1
laboratory	1
Manufacturing - industry	1
Office building	10
Dormitory - college or residential	2
Residential – boarding house	6
Residential – 2 -3 bedrooms apartment	6
Residential – guest house with kitchen	6
Restaurant – fixed seat	4
School - kindergarten	1
School – elementary / junior high	2
School – high school	1

#### 4.11.6 Residential areas

Following figure shows the residential areas in Thinadhoo.



Residential Areas: highlighted in blue

Image © 2016 CNES / Astrium

Figure 22. Residential areas at Thinadhoo (blue highlight)

## 4.12 Air quality

### 4.12.1 Method

Air quality was measured using wolfsense air quality meter. Readings were recorded at the existing powerhouse and proposed powerhouse location. The geo coordinates of the locations are shown below.

Table 12: geocoordinates of air quality measurement locations

Location	Longitude	Latitude
existing temporary powerhouse	72.99319753451118	0.524738681774777
Proposed powerhouse	72.99260325262722	0.5246153982880835

### 4.12.2 Results

Table 13: air quality results

Location	Parameters			
	No <sub>2</sub> / ppm	Nitric Oxide / ppm	So <sub>2</sub> / ppm	Ozone / ppm
Existing powerhouse	2	0	0	0
Proposed powerhouse	0	0	0	0

Nitrogen dioxide was found at 2 ppm concentration near the exhaust chimney of the existing temporary powerhouse. Nitric Oxide, Sulphur Dioxide and Ozone was not found in any location. There are no set standards for air quality in the Maldives, the United Nations Environmental

Protection Agency (USPEA) ambient air quality standards say that Nitrogen dioxide must be below 100 ppm (CDE, 2005, p.60). Therefore, the air pollution at Thinadhoo is not significant.

#### 4.13 Data gaps

Although we were able to establish a full baseline of the noise level, air quality and water quality as specified in the ToR, there may be data gaps. These gaps arise due to quality of the collected data as there will always be uncertainty of the equipment's used.

**5.0 LEGISLATIVE AND REGULATORY CONSIDERATIONS**

**5.1 Law on general public services (4/96)**

Under this law the general public services are electricity, telephone, water and sewerage services.

Article 3 states that any party can provide general public services only after getting registered in the competent authority and according to its regulations.

Article 4 states that any public service must be provided after a contract agreement has been made between the service provider and the customer. The agreement must be made according to the regulations put forward by the competent authority.

Article 5 states that a transfer of service between customers must be made only after a contract has been made between the customers according to the service providers regulations. If the customer fails to comply with the agreement, the service provider can discontinue service only after approval from competent authority.

Article 7 states that the service provider can permanently discontinue its services according to regulation mentioned in article 3 of this law. However temporary discontinuation can be made after giving prior notification to the customers and according to the agreement made between the service provider and the customer.

Article 8 states that the tariffs for the services must be approved from the competent authority prior to implementation. Further, any amendments to tariff structure also must be approved from the competent authority before implementation.

Article 9 states that any damage made to service provider’s facilities by anyone, he can be charged with 10 prison penalty or banishment. Further any action against this law (excluding what is mentioned in article 9(a) of this law) can be charged between MVR 100 to MVR 5000 by the competent authority.

**5.2 Law on Environmental Protection and Preservation of the Maldives (4/93)**

The Maldives law of environmental protection and preservation was enacted to protect the environment and its resources for the current and future generations.

Article 2 states that the instructions for environmental protection will be given from the competent authority and everyone must respectfully follow these instructions.

Article 3 states that all matters relating to environmental protection and preservation must be handled by the Ministry of planning, human resource and environment.

Article 4 states that Ministry of planning, human resource and environment must declare protected sites and species and formulate the regulations to manage them. If any other party wants to declare a protected site or species they must be registered in the Ministry of planning, human resource and environment and managed according to regulations made by the Ministry.

Article 5 states that any projects which pose significant impacts to the environment, an Environmental Impact Assessment report has to be made and submitted to the Ministry of planning, human resource and environment. The projects which require Environmental Impact Assessment and the regulation must be made by Ministry of planning, human resource and environment.

Article 6 states that if any project is found to cause significant adverse impacts, Ministry of planning, human resource and environment have the right to stop the project.

Article 7 states that any waste, oil or hazardous gas must not be dumped into any part of the Maldives, however if strictly needs to be disposed it should be disposed off in an area designated by the Government. If such hazardous gas, waste or oil is to be disposed by combustion, it should be done in a way it does not impact people’s health and environment.

Article 8 states that any hazardous waste must not be disposed into any part of the Maldives. Before trans-boundary transfer of such waste, approval must be taken from the Ministry of Transport and Communication by writing to the Ministry at least 3 months beforehand.

Article 9 states that anybody who violates this law or any regulation under this law punishable to no more than MVR 100 million according to the offence. The fine will be done by the Ministry of planning, human resource and environment.

Article 10 states that any offence to this law or any regulation under this law or any action resulting in environment damage, the price for such damages can be taken through the judicial processes.

**5.3 1<sup>st</sup> addendum to Environmental Protection and Preservation of the Maldives (4/93) law no 12/2014**

Article 3 and 11 of the Environmental Protection and Preservation Act (4/93) of Maldives is amended as follows;

In article 3 all matters relating to environmental protection and preservation must be handled by the Ministry charged with implementation of environmental policy.

**5.4 Environmental Impact Assessment Regulation 2012**

The EIA Regulation, which came into force in 2007, has been revised and the revised EIA Regulation 2012 is currently in force since May 2012. The Regulation sets out the criteria to determine whether a development proposal is likely to significantly affect the environment and is therefore subject to an EIA. Schedule D of the EIA Regulations defines the type of projects that would be subject to Environmental Impact Assessment. Harbors, dredging and land reclamation is among those. The main purpose of this Regulation is to provide step-by-step guidance for proponents, consultants, government agencies and general public on how to obtain approval in the form of an Environmental Decision Statement.

With the 2nd addendum to the environmental impact assessment regulation 2012 in 30<sup>th</sup> August 2015, there were some procedural changes made to the EIA process. The most important was the shifting of tourism related development projects EIAs to the Ministry of Tourism. Other than that slight changes were made to the process such as the finalization of the ToR during the scoping meeting(article 11(b)) and changes in the fees for the review processes under three different categories (article 7(c)).

Under article 8(a) the decisions for a screening form is as follows;

- 1) Environment Management Plan
- 2) Initial Environmental Examination
- 3) Environmental Impact Assessment
- 4) Approval to go forth with the screened project
- 5) Approval to go forth with the project according to the mitigation measures proposed by EPA

Under article 9(b) the decisions for an IEE is as follows;

- 1) Environmental Impact Assessment report if the project is anticipated to have major environmental impacts
- 2) Environment Management Plan
- 3) Approval to go forth with the project if the project is not anticipated to have major environmental impacts

Under article 10 two reviewers are required to review the Environmental Management plan. The reviewers are to be selected according to article 13(b) of the regulation.

Since the development of new powerhouse is in the inclusive list, an EIA report needs to be submitted to the competent authority before the implementation of the project. An EIA application form was submitted to the EPA and a scoping meeting was held on 24<sup>th</sup> March 2016. During the meeting the ToR for the project was issued. The EIA report is this document and will be submitted to EPA for approval.

### 5.5 Waste management regulation

The waste management regulation dictates the principles needed to follow when handling waste. The aim is to minimize adverse impacts to the environment and human health from waste.

Article 6 states that the waste management hierarchy is as follows;

1. Waste collection
2. Waste transportation by land or air
3. Treatment of waste
4. Storage of waste
5. Management of waste site
6. Landfill
7. Management of hazardous waste

The island councils are required to make a waste management plan and submit it to the competent authority. This plan must be reviewed at least every five years.

Article 8 states that hazardous waste are specified in annex (J) and under no circumstance should it be burned or disposed off in any area of the Maldives. While transporting hazardous waste, it must be in a closed container without any leaks. Further a sign must be on the container, specifying that it is hazardous waste. The import of any hazardous waste to Maldives is an offense.

Article 9 states that depending on the type and volume of waste, if it poses any threat to human health and the environment, the competent authority has the right to declare that particular type of waste as special waste. The current list of special waste is in the annex (B) of this regulation. Under no circumstance should special waste be imported to Maldives, burned, transported, recycled, recovered or treated without prior approval from the competent authority. In order to get the approval, the form in annex (F) of this regulation must be filled and submitted with an administrative fee of MVR 500 to the competent authority. Further, special waste must be stored only in designated places by the competent authority, the design conditions of the storage facility is specified in annex (C) of this regulation.

Article 10 states that the principles regarding extended producer responsibility must be declared and gazette within one year after this regulation comes into force.

Article 11 states that waste generated at islands must be disposed off in areas specified for the purpose or areas approved by competent authority. Disposal of waste to following areas is prohibited under this regulation and is an offense;

- Mangroves
- Island Lagoon
- Reef
- Lagoon(falhu)
- Finolhu
- Beach
- Vegetation line
- Harbor
- Park
- Road

Approval to dispose waste to areas not approved by competent authority will be given under following circumstances;

1. Waste is disposed as a measure to protect human health
2. Situation created by natural disaster or a state of emergency

Approval to manage waste at household level is not required for the following actions;

1. Waste segregation at household
2. Composting at household

Article 12 states that anybody responsible for public sites must place and manage a dustbin. The waste in these dustbins must be managed according to this regulation. Disposal of waste to public sites (besides the dustbin) is an offense.

Article 13 states that any sea vessel must have mechanism to store waste until it reaches a harbor. Upon arrival at a harbor the boat captain must take the waste to an area designated for waste disposal. However biodegradable waste such as kitchen waste and fish mulch can be disposed at sea.

Article 14 states that a waste management system must be established at all harbor's by the operator. A proper system must be in place to manage waste oil and other wastes segregated. Further, the operator must maintain information mentioned in annex (E.) and the records must be made available to competent authority upon request.

Article 15 states that any party who wants to commercially recycle and recover waste, approval must be taken from the competent authority by submitting the form in annex (F) and proposal according to annex (D) of this regulation.

Article 16 states that approval must be taken from the competent authority for the following waste management works

1. Waste collection
2. Transportation of waste by land and sea
3. Waste treatment
4. Storage of waste
5. Management of waste disposal sites
6. Landfill
7. Handling of hazardous waste

The number of waste management approvals for a particular area or areas will be decided by the competent authority based on the following;

1. Waste generation
2. Economic gains from waste management actions
3. Environmental protection requirements for the area

Article 17 states that the parties who get approval to manage waste must operate according to the competent authority's directions under article 6 of this regulation. Any action not mentioned in the article 6 can be actioned by prior discussion and approval from the competent authority in order

to protect health and environment. Such actions by the island council or city council must be advertised publicly.

Article 18 states that the approval for waste management must be given for a set duration. The proponent must apply for renewal of the approval before 3 months of approval due date. Approval will be renewed only if the proponent actions were according to the conditions of the given original waste management approval.

Article 19 states that if a proponent wishes to do more than one of the works mentioned in article 16(a) of the regulation, they can submit a single form for all the works.

Article 20 states that if a proponent wishes to transfer the waste management approval to another party, then they must submit the form in annex (G) and submit any further information the competent authority requests. Within 30 days of submission of the form, the competent authority will issue the approval.

Article 21 states that if a proponent wishes to terminate an approval, they must submit the form in annex (H) of this regulation. The approval will be terminated after the competent authority has ensured that the waste management actions have been done according to the regulations by the proponent.

Article 22 states that an administrative fee (mentioned in annex-J of this regulation) has to be paid to the competent authority while applying for waste management approval.

Article 23 states the proponent can take a fee from the customer given that the fee structure is approved from the competent authority. The proponent can make a distinction in the maximum price for houses and business category. The declared fee structure must be advised publicly to the customers.

Article 24 states that the competent authority must maintain a record of the approvals given.

Article 25 states that when transporting waste the best practices outlined in article 6 of this regulation must be strictly followed. Waste generated at inhabited islands and islands given for commercial use must be transported to the regional waste management facility.

Article 26 states that the parties given approval to transport waste must abide by the following;

1. Before transporting waste to a particular site, they must ensure that the type of waste is allowed to be disposed to the site
2. Records of waste transportation must be maintained according to annex (E ) of this regulation and these records must be provided to competent authority when they are requested.

Transport of waste to disposal site from households by another party without giving a fee, is excluded from this article.

Article 27 states that before transport of hazardous out of Maldives, approval must be taken from the competent authority by submitting the form in annex (G) of this regulation before 3 months of the transportation date. When applied for this approval, the competent authority will respond according to the following;

1. Rejection, if the activity is against any principles made by the competent authority under article 6 of this regulation or any international treaties signed by Maldives
2. Resubmission of form, if there is missing information or if the credibility of the information submitted is questionable.
3. Approval, if the activity is accordance with the principles made by the competent authority under article 6 of this regulation and international treaties signed by Maldives.

Approval given under this regulation does not mean that any other approval required from other countries will not be required.

Article 28 states that before transport of hazardous waste through any area of Maldives, approval must be taken from the competent authority by submitting the form in annex (L) of this regulation before 3 months before waste arrive in Maldivian waters. When applied for this approval, the competent authority will respond according to the following;

1. Rejection, if the activity is against any principles made by the competent authority under article 6 of this regulation or any international treaties signed by Maldives
2. Resubmission of form, if there is missing information or if the credibility of the information submitted is questionable.
3. Approval, if the activity is accordance with the principles made by the competent authority under article 6 of this regulation and international treaties signed by Maldives.

Approval given under this regulation does not mean that any other approval required from other countries will not be required. Any vessel that enters Maldivian waters through the approval in this article must not dock in any area of the Maldives. Further if a need arises to inspect the vessel, the party who got the approval must arrange it.

Article 29 states that the party in charge of the management of waste disposal sites must take the approval from the competent authority according to the article 6(a) of this regulation. The management must submit the form in annex(E) of this regulation every 4 months. If the people who come to dispose waste does not go against the principles set by the waste disposal site management, refusing to accept their waste is an offense. The waste disposal site managers must publicly advertise the service hours and rules.

Article 30 states that the competent authority must maintain the records of administrative decisions.

Article 31 states that the competent authority must inspect the waste management sites. Inspection shall be done according to an inspection schedule made by the competent authority. The official from the competent authority may present his monitoring license and then do the monitoring of the site. After inspection of a site, the competent authority must compile an inspection report according to annex (M) and send it to the managers of the site within 7 days. The inspection report must contain any corrective actions to be taken with the due dates for the actions. The managers of the site must implement any corrective actions on specified in the inspection report on due time.

Article 32 states that the competent authority must maintain a database containing information about waste generation (at island level, regional level and country level), type of waste and treatment processes.

Article 33 states that the competent authority must submit a report based on the information on the database mentioned in article 32 annually.

Article 34 states that not following any action mentioned in this regulation is an offense. Further doing any of the following is punishable under EPPA 4/93 article 9(b). The penalty for these offenses will be determined according to annex-(N).

- Import of special category waste or hazardous waste to Maldives
- Transport or treatment of special category waste without prior approval from competent authority
- Disposal of waste to any site which is not approved for waste disposal from competent authority
- Refusing to allow customers to dispose their waste when they have not gone against any rules set by the waste management site managers.

- For any works requiring approval carrying out the works without approval from competent authority
- Managing waste against the principles set under this regulation
- Handling waste against the principles set under this regulation
- Transport of hazardous waste out of Maldives without prior approval from competent authority
- Managing waste against the conditions of a given waste management approval
- Failure to provide information or providing wrong information by any party given approval for waste management
- Failure to manage a public site according to article 12(a) of this regulation by the party responsible for the management of the public site

Doing any of the following is punishable under EPPA 4/93 article 9(a).

- Disposal of waste to an area under article 11(b) of this regulation
- Disposal of waste to a public site (other than the dustbins specified for waste disposal in the area)

The fines for the offenses under this regulation will be decided by the Ministry. The fines will have to be paid to the respective island or city council in the area where the offense was done.

Article 35 states that the competent authority has the right to terminate any approval given under article 16(a) of this regulation with reference to the following;

1. The competent authority finds enough evidence for the incompetence of the waste managers.
2. The works are against this regulation or any other laws
3. Failure to correct the problems mentioned in the inspection report submitted according to article 31 of this regulation

Article 36 states that the arbitration for a decision by competent authority must be made in writing to Ministry within 10 working with a full justification. The reply for the arbitration must be informed within 30 working days by the Ministry.

### 5.6 Regulation on provision of electricity to Male’ and islands

This regulation is made in accordance to article 3 of law on general public services (number 4/93).

Article 1 states that electricity service can be given only after the service provider is registered in MEA.

Article 2 states that an agreement has to be made between the service provider and the customer for the provision of electricity services.

Article 3 states that any MEA approved electricity service provider can give their ownership to another party only after getting approval from MEA. If any customer wants to change ownership then they must get the approval from the electricity service provider and also make an agreement.

Article 4 states that if a customer breaches the agreement in any way, electricity services must be discontinued after getting approval from MEA.

Article 5 states that for any reason electricity services can only be completely discontinued after getting approval from MEA. However temporary discontinuation of services for the purpose of maintenance work or in accordance with the agreement made between service provider and customer is acceptable under this regulation. In such a case also the customer must be notified in advance. Nonetheless emergency discontinuation of electricity is excluded.

Article 6 states that the tariff for electricity must be approved from MEA.

Article 7 states that the regulations under the agreement between electricity service provider and customer must be approved from MEA.

Article 8 is about the technical specifications of powerhouse. The following is stated under this article;

- The engine must be mounted on a foundation and anti-vibration should be also mounted between the engine and the foundation.
- The exhaust pipe must be 24 feet high from ground if the power house is 14 feet high. For powerhouse higher than 14 feet, the exhaust must be at least 4 feet higher than from the highest point of the roof.
- The power house must be constructed and maintained in a fire resistant manner with walls fabricated and iron roofing.
- The powerhouse must be constructed 200 feet away from the nearest residential area. If there is not enough space available in an island then MEA will declare the area for powerhouse construction.
- The ventilation of the powerhouse must be such that when all the engines are operational the difference in temperature inside and outside the powerhouse must be less than 10<sup>0</sup>C compared to ambient temperature.

- Power house construction, fuel storage and handling must be in accordance with pertinent regulations. If there is not pertinent regulation such an activity must be done after consulting with the relevant Ministry and there decision must be submitted to MEA.
- Firefighting equipment must be in accordance to NSS specifications.
- Powerhouse must be wired according to article 12 of this regulation.
- Fire safety notifications must be pasted on easily seen areas of the powerhouse.
- Emergency lights must be mounted such that works inside powerhouse can be done during a power outage.

Article 9 is about the technical specifications of control room, switch board, and distribution feeder. The following is stated under this article;

- Control room and distribution feeder must be in accordance to MEA approved drawings.
- Switch board and panel board must be constructed to MEA standards and must be tested from MEA and approval must be obtained. Wiring details must be submitted.
- Switch board rear end and sides must be closed in way people do not get electrocuted.
- The switch board must include and fulfill the following;
  - Incoming breaker: must be capable of taking 10% – 50% of generated rated current
  - Incoming indication light
  - Phase neutral and phase voltage must be visible
  - Three phase ampere must be visible
  - Able to see generator frequency
  - Able to see generator kilowatt
  - Able to generator energy
  - Earth float protection
  - Breakers capable of handling load for outgoing feeders
  - If there is more than one generator, synchronizing panel or change over switch with capacity to handle 125% of largest generator
- Drawings of panel wiring must be pasted in control room or any other visible area.
- Drawings for First aid instructions must be pasted on control room and engine room.
- Firefighting equipment’s must be readily available to staff in control room

Article 10 is about the technical specifications of the distribution system. The following is stated under this article;

- At any point on the distribution, voltage must not be less 10% of generated voltage

- If distribution is to be made via overhead cables then the drawings must first approved from MEA. The poles can be either metal or wood with a diameter of 4 inches.
- The distance between two poles must be a maximum of 75 feet. The poles must be 1.5 feet from the wall of residential houses.
- The cables must be at least 14 feet from the ground. The distance between the must not be closer than 1 feet.
- Insulation must be in between the cables and the poles. The cables must be capable of handling 25% more of normal load.
- If there are any building as high as the power lane, then the lane must be insulated extending up to 5 feet from the building. After installation of lane it must be maintained to prevent tress from falling over.
- Works must be done on a live lane with proper safety equipment’s like insulated gloves, insulated boots, and safety helmets.
- Work must not be done alone on a live lane. While working on a ladder, the ladder must be secured properly.
- If the distribution system is to be under the ground then the cable technical standard is BS6346 or international accepted standard.
- While laying the cable care must be taken not to damage the outer insulation of the cable. Cable should be buried on 1/3<sup>rd</sup> of the road at depth of 2.5 feet.
- After laying the cable, before backfilling sand must be laid up to 6 inches height and a tape notifying a cable is below must be laid.
- Cable joints must be done by MEA approved personals. The joint should be made by using heat shrink or resin.
- The distributions box’s single line diagram must be approved from MEA and the box should be constructed in accordance to the diagram.
- The distribution box must be weather proof. The box must be constructed with a non-conductive material and its inside must have holes for air circulation.
- The distribution box must be secured with bolts 3 feet above the ground from the bottom of the box. The house connection cable from the distribution box must be inside a pipe or duct.
- The house connection supplies inside the distribution box must be properly secured such that it does not produce any sparks.
- Every distribution box must have a caution notice saying “Danger 400 V”.

Article 11 is about the technical specifications of the house connections. The following is stated under this article;

- The wiring of the houses must be in accordance with article 12 of this regulation.
- At any customer house, there has to be overload protection (cut out fuse MCB, MCCB), earth float protection (ELCBLR) and isolation (main switch) must be installed.
- To all electricity service provided places, a supply drawing must be made. No connection must be made without a drawing.
- Electricity service must be provided with the installment of a meter. The meter must be tested from an MEA approved place. ELCB must also be installed in this manner.

Article 12 is about the wiring standards. The following is stated under this article;

- Electrical wiring must be done by MEA approved professionals.
- Color codes for single phase wiring is; red for phase, black for neutral, green or green with yellow stripes for earth.
- Color codes for three phase wiring is; red for first phase, yellow for second phase, blue for third phase, black for neutral, and green or green with yellow stripes for earth.
- While three phase wiring, if the colored cables are not available sleeving must be inserted on both ends of the cable to identify the color codes.
- For three phase wiring, the load must be balanced to the 3 phases.
- The earth for a building must be connected using an appropriate thickness for the building. Main earth to the ground must be extruded from the specified area from the main switch or D-Board. A lug must be installment before connection of earth cable to earth rod. Earth must be fixed inside a closable junction measuring 8”x8”.
- In all wiring a D-board, main switch and ELCB must be installed. ELCB must be installed after testing from MEA approved place. In single phase places there must be a minimum of one socket with 2 lightings. In three phase places there must be a minimum of 3 socket with 6 lightings.
- ELCCB rating if single phase;
  - trifing - current 30 mA
  - 240V rated current – 30A to 63A
  - 2 pole
- ELCCB rating if three phase;
  - trifing - current 30 mA
  - 440V or 380V
  - 40A – 63A
  - 4 pole
  - If a lower rated ELCCB is to be used then its trifing current must not be higher than 30mA.

- All cables to D-board must have a phase and earth cable. The CB or fuse installed must be appropriate to the circuit. It should not be higher than required.
- Only basbar should be used in D-board. Loofing of the cable shall not be done instead of using basbar. Three phase D-board basbar link must be installed with appropriate gap between two phases.
- If cable diameter is 3/029 or 1.5 mm<sup>2</sup>, circuit must have 5 lightings(fans can be included). However the load from this circuit must not exceed 500W. In socket circuits the cable diameter must be higher than 7/029 or 2.5 mm<sup>2</sup>. The circuit must have 2 sockets if cable used has a diameter of 7/029 or 2.5 mm<sup>2</sup>.
- While wiring if 2 or more gang switch is used, not more than one phase shall be connected to the switches(inside the same box).
- In a single phase circuit, instead of 30A main switch a, an MCCB rated higher than 2 pole 40A should not be installed. If three phase circuit, instead of 60A switch , an MCCB rated higher than 60A 4/3 pole should not be installed. If main switch is to be installed on D-board it should be between 5 and 6 feet from ground.
- All cables must be inside a condute pipe or protective piping like plastic pipe. If cables are not inside a pipe it should be secured using cable ties.
- Current for Air condition, freezer, and other higher load appliances must be given from points which is wired on separate circuit.
- Wiring to machineries must be done using appropriate cables via starter or main switch. Starter or main switch must be installed in a nearby area to workplace from where it can be operated easily.
- The installed D-board edge must be no higher than 6 feet.
- Water proof switches must be used in wet places like the toilets. If another type of switch is to be installed it must be in an area where water cannot reach.
- When using sockets without switches, there has to be a switch. Generally sockets without switch is not approved.
- Wirings in huge buildings, between phase neutral, phase earth, neutral earth resistance must be a minimum of 1 mega ohms. For wiring of less than 5 points if the resistance is 1 mega ohms it will not be accepted. For these type of places the resistance must be 10 mega ohms.
- If a customer wants to use a back up generator during an emergency, current shall be used using change over switch. Change over switch must be capable of cutting phase and neutral. Further the rating must be appropriate to the load of the place.
- If a customer wishes to add new wiring to existing MEA approved wiring, then it shall be done by MEA approved personel after wire testing. MEA unapproved wiring must not be connected to D-board.
- If a wiring done by a personel is found to be wrong, the responsibility must be taken by the person who signs on the wire testing form.

Article 13 states that the staff in powerhouses must be properly trained personals for the job. The highest responsible person in the powerhouse must have an MEA approved level of training. All staff in powerhouse must be trained for firefighting. Besides staff other people should not be allowed inside the engine room. Control room staff must have completed the basic fire extinguish and prevention course by Ministry of Defense and National Security.

Article 14 states that all MEA approved wiring professionals must follow this regulation. Wiring done against this regulation will not be accepted. Further, during wire testing if it comes to MEA notice that wiring done by a particular person has many issues his/her license maybe terminated.

Article 15 states that places wired before 1<sup>st</sup> January 1997 shall be advised to correct its wiring during a given time upon inspections by MEA.

Article 16 states that any breaches to this regulation are punishable by a fine of MVR100 to MVR5000.

### 5.7 Guideline for power system approval

The guideline for power system approval highlights the set of information required to be submitted to MEA for the approval process. Which includes details about the generation system, generator control panel and distribution panel, fuel system, distribution network, electric cable, firefighting system and lighting protection, environmental impact assessment of the generation facility, tariff and rules and regulations of powerhouse for consumers.

### 5.8 The regulation on the use, handling and storage of oil

The purpose of the regulation is to reduce the fire hazards caused by mishandling of oil, to raise awareness on the proper handling methods of oil and to standardize the infrastructure of oil handling and storage. The second article of the regulation details out all the aspects of vehicles that handle and transport oil on land. The third article deals with all the aspects of petrol handling in storage areas and service centers. The forth article highlights the aspects of fuel handling in diesel and kerosene service centers. The fifth article highlights the aspects of fuel pipeline from storage to meters. All the relevant sections in the regulations are understood for the proposed project.

### 5.9 National wastewater guideline

The purpose of the guideline is to assist all stakeholders in the water cycle to manage the discharge of waste water in such a way that it does not limit water’s fitness for use by the different water users. The guideline suggests specific values of the maximum concentration that can be tolerated by future users of each parameter potentially present in waste water. These values may not be exceeded when treated waste water is released back into surface water, ground water or into deep sea. The values are generic and should be used together with Environmental Impact Assessments and clean Production Protocols to finalize the license for the discharge of specific waste water. All the relevant sections in the guidelines are understood for the proposed project.

### 5.10 Regulation on uprooting, cutting and transportation of palms and trees

This regulation was implemented on 1 February 2006 by the Ministry of Environment, Energy and Water. The primary purpose of the regulation is to control and regulate large-scale uprooting, removal, cutting and transportation of palms and trees from one island to another. According to the regulation, certain types of trees and plants that have unique attributes are prohibited to be removed from its natural environment. Also, uprooting and removal of 50 or more trees and palms are subjected to environmental impact assessment (EIA), which is required to be submitted to the Environmental Protection Agency and written approval is required prior to implementation of the project.

The amendment to this regulation (regulation no 2014/R) has specified a set of categories, any tree falling under these categories is not allowed to be removed unless it is a project of the government approved by the parliament.

### 5.11 Waste incinerator guideline (WIG)

The waste incinerator guideline (WIG) of the EPA Maldives came into effect on 2016 aimed at facilitating the construction and operation of incinerators safely and to mitigate the adverse environmental and health impacts that may arise. The objective of the guideline is to prevent or limit, as far as practicable, negative effects on the environment, in particular pollution by emission into air, soil, surface and groundwater, and the resulting risks to human health, from combustion of waste using incinerators.

As per article 4.1 of the WIG, the site for waste incinerators must be selected in ways that it would not pose any hazard to the surrounding environment and the local community. The proposed project complies with this article such that the chimneys of the powerhouses will be installed far away from the residential area and sensitive land uses. Additionally, site is selected so that the prevailing winds carry the emitted gases away from the residential area/island. Preconstruction environmental clearance permits and monitoring will be carried out at the proposed location and background emissions established in order to enable future changes to be identified.

The chimneys will be fitted with filters in order to remove any harmful gases prior to discharge to the environment, which complies with article 4.2 of the WIG.

### 5.12 Waste management policy

The waste management policy which came into effect on 2015 is to ensure that the Maldivians are well aware of the waste management techniques and maintains cleanliness as well as the natural aesthetics and clean air quality of the country is well maintained. Under this policy, all the inhabited islands need to implement a waste management plan and manage all the wastes generated from that island in accordance with that policy.

This project will comply with this guideline such that any wastes generated during the construction and operation phases of this project will be dealt with in accordance with the waste management plans of the island under concern.

### 5.13 International Conventions

#### 5.13.1 United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol

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

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

policies, to cooperate in technical, scientific and educational matters and to promote scientific research and exchange of information.

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

## 6.0 POTENTIAL IMPACTS AND MITIGATION

The impacts from any project can be categorized into two broad categories; impacts during construction and impacts during operation. Impacts during construction are the potential impacts which might arise during the construction of new powerhouse. Impacts during operation are the potential impacts which might arise during the operation of the new powerhouse.

### 6.1 Impact identification methodology

The potential impacts were identified by looking in to the proposed works under this project and comparing it with the environmental setting. An impact matrix with reference to magnitude, extent or location, duration, reversibility and likelihood was used to determine the significance of the impacts. Further, expert judgment, field surveys and other similar EIA reports were used as a reference. Table below shows the characteristics of impacts against which it was analyzed.

Table 14: impact characteristics, where 5 is of highest significance.

Characteristic	Impact significance					
	0	1	2	3	4	5
Type	Direct/indirect					
Nature	Negative/positive					
Magnitude	Negligible	low		moderate		High
Extent/location		small area covered		moderate area covered		large area covered
Duration		very short	Short	intermittent	Long-term	continuous
Reversibility			reversible			irreversible

Likelihood	none	low probability		moderate		high probability
------------	------	-----------------	--	----------	--	------------------

### 6.2 Limitations in impact prediction

While all attempt has been made to accurately predict the potential impacts from this project, there are unforeseen uncertain factors which might causes deviations in the impacts outlined herein. For instance, a natural phenomenon.

Further there is the limitation in our knowledge itself about the environment. Even though thorough brainstorming was done to assess the potential impacts there might always be some impact which is not accounted for because it has not been noticed.

In addition, there is an information gap; there is limited information about the condition of the marine environment prior to anthropogenic disturbances. This makes it very difficult to ascertain a baseline.

### 6.3 Impacts during Construction

During construction the primary impact zone would be the powerhouse premise shown on figure below. This would include impacts on quality of air, water and terrestrial environment. The secondary impact zone would extend up to the desalination plant house and nearest residential area. This would be impacts on air quality and noise disturbance to workers on site.



Figure 23: impact zone during construction. Orange; is primary impact zone and yellow; is secondary impact zone

### 6.3.1 Impacts on Air quality

Cranes will be used to lift the generators and move them to the desired location inside the powerhouse. Operation of other general tools during the construction of the power house will require electricity. As the electricity will be supplied from the existing grid of Thinadhoo no additional generators will be required to run. Therefore the fuel burned daily will be very less. Fuel will only be consumed during the operation of the crane during the transfer of the generators. It is estimated that 150 liters of oil maybe expended for this purpose.

Combustion of any type of fuel releases greenhouse gases to the atmosphere, however the volume of greenhouse gases released during the construction phase of this project is insignificant when compared to the amount of greenhouse gases produced in other countries. Further as the site is near the coast, it is expected that any waste gases would not remain stagnant to cause any health implications to the public. Any waste gases produced would be localized to the plant house area for a very short time.

The significance of the impacts to air quality was considered low as the magnitude of the impact is low and hence is not expected to cause any significant adverse impacts to the environment and the community.

**Mitigation measures**

Daily maintenance of machinery

**6.3.2 Noise Pollution**

The operation of heavy machinery during construction works will generate noise but would be localized to within the vicinity of the powerhouse. It is unlikely the noise will be high near the residential area as the nearest residential district is over 350 feet away. However, noise disturbance to workers working on site will be high and moderately significant.

**Mitigation measures**

Workers wearing noise cancellation headphones

**6.3.3 Impacts on water quality**

No wastewater will be disposed during the construction phase, however pre-fabricated construction utilizes very hazardous chemical. If these chemical are spilled on to the ground, there is high risk that it will contaminated the groundwater near the power house. Further there is risk of oil spills from the operation machinery.

Even though the likelihood of this happening are slim, due to its irreversibility the impact is of high significance.

**Mitigation measures**

Daily maintenance of machinery.

Following chemical handling procedures.

Emergency oil spill cleanup crew on standby during construction.

Follow waste management regulation highlighted in the legal section of this report.

### 6.3.4 Impacts from Waste

It is expected that the waste generated would be minimal, considering the entire power facility will be constructed using pre-fabricated sheets and blocks. It is expected that packaging waste and hazardous chemical waste will be the main type of waste generated.

Any waste generated would be localized to the plant house area and people working in powerhouse. Although the solid waste from packaging waste would be immediately levitated, once the waste is transported to the waste management center, the hazardous chemical waste generated pose a high risk to the workers. Therefore the impacts from waste is of moderate significance.

#### Mitigation measures

Solid waste managed according to waste management regulation.

Waste segregation and stored in closed labelled containers before transfer to waste management center.

Health and safety materials made available to workers specifying instructions on how to handle hazardous waste and how to act during a chemical spill to a person.

### 6.3.5 Impacts on terrestrial environment

It is proposed that only the building footprints will be cleared, the vegetation in all other area will be left. Any small trees which can be replanted will be replanted in another area within the Fenaka premises. However it is estimated that 20 *Cocos nucifera L.* will have to be removed. The trees would be removed in such a way that minimal damage would be caused to the root system of the tree so that it could be replanted elsewhere.

Impacts on terrestrial environment inside the powerhouse premise will be considerable as an estimated 20 out of 57 of *Cocos nucifera L.* will be removed. The trees removed will be thrown away as green waste. As the magnitude of vegetation clearance is moderate the impact is of moderate significance.

#### Mitigation measures

Replanting any small trees within the powerhouse footprint in other areas.

### 6.4 Impacts summary

Following table shows the impacts summary during the construction phase.

Table 15: summary of impacts during construction

Impact	Impact Characteristics							Significance
	Type	Nature	Magnitude	Extent/location	Duration	Reversibility	Likelihood	
Air quality -GHG emissions	Direct	Negative	Negligible	Localized to power house area	Short-term	reversible	High	Low
Noise pollution -operation of heavy machinery	Indirect	Negative	Moderate	Localized to power house area	Short-term	reversible	High	Moderate
Water quality -oil spills -chemical spills	Direct	Negative	Low	Localized to power house area	Short-term	Irreversible	Low	High
Impacts from Waste	Direct	Negative	Low	Localized to power house area and	Short-term	reversible	High	Moderate

-solid waste generation				work force				
-hazardous chemical waste generated								
Terrestrial environment	Direct	Negative	Moderate	Localized to powerhouse premise	Long-term	Irreversible	High	Moderate
-loss of vegetation								

### 6.5 Impacts during operation

During operations primary impacts would be to the powerhouse. While the secondary impacts would be to the entire Thinadhoo island community as the positive impacts will spread to the entire community.



Figure 24: impact zone during operations. Orange; primary impact zone and green; secondary impact zone

### 6.5.1 Impacts on water quality

During the operation and maintenance of the generators there is a small risk of water contamination by accidental spills. Impacts from any spills will be localized to powerhouse area and will be irreversible.

Although no waste water will be disposed during the construction phase, during operation connection will be made to main sewer line to dispose waste water.

Even though the likelihood of an oil spill occurring is low due to the irreversibility of the impact it is of high significance.

### Mitigation measures

Regular maintenance of machinery.

Following chemical handling procedures.

Staff training on emergency oil spill cleanup.

Emergency response plans made for powerhouse operation.

Oil spill cleanup materials made available to the powerhouse.

### 6.5.2 Impacts on air quality

The operation of the power house is not expected to increase the impacts on air quality as already existing generators will be run at the powerhouse. The operation of the 3120 KW generators will produce smoke and greenhouse gases. However as the power house is 200 feet away from the nearest residential house and the location of powerhouse near the coast, it is expected that the smoke will not impact the community in anyway during the NE monsoon. However during SW monsoon smoke maybe blown towards the eastern corner of the island. Even though smoke maybe blown towards the residential houses, it is expected that the disturbance to residents will be minimal as the smoke will be diluted and also will be high above ground as the chimneys of the powerhouse will be 28 feet high.

Due to the low magnitude and location of powerhouse (near coast away from residential area), the impacts on air quality is considered to be of low significance.

### Mitigation measures

Regular maintenance of generators.

Chimneys constructed according to MEA standard

### 6.5.3 Noise disturbance

With the operation of new powerhouse the noise level around the area will be decreased considerably. Currently the generators are operated in a temporary facility but with the operation of new powerhouse the generators will be operated inside a sound proof powerhouse. The powerhouse is located 200 feet away from the nearest residential house, hence noise disturbance to community will be negligible. However the noise level inside the powerhouse will be very high. Therefore the staff working inside the powerhouse will need to wear noise cancellation headphones.

No birds are prevalent within 200 feet radius of the powerhouse. Hence it is expected that the noise from the powerhouse will not disturb any wildlife.

Even though the significance of noise disturbance to community and wildlife is negligible the noise disturbance to staff working in the powerhouse is high.

**Mitigation measures**

Wear noise cancellation headphones while inside plant house.

**6.5.4 Socio-economic impacts**

The new powerhouse will increase the reliability of electricity service of the island. Since the generators in Thinadhoo is currently in temporary facility any severe weather events pose risk of damage to the generators and discontinuation of electricity services. However with the development of new power house, the generators will be inside a protected house.

Since this impact is a positive long-term impact to the entire island community, it is of high significance.

**6.5.5 Health**

There are health implications to the staff working in the powerhouse during operations. During the operation and maintenance of the generators and other machinery they will come in contact with grease, oil, grit and other hazardous chemicals. If proper personal protection wears are not worn it will have adverse impacts to the health of staff. However there is little risk if the proper personal protections are worn and established chemical handling procedures are followed.

**Mitigation measures**

Following chemical handling procedures.

Wear essential personal protection attire at all times.

Health and safety manuals made for the plant.

Staff trainings on chemical handling.

Emergency response plans made for plant operation.

### 6.5.6 Impacts from Waste

Waste oil generated from the generators pose risk to environment if it is not managed properly. It is estimated that an average of 800 liters per month is generated.

#### Mitigation measures

Waste oil must be stored in closed labelled containers in specially designated area on concrete floor with containment and shall be transported to Thilafushi for disposal on a monthly basis.

### 6.5.7 Fire hazard risk and safety

Thinadhoo power facility has already experienced a fire hazard and this project resulted due to this. During the operation, the risk of fire is always there and will cause a considerable damage to the physical and social environment. Depending on the degree of fire, the impact could be low to very high.

#### Mitigation measures

The new facility will have firefighting equipment within the power plant house and within the administrative building. In addition, signs for the emergency procedures will have to be in the vicinity clearly marking where the exits and firefighting equipment's are.

### 6.5.8 Vibration Impacts

According to current regulation of MEA for a 200 feet radius there will not be any residential houses, hence vibration impacts will not be an issue nowadays. In the Thinadhoo the nearest residential house is over 350 feet away, hence vibration would not be an issue.

#### Mitigation measures

Ensuring the 200 feet MEA buffer zone around the new powerhouse.

### 6.5.9 Risk of flooding

During raining season, in the past flooding of the powerhouse road has occurred on several occasions. However, the flooding is not so severe that it reaches the inside of powerhouse premise.

#### Mitigation measures

The new powerhouse floor constructed slightly elevated.

Compacting sand on to the powerhouse road. The reclamation of the powerhouse area is ongoing, sand from the reclamation works can be used for this purpose.

### 6.6 Impacts summary

Following table shows the impacts summary during the operational phase.

Table 16: summary of impacts during operation

Impact	Impact Characteristics							
	Type	Nature	Magnitude	Extent/location	Duration	Reversibility	Likelihood	Significance
Water quality -oil spills	Direct	Negative	low	Localized to powerhouse area	Long-term	Irreversible	low	high
Air quality -GHG emission	Direct	Negative	Low	Localized to powerhouse area	Long-term	reversible	High	Low
Noise disturbance -noise disturbance to staff	Direct	Negative	Low	Localized to powerhouse inside	Long-term	Reversible	High	High

-noise disturbance to wildlife	Direct	Negative	Low	Localized to power house area	Long-term	Reversible	High	low
-noise disturbance to community	Direct	Negative	Low	Localized to power house area	Long-term	Reversible	High	Negligible
Socio-economic - reliability of electricity services	Indirect	Positive	High	Entire Island community	Long-term	Reversible	High	High
Health -health implications to staff	Direct	Negative	Subjective of the scale of spill	Powerhouse	Short-term	Irreversible	Low	High
Waste -waste oil	Direct	Negative	Moderate	Powerhouse	Continuous	Reversible	Low	High
Fire hazard	Indirect	Negative	High	Entire Island	Continuous	Reversible	Low	High

risk and safety				communi ty				
Vibration Impacts	Indirect	Negative	Negligible	Localized to power house area	Long-term	Reversible	Low	Negligible
Risk of flooding	Indirect	Negative	Low	Localized to power house road	Short-term	Irreversible	Medium	High

## 7.0 ALTERNATIVES

### 7.1 No project scenario

The no project scenario means that the new power plant will not be installed in Thinadhoo. This would lead to reduced reliability of electricity services to the island. FENAKA would not be able to provide electricity service sustainably to the community and will lead to a loss of credibility of the company. Further the noise and smoke disturbance to the staff working will remain high.

### 7.2 Alternative locations for powerhouse

#### West side of the island

An alternative location for development of powerhouse is the newly reclaimed land on the western side of the island. However, this area is being developed under the safe island concept as a safe zone during natural hazards like tsunamis. Further this area is not ideal for powerhouse development environmentally, as smoke from the powerhouse will be blown directly inland since wind will predominately blow from the West during South-West monsoon.

### 7.3 Alternative analysis

Alternative	Comparison		
	Environment	Social	Economic
No project	No trees will be removed.	No reliable electricity services to locals causing social unrest.	FENAKA will not have to expend a huge capital at once, however on the long run it will have to expend more if the powerhouse is not established.
Proposed project location for powerhouse development	Trees will be removed.	Reliable electricity services provided to locals.	FENAKA have to expend a huge capital at once, however on

			the long run it will have to expend less.
West side of island	Smoke will be blown into island	Smoke will be blown into island	Costly to relocated generators and cables to different area

The alternatives are compared along with the proposed project option. Upon comparison it is found that the proposed project location is best for powerhouse development in Thinadhoo. Thinadhoo is a densely populated island and there is no available feasible land besides the existing FENAKA premise for establishing the powerhouse. The currently allocated FENAKA premise has enough space for development of a new powerhouse. Therefore, the preferred alternative is proposed project location for powerhouse development.

## 8.0 MONITORING

Monitoring is one of the most essential aspects of EIAs, as only through monitoring can the predicted impacts be confirmed. For negative impacts monitoring allows for the mitigation of these impacts which will allow the prevention or minimization of the negative impacts. For positive impacts monitoring will allow us to determine if the positive impacts are as perceived in the beginning of project allowing to determine the overall success for the project and measures for improvement. Further it will allow us to find any unforeseen impacts. Finally it will allow us to determine if the mitigation measures are working and hence allow us to proposed new mitigation measures.

The baseline data collection for the construction of new powerhouse was conducted on April 2016. Baseline surveys are conducted to determine the reference range, so that comparisons can be made during the monitoring to determine the change.

All monitoring activities must be done under supervision of a registered EIA consultant. The details of the monitoring program are given in the table below.

Table 17: environmental monitoring plan

Parameter	Phase	Method	Indicators	Frequency	Cost / MRF
Groundwater quality	Operation and Construction	Test of groundwater parameters	Hydrocarbons	Every 3 months during construction and every 6 months during operation	800
Noise level	Operation	Noise level measurement using decibel meter	Noise level	Before and after operation	3500

Air Quality	Operation	Air quality meter	Concentration of air pollutants	Every 6 months during operation	4500
-------------	-----------	-------------------	---------------------------------	---------------------------------	------

### 8.1 Monitoring schedule

Monitoring reports must be submitted to EPA as specified in the monitoring schedule below.

Table 18: monitoring schedule

Description	Date
EIA Decision statement issued	June 2016
Monitoring report during construction- 1	August 2016
Monitoring report during construction - 2	October 2016
Monitoring report during construction - 3	January 2017
Monitoring report after project completion- 4	January 2018
Monitoring report after project completion - 5	January 2019
Monitoring report after project completion - 6	January 2020
Monitoring report after project completion - 7	January 2021
Monitoring report after project completion - 8	January 2022

## 9.0 STAKEHOLDER CONSULTATIONS

### 9.1 Public Consultation

The following table shows the details of individuals consulted during the field visit to Thinadhoo. Public consultations were done at local's respective houses. The consultations were done on April 2016 from 10:00-12:00.

Table 19: details of individuals consulted

Name	House	Contact
Faarooq Ali	Garden	7918211
Khalid Ibrahim	Thaazaage	7781325
Ahmed Saeedh	Saavan	9993043
Naseem Moosa	Gangaa	7908078
Ahmed Naseer	Vinsten	7783402
Aishath Zamaau Zameer	White Chalk	7681783
Ahmed Azman	Scarnet	7794797
Ibrahim Shahid	Maleyshaa	9958156
Mohamed Thakurufaanu	Opium	-
Ibrahim Anwar	Maaranga	7848077

Following are the issues, concerns and suggestions highlighted by the general public;

- Shortage of gas for cooking
- Electricity price is high, it should be same price as Male'
- Development of new powerhouse is a good project

- Water, sewerage and electricity services are good
- Design the new powerhouse with reference to future demands, for instance powerhouse should have space for new generator placement
- The fire accident at the powerhouse is purposely done by someone, that is a very bad act
- What the community needs most is road development
- New powerhouse must have firefighting systems installed
- The fuel storage must be designed in such a way that it can contain the leak(the full volume of tank)
- New fuel storage is required
- New powerhouse must have good security; cameras installed.

### 9.2 Meeting with the island council

Following table shows the list of personnel participated in the consultation with G.Dh Island Council.

Table 20: attendees of council meeting

Name	Organization
Ibrahim Assad	Vice President, Thinadhoo Council
Ahmed Nasheer	President, Thinadhoo Council
Gusayyu Abdulla	Member, Thinadhoo Council
Almas Zuhair	Member, Thinadhoo Council
Mahfooz Abdull Wahhab	Consultant

Following are the issues, concerns and suggestions highlighted by council;

- Waste oil and filter discarding to the East of powerhouse from FENAKA.
- The new powerhouse must have security cameras, fences and guard people. Further it should have provision for fire safety, for example fire horses.
- MNDF recommended a fire horse to be placed on roadside of powerhouse.

- There is an existing playground near to the powerhouse. The powerhouse staff can use this playground. However there is still a football pitch to be constructed inside the powerhouse premise. Therefore the council urged to use the land given to FENAKA more wisely.
- Council suggested it would be good to spread out the buildings to prevent spread of accidental fires.
- The tariff for current is too high especially for the business category.
- Schools and hospitals are public places and yet they are billed under business category.
- Coordination with council and FENAKA is poor.
- Bill handing over by FENAKA is not very responsible. The staff may just slide the bill under the door and leave.
- Lighting of the roads are done by the council. The council does not have the necessary expertise for the job. Therefore 2 staff were appointed for the maintenance. Since FENAKA has the expertise it would be good that FENAKA takeover this responsibility.
- No CSR is done by FENAKA, council suggested it would good if FENAKA takes initiative and place dustbins for waste collection in the island.
- Currently what the community needs most is waste management. Council has plans to start composting and are in the process of tendering an incinerator.

### 9.3 Consultations with working staff on site

Following table shows the list of individuals consulted.

Table 21: details of staffs that were consulted.

Name	Designation	Contact
Musthafa Hassan	Technical Manager	9996762
Abdul Saththar	Senior Supervisor	7979950
Mohamed Abdullah	Technician	7730748
Nizar Ali	Engineer	9911644

All staff agreed that the proposed location is the best for the construction of the new powerhouse.

Following are the issues highlighted by the staff;

- Soot from the temporary generators causes breathing difficulty
- High noise level is very disturbing.

### 9.4 EPA air quality section

Following table shows the list of personnel participated in the consultation with EPA air quality section. Consultation with air quality section was done on 28 June 2016 at 11:00 AM at EPA.

Table 22: attendees of meeting with EPA air quality section

Name	Organization
Aminath Mohamed	EPA
Mariyam Shujaa-ath	FENAKA
Mahfooz Abdull Wahhab	Consultant

Following are the issues, concerns and suggestions highlighted by EPA air quality section;

- A fuel handling plan must be made to the operation of the powerhouse
- Currently there is no regulation on air quality.
- Filters must be installed on chimneys to catch particulate matter.

### 9.5 MEA

Upon phone conversation dated 27<sup>th</sup> June 2016 at 10.23 AM, with Mrs. Fathimath Fizna, assistant engineer at MEA, assured that there is no need to conduct a meeting with MEA. It was highlighted that once the construction of the powerhouse is finished, the registration must be done according to MEA guideline for power system approval.

### 9.6 Scoping Meeting

Following table shows the list of personnel participated in the scoping meeting. Scoping meeting was held at EPA Dhiggaa Maalam at 10:00 AM on 24<sup>th</sup> March 2016.

Table 23: attendees of scoping meeting

Name	Organization
Saud Ali	Thinadhoo Council
Abdulla Nashith	FENAKA
Mahfooz Abdull Wahhab	Consultant
Mohamed Ibrahim Jaleel	Assistant Consultant
Ibrahim Naeem	EPA
Muaviyath	MEA

Following are the main issues, concerns and suggestions highlighted during the scoping meeting;

- Thinadhoo council highlighted concerns about mishandling of fuel by Thinadhoo FENAKA branch.
- EPA highlighted that FENAKA should be more careful in fuel handling and to have a fuel handling plan.
- EPA highlighted that a baseline for water quality and noise quality must be established.

## 10.0 CONCLUSION

With the development of the new powerhouse, it is expected that the noise and smoke disturbance will be reduced greatly. The negative impacts from the project will be loss of vegetation during construction and risk of groundwater contamination during operations. To avoid ground water contamination, it is import to segregate waste and keep waste stored in closed labelled containers, follow chemical handling procedures, and to provide health and safety materials to workers. Further during operations, maintenance of machinery must be carried out daily.

The proposed project was compared with the no project alternative finding many disadvantages. If the project is not implemented, FENAKA will not have to expend a huge capital at once but on the long run it will have to expend more and it also means that no reliable electricity services will be provided to Thinadhoo causing social unrest. Therefore, the preferred alternative is to develop the powerhouse at the proposed project location.

All in all, Works presented in this EIA does not pose a huge environmental risk, while the benefits of this project outweigh the risks associated. However, during the construction and operation, the mitigation measures and good environmental conduct must be followed strictly to avoid any potential impacts. It is expected that the development of powerhouse will greatly increase the reliability of electricity services to Thinadhoo. Furthermore, the project will allow sustainable provision of electricity to the residents of Thinadhoo by FENAKA. This will undoubtedly improve the public perception of the company.

## 11.0 REFEEERENCES

*1st amendment to environmental protection and preservation of the Maldives(4/93).* (2014).

Retrieved from <http://www.mvlaw.gov.mv/pdf/ganoon/chapterIV/12-2014.pdf>

CDE. (2005). *Environmental impact assessment for the proposed fourth power system development project 2005.*

FENAKA Corporation Limited (2016). *Environmental impact assessment for the construction of 300 m<sup>3</sup>/day desalination plant at G.DH Thinadhoo.*

ISLES. (2016, June 28). ISLES: Thinadhoo. Retrieved from

<http://isles.egov.mv//Island/?lid=2&id=971>

Kohler, K.E. & Gill, S.M., 2006. Coral Point Count with Excel extensions (CPCe): A Visual Basic program for the determination of coral and substrate coverage using random point count methodology. *Computers & Geosciences*, 32(9), pp.1259-1269. Available at:

<http://linkinghub.elsevier.com/retrieve/pii/S0098300405002633> [Accessed March 12, 2012].

LaMer Pvt. Ltd. (2014). *Environmental impact assessment : soft coastal measure at western shoreline of Thinadhoo, GDh Atoll.* Environmental Protection Agency, Maldives.

*Law on environmental protection and preservation of the Maldives.* (1993). Retrieved from

<http://www.mvlaw.gov.mv/pdf/ganoon/chapterIV/4-93.pdf>

*Law on general public services.* (1996). Retrieved from

<http://www.mvlaw.gov.mv/pdf/ganoon/chapterII/4-96.pdf>

Maldives Energy Authority. (n.d.). Regulation on provision of electricity to Male' and Islands.

Retrieved from [http://www.energy.gov.mv/v1/wp-content/files/lawsandregulations/D02-Downloads-MEA\\_Qawaaidhu01.pdf](http://www.energy.gov.mv/v1/wp-content/files/lawsandregulations/D02-Downloads-MEA_Qawaaidhu01.pdf)

Maldives Energy Authority. (n.d.). Guideline for powers system approval. Retrieved from

<http://www.energy.gov.mv/v1/wp-content/files/downloads/D03-Downloads-Guideline for Power System Approval-Rev200907091230.pdf>

Maldives Meteorological Centre. (2015). Climate of Maldives. Retrieved December 30, 2015,

from <http://www.meteorology.gov.mv/climateofmaldives>

Maldives Meteorological Service. (2015). *Daily Rainfall Data*.

Ministry of Housing and Environment. (2010). *Environmental impact assessment : G.Dh Thinadhoo wastewater collection, treatment & disposal system*. Environmental Protection Agency, Maldives.

National Burea of Statistics. (2015). *Population and housing census 2015*.

President Office of Maldives. (2012, May 8). Environmental impact assessment regulation 2012.

*Gazette of Maldives, 41(81)*. Retrieved from <http://www.mvlaw.gov.mv/pdf/gavaid/minHousing/R27-2012.pdf>

President office of Maldives. (2013, April 9). 1st amendment to environment impact assessment regulation. *Gazette of Maldives, 42(56)*. Retrieved from

<http://www.mvlaw.gov.mv/pdf/gavaid/minHousing/R18-2013.pdf>

President office of Maldives. (2013, August 5). Waste management regulation. *Gazette of Maldives, 42(113)*.

President office of Maldives. (2015, August 30). 2nd amendment to environmental impact assessment regulation. *Gazette of Maldives*, 44(261). Retrieved from [http://epa.gov.mv/index.php?option=com\\_content&view=article&id=89:environmental-impact-assessment-regulation-2007&catid=10:environmental-regulations&Itemid=20](http://epa.gov.mv/index.php?option=com_content&view=article&id=89:environmental-impact-assessment-regulation-2007&catid=10:environmental-regulations&Itemid=20)


Water Solutions Pvt. Ltd. (2016). *Environmental impact assessment for the proposed coastal protection on the south side of Thinadhoo Island, Gaafu Dhaalu Atoll, Maldives*. Environmental Protection Agency, Maldives.


## APPENDICES


## APPENDIX 1: LIST OF ABBREVIATIONS

MEE	Ministry of Environment and Energy
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
MEA	Maldives Energy Authority
NSS	National Security Service (currently known as Fire and Rescue)
NE	North East
SW	South West
mA	milli ampere
ELCCB	Earth leakage circuit breaker
ELCB	Earth leakage circuit breaker
V	Voltage
A	Ampere
CB	Circuit breaker
MCCB	Molded case circuit breaker
mm	millimeter
W	Watt
MW	Mega Watt
CSR	Corporate Social Responsibility

**APPENDIX 2: TERMS OF REFERENCE (TOR)**







203-EIARES/FNK/2016/28

## Terms of Reference for Environmental Impact Assessment for Power Plant Development in GDh. Thinadhoo

The following is the Terms of Reference (ToR) following the scoping meeting held on 24<sup>th</sup> March 2016 for undertaking the EIA of the Proposed Power Plant Development at Thinadhoo island, Gaaf dhaalu Atoll.

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.

- Introduction and rationale** – Describe the purpose of the project and, if applicable, the background information of the project/activity and the tasks already completed. Objectives of the development activities should be specific and if possible quantified. Define the arrangements required for the environmental assessment including how work carried out under this contract is linked to other activities that are carried out or that is being carried out within the project boundary. Identify the donors and the institutional arrangements relevant to this project.
- Study area** – Submit a minimum A3 size scaled plan with indications of all the proposed infrastructures. Specify the agreed boundaries of the study area for the environmental impact assessment highlighting the proposed development location and size. The study area should include adjacent or remote areas, such as relevant developments and nearby environmentally sensitive sites (e.g. coral reef, sea grass, mangroves, marine protected areas, special birds site, sensitive species nursery and feeding grounds). Relevant developments in the areas must also be addressed including residential areas, all economic ventures and cultural sites.
- Scope of work** – Identify and number tasks of the project including preparation, construction and decommissioning phases. The following tasks shall be completed:
 

**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. The following should be provided (all inputs and outputs related to the proposed activities shall be justified):

The main activities works are:

  - Land clearance for infrastructure installation;
  - Project management (include scheduling and duration of the project and life span of facilities; communication of construction details, progress, target dates, construction/operation/temporary labour accommodation, access to site, safety, equipment, waste management (including construction waste, fuel waste etc) and material storage, fuel management and emergency plan in case of spills).

Environmental Protection Agency  
Green Building, 3<sup>rd</sup> Floor, HandhuvaareeHingun  
Male', Rep. of Maldives, 20392

Tel: [+960] 333 5949 [+960] 333 5951 ޯފޯން ނަންބަރު  
Fax: [+960] 333 5953 ފެކްސް ނަންބަރު

ދިވެހިސަރުކާރުގެ ގެޒެޓް ގެ ދަށުން ދެކޮޅު ނަންބަރު  
ދިވެހިރާއްޖޭގެ ޖުމްހޫރިއްޔާގެ ސަރުކާރުގެ ސަރުކާރުގެ ސަރުކާރު  
ކަނޑު، ދިވެހިރާއްޖެ، 20392

އިމެއިލް: secretariat@epa.gov.mv ފެކްސް ނަންބަރު  
ވެބްސައިޓް: www.epa.gov.mv ވެބްސައިޓް ނަންބަރު

1 of 5



**Power plant design**

- Location and capacity of generators and facility;
- Access to power plant;
- Sound attenuation measures;
- Emergency power supply plan;
- Consideration of energy efficiency in power generation

**Fuel Management**

- Volume required for plant operation;
- Rate of waste lube oil generation its collection, storage and disposal;
- Fuel storage tank details (size, location, );
- Pipeline drawings and specifications especially leakage proofing;
- Measures of fuel containment  
Method of fuel transport from harbour to storage

**Hazard vulnerability**

- Fire, electrical and explosion hazard
- Vulnerability of area to flooding and storm surge.

**Health and safety**

- Availability of basic first aid facilities
- Availability of safety gears
- Fire fighting capability of powerhouse operators or fire warden.

**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 with Geographic Positioning System (GPS) including water sampling points, reef transects, vegetation transects and manta tows sites for posterior data comparison. Submit all raw data collected for the purpose of the project along with the soft copy.

**All data must be collected as per the requirements of the EPA Data Collection Guidelines (published on [www.epa.gov.mv](http://www.epa.gov.mv)). The report should outline detailed methodology of data collection utilized.**

Information should be divided into the categories shown below:

*\*There is a description of the specific data collection requirements attached in the appendix of this TOR template.*

**Hydrography/hydrodynamics (use maps)**

- Tidal ranges and tidal currents;
- Wave climate and wave induced currents;
- Wind induced (seasonal) currents and along shore currents;



Environmental Protection Agency  
Green Building, 3<sup>rd</sup> Floor, HandhuvareeHingun  
Male', Rep. of Maldives, 20392  
Tel: [+960] 333 5949 [+960] 333 5951  
Fax: [+960] 333 5953

ދިވެހިސަރުކާރުގެ ގެޒެޓް ގައި ބަޔާންކޮށްފައިވާ ގޮތުގައި  
ދިވެހިރާއްޖޭގެ ޖުމްހޫރިއްޔާގެ ސަރުކާރުގެ ފަރާތުން  
މާލެ، ދިވެހިރާއްޖެ، 20392  
އިމެއިލް: [secretariat@epa.gov.mv](mailto:secretariat@epa.gov.mv)  
ވެބްސައިޓް: [www.epa.gov.mv](http://www.epa.gov.mv)

Fe:  
Po:  
Mf:  
Tel:  
Fax:

[960] 300 7555 : ޕްލީޔަރު  
[960] 332 7555 : ފެކްސް



ދިވެހިސަރުކާރުގެ ގެޒެޓް ގައި ބަޔާންކޮށްފައިވާ ގޮތެއްގައި  
 Environmental Protection Agency EPA

**Ecology**

- Terrestrial surveys: including bird and turtle nesting sites, vegetation biodiversity and abundance;
- Landscape integrity, and
- Ground water quality parameters including temperature, pH, salinity, turbidity and grease and oil test (see appendix for parameter healthy ranges);

**Socio-economic environment**

- Demography: total population, sex ratio, density, growth and pressure on land and marine resources;
- Income situation and distribution
- Land use planning, natural resource use and zoning of activities (approved);
- Community needs;

Absence of facilities in the country to carry out the water quality tests will not exempt the proponent from the obligation to provide the necessary data. The report should outline the detailed methodology of data collection utilized to describe the existing environment.

**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.

**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:

**Impacts on the natural environment**

- Impacts of noise, vibration and disturbance;
- Impacts on ground water table and quality due to construction operations and accidental fuel spillages;
- Impacts on unique or threatened habitats or species (coral reefs, sea turtles etc.), and
- Impacts on landscape integrity/scenery.

**Impacts on the socio-economic environment**

- Noise impacts to local residents;
- Changes in electricity prices, if any;
- Advantages of reliable electrical power supply;
- Population access to power (will access to power improve?)
- Employment and economic opportunities and diversification;
- Impacts on human health;
- Impacts from ground water contamination, if any;
- Impact equity (economic activities, employment, income);
- Social destabilization of the island community, and
- Monitoring of socioeconomic and demographic development.



Environmental Protection Agency  
 Green Building, 3<sup>rd</sup> Floor, HandhuvareeHingun  
 Male', Rep. of Maldives, 20392  
 Tel: [+960] 333 5949 [+960] 333 5951  
 Fax: [+960] 333 5953

ދިވެހިސަރުކާރުގެ ގެޒެޓް ގައި ބަޔާންކޮށްފައިވާ ގޮތެއްގައި  
 ދިވެހިސަރުކާރުގެ ގެޒެޓް ގައި ބަޔާންކޮށްފައިވާ ގޮތެއްގައި  
 20392  
 Email: secretariat@epa.gov.mv  
 Website: www.epa.gov.mv

Fe:  
 Po:  
 M:  
 Tel:  
 Fax:

[960] 300 7555 : ޖެނެރަލް ޕްލޭންޑަރ  
 [960] 332 7555 : ފެކްސް

Email: info@fenaka.com.mv  
 Website: www.fenaka.com.mv

ފޯން:  
 ޕޯސްޓް:  
 މޯބައިލް:  
 ޖެނެރަލް ޕްލޭންޑަރ:  
 ފެކްސް:



**Construction related hazards and risks**

- Pollution of the natural environment (e.g. oil spills, discharge of untreated waste water and solid waste, including construction waste);
- Risk of accidents and pollution on workers and local population, and
- Impacts on social values, norms and belief due to construction workers on local population.
- Potential damage to surrounding buildings during construction

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. Use interaction matrices (E.g. Leopold Matrix) to assess the magnitude and significance of the impacts.

**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”. This should include alternative location and design of facility that includes environmental, social and economic factors. The report should highlight how the location was determined. All alternatives must be compared according to commonly accepted standards and norms and international 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. Comparison of alternatives should be provided in terms of short-term, medium-term and long term costs and environmental impacts and benefits in order to decide the best alternative.

**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. Mitigation measures to avoid or compensate habitat destruction caused will have to be considered. 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 during construction and operation 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. Efficiency of the generator sets and power distribution and consumption should be increased as a mitigation measure.

**Task 7. Development of monitoring plan**– Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan. Ecological monitoring will be submitted to the EPA to evaluate the damages during construction, after project completion and on a yearly basis for five years thereafter. The baseline study described in task 2 of section 2 of this document is required for data comparison. 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 8. Stakeholder consultation, Inter-Agency coordination and public/NGO participation)** – Identify appropriate mechanisms for providing information on the development proposal and its progress to all stakeholders, government authorities such as Ministry of Housing, Transport and Environment, Planning Council, Tourism Ministry, Finance Ministry, government agencies, NGOs, engineers/designers, development managers, staff and members of the general public. The EIA report should include a list of people/groups consulted, their contact details and summary of the major outcomes. If any forms are used for public consultation, it shall be approved by the relevant government authorities and annexed.



Environmental Protection Agency  
Green Building, 3<sup>rd</sup> Floor, HandhuvareeHingun  
Male', Rep. of Maldives, 20392

Tel: [+960] 333 5949 [+960] 333 5951  
Fax: [+960] 333 5953

ދިވެހިސަރުކާރުގެ ގެޒެޓް  
ދިވެހިސަރުކާރުގެ ގެޒެޓް  
20392  
Email: secretariat@epa.gov.mv  
Website: www.epa.gov.mv

Fe:  
Po:  
Mf:  
Tel:  
Fax:

[960] 300 1555 : ޕްލާން ޕްރޮޖެކްޓް  
[960] 332 7555 : ފޯން ނުމާ

Email: info@fenaka.com.mv  
Website: www.fenaka.com.mv

ގަވާއިދު  
ޕްރޮޖެކްޓް  
ފޯމުލަތް  
ފޯމުލަތް



ދިވެހިސަރުކާރުގެ ގެޒެޓް ގައި ބަޔާންކޮށްފައިވާ ގޮތުން  
 Environmental Protection Agency EPA

**Presentation-** The environmental impact assessment report, to be presented in digital format, will be concise and focus on significant environmental issues. It will contain the findings, conclusions and recommended actions supported by summaries of the data collected and citations for any references used in interpreting those data. The environmental assessment report will be organized according to, but not necessarily limited by, the outline given in the Environmental Impact Assessment Regulations, 2012

**Timeframe for submitting the EIA report** – The developer must submit the completed EIA report within 6 months from the date of this Term of Reference

*Handwritten signature*  
 24 March 2016  


Environmental Protection Agency  
 Green Building, 3<sup>rd</sup> Floor, HandhuvareeHingun  
 Male', Rep. of Maldives, 20392  
 Tel: [+960] 333 5949 [+960] 333 5951  
 Fax: [+960] 333 5953

ދިވެހިސަރުކާރުގެ ގެޒެޓް ގައި ބަޔާންކޮށްފައިވާ ގޮތުން  
 ދިވެހިސަރުކާރުގެ ގެޒެޓް ގައި ބަޔާންކޮށްފައިވާ ގޮތުން  
 20392  
 Email: secretariat@epa.gov.mv  
 Website: www.epa.gov.mv

APPENDIX 3: WATER SAMPLE RESULTS FROM MWSC

**Male' Water & Sewerage Company Pvt Ltd**  
**Water Quality Assurance Laboratory**  
 FEN Building 5th Floor, Machanagalhi, Ameenemagu, Male', Maldives  
 Tel: +9603323209, Fax: +9603324306, Email: wqa@mwsc.com.mv



Customer Informations :

Fenaka Corporation Limited  
 Port Complex Building,  
 Hilaalee Magu,  
 Male',  
 Rep of Maldives

**WATER QUALITY TEST REPORT**  
 Test Report No: 30077/2016/25

Date: 12/04/2016

Sample Description / Location	Powerhouse	G. Dh. Thinhadoo	UNIT
Sample Type	Waste water		
Sample Date	4/4/2016		
Sample Received Date	5/4/2016		
Test Requisition Form No.	900163135		
Sample No.	822519		
Date of Analysis	5/4/2016-6/4/2016		
<b>PARAMETER</b>			
Physical Appearance	Clear	Visual	
Conductivity	6420	Method 2510 B. (adapted from Standard methods for the examination of water and waste water, 21st edition)	µS/cm
pH	7.34	Method 4500-H+ B. (adapted from Standard methods for the examination of water and waste water, 21st edition)	°C
Salinity	3.50	Method 2520 B. (adapted from Standard methods for the examination of water and waste water, 21st edition)	°C
Temperature	23.4	Electrometry	mg/L
Total Petroleum Hydrocarbon (TPH)	0.07	UV Fluorescence	NTU
Turbidity	0.401	HACH Nephelometric Method (adapted from HACH 2100N Turbiditymeter User Manual)	

**KEYS:**  
 µS/cm: Micro Siemens per centimeter, %: Parts Per Thousand, mg/L: Milligram Per Liter, °C: Degree Celsius, NTU: Nephelometric Turbidity Unit  
 Lqd: Limit of Quantification

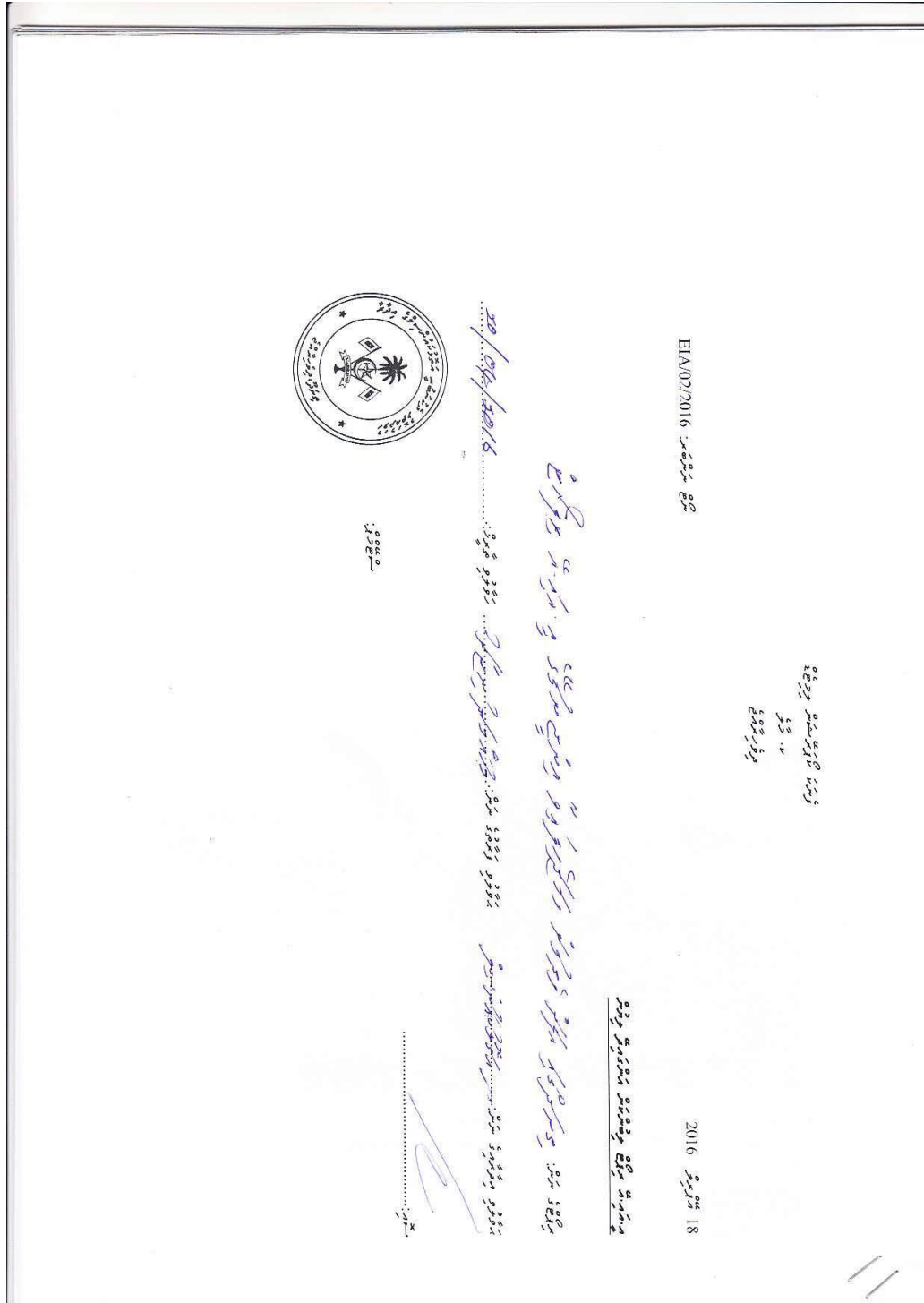
Checked by: *[Signature]* Afnan Farooq  
 Laboratory Executive

Approved by: *[Signature]* Mohamed Eymen  
 Senior Technical Officer

**Notes:**  
**Sampling Authority:** Sampling was not done by MWSC Laboratory  
 This report shall not be reproduced except in full, without written approval of MWSC  
 This test report is ONLY FOR THE SAMPLES TESTED.  
 ~ Information supplied by the customer

\*\*\*\*\*END OF THE REPORT\*\*\*\*\*

**APPENDIX 4: EIA REPORT RECEIVAL RECEIPT FROM G.DH ATOLL COUNCIL**



## APPENDIX 5: DETAILED DRAWINGS OF POWERHOUSE

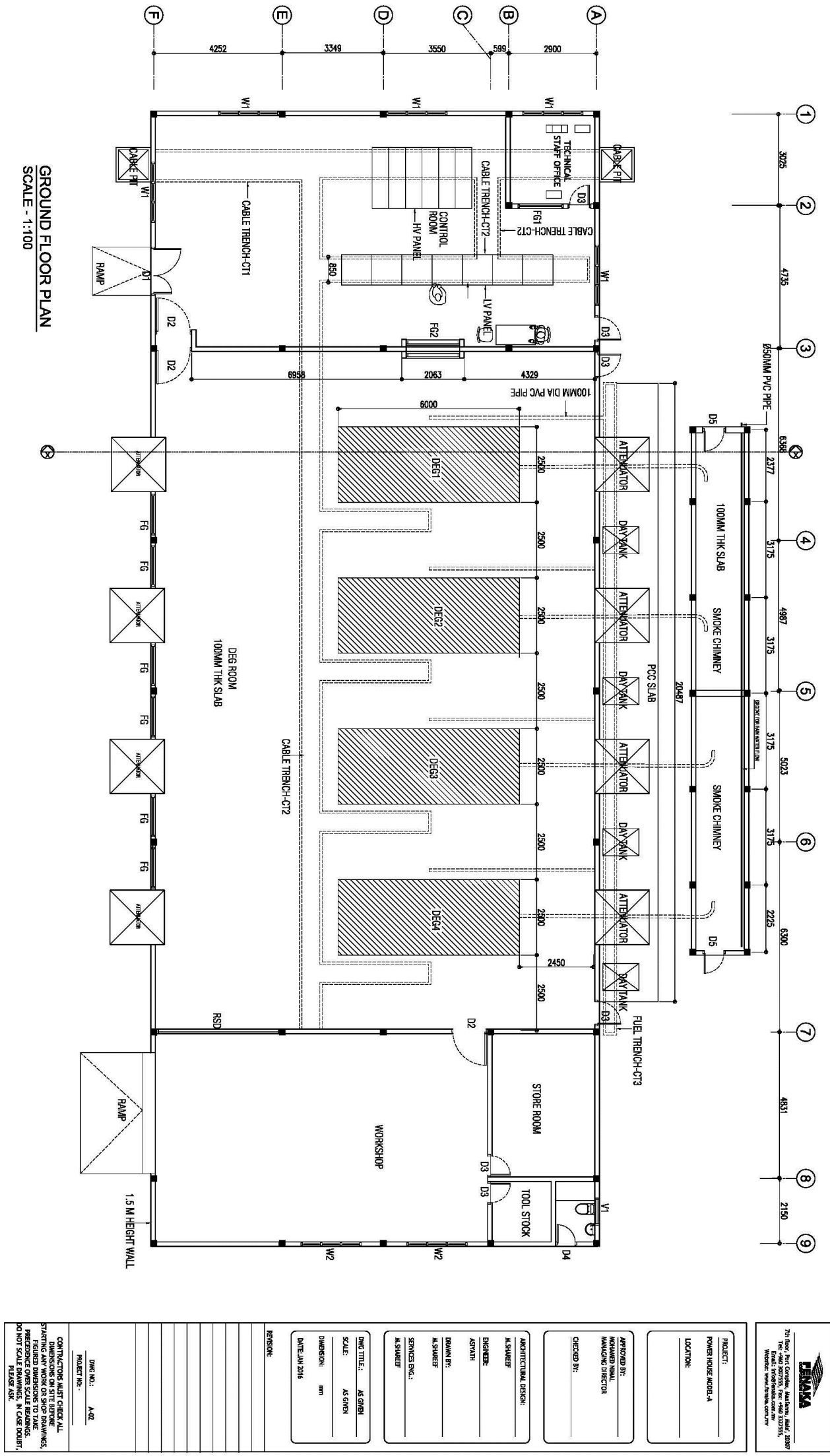
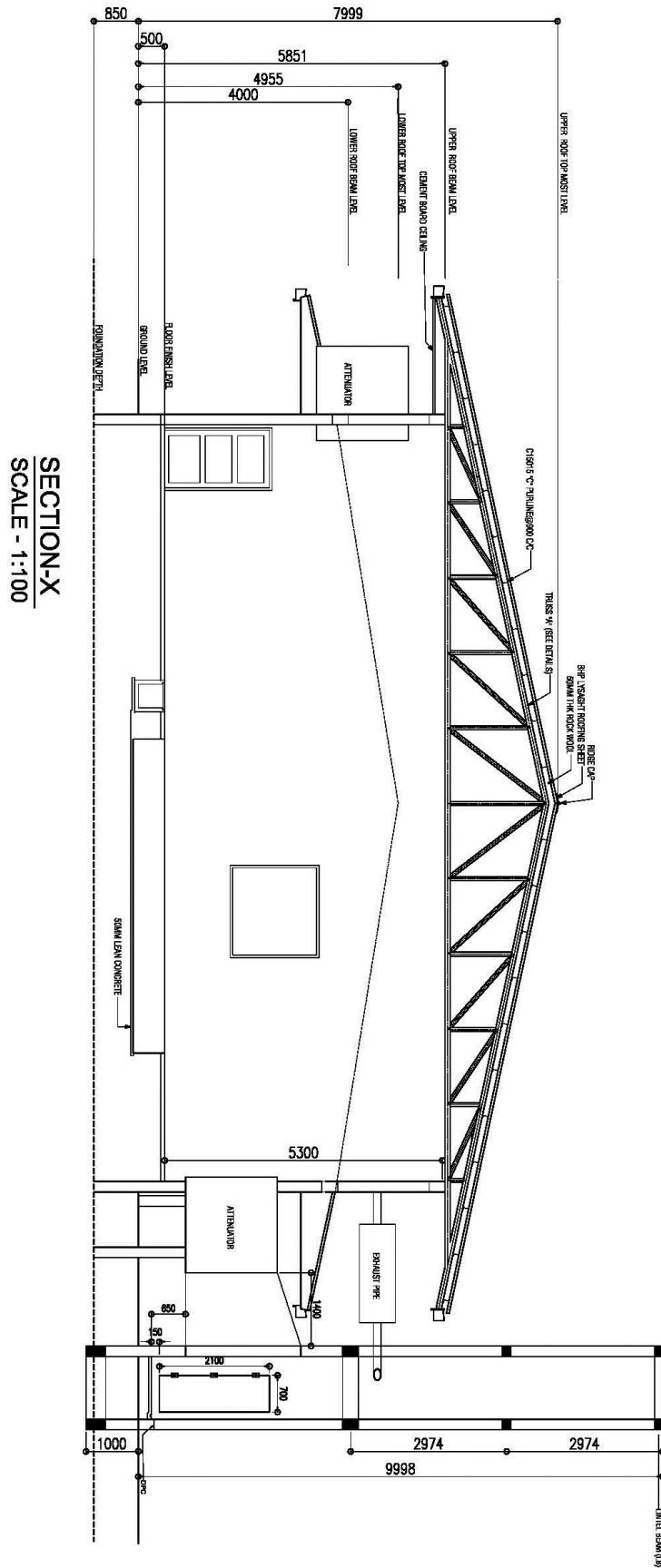


Figure 25: floor plan of powerhouse



SECTION-X  
SCALE - 1:100


 7th Floor, Port Complex, Male' International Airport, Male', 20307 Tel: [960] 332 7555 Email: info@fenaka.com.mv Website: www.fenaka.com.mv	
PROJECT:	POWER HOUSE MODEL-A
LOCATION:	
APPROVED BY:	ACHAARU NIHAL MANAGING DIRECTOR
CHECKED BY:	
ARCHITECTURAL DESIGN:	M. SHARIEF
ENGINEERS:	AS/VA/TH
DRAWN BY:	M. SHARIEF
SERVICES ENG.:	M. SHARIEF
DWG TITLE:	AS GIVEN
SCALE:	AS GIVEN
DIMENSION:	mm
DATE:	JAN 2016
REVISION:	
CONTRACTORS MUST CHECK ALL DIMENSIONS ON SITE BEFORE STARTING ANY WORK OR SHOP DRAWINGS. FIGURED DIMENSIONS TO TAKE PRECEDENCE OVER SCALE READINGS. DO NOT SCALE DRAWINGS. IN CASE DOUBT, PLEASE ASK.	
DWG NO.:	A-03
PROJECT NO.:	

Figure 26: sectional elevation of powerhouse

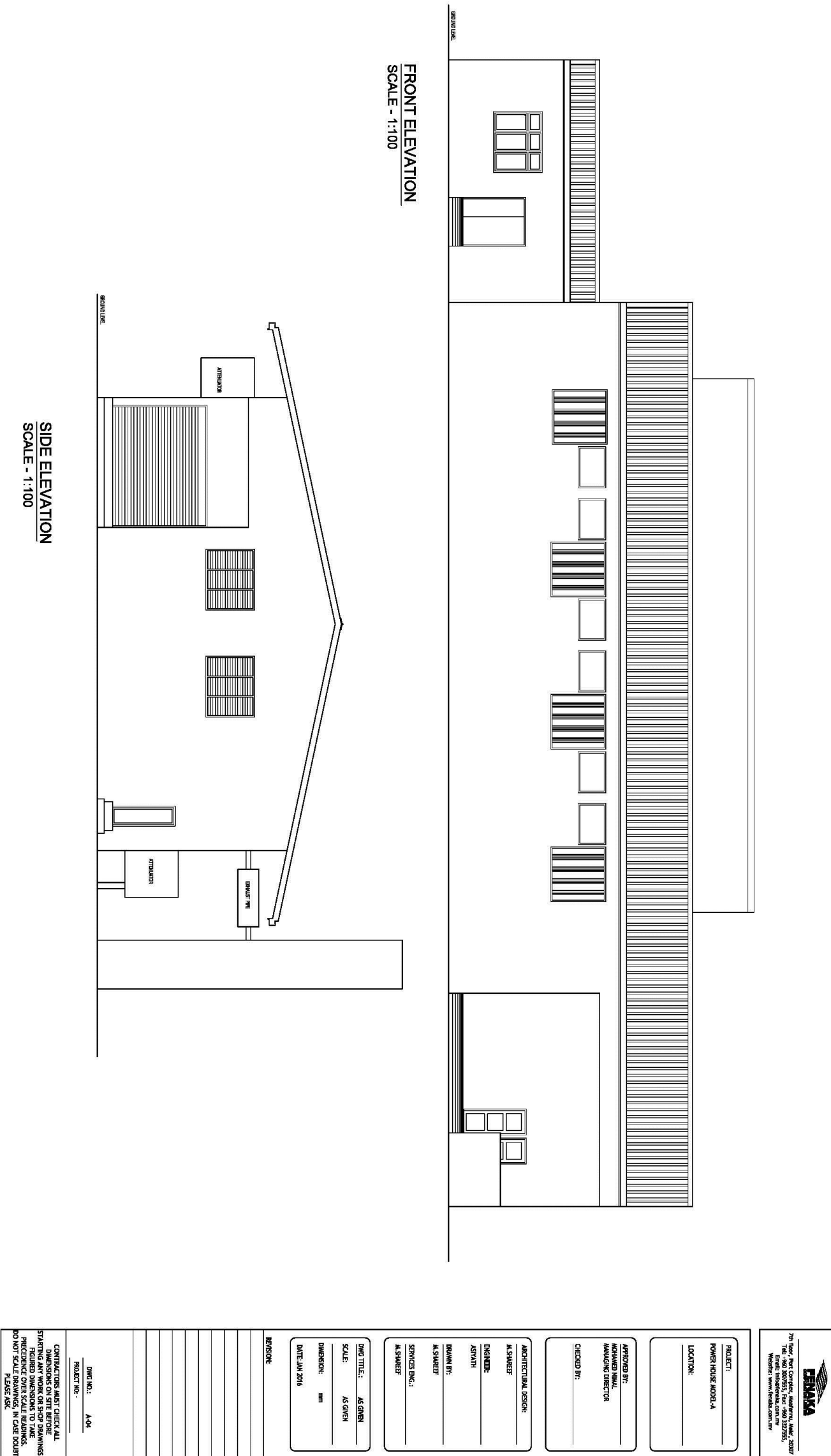
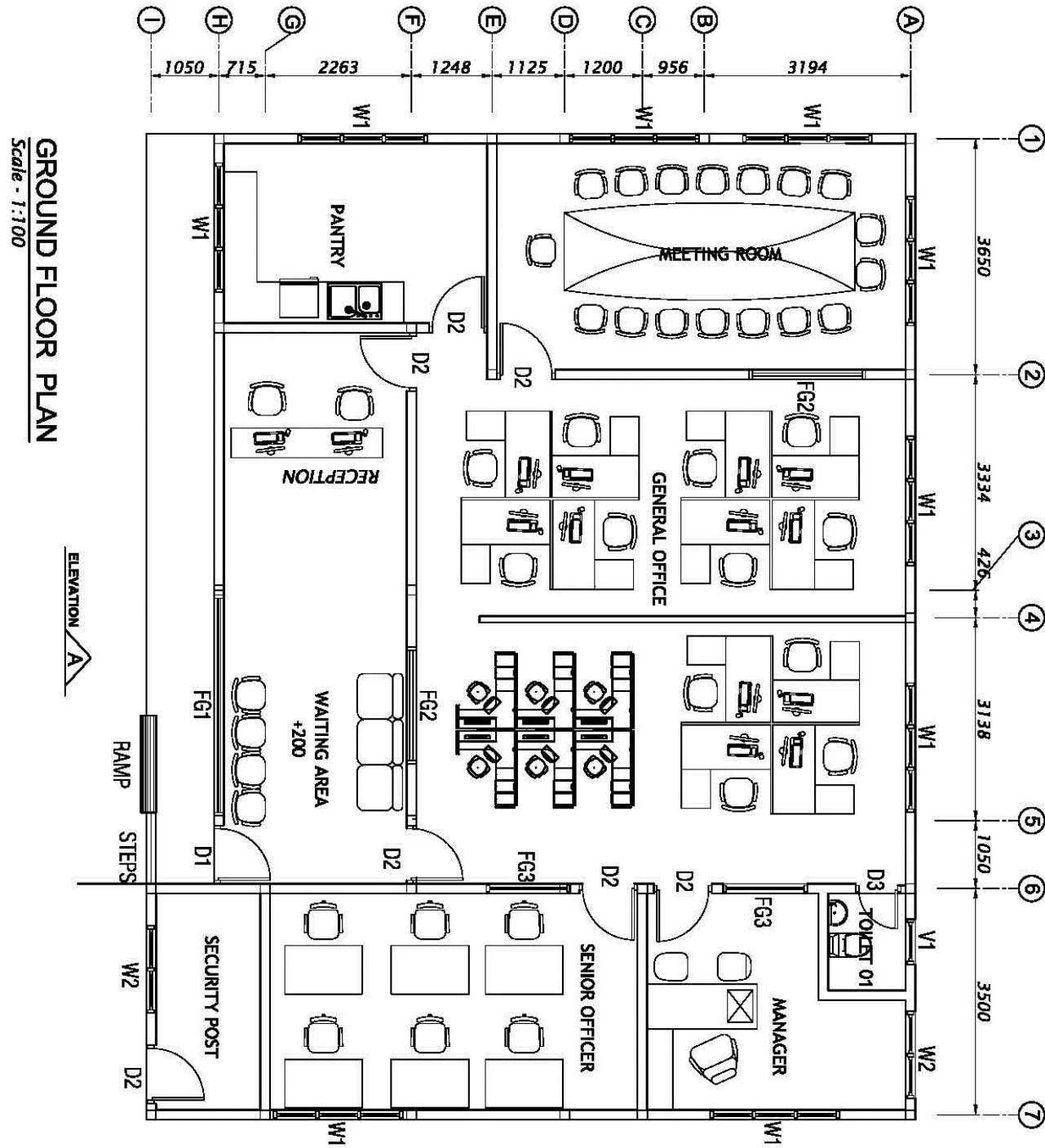


Figure 27: front and side elevation of powerhouse




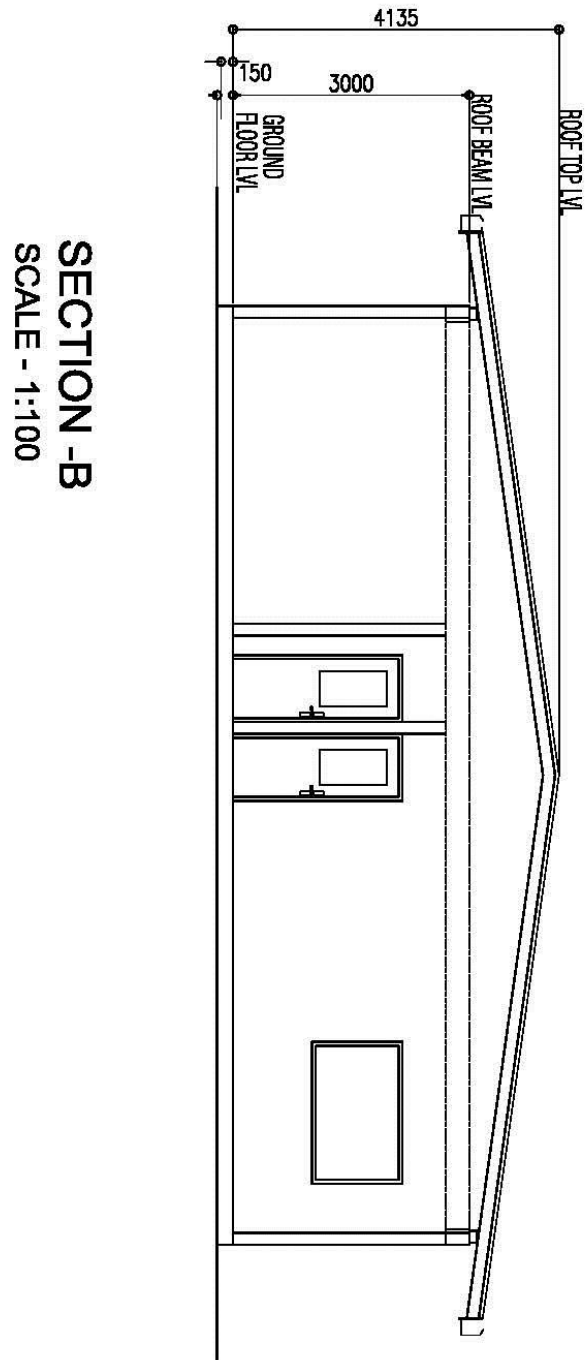
 7th floor Port Complex, Male' Maldives, 20307 Tel: 960 3327555, Fax: 960 3327555 Website: www.fenaka.com.mv	
PROJECT: POWER HOUSE MODEL A LOCATION:	APPROVED BY: MOHAMMED NIHAL MANAGING DIRECTOR CHECKED BY:
ARCHITECTURAL DESIGN: A.S. SHARIEF ENGINEER: ASYATH DRAWN BY: A.S. SHARIEF SERVICES ENG.: A.S. SHARIEF	DWG TITLE: AS GIVEN SCALE: AS GIVEN DIMENSION: mm DATE: JAN 2016 REVISION:
CONTRACTOR MUST CHECK ALL DIMENSIONS ON SITE BEFORE STARTING ANY WORK OR SHOP DRAWINGS. FIGURED DIMENSIONS TO TAKE PRECEDENCE OVER SCALE DIMENSIONS. DO NOT SCALE DIMENSIONS IN CASE DOUBT. PLEASE ASK.	
DWG NO.: A-02 PROJECT NO.:	

Figure 28: floor plan for admin building




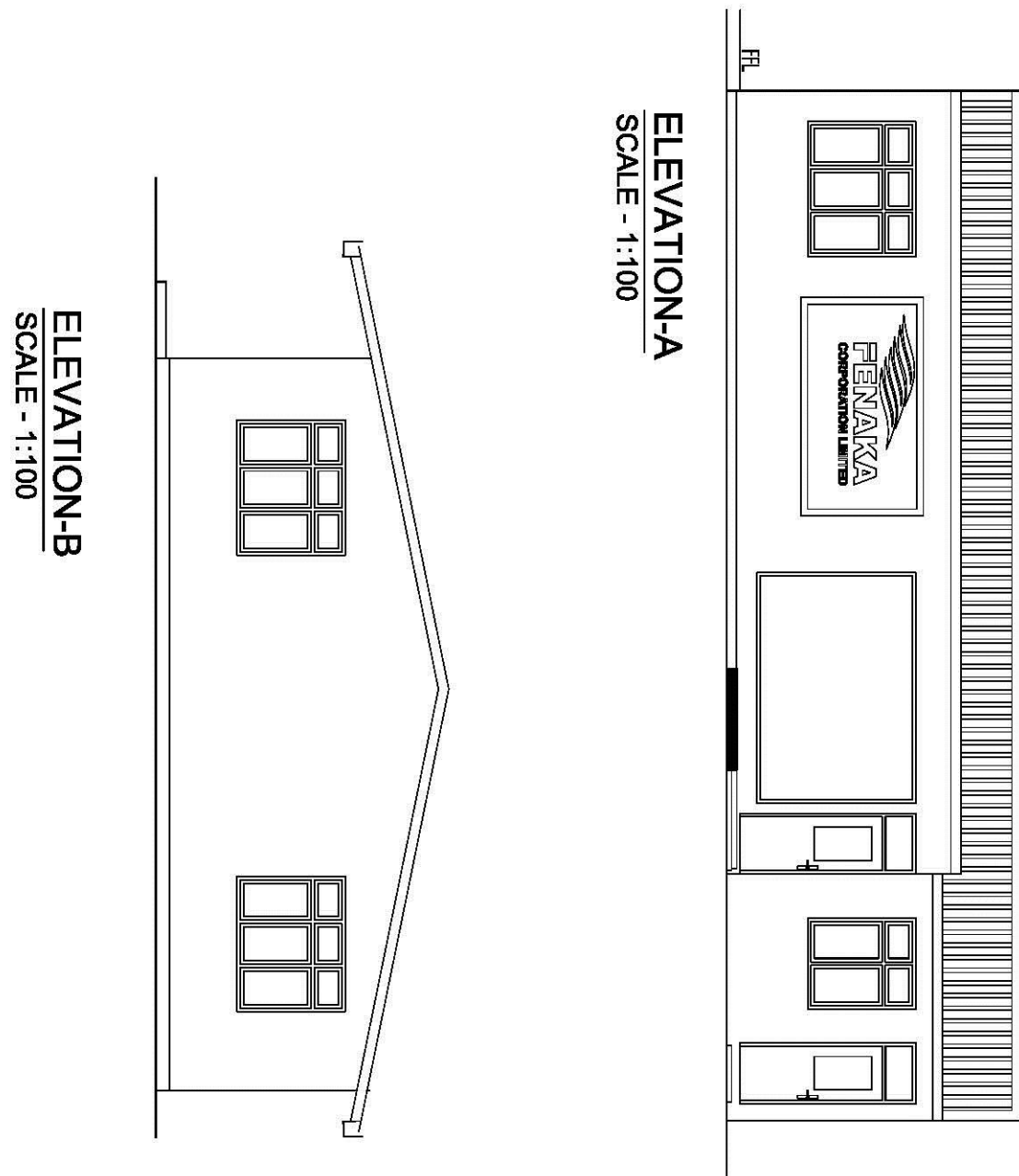
 7th floor, Port Complex, Malé, MALÉ, 20307 Tel: +960 3007555, Fax: +960 3327555, Email: info@fenaka.com.mv Website: www.fenaka.com.mv	
PROJECT:	POWER HOUSE MOD. A
LOCATION:	
APPROVED BY:	APPROVED NAME: MANAGING DIRECTOR
CHECKED BY:	
ARCHITECTURAL DESIGN:	M. SHABEER
ENGINEER:	ASYATH
DRAWN BY:	M. SHABEER
SERVICES ENG.:	M. SHABEER
DWG TITLE:	AS GIVEN
SCALE:	AS GIVEN
DIMENSION:	mm
DATE:	JAN 2016
REVISION:	
CONTRACTORS MUST CHECK ALL DIMENSIONS ON SITE BEFORE STARTING ANY WORK OR BEFORE FIELDING DIMENSIONS TO TAKE PRECEDENCE OVER SCALE REVISIONS. DO NOT SCALE DRAWINGS. IN CASE DOUBT, PLEASE ASK.	
DWG NO.:	A-03
PROJECT NO.:	

Figure 29: sectional elevation of admin building




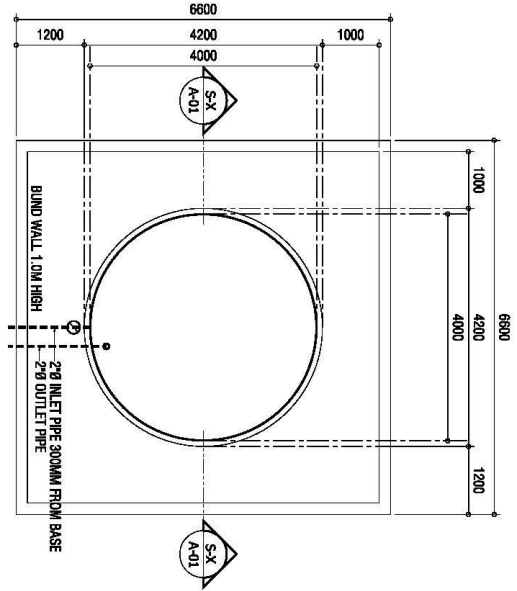
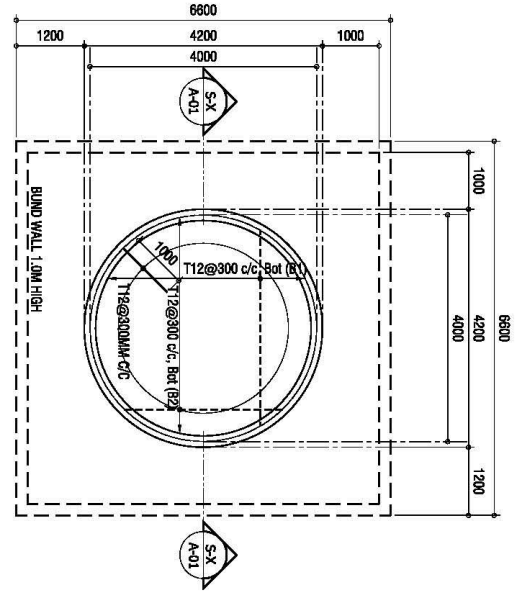
 7th Floor, Port Complex, Male' 20307 Tel: +960 3327555 / Fax: +960 3327555 Website: www.fenaka.com.mv	
PROJECT:	POWER HOUSE MODEL-A
LOCATION:	
APPROVED BY:	MOHAMMED NUAL MANAGING DIRECTOR
CHECKED BY:	
ARCHITECTURAL DESIGN:	M. SHARIEF
ENGINEER:	ASWATH
DRAWN BY:	M. SHARIEF
SERVICES ENG.:	M. SHARIEF
DWG TITLE:	AS GIVEN
SCALE:	AS GIVEN
DIMENSION:	mm
DATE/JAN 2016	
REVISION:	
DWG NO.:	A-04
PROJECT NO.:	
CONTRACTORS MUST CHECK ALL DIMENSIONS ON SITE BEFORE STARTING ANY WORK OR SHOP DRAWINGS. FIGURED DIMENSIONS TO TAKE PRECEDENCE OVER SCALE RENDERING. DO NOT SCALE DIMENSIONS IN CASE OF ANY DISCREPANCY. PLEASE MARK.	

Figure 30: front elevation of admin building

## APPENDIX 6: DETAILED DRAWINGS OF FUEL STORAGE TANKS

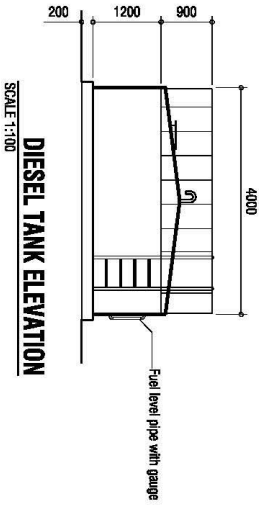


**DIESEL TANK PLAN**  
SCALE 1:100



**FOUNDATION PLAN**  
SCALE 1:100

**Note:**  
 Reinforcement:  
 Provide one layer of reinforcement at bottom (l/w shown) orthogonal direction with T12 @ 300mm c/c B/W (shown). At the circumference provide 1m length T12 @ 300mm c/c radially. Lap length - 450mm  
 Material Grades:  
 Concrete - compressive strength of concrete - 25N/mm<sup>2</sup>  
 Characteristic yield strength of steel - 415N/mm<sup>2</sup>  
 Cover for reinforcement - 50mm  
 Dimensions etc:  
 Diameter - as given above  
 All the parts of the foundation must be properly finished.  
 The gradient required shall be maintained.  
 Allowance from the opening for sludge removal shall be provided in the foundation.  
 Proper water proofing shall be provided.



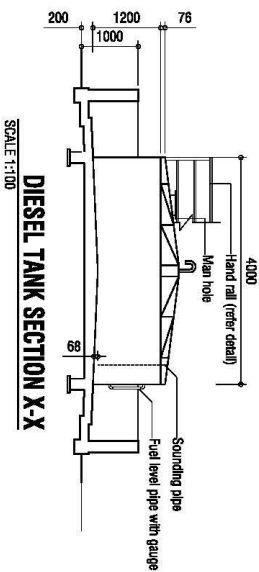
**DIESEL TANK ELEVATION**  
SCALE 1:100

**NOTE:**

1. The location of the tank shall be confirmed before construction.
2. All the services connections shall be solved before fabrication.
3. Shop drawing shall be approved before construction.

**MATERIAL SPECIFICATIONS**

- a). Plates in accordance with BS4360 A
- b). Sections & Bars in accordance with IS0830-1980
- c). Forgings in accordance with BS1530 (carbon & carbon / manganese steel only)
- d). Bolting material in accordance with BS1506
- e). Piping in accordance with BS3602 & BS3603

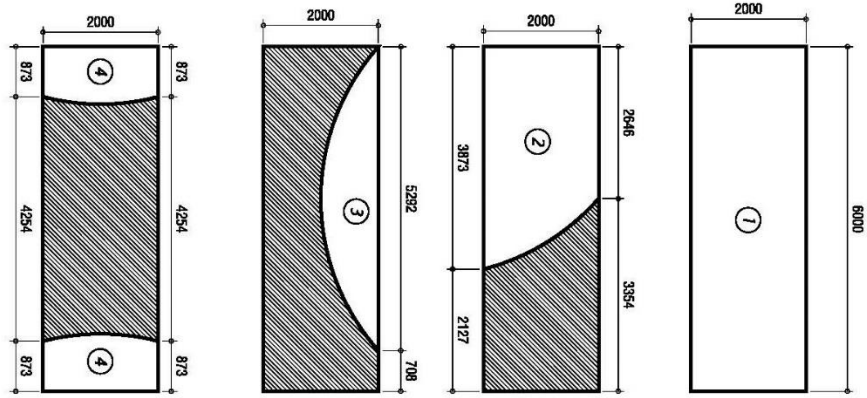
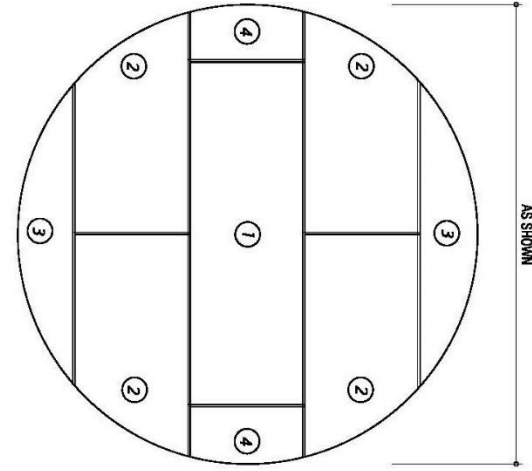


**DIESEL TANK SECTION X-X**  
SCALE 1:100

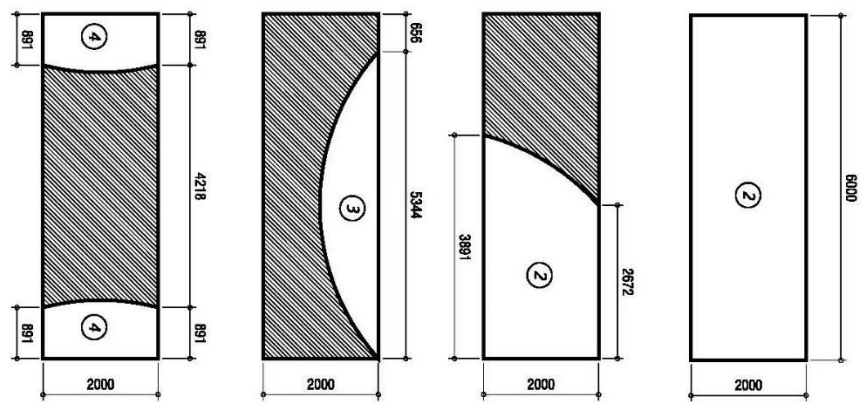
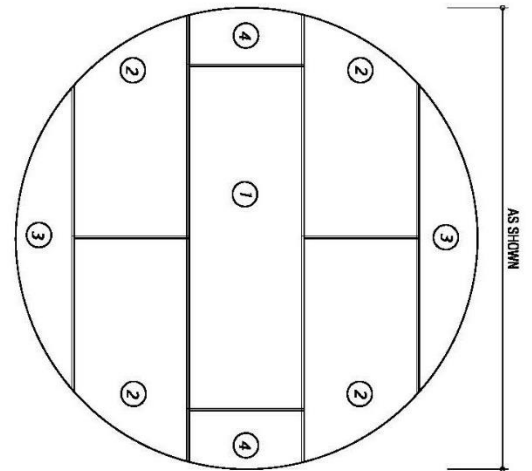
**NOTE:**

1. Tank shall be constructed only after appropriate shop drawings have been produced and approved.
2. The material and workmanship shall be to British standard or equivalent international standard.
3. The interior and exterior shall have approved appropriate paint system suitable for water storage tank.
4. The tank surface shall be sand blasted to Swedish standard before applying the paint.
5. All the parts of the base and top of foundation shall be confirmed to be horizontal before securing the base plate.
6. Any gap left between the base plate and the foundation shall be properly sealed using approved sealant.
7. Appropriate hydrotesting shall be performed before commissioning the tank.
8. Proper safety precautions and measures shall be made during construction to ensure smooth execution.
9. Bituminous paint below base shall be applied.

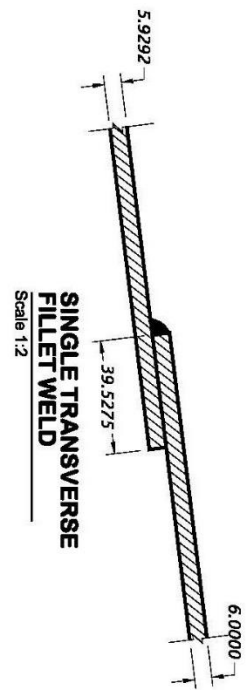
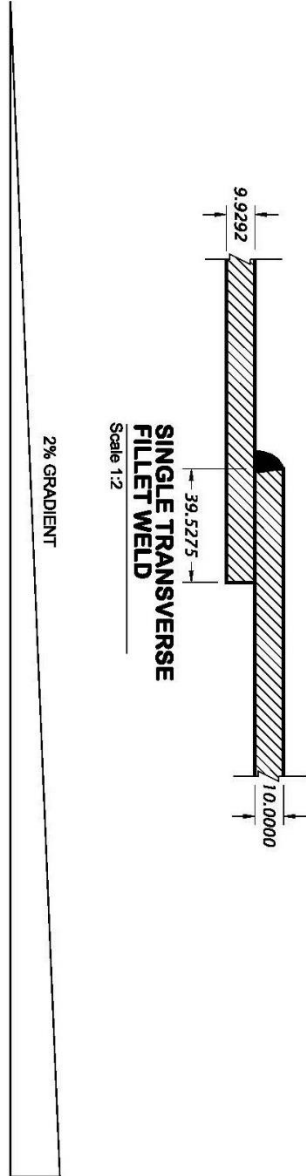
**PLAN - BASE PLATE**  
SCALE 1:100

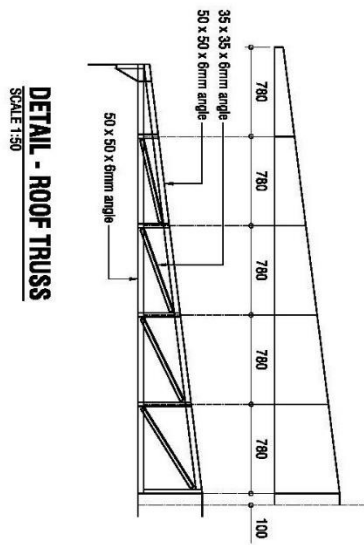
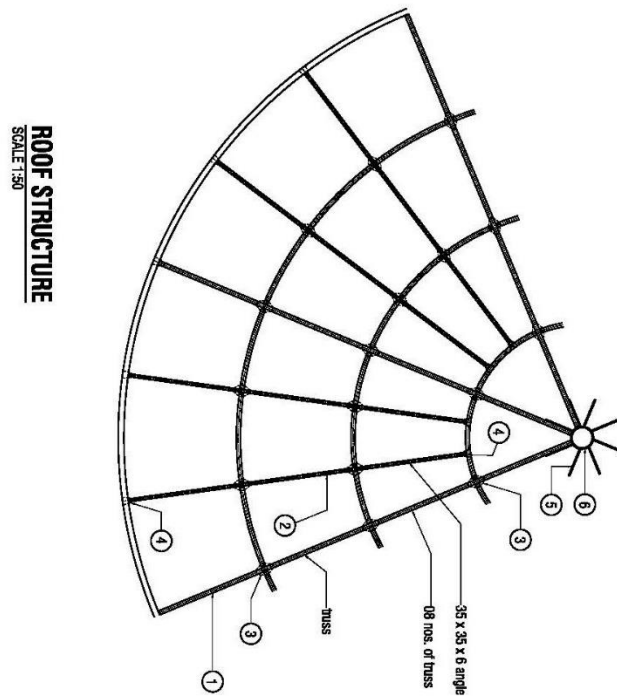
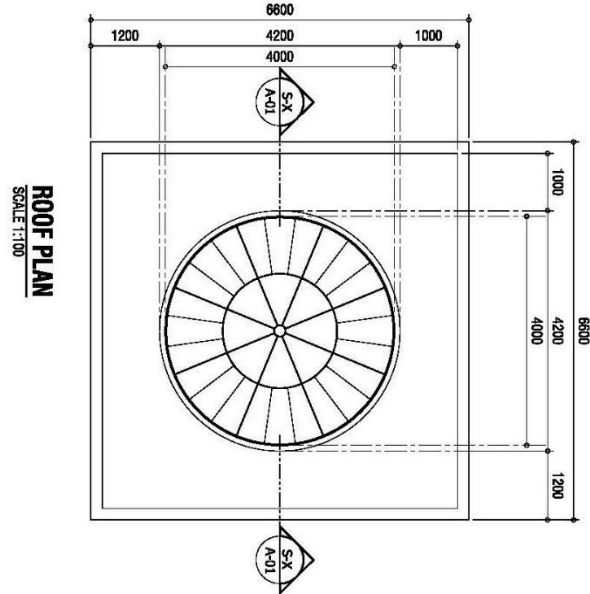


**PLAN - ROOF PLATE**  
SCALE 1:100

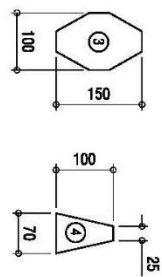


**TANK BOTTOM GRADIENT**  
Scale 1:2

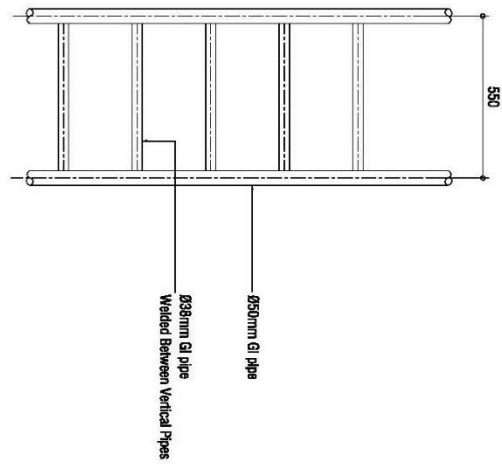




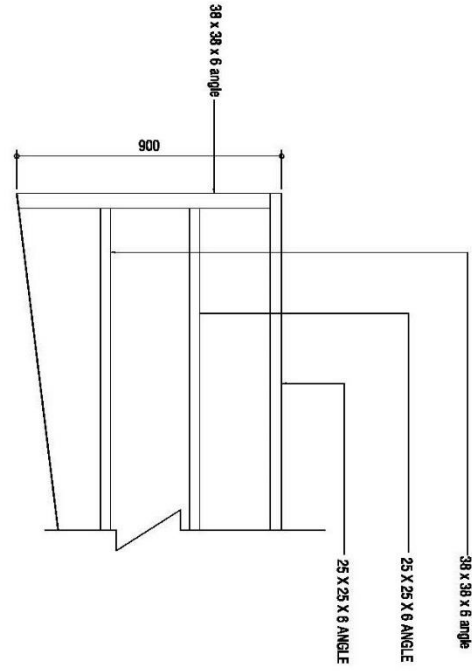
Item	Description
1	50 x 50 x 6mm angle
2	35 x 35 x 6 mm angle
3	3mm thk. plate
4	3mm thk. plate
5	10mm thk. plate
6	10mm thk. cylindrical plate



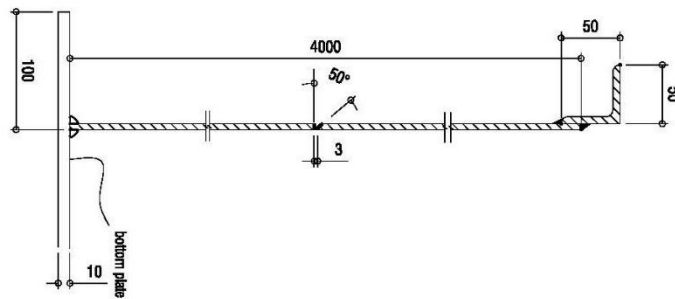
**FRONT ELEVATION - LADDER (PART)**  
SCALE 1:20



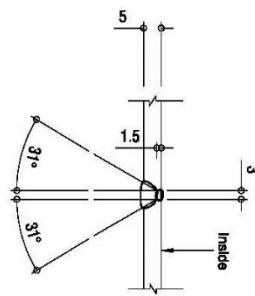
**DETAIL - TOP RAILING**  
SCALE 1:20



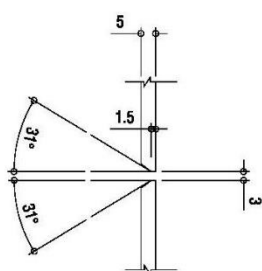
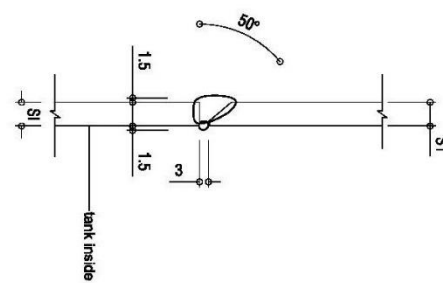
**DETAIL - TOP RAILING**  
SCALE 1:50



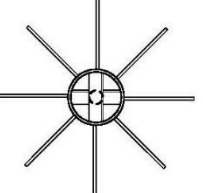
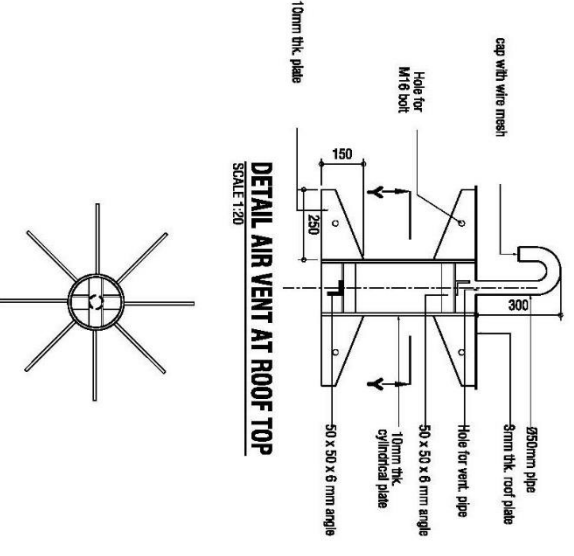
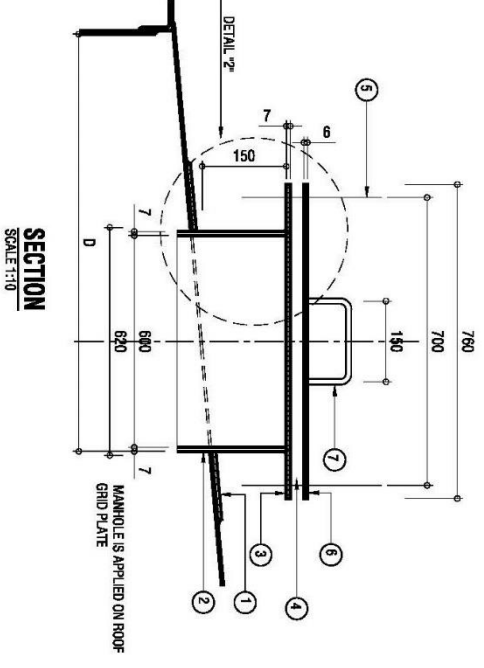
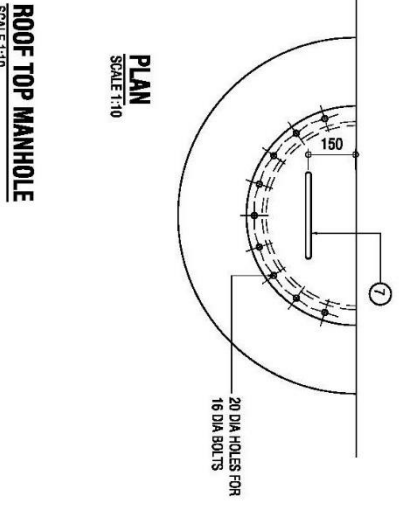
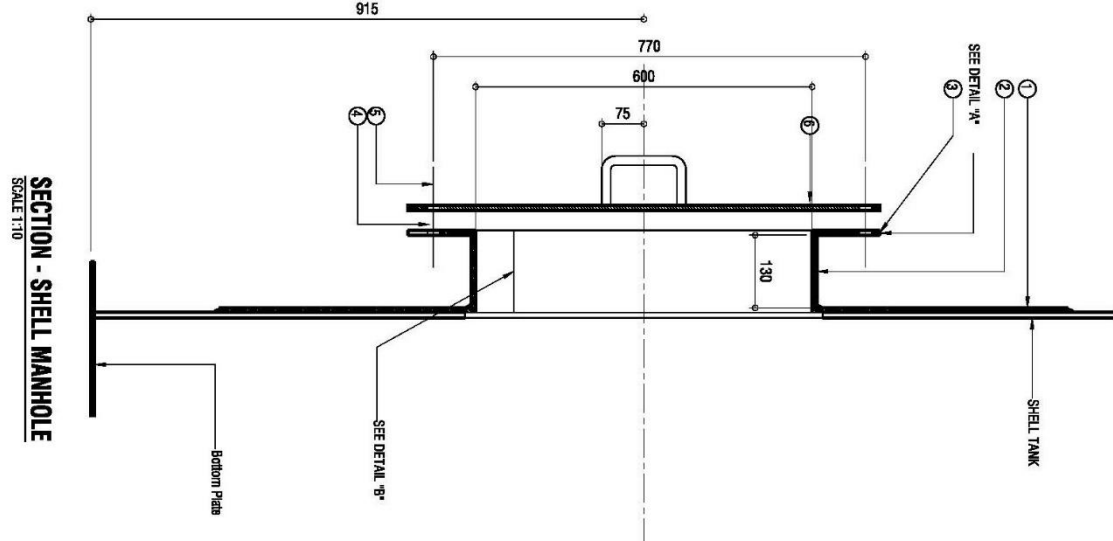
**VERTICAL JOINTS**  
SCALE 1:2

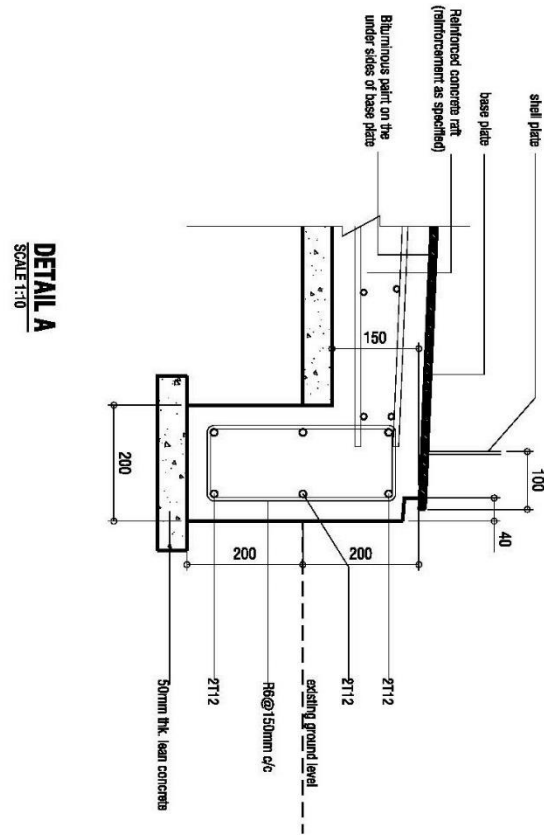
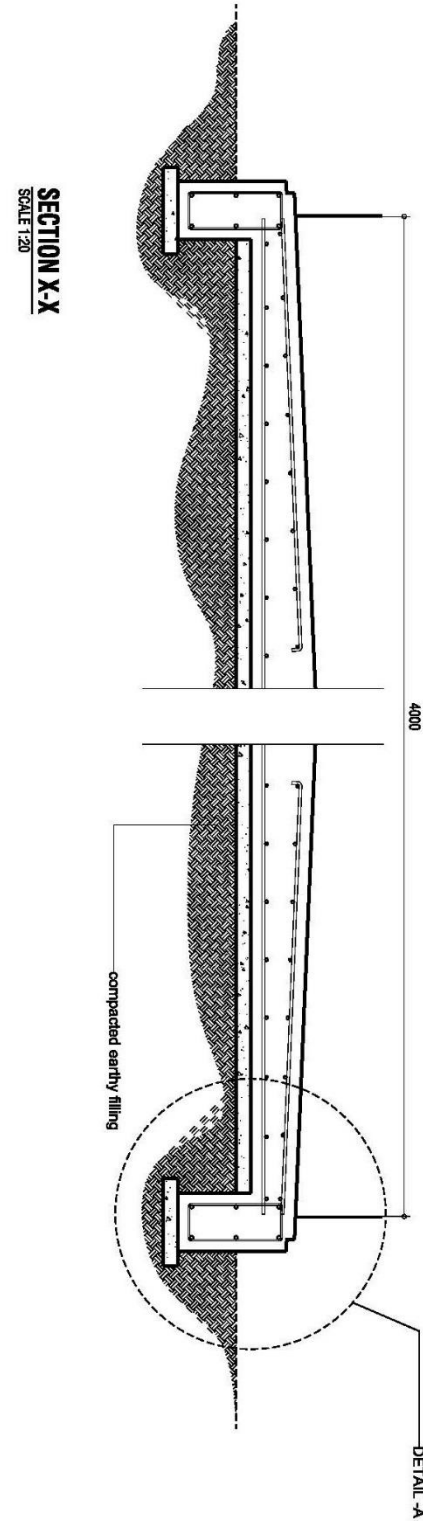


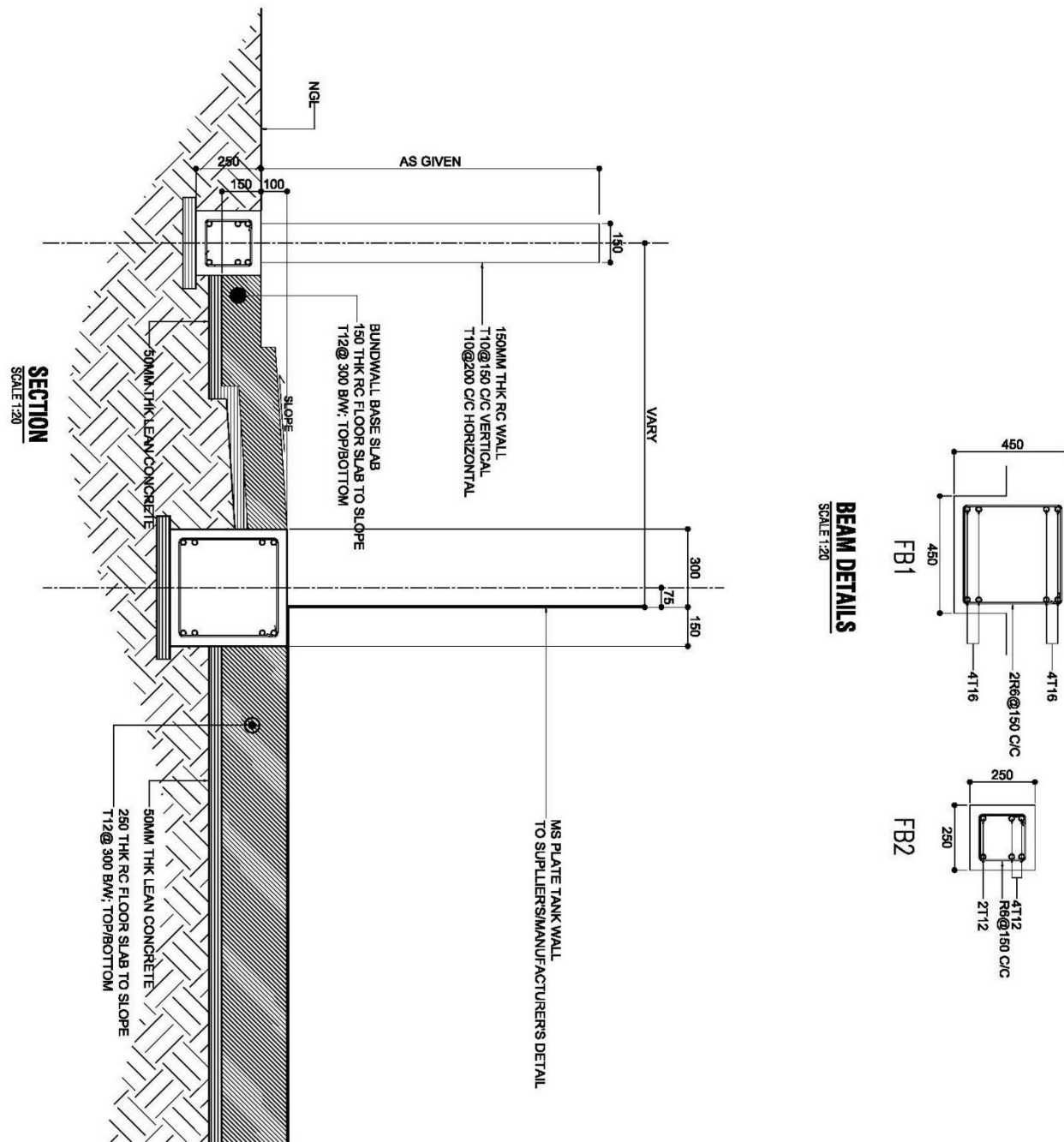
**HORIZONTAL JOINTS**  
SCALE 1:2



Item	Description	Qty/reqd.
1	6mm thick sketch plate	1
2	Pipe from rolled / piece each 80	1
3	2mm thick sketch plate	1
4	2mm thick gasket	1
5	Ø18 x 60 long bolts	32
6	10mm thick disc plate	1
7	Ø18 x 330 long rod	2







## APPENDIX 7: FUEL HANDLING PLAN



## Procedure for Storage and Handling of Fuel at powerhouses

Prepared by:

**Mariyam Shujaa-ath A. Fathah**

**Mahfooz A. Wahhab**

June 2016

## Introduction

This document provides guidance on acceptable practice of managing fuel handling, transportation and storage in the islands of Maldives. The proposed actions are intended in view of the regulation on safe use, handling and storage of fuel (2015/R-160) gazette on 12 August 2015 by the Ministry of Defense and National Security of the Maldives. The purpose of this legislation was to minimize oil related fire hazards and to protect lives and assets of the locals due to such incidents, to inform locals about the safe use of hydraulics as well as to ensure that the buildings constructed for oil trade meets an acceptable standard for safe storage and handling.

## Purpose

It can be reasonably expected that a discharge of fuel or oil will enter groundwater, and possibly surrounding marine environment, polluting the environment. The objective of this manual is to implement and enforce a spill prevention and control plan for all the powerhouses owned by FENAKA Corporation and in the event of a spill, to minimize the adverse impacts of spill on the environment.

## Fuel use

All fuel types maintained and owned by FENAKA Corporation shall only be used to operate machinery/equipment registered to FENAKA Corporation. Any unauthorized use is a serious offence and may subject the offender to dismissal.

## Delivering and dispensing of fuel

### Current delivering and fuel dispensing procedure

Fuel delivery methods for the islands of Maldives depend on population size and capacity of the fuel storage tank. Currently followed fuel delivery procedures are summarized below:-

- For the islands with a fuel storage capacity of 1000 L or more and the distance between the unloading harbor and the storage tank is within a 300 feet radius, fuel is delivered by the Fuel Supplies Maldives Pvt. Ltd. (FSM) directly to the island via oil tankers after which fuel is directly transferred from the oil taker to the storage tanks with the aid of a fuel hose. FSM also delivers fuel up to 150 feet additional distance (due to pressure issues) where FENAKA provide the extra hose.

- If the distance between the unloading harbor and the storage tank is greater than 300 feet for the islands with a high fuel storage capacity, fuel is first dispensed to a bowser via a hose and then transferred to the storage tank.
- For the islands with a smaller storage capacity, oil is contained in metal and plastic barrels and supplied to the island via carrier boats. The metal barrels are unloaded at the harbor and transported to the powerhouses either by rolling the barrels all the way up to the powerhouse or by mounting to a wheelbarrow or a truck.
- Islands which does not have bowser, fuel in transferred to metal and plastic barrels at the harbor by fuel supplier. Barrels are transported on vehicle (pickup) in islands where there is a vehicle and in islands where there are no vehicles it is taken to powerhouse by rolling the barrels.

**Additional fuel delivery/dispensing requirements at berth**

- At a berth, fuel shall not be dispensed to the storage tank while:-
  - Oil tanker’s engine is running;
  - Any source of ignition is present within 3 m of the dispensing nozzle where it enters the tank to be refueled; and
  - There is a source of ignition on board
- The fuel tanker or marine vessel shall be securely mounted to the harbor or wharf with proper marine lines prior to fuel unloading; and
- The attendant shall be particularly vigilant in scanning the water area adjacent to the fuelling operation for possible leaks or spills.

**Fuel transporter vehicles**

The following actions are proposed in light of article 5 of the fuel use, storage and handling regulation of the Maldives:-

- All fuel transporter vehicle shall be installed either with an intrinsically safe flashing light or shall have a safety reflector;
- The transporter vehicle shall not be parked within a 5 m radius of residential area. This excludes cases where the vehicle has broken down, in which case the driver shall not leave the vehicle and if at night, the flash light or the safety reflector shall be on at all times;

- The transporter vehicle shall be parked at designated areas allocated exclusively for such vehicle by the island council and during loading and unloading, the vehicle driver shall be present at all times;
- The transporter vehicle shall be an authorized vehicle for transportation of hydraulics by any government authority and shall only be unloaded at designated areas authorized by a government authority;
- The transporter vehicle (1.5 T) shall be installed with at least two fire extinguishers (foam and powder) of 9 kg each at an easily accessible position;
- All transporter vehicle shall be maintained in a clean state and ensure that there is no leakage from the vehicle;
- If transporting via other means of transporter vehicle, oil shall be contained in metal barrels only;
- In the incidents of leakage, the vehicle shall be stopped, the ignition switched off and the MNDF or Fire and Rescue Services immediately be notified; and
- Oil container barrels shall be installed with vents to prevent fire incidents due to pressure differences. Additionally, the barrels shall have pressure release valves installed to allow auto release of pressure which might build up inside the barrels.

### Fuel dispensing

The following procedure shall be followed when dispensing fuel to the storage tanks from the oil tanker/oil barrels as well as while dispensing fuel from the storage tank to the day tanks:-

- All dispensing or transferring of fuel should be attended for the duration of the operation by a competent powerhouse personnel. The attendant must be aware of proper fuel handling procedures to minimize the risk of a spill and shall continuously scan the area adjacent to the fueling operation for possible leaks or fuels;
- Bowsers shall only be operated by a competent person;
- The transferring and dispensing of fuel shall be done with pumping equipment, an approved hose and top fill nozzle;
- Ensure that a site-appropriate spill containment kit is readily available. Refer to Appendix A of this document for a sample spill containment kit which shall be provided to all powerhouses owned by FENAKA Corporation;
- When unreeling the fuel transfer hose and nozzle, the nozzle must be in upright position and the nozzle shall be kept clear of ground when returned to the reel or storage position;

- Verify that there is a proper connection between the fuel hose and the fill pipe of the bowser. Also, verify that the fill valve is open.
- Transfer of fuel must be stopped prior to overflowing, mobile refueling tanks on vehicles are not to be overfilled;
- The operation of a moving equipment in the immediate fueling area shall be suspended; and
- Maintain regular inspections of fuel systems and their components. Check for leakage, deterioration or damage.

### Spills

Preventative measures are the best means of avoiding an accidental release of petroleum products, however, in the event of an accidental release, the following shall be immediately executed:-

- The powerhouses shall be equipped with appropriate spill response equipment readily available;
- Cleanup action shall follow the spill contingency plan. All spills or suspected spills of petroleum products, on land or into the water, regardless of the size, shall be reported immediately to the station manager. The station manager shall ensure notification to appropriate authorities at FENAKA Corporation.

### Fuel storage

- Fuel shall be stored in appropriate containers/ storage tanks. Currently used fuel storage tanks include, syntax HBP tanks, metal storage tanks, metal barrels and plastic barrels.
- The fuel storage tanks shall be properly bunded in a concrete chamber to prevent oil leachate into the soil and groundwater in case of leakage or oil spills. As per the fuel use, storage and handling regulation. Refer to Appendix B for a sample site plan of a bunded storage tank :-
  - The bundwall shall be slanted by 1 % at least 15 m from the storage tanks;
  - The bundwall capacity shall be larger than the storage tanks and shall be able to contain the full volume of oil in case of a large spill;
  - The bundwall shall be made of metal or concrete in order to prevent leachate;
  - The pipeline shall be laid over the bundwall;
  - The bundwall shall be designed in such a way that any spillage does not contaminate the waterway or sewer near the bunding;

- No combustibles (including empty oil containers) shall be kept inside or near the bundwall area;
- Bundwall shall be constructed with a permanent staircase to allow easy access to in and out of the chamber;
- At least 2 DCP fire extinguishers of 9 kg shall be located near fuel storage areas of and be of a suitable type and size to permit the evacuation of workers during a fire.
- Smoking shall not be permitted in the area of the fuel storage tank and “NO SMOKING” signs in both English and local script shall be posted. Smoking shall not be permitted during any fueling operation. “No Smoking” signs are to be maintained in good condition;
- In addition to no smoking signs, the storage tanks shall have the following signs posted both in English and local script:-
  - NO NAKED LIGHTS
  - FLAMMABLE LIQUID
- Waste oils, lubricants, greasy or oily rags, or any other materials subject to spontaneous combustion shall be retained in a labelled container used for that purpose exclusively and shall be disposed of at frequent intervals by transferring to Thilafushi, until then, they shall be stored safely in appropriate containers, for e.g. metal barrels;
- Appropriate emergency spill equipment shall be made available in the fuel storage area. See Appendix A for a list of such equipment which shall be provided to all the powerhouses owned by FENAKA Corporation;
- No “hot work” shall take place within 3 m of the storage zone;
- Fuel storage rooms as well as engine rooms and control room shall be installed with an appropriate number of fire extinguishers as per section *haa* of article 4 of the fuel use, storage and handling regulation of the Maldives;
- The main switch of the storage room shall be installed outside the room;
- The cleanliness of the storage room shall be strictly maintained;
- If there are more than 1 storage tank, a gap of at least 1 m between the storage tanks shall be maintained;
- There shall be enough space between the bundwall and the storage tank to allow for pressure release and the tank shall be designed with auto pressure release systems in case of fire;
- No combustible activities shall be carried out anywhere near any area where combustible gases are being released, particularly inside the bundwall;

- Containers shall be tested at least once every 5 years, on suspicion of leakage or after every maintenance. These tests shall only be done by technical experts only after making the containers gas free and in accordance with the NFPA 30 “Flammable and Combustible Liquid Code”;
- The area shall be bonded in accordance with the NFPA 780 “Lightning Protection Code”;
- Wiring near the storage tanks shall comply with the standards of Maldives Electricity Bureau, in addition, the siring shall be enclosed with conduit pipes. Lightings, switches and plugs installed shall be flame proof;
- Storage tanks of 3000 L or more shall be installed with automatic foam spring systems as well as automatic drencher systems;

### Refueling of day tanks

- Day tanks shall be kept at a separate room to that of the engine room at all times;
- Day tanks shall be properly banded in a concrete chamber to prevent oil leachate into the soil and groundwater in case of leakage or oil spills;
- In cases where auto level sensors are absent, proper care should be taken to prevent overflow.

### Posting of procedure

This procedure shall be posted to all the powerhouses owned by FENAKA Corporation and shall be incorporated in the company safety policies and procedures and shall be accessible from the company website.

## References

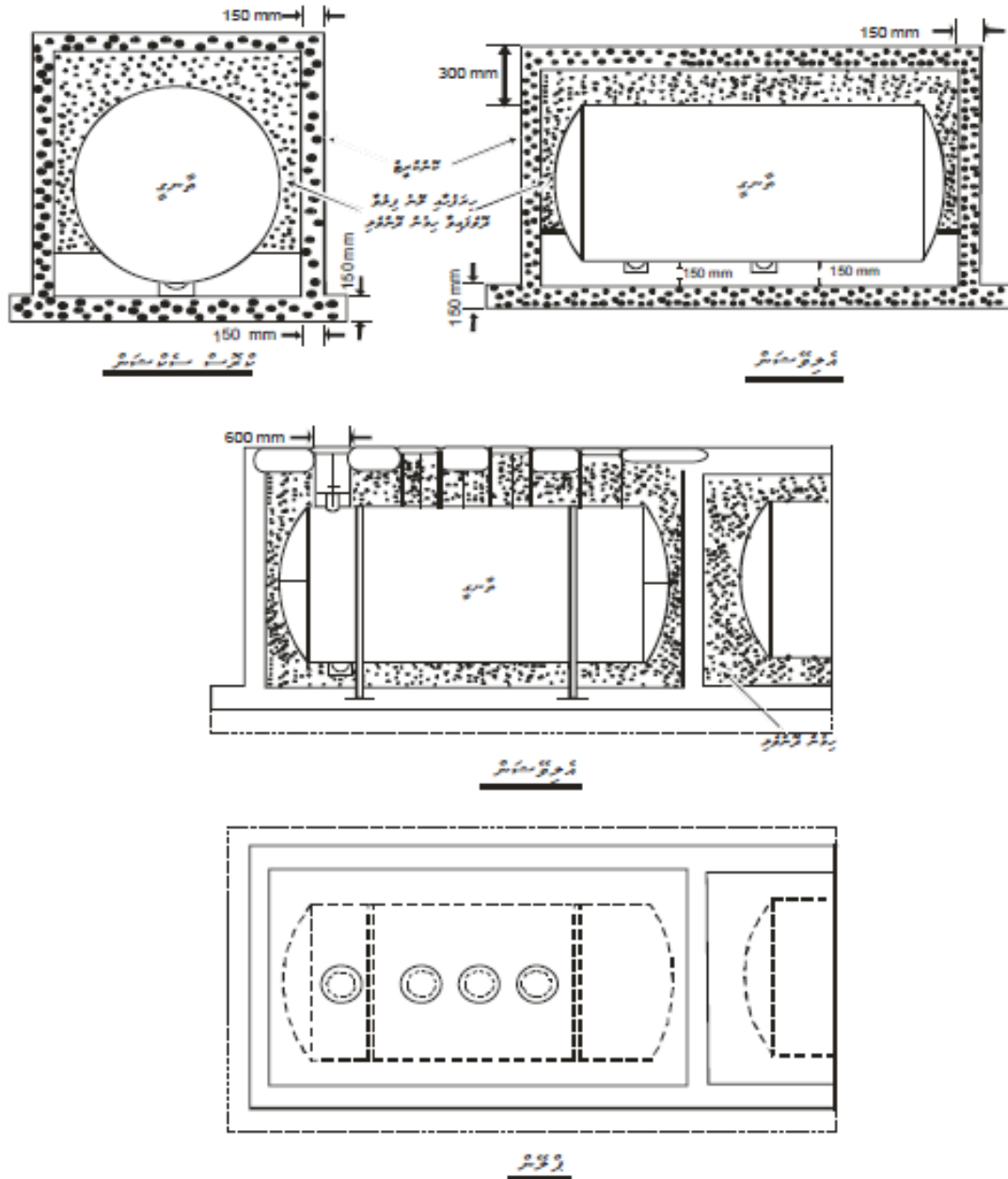
U.S. Department of the interior: Office of aircraft services, (1994). *Aviation fuel handling handbook*. U.S.A.

## Appendix A - Spill response equipment to be available at all the powerhouses

The following supplies shall be kept readily available to respond to and contain a diesel fuel spill:-

1. 3” dia. x 48” oil socks. Quantity: 10
2. 3” dia. x 10” oil socks. Quantity: 3
3. 17” x 19” oil pads. Quantity: 40
4. 18” x 18” x 2” pillows. Quantity: 8
5. Disposable material containment bags. Quantity: 10
6. Latex gloves. Quantity: 2 pairs
7. Granular absorbent. Quantity: 4 gal
8. Polyethylene salvage drum container. Quantity: 1 with 55 gal. capacity

## Appendix B- Sample floor plan of a bunded storage tank



Source: Fuel use, storage and handling procedure of Maldives

**APPENDIX 8: SCOPING MEETING ATTENDANCE SHEET**








Environmental Protection Agency  
Male', Rep of Maldives

Meeting: ބޯޅަ، ތިރުކުލާސާ ދަލަބު ފަސަދާ ޕްލާން

Date: 24 | 5 | 16

Time: 10:00

**MEETING ATTENDANCE**

No.	Name	Designation	Office	Email	Phone No.	Signature
01	Saeed Ali	councilor	Council	Saeed.ali.1516@gmail.com	7772057	
02	Ali Shaan	F/councilor		anaashud@gmail.com		
03	Abdulla Naeem	Director	Fenaka	abdulla.naeem@fenaka.com	9993669	
04	Mohamed Ibrahim	A. consultant		mohamed.ibrahim@fenaka.com	9768999	
05	Muhammad Ibrahim	Consultant	Fenaka	muhammad.ibrahim@fenaka.com	9994467	
06	I. Naeem	Off	EPA	ibrahim.naeem@epa.gov.mv	778461	
07	Muhammad	Director	MEA		7787867	
08						
09						
10						

## APPENDIX 9: ENVIRONMENTAL IMPACT ASSESSMENT TEAM

The EIA was carried out by a team led by Ali Shareef (ETA 19/11). Supporting members of the team include Mahfooz Abdull Wahhab (Registration no: EIA TA03/15) and Mohamed Ibrahim.

## CURRICULUM VITAE OF MAHFOOZ ABDULL WAHHAB

### PERSONAL DETAILS

**Name:** Mahfooz Abdull Wahhab  
**Nationality:** Maldivian  
**Gender:** Male  
**Date of Birth:** 10<sup>th</sup> December 1992

**Present address for communication:** No Chance  
K. Villingili  
Malé  
Republic of Maldives  
Tel: (960) 9994467 (M)  
Email: [mahfoozabdullwahhab@gmail.com](mailto:mahfoozabdullwahhab@gmail.com)

### EDUCATIONAL QUALIFICATION

#### SECONDARY EDUCATION:

##### High School Diploma

2008-2010 Centre for Higher Secondary Education, Male', Maldives

##### GCE O' level

2005-2007 Dharumavantha School, Malé, Republic of Maldives

#### TERTIARY EDUCATION:

##### Bachelor of Environmental Management

2012-2014 Maldives National University, Male', Maldives

### OTHER QUALIFICATIONS

- PADI Advance Open water Diver
- Certificate II in Information Technology
- Registered EIA consultant

**PROFESSIONAL EXPERIENCE**

EIA for the coastal modification and protection measures of B. Voavah, January 2016. The project was to determine the environmental impacts arising from the coastal modification and protection works around B. Voavah. I was involved in the survey and the formulation of the EIA report to assess the environmental impacts arising from the project.

Survey of sewer system in H.Dh Nolvivaranfaru, December 2015. The survey was to determine the condition of the sewer system in Nolvivaranfaru. I was involved in the inspection of the manholes, pump stations and sea outfall.

EIA for the partial renovation and upgrade works of Six senses Laamu, L. Olhuveli, October 2015. The project was to determine the environmental impacts arising from the renovation works at Six senses Laamu jetties and Villas. I was involved in the survey and the formulation of the EIA report to assess the environmental impacts arising from the project.

EIA for the partial renovation and upgrade works of Four Seasons Kuda Huraa, August 2015. The project was to determine the environmental impacts arising from the renovation works at Kuda Huraa water villas and walkway jetties. I was involved in the survey and the formulation of the EIA report to assess the environmental impacts arising from the project.

EIA for the relocation of Trees from B.Kihaadhoo to B.Voavah, August 2015. The project was to relocate 50 trees from B.Kihaadhoo housing plots to B.Voavah which is going to be developed as a Luxury Tourist Resort. I was involved in the survey and the formulation of the EIA report to assess the environmental impacts arising from the project.

EIA for the development of B.Voavah as a Luxury Tourist resort, July 2015. The project was to determine the environmental Impact arising from the development of B.Voavah as a tourist. I was involved in the survey and the formulation of the EIA report to assess the environmental impacts arising from the project.

EIA for Coral Frame Project at Maalifushi, Thaa Atoll, May 2015. The project aims to rehabilitate the coral reef of Maalifushi by deploying coral frames around the reef. I was involved in the survey and the formulation of the EIA report to assess the environmental impacts arising from the project.

Coral Frame Project at Kanifushi, Kaafu Atoll. Monitoring of the coral frames in April 2015 under the project.

Coral Frame Project at Kuda Huraa, Kaafu Atoll. Monitoring of the coral frames in March 2015 under the project.

EIA for Coral Frame Project at Kanuhuraa, Lhaviyani Atoll, October 2014. The project aims to rehabilitate the coral reef of Kanuhuraa by deploying coral frames around the reef. I was involved in the survey and the formulation of the EIA report to assess the environmental impacts arising from the project.

Coral Frame Project at Kanuhuraa, Lhaviyani Atoll. I was involved in the launching of the project in August 2014. This involved transplantation of corals to the frames and its consecutive deployment in Kanuhuraa reef. In addition, the initial monitoring of the frames after transplantation.

Coral Frame Project at Landaa Giraavaru, Baa Atoll. Monitoring of the coral frames in August 2014 under the project.

## CURRICULUM VITAE OF MOHAMED IBRAHIM JALEEL

### Curriculum Vitae of MOHAMED IBRAHIM JALEEL

1.	<b>NAME</b>	:	Mohamed Ibrahim Jaleel												
2.	<b>DATE OF BIRTH</b>	:	9 May 1991												
3.	<b>CITIZENSHIP</b>	:	Maldivian												
4.	<b>PERSONAL ADDRESS</b>	:	V.Edhuruvehi Male'												
5.	<b>TELEPHONE NO.</b>	:	(960)9768999												
	<b>E-MAIL ADDRESS</b>	:	Mohamed.ibrahimjaleel@hotmail.com												
	<b>EDUCATION</b>	:	General Certification of Education, (GCE) Ordinary Level. In 2007 (Science stream)												
			General Certification of Education (Edexcel), in Advance Level. In 2010 (Science stream)												
			Certificate in Project Management from Clique college												
			Bachelor's Degree on Environmental Management from the Maldives National University.												
			Post Graduate Diploma in Research Studies												
6.	<b>OTHER TRAINING</b>	:	Graphics designing short course from IBI												
			Took part in lecture series held by IUCN Maldives on various conservation issues and opportunities in the Maldives												
			Training on preparation of EMMP under the MGCC project of USAID												
			Training workshop on IVRM concepts under the GEF project, Kenya, Nivasha												
			Took part in the development of the Maldives National Strategic Action Plan as focal point from Water and Sewer sector												
7.	<b>LANGUAGE &amp; DEGREE OF PROFICIENCY</b>	:	<table border="0" style="width: 100%;"> <tr> <td></td> <td style="text-align: center;"><u>Speaking</u></td> <td style="text-align: center;"><u>Writing</u></td> <td style="text-align: center;"><u>Reading</u></td> </tr> <tr> <td>English</td> <td style="text-align: center;">Excellent</td> <td style="text-align: center;">Excellent</td> <td style="text-align: center;">Excellent</td> </tr> <tr> <td>Dhivehi</td> <td style="text-align: center;">Mother tongue</td> <td style="text-align: center;">Mother tongue</td> <td style="text-align: center;">Mother tongue</td> </tr> </table>		<u>Speaking</u>	<u>Writing</u>	<u>Reading</u>	English	Excellent	Excellent	Excellent	Dhivehi	Mother tongue	Mother tongue	Mother tongue
	<u>Speaking</u>	<u>Writing</u>	<u>Reading</u>												
English	Excellent	Excellent	Excellent												
Dhivehi	Mother tongue	Mother tongue	Mother tongue												
8.	<b>MEMBERSHIP IN CIVIC AND PROFESSIONAL SOCIETIES</b>	:													
9.	<b>Referees</b>	:	<ul style="list-style-type: none"> <li>• Hussain Hameez – Director, Fenaka Corporation.</li> <li>• Ahmed Zahid – Managing Director of Sandcays Pvt. Ltd. ( 7781535 )</li> <li>• Aishath Ali – Registrar of the Maldives National University ( 7786167 )</li> <li>• Shaheeda Adam Ibrahim – Director General of Water and Sanitation department, MEE. ( 3018381 )</li> </ul>												

MOHAMED IBRAHIM JALEEL

10. EMPLOYMENT RECORD :

FROM: Jan 2016  
EMPLOYER  
POSITION HELD AND  
DESCRIPTION OF DUTIES

TO: Present  
Classy pool Pvt, Ltd  
Environmental Engineer.  

- Overseeing all the EIA related projects of the company

FROM: May 2015  
EMPLOYER  
POSITION HELD AND  
DESCRIPTION OF DUTIES

TO: Present  
Fenaka Corporation, Utilities Services Division  
Assistant Director.  

- Overseeing all the water and sanitation related projects under the company
- Overseeing all the water and sewer systems operated under the company.

FROM: Jan 2015  
EMPLOYER  
POSITION HELD AND  
DESCRIPTION OF DUTIES

TO: May 2015  
Ministry of Environment and Energy, Water and Sanitation Department  
Assistant Director.  

- Overseeing all the donor related water and sewerage projects.
- Manage and supervise the implementation of project work on a daily basis.
- Administrative and Policy related works of the sector.

FROM: Feb 2014  
EMPLOYER  
POSITION HELD AND  
DESCRIPTION OF DUTIES

TO: January 2015  
Sandcays Pvt. Ltd.  
Research assistant. Assisting in environmental research, environmental surveys and monitoring, drafting of EIA/ESIA reports and other documentation.

FROM: 2011  
EMPLOYER  
POSITION HELD AND  
DESCRIPTION OF DUTIES

TO: 2011  
Ministry of Health and Gender  
Child care supervisor (full time). Monitoring and reporting the actions of the child care officers and the needs of the children in Kudakudhinge hiyaa. Carrying out and planning various activities that are necessary for the growth and development of the children. Formulating the annual and the monthly schedule for the children and the child care workers. Attending to emergencies and accidents that occur within the kudakudhinge hiya sector.

FROM: 2011  
EMPLOYER  
POSITION HELD AND  
DESCRIPTION OF DUTIES

TO: 2012  
Maldives National University  
Admission and Registration officer. Carrying out the respective works of the admission and registration section of the Maldives National University.

MOHAMED IBRAHIM JALEEL

**12. RELEVANT WORK EXPERIENCE**

Project Name : Study and EIA for proposed Reclamation and Resort Development on K. Tholhimarahura  
 Client : J Lagoons pvt. Ltd.  
 Period : Sep 2014 Time Spent: 4 week  
 Position Held : Research assistant  
 Duties : Assisted in drafting/compiling of report

Project Name : Study and EIA for proposed STP for Alimatha Aquatic Resort, Vaavu Atoll  
 Client : Alimatha Aquatic Resort  
 Period : Aug 2014 Time Spent: 3 week  
 Position Held : Research assistant  
 Duties : Assisted in drafting/compiling of report

Project Name : Survey and EIA for proposed STP for Mayaafushi Island Resort, Alif Alif Atoll  
 Client : Mayaafushi Island Resort  
 Period : Aug 2014 Time Spent: 3 week  
 Position Held : Research assistant  
 Duties : Assisted in drafting/compiling of report

Project Name : Study and EIA for proposed STP for Diggiri Tourist Resort, Vaavu Atoll  
 Client : Dhiggiri Tourist Resort  
 Period : Aug 2014 Time Spent: 3 week  
 Position Held : Research assistant  
 Duties : Assisted in surveying activities and drafting/compiling of report.

Project Name : Survey of Ensis RO plant Registration, Hulhumale'  
 Client : Ensis Pvt. Ltd.  
 Period : Aug 2014 Time Spent: 2 days  
 Position Held : Research assistant  
 Duties : Assisted in surveying activities

Project Name : Study and EIA for proposed Resort development project in Kanbaalifaru, Shaviyani Atoll  
 Client : Kanbaalifaru Investments Pvt. Ltd.  
 Period : June 2014 Time Spent: 4 weeks  
 Position Held : Research assistant  
 Duties : Assist in the drafting/compiling of the EIA report based on previous work

Project Name : Study and EIA for the proposed Water Supply system in HA. Thuraakunu  
 Client : Upper North Province Council  
 Period : June 2014 Time Spent: 3 weeks  
 Position Held : Research assistant  
 Duties : Assist in the drafting/compiling of the EIA report based on previous work

Project Name : Study and EIA for the Aa.Thoddoo water supply project  
 Client : MWSC  
 Period : May 2014 Time Spent: 1 week  
 Position Held : Research assistant  
 Duties : Responsible for the survey equipment, assisted in all surveying activities

Project Name : As built Survey of B. Kihaadhufaru Resort  
 Client : lbsun pvt.ltd  
 Period : May 2014 Time Spent: 1 week  
 Position Held : Research assistant  
 Duties : Responsible for the survey equipment, assisted in all surveying activities

Project Name : Survey of H.Marvel EIA  
 Client : Adam Saleem  
 Period : May 2014 Time Spent: 1 day  
 Position Held : Research assistant  
 Duties : Assisted in survey of the EIA report based on previous work

Project Name : Study and EIA for proposed Coastal protection of Paradise Island Resort, North Male' Atoll  
 Client : Diza Travels and Trade Pvt.Ltd  
 Period : April 2014 Time Spent: 4 weeks  
 Position Held : Research assistant  
 Duties : Assist in the drafting/compiling of the EIA report based on previous work

Project Name : Study and EIA for proposed Resort development project in Maareha, Gaaf Alif Atoll  
 Client : Moving International Pvt.Ltd  
 Period : April 2014 Time Spent: 4 weeks

March 2016

Page (3)

MOHAMED IBRAHIM JALEEL

Position Held	: Research assistant	
Duties	: Assist in the drafting/compiling of the EIA report based on previous work	
Project Name	: ESIA for five schools under Enhancing Education Development Project	
Client	: Ministry of Education	
Period	: February 2014	Time Spent: 4 weeks
Position Held	: Research assistant	
Duties	: Assist in compiling socio-economic profiles of islands and review of ESIA report	
Project Name	: EIA for proposed harbour rehabilitation in Holudhoo, Noonu Atoll	
Client	: Maldives Transport and Contacting Company (MTCC)	
Period	: March 2014	Time Spent: 4 weeks
Position Held	: Research assistant	
Duties	: Assist in the drafting/compiling of the EIA report based on previous work	
Project Name	: EIA for proposed harbour Construction in Dhangethi, Alif Dhaal Atoll	
Client	: Maldives Transport and Contacting Company (MTCC)	
Period	: March 2014	Time Spent: 2 weeks
Position Held	: Research assistant	
Duties	: Assist in drafting/compiling the EIA report	
Project Name	: EIA for proposed Airport Development at Dh.Kudahuvadho	
Client	: Reollo Investments	
Period	: March 2014	Time Spent: 4 weeks
Position Held	: Research assistant	
Duties	: Assist in drafting/compiling the EIA report. Carried out monitoring surveys in the implementation phase.	

MOHAMED IBRAHIM JALEEL

Project Name	: Survey for L. Maamendhoo Sewerage project
Client	: Fenaka
Period	: Time Spent: 1 weeks
Position Held	: Research assistant
Duties	: Carried out the survey for the initial concept design of the project, which included taking the block level survey of as built and the levels (elevation) survey for the island.
Project Name	: OFID (Phase 1) Provision of Water Supply Facilities 04(Four) Island and Sewerage Facilities in 05 (Five) Island, Maldives
Client	: OFID
Period	: Time Spent: 2 weeks
Position Held	: Research assistant
Duties	: Team leader responsible for overseeing all the project activities and issues
Project Name	: EMP for the proposed project to update the STP in Dhiggiri Resort
Client	: Aqua Solutions
Period	: Time Spent: 2 weeks
Position Held	: Research assistant
Duties	: Assist in drafting/compiling the EIA report. Carried out monitoring surveys in the implementation phase.
Project Name	: Survey and EMP for the proposed project to update the STP in Mayaafushi Resort
Client	: Aqua Solutions
Period	: Time Spent: 2 weeks
Position Held	: Research assistant
Duties	: Assist in drafting/compiling the EIA report. Carried out monitoring surveys in the implementation phase.
Project Name	: Survey and EIA for the proposed Phase (2) of Niyaama Resort
Client	: Niyaama Resort
Period	: Time Spent: 4 weeks
Position Held	: Research assistant
Duties	: Was involved in the survey activities and carried out all the respective works of drafting/compiling the EIA report.
Project Name	: OFID Loan phase 2 – Water Supply and Sewerage Project ( 04 Island Sewerage, 10 Island Water Supply Facilities and 29 Island RO Installation and Storage Enhancement )
Client	: OFID
Period	: Time Spent: To April 2015
Position Held	: Assistant Director
Duties	: Managing the project as team leader, preparation and review of bids and proposals, evaluation reports and drafting of contract documents.
Project Name	: IDB – Sanitation in Five Island Project
Client	: IDB
Period	: Time Spent: To May 2015
Position Held	: Assistant Director
Duties	: Managing the project as team leader, preparation and review of bids and proposals, evaluation reports and drafting of contract documents.
Project Name	: Water supply project (UNOPS) in Lh. Hinnavaru with the inclusion of awareness component (CHEMONICS)
Client	: USAID
Period	: Time Spent: To May 2015
Position Held	: Assistant Director
Duties	: Team leader responsible for overseeing all the project activities and issues
Project Name	: KUWAIT FUND water supply project in Gn.Fuvahmulah
Client	: KUWAIT FUND
Period	: Time Spent: To May 2015
Position Held	: Assistant Director
Duties	: Managing the project as team leader, preparation and review of bids and proposals, evaluation reports and drafting of contract documents.
Project Name	: National water awareness campaign
Client	: MEE
Period	: Time Spent: To May 2015
Position Held	: Assistant Director
Duties	: Team leader responsible for overseeing all the programme activities and resolve any setbacks.

MOHAMED IBRAHIM JALEEL

Project Name	: Establishment of water supply services in all the islands of Addu city
Client	: MEE
Period	: Time Spent: To present
Position Held	: Assistant Director
Duties	: Responsible for overseeing all the project activities and issues
Project Name	: Design and Built of Sewer Systems in the islands of Th.Buruni, Th.Madifushi
Client	: MEE
Period	: Time Spent: To present
Position Held	: Assistant Director
Duties	: Responsible for overseeing all the project activities and issues
Project Name	: Design and Built of Sewer Systems in the islands of L.Maamendhoo
Client	: MEE
Period	: Time Spent: To present
Position Held	: Assistant Director
Duties	: Responsible for overseeing all the project activities and issues
Project Name	: Provision of Sewer service to – housing units in L.Fonadhoo
Client	: MEE
Period	: Time Spent: To present
Position Held	: Assistant Director
Duties	: Responsible for overseeing all the project activities and issues
Project Name	: Provision of Sewer service in Addu city, Hithadhoo, central area
Client	: MEE
Period	: Time Spent: To present
Position Held	: Assistant Director
Duties	: Responsible for overseeing all the project activities and issues

13. CERTIFICATION:

I, THE UNDERSIGNED, confirm that to the best of my knowledge, this CV correctly describes me, my qualifications and my experience

Mohamed Ibrahim Jaleel