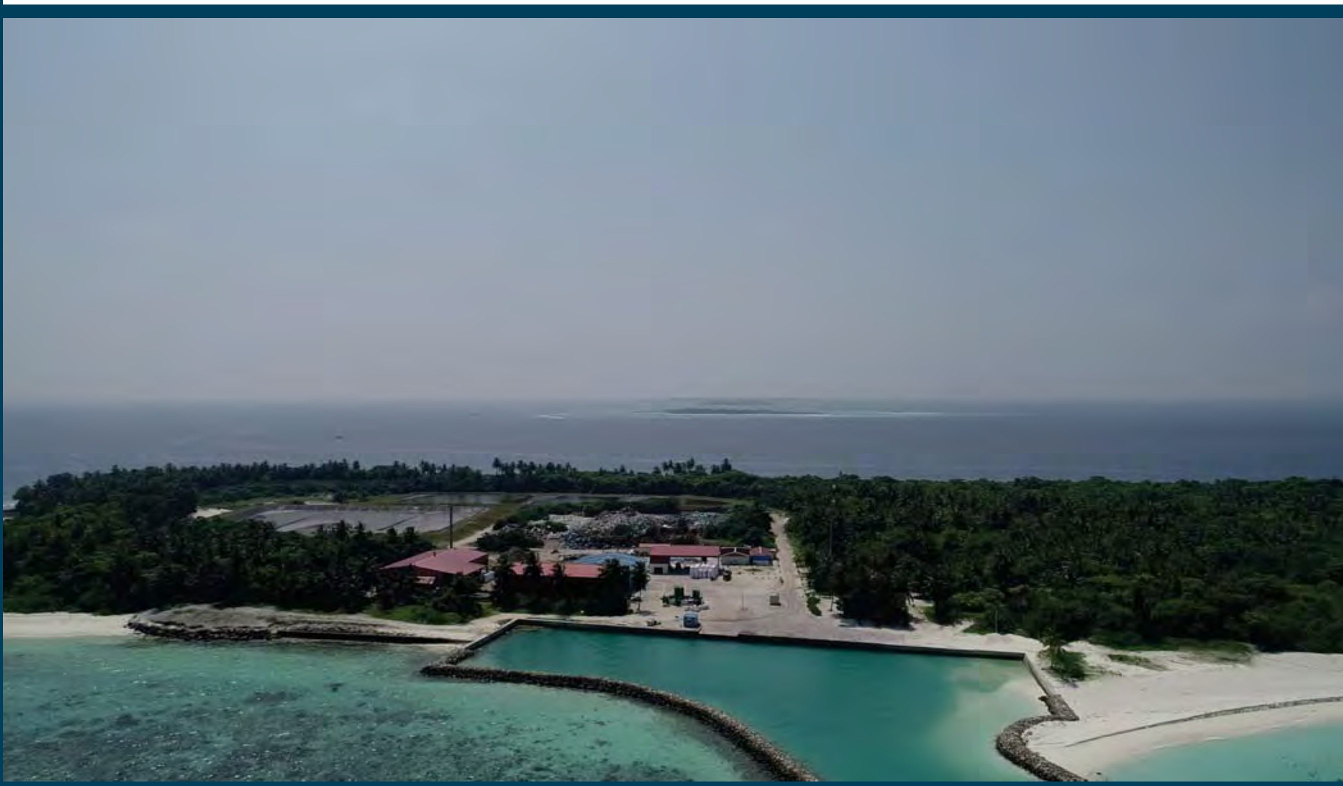
Ministry of Environment

Environmental and Social Impact Assessment Report

Upgrading of infrastructure at Regional Waste Management Facility Zone II, Raa, Vandhoo



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Consultants Declaration

I certify that to best of my knowledge the statements made in this Environmental and Social Impact Assessment report for “Upgrading of Infrastructure at Regional Waste Management Facility at Zone II, R. Vandhoo” are true, complete and correct.

Name: Hussain Zahir

Consultant Registration Number: EIA P04-2007

Signature:

Company Name: Land and Marine Environmental Resource Group Pvt Ltd

Date: 24th January 2019

Proponents Declaration

بسم الله الرحمن الرحيم

Ministry of Environment
Male', Republic of Maldives.

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މާލެ، ދިވެހިރާއްޖެ.

އިޤްތިޞާދީ ފުދުންތެރިކަން – އިޖްތިމާޢީ ހަމަޖެހުން

Date: 21 January 2019

No: 438/203/2019/8

Mr. Ibrahim Naeem
Director General
Environmental Protection Agency
Male', Maldives

Subject: Environmental and Social Impact Assessment Report for Upgrading of Infrastructure at Regional Waste Management Facility Zone 2, Raa, Vandhoo.

Dear Sir,

As the proponent of the project "Environmental and Social Assessment Report for Upgrading of Infrastructure at Regional Waste Management Facility Zone 2, Raa, Vandhoo", we hereby confirm that we have read and understood the report, and to the best of our knowledge all the information with regard to the project description and other non-technical information provided in this ESIA report are true.

We also confirm our commitment to execute and cover the cost of environmental mitigation and monitoring measures outlined in the ESIA report.

Sincerely,

Ahmed Nizam,
Project Manager
(Maldives Clean Environment Project)

Executive Summary

The following Environmental and Social Impact Assessment (ESIA) is formulated to address the proposed upgrades to the existing Regional Waste Management Facility (RWMF) located on the island of Vandhoo in the Republic of the Maldives. The ESIA has been developed in accordance with the Environmental and Social Assessment Framework (ESAF) of the Maldives Environmental Impact Assessment Regulations (2012) and the World Bank requirement for a full Environmental Assessment to be undertaken for Category 'A' projects, which require a full ESIA. The ESIA contained herein aims to address those requirements.

The overall objective of the Environmental & Social Impact Assessment (ESIA) presented herein is to determine whether the project is feasible in terms of the non-mitigable social and environmental impacts that would offset positive contributions from the RWMF. The process used to develop this ESIA study follows the environmental reporting requirements for the proposed development of the RWMF on Vandhoo Island, Raa Atoll. A baseline for the most components of the proposed development had already been set by the initial ESIA process. Therefore, this report mainly aims to analyse the deviation from the baseline conditions through comparison of current conditions with that of the baseline conditions.

The main objective of the RWMF was to provide an alternative for the islands in the Northern Province to reduce the volume of waste that must be burned and dumped in an unsustainable manner by providing a RWMF that puts into practice the concept of waste separation and recycling, composting, and incineration of solid waste from islands in the Northern Province of the Maldives. However, the established facility at Vandhoo has failed to meet its ultimate goal due to lack of several facilities. As a result, upgrades to the existing facilities are proposed which are addressed in this ESIA.

The ESIA examined two possible scenarios, namely, the potential impacts associated with:

- **Scenario 1**: proposed upgrades to RWMF are established;
- **Scenario 2:** proposed upgrades to RWMF are not established and the facility is used as it is.

The analysis of Scenario 2, the situation without the proposed project, indicates that there *are 10 potentially significant negative changes* that would seriously affect the Maldives and its people. *Only 1 positive change were identified for Scenario 2.* Although it should be evident that no construction impacts would be expected if the RWMF is not built, it is noteworthy that the RIAM analysis identified a total of 10 significant negative changes both inside and outside of the immediate project area if the RWMF is not built and made operational. The results of the analysis highlight the critical situation that is developing without immediate solutions to the solid waste issues facing the Maldives.

There are *16 potentially negative changes* expected to occur if the RWMF is upgraded and operated. However, only one of the impacts are identified as a significant negative change (-D) and it is associated with extensive vegetation clearance. However, all of the negative changes associated with the construction and operation of the RWMF can either be reduced or considerably eliminated, provided that the applicant and its contractors apply the best practice measures described in the Environmental and Social Monitoring Program (ESMP). The permanent elimination of vegetation on the building and road development areas is unavoidable and alternatives are proposed as a mitigation measure.

This notwithstanding, it is worth highlighting that there are 12 significantly positive changes associated with proposed upgrade to the existing RWMF at Vandhoo. Each potential change requires a corresponding baseline and mitigation measures, which are presented in Sections 6 and 7 respectively.

Based on the impact analysis, the ESIA concludes that the project is environmentally and socially viable, provided that the mitigation measures presented in Section 7 are closely followed. Additionally, monitoring is required for the priority impacts that are identified in Section 6.

1. ޚުލާޞާ

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މި ރިޕޯޓަކީ ރ. ވަންދޫގައި ހެދިފައިވާ ރީޖަނަލް ވޭސްޓް މެނޭޖްމަންޓް ފެސިލިޓީ އިމާރާތް ތަރައްގީކުރުމުގެ ގޮތުން ކުރަން ހުށަހެޅިފައިވާ މަސައްކަތްތައް ފެށުމުގެ ކުރިން އެމަސައްކަތުގެ ސަބަބުން އެސަރަހައްދުގެ ތިމާވެށްޓާއި އިޖްތިމާޢީ ހާލަތަށް އަންނާނެ ބަދަލުތައް އެކުލަވާލެވިފައިވާ ރިޕޯޓެކެވެ. މި ރިޕޯޓަކީ ދިވެހިރާއްޖޭގެ އެންވަޔަރަންމަންޓަލް އެންޑް ސޯޝަލް އެސެސްމަންޓް ރެގިއުލޭޝަންސް، އަދި ތިމާވެށްޓަށް އަސަރު ފޯރާނެ މިންވަރު ބަޔާންކުރާ ރިޕޯޓު ހެދުމާބެހޭ ގަވާއިދު 2012 އާއި އެއްގޮތަށް ތައްޔާރުކުރެވިފައިވާ ރިޕޯޓެކެވެ. މީގެ އިތުރުން މިމަސައްކަތަކީ ވޯލްޑް ބޭންކް އެހީގައި ކުރާ މަސައްކަތަކަށް ވުމުގެ ސަބަބުން [illegible] ސޭފްގާޑް [illegible] [illegible] ކެޓަގަރީ A ގައި ހިމެނޭ މަޝްރޫޢެއް [illegible] [illegible] ފުރިހަމަ އެންވަޔަރަންމަންޓަލް އެންޑް ސޯޝަލް އިމްޕެކްޓް އެސެސްމަންޓެއް [illegible] ކުރަން ޖެހިގެންނެވެ.

މިރިޕޯޓުގެ މައިގަނޑު މަޤްސަދަކީ މިމަޝްރޫޢުގެ ސަބަބުން ލިބޭ ގެއްލުންތަކާއި [illegible] (އެ ގެއްލުންތަކުގެ އަސަރު ކުޑަކުރުމަށް [illegible] ކަނޑައަޅައި) މިމަޝްރޫޢުގެ ސަބަބުން ލިބޭ ފައިދާތަކާއި މިމަޝްރޫޢު ކުރިއަށް ގެންދިއުމުގައި އެކަށީގެންވާ ކަމަށް ބުނުމެވެ. މިރިޕޯޓު ތައްޔާރުކުރުމުގައި ބެލިފައިވަނީ ވަންދޫގައި ރީޖަނަލް ވޭސްޓް މެނޭޖްމަންޓް ފެސިލިޓީ [illegible] [illegible] [illegible] ޑިޒައިން މިންގަނޑުތަކެވެ. މިގޮތުން ދިރާސާކޮށްފައި [illegible] ބައިތަކުގެ [illegible]

ވަންދޫގައި ހެދިފައިވާ ރީޖަނަލް ވޭސްޓް މެނޭޖްމަންޓް ފެސިލިޓީގެ މައިގަނޑު މަޤްސަދަކީ އުތުރު ޕްރޮވިންސްގެ ރަށްތަކުން [illegible] އުފެދޭ ކުނި [illegible] [illegible] މިހާރު ގެންގުޅޭ ގޮތް [illegible] ބަދަލުކުރުމެވެ. މިގޮތުން [illegible]

މިރިޕޯޓުގައި ތިމާވެށްޓަށް ކުރާނެ އަސަރުތައް ބެލިފައިވަނީ 2 ހާލަތަކަށް ބެހިގެންނެވެ:

1. ރިޖަނަލް ވޭސްޓް މެނޭޖްމަންޓް ފެސިލިޓީއަށް ގެންނަން ހުށަހެޅިފައިވާ ބަދަލުތައް ގެނައުމުގެ ސަބަބުން ކުރާނޭ އަސަރުތައް
2. ރިޖަނަލް ވޭސްޓް މެނޭޖްމަންޓް ފެސިލިޓީއަށް ގެންނަން ހުށަހެޅިފައިވާ ބަދަލުތައް ނުގެނެސް އެތަން ބޭނުންކުރުމުގެ ސަބަބުން ކުރާނޭ އަސަރުތައް

ރިޖަނަލް ވޭސްޓް މެނޭޖްމަންޓް ފެސިލިޓީއަށް ގެންނަން ހުށަހެޅިފައިވާ ބަދަލުތައް ނުގެނެސް އެތަން ބޭނުންކުރުމުގެ ސަބަބުން ކުރާނޭ އަސަރުތަކަށް ބަލާލާއިރު، [illegible] ގޮތުން [illegible] ނޭދެވޭ ގޮތުން [illegible] އަސަރުތަކެއް (10 ބާވަތެއްގެ) ކުރާނޭ ކަމަށް ފެނެއެވެ. މިއީ މިހާރުވެސް ހިނގައިވާ ކަންތައް ވުމުން، އެހެން އިމާރާތްކުރުމުގެ ތެރޭގައި އަންނާނެ އަސަރުތައް މިރިޕޯޓްގައި ބަޔާންކޮށްފައެއް ނުވާނެއެވެ.

މިހާރު ވަނދޫގައި ހެދިފައިވާ ރިޖަނަލް ވޭސްޓް މެނޭޖްމަންޓް ފެސިލިޓީއަށް ގެންނަން ހުށަހެޅިފައިވާ ބަދަލުތައް ގެނެސް އެތަން ތަރައްޤީކޮށްފިނަމަ 16 ވައްތަރުގެ ނޭދެވޭ އަސަރުތަކެއް ކުރާނޭ ކަމަށް ފެނެއެވެ. އެހެންނަމަވެސް މިއަސަރުތަކުގެ ތެރެއިން ފާހަގަކުރެވޭ ވަރުގެ ނޭދެވޭ އަސަރުތަކެއް [illegible] ސަބަބުން ކުރާ އަސަރެވެ. އެހެންނަމަވެސް މިރިޕޯޓްގައި ދެއްކިފައިވާ އެންވަޔަރަންމަންޓަލް [illegible] މޮނިޓަރިން [illegible] ފުރިހަމައަށް ތަންފީޒުކޮށްފިއްޖެނަމަ މިރިޕޯޓުގައި ފާހަގަކޮށްފައިވާ ގިނަ ނޭދެވޭ އަސަރުތަކުގެ މިންވަރު ދަށްކޮށްލެވިދާނެކަމަށް ފެނެއެވެ. އެހެންނަމަވެސް މިމަޝްރޫޢުގެ ތެރެއިން ބިންހުސްކުރުމުގެ [illegible] [illegible]. މިމަސައްކަތުގެ ސަބަބުން ކުރާ އަސަރުތަކުން [illegible] މިރިޕޯޓުގައި ބަޔާންކޮށްފައިވާނެއެވެ (ބަދަލުގައި ކުރެވިދާނެ ކަންތައްތަކުގެ ތެރެއިން).

މިމަޝްރޫޢުގެ ސަބަބުން ކުރާ ނޭދެވޭ އަސަރުތައް ވިޔަސް [illegible] އަސަރުތައް ވެސް [illegible] (ޖުމުލަ 12). މިގޮތުން މިކަންކަމުގެ ތަފްސީލް މިރިޕޯޓުގެ ސެކްޝަން 6 އަދި 7ގައި ބަޔާންކޮށްފައިވާނެއެވެ.

މިދިރާސާގެ އަލިގައި ފެންނަގޮތުން މިމަޝްރޫޢުގެ ސަބަބުން ކުރާ އަސަރުތައް ގިނަކަމުގައި ވިޔަސް މިމަޝްރޫޢު ކުރިއަށް ގެންދިއުމަކީ ތިމާވެށްޓަށް މާބޮޑު އަސަރުތަކެއް ނުކޮށް ކުރެވިދާނެކަމެކެވެ. މިގޮތުން ކުރިއަށް ގެންދިއުމުގައި މަސައްކަތުގެ ސަބަބުން ކުރާ ނޭދެވޭ އަސަރުތަކުގެ މިންވަރު ކުޑަކުރުމަށް އަޅަން ހުށަހެޅިފައިވާ ފިޔަވަޅުތައް [illegible] [illegible] ބަދަލުތައް [illegible].

1 Introduction

Solid Waste Management (SWM) and proper disposal has been a persistent issue in the Maldives for a long time. It may well be argued that this is the greatest challenge currently imposing on the fast-growing population of Maldives spread over 250 small islands. Improper handling and lack of proper waste disposal systems are not just a social nuisance but also a cause of a number of detrimental environmental impacts. This is especially significant with the pollution of the marine environment which is the "blood line" of Maldives. The country's economy is driven by tourism and fishery industries, both of which are highly dependent on a healthy marine ecosystem.

Specific enclosed waste collection points are constructed on some islands of the Maldives. However, there is a lack of final disposal and treatment facilities even on these islands. Moreover, islands where an enclosed waste collection center is absent, waste dumping areas are allocated near the shorelines around the islands. Once these waste collection areas are full, they are burnt in the open air. It is not unusual in smaller congested islands for these landfills to be located very close to the local population.

As a result of improper waste management and disposal, all sorts of waste from organic to non-biodegradable waste make their way into the sea and it is a common sight in Maldives to see waste collected in harbors and on the shorelines around the inhabited islands. These solid wastes even drift on to the shorelines of uninhabited islands as well.

In efforts to overcome this formidable challenge, the Government of Maldives took a decision to invest heavily in the waste sector with support from various donors and international agencies to build necessary infrastructure to develop an integrated and sustainable solid waste management system throughout the country on a zonal approach. This process was initiated in 2008 with the support of the World Bank Group, under the International Development Association (IDA) credit to develop an integrated SWM system for Zone II, namely the Maldives Environment Management Project (MEMP). This project was completed in 2015, by developing SWM systems on inhabited islands as well as a Regional Waste Management Facility (RWMF) in the uninhabited island of Raa Vandhoo for final disposal of residual wastes from Zone II islands (Table 1). Figure 1 shows a map of the northern province of Maldives with Raa Atoll and 17 different islands taken into consideration for the Best Practicable Environmental Options (BPEO) report under the North Province Regional Waste Management Project (SENES and CDE, 2010).

Following completion of MEMP project, the Government of Maldives applied for a grant from IDA for another regional waste management project under the title “Maldives Clean Environment Project” (MCEP), effective from September 2017. Sub-component 2a of MCEP would support investment activities in Zone II for operationalization of the facilities created under MEMP in Vandhoo. Details of facilities under the new upgrade are discussed in the upcoming sections.

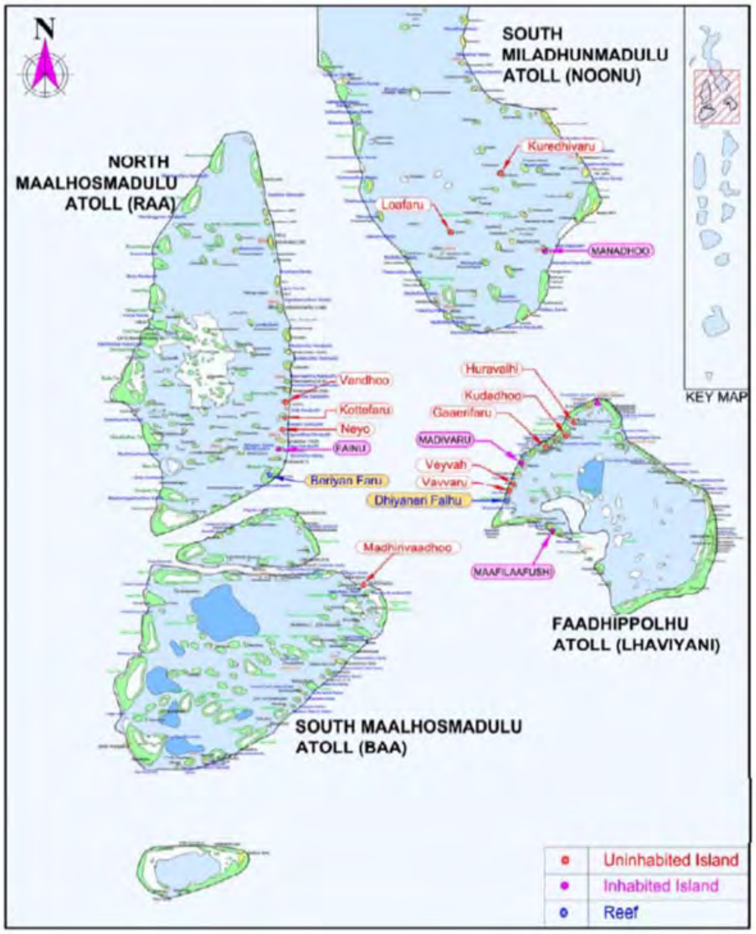

N
SOUTH MILADHUNMADULU ATOLL (NOONU)
Kuredhivaru
Loafaru
MANADHOO
NORTH MAALHOSMADULU ATOLL (RAA)
Vandhoo
Kottefaru
Neyo
FAINU
Boriyan Faru
Huravalhi
Kudadhoo
Gaaerifaru
MADIVARU
Veyvah
Vavvaru
Dhiyaneri Falhu
Madhirivaadhoo
MAAFILAAFUSH
FAADHIPPOLHU ATOLL (LHAVIYANI)
SOUTH MAALHOSMADULU ATOLL (BAA)
KEY MAP
Uninhabited Island
Inhabited Island
Reef

Figure 1. Map showing the Northern Province (Raa) Atoll, as well as seventeen different islands (in red font) taken into consideration by the BPOE Scoping Study (SENES and CDE 2010)

Prior to the development of RWMF at Vandhoo, a thorough Environmental and Social Impact Assessment (ESIA) had been done (Riyan and NIRAS, 2012) and this report will compare survey data from this initial assessment as a baseline wherever possible in order to understand any significant impacts on the environment since the proposed project took off.

The estimated investment cost of the proposed project is USD 1,820,000.00 Funding for project has already been secured through grant money from the World Bank.

1.1 Status of the existing facility at Vandhoo

The condition of the existing facility has been thoroughly analyzed by the Field Investigation Report prepared under the MCEP (Mostafa, 2018). The findings of the report are summarized below.

Zone II comprises of 4 Atolls: Noonu, Raa, Baa and Lhaviyani (Figure 1) which includes 46 inhabited islands, 226 uninhabited islands, 13 resorts, 15 proposed resorts and 9 industrial islands. Distribution of islands and resorts for the region is provided in Table 1 (Mostafa, 2018).

Table 1. Distribution of islands and resorts in zone II (Mostafa, 2018).

Atoll	No. of Inhabited Islands	No. of Uninhabited Islands	Resort	No. of Industrial Islands
Baa	13	57	6	1
Raa	15	66	1	2
Noonu	13	54	2	0
Lhaviyani	5	49	4	6
Total	**46**	**226**	**13**	**9**

The initial waste collection points are located at island levels at the Island Waste Management Centers (IWMC) of each island. The waste then gets transferred to the RWMF at Vandhoo via 2 vessels owned by Waste Management Corporation (WAMCO) of Maldives; *Saafu 1*, a large 200 ton vessel and *Saafu 2*, a smaller waste collection vessel. *Saafu 1* is equipped with a truck and loader onboard to facilitate loading from the IWMCs (which are usually far from the harbor and the Islands in general do not have the means to transport from the IWMC to the loading point) to the vessel. *Saafu 1* unloads manually to *Saafu 2* the jumbo bags, which are then taken to RWMF (Mostafa, 2018).

The operation is definitely very expensive and labor intensive. With significant time of the operation being spent at the Island level, supervision of the crew and their performance is questionable. *Saafu 1* being equipped with loader and truck (which consumes at least 40% of the volume of the vessel) and much heavier loads at all times translates to higher fuel costs and operational expenditures in general.

The harbour area where offloading takes place, is very small despite being designed to serve the purpose for 25 years. Due to the tide, the harbor is very shallow at the circumference and especially at the entrance area. The reception area is very small and packed with almost 7 months of accumulated waste, emptying of which will be a challenge as no maneuverability area is available. Shredder has been out of service for a period of time. Other reported problems include conveyor belt unalignment and smoke coming out from hopper area. These problems are primarily due to the nature of waste fed to the plant (large size material that get clogged and pushed with continuous loading of waste) (Mostafa, 2018).

The incineration plant was not operational due to various reasons including unavailability of compressor oil and ongoing maintenance works. The consultant for the report highlights that even though the incinerator is of very high quality, the type and composition of waste fed to the plant is not compatible with the incinerator. Although grate technology used in the incinerator is a very flexible technology, it has its limitations and cannot deal with certain types and size of waste. WAMCO operation staff on site are not experienced, however to all fairness, no experienced operator can operate the plant under the existing plant configuration and lack of essential upstream processes / equipment (Mostafa, 2018).

The facility is designed as a treatment and final disposal facility and not a regional facility. As a result, recycles are stored at 10 random locations scattered on the island, either in large waste bins, jumbo bags, styrofoam boxes or loose. Moreover, electronic waste (e-waste) is stored along with bulk waste and are not separated (Mostafa, 2018).

Liners at various locations of the cells were torn/cracked. Fly and bottom ash are disposed of in the open air, which is a major health concern to the team onsite, surrounding areas and is an environmental concern. Leachate ponds have accumulated rain water, which due to stagnant conditions, is turning anaerobic with severe growth of algae, presenting major problems with the operation of these ponds (Mostafa, 2018).

All the operational staff (excluding laborers) are primarily for the incineration plant, with no staffing for other types of wastes or final disposal / landfill. Even so, staff onsite are not experienced in the operation and maintenance of the incineration plant (Mostafa, 2018).

1.2 Aims and objectives of the ESIA

The overall objective of the ESIA presented herein is to determine whether the project is feasible in terms of the non-mitigable social and environmental impacts that would offset positive contributions from the RWMF.

The process used to develop this ESIA study follows the environmental reporting requirements for the proposed development of the regional waste management facility on Vandhoo Island, Raa Atoll. It aims to the overall objective through the collection and analysis of primary and secondary data to establish a baseline on social, economic and environmental aspects that could be affected by the project. The results of the analyses of these diverse data sets provide a clear scope of the potential impacts associated with the project, as well as those potential impacts that are considered to be significant or others that require that the Precautionary Approach be applied due to their uncertainty and unpredictability. As a consequence, the ESIA primarily focuses on those potential impacts that are considered to be significant, moderately significant or unpredictable. As a result, the Impact Analysis (described in Section 7) highlights only the most pertinent changes that require that a baseline be established in order to monitor the effectiveness of the mitigation measures that are included in the Environmental and Social Management Program (ESMP) and for selecting those parameters ESMP.

1.3 Structure of the ESIA

The structure of the report is based on the Terms of Reference formulated by Environmental Protection Agency (EPA) of Maldives after the EIA scoping meeting to finalise the terms of reference that were approved on 16th December 2018 (A copy of the Terms of Reference is given in Appendix 1). However, the sequence of these Sections is structured in a way that follows the iterative and systematic framework that is laid out by the RIAM method (described in Chapter 4), as well as to reduce the volume of the main body of the final ESIA. As a result, the ESIA Sections are structured according to the following sequence: -

- **EXECUTIVE SUMMARY**

Section 1	**Introduction**
Section 2	**Project Description**
Section 3	**Policy, Legal and Administrative Framework**
Section 4	**Methodology**
Section 5	**Existing Environment**
Section 6	**Stakeholder Consultations**
Section 7	**Impact Assessment and Baselines for Significance Impacts**
Section 8	**Project Alternatives**
Section 9	**Environmental and Social Management Plan (Mitigation and Monitoring)**
Section 10	**Conclusions and Recommendations**

1.4 Purpose of the report and need for the ESIA

The RWMF Project is classified under Safeguards Category "A", which requires that the potential risks and impacts involved in the construction and operation of the regional solid waste management facility take into account the fragile ecosystems surrounding all of the Maldivian islands and its inhabitants. Even with an operational waste management facility at Vandhoo, waste is still disposed in an *ad hoc* and unsanitary manner on all inhabited islands within the project area, with considerable risks to human health and to marine and terrestrial ecosystems. Floating debris, plastic bags, nappies, sanitary napkins, discarded medicines and bandages, bottles, PET (polyethylene terephthalate) containers, cans, discarded electronic equipment and lubricant wastes are a growing and highly visible hazard to the coral reefs and marine life, and humans. Although upgrading the current facility at Vandhoo could generate adverse environmental impacts over the short term, the net environmental and social impacts should be highly beneficial.

In accordance with the Environmental and Social Assessment and Management Framework (ESAMF), the Project will support the development of a full Environmental and Social Impact Assessment in accordance with the Maldives Environmental Impact Assessment Regulations (2012) and the World Bank Social and Environmental Safeguards Operational Policies; Environmental Assessment and Natural Habitats. The Maldives Environmental Impact Assessment Regulation (2012) is administered by the Maldives EPA, and describes the process for assessment and concurrence of development which has the potential to cause harm to the environment in the Maldives.

Additionally, the World Bank require a full Environmental Assessment to be undertaken for Category ‘A’ projects in order to ensure that all potential adverse environmental impacts can be identified and suitable mitigation measures can be incorporated into project design and implementation.

1.5 Scope of the ESIA

In broad terms, the scope of ESIA covers the four fundamental dimensions of sustainable development and it attempts to balance the demands that the project will place on the Biological-Ecological (BE) and the Physical-Chemical (PC) dimensions and maximize the benefits the project offers to the Social-Cultural (SC) and Economic-Operational (EO) dimensions associated with the project (Figure 2). The Consulting Team identified *30* scoping components (i.e., potential changes that project produces within each of the 4 dimensions of sustainable development) for the analysis of potential impacts associated with the project. Each Component was subsequently analysed using the Rapid Impact Assessment Method (RIAM). Each component was derived from the Consultancy Team’s field studies, as well as previous studies carried out by other consultancies (SENES 2010, 2011; GreenTech *et al.* 2010; Riyan and NIRAS 2012).

Physical-chemical
Biological-ecological
ESIA
Social-cultural
Economic-operational

Figure 2. Conceptual diagram showing how ESIA integrates the 4 dimensions of sustainable development.

1.6 Terms of Reference (ToR)

All development projects that have a socioeconomic environmental relevance and are listed in Appendix Raa of the EIA Regulations 2012 are required to submit an Environmental Impact Assessment report which forms the basis for project approval. As such, projects are required to follow a screening process identifying the environmental impacts associated with the project. Projects which are not listed in the above-mentioned schedule has to follow a screening process, based on which EPA decides whether the project requires the submission of an Initial Environment Evaluation report or an Environmental Monitoring report. Based on the findings of this report, EPA as the regulator makes a decision on whether the specified project further requires the submission of an ESIA based on the impacts associated with the project.

In accordance with the regulations of Ministry of Environment, an EIA application form and project brief were sent stating the nature of the project and likely impacts associated with the environment. The scoping meeting was held at EPA on the 3rd of December 2018 with the project proponent, consultant and EPA officials. Based on the discussions at the meeting, a draft Terms of Reference (TOR) which had been submitted was finalized and approved by EPA on the 16th of December 2018 (see Appendix 2).

Moreover, since this is a World Bank funded project, social and environmental safeguard operational policies of the World Bank need to be taken into account. As such, the draft TOR that was submitted to the EPA was communicated to the World bank and approved on 9th October 2018.

The ESIA report is prepared as per the TOR given by EPA. All efforts have been made to address the requirements identified in the TOR and the World Bank Social and Environmental Safeguards Operational Policies; Environmental Assessment and Natural Habitats.

2 Project Description

2.1 Project objectives and components

The proposed development is undertaken as a sub-component of MCEP and has the following objectives: -

- The project development objective is to support improvements to solid waste management in participating Atolls and Islands.
- The project development objective would be achieved through the design, implementation, operation and maintenance of integrated solid waste management systems.

Information used for the preparation of this and subsequent Sections of the ESIA is cited in the subsections that follow and the referenced material can be found in the bibliography section in this report.

2.2 Land ownership

Even though state owned, the island of Vandhoo was historically leased by Raa Atoll Council. On August 2010, an area of 0.15 km^2 (15 ha) was allocated for construction of the RWMF on this island (Riyan and NIRAS, 2012). As a bigger area is required for the current upgrade, as well as for the expansion of waste management facility to Zone I islands, the whole island has now been handed over to ME. Land acquisition letter issued from the President's Office to ME is attached in Appendix 3 of this report.

2.3 The proponent

The proponent of the proposed project is the Government of Maldives, who will implement the project through the ME. Overall operating agency as well the party enforcing environmental standards and regulations during operational phase for the project will be WAMCO. Financing of the project has already been secured through grant money from the World Bank.

2.4 Need and justification of the project

The need of the proposed upgrade to the existing facility at RWMF is justified in light of the condition of existing facility at Vandhoo.

The initial area allocated for RWMF is 15 ha. Within these 15 ha the following components have already been established: Waste unloading and primary segregation shed, temporary storage recyclables, incineration plant, landfill cell, leachate collection and management system, coastal protection structure, fencing, berth and access channel, administration building, utility building, water and fuel storage tabks, roads and storm water drains (refer to Appendix 4 for the masterplan showing existing and proposed facilities).

However, the existing facilities are not provided with sufficient facilities to cater to the growing demand in waste management facility for the Zone II islands. Consequently, it has been proposed to upgrade the existing facilities.

Condition of the existing facility has been analyzed after consultation with the current operator of Vandhoo RWMF, WAMCO, as well as by referring to the Field Investigation Report prepared under MCEP (Mostafa, 2018). Operational challenges currently met by WAMCO are outlined below:-

- Lack of offloading facility- The capacity of the harbour is too small to accommodate the number of vessels incoming from several resorts as well as inhabited islands. Moreover, the harbour design does not cater to offloading of the incoming waste. As there is no offloading mechanism, a wheel loader and a tele handler is used for offloading purpose which takes about 5 to 6 hours minimum. Moreover, the waste which is being brought in are not properly sorted.
- Temporary storage capacity is too low- Even though the capacity of the incinerator is 36 tons/hr, enough volume of burnable waste is not brought in for a continuous operation of the incinerator. The maximum quantity of burnable waste which could be collected from all Zone II islands combined is estimated at 16 tons. Therefore, since the incinerator does not run continually, waste needs to be collected and stored until enough volume is collected, however, storage space is limited.
- Lack of component storage space- Another problem of not having enough storage space is not being able to sort the waste. Component storage is required for recycling as well. Nevertheless, some recyclables such as metals are segregated for distribution, however enough volume to meet the customers demand is not available for export as it is.
- Technical issues- Lack of electric engineers qualified enough to work with the incinerator used in the facility;
- Shortage of staff – Disinterest of people with technical backgrounds to work at Vandhoo RWMF. Even though there is a shortage in support staff, accommodation facility is limited. Currently, staff from Innamaadhoo and Rasmaadhoo return home once the shift is over daily, however, the accommodation blocks are crowded with staff from other islands.

- Delay in waste collection – Currently, WAMCO does not have a fleet large enough to cater to all Zone II islands. This, as well as the aforementioned problems all add up to delays in waste collection from Zone II islands and loss of customer satisfaction.

Furthermore, the Field Investigation Report concludes that the RWMF at Vandhoo has not been designed and built as a "regional solid waste management facility", but rather, it has been designed and built as a "treatment and final disposal facility" (Mostafa, 2018).

Therefore, in order to provide a solution to the limitations in the RWMF at Vandhoo, the GOM has secured funding to upgrade the facility. However, not all aforementioned problems can be addressed at this phase of the project as the funding is limited.

2.5 The Project

The RWMF at Vandhoo has been designed to provide long term environmentally sustainable solutions for waste management in north province. The design of RWMF has been done considering factors such as waste composition, quantity reaching RWMF, applicability in the local condition and regulatory compliance. Limitations of scarcity of land and the requirement to protect the fragile eco-system have also been considered during the design of RWMF.

The proposed project is an upgrade of the existing waste management facility. Scope of work includes the following: -

1. Extension of existing waste processing bunker 1;
2. Construction of additional waste storage bunker;
3. Construction of hazardous waste storage facility;
4. Construction of proposed recycling facility with storage for recyclables;
5. Construction of new staff quarters (accommodation) with mess;
6. Extension of utility building (to accommodate additional genset);
7. Construction of incinerator maintenance room (for tools and critical spares);
8. Construction of store room 3 (for spares);
9. Construction of additional water tanks (250 m^3 x 2 nos.);
10. Relocation and upgrade of fuel storage (100 m^3 x 2 nos.);
11. Rehabilitation of the existing landfill and leachate pond (with pumps);
12. Upgrading/upscaling of existing fire protection system (include additional buildings);
13. Upscaling of existing RO plant (with borehole); and

14. Upscaling of the existing RO plant (with borehole).
15. Establishment of water and sewer network to the accommodation blocks.

Schematic of the existing facilities and proposed facilities are detailed in the drawings on Appendix 4 of this report.

2.5.1 RO plant, water tanks and distribution network

The existing facility has a Reverse Osmosis (RO) plant of capacity 15 m^3/day (15 ton/day) and 3 x 10,000L water storage tanks. Drinking water is provided to the personnel working on site.

It has been proposed to upgrade the existing system to an RO plant of capacity 50 tons. Water intake for the RO plant will be via a borehole. Typical water treatment process from borehole to storage tanks is provided on the diagram below (Figure 3). A borehole to a depth of 30 m will be constructed at the proposed utility building (Refer to Figure 4 and masterplan in Appendix 4). Brine outfall from the RO plant is proposed to be established at the southern side of the island where wave action is not very strong (refer to Figure 4 for brine outfall location). Additionally, 2 x 200 m^3 water storage tanks are to be built for water storage. Refer to Figure 4 and masterplan in Appendix 4 for the location of water storage tanks (building no. 06). Water distribution from the RO plant to accommodation block will be via HDPE pipe DN110 laid from the main road.

Once the new water storage tanks have been established, the existing storage tanks will be decommissioned. The new water production facility will be established at a new location. Figure 4 below indicates the current location as well as the proposed location of desalination building where RO plant, borehole and water storage tanks will be located. Details of water storage tanks are provided in Appendix 5 of this report.

Properties of product water quality produced from the RO plant will be in compliance with EPA's guideline for drinking water quality.

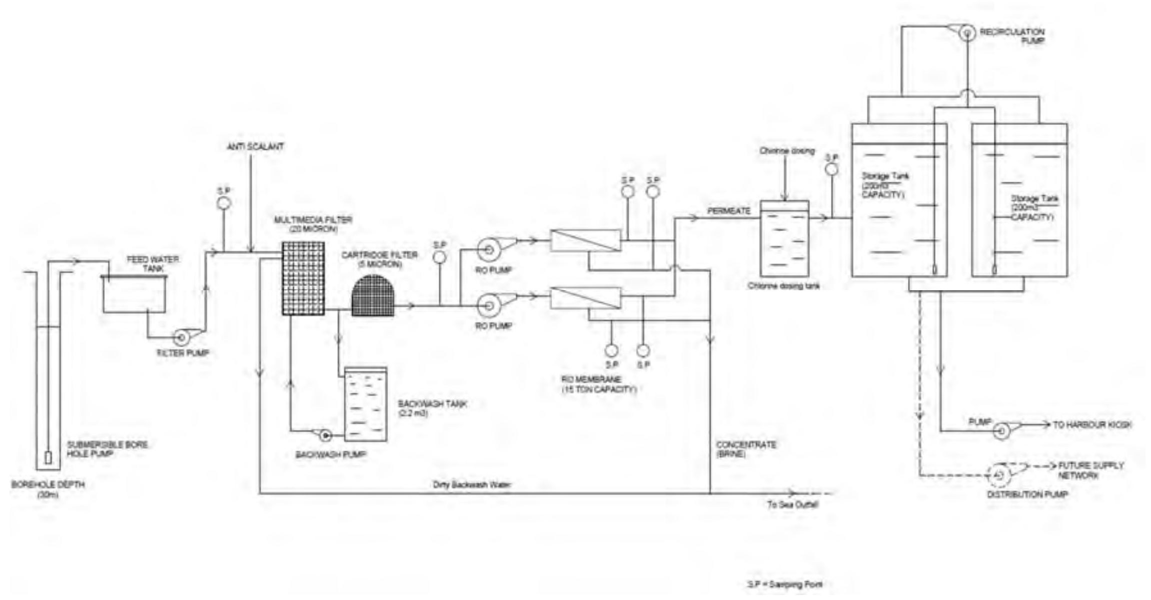

RECIRCULATION PUMP
ANTI SCALANT
S.P
MULTIMEDIA FILTER (20 MICRON)
FEED WATER TANK
CARTRIDGE FILTER (5 MICRON)
S.P
RO PUMP
RO PUMP
FILTER PUMP
S.P
S.P
Chlorine dosing
S.P
PERMEATE
Storage Tank (200m3 CAPACITY)
Storage Tank (200m3 CAPACITY)
Chlorine dosing tank
S.P
S.P
RO MEMBRANE (15 TON CAPACITY)
BACKWASH TANK (2.2 m3)
SUBMERSIBLE BORE HOLE PUMP
BACKWASH PUMP
BOREHOLE DEPTH (30m)
Dirty Backwash Water
CONCENTRATE (BRINE)
To Sea Outfall
PUMP
TO HARBOUR KIOSK
FUTURE SUPPLY NETWORK
DISTRIBUTION PUMP
S.P = Sampling Point

Figure 3. Typical water treatment process from borehole to water storage tanks

2.5.1 Relocation and upgrade of fuel storage tanks

At present, the RWMF consists of 1 x 24,000 L diesel storage tank and 1 x 8,000 L used oil storage tank. These storage tanks are located at the existing utility building as shown on Figure 4.

It has been proposed to construct a new fuel farm near the harbor area with fuel supply pipeline (building no. 05 on Figure 4 and Appendix 4). The newly established fuel farm will consist of 2 x 200 m^3 for diesel and used oil storage purpose. Refer to the drawing in Appendix 6 for the location of inlet and outlet pipes of fuel transfer. Oil storage tanks will be constructed with carbon steel with flat steel flooring for placement on concrete foundation. Moreover, existing fuel tanks will be relocated to the proposed fuel farm. Specifications of diesel steel tanks are attached on Appendix 7 of this report.

A Genset of capacity 250 KVA is currently present in Vandhoo located in the existing powerhouse. Moreover, an additional Genset of capacity 250 KVA will be provided at extension of existing utility building (building no. 08A in Figure 4 and Appendix 4). There is a backup Genset of capacity 120 KVA at the project site.

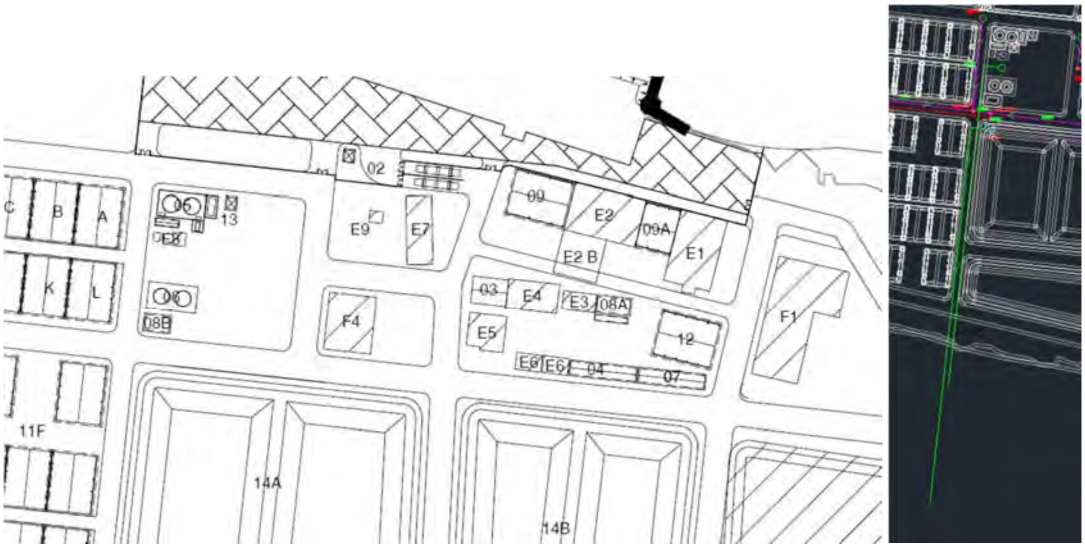


Figure 4. Location of utility building and brine out fall. Existing utility building is marked as E3. New borehole will be established adjacent to the proposed desalination building (image on right). Water storage tanks are to be established at building no. 06 and fuel and waste oil storage tanks at building no. 05. Building no. 08A is the proposed powerhouse and 08B desalination building.

2.5.2 Rehabilitation of ash disposal landfill and leachate pond

The existing landfill has a total volume of 18,500 m^3 (cut and fill) that is surrounded by a 3 x 300 mm compacted subgrade. The landfill covers an area of about 1.39 ha. Reticulation includes a leachate pond/ stormwater pond, pump station and an integral HDPE pipe, sprinkler (1l/s, 15m cast). The landfill has a stormwater collection and storage area with a capacity to receive 4,850m^3 of stormwater. A sub-grade of 3 x 300mm compacted to minimum 95 % of Proctor density would also be employed. The leachate pond takes up an area of about 0.72 ha.

The proposed rehabilitation works to the landfill include placing of an additional geo textile layer and changing the existing pumps to submersible type. Same boundaries will be maintained and no change will be brought to the size and dimension of the landfill cell.

2.5.3 Upgrading of existing fire protection system

The firefighting system will be located next to the fuel farm (building no. 03 on Figure 4 and master plan on Appendix 4). Following upgrades will be applied to the existing firefighting system:-

Fire extinguishers	- Servicing of existing fire extinguishers for performance and content. Undertake refilling if required. - Placing of fire extinguishers in cabinets.
Fire hydrant system	-Connect electricity to the existing fire hydrant system.

	- Servicing the pumps - Grease all hydrants.
Fire alarm system	-Commissioning of existing fire alarm system.
Drencher and foam pouring system	- Automate the existing system, redesign and install according to MNDF's latest requirements.

The following components will be installed at the proposed development: -

Fire alarm system	- Installation of fire alarm systems in all new infrastructures where required.
Fire hydrant system	- Installation of fire hydrant systems in the proposed area for development.
Fire extinguishers	- Installation of fire extinguishers in all new infrastructure where required.
Drencher and foam pouring system	- Relocation of existing drencher and foam pouring system to the new location and automating and redesigning the system as per MNDF's latest requirements. - Installation of drencher and foam pouring system in the proposed new fuel tanks.
Mobile firefighting pumps	-Installation of mobile firefighting pumps for use in emergencies.

2.5.4 Construction of roads and paving

Road paving is only proposed just enough to provide access to the buildings proposed to be constructed during this phase of the project (highlighted areas in Figure 5). The roads will have a 2m green zone, 1m side walk pavements, 1m green zones and curb stones on either side. Additionally, provision for pipelines for utility services under the road will be provided. Typical road section and road paving details are given in Appendix 8 of this report.

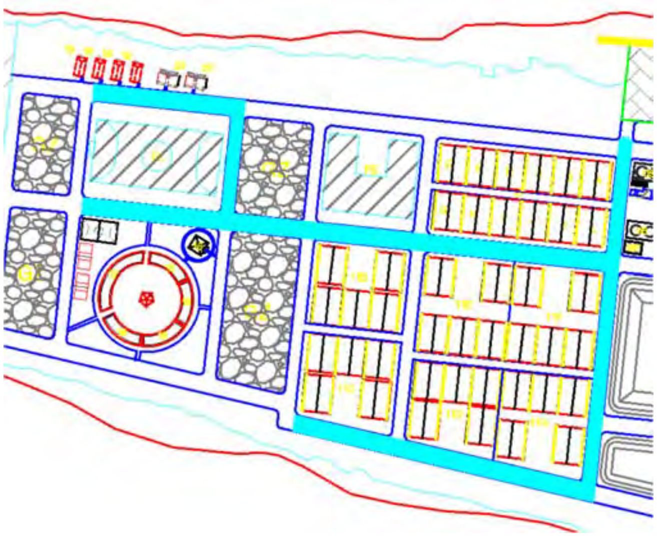


Figure 5. The roads proposed to be paved are highlighted in blue

2.5.5 Construction of new infrastructure

Only the following facilities are proposed to be constructed during this phase of the project. These facilities are marked with an asterisk on the masterplan (Appendix 4).

Table 2. Building sizes of the facilities to be constructed under this project

Building No.	Details	Size (m^2)
02.	Guard house and weigh bridge	32.9
03.	Vehicle shed extension building	197.8
04.	Storage extension building	223.2
05.	Fuel farm	431.3
06.	Water storage tanks	272.7
07.	Mechanical storage	223.2
08A.	Power house	191.9
08B.	Desalination building	103.8
09.	Waste sorting shed extension	613.3
09A.	Sorting shed to incinerator shading	361.3
11. 11B. 11C. 11D. 11E. 11F. 11G.	Waste management facilities:- -Recyclables -Recycling (with compaction and bailing plant) -E-waste -Bulk waste -Compost -Hazardous waste	18529.2
12.	Unprocessed waste bunker	616.1
13.	Fire pump room	32.9
20.	Consultants accommodation x 2	362.3

2.5.6 Construction of water and sewer network to the accommodation blocks

Sewer and water network will not be laid on the whole island during this phase of the project. However, water distribution from the RO plant to accommodation block will be via HDPE pipe DN110 laid from the main road. Waste water from the accommodation blocks will be via lifting stations from the accommodation block to the outfall pumping station (Appendix 6).

2.5.7 Composting

Composting will not take place at the RWMF. Composting facility will be provided to the islands and any biodegradable (food and green waste) shall be composted. This compost, produced at the IWMF will be packaged and distributed via the RWMF. The packaging process will take place at building no. 11F (refer to Master Plan on Appendix 4).

2.5.8 Trainings

There are continuous training programs for the WAMCO staff working at RWMF at Vandhoo. In addition to this, a 12 month training program from support contractors hired from overseas is planned for 2019 facilitated by ME.

Weighing scales will be provided to all the serviced islands in order to log the weight of different types of waste prior to loading to the vessel.

2.6 Construction phase

No demolition works is required for the proposed works, however, vegetation clearance is necessary for the proposed plots and roads. The extent of vegetation clearance and types of vegetation to be removed are specified in section 5 of this report.

2.6.1 Major Inputs and Outputs

2.6.1.1 Inputs (description of the project in terms of raw materials, processes, equipment and work force)

Access to site, mobilization and material unloading

Construction material for the project, such as building material, galvanized iron pipes and nets will be brought to the island on bigger vessels. Materials will be unloaded to the island at the existing harbor. Construction materials will be temporarily stored at the areas indicated on Figure 6 below as these areas are currently barren. Vegetation clearance for temporary storage is not recommended. Once the land gets cleared for building plots, some material can be moved about to those areas as well.

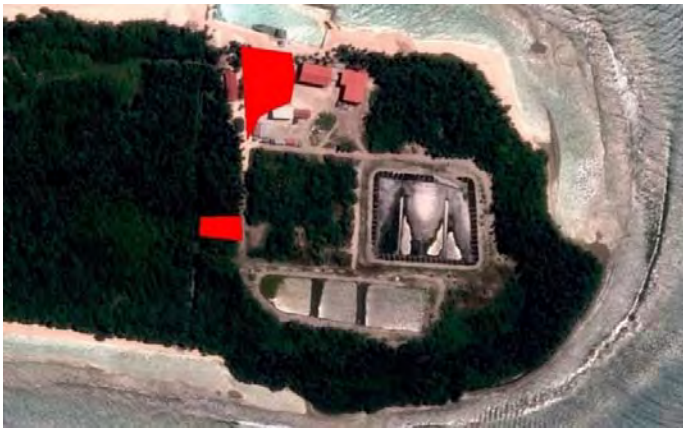


Figure 6. Recommended areas for temporary material storage

Construction methodology

The construction methodology and equipment planned to be utilized for the works proposed under this development is summarized in the inputs and outputs table below:-

Table 3. Inputs and Outputs for the proposed project

Inputs			**Outputs**	**Management**
Materials	**Equipment**	**Source**		
Steel rolled tapered panels (RTP panels)	Excavator	Imported material, contractor may purchase locally or import directly	Water tanks and network pipes	ME
Steel rolled tapered panels (RTP panels)	Hydraulic jacks (tank erection) Excavator (foundation works)		Fuel storage tanks and pipeline	
Tar/Asphalt	Conventional civil construction methods employed in Maldives		Paved roads	
Cement			Building structure and walls	
River sand			Building structure and walls	
Aggregate			Building structure and walls	
Gypsum board			Building ceilings	
Wood			Building ceilings	
GI pipes			Building ceilings	
Corrugated sheets			Building ceilings	
Geo textile			Ash disposal cell	

Conventional civil construction methods employed in Maldives will be used to construct the buildings and concrete tanks; concrete foundations, columns, beams and sheets, masonry walls, wall plastered. Building sizes of the facilities to be built under this project are provided in Table 2. Mobile concrete machine will be used for concrete mixing, only a limited heavy machinery will be mobilized due to small scale of the project. Water for construction will be sourced from existing RO plant on the island.

2.6.2 Workforce and temporary facilities

The exact size of workforce, workers and their origin will be decided by the contractor. An estimate is provided in Table 4 based on the scale of the work needed. Recruitment process of the workers/contractors will comply with the World Bank's tender process as well as the National Competitive Bidding process. As for the temporary accommodation facilities, Contractor can decide whether to construct temporary accommodation blocks within the facility or alternatively find accommodation in nearby islands Rasmaadhoo and Innamaadhoo.

Food should be provided by the contractor; currently there are 2 chefs and a mess room at Vandhoo. Contractor has the option to make arrangements with the existing facility. Utility services such as sewer, water and electricity will be provided via the existing facility at Vandhoo.

Table 4. Estimated workforce required for the project

Designation	Numbers
Project manager	1
Works manager	1
Project administrator	1
QA/QC/HSES officer	1
Chief surveyor	1
Project engineer	1
Laborers: Construction	34

2.6.3 Waste management

Since the island itself is a waste management facility, all the construction wastes will be segregated on site and then disposed of at the facility according to the current practice.

2.6.4 Project schedule

The project duration for the construction and establishment of proposed facilities at RWMF is estimated to last about 2 months. Detailed work schedule is provided in Appendix 9 of this report.

2.6.5 Outputs

Key outputs of the project include:

- new staff accommodation and guest accommodation facilities,
- waste processing bunkers and additional storage bunkers;
- utility buildings with additional gensets, RO plant and firefighting facility;

Secondary outputs as a result of the operation of the facility include better waste management from Zone II islands. Recycling of waste and better training are additional outcomes expected as a result of the proposed upgrade of RWMF at Vandhoo.

2.7 Operational phase

The operation will involve the following components: -

- Island Waste management System in terms of waste segregation and packing;
- Transportation of waste from islands to RWMF; and
- Operation and management at RWMF.

Waste management process is summarized in the flow diagram below (Figure 7).

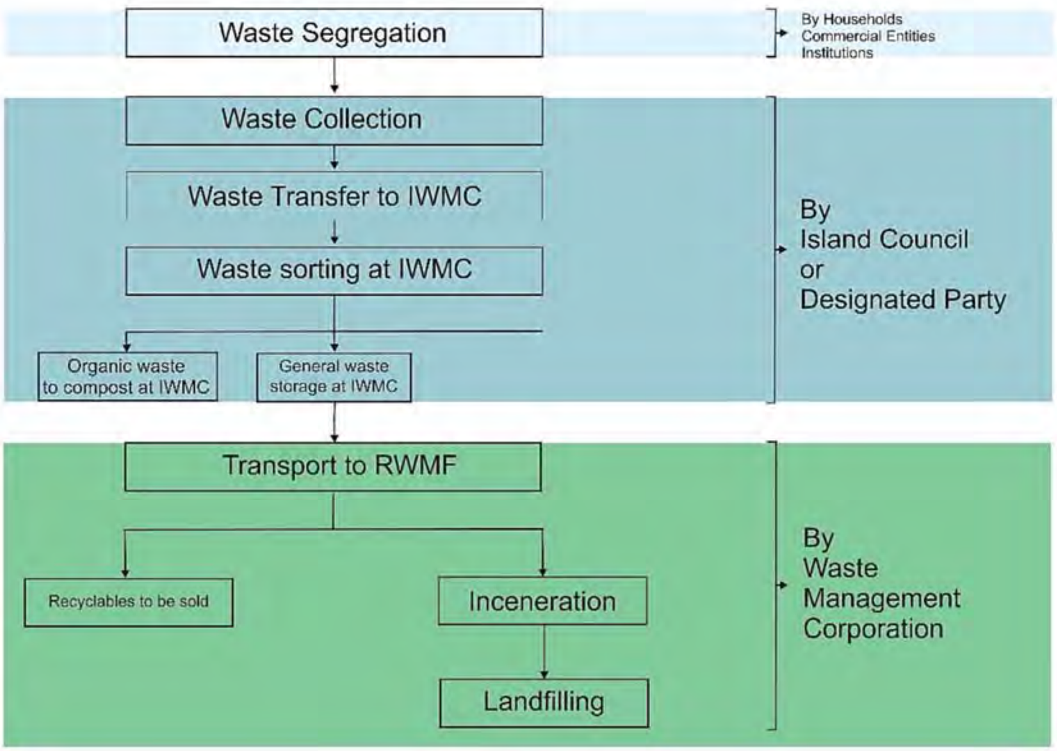

Waste Segregation
By Households
Commercial Entities
Institutions
Waste Collection
Waste Transfer to IWMC
Waste sorting at IWMC
By
Island Council
or
Designated Party
Organic waste
to compost at IWMC
General waste
storage at IWMC
Transport to RWMF
Recyclables to be sold
Inceneration
Landfilling
By
Waste
Management
Corporation

Figure 7. Waste management process flow from island waste management centers to RWMF

2.7.1 Service Area

The RWMF of Vandhoo will be operated by WAMCO. Figure 8 below shows the areas (known as zone II) serviced under the mandate of RMFW at Vandhoo.

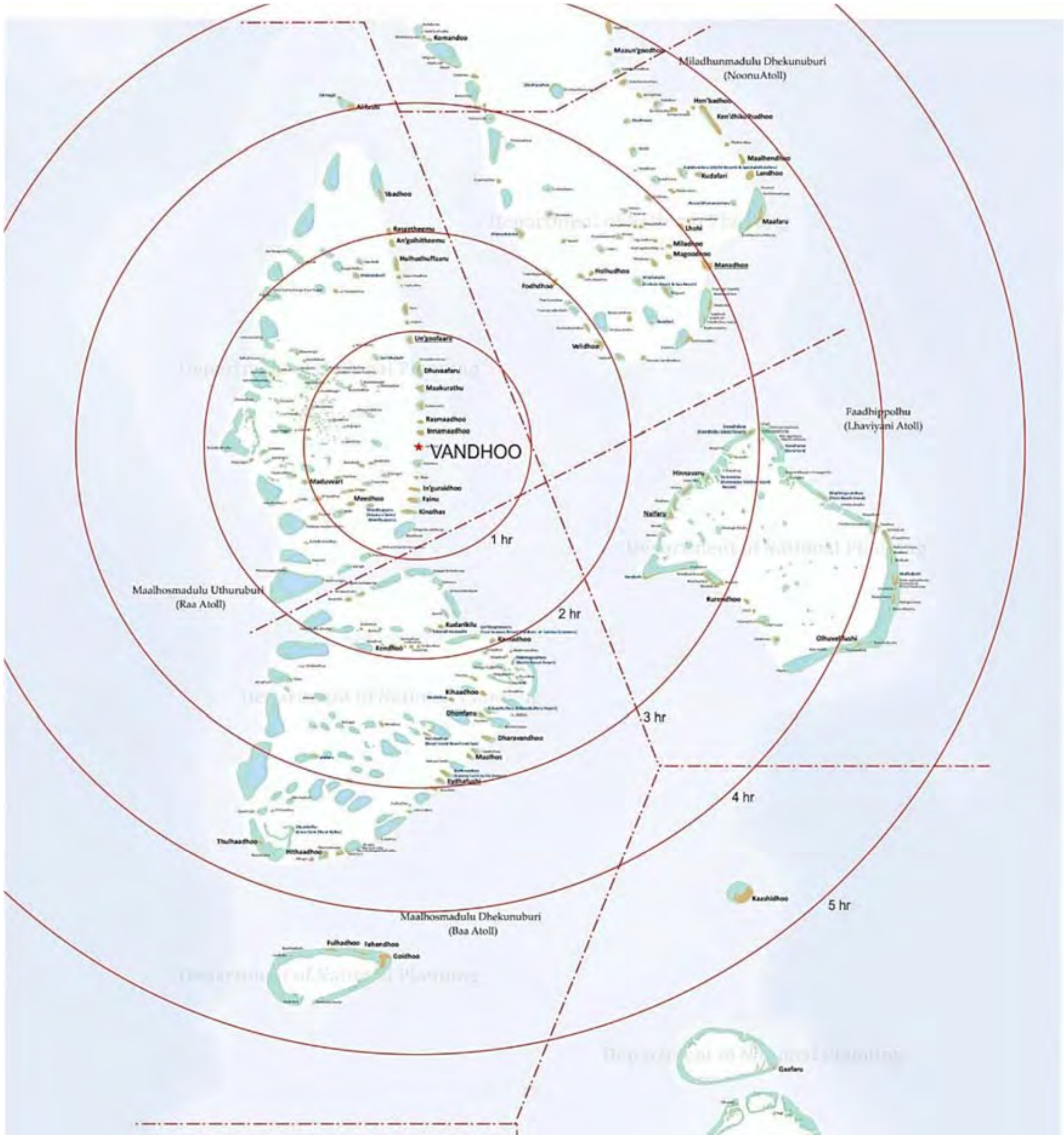

Komandoo
Maaun'goodhoo
Miladhunmadulu Dhekunuburi
(NoonuAtoll)
Alifushi
Hen'badhoo
Ken'dhikulhudhoo
Maalhendhoo
Landhoo
Kudafari
Vaadhoo
Maafaru
Rasgetheemu
An'golhitheemu
Hulhudhuffaaru
Miladhoo
Magoodhoo
Holhudhoo
Manadhoo
Fodhdhoo
Velidhoo
Un'goofaaru
Dhuvaafaru
Maakurathu
Rasmaadhoo
Innamaadhoo
VANDHOO
Faadhippolhu
(Lhaviyani Atoll)
Hinnavaru
Naifaru
Maduvvari
Meedhoo
In'guraidhoo
Fainu
Kinolhas
1 hr
Kurendhoo
Maalhosmadulu Uthuruburi
(Raa Atoll)
2 hr
Kudarikilu
Kendhoo
Olhuvelifushi
Kihaadhoo
Dhonfanu
3 hr
Dharavandhoo
Maalhos
Eydhafushi
4 hr
Thulhaadhoo
Hithaadhoo
Kaashidhoo
5 hr
Maalhosmadulu Dhekunuburi
(Baa Atoll)
Fulhadhoo
Fehendhoo
Goidhoo
Gaafaru

Figure 8. Coverage area serviced under the mandate of RWMF, R. Vandhoo

2.7.2 Human resource plan

Figure 9 below shows the human resource plan proposed during the operational phase of RWMF.

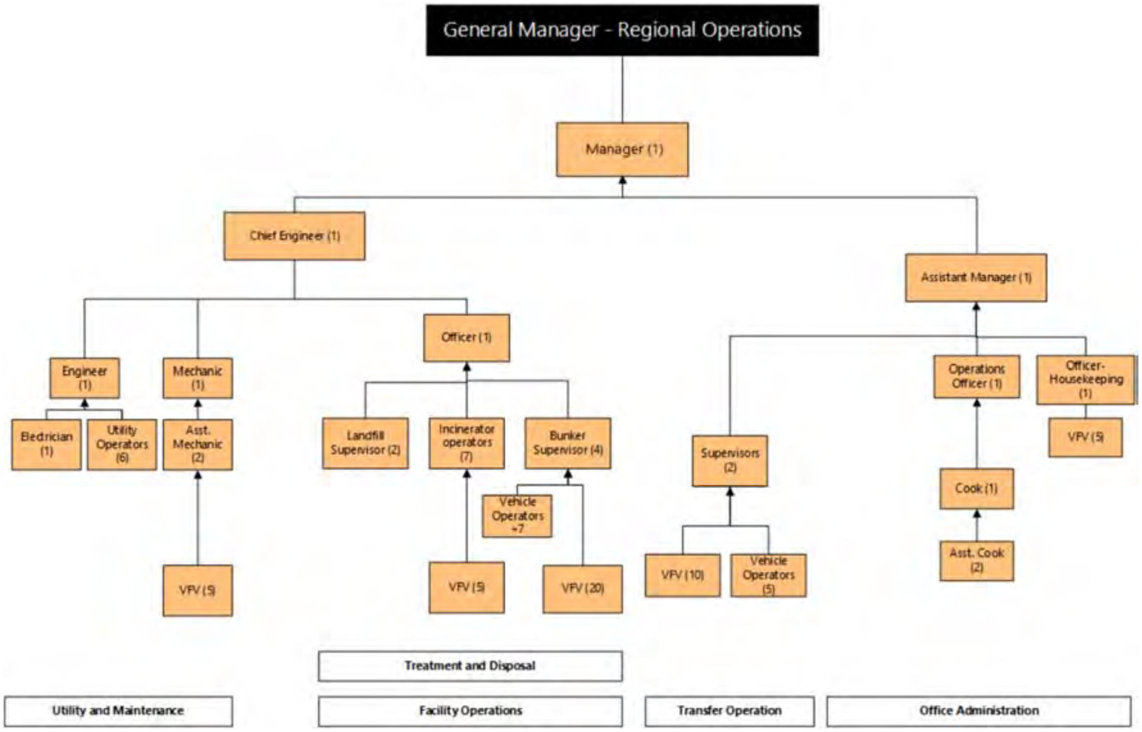

General Manager - Regional Operations
Manager (1)
Chief Engineer (1)
Assistant Manager (1)
Engineer (1)
Mechanic (1)
Officer (1)
Electrician (1)
Utility Operators (6)
Asst. Mechanic (2)
Landfill Supervisor (2)
Incinerator operators (7)
Bunker Supervisor (4)
Vehicle Operators +7
VFV (5)
VFV (5)
VFV (20)
Operations Officer (1)
Officer-Housekeeping (1)
VFV (5)
Supervisors (2)
Cook (1)
Asst. Cook (2)
VFV (10)
Vehicle Operators (5)
Treatment and Disposal
Utility and Maintenance
Facility Operations
Transfer Operation
Office Administration

Figure 9. Human resource management plan of RWMF, Vandhoo

2.7.3 Occupational health and safety

WAMCO has formulated an exhaustive occupational health and safety procedure for the employees. All management and employees are thoroughly instructed and integrated into comprehensive safety philosophy when first hired. The occupational health and safety measures extracted from the operations and maintenance procedure of WAMCO for the RWMF at Vandhoo is attached in Appendix 10 of this report.

2.7.4 Future expansion plans

In addition to zone II islands, the GOM has decided to expand the serviced islands under RWMF at Vandhoo to zone I islands as well. The waste from Zone I will first be collected at a zonal collection point prior to transferring to the RWMF. An island will later be assigned as a zonal collection point after carrying out the necessary assessments.

2.8 Location and Extent of Site Boundaries

The locations proposed for the proposed facilities are shown on the masterplan in Appendix 4 of this report

3 Policy, legal and administrative framework

The project conforms to the requirements of the Environmental Protection and Preservation Act of the Maldives (Law no. 4/93). The EIA has been undertaken in accordance with the EIA Regulation 2012 of the Maldives by a registered consultant. It adheres to the principles underlined in the regulations, action plans, programs and policies of the Maldives, as well as international agreements that are pertinent to the construction and operation of the project

3.1 Environmental Protection and Preservation Act (Law 4/93)

The Environmental Protection and Preservation Act (EPPA) of Maldives (Law 4/93) was enacted in 1993 and serves as the main legal instrument to protect and preserve the environment of Maldives. EPPA stipulates that all developmental projects which have a potential impact on the environment should have an Environmental Impact Assessment done, prior to commencement of the project. Furthermore, with relevance to this project, EPPA also stipulates that "any type of waste, oil, poisonous gases of any other substance that may have a harmful effect on the environment shall not be disposed within the territory of the Maldives. In case where the disposal of such a substance becomes absolutely necessary, they shall be disposed only within the areas designated for the purpose by the government. If such waste is to be incinerated, appropriate precautions shall be taken to avoid any harm to the health of the population".

3.2 Environmental Impact Assessment Regulation (N0. 2012/R-27) and amendments

EPA stipulates that any development project which has the potential to impact the environment should be cleared through an Environmental Impact Assessment prior to work commencement. The EIA Regulation was developed in 2012 to better facilitate this process. Appendix D of the Regulation gives a list of projects which require submission and approval of an EIA prior to work commencement and the proposed works falls under the category of projects listed in this Appendix.

3.3 The Regulation on Environmental Liabilities (Regulation No. 2011/R-9)

The objective of the regulation on Environmental Liabilities is to prevent actions violating the Environmental Protection and Preservation Act 4/93 and to ensure compensations for all the damages that are caused by activities that are detrimental to the environment.

The regulation sets mechanisms and standards for different types of environmental liabilities and equal standards that shall be followed by the implementing agency while implementing the regulation.

According to this regulation the Government of Maldives reserves the right to claim compensation for all the activities which have breached the Environmental Protection and Preservation Act 4/93.

3.4 Leasing of Uninhabited Islands

The authority to lease uninhabited islands is vested within the Ministry of Fisheries and Agriculture through Law 20/98 (Law on Uninhabited islands of Maldives). As per regulation the Ministry also has the authority to take back islands leased through the Varuvaa system, even though the lessee has not violated the agreement, for different reasons; if the island is required for defense purposes or for use by the government or to carryout works approved by the government. However, as per the Regulation, in such instances, the lessee should be given an amount equivalent to 2 years worth of payment for lease. While the regulation states this, the *Guidelines followed in leasing of uninhabited islands* published in the Government Gazette states that in an instance where the island given under the Varuvaa system is taken back by the government, the lessee should be given back balance of his payment for remaining part of his agreement (given that the payment has been made).

3.5 Waste Management Regulation (R-58/2013)

The Waste Management Regulation of the Maldives was gazetted on the 5th of August 2013 and came into effect 6 months from the date, on 5th of February 2014. The Regulation was enacted through the powers given to the Ministry through Law 4/93. The main objective of this regulation is to implement the national policy on waste management and through its implementation, facilitate the following so as to preserve the environment:

- Minimise both direct and indirect impacts due to waste on environment and human health.
- Establish standards for waste management
- Formulate an integrated framework for waste management, and establish environmentally sound and sustainable means for waste management
- Encourage waste minimisation, reuse, recycling and recovery
- Implement “Polluter Pay” principle
- Introduce “Extended Producer Responsibility”

The regulation has five focus areas:

- Waste Management Standards; defines standards for waste collection, transfer, treatment, storage, site management, landfills and managing of hazardous waste
- Procedure for approval of Waste management permits (for waste management sites)
- Standards and permits required for transport of waste (land and sea)
- Monitoring and reporting requirements
- Enforcement and implementation procedures and penalties

3.6 National Solid Waste Management Policy of 2015

The first National Solid Waste Management Policy of Maldives was formulated in 2008, with a new policy being announced in 2015. The policy has 10 key points:

1. Every individual is responsible for the waste they generate and should treat/dispose the waste as per measures and regulations established by his/her local governing authority
2. Waste generated at household level should be disposed of as per measures and regulations established by the local governing authority
3. Waste management at all inhabited islands should be according to a plan formulated by the Island Council and community and which has been approved by the governing authority
4. Waste collection and management should be carried out based on a fee-based system for all households and industries
5. Encourage waste management work to be carried out by government utility companies on the islands, through agreements made with these companies
6. Establish waste management centres on all inhabited islands of the Maldives with sufficient capacity to facilitate the process on these islands (based on population)
7. Establish and operate Regional Waste Management Centres throughout the country
8. Establish and operate a system to facilitate removal of residual waste from inhabited islands and transport to a RWMF
9. Encourage waste management as an income earning avenue, on islands with such capacities and use the income generated for proper waste management on the island
10. Carryout waste management training and awareness campaigns on a national level

3.7 Dewatering Regulation (2013/R-1697) – 31st January 2014

The Dewatering Regulation has been formulated to introduce measures so as to minimize impact on the environment and ecosystem due to dewatering which may be carried out as part of construction works or during other works. Any development which requires dewatering as part of the project, can only implement the dewatering phase after obtaining the required approval from the EPA, which is the implementing agency for the regulation. The regulation does not apply to dewatering which may be required for the installation/cleaning of a groundwater well for personal use or use of groundwater for agricultural purposes.

Prior to carrying out dewatering the proponent of such projects have to submit an application form to EPA with required documents which are detailed in the regulation and application form. It is also the responsibility of the proponent to inform the relevant councils, if there are residential areas or agricultural lands within 100m radius of the site where dewatering will be carried out.

The regulation further details what should be done with the water extracted during dewatering, and what actions should be taken should dewatering impact resource users within 30m radius of the site.

The regulation further specifies fines which will be applicable if the regulation is not followed.

3.8 Regulation on fuel storage and use (2015/ R-160)

The objective of this regulation is to:

- Decrease the number of accidents due to fuel usage and storage and protect the people and their belongings from such incidences
- Raise awareness regarding protective measures which should be in place when using/storing fuel
- Establish means which would enable all places which sell fuel (currently established and in the future) to do so under proper protective measures

The implementing agency for this regulation is the Ministry of Defense and National Security and enforcement of the regulation began on the day the regulation was published in the government gazette (12th August 2015).

All current establishments which use and store fuel have to abide by the regulation and existing establishments were given grace periods of 6 months and 1 year to modify their setups so as to meet the criteria outlined in the Regulation.

Future establishments should be set up as per the regulation, inclusive of firefighting and safety measures. Operation of new facilities can only commence once its been checked and approved by the implementing agency Maldives National Defense Force (MNDF). Existing facilities (at time of implementation of regulation) which had not prior obtained permission from MNDF should also continue their operations after getting the required approval.

Appendix 6 of the Regulation states distance which should be left between the bund wall adjacent residential areas (inclusive of road). These distances are based on the capacity of the facility.

The implementing agency has the authority to make inspections at the facilities once every 6 months and this will be done in the presence of the owner of the facility. During such inspections, the implementing authority will advise if any changes have to be brought to the facility. In such instances the facility will be checked again after been given a time period to make this change.

3.9 By-law on cutting down, uprooting, digging out and export of trees and palms from one island to another

As stated in previous ESIA report for the development of RWMF at Vandhoo (Riyan and NIRAS, 2012) pursuant to law number 4/93 (Environment Protection and Preservation Act of Maldives), the Ministry of Housing and Environment has made a by-law with the purpose of educating developers about the importance of trees including best management practices for maintaining trees and provide standards for preservation of trees in the Maldives and set down rules and regulations to be adhered to prior to commencing felling, uprooting, digging out and exporting of trees and palms from one island to another in Maldives.

The bylaw states that the cutting down, uprooting, digging out and export of trees and palms from one island to another can only be done if it is absolutely necessary and there is no other alternative. It further states that for every tree or palm removed in the Maldives, two more should be planted and grown in the island.

The bylaw prohibits the removal of following tree types;

- The coastal vegetation growing around the islands extending to about 15 meters into the island are protected by this bylaw;
- All the trees and palms growing in mangrove and wetlands spreading to 15 meters of land area are protected under this bylaw;
- All the trees that are in a designated protected area;
- Trees that are being protected by the Government in order to protect species of animal/organisms that live in such trees; and
- Trees/palms that are unusual in structure

3.10 IFC Requirements

3.10.1 Environmental, Health and Safety Guidelines

IFC Environmental, Health and Safety Guidelines relevant to the prposed work are:

EHS guideline on air emissions and ambient air quality

EHS guideline on Hazardous materials management

EHS guidelines for Waste management facilities

These guidelines were formulated in 2007 and have been discussed in detail in Riyan and NIRAS (2012). Readers are referred to Section 3.6 of Riyan and NIRAS (2012) for further details.

4 Methodology

4.1 Context and General approach for data collection

One of the most important aspects of the ESIA is the analysis of potential impacts associated with the project and the subsequent collection and compilation of environmental and socio-economic data for establishing baseline conditions. This is essential for addressing the primary requirements of the Terms of Reference, which were formulated by the EPA. Consequently, the main focus of this Section is to provide a concise account of the overall approach to the ESIA and the methods used to collect relevant information and data in the indicated target areas that have been highlighted by the Consulting Team's approach.

The approach to data collection and compilation of this report includes;

- Consultation and discussion with the proponent with regard to design and work methodology that would be used to implement the proposed activities of the project,
- Examination of the existing environment to identify significant environmental components that are likely to be affected,
- Consultation with major stakeholders to exchange information on the project and to follow the ESIA procedures required for the report, and
- Evaluation of available and relevant literature on environmental impacts associated with similar projects.

Information on existing environment was collected during the field visit to the project site in November 2018. General information on the existing environment was based on available secondary data, such as climatic data from the meteorological center.

The following sub sections describe the methods that were employed to: *a) guide the iterative process for identifying potentially significant changes in the environmental, social and economic dimensions of the construction and operation of the proposed Regional Waste Management Facility at Vandhoo,* and *b) measure and establish baselines for those potentially significant impacts so that they can be monitored over time in order to assess the effectiveness of the proposed mitigation measures presented in the ESMP*. Additionally, baseline data from the initial ESIA report (Riyan and NIRAS, 2012) has been used to compare the current environmental conditions at Vandhoo.

4.2 The RIAM Approach

Rapid Impact Assessment Method was used in Riyan and NIRAS (2012) to understand the potential impacts associated with the construction and operation of RWMF at Vandhoo. The same approach is used here to assess impacts associated with proposed work for the current project. The methodology for this approach is summarized in this sub-section and has been directly sourced from Riyan and NIRAS (2012).

The RIAM approach also helps to establish a framework that enables the GoM to develop and implement mitigation measures. These measures will not only help reduce or eliminate impacts, but to contribute to the economic, social and environmental sustainability of the project as well. Figure 10 summarizes the iterative framework that was used to guide the revised ESIA process and to evaluate potential impacts associated with the RWMF.

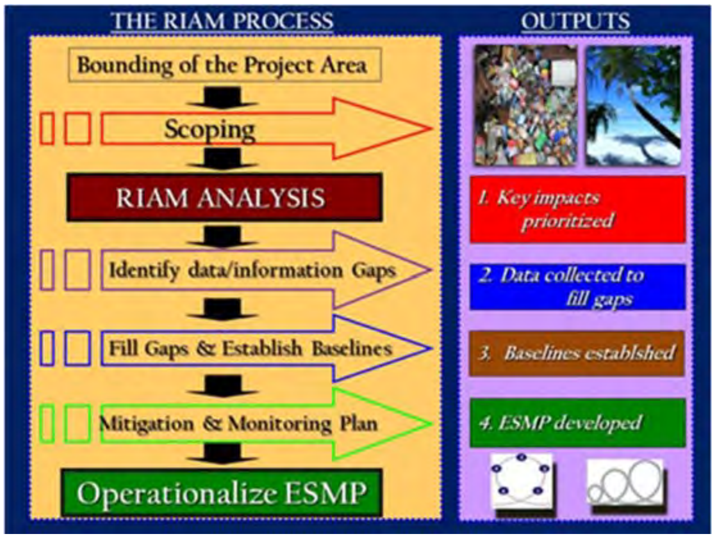

THE RIAM PROCESS
OUTPUTS
Bounding of the Project Area
Scoping
RIAM ANALYSIS
Identify data/information Gaps
Fill Gaps & Establish Baselines
Mitigation & Monitoring Plan
Operationalize ESMP
1. Key impacts prioritized
2. Data collected to fill gaps
3. Baselines established
4. ESMP developed

Figure 10. Diagram showing the RIAM process

STEP 1: RIAM initiates with **Bounding** or a definition of the primary and secondary areas of the project's influence. The area is divided into the Area of Direct Impact (ADI) and the Area of Indirect Impact (AII). The ADI is the area where the project is most likely to produce changes identified in the RIAM analysis, whereas the AII encompasses those areas where the impacts (changes) are due to indirect spillover of the project.

STEP 2: Once the delimitation has been completed, the next step is the detailed exercise of **Scoping**, which involves identifying the social, economic and environmental *changes* (i.e., *impacts*) that are potentially caused by the project and that could affect the sustainable use of the island and its surrounding marine biodiversity, potential risks if no action is taken and the level (and costs) of interventions required to ensure sustainable use of coastal resources. The Scoping (component identification) exercises are carried out by a multidisciplinary team that identifies all potential socio-cultural (S/C), biological-ecological (B/E), physical-chemical (P/C) and economic –operational (E/O) changes.

__STEP 3:__ Once the potential changes have been identified in the scoping process, the **RIAM Analysis** is carried out in order to prioritize the potential changes according to their significance. Table 5 summarizes the RIAM scoring system which is based on a set of five different criteria (A1 and A2, B1, B2 and B3) that are used to assess the degree to which the impact is significant:

Table 5. Summary of the criteria used to assess significance of an impact

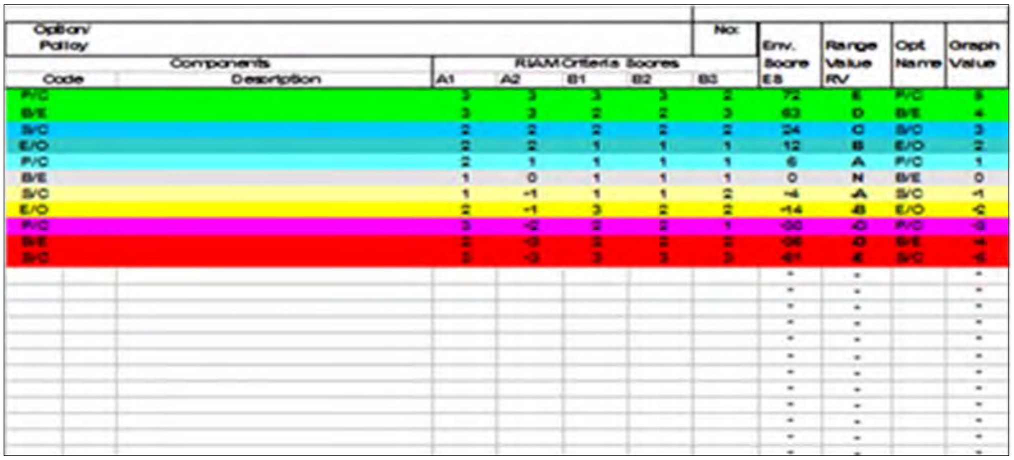
Code	Criterion	Measurement	Scores	
A1	**Importance**	***Spatial extent of the Change***	International/national influence	4
			National/regional influence	3
			Extending outside the local area	2
			Within the local area	1
			No change/not applicable	0
A2	**Magnitude**	***Magnitude of Change***	Major change	3
			Significant change	2
			Slight change	1
			No change/not applicable	0
			Slight negative change	-1
			Negative significant change	-2
			Major negative change	-3
B1	**Permanence**	***Permanence of the Change***	Permanent	3
			Temporary	2
			No change/not applicable	1
B2	**Reversibility**	***Reversibility of the Change***	Irreversible	3
			Reversible	2
			No change/not applicable	1
B3	**Cumulativity/ Synergy**	***Cumulative or synergistic effects of the Change (its influence on other factors)***	Cumulative/synergistic	3
			Non-cumulative/synergistic	2
			No change/not applicable	1

One feature of the RIAM system is that it can eliminate components that are not relevant - any RIAM component that scores “0” would receive a value of “N”, and therefore not warrant further attention. The scores obtained are then translated into range bands, as shown in Table 6. Each color-coded band describes the level of an expected change (positive or negative) and they also represent the final judgment from the RIAM analysis.

Table 6. Summary of RIAM scores and corresponding color bands to identify change impacts

Scoring Values			Alphabetic Criteria	Value of the Criterion	Description of the Color Band
108	to	72	**E**	5	Important Postive Change/impact
71	to	36	**D**	4	Significant Postive Change/impact
35	to	19	**C**	3	Moderate Postive Change/impact
10	to	18	**B**	2	Postive Change/impact
1	To	9	**A**	1	Minimal Postive Change/impact
	0		**N**	0	Neutral/ No impact
-1	To	-9	**-A**	-1	Minimal Negative Change/impact
-10	to	-18	**-B**	-2	Negative Change/impact
-19	to	-35	**-C**	-3	Moderate Negative Change/impact
-36	To	-71	**-D**	-4	Significant Negative Change/impact
-72	to	-108	**-E**	-5	Important Negative Change/impact

The bands range from +/- A (A´’ values represent slight, but insignificant) to +/-E change (E being an important change/impact) and these values are used as the determination of the overall picture of change (Figure 11).



Option/ Policy

No:

Components		RIAM Criteria Scores					Env. Score ES	Range Value RV	Opt Name	Graph Value
Code	Description	A1	A2	B1	B2	B3				
P/C		3	3	3	3	2	72	E	P/C	5
B/E		3	3	2	2	3	63	D	B/E	4
S/C		2	2	2	2	2	24	C	S/C	3
E/O		2	2	1	1	1	12	B	E/O	2
P/C		2	1	1	1	1	6	A	P/C	1
B/E		1	0	1	1	1	0	N	B/E	0
S/C		1	-1	1	1	2	-4	-A	S/C	-1
E/O		2	-1	3	2	2	-14	-B	E/O	-2
P/C		3	-2	2	2	1	-30	-C	P/C	-3
B/E		2	-3	2	2	2	-36	-D	B/E	-4
S/C		3	-3	3	3	3	-81	-E	S/C	-5
							-	-		-
							-	-		-
							-	-		-
							-	-		-
							-	-		-
							-	-		-
							-	-		-
							-	-		-
							-	-		-
							-	-		-
							-	-		-

Figure 11. Example of a hypothetical RIAM Matrix showing the values for each criterion and the corresponding color bands for each criterion

Because RIAM is independent of any specific discipline, it can be used as a comparative platform for all disciplines. Green and blue color bands represent positive changes; whereas magenta and red bands identify significant and priority negative changes that require immediate management measures.

Figure 12 shows the results of the RIAM analysis of two scenarios - with and without the RWMF project at Vandhoo. In the figure it is easy to compare two scenarios using the different color bands. The red and magenta color bands highlight those potential changes that require a *pre-project baseline*, as well as *mitigation measures* and *monitoring* of the effectiveness of those measures based on changes in the baseline for each of the relevant physical-chemical (P/C), Biological/ecological (B/E), social-cultural (S/C) and economic-operational (E/O) components changes caused by the project.

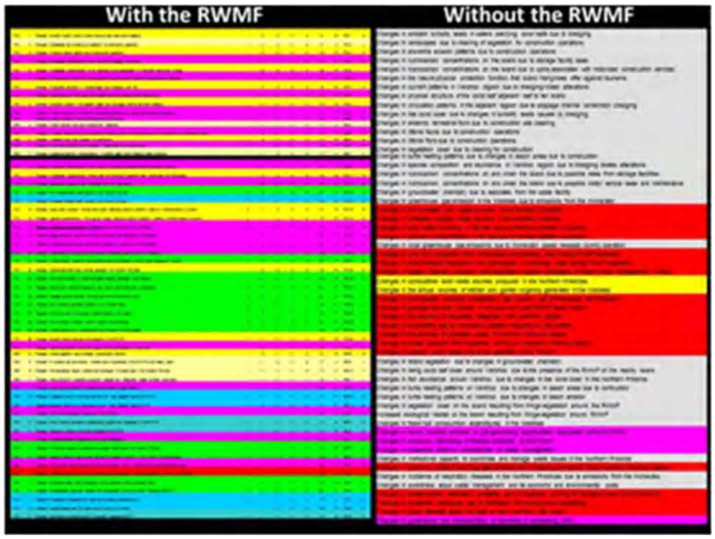

With the RWMF
Without the RWMF

Figure 12. Graph showing the results of the RIAM analysis of the scenario with the RWMF and the scenario without it.

In the figure, negative values between –D and –E all require setting up a baseline, as well as mitigation measures and a monitoring plan designed to evaluate the effectiveness of management tools selected to confront the negative changes. In some cases, the team has invoked the Precautionary Principle for some –C and –B values because there is just not enough information to determine the magnitude of those potential impacts. This structured approach is transparent and facilitates the development of relevant mitigation measures and the ESMP.

STEP 4: Establishing the **Baseline** involves reviewing each component to determine whether sufficient reliable information is available. The Baseline will serve as a measure of the situation *before* the project took place. The monitoring system must be designed so that the observed changes in the baseline are due to the project or the proposed mitigation measures, or whether the changes resulted from another driver that was not related to the project at all.

The lack of reliable, time series data is a major constraint to any form of predictive assessment, and obtaining reliable data is difficult. Practical forms of obtaining primary data are through interviews (socio-cultural dimension) and direct observations (which may be recorded by meeting notes and photographs).

STEP 5: Developing Mitigation Measures and Contingency Plans involves identifying mitigation measures that can be used to confront significant negative changes identified in the previous steps. These management tools and their formulation are addressed in Section 8. The mitigation measures (*social*, *regulatory*, *physical structures* and *financial-economic incentives and disincentives*, described elsewhere) are tested through the monitoring and evaluation (M&E) process to evaluate their effectiveness in changing the color bands over time, using the baseline as a reference point, and completing the Project Cycle.

STEP 6: Monitoring and Evaluation By using the dynamic project cycle framework, the effectiveness of the management tools are tested and evaluated through the monitoring and evaluation (M&E) process. Effectiveness of the mitigation measures (which are essentially management tools) is measured during the evaluation step by examining any changes in the colors of the color bands produced during the RIAM analysis. For example, if a priority issue (red band) changes to yellow and then green, then the management tool would be considered to be effective. However, if there is little or no change, the management tool must be reconsidered, and/or eliminated and replaced with another mitigation measure that is more effective.

This monitoring process is the motor for a dynamic ESIA that fits well into protecting the fragile ecosystems surrounding the Maldives and the people who depend on the rich biodiversity. However, it also requires a transparent, understandable (through awareness and education) and participatory approach that allows for the active participation of all relevant stakeholders. The process aims to eventually put the Maldives on a path toward the sustainable development by confronting and eventually reducing an environmental and health problem that is of considerable magnitude. The lessons learned on Best Management practices could subsequently be institutionalized and used for other waste management issues in the Maldives.

4.3 Physical environment

4.3.1 Climate

The meteorological data including wind climate, rainfall, temperature, waves, currents and tides presented here are from secondary data collected by the nearest meteorological station to Vandhoo at Hanimaadhoo metrological center of the Maldives.

4.3.2 Shoreline and vegetation line survey

Shoreline survey was carried out using Topcon HiperII Differential Global Positioning System (DGPS) system with fixed error margin of ±15mm for horizontal coordinates. Initially three Permanent Survey Marks were established on the island, after which static survey method is used to attain Global Positioning System (GPS) coordinates. The shoreline survey is done in Real Time Kinematic (RTK) mode using one DGPS as base and the other as a rover. Data is processed using Topcon Tools software.

Vegetation line was surveyed using drone imagery technology. Drone image data set was collected using DJI Phantom 4 Pro drone, using Drone Deploy software. Images were collected at 60 m elevation with 70% overlap front and side. The image processing was done using Drone Deploy platform while georeferencing was done using Surfer 13 software. Ground Control Points were established initially using Topcon Gr5 DGPS. These control points were used for referencing to Universal Transverse Mercator (UTM) 43N, WGS84 projection.

4.3.3 Beach profiles

For the initial ESIA report, 5 beach profile locations were established as a baseline, out of which 2 were not accessible at present. Beach profiles were repeated at 3 remaining locations, in addition to 3 new locations. Ongoing beach profile survey has been carried out by LaMer Pvt Ltd. for Vandhoo as part of the monitoring works since initial ESIA. The accumulated data has been used to compare the beach movement around the island in this report.

Beach profile locations are indicated on Figure 13 and GPS coordinates are given in Table 7 below. Beach profiles were taken using an electronic level instrument (Leica Sprinter 200M).

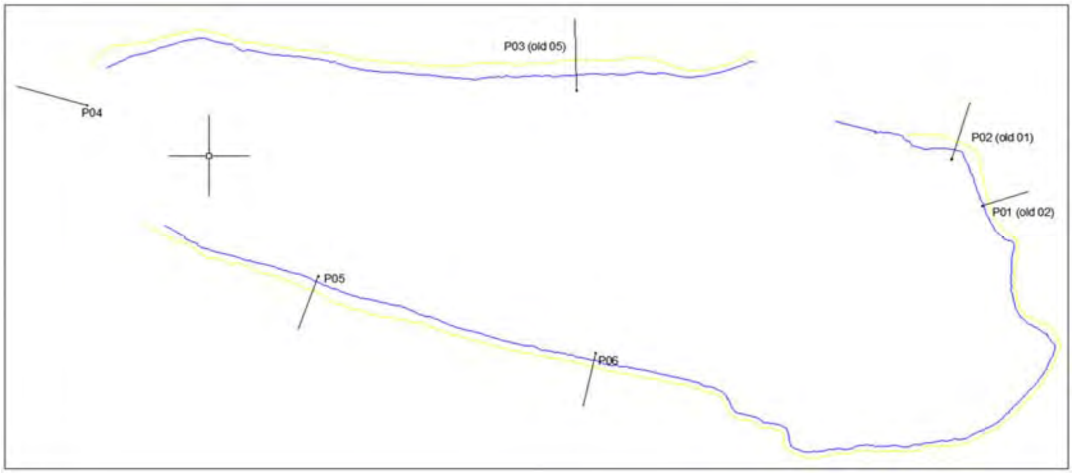


Figure 13. Beach profile locations

Table 7. GPS coordinates of beach profile locations

Profile	Grid Northing (m)	Grid Easting (m)
P01 (old-02)	611815.7490	283589.9980
P02 (old-01)	611873.8940	283551.9680
P03 (old-05)	611958.2930	283087.5780
P4	611940.2130	282480.7220
P5	611728.3340	282767.5600
P6	611633.5220	283110.5540

4.3.4 Bathymetric survey

Bathymetric survey of project area was carried out using Ohmex Sonarmite Echo sounder combined with Trimble Geo explorer 7 GPS system. The depth reading data collected was reduced to MSL using predicted tide data for Hanimaadhoo.

4.4 Biological environment

4.4.1 Vegetation survey

Coconut palms which fall on the proposed construction plots were identified using the drone imagery. Other plants were identified using a hand held GPS (Trimble Geo explorer 7 GPS system).

4.4.2 Reef survey

Two Reef Survey sites RS1 and RS2 that was surveyed for the ESIA of the first phase in December 2012 was resurveyed along with an additional site, RS3. All three sites were geo-referenced and are shown in Figure 14 and Table 8. The data for the sites RS1 and RS2 were compared with the data taken in the 2014 Monitoring survey, and the data for RS3 would be considered a new baseline.

A coral reef expert using snorkeling gear and an underwater camera took a series of photos along the reef at a depth of 2-3m, in a belt measuring 200m by 5m, at each site. 40 of these photo quadrats were randomly selected from each site and analysed using Coral Point Count with Excel extension (CPCe) software. The mean percentage live coral cover, the species of coral present, the cover of other life forms and abiotic substrate was calculated.

Reef fish abundance and diversity was assessed along the same belt the reef survey was done, at a depth of 2-3m. The assessment was generally made at the family level, with the focus on estimating the presence of major fish groups and predominant species.

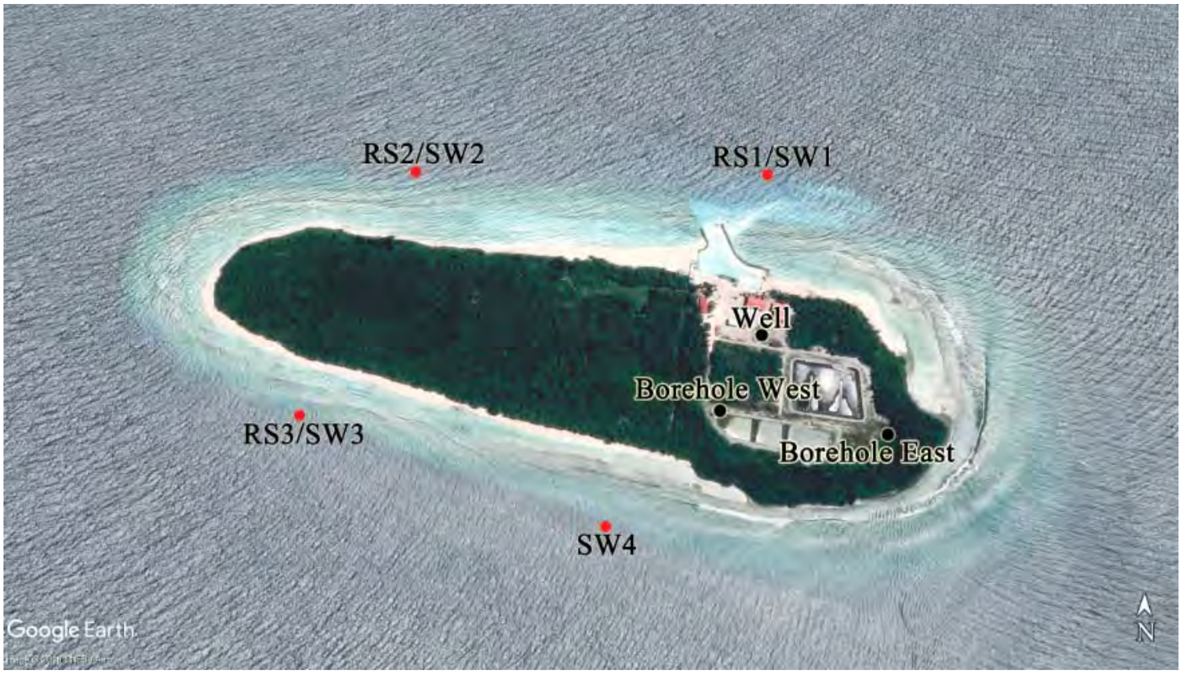


Figure 14. Reef survey and water sampling sites at Vandhoo

Table 8. The GPS coordinates of the reef survey and water sampling sites at Vandhoo

Site	Latitude	Longitude
RS1/SW1	5° 32.098'N	73° 2.704'E
RS1/SW2	5° 32.094'N	73° 2.350'E
RS3/SW3	5° 31.826'N	73° 2.278'E
SW4	5° 31.729'N	73° 2.544'E
Borewell East	5° 31.814'N	73° 2.784'E
Borewell West	5° 31.834'N	73° 2.641'E

Well	5° 31.912'N	73° 2.684'E

4.4.3 Water quality

Water quality samples were taken at the four marine survey rise sites SW1-SW4, two borewells and a well on the island. SW3 and SW4 (proposed sewage outfall location) are new sites and the data from these sites would be considered a baseline for any further monitoring whereas rest of sites have been surveyed during the ESIA done in December 2012. All sites were geo-referenced and shown in Figure 14 and Table 8.

Water quality (physical and chemical parameters) were analysed in-situ using a (in) portable multi-parameter water testing instrument (that has been calibrated in accordance to manufacturer's guidelines): Hanna HI 9820 at all the marine and groundwater sites. Laboratory analysis of the water was carried out at the Water Quality Assurance Laboratory of the Malé Water and Sewerage Company Pvt Ltd at all the marine sites except SW4, and all the groundwater sites.

4.5 Noise and air quality

The proposed upgrade to RWMF at Vandhoo do not include any facilities which may have a more significant impact than the already existing facilities in terms of noise level to the nearby islands, R. Rasmaadhoo and Innamaadhoo. Therefore, data collected from initial ESIA are used as the ambient noise level.

The proposed upgrade of waste management facility at Vandhoo does not involve installation of new incinerators, although the powerhouse at the facility will undergo an upgrade. Given this scope, while there will be added emissions from the new generators to be installed, these are considered insignificant to the existing conditions at the site, due to waste incineration and other waste management processes. Air quality of the site prior to construction of the RWMF at Vandhoo is discussed in detail in Riyan and NIRAS (2012) (Page A34). For the purpose of this report, air quality at the site will be discussed as sourced from predictions for incinerator emissions in the project ESIA report.

4.6 Socio-economic environment

As the project is an upgrade of an already existing facility located in R.Vandhoo, where extensive social assessments have already been conducted, the socio-economic aspects for his report were concentrated more on the natural features, landscapes and cultural/traditional significance of the island.

The previous studies that discussed the socio-economic environment of the project impact area includes the Social Assessment for the Solid Waste Management Component carried out by Greentech et al (2010) for the 46 inhabited islands that would be served by the waste management facility, BPEO report prepared under the North Province Regional Waste Management Project by SENES et al (2010).

In addition, in order to understand the social issues related to this facility, the issues and challenges associated with operation of the existing facility, were explored. These in the form of qualitative data were obtained from structured interviewing, focus group discussions. These are detailed in Chapter 6.

5 Existing environment

The paragraphs that follow describe the general characteristics of the project area. Baseline data from the initial ESIA is used as a reference to compare the current environmental conditions with the conditions prior to any development on Vandhoo.

5.1 General setting

The double chain of 25 natural atolls that make up the Maldives archipelago (Figure 15) are part of the largest submarine carbonate structure in the Indian Ocean lying on the submarine ridges known as Lacadive-Chagos ridge in the central part of the Indian Ocean. The atolls are separated by deep running channels that run predominantly east to west. The atolls contain 1190 islands that vary in shape from circular and oval to elliptical, of which only 198 are inhabited. The total reef area of Maldives is 4,493.85km^2 while the total land area is 227.45km^2 (Naseer, 2004). Approximately 80% of Maldivian land area is less than 1m above mean sea level.

The characteristics of reefs and coral islands of the Maldives vary considerably from north to south. The atolls to the north are broad banks discontinuously fringed by reefs with small coral islands and with numerous patch reefs and faros (the word faros is derived from the Maldivian word "*faru*") in the lagoon. To the south the depth of atoll lagoon increases, faros and patch reefs are rare in the lagoon, the continuity of the atoll rim is greater and a large proportion of the perimeter of the atolls is occupied by islands (Woodroffe, 1992). The islands have shallow reef flats on their seaward side, some with shingle ramparts at the seaward limit of the reef flat. The islands and the shingle ramparts owe their origin to the deposition of shingle or coral debris during storms. A number of islands can be found on a single reef. These islands may be separated by shallow passages that run across the reef flat. The width of some of these passages could be less 100m while some passages are over a few hundred meters wide.

5.2 Geographic location and general setting of Vandhoo

Vandhoo is located on the eastern periphery of the Raa Atoll, some 158 km South-east of the capital located at Male'. The length and width of the island are approximately 1.27 km and 0.34 km respectively with an area of about 40.4 ha.

Vandhoo is about 15 km north from Ungoofaaru which is the capital of Raa Atoll (Figure 15). The island is just 1.96 km to Innamadhoo, the nearest inhabited island, and about 3.46 km to the north of Rasmaadhoo. The uninhabited island of Kottefaru is located about 2.42 km to the south.

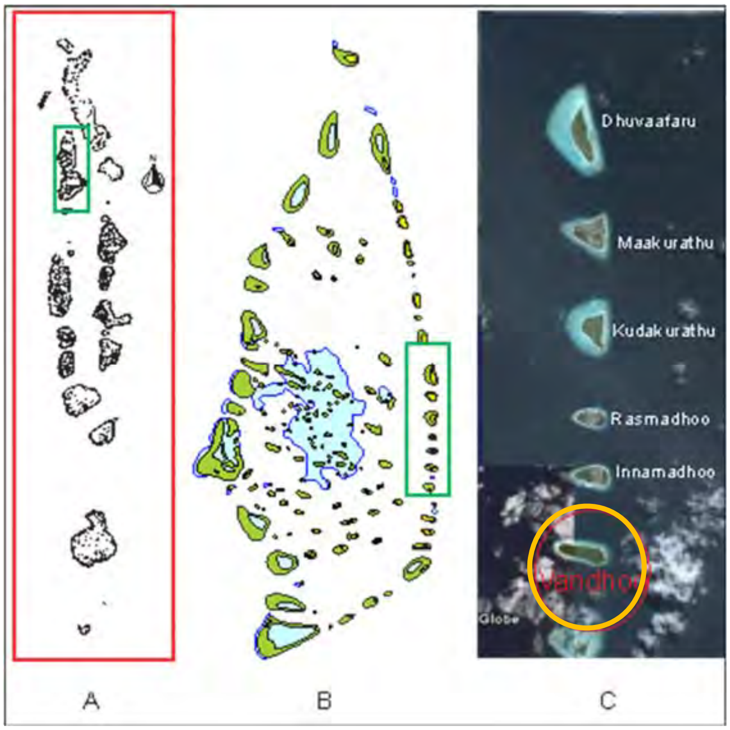


Figure 15. Geographic location of Vandhoo within the Raa Atoll

5.3 Physical environment

5.3.1 Wind climate

Wind climate in the Maldives is dominated by the Indian monsoon climate South West (SW) monsoon and North East (NE) monsoon. The Indian monsoon system is one of the major climate systems of the world, impacting large portions of both Africa and Asia (Overpeck et, al., 1996). The monsoon climate is driven by the atmospheric pressure differences that arise as a result of rapid warming or cooling of the Tibetan Plateau relative to the Indian Ocean (Hastenrath 1991; Fein and Stephens 1987). During the summer of northern hemisphere the Tibetan Plateau warms rapidly relative to the Indian Ocean which results in an atmospheric pressure gradient (Low pressure over Asia and high pressure over the Indian Ocean) between the Asian landmass and the Indian ocean, which drives the prevailing wind from south to westerly directions. The period during which prevailing winds are from south to westerly direction is known as the SW monsoon. In the winter of northern hemisphere, the continent cools relative to the ocean. This reverses the pressure gradient (low pressure over the Indian Ocean high pressure over the Asian landmass) and the prevailing winds become northeasterly.

The period during which prevailing winds are from northeasterly directions is known as NE monsoon. The transitions from NE to SW monsoon and vice versa are distinctly different from SW or NE monsoon. During these transition periods the wind becomes more variable.

The SW monsoon lasts between May and September while the NE monsoon lasts between December and February. The period between March and April is the transition period from the NE monsoon to SW monsoon known locally as the Hulhangu Halha, while the transition period from SW monsoon to NE monsoon is known as Iruvai Halha, which lasts from October to November (Table 9).

Table 9. The months characterizing the two monsoon periods and the transition periods

Season	Month
NE-Monsoon (Iruvai	December
	January
	February
Transition Period 1 (Hulhangu Halha)	March
	April
SW-Monsoon (Hulhangu)	May
	June
	July
	August
	September
Transition Period 2 (Iruvai Halha)	October
	November

The SW monsoon is generally rough and wetter than the NE monsoon. Storms and gales are infrequent in this part of the world and cyclones do not reach as far south as the Maldivian archipelago (Ministry of Construction and Public Works, 1999).

Since there were no site-specific wind data, wind regime around the island was assumed to be similar to that at the closest meteorological station, which is at Haa Dhaalu Hanimaadhoo, approximately 135 km north of Vandhoo. An analysis of the wind climate was done using hourly wind data between the period of May 2008 to December 2012 from Hanimaadhoo meteorological station. In this analysis, wind rose diagram based on wind speed and direction and the frequency of speeds and direction was produced.

Wind rose plot (Figure 16) shows that winds from the western quadrant are dominant reaching speeds as high as 30 knots. Winds from the northern and eastern quadrant are less prevalent and with comparatively low speeds. Wind speeds above 18 knots were found to be a rare occurrence, and the instances when it does occur, wind direction was from the western quadrant (Table 9), thus indicating that this was during the SW monsoon, when winds are generally stronger.

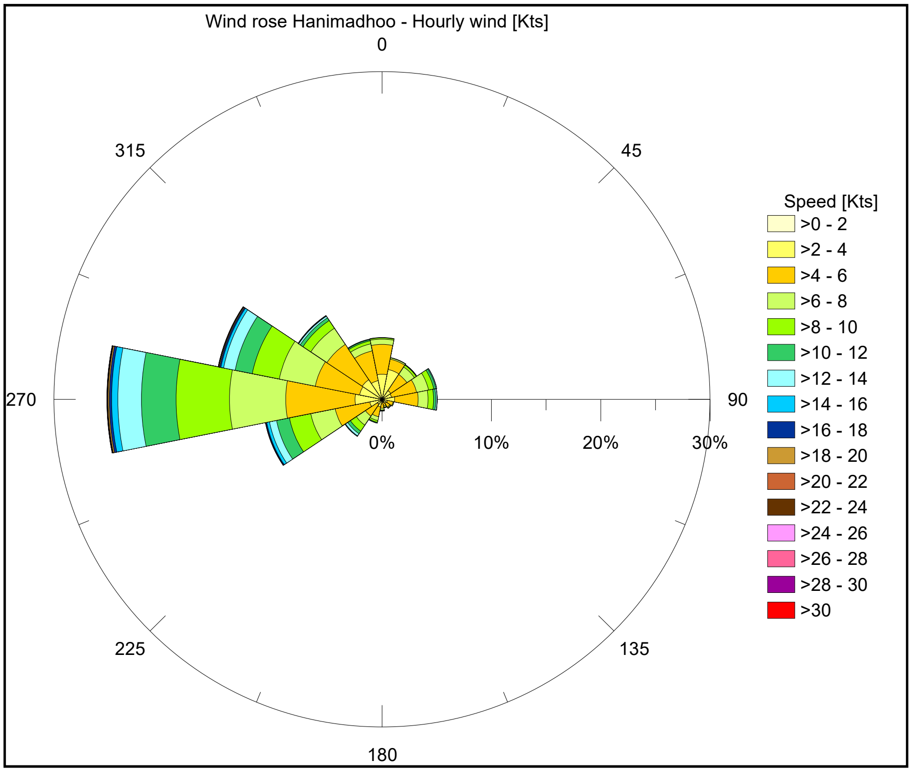


Figure 16. Wind rose plot for Hanimaadhoo Meteorological station, based on hourly wind data for the period of May 2008 to December 2012

Table 10. Hourly wind data from Hanimaadhoo Meteorological station

				Wind Speed (Knots)														
Wind Direction		Freq	Cum. Freq.	**>0 - 2**	**>2 - 4**	**>4 - 6**	**>6 - 8**	**>8 - 10**	**>10 - 12**	**>12 - 14**	**>14 - 16**	**>16 - 18**	**>18 - 20**	**>20 - 22**	**>22 - 24**	**>24 - 26**	**>26 - 28**	**>28 - 30**
22.5	NNE	3.9%	3.9%	0.005%	2.784%	0.964%	0.119%	0.020%	0.005%	0.008%								
45	NE	3.8%	7.7%		0.961%	1.777%	0.821%	0.211%	0.033%	0.015%	0.005%	0.003%						
67.5	ENE	5.1%	12.8%		0.882%	2.339%	1.111%	0.486%	0.191%	0.074%	0.015%	0.005%						
90	E	5.1%	17.9%		1.154%	2.146%	0.905%	0.511%	0.211%	0.104%	0.018%	0.003%						
112.5	ESE	1.1%	19.0%		0.501%	0.534%	0.069%	0.013%										
135	SE	1.0%	20.0%		0.440%	0.422%	0.086%	0.036%		0.003%	0.003%							
157.5	SSE	0.8%	20.8%		0.285%	0.346%	0.114%	0.041%	0.020%	0.003%								
180	S	1.1%	21.9%		0.338%	0.460%	0.168%	0.066%	0.028%	0.005%			0.003%					
202.5	SSW	2.2%	24.1%		0.702%	0.913%	0.358%	0.163%	0.064%	0.013%	0.005%							
225	SW	4.1%	28.2%		0.519%	1.312%	0.994%	0.661%	0.297%	0.226%	0.051%	0.010%	0.005%					
247.5	WSW	10.9%	39.0%		1.147%	3.216%	2.278%	1.996%	1.200%	0.653%	0.264%	0.074%	0.036%	0.005%	0.005%			
270	W	25.2%	64.2%		2.464%	6.349%	5.133%	4.884%	3.165%	2.153%	0.572%	0.211%	0.117%	0.043%	0.041%	0.013%	0.008%	0.003%
292.5	WNW	15.3%	79.5%		2.087%	4.131%	3.351%	2.520%	1.599%	1.078%	0.249%	0.117%	0.066%	0.033%	0.025%	0.008%	0.008%	0.003%
315	NW	9.2%	88.7%		2.174%	3.882%	1.775%	0.859%	0.305%	0.153%	0.046%	0.028%	0.008%	0.003%				
337.5	NNW	5.6%	94.3%		1.752%	2.771%	0.658%	0.287%	0.107%	0.043%	0.005%	0.013%						
360	N	5.7%	100.0%		2.303%	2.733%	0.481%	0.114%	0.023%	0.013%								
Cumulative %				0.005%	20.49%	34.30%	18.42%	12.87%	7.249%	4.543%	1.233%	0.463%	0.234%	0.084%	0.071%	0.020%	0.015%	0.005%

5.3.2 Rainfall Characteristics

Vandhoo is located in the northern region where the average rainfall tends to be less than southern regions of Maldives. This is corroborated by the weather records from the closest weather station, Hanimaadhoo and weather station in the South, S. Gan. Rainfall records indicate that the average annual rainfall is 1697.3 mm (Standard deviation of 251.0 mm) and mean monthly rainfall is 141.4 mm (Figure 17).

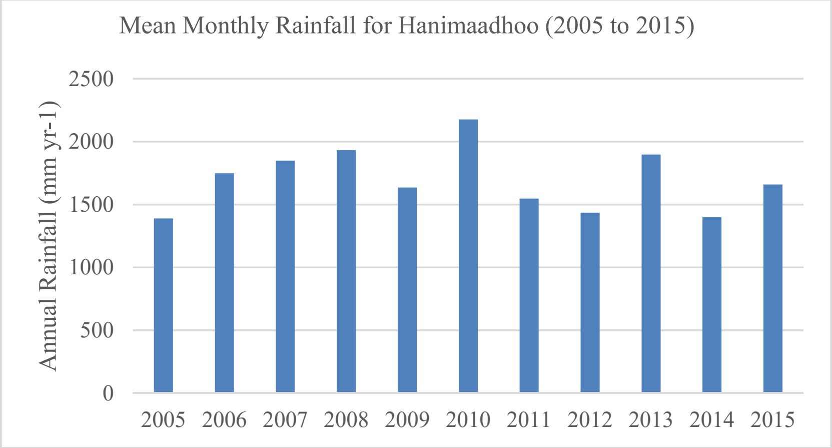


Figure 17. Rainfall pattern for Hanimaadhoo Meteorological Centre (rainfall data provided by Maldives Meteorological Centre)

Intensity Frequency Duration (IFD) Curves was derived from data provided by meteorological department for the period August 2013 to February 2017 (Figure 18). In addition to this, three-hour rainfall data from January 2005 to July 2013 were also used.

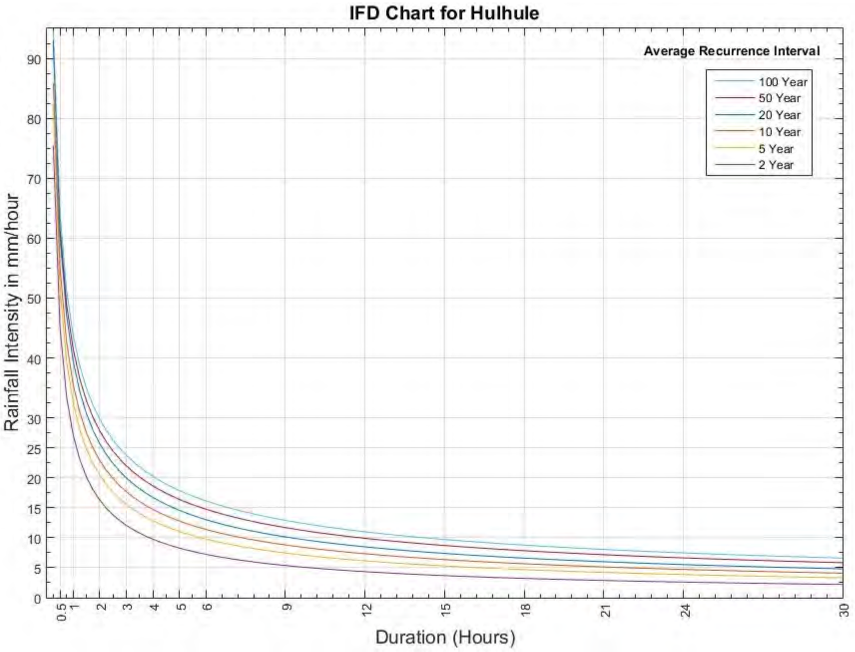


Figure 18. IFD chart for Hulhule (source: Riyan Pvt Ltd, 2017)

5.3.3 Temperature

The Meteorological station at HDh. Hanimaadhoo records temperature on an hourly basis. Data on mean daily temperature was obtained from the station for the period of May 2008 to

December 2012. The whole data set was analyzed to obtain a frequency distribution of daily mean temperature for the given period. Results of this analysis are shown in Figure 19, which shows that temperature in the region was most commonly at temperatures between 28°C and 29°C. The lowest recorded temperature was at 24.2°C while the highest recorded temperature was at 32.5°C.

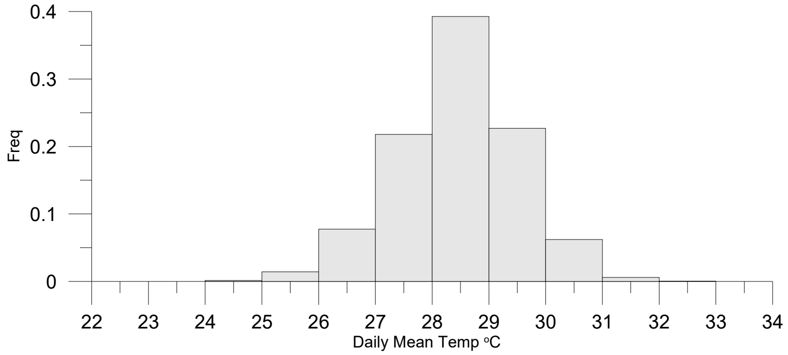


Figure 19. Frequency distribution of daily mean temperature recorded at HDh. Hanimaadhoo station (May 2008 – December 2012)

5.3.4 Waves and currents

Data on wave climate in the Maldives is limited, but ten years of satellite altimetry data on wave climate for the region (Young 1999) indicates that the dominant swell approaches Maldivian archipelago from southerly quarters (Young 1999).

On a seasonal basis, swell is from the south-southwest from March to October with a peak significant wave height (Hs) of 1.8 m in July, and from the southeast from November to February with a minimum mean Hs of 0.75 m in March. These estimates and seasonality in wave height conditions are consistent with independent analysis of a shorter three-year record of satellite altimetry data by Harangozo (1992).

A study carried out in Baa Atoll shows that there is a general reduction in wave energy across the atoll (windward to leeward) in each season. Therefore, there is a wave energy gradient across atolls. There is a shift in dominance from swell to wind-generated wave energy across the atoll. The direction of wind-generated wave energy switches between monsoon periods although oceanic swell propagates from the Southern Ocean throughout the year. The wave energy gradient across the atoll reverses between the west and northeast monsoons.

Kench *et al.* (2006) also reported from the experiments carried out on reef platform scale around the perimeter of reef islands which showed that: -

- Windward shorelines receive greater input of energy through a combination of swell and wind-wave energy.
- Leeward shorelines receive lower total energy input in each season as wind-wave energy is effectively dissipated on windward reef surfaces.
- Swell wave energy is of equal height around reef island shorelines as it refracts around island shorelines.
- Tides act to modulate the amount of wave energy that leaks onto reef surfaces. Greatest wave energy accesses reef island shorelines at higher tidal stages.
- Monsoon seasons promote changes in the areas of a reef island shoreline that receive greatest wave energy.
- Velocities under waves are sufficient to entrain sediment in the near-shore and beach environment under normal energy conditions.

Since site specific wave data is not available for Vandhoo; data collected at a nearby island (located at the eastern periphery as Vandhoo) was used to understand the wave climate of the area. The island of Kudakurathu is proposed for resort development and as part of Environmental data collection; LaMer Pvt Ltd has collected wave and tide data from this island. The island of Kudakurathu is approximately 4.7 km north of Vandhoo (Figure 20 shows location of Kudakurathu and wave gauge). RBR model TWR 2050 was used to collect wave data at 30 min interval burst.

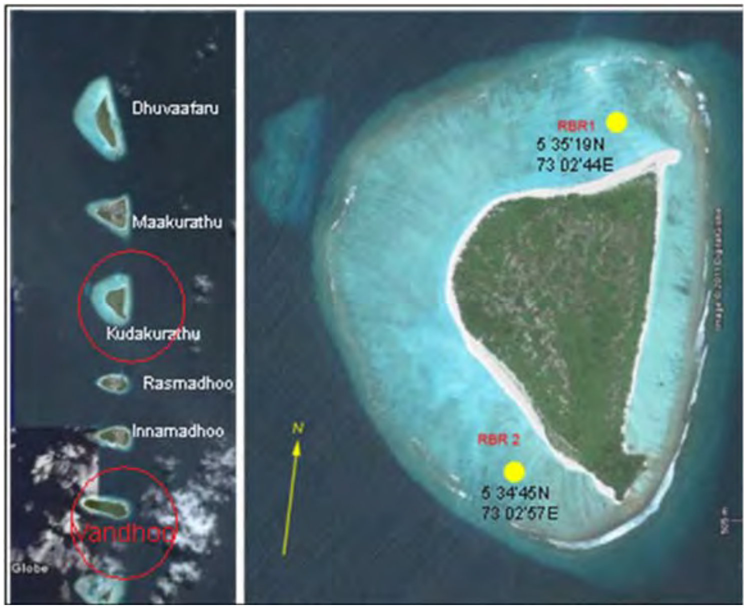


Figure 20. Location of Kudakurathu with respect to Vandhoo and location of wave gauges

The Vandhoo reef system is subject to three main oceanic climate factors. These include diffracted swells, which hit the eastern side of the island (swell waves at "*Baraveli kandu*" sea between greater Thiladhumathee Atoll, Raa Atoll and Lhaviyani Atoll), the southwest monsoon wind waves, and the northeast monsoon wind waves.

Waves play a significant role in the modification of the beach environment and the surrounding. Determining its characteristics is crucial in the designing of harbours, jetties, water bungalows etc. Waves around Kudakurathu were studied using an RBR- gauge deployed in the shallow lagoon on the northern and southern side of the island. Figure 20 shows the location where RBR-gauge was deployed to study the wave characteristics. Water level was sampled at a frequency of 2 Hz for a period of 30 minutes and a total of 3421 bursts were recorded over a period of 15 days. The data is analyzed using the spectral analysis method. Among the various parameters analyzed, following characteristics are highlighted: -

- Significant wave height (Hs)
- Mean period of significant wave heights (Ts)
- Percentage of capillary waves observed
- Percentage of wind waves observed
- Percentage of swell waves observed
- Percentage of infra-gravity waves observed
- Percentage of far-gravity waves observed

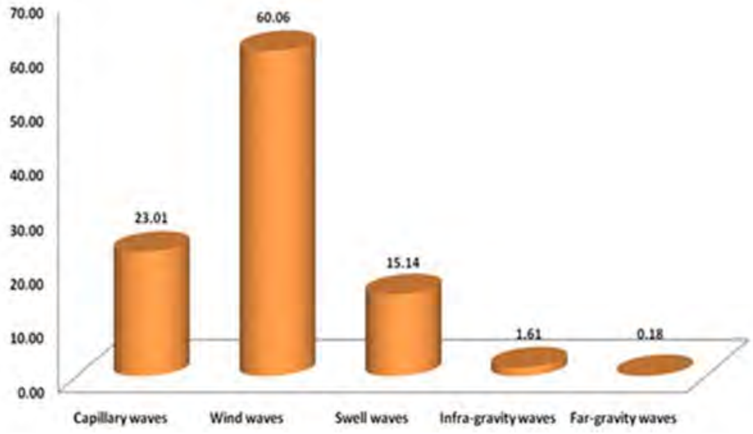


Figure 21. Types of waves observed on the northern side

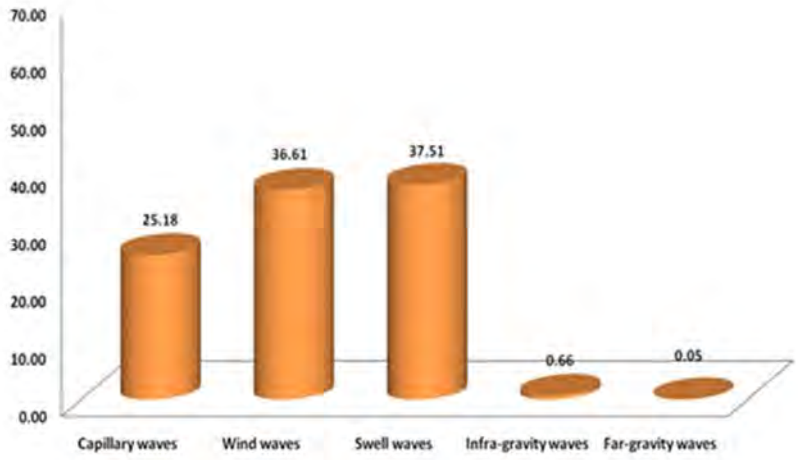


Figure 22. Types of waves observed on the southern side

Figure 21 and Figure 22 shows the types of waves observed during the field visit at the northern side and southern side respectively. Analysis of the results indicates that wind waves are the dominant type (60%) at the northern side of the island while wind (36.6%) and swell waves (37.5%) have a similar share on the southern side during the observation period. Probably this share is similar since the opening on the reef flat is more compared to the northern side. These dominant types of wind and swells could be expected since the observations were done undertaken towards the end of the southwest monsoon where high winds and swells are expected.

It could be inferred that in general, the significant wave heights at both the locations are very similar in height at any given time although differences are observed. Significant wave heights vary between 0.1 m – 0.52 m. The mean wave period of the significant waves varies between 2.47 – 5.47 seconds in the north and 1.92 – 5.39 seconds in the south.

The swells breaking at the eastern side also creates a current east to westwards inside the lagoon at the southern and northern side of the island. Surface current which is associated with the monsoonal wind waves are strongest during the NE monsoon since swell, wind waves and current associated with tidal flux are combined. During the NE monsoon, wind wave induced currents will be flowing east to west at the channels, which will be coupled with swell induced currents. During the SW monsoon, wind wave induced currents will be in the direction of west to east and northwest to east (see Figure 23 for assumed current regime at Vandhoo reef system based on wind data).

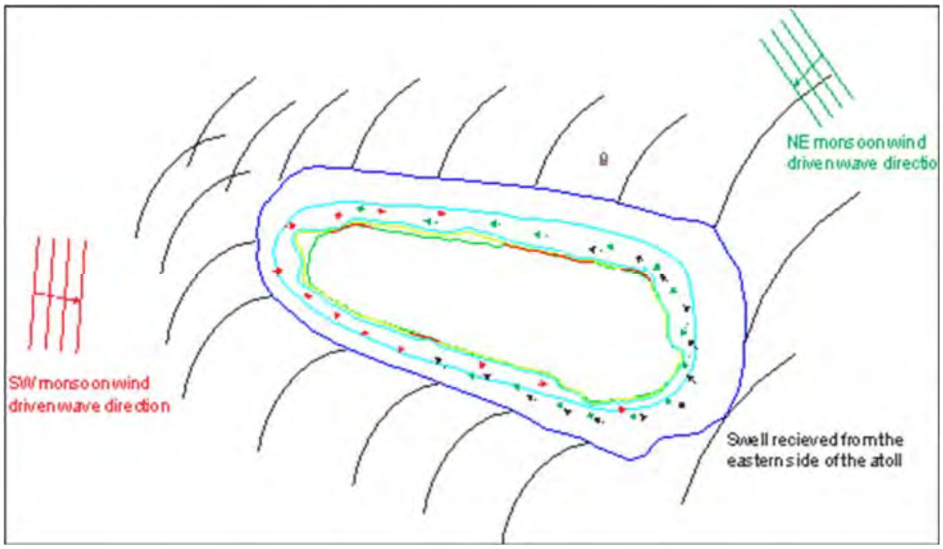

NE monsoon wind driven wave directio
SW monsoon wind driven wave direction
Swell recieved from the eastern side of the atoll

Figure 23. Assumed current regimes around the Vandhoo (colour of arrows represents wave types that generates current)

5.3.5 Tides

All coastal development projects require determination of the water level or water datum. The tide which consists of a number of wave forms, termed tidal constituents, generate many different water levels that are used as different datums. The most commonly used tidal datum in the Maldives is the Mean Sea Level (MSL). The Consultancy Team assumes that the astronomical tide at Vandhoo is the same as that at Hanimaadhoo (closest tide station – Figure 24).

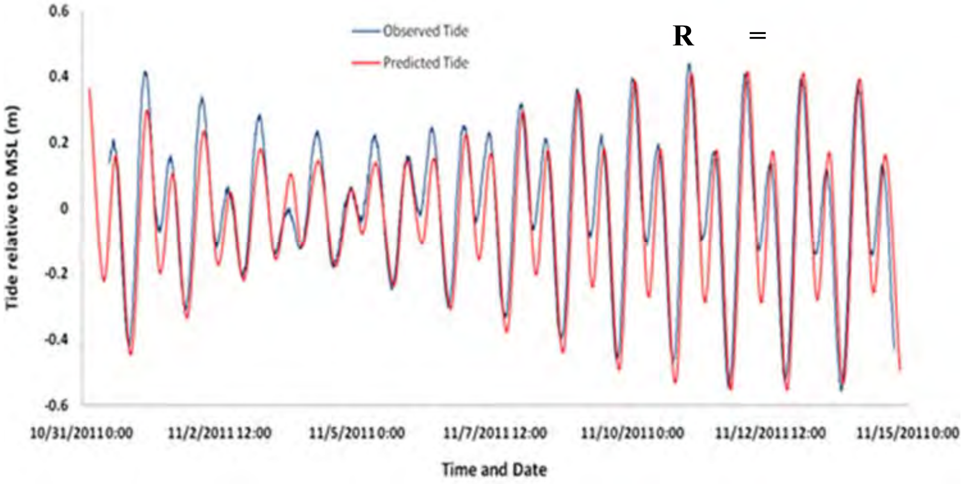


Figure 24. Tide measured by the tide gauge and the superimposed predicted tide

Long-term water-level records for Hanimadhoo are available from the website of University of Hawaii. Analysis of the long-term tidal records from Hanimadhoo (November 2002 to November 2007) indicated that the tide at Hanimadhoo is a mixed diurnal – semi diurnal tide with a dominant lunar semidiurnal constituent followed by the Luna-solar declinational diurnal constituent (Figure 25 and Figure 26). The diurnal constituent of the tide at Hanimadhoo is 23% greater than the second largest constituent (Luna solar declinational diurnal constituent) (Table 11 and Table 12).

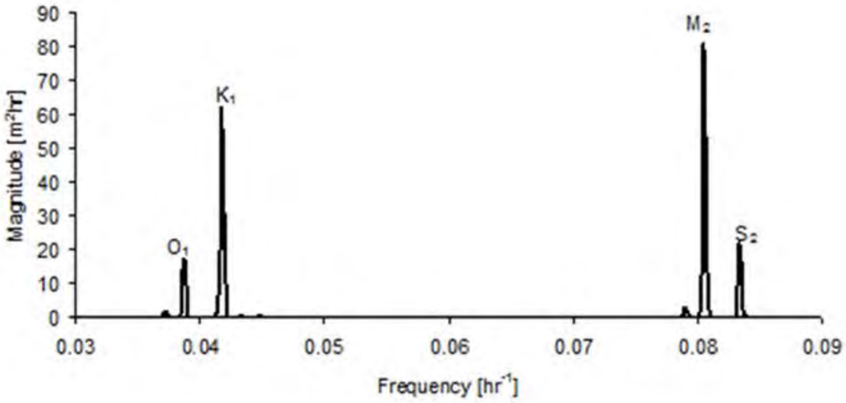


Figure 25. Spectral density for the tide of Hanimaadhoo

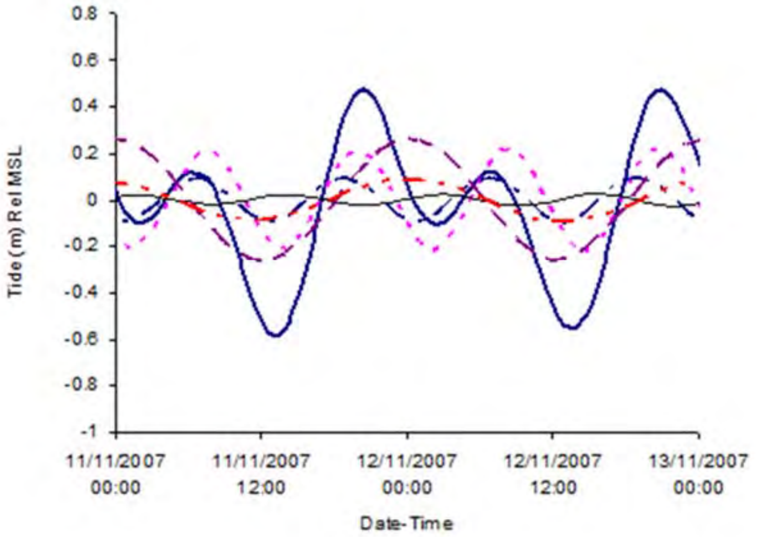


Figure 26. Time series plot of the dominant constituents of the tide at Hanimaadhoo showing the significance of each of these constituents in the tidal signal

Table 11. Magnitude of the dominant tidal constituents for the tide at Hanimaadhoo

Tidal Constutuent	Magnitude
M_2 - Principal lunar semidiurnal constituent	80.84
S_2 – Principal solar semidiurnal constituent	21.68
N_2 - Larger Lunar elliptic semidiurnal constituent	2.92
K_1 - Luni-solar declinational diurnal constituent	62.34
O_1 - Lunar declinational diurnal constituent	16.94

Table 12. Summary of tide levels at Hanimaadhoo, Hdh Atoll (nearest tide station)

Tide Level	Water level reference to mean sea level (m)
Highest Astronomical Tide (HAT)	0.56
Mean Higher High Water (MHHW)	0.26
Mean Lower High Water (MLHW)	0.06
Mean Sea Level (MSL)	0
Mean Higher Low Water (MHLW)	-0.34
Mean Lower Low Water (MLLW)	-0.54
Lowest Astronomical Tide (LAT)	-0.74
Maximum Tidal Range	1.32

5.3.6 Beach profiles

Beach profiles at P01 showed that the beach height had remained relatively stable between 0.9 m to 1.8 m. Sediment loss was observed at beach berm since baseline (Feb 2012). However, beach length was observed to have increased, indicating that the beach at this location had flattened (Figure 27).

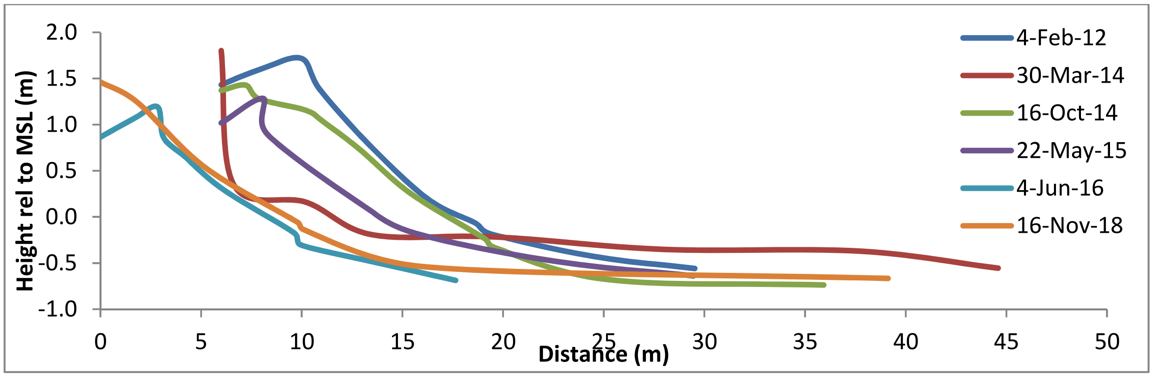


Figure 27. Beach profile P01 (old 02) showing shoreline characteristics from February 2012 to November 2018 at Vandhoo.

Beach accretion was observed at profile P02 area. Seasonal loss and gain of sand were clearly visible at this area, i.e. beach erosion was observed on March 2014 since Feb 2012. Beach accretion was observed on Oct 2016 and major erosion was observed on May 2015 which accreted on June 2016 yet again. Most significant increase in beach volume in terms of beach height and length was observed during the current survey period (Nov 2018) (Figure 28).

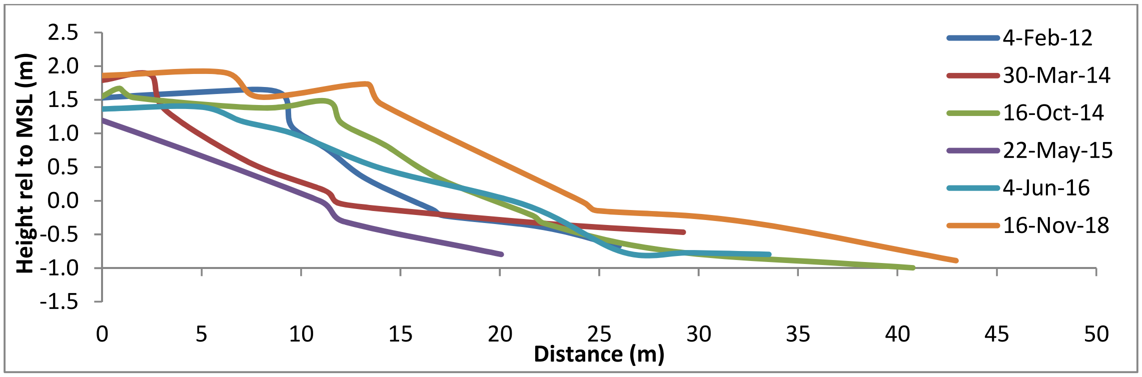


Figure 28. Beach profile P02 (old 01) showing shoreline characteristics from February 2012 to November 2018 at Vandhoo.

A similar trend in seasonal gain and loss of beach material was observed at P03 as well. Beach profile analysis further showed a significant increase in beach height and length compared to the baseline and monitoring dates (Figure 29).

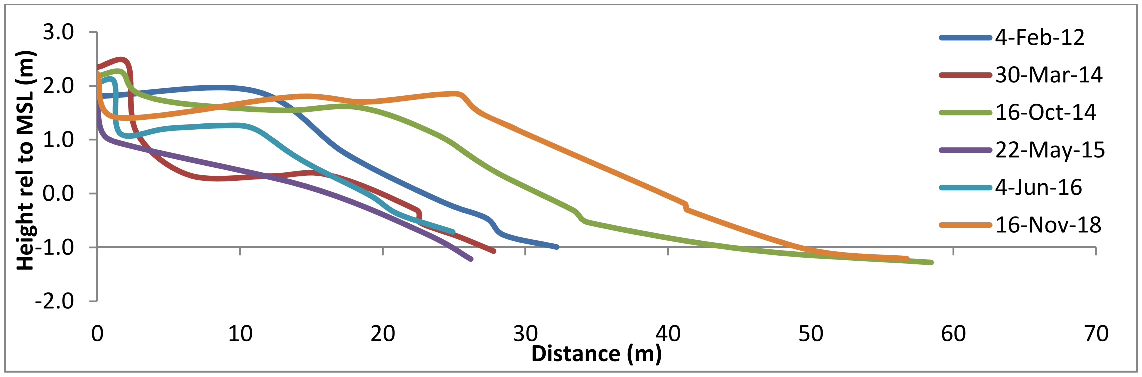


Figure 29. Beach profile P03 (old 05) showing shoreline characteristics from February 2012 to November 2018 at Vandhoo.

New beach profiles were established at locations P04 to 06. Beach height at these locations were between 1.5 to 2.0 m and beach lengths were between 24 and 33 m (Figure 30 to Figure 32).

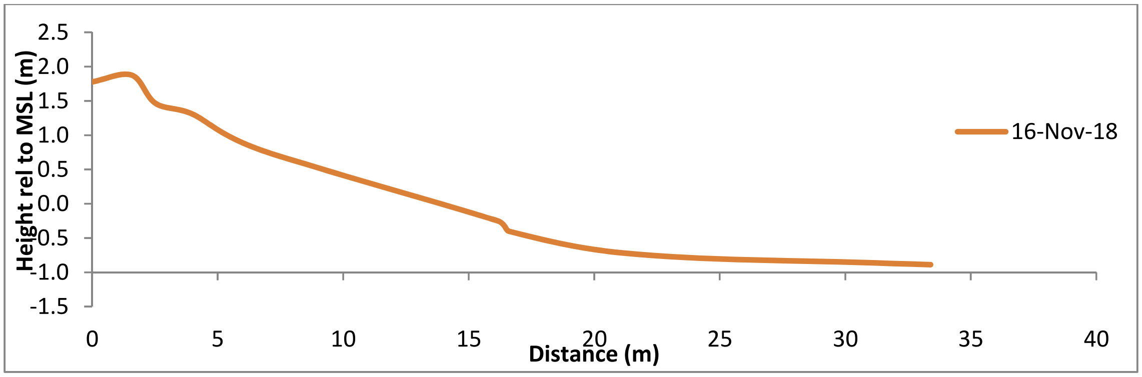


Figure 30. Beach profile P04 showing shoreline characteristics on November 2018 at Vandhoo.

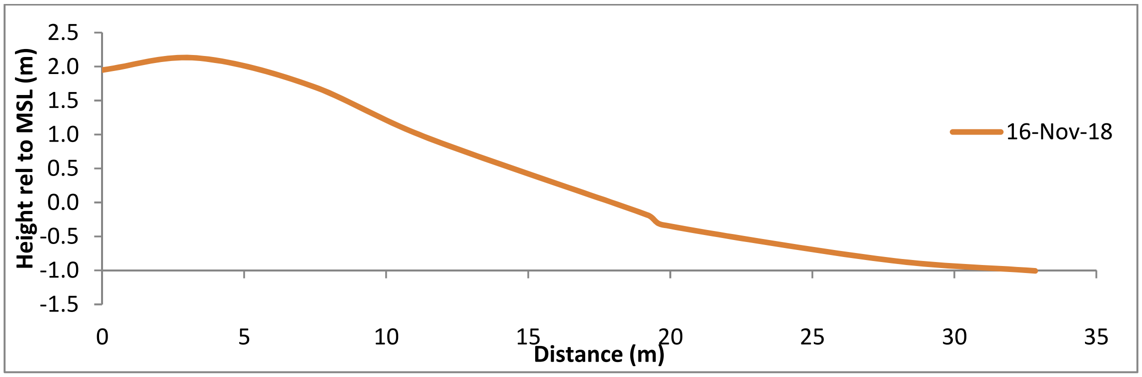


Figure 31. Beach profile P05 showing shoreline characteristics on November 2018 at Vandhoo.

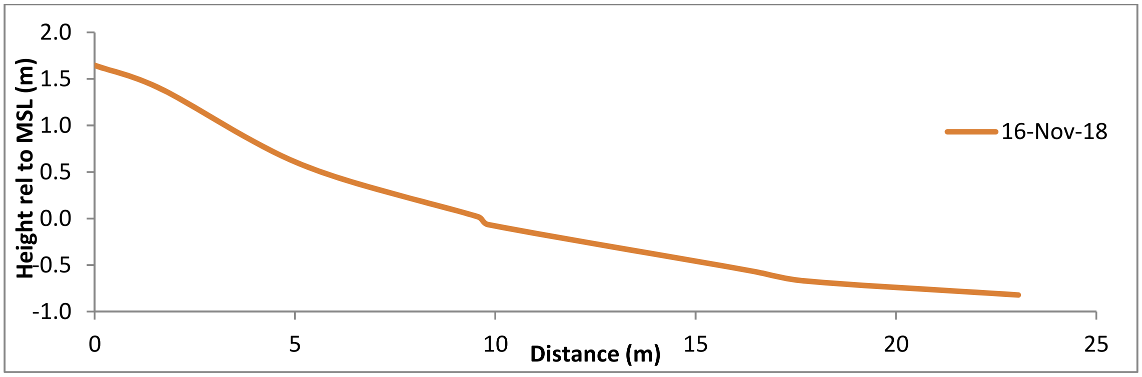


Figure 32. Beach profile P06 showing shoreline characteristics on November 2018 at Vandhoo.

5.3.7 Shoreline survey

In addition to the shoreline survey carried out during this survey period (Nov 2018), shoreline surveys during the monitoring period from December 2011 to June 2016 were used to further analyze the beach movement around the island. Seasonal movement of beach material at the western tip of the island is very prominent from the shoreline analysis.

Shoreline survey maps are attached on Appendix 11 of this report.

5.3.8 Description of aquifer

Riyan and NIRAS (2012) gives a thorough description of the groundwater aquifer, as a part of the description of the existing environment of the island prior to project commencement. This section of the report has been directly sourced from Riyan and NIRAS (2012).

Groundwater occurs in the form of 'freshwater lenses' on atoll islands all over the world including islands in the Maldives. These freshwater lenses are an important and valuable source of water supply both to the ecology and domestic use. Freshwater lenses are highly susceptible to saline intrusion as a result of excessive extraction and vulnerable to various types of pollution from surface and sub-surface waste disposal, particularly from leachates, solid waste and leaks from sewage disposal systems. On some islands, they are also vulnerable to saline intrusion as a result of overtopping from tidal surges and other similar flooding (Riyan and NIRAS, 2012).

Freshwater lens conditions in selected islands of the Maldives have been described in a number of groundwater investigation reports (e.g. Falkland; 2000, 2001a, 2001b, 2004 and GWP; 2005, 2006). These reports are based on extensive investigations including drilling, geophysical surveys and well surveys to assess the occurrence and behaviour of freshwater lenses. The investigations revealed that there are considerable variations in thickness, area and volume of freshwater lenses between the islands. Some islands show quite thick and extensive freshwater zones, while others have very small and thin freshwater zones (Riyan and NIRAS, 2012).

Detailed studies on other atolls in the Pacific and Indian Oceans, including extensive coring on the Cocos (Keeling) Islands in the Indian Ocean (Woodroffe and Falkland, 1997), have commonly found the existence of two layers of sediments. A geological unconformity, separating these two layers at typical depths of 10-15 m below mean sea level, is one of the main controls to freshwater lens thickness. The freshwater zone is mainly or solely contained in the relatively low permeable coral sediments as mixing of freshwater and seawater occurs readily in the high permeability limestone. Based on limited coring on Addu atoll, similar conditions were found on that atoll (Falkland, 2000). Hence, it would be expected that similar conditions apply throughout the islands of the Maldives including Vandhoo (Riyan and NIRAS, 2012).

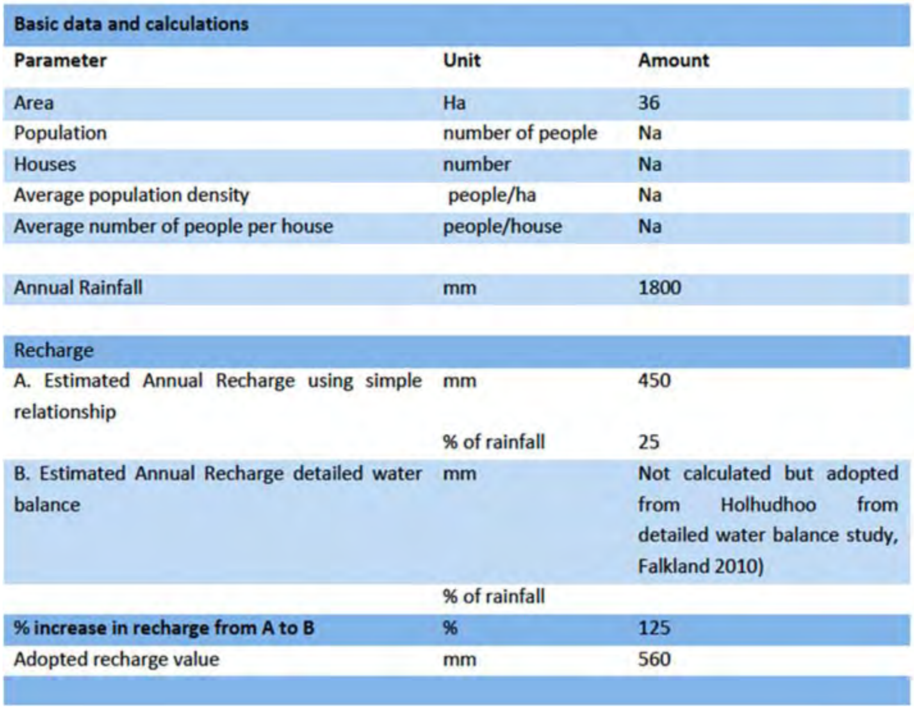
In addition to the vertical variation in permeability, there is often an across-island variation in permeability. Often finer sediments with lower permeability accumulate on the more tranquil side of the island while coarser, higher permeability sediments are found on the more exposed shorelines. In this context, exposed shorelines are those that are most affected by storms and wave action. Where finer sediments are found, the freshwater lens tends to be thicker due to less mixing of fresh and saline water than in coarser sediments. For this reason, wells at a given distance from the more tranquil shoreline tend to have lower salinity than wells at the same distance from the more exposed shoreline (Riyan and NIRAS, 2012).

The water balance estimation data from initial ESIA for Vandhoo RWMF is summarized in Table 13. The estimation was made based on annual rainfall estimate per year from the nearest meteorological center at Hanimaadhoo which was valued at1800 mm/year (Riyan and NIRAS, 2012).

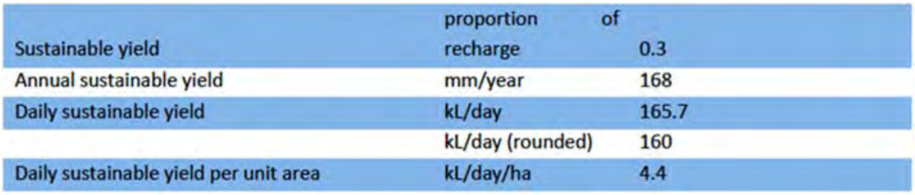
An exponential relationship between the ratio of the lens thickness and the annual rainfall and the logarithm of the island width is given as:

$H = p (6.94\log W-14.39$
H= Depth of the freshwater-seawater interface (m)
P = Annual rainfall rate (m/y) = 1.8
W = island width (m) = 350
Based on this relationship the depth or the thickness of the freshwater lens is estimated as 6m.

Table 13. Water balance calculation for Vandhoo (Sourced from Riyan and NIRAS, 2012)



Basic data and calculations		
Parameter	**Unit**	**Amount**
Area	Ha	36
Population	number of people	Na
Houses	number	Na
Average population density	people/ha	Na
Average number of people per house	people/house	Na
Annual Rainfall	mm	1800
Recharge		
A. Estimated Annual Recharge using simple relationship	mm	450
	% of rainfall	25
B. Estimated Annual Recharge detailed water balance	mm	Not calculated but adopted from Holhudhoo from detailed water balance study, Falkland 2010)
	% of rainfall	
% increase in recharge from A to B	%	125
Adopted recharge value	mm	560



Sustainable yield	proportion of recharge	0.3
Annual sustainable yield	mm/year	168
Daily sustainable yield	kL/day	165.7
	kL/day (rounded)	160
Daily sustainable yield per unit area	kL/day/ha	4.4

5.3.9 Bathymetric survey

Bathymetric survey at Vandhoo reef was done at the proposed brine and sewer outfall area at the southern side of the island. Bathymetric survey shows that the depth of lagoon area where outfall pipes will be laid ranges between -0.6 m to -4 m from MSL (see Appendix 11 for bathymetric survey map).

5.4 Biological environment

5.4.1 Vegetation survey

Vegetation survey shows that a thick coconut grove exists at the areas proposed for most development plots. Island vegetation consists of plant typically found in Maldivian soil. Table 14 below shows the number and names of plants required to be cleared from the footprint areas. It is estimated that about 18.5 % of vegetation will need to be cleared from the existing vegetation. Building / road footprint areas which require vegetation clearance to develop the plots and roads as per the proposed masterplan are indicated on Figure 33.

Table 14. Number and names of plants which fall into the building/road foot print areas

Block	**Name of plant**	**Scientific name**	**Local Name**	**Foot print Area**	**Qty (nos)**
Accommodation	Pandanus tree	*Pandanus tectorus/ P.zeylanicus*	Boa-kashikeyo	10,505 m^2	7
	Coconut palm	*Cocos nucifera*	Dhihevi ruh	Thick growth of Sea hibiscus (shrub form spreading at large area), Pandanus patches and Sea lettuce within the block	23
	Sea hibiscus	*Hibiscus tiliaceus*	Dhigga		10
	Corkwood	*Ochrosia borbonica*	Dhun'buri		2
	Sea lettuce	*Scaevola taccada*	Magoo		1
	Country Almond	*Terminalia catappa*	Midhili		22
	Nit pitcha	*Guettarda speciosa*	Uni		13
Block 11 (waste management, bulk storage)	Pandanus tree	*Pandanus tectorus/ P.zeylanicus*	Boa-kashikeyo	27,125m^2	19
	Coconut palm	*Cocos nucifera*	Dhihevi ruh	Thick growth of Sea hibiscus (shrub form spreading at large area), Pandanus	169
	False Elder	*Premna obtusifolia/syn.p. acuminata*	Ginaveli		1
	Sea hibiscus	*Hibiscus tiliaceus*	Dhigga		9
	Corkwood	*Ochrosia borbonica*	Dhun'buri		1

	Alexander Laurelwood	*Calophyllum inophyllum*	Funa	patches and Sea lettuce within the block	16
	Sea lettuce	*Scaevola taccada*	Magoo		1
	Country Almond	*Terminalia catappa*	Midhili		64
	Banyan tree	*Ficus benghalensis*	Nika		1
	Nit pitcha	*Guettarda speciosa*	Uni		21
Utility Block	Pandanus tree	*Pandanus tectorus/ P.zeylanicus*	Boa-kashikeyo	5,014 m^2 Predominantly Coconut palms	5
	Coconut palm	*Cocos nucifera*	Dhivehi ruh		81
	Sea hibiscus	*Hibiscus tiliaceus*	Dhigga		2
	Country Almond	*Terminalia catappa*	Midhili		10
	Nit pitcha	*Guettarda speciosa*	Uni		1
Consultant Accommodation	Coconut palm	*Cocos nucifera*	Dhivehi ruh	422 m^2	1
	Nit pitcha	*Guettarda speciosa*	Uni		1
	Alexander Laurelwood	*Calophyllum inophyllum*	Funa		1
Roads	Pandanus tree	*Pandanus tectorus/ P.zeylanicus*	Boa-kashikeyo	10,400 m^2 Thick growth of Sea hibiscus (shrub form spreading at large area), Pandanus patches and Sea lettuce within the block	12
	Coconut palm	*Cocos nucifera*	Dhivehi ruh		126
	False Elder	*Premna obtusifolia/syn.p. acuminata*	Ginaveli		1
	Sea hibiscus	*Hibiscus tiliaceus*	Dhigga		13
	Alexander Laurelwood	*Calophyllum inophyllum*	Funa		1
	Jack in the Box tree	*Hernandia nymphaeifolia*	Kin'bi		2
	Sea lettuce	*Scaevola taccada*	Midhili		2
	Country Almond	*Terminalia catappa*	Midhili		31

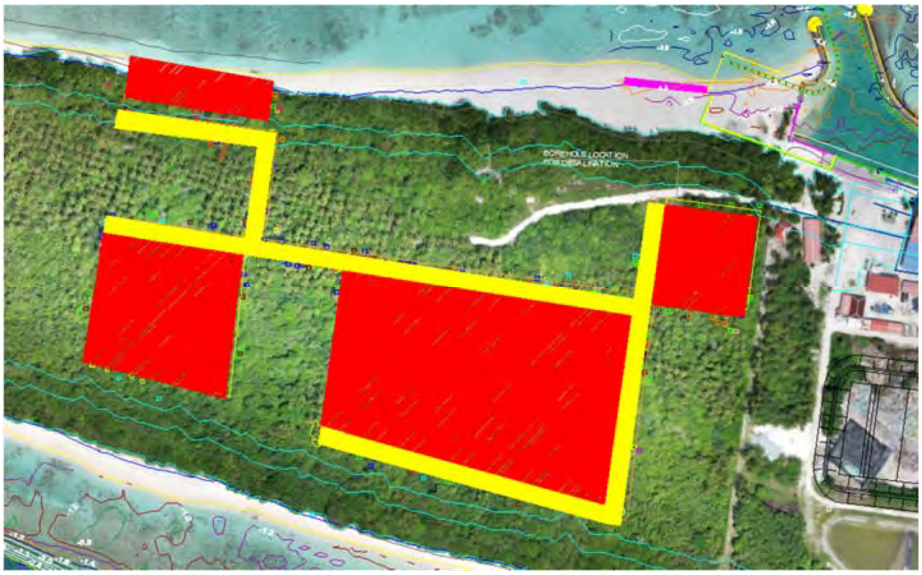


Figure 33. Areas which require vegetation clearance to develop the plots (red) and roads (yellow) as per the proposed master plan

5.4.2 Terrestrial fauna

Visual observations of several bird species commonly found in the Maldives were identified during the field visit. These include crows, common sandpiper, asian koel, white-tailed tropic bird, grey heron, white-breasted waterhen, whimbrel and cattle egret. In addition to birds, mammals observed include fruit bats and mice as well as presence of rats were obvious from rat-eaten coconuts.

Since Vandhoo is identified as a turtle nesting site, evidence of turtle nesting sites was assessed by walking on the beach and visually inspecting the beach for signs such as nesting pits and turtle crawls. As such, about 4 turtle nesting pits were observed during the site visit in November 2018. Absence of tracks at these pits indicated that the pits were about few weeks to few months old. Human exploitation was observed at all 4 pits. The nesting pits were not necessarily confined to the turtle conservation area identified in the Masterplan (Appendix 4), but rather, the nesting pits were observed all around the island.

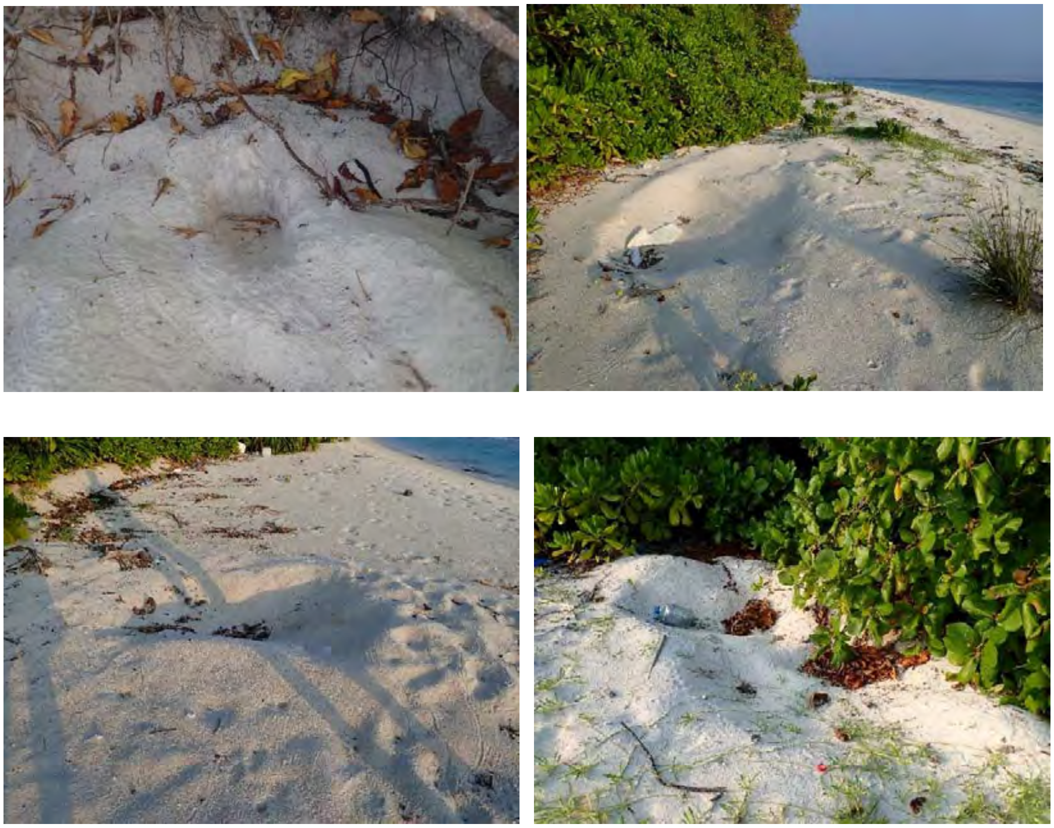


Figure 34. Evidence of turtle nesting pits observed at Vandhoo

5.4.3 Soil characteristics

The soils of the Maldives are geologically young and consist of substantial quantities of the coral reef-based material, coral rock and sand that are not weathered. In most of the places, soils are coarse in texture and shallow in depth with a top layer of brown soil (0 to 50 cm in depth) followed by a transition zone on top of the underlying parent material of coral reef limestone (MFAMR, 1995). In many places, top layers of the soils have a weakly developed structure and at times a 30 cm thick hard-pan layer cemented with calcium carbonate is present, preventing penetration of the roots of most plants except large trees. The water-holding capacity of the soil is very poor due high porosity and very high infiltration rates.

Soils are generally alkaline with pH values between 8.0 and 8.8. This is mainly due to the presence of excess calcium and soils containing higher levels of humus, as in depressions and lagoons, are less alkaline. The soils are generally poor and deficient in nitrogenous nutrients, potassium and several micronutrients particularly iron, manganese and zinc. Though the phosphorus content of the soils is high it is present mostly in the form of calcium phosphate and, thus, remains unavailable to plants (Riyan and NIRAS, 2012).

5.4.4 Groundwater quality

Water quality results were compared with the reference ranges specified for groundwater by the EPA, Maldives (Table 15). Among the parameters tested only a few guideline values are specified by the EPA of Maldives. pH remained within the reference range at all sites. Total Dissolved Solids (TDS), Conductivity and sulphate levels were higher than the reference range at site named “well”. The site is located near the shore (Figure 14) which explains the higher concentrations of all the parameters than the rest of the sites tested (Table 16 and Table 17).

Table 15. Optimal conditions for drinking water as specified by EPA, Maldives (source WHO)

PARAMETER	REFERENCE RANGE
PH	6.5-8.5
Physical Appearance	Clear and colourless
Conductivity	< 1500 µS/cm
Total Dissolved Solids	<1000 mg/l
Sulphates	<250 mg/l

Table 16. Insitu water testing data at the three groundwater sampling sites taken using the Hanna HI 9820 multi-probe, taken during November 2018 ESIA survey.

Parameter	Site		
	Bore well East	Bore well West	Well
Temperature (°C)	28.63	28.73	29.09

pH	7.64	7.53	7.38
Conductivity (µS/cm)	612.70	439.00	4604.40
Total Dissolved Solids (ppm)	306.40	219.80	2302.30
Salinity (PSU)	0.29	0.21	2.44
Dissolved Oxygen (mg/L)	0.13	0.00	1.06

Table 17. Results of water testing done for water from the three ground water sampling sites tested at the Water Quality Assurance Lab at Malé Water and Sewerage Company Pvt Ltd (full reports attached in Appendix 13).

Parameter	**Site**		
	Bore well East	**Bore well West**	**Well**
Physical Appearance	Pale yellow with particles	Pale yellow with particles	Pale yellow with particles
Total Suspended Solids	285	82	<5 (LoQ 5 mg/L)
Nitrogen Ammonia	0.03	0.46	0.06
Sulphate	<10 (LoQ 10 mg/L)	<10 (LoQ 10 mg/L)	270
Phosphate	0.1	0.12	0.22
Zinc	0.05	0.02	0.04

5.4.5 Reef survey

Hard coral was the dominant form of benthic cover at RS1 and RS2 during the 2014 and 2018 ESIA survey (Table 18). The dominant form of benthic cover at RS3 was rock (Table 18). There was no recently bleached or killed coral at any of the sites during the 2018 survey. Algae and Dead Coral Covered with Algae decreased at RS1 and RS2 between 2014 and 2018.

Table 18. Summary of the benthic cover data taken during the monitoring survey done in 2014 compared with the data taken during the 2018 ESIA survey.

Type of benthic cover	RS1				RS2				RS3	
	2014		**2018**		**2014**		**2018**		**2018**	
	Mean	**SE**	**Mean**	**SE**	**Mean**	**SE**	**Mean**	**SE**	**Mean**	**SE**
Algae	1.53	0.74	0.38	0.13	6.37	2.28	0.38	0.24	1.25	0.63
Hard Coral	60.08	6.07	55.00	0.96	41.63	5.04	31.88	4.21	12.13	3.94
Sponges	0	0	0.13	0.13	0	0	0	0	0.13	0.13
Zoanthids	0.52	0.32	0	0	0	0	0	0	0	0
Macroalgae	0.77	0.77	0	0	0	0	0.25	0.14	0	0
Other life forms	0.77	0.32	0.38	0.13	0.25	0.25	0.25	0.14	0	0
Dead Coral Covered with Algae	1.28	0.57	1.25	0.92	1.28	0.57	2.13	1.26	1.63	0.63
Coralline Algae	18.17	2.95	2.00	0.74	19.22	4.01	1.88	0.97	0.88	0.59

Soft Coral	0	0	0	0	0	0	0	0	0.13	0.13
Rock	15.60	3.89	37.00	1.31	27.15	1.08	47.75	4.33	40.63	1.99
Rubble	0.26	0.26	1.75	0.92	1.53	0.74	14.00	1.54	42.38	5.77
Sand	0.51	0.51	2.13	0.38	2.32	1.44	1.50	0.61	0.88	0.24

The mean percentage coral cover decreased slightly at RS1 from 2014 to 2018 and decreased at R2S as well between 2014 and 2018 (Figure 35). During the 2018 survey, the mean percentage coral cover was the lowest at RS3 (Figure 35).

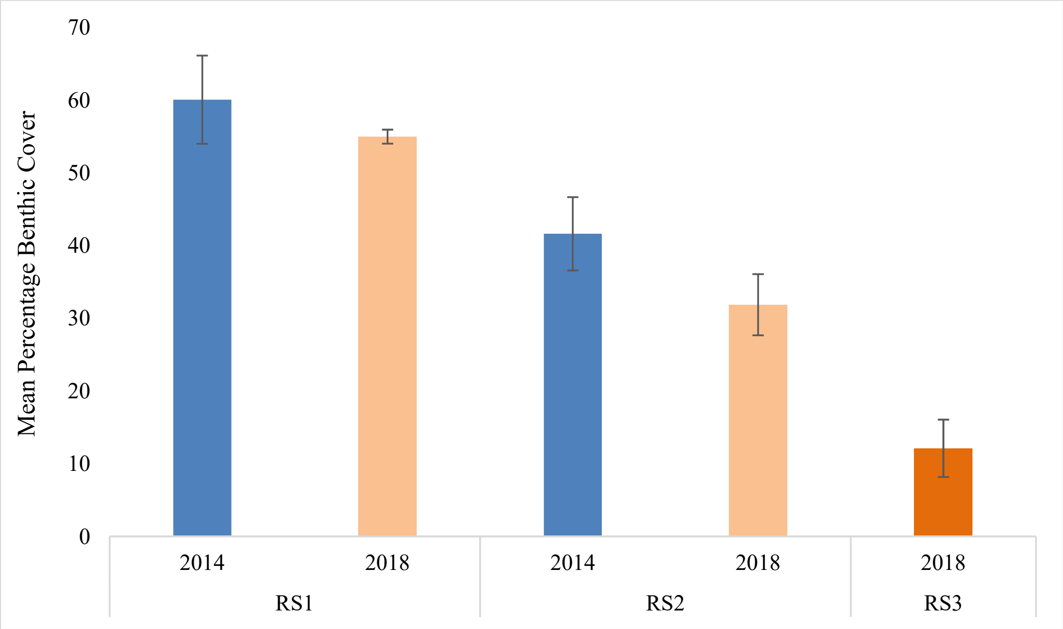


Figure 35. Comparison of mean percentage live coral cover at RS1 and RS2 during the 2014 monitoring survey and the 2018 ESIA survey, and the mean percentage live coral cover at R3 during the 2018 ESIA survey.

Porites (massive) was the most dominant type of coral across all three sites during both the 2014 and 2018 ESIA survey (Figure 36). The mean percentage cover of Porites (massive) increased from 35.71% to 49.75% from 2014 to 2018, and the mean percentage cover of Porites decreased from 34.68% to 29.13% from 2014 to 2018 at R2 (Figure 36). During the 2018 survey, the mean percentage cover of porites was the lowest at R3 at 7.25% which was considerably lower compared to the other two sites. There was no Acropora found at R1 during both survey years and the mean percentage cover was less than 1% at R2 during both survey years and less than 1% at R3 (Figure 36)

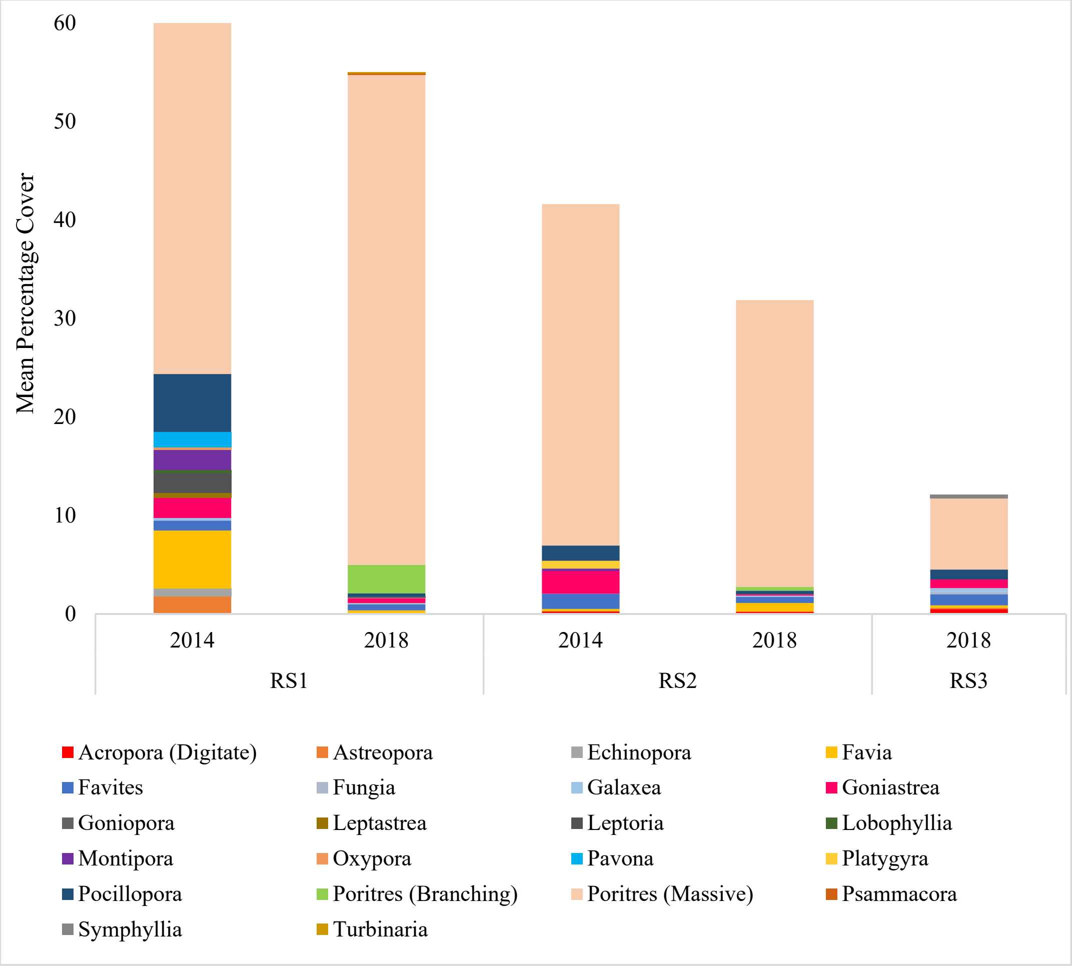


Figure 36. Percentage composition of hard coral at R1 and R2 during the 2014 monitoring survey and 2018 ESIA survey, and the mean percentage live coral cover at R3 during the 2018 ESIA survey.

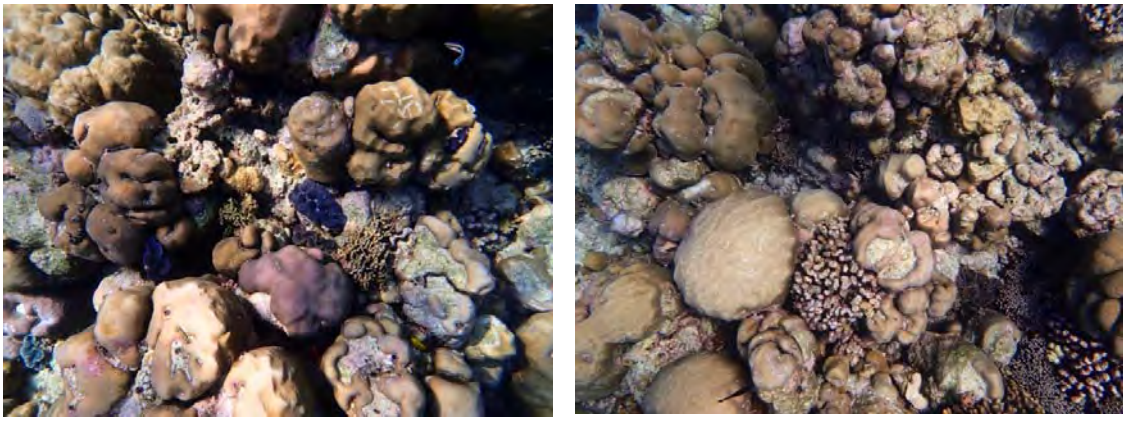


Figure 37. General condition of the reef at site RS1, as of November 2018.

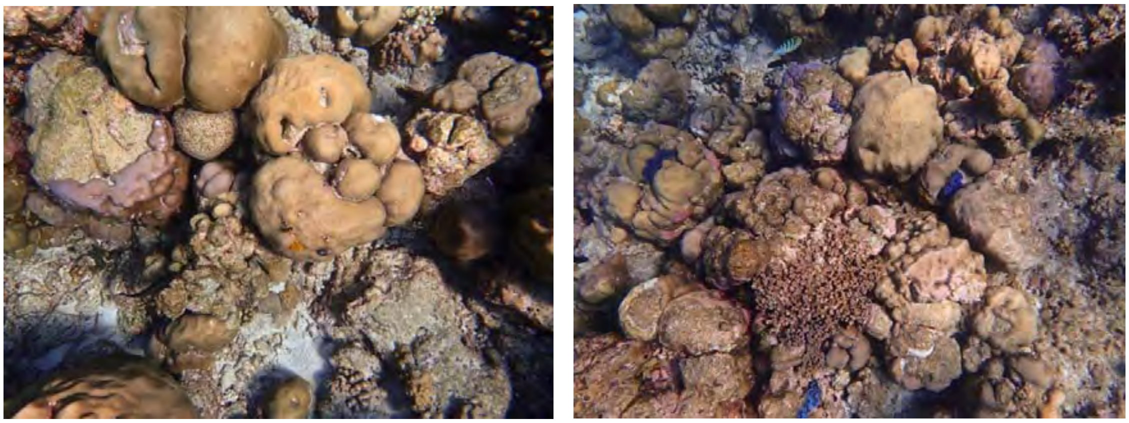


Figure 38. General condition of the reef at site RS1, as of November 2018.

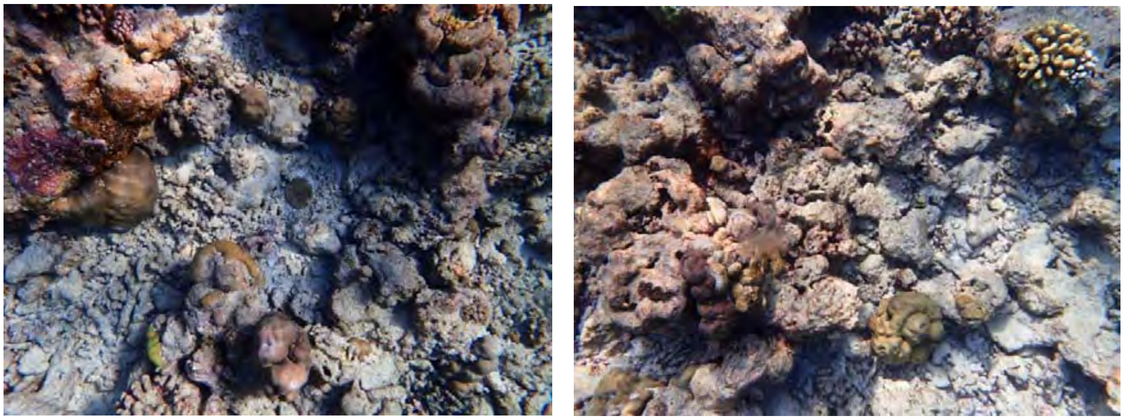


Figure 39. General condition of the reef at site RS1, as of November 2018.

A total of 46 different fish species were seen during the 2014 survey at RS1 whereas the number decreased to 34 in 2018 (Table 19). 43 different fish species were seen during the 2014 survey at RS2 whereas the number decreased to 37 in 2018 (Table 19). 35 different fish species were observed at RS3 (Table 19). There was a decrease of the number of herbivorous fish species observed at RS1 and RS2 between 2014 and 2018, but there was no substantial difference in the number of different carnivorous fish species at these two sites between 2014 and 2018. Overall, at RS1 and RS2, there has been a reduction in the abundance of fish species observed in 2018 compared to 2014. There were no fish species that can be classified as being abundant (A) in RS1 or RS3 during the 2018 survey. *Thalassoma amblycephalum* was the only species that was considered abundant during the 2018 survey at it was observed at RS2.

Table 19. Fish survey data at R1 and R2 during the 2014 and 2018 ESIA survey and the fish survey data at R3 during the 2018 ESIA survey.

Family	*Species*	Functional Group	R1		R2		R3
			2014	2018	2014	2018	2018
Herbivores							
Acanthuridae	*Acanthurus bariene*	Grazer	C	N	C	N	N
Acanthuridae	*Acanthurus dussumieri*	Grazer	C	N	C	N	N
Acanthuridae	*Acanthurus leucocheilus*	Grazer	C	N	C	N	N
Acanthuridae	*Acanthurus leucosternon*	Grazer	C	C	C	C	C
Acanthuridae	*Acanthurus lineatus*	Grazer	A	N	A	N	C
Acanthuridae	*Acanthurus nigricauda*	Grazer	A	N	A	N	R
Acanthuridae	*Acanthurus triostegus*	Grazer	N	N	N	N	R
Acanthuridae	*Ctenochaetus striatus*	Grazer	N	C	N	C	C
Acanthuridae	*Naso brevirostris*	Browsers	A	N	A	N	N
Acanthuridae	*Naso elegans*	Browser	N	N	N	R	R
Acanthuridae	*Naso lituratus*	Browsers	A	N	A	N	N
Acanthuridae	*Naso unicornis*	Browser	N	C	N	N	N
Acanthuridae	*Zebrasoma desjardinii*	Grazer	N	N	N	N	R
Acanthuridae	*Zebrasoma scopas*	Grazer	C	R	C	N	N
Acanthuridae	*Zebrasoma veliferum*	Grazers	R	N	R	N	N
Kyphosidae	*Kyphosus cinerascens*	Browsers	C	N	C	N	N
Scaridae	*Cetoscarus bicolor*	Grazer	C	N	C	N	N
Scaridae	*Chlorurus sordidus*	Grazer	N	R	N	C	C
Scaridae	*Chlorurus strongylocephalus*	Grazer	N	N	N	C	N
Scaridae	*Hipposcarus harid*	Grazer	C	N	C	N	C
Scaridae	*Scarus festivus*	Grazer	C	N	C	N	N
Scaridae	*Scarus frenatus*	Grazer	C	C	C	R	N
Scaridae	*Scarus ghobban*	Grazer	C	N	C	N	N
Scaridae	*Scarus niger*	Grazer	N	R	N	C	R
Scaridae	*Scarus scaber*	Grazer	N	C	N	R	C
Siganidae	*Siganus corallinus*	Grazer	R	N	R	N	N
Siganidae	*Siganus canaliculatus*	Grazer	C	N	N	N	N
Zanclidae	*Zanclus cornutus*	Browser	C	N	C	R	C
Carnivores							
Acanthuridae	*Naso hexacanthus*	Planktivore	C	C	C	N	N
Balistidae	*Balistapus undulatus*	Browser	C	C	C	R	C
Balistidae	*Balistoides conspicillum*	Grazers	R	N	N	N	N
Balistidae	*Melichthys indicus*	Browser	A	C	A	C	C
Balistidae	*Odonus niger*	Browser	A	N	A	N	N
Caesionidae	*Caesio xanthonota*	Planktivore	A	N	A	N	N
Caesionidae	*Pterocaesio chrysozona*	Planktivore	A	N	A	N	N
Chaetodontidae	*Chaetodon melannotus*	Coralivore	C	N	C	N	N
Chaetodontidae	*Chaetodon collare*	Coralivore	N	C	N	R	N
Chaetodontidae	*Chaetodon falcula*	Coralivore	N	N	N	C	C

Chaetodontidae	*Chaetodon guttatissimus*	Coralivore	C	R	C	N	N
Chaetodontidae	*Chaetodon kleinii*	Coralivore	C	N	C	C	R
Chaetodontidae	*Chaetodon lunula*	Coralivore	N	N	N	R	N
Chaetodontidae	*Chaetodon meyeri*	Coralivore	N	N	R	N	R
Chaetodontidae	*Chaetodon triangulum*	Coralivore	N	R	N	N	R
Chaetodontidae	*Chaetodon trifasciatus*	Coralivore	C	C	C	C	C
Chaetodontidae	*Chaetodon bennetti*	Coralivore	N	N	R	N	N
Chaetodontidae	*Chaetodon xanthocephalus*	Coralivore	N	N	N	R	R
Chaetodontidae	*Forcipiger longirostris*	Coralivore	C	N	C	C	N
Chaetodontidae	*Hemitaurichthys zoster*	Planktivore	N	C	N	C	C
Chaetodontidae	*Heniochus pleurotaenia*	Browser	N	N	N	C	C
Diodontidae	*Diodon hystrix*	Browser	N	N	N	N	R
Holocentridae	*Sargocentron microstoma*	Browser	C	N	C	N	N
Labridae	*Bodianus diana*	Browser	N	N	N	N	C
Labridae	*Gomphosus caeruleus*	Browser	N	R	N	R	N
Labridae	*Halichoeres hortulanus*	Browser	N	N	N	R	R
Labridae	*Hemigymnus fasciatus*	Browser	N	R	N	N	N
Labridae	*Labroides dimidiatus*	Browser	N	C	N	R	C
Labridae	*Thalassoma amblycephalum*	Planktivore	N	N	N	A	C
Labridae	*Thalassoma hardwicke*	Browser	N	N	N	C	C
Labridae	*Thalassoma lunare*	Browser	N	R	N	N	N
Lethrinidae	*Gnathodentex aurolineatus*	Browser	A	N	A	N	N
Lethrinidae	*Monotaxis grandoculis*	Browser	C	N	C	N	N
Lethrinidae	*Lethrinus harak*	Predator	R	N	N	N	N
Lutjanidae	*Lutjanus argentimaculatus*	Predator	C	N	N	N	N
Lutjanidae	*Lutjanus Kasmira*	Predator	A	N	A	N	N
Lutjanidae	*Aprion virescens*	Predator	N	R	N	N	N
Lutjanidae	*Lutjanus biguttatus*	Predator	N	C	N	N	N
Lutjanidae	*Lutjanus gibbus*	Predator	A	R	N	C	N
Mullidae	*Parapeneus macronema*	Browser	N	R	N	N	N
Mullidae	*Parapeneus trifasciatus*	Browser	N	N	N	N	R
Pomacanthidae	*Pomacanthus xanthometopon*	Browser	R	N	R	N	N
Pomacanthidae	*Centropyge multispinis*	Browser	R	R	R	N	N
Pomacanthidae	*Pygoplites diacanthus*	Browser	C	R	C	N	R
Pomacentridae	*Chromis opecularis*	Browser	C	N	C	N	N
Pomacentridae	*Chromis ternatensis*	Planktivore	C	N	C	N	N
Pomacentridae	*Chromis viridis*	Planktivore	A	N	A	N	N
Pomacentridae	*Dascyllus aruanus*	Planktivore	C	N	C	N	N
Pomacentridae	*Abudefduf notatus*	Browser	N	R	N	N	N
Pomacentridae	*Abudefduf vaigiensis*	Browser	N	C	N	C	C
Pomacentridae	*Chromis atripectoralis*	Planktivore	C	N	C	N	C
Pomacentridae	*Chromis dimidiata*	Planktivore	N	C	N	C	N
Pomacentridae	*Chromis flavipectoralis*	Planktivore	N	N	N	C	C

Pomacentridae	*Chromis weberi*	Planktivore	N	N	N	C	N
Pomacentridae	*Pomacentrus indicus*	Planktivore	N	C	N	C	C
Pomacentridae	*Pomacentrus philippinus*	Planktivore	N	R	N	R	N
Serranidae	*Aethaloperca rogaa*	Predator	N	C	N	C	N
Serranidae	*Anyperodon leucogrammicus*	Predator	N	N	N	R	N
Serranidae	*Cephalopholis argus*	Predator	N	C	N	C	R
Tetraodontidae	*Arothron meleagris*	Browser	N	R	N	R	N
Tetraodontidae	*Arothron nigropunctatus*	Browser	N	N	N	R	N

5.4.6 Seawater quality

Table 21 shows comparison between baseline (Dec 2011) conditions and current conditions at 2 sites SW1 and SW2 for the parameters tested In-situ. Test results show a slight increase in conductivity, TDS and salinity at both sites, however, not significant. Dissolved oxygen concentration, on the other hand, had increased at SW1 but decreased at SW2.

Optimal conditions specified by EPA, Maldives for sea water are given on Table 20 below.

Table 20. Optimal conditions for seawater quality specified by EPA, Maldives.

PARAMETER	**OPTIMAL RANGE**	**REFERENCE**
TEMPERATURE	18^0C and 32^0C *Changes should not surpass 1^0C above the average long-term maximum	GBRMPA, 2009
PH	8.0-8.3 *Levels below 7.4 pH cause stress	
TURBIDITY	3-5 NTU >5 NTU causes stress	Cooper *et al.* 2008
AMMONIA	Max. 2-3 mg l^{-1} N	UNESCO/WHO/UNEP, 1996
PHOSPHATE	0.005 - 0.020 mg l^{-1} PO_4^-P	UNESCO/WHO/UNEP, 1996
SULPHATE	2 mg l^{-1} and 80 mg l^{-1}	UNESCO/WHO/UNEP, 1996

Comparing the current conditions with that of the reference ranges, it can be observed that pH, turbidity, Nitrogen Ammonia are within the reference range. Sulphate and phosphate concentrations, however, had exceeded the reference value (Table 21 and Table 22).

Table 21. Insitu water testing data at the four seawater sampling sites, SW1-4, taken using the Hanna HI 9820 multi-probe, taken during the November 2018 ESIA survey and February 2012.

Parameter	**Site**					
	SW1		**SW2**		**SW3**	**SW4**
	Dec-11	**Nov-18**	**Dec-11**	**Nov-18**	**Nov-18**	**Nov-18**
Temperature (°C)	28	29.45	29.45	29.14	28.93	26.06
pH	8	8.15	8.15	8.11	8.10	8.11

Conductivity (µS/cm)	50801	51906.00	51906	51820.00	51398.00	48903.10
Total Dissolved Solids (ppm)	25664	25949.00	25949	25908.00	25697.00	24449.76
Salinity (PSU)	33	34.00	34	33.95	33.65	31.91
Dissolved Oxygen (mg/L)	1	1.82	1.82	1.30	0.83	1.41

Table 22. Results of water testing done for water from three sea water sampling sites, SW1-3, tested at the Water Quality Assurance Lab at Malé Water and Sewerage Company Pvt Ltd (full reports attached in Appendix 13).

Parameter	**Site**		
	SW1	**SW2**	**SW3**
Physical Appearance	Clear with particles	Clear with particles	Clear with particles
Total Suspended Solids	<5 (LoQ 5 mg/L)	<5 (LoQ 5 mg/L)	<5 (LoQ 5 mg/L)
Turbidity	0.162	0.156	0.165
Nitrogen Ammonia	<0.02 (LoQ 0.02 mg/L)	0.03	0.03
Sulphate	3550	3400	2850
Phosphate	0.26	0.1	0.08

5.4.7 Environmentally sensitive areas

A small mangrove area exists at the southeastern periphery of the island just below the leachate ponds (Figure 40). This area is preserved and no development activities will reach this area. Moreover, an area of about 42,400 m^2 at the western tip (Figure 40) of the island is preserved for turtle conservation under this project, however, turtle nesting is not necessarily confined to the area marked as a turtle conservation area on Figure 40. Vandhoo was reportedly a nesting site for hawksbill turtles (*Eretmochelys imbricata*) (Riyan and NIRAS, 2012).

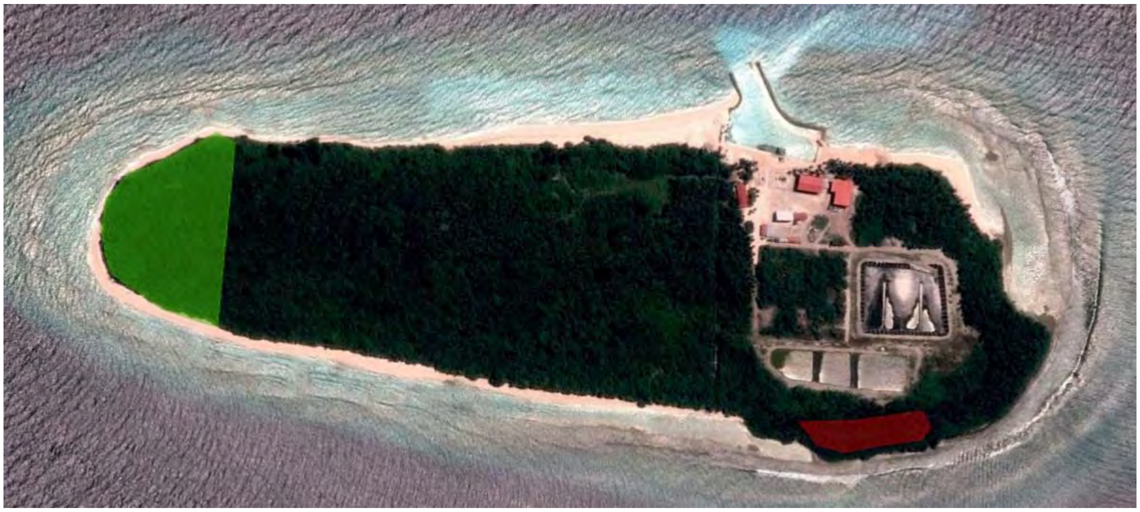


Figure 40. Area with mangrove (red highlight) and turtle conservation area (green highlight).

5.5 Air quality

The proposed upgrade of waste management facility at Vandhoo does not involve installation of new incinerators, although the powerhouse at the facility will undergo an upgrade. Given this scope, while there will be added emissions from the new generators to be installed, these are considered insignificant to the existing conditions at the site, due to waste incineration and other waste management processes. Air quality of the site prior to construction of the RWMF at Vandhoo is discussed in detail in Riyan and NIRAS (2012) (Page A34). For the purpose of this report, air quality at the site will be discussed as sourced from predictions for incinerator emissions in the project ESIA report.

Final choice of incinerator to be installed at the facility had not been decided at the time of ESIA report preparation for the project. Based on the assessment of air emission impacts, it was suggested to install a system with a good Air Pollution Control System which includes Electrostatic Precipitator (ESP) and multiple scrubbers, spray-dryer and baghouse or other similar combinations (Riyan and NIRAS, 2012) and various options for incinerator technology were discussed and are given in the ESIA report for the project, although some were opted out due to economical restrictions.

The USEPA's ISCTS3 Model was used for dispersion modelling to calculate contribution of various pollutants from the incinerator to the background concentrations present in the ambient air at the surroundings. At the time of survey for the main project, no data existed on background concentrations of pollutants of interest in the project area. However, predictions for background concentrations were made based on a study done in Male' and for other remote areas (Riyan and NIRAS, 2012). Table 23 gives emission factors used for best- and worst-case scenarios for the incineration system (sourced from Riyan and NIRAS, 2012).

Table 23. Emission factors used for relevant scenarios with and without APCS implemented for the given parameters (Sourced from Riyan and NIRAS, 2012)

	Unit	**Emission factor**	
		Best case (with APCS)	**Worst case (no APCS)**
PM_{10}	g/sec	0.13	6.34
TSP	g/sec	0.17	8.47
SO_2	g/sec	Not relevant	0.79
NO_x (NO_2)	g/sec	Not relevant	0.83
Dioxins / furans*	Pg I-TEQ/sec	Not relevant	162,037

Furthermore, it was predicted that the stack gas at the time of release would potentially be high (approximately 350°C), for an incinerator without APCS. However, the system at

Vandhoo was planned to have an APCS for particulate matter, which would reduce the temperature to 150ºC.

The study zone for the project EIA was defined within a radius of 6000m from the location of the incinerator. All receptor points were observed to be between 0 to 1m above sea level. Based on the model calculations, Innamaadhoo, about 1.7km to the north of Vandhoo was predicted to have the highest impact, while impact on other islands within 6km radius of Vandhoo was significantly less.

5.6 Noise amenity

Baseline noise measurements for both inhabited and uninhabited islands in the Maldives were established in June 2009 using a calibrated Quest 2200 noise measurement device owned and operated by EPA. The Quest 2200 was field calibrated between recordings and the field calibration device was within its calibration range. Background noise measurements were recorded as 15-minute time weighted averages (LEQ). The highest 10% of the noise measured over a 15-minute period (LA Max) was also taken for each site. Wind speed is taken to be in the range of 15-20 km/h, the temperature around 30°C and conditions fine. The baseline noise measurement results for typical inhabited and uninhabited islands in the Maldives are given in Table 24. Although there may be some seasonal variation with changes in wind strength and direction across monsoons, the noise levels are considered to be typical for most islands (Riyan and NIRAS, 2012).

Table 24. baseline noise measurement results for typical inhabited and uninhabited islands in the Maldives (Riyan and NIRAS, 2012)

Description	dbA (LEQ)	dbA (LAMax)	Influences
Uninhabited island (typical background noise level)	45-46	50	Ambient influences- wave action/ wind action/ bird
Inhabited island harbour (typical daytime noise level)	50-55	62-64	Influences noted for ambient- chatter/ birds/ vehicles (motorbikes)/ wave action Influences noted for maximum range- motor bikes/ vessels entering and existing harbour/ prayer call

Sensitive noise receptors in R. Innamaadhoo and Rasmaadhoo

Given the high per capita populations of islands in the Maldives, and the lack of historical planning mechanisms it is not particularly useful to distinguish noise levels at particular sensitive receptor locations. On both R. Innamadhoo and Rasmaadhoo the school is the only distinguishable potential sensitive noise receptor, however, in both cases the schools are affected by the same background and maximum noise influences as elsewhere on the island. This is to say that any noise contribution made by future activities on R.Vandhoo will influence the island as a whole with no particular effect on the schools (Riyan and NIRAS, 2012).

Noise level at proposed facility on R. Vandhoo

The main noise generating activity from the proposed activity likely to affect background noise levels on the nearest and adjacent island is the operation of the incinerator. The incinerator has a sound power level of 85 dbA. Other activities which may influence the maximum noise levels generated on R. Vandhoo are the operation of the front-end loaders, operation of the generator and tipping of bins. Such activities will be generated routinely during the day but not at night. Although these activities may contribute to the cumulative background noise levels from time to time, they are unlikely to exceed the LEQ sound power level of the incineration plant. Incident noise levels may occasionally be generated such as during maintenance but these are unlikely to significantly contribute to noise nuisance at the nearest or adjacent islands. Nominally maximum (LA Max.) noise levels are given at 95 dbA. Night time noise levels will be limited to the operation of the incinerator as the waste bunker will be filled during the evening in preparation for automatic loading over the night, and ash disposal at the landfill will only occur during daylight hours (Riyan and NIRAS, 2012).

As for the impacts of noise on staff accommodation, the staff accommodation blocks are located away from the incinerator and utility area. Furthermore, a green buffer zone is considered adjacent to the facility operating area which would also act as a noise barrier.

5.7 Socio-economic environment

Aspects such as accessibility, health, population, income etc. covering the project impact area have already been discussed in detail in the initial ESIA-subsection 5.9 (Riyan and NIRAS, 2012) which was also based on the social assessments carried out by GreentTech et.al (2010). Thus, this section briefly discusses the existing landscape and natural features of the island, its visual amenity and its cultural significance.

5.7.1 Natural Features and Landscapes with cultural significance

The island’s strategic location and its dense vegetation are the most significant attributes of the island. The dense vegetation offers many resources that the neighbouring islands were benefitting from. These includes wood, dry coconut leaves, coconut husks, coconuts, other fruits trees such as breadfruits, mango etc. The details of vegetation are presented in subsection

7.4.1 of this report. The island also has a small wetland area at the southern side of the island and Vandhoo is also noted as a turtle nesting site.

5.7.2 Visual Amenity from nearest uninhabited islands

The island still remains to be highly vegetated hence there is no significant change in the visual amenity from the nearest and adjacent inhabited islands. This is mainly because the developments are carried out within a very wide buffer zone surrounding the island.

5.7.3 Cultural/Religious significance

As it was also noted in the initial ESIA, the only potential cultural/archaeological site on Vandhoo is a decomposed gravesite which is not considered to have any important religious, cultural or archaeological significance (Riyan and NIRAS, 2012). Traditionally, up until the development of the RWMF, the island has been used by neighbouring islands for its forest resources and recreation such as going to Vandhoo for picnics.

6 Stakeholder consultation

A stakeholder analysis was carried out during the scoping meeting to identify the relevant stakeholders of the proposed project. It was decided that all the atoll councils of Zone 2, the Ministry of Environment, EPA and the closest inhabited island to the RWMF shall be consulted regarding the project.

All the identified stakeholders were consulted to understand the current status of the RWMF and to discuss the proposed changes to the site. Considering the fact that extensive consultations and studies have already been carried out for the development of Vandhoo as a Regional Waste Management Facility at its initial phase, the current consultations were mainly focused on the upgrade of the project. Through the meetings, the specifics of the proposed project and the current issues faced by the different stakeholders were discussed. Based on the outcomes of the consultations, the possible impacts, both positive and negative were identified (see section 7). Recommendations were then discussed with the project unit on addressing the issues and to minimize the potential negative impacts. The discussions were carried out in the form of focus group discussions and interviews. The flow diagram below (Figure 41) summarises how the consultations were carried out in the order they were carried out and how the outputs shall be incorporated into the project in the different stages of this assessment.

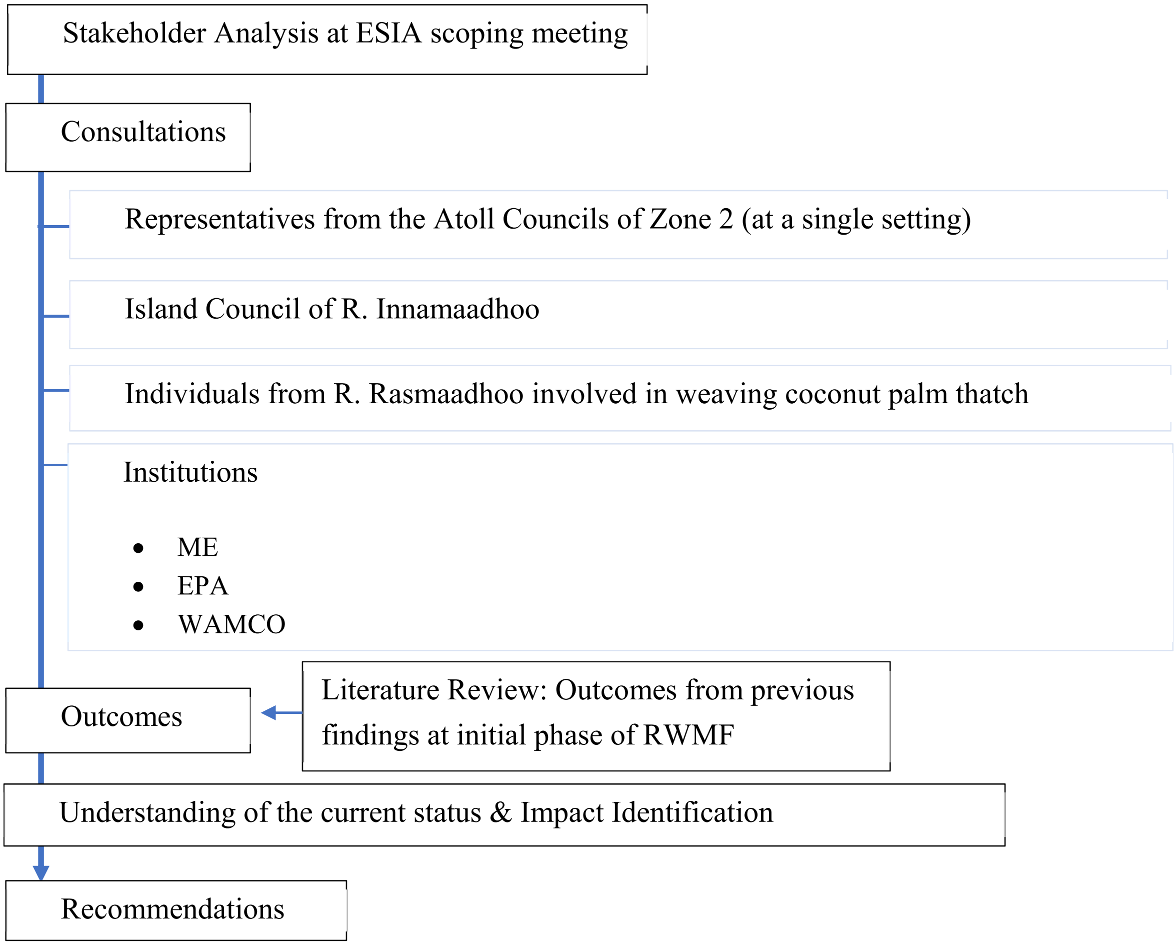

Stakeholder Analysis at ESIA scoping meeting
Consultations
Representatives from the Atoll Councils of Zone 2 (at a single setting)
Island Council of R. Innamaadhoo
Individuals from R. Rasmaadhoo involved in weaving coconut palm thatch
Institutions
ME
EPA
WAMCO
Outcomes
Literature Review: Outcomes from previous findings at initial phase of RWMF
Understanding of the current status & Impact Identification
Recommendations

Figure 41. Stakeholder consultation methodology

6.1 Outcomes from previous findings at initial phase of RWMF

Extensive consultations were conducted (Greentech et al, 2010; SENES et.al, 2010; NIRAS et.al 2012) to understand the environmental and socials aspects related to the development of Vandhoo as a Regional Waste Management Facility at the initial development phase. Below is a summary of these consultations (mostly in regards to the social-cultural findings). The summary also includes findings that are already presented in section 5.9 of the initial ESIA prepared for Vandhoo RWMF (Riyan and NIRAS 2012) as well.

In 2010, a comprehensive social assessment was conducted in 46 islands of north province for solid waste management component of the Maldives Environmental Management (EMP) project. The report presented the situation of solid waste management in the 4 atolls of the north province. The report noted the awareness level of the communities on the social impacts associated with not having an organised solid waste management system (72%) and the economic impacts (54%). The raising issues related to waste management in the islands were discussed in detailed. The assessment also included a willingness to pay survey for a proper waste management system (Greentech et al, 2010).

The public consultations conducted as part of the assessment concluded that awareness/education campaign regarding all aspects of waste management is most necessary at that stage.

Adding to the social assessment, a Best Practicable Environmental Option (BPEO) report was also prepared in the same year (SENES et al,2010). This was carried out "to implement a best practicable option selection process for the RWMF islands and waste technology and to undertake a technical and financial feasibility study for the preferred regional waste management system option at the final selected locations(s)" (SENES et al, 2010, p.1-2). As per this report, R. Vandhoo was selected as the most feasible option to develop the waste management facility for the North Province.

Traditionally R. Vandhoo was used by the communities of the neighbouring islands for agriculture and to gather forestry resources (coconut, wood, and dry coconut leaves). During the time of preparation of the BPOE, R. Vandhoo was under the Atoll Council whereby locals can visit the island on Saturdays with an Island Office official to gather the resources. In addition, some of the communities showed interest to get plots for boat building and others for small scale economic purposes (SENES et al, 2010).

Nevertheless, the communities were generally in favour of establishing the RWMF in Vandhoo provided that they are allowed to conduct their boat building activities at a part of Vandhoo as they have a genuine shortage of land in both Rasmaadhoo and Innamaadhoo and it is not safe to carry our fibre works near the residential areas. They were in favour of a mixed development.

It was also noted in the BPOE that the potential development of Kottafaru Island (2.1km) as a tourist resort may not be aesthetically acceptable if the RWMF would be developed in Vandhoo as recommended.

6.2 Outcomes from current consultations

The above-mentioned studies were conducted as part of the initial development of the RWMF which was prior to any operation of the facility. Further consultations have now been conducted as part of this upgrading project to understand the current issues experienced by the islands during the operation of the facility. Also, the reservations of the island communities regarding the expansion of the facility to use the whole island for the RWMF were also discussed which also reflects some of the findings already stated in the previous reports.

6.2.1 Consultation with Atoll Councils of Zone 2 (Baa, Raa, Lhaviyani & Noonu Atoll) of the Maldives

Consultation with the Atoll Councils was held at the Ministry of Environment on the 19th of December 2018 at 10:30 am. Participants of the meeting are listed in Appendix 11. PMU also participated in this meeting. A brief presentation was provided by the PMU on the background of the project, the current status of the RWMF and the proposed developments. Major concerns highlighted at the consultation meeting are listed below: -

- The current status of the RWMF.
    - It was noted that though there are 45 islands, only 30 islands are under WAMCO and among these 30, for now WAMCO is able to do regular collections from 20 islands
    - The challenges of not fully being able to operate the system were highlighted. These include
        - Segregation of solid waste that has been accumulated for 10 years to 30 years in some islands
        - Irregular monthly-collection due to lack of means of collection
        - Lack of human resources to provide an efficient service
        - Lack of capacity; shortage of vessels and vehicles, shortage of storage, lack of technical capacity
        - 10 islands remained to be registered to the system which has been kept on-hold given the challenges.
- Raa Atoll council noted their disappointment regarding how the island which was leased to the Atoll Council as "*Varuvaa"* by the Ministry of Fisheries was taken back for the development of RWMF without proper consultation/information. Following are some of the concerns raised by the Atoll council of Raa"
    - Even after the initial development of the RWMF in part of Vandhoo, the rest was used by the Atoll council until they were not allowed to enter the island.
    - It was noted that due diligence was not followed in taking back the island and handing over the whole island to Ministry of Environment for development of the facility.
    - Atoll council noted the importance of the forest resources to the neighbouring islands. Eg: Weaving coconut palm thatch by the women of R. Rasmaadhoo was noted as an example as they were earning a good income by selling the thatch works to resorts for Palm Thatch Roofing of their rooms.
    - It was proposed that a possible alternative to Vandhoo shall be provided for these two islands.

    - They also said that although Vandhoo is in Raa Atoll, now the island does not belong to the atoll.
    - Communication gaps, information sharing gaps:
        - It was also noted that although it is under the mandate of the atoll council to maintain the register of the islands in the atoll, they are not informed of the new developments in the islands, notable the uninhabited islands. They only come to know when they see a physical development or when someone is not allowed enter the island.
- All councils were asked to share their concerns regarding the existing waste management system. The issues presented are summarized below:
    - Lack of vehicles at island level to collect waste
    - Lack of a proper waste management system due to lack of capacity
    - The Fee system is not feasible in islands with smaller populations
    - The frequency at which waste needs to be collected from the islands are not met. It was noted by Baa Atoll council that, it takes more than 3 months for the collection of waste from Eydhafushi and other islands of Baa Atoll.
    - Resorts bringing waste to islands, which is not allowed.
    - Issue of composting in islands: not sustainable in most islands due to lack of space and human resources.
    - Just one landing craft is not enough to cater to whole region.
    - Issues regarding how WAMCO has been handling the whole process were raised. All atolls shared a common dissatisfaction over the existing system.
    - Some were concerned about the amount of garbage that will be disposed at Vandhoo and whether this would cause any negative impact to the neighboring islands and its environment.

- ESIA consultant raised the issue of vegetation clearance. Things discussed include:
    - What will happen to the uprooted trees, especially the coconut palms
    - It was noted by PMU that the local islands can take them and replant in their islands and that they will not sell it to other parties
    - It was noted that no plant will be removed from the Turtle conservation zone proposed in the new development

6.2.2 Consultation with R. Innamaadhoo (nearest inhabited island) and R. Rasmaadhoo

Consultation with R. Innamaadhoo Council was held at the island council office on the 23rd of December 2018. Participants of the meeting are listed in Appendix 14. The proposed project was shared with the council and their concerns discussed are as follows:

- Their main concern was that with this new development, they will not be able to get land for boat yard which was already given by the atoll councils before it was decided to develop the whole island.
- They also noted that the people of Innamaadhoo was using the island as a picnic island but now they have lost that opportunity as well- both Rasmaadhoo and Innamaadhoo do not have good enough beaches for the locals to enjoy.
- As for the services provided by WAMCO, they noted that they are yet to get the service and it has been more than a year since they have signed the contract with WAMCO with no avail and Innamaadhoo is the nearest uninhabited island to Vandhoo. Until today they have been practicing open burning, even the waste from the boat yards are disposed this way which is a bigger health hazard.
    - According to WAMCO, at the initial phase Innamaadhoo did not want to get the service and later after the facility was handed over to WAMCO, they have been having challenges in catering all islands. With the new upgrades they hope to provide a better service.

In addition to meeting with Innamaadhoo council, few women of R. Rasmaadhoo who highly depended on the forest resources from Vandhoo for their income generating activities were also consulted to understand how this would impact their livelihood.

- The women of Rasmaadhoo, in every household, are actively involved in weaving as there is a high demand for the coconut leaves thatches from resorts in Raa and Baa atoll. One of the women (Aarifa Hussein) who has been doing this for decades raised her concerns:
    - Previously when they were allowed to go to Vandhoo and bring the forest resources, it was very convenient. But now they do not get enough coconut leaves to cater for the demands as now they have to source it from other islands with limited supply. Also, now they have to buy the leaves. Since there is a high demand for this material, both Innamaadhoo and Kinolhas is not able to meet the demand. It was informed that interested individuals pay in advance to get their supply. Ms. Aarifa noted that they usually have to wait 1 or 2 months to get their supplies. They used to earn approximately MRF 6,000 per month but now they earn MRF 4,000 maximum provided they get a relatively good amount of leaves from the islands. In addition to coconut leaves, they used to collect coconut husks from Vandhoo from which they make coir rope which are used in weaving and sold separately too.

6.3 Consultation with Environmental Protection Agency-EPA

Consultation with EPA was held on the 31st of December 2018. Participants of the meeting are listed in Appendix 14. The concerns raised by EPA that needs to be considered in completing the ESIA and also developing and operating the project are summarised below:

- They noted that all due processes regarding waste management shall be adhered, both in construction and operation phase.
- They were concerned about the water and sewer networks. They noted that both brine outfall and sewer outfall shall be properly anchored to avoid any leakage issue and special consideration needs to be given as a turtle conservation area is located just near the proposed outfall area. As for RO plant, they recommended to have 2 boreholes than 1 proposed for the project.
- They asked about the contingency plans and frequency of transport of waste from the islands to the facility. These are included in the Operation and Management Plan of WAMCO prepared in 2018.
- Rainwater harvesting possibilities were discussed.
- Concerns were raised regarding the extensive vegetation clearance that would be required for the proposed development. They wanted to know the percentage of uprooted vegetation that will be recovered within the island of Vandhoo. These are further discussed in the Section 10 (Project Alternatives).
- Regarding the proposed conservation zone for turtle breeding, emphasis was made on following code of conduct of the conservation guidelines which requires adequate buffer zones, zero disturbance, no lights, no intrusion, etc.

6.4 Consultation with the Ministry of Environment (Waste Management Section)

Consultation with Ministry of Environment (Waste Management Section) was held at the Ministry on 6th of January 2019. Things discussed are summarized below:

- The roles of the section are waste management planning and monitoring of waste management practices in the different regions of Maldives
- As for Vandhoo, they have outsourced the management to WAMCO though they will still be monitoring the process on a regular basis.
- Future plans of developing regional waste management facilities in all the zones were discussed.
- It was noted that given the quantity of waste from the whole zone 1, it has now been decided that all waste of Zone 1 shall be collected at a single point and brought to

Vandhoo with Zone 2 waste. Likewise, other zones may also be combined to one island in that region with regards to the amount of waste produced per zone.

6.5 Consultation with the Waste Management Corporation (WAMCO)

Consultation with WAMCO was also held at the Ministry of Environment on 6th of January 2019. Details of the participant is listed in Appendix 14. The representative from WAMCO detailed out the challenges they have been facing up to date in operation of Vandhoo RWMF. These are summarised below:

- Shortage of Harbour facility due to its small size and design:
  - The existing harbor cannot cater the Island and resort vessels at one time.
  - Difficulty in offloading as there is only 1 ramp and there is no mechanism built for off-loading. Now it is done manually and takes 5 to 6 hours to offload.
- Segregation of waste at site:
  - The waste which has been already collected at the islands without proper segregation for decades needs to be sorted before they are being incinerated or sent for recycling. This takes a long time as most works are done manually with limited human resources.
  - Lack of storage facilities at the island of Vandhoo
- Incinerator Issues:
  - The incinerator is not able to function at its full volume, as only 16 tonnes of combustible waste can be brought from zone 2 per day though the capacity of Incinerator is 36tonnes/day. It is not feasible to run the incinerator if can't feed full volume. Hence, they need more storage space to store the waste and collect the full volume prior to feeding the incinerator.
- Technical issues:
  - lack of technical capacity to address the issues
- Delayed island collection
  - Island collection from some islands are kept on hold due to lack of storage facilities, shortage of vessels and human resources.
- Staff Accommodation needed in the island
- Currently recycling process also cannot be implemented due to lack of storage space and technology.
- They hope with this upgrade, many of these issues will be addressed and they can commence their service as per their plans.

6.6 Summary of consultations

From the consultations it is evident that both the service provider and the customers are facing challenges with the current system. With the proposed developments, it is envisaged that most of these issues will be addressed. However, in addition to the positive impacts predicted with the expansion of this project, there are some negative impacts that needs to be addressed which includes the impact to the communities who were depending on the island of Vandhoo for different needs (forest resources, land, economic opportunities). How to mitigate these impacts with recommendations are presented in Section 11 of this report.

7 Impact assessment and baseline for significant impacts

This section provides the results of the RIAM analysis (described earlier in Section 4) of two possible scenarios, namely, the potential impacts associated with:

- **Scenario 1**: proposed upgrades to RWMF are established;
- **Scenario 2:** proposed upgrades to RWMF are not established and the facility is used as it is.

The discussions that follows will focus only on those potential changes that are considered to be either negatively or positively *moderate* or *significant*. They also describe any of the identified changes that are associated with *uncertainty* (e.g., synergies between project-related impacts and climate-change-induced impacts), which have led the team to invoke the Precautionary Principle, so that if there were errors in estimating impacts, they would be made to favor the Maldives people and its fragile environment.

Taking the previous paragraph as a point of departure, the RIAM analysis flagged significant and moderate impacts that could be caused *with* and *without* proposed upgrades to the RWMF. Figure 42 a and b summarize those.

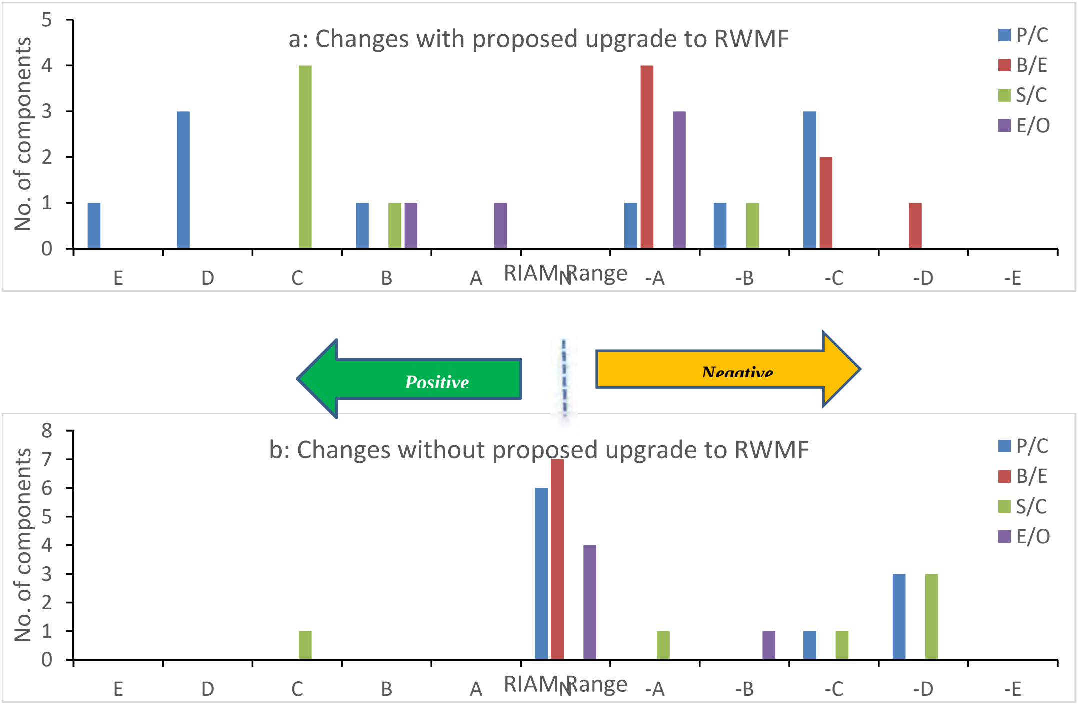


Figure 42. a and b summary of the potential changes resulting from the RIAM analysis of the two scenarios (with and without the RWMF). Significant changes are classified as D or E (see section 4 for a

more detailed explanation of RIAM). Negative changes are to the right side of neutral values, whereas positive changes are shown on the left side of the graph.

The most significant changes associated with the project are identified on the far left (positive impacts) and far right (significant negative changes) hand sides of the two figures (Figure 42). Neutral (N) values in the center of the figures indicate that there are no changes expected. Values labeled +/-D (positive or negative) and +/-E (positive or negative) are considered to be *significant changes*. Significant positive changes are highlighted in green (on the left-hand side of the graph), whereas significant negative changes are circled in red (on right hand side of the graph).

Results of the analyses of the two scenarios shown in Figure 42 can also be presented in a different way. Table 25 shows the same results of the RIAM analysis for the scenario with the proposed upgrade to the RWMF and without it, but presented in a matrix format in which the different color-coded bars correspond to different values assigned to a potential change caused by the project (the values assigned to each color-coded bar are described in Section 4). The reason for presenting Table 25 is that the Consultancy Team has organized the subsections that follow according to those potential changes that are considered to be significant (D and E values). Significant changes (negative changes are highlighted by red shading, whereas significant positive changes are represented by green shading) for the scenario with and without the RWFM.

Table 25. Comparison of the RIAM color-shaded matrices that were generated for the analysis of the two different scenarios (with and without RFWM). Red-shaded rows designate significant negative changes (-D and –E categories), magenta shading highlights moderate

Option/ Policy		Option with proposed upgrades to RWMF										Option without proposed upgrades to RWMF
Components		Description	RIAM Criteria Scores					Env. Score ES	Range Value RV	Opt. Name	Graph Value	Range Value RV
Code			A1	A2	B1	B2	B3					
P/C	1	Changes in landscapes due to clearing of vegetation for construction operations	1	-1	2	2	3	-14	-A	P/C1	-1	N
P/C	2	Changes in hydrocarbon concentrations on the island due to storage facility leaks	1	-3	3	3	3	-27	-C	P/C2	-3	N
P/C	3	Changes in hydrocarbon concentrations on the island due to spills associated with motorized construction vehicles	1	-2	3	3	3	-18	-B	P/C3	-2	N
P/C	4	Changes in groundwater chemistry of Vandhoo due to leachates from the waste facility	1	-3	3	3	3	-27	-C	P/C4	-3	N
P/C	5	Changes in groundwater chemistry due to oil and waste oil leachate from power house and fuel farm	1	-3	3	3	3	-27	-C	P/C5	-3	N
P/C	6	Changes in untreated daily waste volumes in the northern province	2	3	3	2	3	42	D	P/C6	4	-D
P/C	7	Changes in untreated clinical and e-waste volume in the northern province	4	3	3	2	3	40	D	P/C7	4	-D
P/C	8	Changes in pollutant concentration in the sea due to poor waste management practices	4	3	3	2	3	75	E	P/C8	5	-D
P/C	9	Changes in recyclable waste usage and availability	4	3	3	2	3	45	D	P/C9	4	-C
P/C	10	Changes in water quality for daily use to the workers due to provision of RO plant	1	1	3	2	3	15	B	P/C10	2	N
B/E	1	Changes in endemic terrestrial flora due to construction site clearing	3	-1	3	3	3	-27	-C	B/E3	-3	N
B/E	2	Changes in littoral flora and fauna due to construction operations	1	-1	2	2	3	-7	-A	B/E4	-1	N
B/E	3	Changes in vegetation cover due to clearing for construction	1	-3	3	3	3	-37	-D	B/E5	-4	N
B/E	4	Changes in turtle nesting patterns due to disturbance	3	-1	3	3	3	-27	-C	B/E6	-3	N
B/E	5	Impacts on marine habitat due to sewer and brine outfall pipe laying activities	1	1	2	2	3	-7	-A	B/E7	-1	N
B/E	6	Changes in flora and fauna of Vandhoo in response to pollutants released from inadequately treated scrubber wastewater	1	-1	3	2	1	-6	-A	B/E8	-1	N
B/E	7	Changes in live coral cover and water quality of Vandhoo due to the operation of brine and sewer outfall	1	-1	3	2	1	-7	-A	B/E9	-1	N
S/C	1	Changes in groundwater chemistry in islands of northern province due to better waste management practices	3	3	3	2	3	35	C	S/C1	3	-D
S/C	2	Changes in general hygiene and aesthetics of northern province islands due to better waste management practices	3	3	3	2	3	35	C	S/C2	3	-D
S/C	3	Changes in outburst of airborne and water borne diseases islands of northern province due to better waste management practices	3	3	3	2	3	35	C	S/C3	3	-D
S/C	4	Changes in smoke pollution and smoke related respiratory problems from household burning in the northern province	3	3	3	2	3	18	B	S/C4	2	-C
S/C	5	Changes in social attitudes about the need to live in harmony with nature	4	1	2	2	3	28	C	S/C5	3	-A
S/C	6	Changes in resource use from Vandhoo by the neighboring islands	3	-2	3	3	3	-15	-B	S/C6	-2	C
E/O	1	Changes in soil fertility due to composted material produced and distributed through this project	3	1	3	2	3	9	A	E/O1	1	N

E/O	2	Changes in family incomes provided by job-generating opportunities associated with the RWMF	3	3	3	2	3	14	B	E/O2	2	-B
E/O	3	Risks associated with bulk storage of waste oils	1	-1	3	3	3	-9	-A	E/O3	-1	N
E/O	4	Changes in air quality due to operation of heavy machinery and equipment	1	-1	3	2	3	-8	-A	E/O4	-1	N
E/O	5	Changes in ambient noise level due to operation of heavy machinery and equipment	1	-1	3	2	3	-8	-A	E/O5	-1	N

7.1 Summary of the potential changes with and without the proposed changes to existing RWMF

Significant negative changes identified in the RIAM analysis are described in the following subsections. Each significant change will not only require mitigation measures to minimize or eliminate a potential change (impact), each of these significant changes will also need to have a corresponding baseline that describes the social-cultural, economic and environmental conditions *before* any construction or operational activities, and a corresponding monitoring strategy for measuring the effectiveness of the mitigation measures proposed in the Environmental and Social Management Program (ESMP) presented in Chapter 9.

Based on this rationale, the present sub section lays the groundwork for focusing the impact analysis on significant changes that could be produced by the project, as well as identifying those parameters requiring a baseline and the mitigation measures and monitoring requirements, as outlined in the ESMP.

7.1.1 Summary of potential changes with the proposed changes to existing RWMF

As shown in Figure 42 and Table 25, there are ***5 moderate negative changes (-C)*** expected to occur if the ***RWMF*** is built and operated. There is only ***1 significant negative change (-D)*** associated with the operational phase. However, all of the negative changes associated with the construction and operation of the RWMF can either be reduced considerably or eliminated, provided that the applicant and its contractors apply the best practice measures described in the ESMP. Additionally, it is worth highlighting that there are ***3 significantly positive (D) and 1 important positive (E) changes*** associated with operating the RWMF at Vandhoo. Each potential change that require a baseline and mitigation measures will be described later in this section. Overall this option scored 12 positive changes and 16 negative changes (Figure 42 and Table 25).

7.1.2 Summary of potential changes without the proposed changes to existing RWMF

The analysis of Scenario 2, the situation ***without the project***, indicates that there are ***6 potentially significant negative changes*** that would seriously affect the Maldives and its people. Only 1 positive change was identified for Option 2 which was just moderately positive.

Although it should be evident that no construction impacts would be expected if the RWMF is not built, it is noteworthy that the RIAM analysis identified a total of ***6 significant negative changes*** both inside and outside of the immediate project area if the RWMF is not built and made operational. The results of the analysis highlight the critical situation that is developing without immediate solutions to the solid waste issues facing the Maldives.

Overall this option scored 1 positive change, 17 neutral and 10 negative changes (Figure 42 and Table 25).

7.2 Results of analysis of the scenario with the proposed changes to existing RWMF

7.2.1 Potential impacts associated with the construction phase

There are 9 changes identified during the construction phase of the project all of which are negative (Table 26). The 2 moderate negative, 1 significant negative and 1 negative impact require a baseline and mitigation measure prior to project commencement.

Table 26. Summary of changes during construction phase of the project

P/C	1	Changes in landscapes due to clearing of vegetation for construction operations
P/C	3	Changes in hydrocarbon concentrations on the island due to spills associated with motorized construction vehicles
B/E	1	Changes in endemic terrestrial flora due to construction site clearing
B/E	2	Changes in littoral flora and fauna due to construction operations
B/E	3	Changes in vegetation cover due to clearing for construction and guest accomodation
B/E	4	Changes in turtle nesting patterns due to disturbance
B/E	5	Impacts on marine habitat due to sewer and brine outfall pipe laying activities
E/O	4	Changes in air quality due to operation of heavy machinery and equipment
E/O	5	Changes in ambient noise level due to operation of heavy machinery and equipment

Physical-chemical impacts and baselines

There are 2 changes identified under this category and are discussed below: -

P/C	1	Changes in landscapes due to clearing of vegetation for construction operations

Changes in landscape including flora and vegetation due to construction activities (excluding site clearance at construction plots and roads) are expected to be minimal.

P/C	3	Changes in hydrocarbon concentrations on the island due to spills associated with motorized construction vehicles

All of the mechanized equipment associated with the project requires refined fossil-fuel products oils and greases, combustible fuels, etc.) and storage tanks that are required to store and dispense these products during both the construction and operational phase of the project. As a result, the RIAM analysis has flagged the potential spillage of hydrocarbons onto the island and into groundwater supplies, unless proper mitigation measures are taken (see Section 9 for the measures specified under the ESMP). The permeability of the soils on Vandhoo would make it easy for any accidentally spilled hydrocarbons to enter the underlying groundwater readily and this potential impact raises serious concerns about the contamination of groundwater supplies by hydrocarbons, because this would likely render the groundwater unusable as a potable water source. Consequently, PC3 has been pointed out as being potentially negative change. These have been flagged under the precautionary principle. It follows that both components require a baseline to establish existing anthropogenic hydrocarbons in groundwater, as well as mitigation measures and follow-up monitoring.

The baseline for hydrocarbons were not tested during this ESIA survey as this was not specified under the ToR for this ESIA. However, groundwater was tested for other physical and chemical components results of which are presented in Table 16 and Table 17. It is recommended to test water quality for hydrocarbons during the monitoring process.

Biological ecological impacts and baselines

The impact identified under this category is discussed below: -

B/E	5	Impacts on marine habitat due to sewer and brine outfall pipe laying activities

Changes in live coral cover due to construction of brine and sewer outfalls are predicted to have moderate negative impacts as it may lead to loss of marine habitats.

The baseline conditions of marine environment including coral cover, fish abundance as well as seawater quality was already established prior to the development of RWMF at Vandhoo (Riyan and NIRAS, 2012). Current conditions were compared with the initial ESIA and the results are presented in section 5 of this report.

B/E	1	Changes in endemic terrestrial flora due to construction site clearing
B/E	2	Changes in littoral flora and fauna due to construction operations
B/E	3	Changes in vegetation cover due to clearing for construction

The island having a thick vegetation, vegetation clearance was identified as the impact with highest significance (B/E3). Moreover, most building plots were proposed at areas with a thick coconut grove. In addition to heavy vegetation, changes in endemic terrestrial flora and fauna due to construction and operation phase are also identified. Few protected banyan trees were identified, one of which falls on a construction plot (Figure 44).

Terrestrial fauna and vegetation cover which falls on the building plots and road areas were identified and are presented in Figure 33 and Table 14.

B/E	4	Changes in turtle nesting patterns due to disturbance

Even though there were no evidence of turtle nesting identified during the initial ESIA (Riyan and NIRAS, 2012), at least 4 turtle nesting sites were identified during the field survey for preparation of this report. The nesting pits were not necessarily confined to the turtle conservation area identified in the Masterplan (Appendix 4), but rather, the nesting pits were observed all around the island.

Human exploitation of all the identified sites were also evident. Since the island is no longer available to the public, it is predicted that the exploitation could be from the staff working on the RWMF at Vandhoo.

Different forms of legislation have been in place over the years to provide protection for turtle species found in the Maldivian waters (discussed in turtle management plan on Appendix 15). A 10 year moratorium on turtle capture was initially passed in 2005 (under Section 10 of the Fisheries Law 5/87), which was again renewed for additional 10 years in 2006. The expiration of this ban in 2016 was followed by a blanket ban on turtle capture and egg harvesting under the Environmental Protection and Preservation Act (Law 4/93).

A Sea Turtle Management plan to be enforced during operation of the facility was formulated in 2014 and includes measures to minimize impact on sea turtles utilizing the beach at Vandhoo (Appendix 15). However, it should be noted that not all the measures identified in the Plan have been implemented to date at the RWMF. Hence the Consultant advises full implementation of the plan during the construction phase of the current project and future operations at the facility.

Economic operational impacts and baseline

E/O	4	Changes in air quality due to operation of heavy machinery and equipment
E/O	5	Changes in ambient noise level due to operation of heavy machinery and equipment

The two impacts identified under this category were only assumed to have a minimum negative impact on the environment. Inherent to any construction project, impacts on air quality and noise level is expected to arise from construction activities of the buildings proposed in this project. Since the project site is far from urban areas or communities impact on air and noise is negligible.

7.2.1 Potential impacts associated with the operational phase

There are 20 changes identified during the operational phase of the project, 6 of which are negative and 12 positive changes (Table 27).

Table 27. Summary of changes during operational phase of the project

P/C	2	Changes in hydrocarbon concentrations on the island due to storage facility leaks
P/C	4	Changes in groundwater chemistry of Vandhoo due to leachates from the waste facility
P/C	5	Changes in groundwater chemistry due to oil and waste oil leachate from power house and fuel farm
P/C	6	Changes in untreated daily waste volumes in the northern province
P/C	7	Changes in untreated clinical and e-waste volume in the northern province
P/C	8	Changes in pollutant concentration in the sea due to poor waste management practices
P/C	9	Changes in recyclable waste usage and availability
P/C	10	Changes in water quality for daily use to the workers due to provision of RO plant
B/E	4	Changes in turtle nesting patterns due to disturbance
B/E	6	Changes in flora and fauna of Vandhoo in response to pollutants released from inadequately treated scrubber wastewater
B/E	7	Changes in live coral cover and water quality of Vandhoo due to the operation of brine and sewer outfall
S/C	1	Changes in groundwater chemistry in islands of northern province due to better waste management practices
S/C	2	Changes in general hygiene and aesthetics of northern province islands due to better waste management practices
S/C	3	Changes in outburst of airborne and water borne diseases islands of northern province due to better waste management practices
S/C	4	Changes in smoke pollution and smoke related respiratory problems from household burning in the northern province
S/C	5	Changes in social attitudes about the need to live in harmony with nature
S/C	6	Changes in resource use from Vandhoo by the neighboring islands
E/O	1	Changes in soil fertility due to composted material produced and distributed through this project
E/O	2	Changes in family incomes provided by job-generating opportunities associated with the RWMF
E/O	3	Risks associated with bulk storage of waste oils

Physical chemical impacts and baseline

There are 8 changes associated with the proposed development under this category and are discussed below: -

P/C	2	Changes in hydrocarbon concentrations on the island due to storage facility leaks
P/C	4	Changes in groundwater chemistry of Vandhoo due to leachates from the waste facility
P/C	5	Changes in groundwater chemistry due to oil and waste oil leachate from power house and fuel farm

As mentioned in the previous subsection describing physical-chemical changes during the construction phase, refined fossil fuel leaks from mechanized project- support equipment and from fuel storage tanks are a serious concern and as a consequence, thereby P/C2, P/C4 and P/C5 have been flagged as moderate changes under the precautionary principle. These components require a baseline to establish existing anthropogenic hydrocarbon as well as chemical and physical groundwater chemistry, as well as mitigation measures and follow-up monitoring.

As previously noted, the baseline for hydrocarbons were not tested during this ESIA survey as this was not specified under the ToR for this ESIA. However, groundwater was tested for other physical and chemical components results of which are presented on Table 16 and Table 17. It is recommended to test water quality for hydrocarbons during the monitoring process.

P/C	6	Changes in untreated daily waste volumes in the northern province
P/C	7	Changes in untreated clinical and e-waste volume in the northern province
P/C	8	Changes in pollutant concentration in the sea due to poor waste management practices
P/C	9	Changes in recyclable waste usage and availability

Major positive changes due to better waste management and treatment are expected from the proposed development, which is the ultimate goal of the project. Proper treatment and disposal of waste from the source points in the islands will contribute to reduce the amount waste which make their way into the oceans as well. With the introduction of recyclable waste storage facilities, recyclables such as metals, glass, plastics etc, will be made available for the public.

P/C	10	Changes in water quality for daily use to the workers due to provision of RO plant

With the development of the RO plant, the workers residing on the island will be provided with clean water for daily use.

Biological ecological impacts and baseline

The 3 changes associated under this category are discussed below: -

B/E	4	Changes in turtle nesting patterns due to disturbance

As discussed in the previous subsection, changes in turtle nesting patterns are also expected during the operational phase as well. These include disturbance from lights, noise and trespassing. Refer to the previous sub-section for further details on B/E4.

B/E	6	Changes in flora and fauna of Vandhoo in response to pollutants released from inadequately treated scrubber wastewater

Inadequately treated scrubber wastewater, if released into the ground could have negative impacts on island's flora and fauna.

B/E	7	Changes in live coral cover and water quality of Vandhoo due to the operation of brine and sewer outfall

Wastewater and brine released from the sewer and brine outfalls are expected to impact negatively on the marine ecosystem. However, since sewer outfall will be extended beyond the reef edge and the area where outfalls are constructed is a high mixing zone, B/E7 is classified as a minimal negative change.

Social cultural impacts and baseline

There are 6 impacts identified under this category, 1 of which is negative: -

S/C	1	Changes in groundwater chemistry in islands of northern province due to better waste management practices
S/C	2	Changes in general hygiene and aesthetics of northern province islands due to better waste management practices
S/C	3	Changes in outburst of airborne and water borne diseases islands of northern province due to better waste management practices
S/C	4	Changes in smoke pollution and smoke related respiratory problems from household burning in the northern province
S/C	5	Changes in social attitudes about the need to live in harmony with nature

Although an indirect impact, the proposed development will bring about several positive impacts as a result of better management practices on the islands on northern province. It will put an end to the need to burn accumulated waste on the islands thereby preventing respiratory problems. Moreover, a lot of airborne and water borne disease outburst which commonly occur in the islands of Maldives are due to accumulation of waste on the islands. Occurrence of such incidents are expected to lower due to the proposed upgrade to the RWMF. In addition to this, groundwater chemistry of the island is expected to improve as chemical leachate from waste will be prevented. Overall, islands with proper waste management practices are aesthetically more pleasing, more hygienic and as result people's attitude will change towards waste disposal practices and realize the importance of living in harmony with nature.

S/C	6	Changes in resource use from Vandhoo by the neighboring islands

The island was previously used by the neighboring islands (specifically Rasmaadhoo and Innamaadhoo) to source natural resources such as coconuts and dry coconut leaves. Dry coconut leaves were extensively farmed from Vandhoo by Rasmaadhoo inhabitants for thatching. There is a high demand for weaved thatches from nearby resorts and a large income is generated by selling these to the resorts. Since the development of RWMF at Vandhoo, local access has been banned to Vandhoo. This issue is discussed in further detail in the social assessment section of this report.

The possible socio-cultural impacts mentioned in the TOR for this report which includes the impact on the natural features and landscape of the project also ties with S/C6. Vegetation clearance would change the natural landscape and also would limit the availability of forest resources which could potentially still can be sourced to the locals interested as proposed in the mitigation measures of this ESIA. Alternatives are proposed in section 8 to minimize the area of vegetation that needs to be cleared.

No significant impact is envisaged to the visual amenity of the island as the thick buffer zone still remains.

Economic operational impacts and baseline

E/O	1	Changes in soil fertility due to composted material produced and distributed through this project

During public consultations it was identified that even though composting is possible at the islands, sales and distribution is difficult. Therefore, compost produced at the islands will be brought to the RWMF at Vandhoo, for packing and distribution.

E/O	2	Changes in family incomes provided by job-generating opportunities associated with the RWMF

The proposed facility will generate several job opportunities for the locals.

E/O	3	Risks associated with bulk storage of waste oils

Bulk storage of waste oils, if not properly handled, may lead to a disastrous incident, however, since the design of waste storage oil tanks and the fuel farm is very stringent, this component is classified as a minimal negative impact.

7.3 Potential risks of the project

7.3.1 Construction phase risks

The construction work may generate *dust and noise* causing a health hazard to the workers. This risk, however, can easily be minimized by using appropriate equipment (masks, earmuffs). Occupational accidents represent another risk and protocols and guidelines outlined in the ESMP will help minimize these risks to the workers during the construction phase.

7.3.2 Operational phase risks

The most serious risks to eliminate and/or reduce will occur in the operational phase. These include respiratory and other pollution-related diseases in workers associated with the incinerators. However, since any works related to the incinerator is not in the scope of proposed upgrade, these will not be discussed in further detail. Other risks include risks of fire associated with the fuel farm, health hazards to workers due to handling of waste. As a risk reduction measure, the occupational health and safety procedure formulated by WAMCO (attached in Appendix 10) should be strictly followed by the workers.

8 Project alternatives

The proposed project involves upgrade of RWMF at R. Vandhoo. Location of the project has been identified by the proponent after carrying out intensive analyses of the islands in the northern province. Since the island already has an acceptable facility on this island, the location is ideal for this project as this will be an extension of the current facility and the proponent will be able to well-establish the current resources under the available budget. To change the project location means having to construct all the resources which is neither environmentally, nor economically feasible.

Nevertheless, specific options related to different components of the project are discussed below: -

8.1 Considered alternatives

8.1.1 Guest accommodation blocks

Proposed: The proponent proposes to construct beach front accommodation blocks for guests and consultants who visit the RWMF.

Alternate: Allocate single rooms for consultants within the proposed staff accommodation blocks.

Recommended option: *Key impact due to the project is due to vegetation clearance. Construction of beach front rooms for the Consultants requires additional vegetation clearance for the room footprint as well as that for the access roads to the area. Consultation team does not see the need for constructing beach front accommodation for visitors in a waste management facility, rather, rooms within the proposed staff accommodation facilities are considered to be sufficient. Selection of this alternative means that the vegetation within the proposed guest accommodation areas as well as access roads to the areas will be retained. In addition to negative environmental impacts, the beach front accommodation blocks are economically not feasible.*

8.1.1 Road network

Proposed road network: Highlighted in yellow in Figure 43.

Alternate road network: Indicated in magenta in Figure 43.

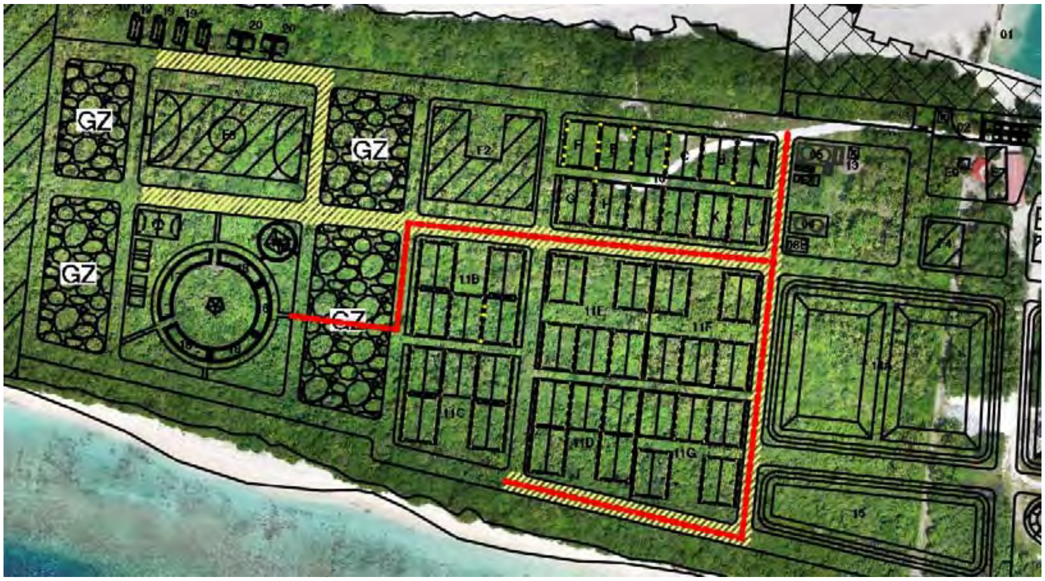


Figure 43. Proposed road network (yellow highlight) and alternate road network (red) for RWMF at Vandhoo

Selected road network: *a total of 17.7% of vegetation clearance is required for all building footprint area and road development. Approximately 19.5% of this area is contributed to by the area to be cleared for road development (which encompasses a total of 188 significant trees and coconut palms). Thus the Consultant feels that an alternate route which requires less vegetation clearance would be more feasible in terms of environmental impacts. Alternate route for road development (with width 10m) is given in Figure 43 and total area which requires to be cleared for proposed development with this route is approximately 16.6%, while 14% of this total is accounted for by road clearance (Approximate number of significant vegetation required to be cleared is 60). Furthermore, the proposed route provides access to guest blocks to be developed on the beach side, which as discussed in Section 8.1.3 are considered unnecessary and thus there is no reason to develop roads providing access to the area. Hence based on the area of clearance required, the Consultant considers the alternative route to be feasible and is selected for in the report.* Table 28 *compares the vegetation clearance required for the proposed road network with that of the alternative network.*

Table 28. Vegetation clearance required for different road widths and network

Route	Width (m)	Area to be cleared (m^2)	% of total vegetation clearance (m^2)
Proposed	12	10,400	19.5
Proposed	10	9,400	17.9
Alternative	10	7,330	14.5

8.1.2 Road widths

Proposed width: 12 m

Alternate width: 10 m

Selected width: *vegetation clearance is the most significant negative impact due to the proposed project. Hence it is crucial to minimize this impact to the greatest extent possible. Road construction with a width of 12m contributes approximately 19.5% of the area to be cleared for the proposed works. Although these routes will be used by heavy vehicles on a regular basis, the Consultant feels that narrowing of the road widths is a feasible option, especially with the decreased impact on the environment due to this option. Hence we propose to decrease the road width to the minimum required width for industrial zones, which is 10m. A consequence of this would be decreased area of vegetation clearance (16.6% total with contribution of 14.5% by road clearance work) and thus decreased impact on the environment.*

8.1.3 Number of boreholes

Proposed: The proponent proposes to establish one borehole at the RO facility.

Alternate: Establish 2 boreholes adjacent to each other

Selected option: *The alternate option of establishing 2 boreholes in case one of them fails.*

8.1.4 The no-project scenario

The no-project scenario is also an available option. If this option is selected, the environmental impacts due to the project will be avoided. Impacts during construction phase are minor, although impacts due to operation of the proposed facility are envisaged to be moderate (based on literature). The socio-economic benefits due to the project is also envisaged to be high. The status of the existing facility and why it has failed to serve its goal is discussed in the previous subsections of this report. Moreover, since the RWMF facility is already established at Vandhoo, major environmental impacts are already addressed and discussed during the initial development of this project. Therefore, it will be economically, environmentally and socially more feasible to upgrade an already existing facility to its full potential.

9 Environmental and social management plan

The Environmental and Social Management Program (ESMP) described herein has been developed in order to mitigate the priority list of potential impacts described in Section 7, which are expected during the construction and operational phase of the proposed RWMF at Vandhoo Island. The ESMP recognizes fine different types of mitigation, which include the following: -

1. **Prevention** – involves total prevention of a potential impact;
2. **Minimization** – minimizes potential impacts by limiting the magnitude of action and its implementation;
3. **Restoration** – this requires repair or rehabilitation of the component that is affected by the project;
4. **Maintenance** – reduces or eliminates the impact through operations designed to preserve the status quo during the activity;
5. **Compensation –** compensates affected party(ies) or the environment by replacing lost goods or service that has been changed by the activity.

The ESIA has focused on measures 1 and 2, while aiming to avoid the other types of mitigation measures. Following subsections describe the proposed measures and monitoring requirements for those issues that were highlighted within the biological-ecological, physical-chemical, social-cultural and economic-operational dimensions.

9.1 Summary of mitigation and risk reduction measures during construction and operational phase

Mitigation measures that are explored below (Table 29) emerged out of the discussions and consultations during work on this report with the project proponent and based on literature. Mitigation measures are proposed to reduce or eliminate the severity of any predicted adverse environmental effects and improve the overall social and environmental performance of the project.

Mitigation measures are discussed both for the construction and operation stage of the project. As described in Section 7, most of the potential changes produced during construction phase are short-lived, of low intensity and consequently with very low significance. Some, however, are irreversible, including intensive vegetation clearance. During the construction stage it is also important to take measures to minimize impact on environment due to methods used.

During operational phase, even though the significance of impacts is less, the impacts are more long term, permanent and irreversible. Therefore, best practice methods are well recommended once the proposed changes to the existing facility at Vandhoo become operational. It is also of noteworthy that operational impacts bring about several social economic positive impacts.

Table 29 summarizes the proposed mitigation measures for potential impacts that could be produced during both construction and operational phase. However, the ESMP will focus only on those potential changes that were flagged by the RIAM process and described for each dimension. Additionally, Table 29 identifies the most serious risks and it summarizes steps to be taken to address them. Table 29 summarizes monitoring requirements as well. Table 29 also includes some additional, non-significant and minor impacts that are flagged in order to ensure that even the most responsible contractors and facility operators are reminded that it is essential to take necessary precautions to eliminate these impacts and risks.

Commitment from the proponent for carrying out the proposed mitigation and monitoring plan is given in the declaration of the proponent.

Table 29. Measures to mitigate/monitor potential impacts and occupational health risks during the construction and operational phase of the project

Activity	No.	Potential impacts	Mitigation Measures	Location/ Time frame	Monitoring*	Responsibility
CONSTRUCTION PHASE						
Fuel storage and fuel dispersal to vehicles	PC2	Accidental spills of hydrocarbon on the island due to storage facility leaks	Construct concrete berms around the tank and fueling areas, install sumps to pump out spilled products, emergency warning spill alert equipment.	Fuel storage tank site/ Prior, during and after construction phase	Groundwater quality as specified in Table 30	ME, WAMCO, RWMF supervisor
Maintenance and refueling of project support vehicles	PC3	Accidental spills of hydrocarbon on and under the island associated with motorized support-vehicles	Construct concrete line maintenance areas with capacity to collect and use-recycle used hydrocarbons. Ensure proper maintenance of machinery, appropriate workshop facilities, appropriate handling of all waste (store in a safe place for later removal / incineration in the incinerator).	Maintenance areas/ Prior, during and after construction phase	Groundwater quality as specified in Table 30	Construction supervisor, WAMCO, RWMF supervisor
Laying of brine and sewer outfalls	BE1	Changes in live coral cover and contamination of seawater	Avoid trampling on areas outside of project boundary. Outfall pipes should be properly anchored to prevent pipeline movement, especially to prevent the pipes from drifting to the turtle conservation area.	Reef flat on southside/ during construction phase	Marine environment and seawater quality as specified in Table 30	ME, WAMCO, RWMF supervisor
Construction activities	EO4 EO5	Air pollution and noise impacts	Avoid unnecessary operation of machinery and equipment. Limit use of heavy machinery to project site only. Regular maintenance of machinery	Whole islands/ during construction phase		ME, Construction supervisor
Clearing of vegetation in the project area and guest accommodation	BE5	Vegetation removed from most of the site	Erosion and dust control devices in place prior to construction. Ensure protection of the vegetation buffer zone along the coast (50 m wide) and around the wetland. The buffer should be 70 m in the area where the wetland is found. Coconut palms, if possible, to be moved from the cleared area to the buffer area. Vegetation falling outside project boundary shall not be	RWMF site/ During construction	None	ME and Construction supervisor

	🟥		harmed in any way. Coconut palms removed from the construction sites, if not replanted, should be taken to a nearby island and rehabilitated. An alternative option for road widths are described in section 8 in order to minimize the no. of coconut palms to be removed. Plant some of the cleared vegetation on either side of the roads as well as the areas shown on Figure 44. Beach front guest accommodation blocks are not recommended, instead, allocate guest rooms at the proposed staff accommodation block as discussed under project alternatives section. Few protected banyan trees were identified, one of which falls on a construction plot (Figure 44). It is recommended to shift the block to avoid the banyan tree. All banyan should be conserved during and operation of the facility.			
Overall construction and operation of the project	BE6	Changes in turtle nesting patterns due to changes in beach areas due to construction, noise and lights	Document the relative importance of the beaches as nesting areas for each turtle species, if considered important, take measures such as infrared lights at night, turtle protection measures. No trespassing signs shall be enacted at the turtle conservation area and the area should not be disturbed by any means. Any exploitation, if reported shall be punished.	Turtle conservation area	None	ME, EPA, Construction supervisor
OCCUPATIONAL HEALTH AND SAFETY RISKS DURING CONSTRUCTION						
Dust generated during construction		Worker's health may be affected	Provide masks to the worker where dust is prone in the work area	Site specific	During construction	Construction supervisor
Noise from machinery / construction		Worker's health may be affected	Workers should have protective gear including earmuffs.	Site specific	During construction	Construction supervisor

Work accidents		Worker's health may be affected	Establish and enforce appropriate safety rules and work routines and compulsory use of safety equipment (helmets, protective wear). First aid kit accessible on site, routines for emergencies established and known to all.	Site specific	During construction	Construction supervisor
OPERATIONAL PHASE						
Fuel storage and fuel dispersal to vehicles	PC5	Changes in hydrocarbon concentrations on the island due to possible leaks from storage facilities during operational phase	Construct concrete berms around the tank and fueling areas, install sumps to pump out spilled products, emergency warning spill alert equipment to alert o	Fuel storage tank site/ Prior to, and during operational phase		EPA, WAMCO RWMF supervisor
Maintenance and refueling of project support vehicles	PC5	Changes in hydrocarbon concentrations on the island due to possible motor vehicle leaks and maintenance during operational phase	Construct concrete line maintenance areas with capacity to collect and use-recycle used hydrocarbons. Ensure proper maintenance of machinery, appropriate workshop facilities, appropriate handling of all waste /store in a safe place for later removal / incineration in the incinerator	Maintenance areas/ prior to, and during operational phase		WAMCO RWMF supervisor
Leaching from land-fill to ground water and / or the marine environment	PC4	Changes in groundwater chemistry due to leachates from the waste facility; Impact to the soil and potential groundwater/coastal water contamination	Adhere to the regular monitoring of soil and groundwater for leachates	Soil, groundwater and coastal waters/ During operation		WAMCO
Leakage / overflows from wastewater treatment	BE8	Changes in groundwater chemistry/ flora and fauna due to leachates and effluents from the waste facility	Maintain sufficient storage capacity; Regular monitoring of soil and groundwater for leachates, emergency procedures pre-defined in case of leakage. Maintain scrubbers of the RWMF	Soil, groundwater and coastal waters/ During operation		WAMCO
Wastewater treatment. Leakage from plant or insufficient cleaning of wastewater.	BE8	Contamination of soil, groundwater, seawater causing harm to people, flora, fauna.	Wastewater treatment plant designed to treat sanitary and other waste.	Soil, groundwater and coastal waters/ During operation		WAMCO

Release of brine and sewer wastewater into the lagoon	BE9	Loss of marine habitat, contamination of seawater quality	Treatment of wastewater prior to releasing into the lagoon. Ensure outfall pipes are intact and in place with rigid anchoring. Monitor water quality at the outfall areas and check for optimal range of parameters	During operation	Marine environment and seawater quality as specified in Table 30	EPA, WAMCO
Operation of fuel farm and power house	PC5	Changes in groundwater chemistry. Risk of accidents.	Construct concrete berms around the tank and fueling areas, install sumps to pump out spilled products, emergency warning spill alert equipment. Follow MNDF's fuel handling procedure. Have emergency oil spill cleanup equipment available.	During operation	Groundwater quality as specified in Table 30	EPA, WAMCO
Bulk storage of oils and waste oils	EO3	Changes in groundwater chemistry. Risk of accidents.	Construct concrete berms around the tank and fueling areas, install sumps to pump out spilled products, emergency warning spill alert equipment. Follow MNDF's fuel handling procedure. Have emergency oil spill cleanup equipment available.	During operation	Groundwater quality as specified in Table 30	EPA, WAMCO
Changes in resource use from Vandhoo by neighboring islands	SC6	Impacts on livelihood of locals as an income generating facility was no longer available	WAMCO to collect and sell resources such as dry coconut leaves to potential buyers	During operation	NONE	WAMCO
Overall operation of the project	BE6	Changes in turtle nesting patterns due to changes in beach areas due to construction, noise and lights	Implement turtle management plan attached on Appendix 15 of this report. Restrict entry to turtle conservation area indicated through clear sign boards. Demarcate boundaries through fencing. Conduct regular briefing sessions to the staff at the facility. Regular monitoring through environmental officer recruited by the operator, WAMCO. Any exploitation, if reported shall be punished.	Turtle conservation area	NONE	WAMCO
Waste lost into the sea during transport		Visual impact (affecting tourism, people in general); impact on marine flora/fauna	Custom-built vessels with protective shields, preventing movement of light fractions. Vessels to follow existing regulations regarding transport vessels. Compulsory logbooks of all waste loaded and unloaded	Marine environment / sea- During transport	NONE	Vessel operators and WAMCO

Waste lost into the sea during loading / unloading of waste		Visual impact (affecting tourism, people in general); impact on marine flora/fauna	Mesh fence and green belt towards the seaside, preventing movement of light fractions. Custom-built vessels such as landing crafts, truck loads and compactors ensuring effective operation of the facility	Transfer area between facility and sea/ During operation	NONE	Vessel operators and WAMCO
Visual impact of facility		Visual impact affecting tourist impression	Replanting and green belts, camouflaging the facility from distance, comply with the recommendation for vegetation buffer-zone, ensure area light is concealed (as far as possible) from the surroundings.	Surroundings of Vandhoo Island/throughout operation	NONE	Design engineers; Facility operators
Operation of RO plant		Risk of distribution of improperly treated water	Properties of product water quality produced from the RO plant should be in compliance with EPA's guideline for drinking water quality. Prior to RO plant becoming operational, RO plant shall be registered at EPA and monitoring of product water shall be carried out as per the operating license. EPA to monitor whether reporting is being done by the operator.	During operation	As per operating license	WAMCO, EPA
OCCUPATIONAL HEALTH AND SAFETY RISKS DURING OPERATION						
Waste unload and waste storage		Workers health may be affected	Reduce speed of vehicles, provide masks to the worker where dust is prone in the work area	Site specific	During operation	Facility operator / safety officer
Waste recycling activities (removing recyclables, toxic and hazardous waste)		Workers health may be affected	Workers should have protective gear including earmuffs.	Site specific	During operation	Facility operator / safety officer
Waste handling (from storage to incinerator)		Workers health may be affected	Establish and enforce appropriate safety rules and work routines and compulsory use of safety equipment (helmets, protective wear). First aid kit accessible on site, routines for emergencies established and known to all.	Site specific	During operation	Facility operator / safety officer

Landfill		Unpleasant working environment, potentially harmful (pathogens, toxics)	Protective equipment that ensures no direct contact between workers and waste	On site	During operation	Facility operators
Noise from operation of machinery for waste handling and power house		Unpleasant working environment	Appropriate earmuffs, protecting against noise	On site	During operation	Facility operators
Handling of waste (sorting of waste, handling for recyclables and hazardous materials, work on the landfill)		Health hazard to the workers (pathogens, toxic / hazardous waste)	Protective equipment that ensures no direct contact between workers and waste.	On site	During operation	Facility operator / safety officer
Accidents in the processes		Injury due to poor handling or malfunctioning machinery and equipment	Well-developed and well enforced safety guidelines and streamlined processes for operation; compulsory safety training for all employees; compulsory use of adequate protective equipment. Access to first aid kit on site.	On site	During operation	Facility operator / safety officer

**Please refer to the monitoring table on Table 30 for the complete monitoring plan proposed for the project*

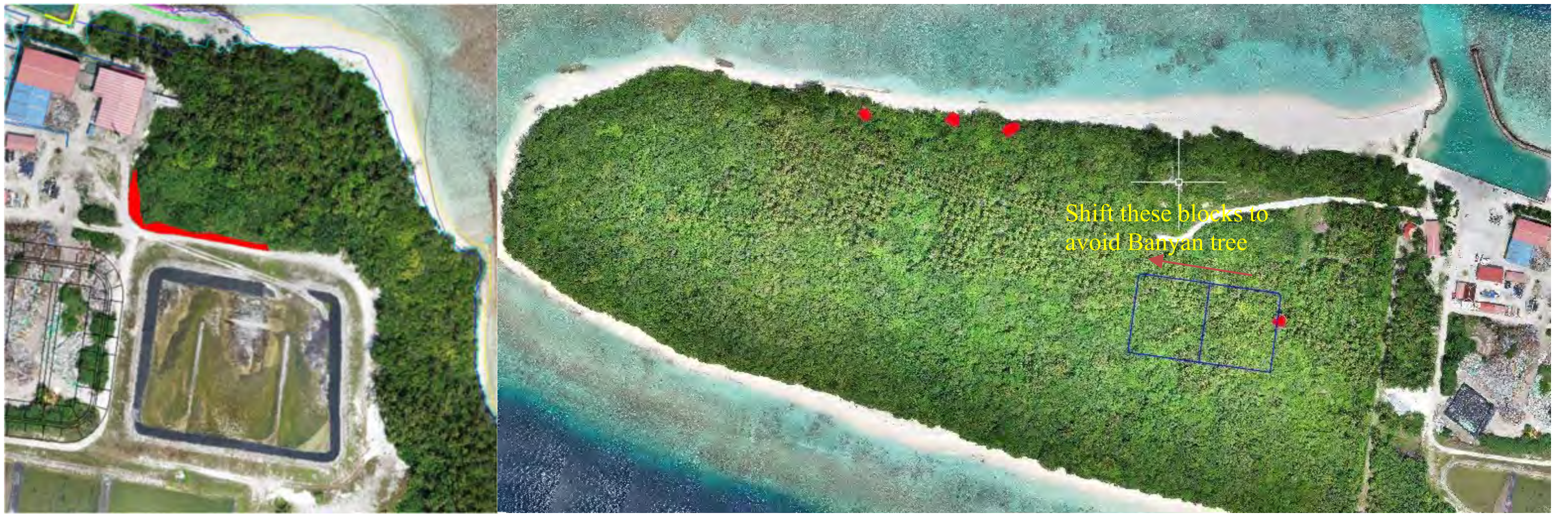

Shift these blocks to avoid Banyan tree

Figure 44. Area proposed for relocation of some of the removed coconut palms (left). Locations of Banyan trees (right).

9.2 Environmental monitoring plan

The natural environment of Maldives has been regarded as sensitive to both natural and human related environmental changes. Solid waste disposal and management has been one of the most concerned issues with regard to the negative environmental changes resulting from improper waste disposal to human health, and natural environment. RWMF is the first modern waste management facility that was designed with due consideration given to the socioeconomic and environmental concerns at local level.

Primary basis of modern waste management is to maximize environmentally sound waste disposal to minimize the quantity of municipal solid disposed to landfill. This is normally accomplished by reducing the quantity of waste initially produced; and diverting waste material to beneficial reuse, recycling, composting, incineration and landfills. Engineered lined landfill systems are constructed to contain residual waste material in an environmentally secure manner. Similarly, incinerators have the capacity to reduce harmful emission to acceptable standards through high temperature combustion.

Environmental standards are often set to address the siting, design, construction, operation of waste management facilities, to substantially reduce and mitigate adverse environmental impacts associated with management of waste material. These impacts may include: dust, odour or impaired air quality, noise, leachate, and hazardous material spills, explosions or fire. Effective operations management and good housekeeping practices are always required, in addition to properly trained staff, and current Operations Management/Maintenance manuals/plans, and Environmental Health and Safety Contingency Plans.

Innovative planning and design are encouraged to maximize safe, efficient and productive use of the property that is dedicated to waste management over the life of a facility.

As such an appropriate environmental monitoring program shall be developed for all waste management facilities at Vandhoo. The operator shall prepare and propose a program which satisfactorily addresses emission, storm water management, groundwater monitoring, leachate collection/management, and landfill management. Environmental monitoring requirements also shall include air quality and nuisance factors such as litter and rodents with respect to problem prevention and control.

It is proposed that the operator is required to submit an annual report outlining the results of the environmental monitoring programs and providing an assessment of compliance and impact. If monitoring indicates that there are negative environmental impacts as a result of the operation, then corrective measures must be put in place and appropriate authority shall be notified. It is proposed that the report be prepared by a professional.

The following is proposed as part of the overall environmental management plan for the waste management facility in the context of various components of the project and their impacts to natural and human environment. The outcome of the monitoring is used to prepare an annual report based on the specific monitoring programs.

- Air Quality
- Groundwater Monitoring
- Leachate Management
- Reef quality
- Shoreline
- Vector Control
- Load and off-load of waste (log-book)

A very exhaustive air quality monitoring had been specified under the initial ESIA of the proposed development (Riyan and NIRAS, 2012) due to the development of incinerators. However, the scope of the proposed upgrade works does not include any incinerator related works, therefore, air quality monitoring will be limited to those associated with operation of powerhouse.

Following table (Table 30) provide a schedule for the impact monitoring that shall be followed as part of the overall environmental monitoring.

Table 30. Environmental monitoring program proposed for the waste management facility at Vandhoo.

Component	Parameter	Monitoring location	Frequency	Responsible agency	Estimated yearly cost (USD)
Air quality	Particulate Matter (PM_{10}) Carbon Monoxide (CO) NOx SO2	Direct emission measurement at powerhouse chimney	3 months after the start-up of powerhouse. Hereafter annually.	WAMCO	5,000
Effluents (Leachates)	BOD5; pH; TSS Ammonia; Zinc Benzoic acid; Phenols	At the landfill cells	Bi annually	WAMCO	1000

Ground-water	Temperature; pH; Electrical conductivity; TDS; TSS; DO; Ammonia; Phosphate; Sulfate; Zinc; Benzoic acid, Phenols, hydrocarbons	Borewell east Borewell west Well	quarterly	WAMCO	500.00
Reef	Coral cover (diversity) Algal cover Fish community (abundance and trophic groups)	SW1 SW2 SW3 SW4	Bi annual	WAMCO	1200.00
Seawater	Temperature; pH; Salinity Electrical conductivity; TDS; TSS; Turbidity Ammonia; Phosphate; Sulfate	SW1 SW2 SW3 SW4	Bi annual	WAMCO	500.00
Shoreline	High tideline; Low tideline Vegetation line	Shoreline of the island	Bi annual	WAMCO	1000.00
Human health	Vectors; Noise; Dust	At the facility, Systematic records according to the monitoring plans	As in the monitoring plans	Operator staff/ safety officer	NA
Waste	Waste loaded (from sources) and unloaded (at Vandhoo)	Tonnes of waste	Continuous	Waste provider; facility operator EPA controlling (samples)	

9.3 Capacity development and training

There are ongoing capacity development and training programs currently in place for the personnel working in the RWMF of Vandhoo. Moreover, a 12-month training program is planned for technical training by bringing technicians from abroad.

It is understood from the consultation with the current operator of the facility, WAMCO and the field report (Mostafa, 2018) that lack of technical capacity in the existing facility is a major issue which needs to be overcome in order to proper functioning and to achieve the desired goals of the project. At present there is a quality engineer/ technician on site upkeeping the incinerator, however, lack of supporting staff is a major concern.

The roles of government agencies and institutions responsible for carrying out particular mitigation, monitoring and enforcing agencies are specified for each component in the mitigation (Table 29) and monitoring (Table 30) tables for ease of reference.

10 Conclusion and recommendations

This ESIA supports and recommends the upgrade facilities proposed for the existing RWMF at Vandhoo. In light of the stakeholder consultations and field investigation report (Mostafa, 2018), it is evident that the existing facility neither has the capacity or facilities to cater to manage waste of the zone II islands. In other words, at present the facility does not meet its purpose. Consultation team also understood that the proposed upgrades will only address part of the many problems identified in the existing facility. However, due to financial limitations, only the proposed facilities could be established at the RWMF. Addressing other identified issues to complete the loop is highly recommended.

As part of the impact identification process, impact with the highest negative impact was identified to be vegetation clearance. It was estimated that about 17.7% of vegetation will need to be cleared in order to accommodate the proposed development. Alternative road designs and narrowing of road widths are thus selected alternatives and are highly recommended to limit the extent of vegetation clearance. Selection of the alternative route also reduces the number of significant which needs to be cleared for road construction. Given that majority of that to be cleared are Coconut palms, this is a significant incentive for selection of the alternative. These options are discussed under project alternatives of this report. Other mitigation measures include rehabilitation of some removed coconut palms within the plot areas and at either side of the road. All the coconut palms removed under this project should be relocated to another island and rehabilitated. Mitigation measures are discussed in more detail in section 9 and Table 29.

The consultation team also observed that the RWMF has a large catchment area for rainwater. However, as rainwater harvesting is not recommended health wise, catchment pits for proper drainage should be well incorporated at the buildings to prevent flooding. As such, groundwater enhancement is expected on this island.

Even though air pollution due to incinerator operation is a major significant impact expected from a project of this nature, this ESIA does not discuss air pollution in much detail since no incinerator related works were part of the scope of this project. A very thorough investigation of impacts due to incinerator operation was carried out in the initial ESIA of the project (Riyan and NIRAS, 2012). The only significant source of air pollution is expected to be generated from the operation of powerhouse and heavy vehicles.

Major positive impacts due to the proposed facility were identified. Analysis of the two options, a: changes with the proposed upgrade to RWMF and b: changes without the proposed upgrades revealed that that even though the latter option avoids the negative impacts due to the proposed works, the socio-economic benefits due to the former option outweighs the negative impacts (Figure 42).

In conclusion, and based on the information available, the consultation team finds that the proposed upgrade to the RWMF is absolutely critical, and that the social and environmental benefits of a properly functioning facility which meets its requirement clearly outweighs the negative, residual impacts from the project. The benefits may be further strengthened by using the entire process as a learning experience for all involved parties.

Acknowledgements

The consultation team acknowledges the contribution provided by the team members in this report for the valuable contribution to the report and at the field. The consultant also acknowledges the assistance provided by ME and WAMCO.

CVs of team members are given below.

Curriculum Vitae

Position	Environmental Consultant
Name	Shahaama Abdul Sattar
Address	G. Helengeli, Lily Magu Male', Rep. of Maldives
Contact	Mobile: +9607904985 Email: shahaama.abdulsattar@lamer.com.mv shahaama.sattar@gmail.com
Date of Birth	30 September 1980
Nationality	Maldivian
Education	**Master of Science (MSc)** in Fisheries Biology and Fisheries Management, University of Bergen. Bergen, Norway, 2004 - 2006 **Bachelor of Science (BSc.),** The Flinders University of South Australia, Adelaide, South Australia, 1999 - 2001
Membership of Professional Associations	Small Island Research Group (SIRG) Maldives, Vice President
Countries of Work Experience	Maldives
Languages	**Dhivehi** Mother tongue **English** Fluent

Employment Record

From: 2008 - 2011
Employer: Marine Research Centre, Ministry of Fisheries and Agriculture, Male', Maldives.
Position: Fisheries Biologist

From: 2006 to 2008
Employer: Marine Research Centre, Ministry of Fisheries Agriculture and Marine Resources, Male', Maldives.
Position: Senior Research Officer

From: 2002 – 2004
Employer: Marine Research Centre, Ministry of Fisheries Agriculture and Marine Resources, Male', Maldives.
Position: Research Officer

Line of work at MRC included:
Assessment of the reef and grouper fisheries of Maldives, with surveys to monitor fisheries and fish species behavior. Compilation and analysis of data, for regular reviews and reporting and formation of management recommendations. Key role in the formulation of the Grouper Fisheries Management Plan / Grouper Fisheries and Export Regulation

Focal point for the IUCN funded project on identification of reef fish spawning aggregations in the Maldives through fishermen interviews (2007)

Secretariat and key organizer – Indian Ocean Cetacean Symposium 2009

Project Partner for Maldives for the Darwin Initiative Coral Reef Fish Project, Maldives

MRC Focal Point for the Atoll Ecosystem Conservation Programme, Ministry of Housing and Environment (2009 – 2011)

Participated in the Biodiversity Valuation survey of Baa Atoll Maldives carried out by AEC project and IUCN

From: May 2011 – Dec 2012
Employer: Darwin Reef Fish Project / Marine Research Centre (Maldives) and Marine Conservation Society (UK)
Position: Consultant, Darwin Reef Fish Project (4 year joint collaboration between MRC and MCS, UK)
Assess the various reef fisheries (grouper, aquarium and food fisheries) of the Maldives and aims to establish management plans for these fisheries. Provision of technical support and assistance to the project staff and MRC in implementing the project and formulation of the management plans.

From: July 2011 – Dec 2011
Employer: Bay of Bengal Large Marine Ecosystem Project
Position: BOBLME Sharks Working Group Coordinator
Coordinator for the Sharks WG of BOBLME project, and work with the focal points in the member countries, to assist in the formulation and implementation of their National Plans of Action for Sharks.

From: June 2011 to Present
Employer: Land and Marine Environmental Resource Group Pvt Ltd
Position: Environmental Consultant

Workshops/Seminars Participated

15-21 March 2003 - Training Workshop on the Implementation of Multilateral Agreements in the Conservation of Biodiversity with special focus on Marine Biodiversity. Kushiro, Japan

14-16 November 2006 – Sixth William R. and Lenore Mote International Symposium – Life history in Fisheries Ecology and Management. Sarasota, Florida

03-05 March 2008 – Olhugiri and Dhigalihaa Protected Areas Management Planning Workshop. Eydhafushi, Maldives

11 March 2008 – Applying the Ecosystem Approach to managing Atoll Ecosystems in the Maldives. Hulhule Island Hotel, Maldives

24-26 March 2008 – Regional Consultation on Preparation of Management Plans for Shark Fisheries. Beruwela, Sri Lanka

17-19 June 2008 – Workshop on Assessment and Management of the Offshore Resources of

South and Southeast Asia. Bangkok, Thailand
22-23 March 2009 – BOBP-IGO National Workshop on Monitoring, Control and Surveillance in Marine Fisheries. Male', Maldives

18 – 20 July 2009 – Indian Ocean Cetacean Symposium 2009. Paradise Island Resort and Spa, Maldives.

09-11 August 2009 – Second Regional Consultation on Preparation of Management Plans for Shark Fisheries. Kulhudhuffushi, Maldives

24-25 February 2010 – BOBLME Project – National Inception Workshop, Male', Maldives

2-3 June 2010 – BOBP-IGO Technical Advisory Committee – 5th Meeting, Male', Maldives

13-14 September 2010 – BOBLME Fisheries Assessment Working Group – 1st Meeting, Bangkok, Thailand

14-16 December 2010 – EWS-WWF 2nd Marine Conservation Forum for the Gulf Region In partnership with the Pew Environment Group – Local Actions for Global Challenges, Abu Dhabi, United Arab Emirates

18-19 January 2011 – Bay of Bengal Large Marine Ecosystem Project – Workshop on the Status of Marine Managed Areas in the Bay of Bengal, Penang, Malaysia

5-7 July 2011 –Bay of Bengal Large Marine Ecosystem Project – First meeting of the BOBLME Sharks Working Group, Male', Maldives

7-8 September 2011 – Workshop to formulate the Grouper Fisheries Management Plan, DRFP/MRC, Male', Maldives

15-17 September 2011 – SEAFDEC Special Meeting on Sharks Information Collection in Southeast Asia, Bangkok, Thailand

10 April 2014 - Stakeholder Consultation to present the National Plan of Action on the Conservation and Management of Sharks (NPOA-Sharks), Male', Maldives

Publications

Sattar, S. A., Najeeb, A., Islam, F., Afzal, M. S. and Wood, E. (2012) Management of the grouper fishery of the Maldives, *Proceedings of the 12th International Coral Reef Symposium, Cairns, Australia*, *9-13 July 2012, Session 13E* (in press)

Ushan, M., Wood, E., Saleem, M. and Sattar, S. A (2012) Maldives Sharkwatch Report for 2009 - 2010, *Proceedings of the 12th International Coral Reef Symposium, Cairns, Australia*, *9-13 July 2012, Session 13D* (in press)

Sattar, S. A., Andréfouët, S., Ahsan, M., Adam, M. S., Anderson, C. R. and Scott, L (2012) Status of the Coral Reef Fishery in an Atoll under tourism development: the case of Central Maldives, *Atoll Research Bulletin 590*: 163-186

Sattar, S. A., Amir, H. and Adam, M. S. (2012) Reef fish tagging programme – Baa Atoll Pilot project, *Atoll Research Bulletin 590*: 187-200

BOBLME (2011) Report of the BOBLME Sharks Working Group, 5-7 July 2011, Male' Maldives, *Prepared for the Bay of Bengal Large Marine Ecosystem Project by Sattar, S. A. and Anderson, R. C.*

Saleem, M., Sattar, S. A. (2009) Study on post-tsunami restoration and conservation projects in Maldives, *Prepared for the International Union for Conservation of Nature*.

Tamelander, J., Sattar, S., Campbell, S., Hoon, V., Arthur, R., Patterson E. J.K., Satapoomin, U., Chandi, M., Rajasuriya, A. and Samoilys, M. (2009) Reef fish spawning aggregation in the Bay of Bengal: Awareness and Occurrence, *Proceedings of the 11th International Coral Reef Symposium, Ft. Lauderdale, Florida, 7-11 July 2008,* Session 22

Sattar, S. A., Jørgensen, C., Fiksen, Ø. (2008) Fisheries Induced Evolution of Energy and Sex Allocation. *Bulletin of Marine Science*, 83(1): 235-250

Sattar, S. A. (2008) Review of the Reef fishery of the Maldives, Marine Research Centre, Male', Maldives. 62 pp

Sattar, S. A. and M. S. Adam (2005) Review of the Grouper fishery of the Maldives with additional notes on the Faafu Atoll fishery. Marine Research Centre, Male', Maldives. 54 pp

Environmental Impact Assessments Reports and other studies

The following are a selected list of the projects I have been involved in as an environmental consultant at LaMer Group Pvt Ltd.

Name of assignment or project	EIA for development of domestic airport facility at Funadhoo, Shaviyani Atoll
Year	2018
Location	Funadhoo, Shaviyani Atoll, Maldives
Client	Regional Airports, Ministry of Tourism
Project features	Development of domestic airport facility at Funadhoo
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA for agricultural development project at Hulhidhoo, Vaavu Atoll
Year	2017
Location	Hulhidhoo, Vaavu Atoll, Maldives
Client	Aarah Investments Pvt Ltd
Project features	Development of Hulhidhoo as a mix-use island with an agricultural (hydroponics) and tourism component
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA for development of 100 bed hospital at Addu City
Year	2017
Location	Addu City, Maldives
Client	Ministry of Housing and Infrastructure
Project features	Redevelopment of Equatorial Convention Centre as a 100 bed tertiary level hospital
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA for relocation of sewer outfalls at IGMH and Westpark area, Male' City
Year	2017
Location	Male', Maldives
Client	MWSC Pvt Ltd
Project features	Relocation of sewer outfalls at IGMH and Westpark area to industrial village area of Male'
Positions held	EIA team member

Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA for resort development at Islands I and E of Emboodhoofalhu Finolhu Development project
Year	2017
Location	Emboodhoofalhu Finolhu, Maldives
Client	Dream Islands Development Project
Project features	Development of reclaimed islands I and E of Emboodhoofalhu Finolhu as tourist resorts
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	Environmental Impact Assessment Report for aquatic animal quarantine facility at Hulhumale'
Year	2016
Location	Hulhule, Maldives
Client	Ministry of Fisheries and Agriculture
Project features	Setting up an animal quarantine facility within plant quarantine service area in Hulhule
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	Environmental Impact Assessment report for relocation of Male' Submarine cable landing
Year	2016
Location	Male', Maldives
Client	Dhiraagu
Project features	EIA related to relocation of the submarine cable from existing location to a new location
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	Socioeconomic Situation analysis of selected fishing communities as part of formulation of Master Plan for Sustainable Fisheries (MASPLAN)
Year	2015
Location	ADh. Mahibadhoo, F. Bilehdhoo, GA. Villingili, HA. Ihavandhoo, L. Gan, L. Maamendhoo, Lh. Naifaru, S. Maradhoo, Maldives, Maldives
Client	Ministry of Fisheries and Agriculture
Project features	Socioeconomic survey of selected islands, to undertake a situational analysis of the island communities
Positions held	Fisheries Management Consultant
Responsibilities	Carryout socioeconomic surveys in forms of group discussions and household surveys. Data collection and analysis and report formulation (trip reports and overall situational analysis).
Name of assignment or project	Development of Training material for project staff on mainstreaming and increasing awareness on climate change adaptation and mitigation measures in tourism operation
Year	2015
Location	Male', Maldives
Client	Ministry of Tourism
Project features	Mainstreaming and increasing awareness on climate change adaptation and mitigation measures in tourism operation
Positions held	Team member
Responsibilities	Material development and presentation
Name of assignment or project	Development of water supply and a sewerage system at Fuvahmulah
Year	2015
Location	Fuvahmulah, Gnaviyani atoll. Maldives
Client	Ministry of Environment and Energy
Project features	Setting up a water supply and a sewerage facility
Positions held	EIA team member

Responsibilities	Preparation of the EIA report
Name of assignment or project	Environmental Impact Assessment for soft coastal protection works at GDh. Thinadhoo
Year	2014
Location	GDh. Thinadhoo, Maldives
Client	Ministry of Environment and Energy
Project features	Beach Nourishment and Coastal protection
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	Beach Nourishment and Coastal Protection works at a private land at Praslin, Seychelles
Year	2014
Location	Praslin, Seychelles
Client	Ahmed Didi
Project features	Beach Nourishment and Coastal protection at Praslin, Seychelles
Positions held	Environmental assessment team member
Responsibilities	Preparation of the report submitted to the client
Name of assignment or project	1500 Housing Unit construction Project Maldives
Year	2014
Location	Fuvahmulah, Gadhdhoo, Hoadedhdhoo, Hithadhoo, Holhudhoo, Madaveli, Thinadhoo, Maldives
Client	Ministry of Housing and Infrastructure
Project features	Construction of Housing Units at the specified Islands
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for Coastal modification at Robinson Club Maldives
Year	2013
Location	Ga. Funamaudua, Maldives
Client	Robinson Club Maldives, Maldives
Project features	Coastal modification at the NW side of the island, construction of geo-bag revetment and harbor basin maintenance dredging works
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for construction of gravity type waste water collection system at ADh Omadhoo
Year	2013
Location	ADh Omadhoo, Maldives
Client	ADh Omadhoo Island Council Office
Project features	Construction of gravity type waste water collection system and sea outfall pumping system
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for upgrading of Maldive Gas Pvt Ltd Gas jetty
Year	2013
Location	Thilafushi, Maldives
Client	Maldive Gas Pvt Ltd
Project features	Reconstruction of existing gas jetty head and expansion of jetty head
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for Resort development at GDh Havvodaa
Year	2013
Location	GDh Havvodaa, Maldives
Client	Crystal Plaza Pvt Ltd, Maldives
Project features	Construction of a resort hotel and all the related amenities
Positions held	EIA team member
Responsibilities	Preparation of the EIA report

Name of assignment or project	EIA report for Coastal protection, coastal modification, beach nourishment, coral nursery setup and entrance channel maintenance dredging work
Year	2013
Location	Gili Lankanfushi, Maldives
Client	Gili Lankanfushi, Maldives
Project features	Coastal protection, coastal modification, beach nourishment, coral nursery setup and entrance channel maintenance dredging work
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for Harbor development project at Dh. Maaenboodhoo
Year	2013
Location	Dh. Maaenboodhoo, Maldives
Client	Ministry of Housing and Infrastructure
Project features	Development of harbor facility (dredging of harbor basin, construction of wharfs and breakwater)
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for Flood mitigation and reclamation work at Faresmaathoda
Year	2013
Location	GDh. Faresmaathodaa, Maldives
Client	United Nations Office for Project Services (UNOPS)
Project features	Construction of breakwater and reclamation of land
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for Development of Domestic Airport Facility
Year	2012
Location	Th. Thimarafushi, Maldives
Client	Maldives Airports Company Limited
Project features	Construction of runway apron
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for Wharf reconstruction and upgrading of existing berthing facility and slipway
Year	2012
Location	Thilafushi, Maldives
Client	Fuel Supply Maldives Pvt Ltd, Maldives
Project features	Reconstruction of wharf and upgrading of existing berthing facility and slipway
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for Resort development at B. Kanifinolhu
Year	2012
Location	B. Kanifushi, Maldives
Client	Coastline Hotels and Resorts Pvt Ltd, Maldives
Project features	Construction of a resort hotel and all the related amenities
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for Borehole construction at Cyprea Mrine Food Fish Factory
Year	2012
Location	K. Himmafushi, Maldives
Client	Cyprea Marine Food Pvt Ltd, Maldives
Project features	Construction of a 8 inch borehole at factory premise
Positions held	EIA team member
Responsibilities	Preparation of the EIA report

Name of assignment or project	EIA report for resort development at K. Kudavilligili, Maldives
Year	2011
Location	K. Kudavilingili, Maldives
Client	Yacht Tours Pvt Ltd, Maldives
Project features	Construction of resort hotels and all the related amenities. In addition a large reclamation of the shoreline as additional land as part of the resort development is also part of the project
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for development of city hotel, hospitality institute and resort development at Gasfinolhu and Bodufinolhu, L. Atoll
Year	2011
Location	L. Gan, Bodufinolhu and Gasfinolhu, Maldives
Client	Premier Equities Pvt Ltd, Maldives
Project features	Construction of a resort hotel and required amenities including a training hotel for hospitality industry
Positions held	EIA team member
Responsibilities	Preparation of the EIA report

Referees

Dr. Mohamed Shiham Adam, PhD
Marine Research Centre
Ministry of Fisheries and Agriculture
Male’, Republic of Maldives
Tel. No: +960 331 3681
Email: msadam@mrc.gov.mv

Dr. Charles Anderson
anderson@dhivehinet.net.mv
charles.anderson11@btinternet.com

Certification

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes my qualifications, my experience, and me. I understand that any willful misstatement described herein may lead to my disqualification or dismissal, if engaged.

Shahaama A. Sattar Date: October 2018

CURRICULUM VITAE

NAME:	Aishath Abdulla
DATE OF BIRTH:	10th September 1986
NATIONALITY:	Maldivian
PERSONAL ADDRESS:	H.Regalge, MajeedheeMagu Male' Rep. of Maldives
EDUCATION:	2012 Masters in Environment & Development, University of Melbourne, Australia 2010 BA (Hons) in Urban and Regional Planning, International Islamic University Malaysia, Malaysia
LANGUAGE AND DEGREE OF PROFICIENCY:	
	English – Fluent Dhivehi – Mother tongue
COUNTRIES OF WORK EXPERIENCE:	
	Maldives Malaysia

EMPLOYMENT RECORD:

February 2013- Present	Environmental Planner LAMER Group Pte Ltd Male' Maldives
November 2010 – January 2011	Urban Planner/ Acting business development Manager Riyan Pte.Ltd Male' Maldives
May 2009 - July 2009	Trainee ANZ PLANNERS SDN. BHD Selangor Malaysia
August 2005 - October 2005	Surveyor Ministry of Fisheries and Agriculture Male' Maldives
December 2003	Surveyor Ministry of Planning and National Development Male' Maldives
May 2003-August 2003	Volunteer UNICEF Male' Maldives

OTHER MEMBERSHIPS:	Secretary of the NGO, Small Island Research Group, Maldives

CONFERENCES & EXPERT GROUP MEETINGS	Attended the Expert Group Meeting (EGM) on: Urbanization in Small Island Developing States as a planner from the Maldives; at the United Nations in New York (June 2016)
ADEQUACY FOR THE ASSIGNMENT	
DETAILED TASKS ASSIGNED:	**WORK UNDERTAKEN THAT BEST ILLUSTRATES CAPABILITY TO HANDLE THE TASKS ASSIGNED**
Provision of input on the environmental components of the project **Ensure the integration of the component of the climate change adaptation project in the training materials and training sessions**	**ENVIRONMENTAL PROJECTS** **Assessment of Climate Sensitive Natural Resources in Laamu Atoll and Preparation of Resources Maps** Year: Ongoing Client: UNDP Position Held: Project Coordinator Duties Rendered: Overall coordination of the project which includes project planning, keeping PMU updated on the progress of the project, facilitate the project team in addressing the issues, delays etc during the project **Preparation of Environmental Impact Assessments (EIAs) for IDB-Sanitation Project in Five Islands** Year: 2016-2017 Client: Ministry of Environment and Energy Duties Rendered: Data analysis and preparation of the report for the EIAs conducted on the proposed project of establishing sewerage systems in Th. Veymandoo and Lh. Naifaru based on the inputs from the environmental consultants. **Developing a Handbook to Enhance the Capacity of Trainers to Increase the Resilience of People with Disabilities to DRR and CCA** Year : Ongoing Client: National Disaster Management Center Position Held: Consultant Duties Rendered: Review and analyze existing; provide input in relevant stakeholder consultations; Preparation of the handbook **Tool Kit and Training Materials for Increasing Awareness on Climate Change Adaptation & Mitigation Measures in Tourism Sector (Kaaf, Alif Alif, Alif Dhaal, Baa & Lhaviyani Atoll)** Year : 2015 Client: Ministry of Tourism Position Held: Project manager Duties Rendered: Preparation of Materials, Conducting workshops **Tool Kit and Training Materials for Increasing Awareness on Climate Change Adaptation & Mitigation Measures in Tourism Sector (For Tourism Staff)** Year : 2015 Client: Ministry of Tourism

Position Held: Project manager
Duties Rendered: Preparation of Materials, Conducting workshops

Situation Analysis for the formulation of Master Plan for Sustainable fisheries (MASPLAN)
Year : 2015
Client: JICA
Position Held: Consultant
Duties Rendered: Community Consultations, Analysis and reporting

Integration of Climate Change Risk Resilience into Land Use Planning
Location: Maldives
Year: 2011
Client: Ministry of Housing and Environment
Position Held: Planner/Project Coordinator
Duties Rendered: Provide input in planning perspective and also over all coordination of the project inclusive of conducting a workshop to present the findings

URBAN PLANNING

Preparation of AA. Feridhoo Land use plan
Year : 2016
Client: Feridhoo Island Council
Position Held: Planner
Duties Rendered: Community Consultations, land use planning and reporting

Preparation of K. Himmafushi Land use plan
Year : 2016
Client: Himmafushi Island Council
Position Held: Planner
Duties Rendered: Community Consultations, land use planning and reporting

Preparation of AA. Bodufolhudhoo Land use plan
Year : 2015
Client: Bodufolhudhoo Island Council
Position Held: Planner
Duties Rendered: Community Consultations, land use planning and reporting

Formulation of Coastal Protection Regulation, ICCRRIP Project
Client: Ministry of Environment & Energy
Position Held: Project Coordinator
Duties Rendered: Consultations, Input in formulation of Regulation and reporting

Preparation of AA. Mathiveri Land Use Plan
Year : 2014
Client: Mathiveri Island Council
Position Held: Planner

Duties Rendered: Community Consultations, land use planning and reporting

Development of a National Framework/plan on managing IDP's (internally displaced) persons/population caused by crises, emergencies and climate change
Year : May 2014 –Dec 2014
Client: UNDP/NDMC
Position Held: Team Leader
Duties Rendered: Overall project coordination and delivery

Preparation of Disaster Management Plan for a Guest House
Year : 2014
Client: Sea Side Lodge Guesthouse Manager, Hulhumale'
Position Held: Planner
Duties Rendered: Preparation of the disaster management plan according to the guidelines set by

Perceptions and understandings of climate change and migration survey (K.Guraidhoo and R.Dhuvaafaru) carried out by a Norwegian Research Institute
Year : 2013
Client: CICERO - Center for Climate and Environmental Research – Oslo ; Norwegian Academic Institution
Position Held: Local Consultant
Duties Rendered: Assisted (CICERO to carry out the household survey, focus group discussions and the key informant interviews

Review and Update the Detailed Island Risk Assessment in the Maldives prepared for HDh. Kulhudhuffushi and GDh. Thinadhoo
Year: 2013
Client: Ministry of Environment and Energy
Position Held: Social Planner/Project Coordinator
Duties Rendered: Review all relevant documents related to DIRAM study, study the social aspects impacting the risks of the islands and overall management of the project.

Preparation of Heritage Action Plan and Preliminary Inventory
Year: 2011
Client: Department of National Heritage
Position Held: Team Leader
Duties Rendered: Proposed action plan for the protection and safeguarding of national heritage. Prepared a preliminary inventory of the existing tangible and intangible heritage of Maldives

Preparation of Atoll and Island Development Plans for AA. Atoll
Year: 2011
Client: Secretariat of AA Atoll council
Position Held: Planner/ Project Manager
Duties: Manage and prepare the development plans

Reviewing the Third Tourism Master Plan 2005-2011
Year : 2011

Client: Ministry of Tourism Arts and Culture
Position Held: Planner/Project Coordinator
Duties Rendered: Provide input in planning perspective and also over all coordination of the project inclusive of conducting a workshop to present the findings

Preparation of a detailed Layout Plan for Tourism Zone (Asseyri Project)
Year :2011
Client: Ministry of Tourism Arts and Culture
Position Held: Planner/Project Coordinator
Duties Rendered: Provide input in planning perspective through preparing the layout plan and also over all coordination of the project inclusive of conducting a workshop to present the findings

Appraisal of Hithadhoo Regional Hospital Development
Location: S. Hithadhoo, Maldives
Year :2010
Client: OPEC Fund for International Development (OFID)
Position Held: Socio Assessment Specialist/Project Coordinator
Duties Rendered: Overall Coordination of the project and carry out social Impact assessment study.

Mapping study of infrastructure and resources for Youth
Location:
Year : 2010
Client: UNDP
Position Held: Assistant project coordinator
Duties Rendered: Assisting in overall coordination of the project

***Draf RancanganTempatan* DAERAH KUALA LANGAT (*Draft Local Plan* for Kuala Langat District)**
Location: Kuala Langat, Selangor, Malaysia
Year :2009
Client: JPBD (Town and country planning department, Selangor)
Position Held: Support consultant
Duties Rendered: Assisting in the planning process including the report writing, consultations, preparing layout plans and 3D sketch-up models

Reviewing the Master Plan of Badra and Sweirra, Iraq
Location: Badra and Sweirra, Iraq
Year :2009
Client: City council, Badra and Sweirra
Position Held: Support consultant
Duties Rendered: Providing consultancy on the master plan. Reviewing the EIA and preparing SIA for the master plan of Badra and Sweirra.

HELIPAD Development; PRINCE COURT Hospital
Location: Ampang, Kuala Lumpur, Malaysia
Year :2009
Client:
Position Held: Support Consultant
Duties Rendered: Reviewing the guidelines for HELIPAD development, preparing proposal presentations for the development

Professional Referees

Name: Najfa Shaheem Raazee
Position: Project Manager of ICCRRIP Project
Email Address: najfa.raazee@environment.gov.mv

Name: Ilan Celman
Position: Former project manager for Perceptions and understandings of climate change and migration survey (K.Guraidhoo and R.Dhuvaafaru)
Email Address: ilan_kelman@hotmail.com

CERTIFICATION
I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes me, my qualifications, and my experience. I understand that any willful misstatement described herein may lead to my disqualification or dismissal, if engaged.

Aishath Abdulla

Aishath Abdulla
03 July 2017
Contact Number: + (960) 7987809 Email: ayshath.abdulla@gmail.com.

Mariyam Shujaa-ath Abdul Fathah
Musaafaa, Lh. Naifaru
Mobile: 9696169
Email: mariyam.shujaath@gmail.com

EDUCATION

2015
Bachelor of applied science (Honours) - University of Canberra, Australia.

- Title: Metal contamination and mercury speciation in fish of the Maldives.
- First class honours.
- Course GPA: 7.0 out of 7.0.

2012-2014
Bachelor of Environmental science - University of Canberra, Australia.

- Majored in Environmental Chemistry and Analytical Chemistry.
- Course GPA: 5.833 out of 7.0.

2008-2010
College – Edexcel General Certificate of Education.

2005-2007
University of Cambridge general certificate of Education (GCE).

1998-2004:
Primary Education-Madhrasathul Ifthithaah (Maldives).

IELTS overall band score: 8.0 out of 9.0

OTHER TRAININGS

Certificate in Practical Use of FIDIC Contracts, 2018.

Participated in training course on Managed Aquifer Recharge (MAR) under the Enhance Climate Resiliency and Water Security in the Maldives (Maldives GCC) Project funded by USAID.

Course work on Project Management, Cyrix College, Maldives.

WORKSHOPS

Consultant from FENAKA Corporation Ltd. for the formulation of Global Analysis and Assessment of Sanitation and Drinking - Water (GLAAS) for the Maldives, 2016.

Consultant from FENAKA Corporation Ltd. for workshop to formulate the national strategic action plan and indicator framework for water and sewerage for the Maldives, 2017.

LANGUAGES AND DEGREE OF PROFICIENCY

Divehi- mother tongue
English- fluent

COUNTRIES OF WORK EXPERIENCE

Maldives
Australia

EMPLOYMENT RECORD

2017 to present - Project Manager, Land and Marine Environmental Resource Group Pvt. Ltd., Male ʼ , Maldives.

- Project management for the dredging, reclamation and shore protection works for reclamation of 9 islands for resort development purpose at Emboodhoo Lagoon, South Male’ Atoll, Maldives.
- Provide the most feasible and environmentally sound advice to the client.
- Field survey to collect data for EIA.
    - Referee
        - Mohamed Aslam
            - Director
            - Land and Marine Environmental Resource Group Pvt. Ltd.
            - Email: mohamed.aslam@lamer.com.mv
            - Telephone: +960 7782 866

2016 to 2017 - Assistant Director, Utilities Services Division, FENAKA Corporation Ltd., Male, Maldives.

- Water quality monitoring for water and sewer branches registered under FENAKA.
- Providing Environmental consultancy for the Company.
- Compiling Environment Impact Assessment reports for projects carried out by the company.
- Head of 29 desalination plants and 32 sewerage systems registered under FENAKA Corporation.
- Overseeing water and sewerage related projects operated under the company.
- Project management of water and waste water related projects of the company.
- Conduct environmental research, environmental surveys and environmental monitoring for the company.
    - Referee
        - Hussein Hameez
            - Director
            - Utilities Services Division, FENAKA Corporation Ltd.
            - Email: hussein.hameez@fenaka.com.mv

            - Telephone: +960 7774 602

March 2016 to June 2016- Land and Marine Environmental Resource Group Pvt. Ltd., Male', Maldives.

- Providing environmental consultation to developing and developed resort hotels.
- Compilation of Environment Impact Assessment reports for Government and private development projects
- Assisting in environmental research, environmental surveys and environmental monitoring
- Field survey to collect data for EIA.
    - Referee
        - Mohamed Aslam
            - Director
            - Land and Marine Environmental Resource Group Pvt. Ltd.
            - Email: mohamed.aslam@lamer.com.mv
            - Telephone: +960 7782 866

2015- Research student-Eco chemistry laboratory, University of Canberra Australia.

- Completed honours project on metals and mercury speciation in fish of the Maldives.
- Experienced analytical methods in sampling metals of the fish.
- Mercury speciation analysis techniques.
- Data analysis and statistical methods.
- Web based research work and literature reviews about metals in fish of the Maldives.
- Did research on health related issues on eating fish of the Maldives and able to give consumption advisories about which fish and how much to consume.
- Currently preparing research papers on metals in fish of the Maldives
    - Referees
        - Professor Bill Maher (primary supervisor)
            - Professor in Applied Science
            - University of Canberra, Australia
            - Email: Bill.Maher@canberra.edu.au
            - Telephone: (02) 6201 2531
        - Dr. Simon Foster (secondary supervisor)
            - Assistant professor in Environmental Sciences
            - University of Canberra, Australia
            - Email: Simon.Foster@canberra.edu.au
            - Telephone: (02) 6201 2540

2014- Volunteer research student - Fresh water laboratory-University of Canberra, Australia.

- Report preparation for biological response to flow downstream of Corin, Bendora, Cotter and Googong dams, ACT, Australia.
- Field work to Corin, Bendora, cotter and Googong Rivers.
- Experienced fresh water biological assessment methods and water sampling.
- Sorting macroinvertibrates.
- Processing macroinvertibrates and algae in the laboratory.
- Writing scientific reports.Writing scientific reports.
- Writing scientific reports.
    - Referee
        - Dr. Evan Harrison
            - Technical officer and project manager
            - Institute for Applied Ecology, University of Canberra, Australia
            - Email: Evan.Harrison@canberra.edu.au
            - Telephone: (02) 6201 2400

August 2010 to December 2011- Assisstant cashier, Bank of Maldives

- Handling cash
- Interacting with consumers face-to-face.
- Providing information to customers face-to-face.
    - Referee
        - Mrs. Dheena Mohamed
            - Assistant manager
            - Bank of Maldives, Lh, Naifaru
            - Telephone: 6620319

DETAILED TASKS

Work undertaken that best illustrates capability to handle the tasks assigned: -

PROJECT MANAGEMENT

Project management for the dredging, reclamation and shore protection works for reclamation of 9 islands for resort development purpose at Emboodhoo Lagoon, South Male' Atoll, Maldives.
Location: Emboodhoo Lagoon, South Male' Atoll
Year : 2016 to present
Client: Dream Islands Development Ltd.
Position Held: Project manager
Project Summary: The project involves reclamation of 9 islands, totaling up to a land area of approximately 63 ha which requires about 2.1 million cum of dredged material. This fill material was dredged from a deeper lagoon at North male' Atoll via a Trailer Suction Hopper Dredger. Coastal protection works include construction of revetments and groynes. A marina of depth -4 m is underway as well.
Duties Rendered: Lead the technical teams to deliver the project objectives on time. Providing feasible and sound environmental advice to the client when faced with diverse engineering and technical challenges with a sense of purpose and urgency. Routine site inspections to ensure project works are going smoothly and as per the design. Conduct weekly progress meetings with the Contractor to ensure the work is on schedule and to resolve any issues related to work. Communicate between the Client and the Contractor to ensure project deliverables are smooth and on schedule. Execute all duties of the Engineer as per the FIDIC blue book forms of contract.
Project value: USD 34 Million.

Project management for design and built basis for sewerage collection networks, sewage pumping stations and sea outfall pumping station and allied work in the island of L. Maamendhoo.
Location: L. Maamendhoo
Year : 2016-2017
Client: Ministry of Environment and Energy.
Position Held: Project manager
Project Summary: The project involved design and built of wastewater collection and disposal of a gravity system. The sewer network as designed and built for the entire island of Maamendhoo. Project also involved design and built of pump stations and sea outfall at the most environmentally and socially feasible locations.
Duties Rendered: Monitoring project progress and responsible for overseeing project activities and solve issues. Arrange inspection trips to review project activities.

Project management for provision of sewage facilities in Hithadhoo (central area), Addu City.
Location: S, Hithadhoo
Year : 2016-2017
Client: Ministry of Environment and Energy.
Position Held: Project manager
Project Summary: The project involved all construction works of the waste water collection and disposal of a vacuum system in the central area of Hithadhoo. Provision of house connections, construction of pump stations and sea outfall were part of the project.
Duties Rendered: Monitoring project progress and responsible for overseeing project activities and solve issues. Site inspection of project activities.
Project value: MVR 12 Million.

Project management for consultancy services for survey, design of seweage facilities in F. Biledhoo, GDh. Madaveli, R. Innamaadhoo and Sh. Feevah, Maldives.
Location: F. Biledhoo, GDh. Madaveli, R. Innamaadhoo and Sh. Feevah
Year : 2017
Client: Ministry of Environment and Energy.
Position Held: Project manager
Project Summary: The project involved design of gravity wastewater collection networks for the 4 islands based on the projected population for the coming 30 years. The most environmentally and socially feasible locations for the pump stations and sea outfall were identified via field surveys.
Duties Rendered: Monitoring project progress and responsible for overseeing project activities and solve issues. Assign tasks to the technical team and arrange resources. Identification of most environmentally and socially feasible options. Communicate with the client and report work progress.

ENVIRONMENT CONSULTANCY PROJECTS AND REPORTS

Report preparation for biological response to flows downstream of Corin, Bendora, Cotter and Googong Dams.
Location: ACT, Australia
Year :2014
Client: ACTEW Water, Australia
Position Held: Researcher/surveyor (intern)
Duties Rendered: Assisted in field work to rivers and in processing macroinvertebrates and algae in the laboratory. Data analysis and writing scientific reports.

Environment Impact Assessment report for resort development works at GDh. Havoddaa, Maldives
Location: GDh. Havoddaa
Year : 2016
Client: Crystal Plaza Resorts Pvt. Ltd.

Position Held: Environment Officer
Duties Rendered: Assessment of beach environment of the project site and assisted in compilation of the EIA report.

Environment Impact Assessment report for harbour extension works at GDh. Fares-Maadhoda, Maldives
Location: GDh. Fares-Maathoda
Year : 2016
Client: Ministry of Housing and Infrastructure
Position Held: Environment Officer
Duties Rendered: Assessment of beach environment of the project site and assisted in compilation of the EIA report.

Environment Impact Assessment report for backfilling of lake and boundary wall reconstruction at K. Funadhoo, Maldives
Location: K. Funadhoo
Year : 2016
Client: State Trading Organization Plc. (STO)
Position Held: Environment Officer
Duties Rendered: The study involved groundwater analysis at the backfill area and identification of potential environmental impact areas related to the proposed project boundary area. As such, a mitigation plan was proposed to decrease the identified impacts.

Environment Impact Assessment report for retrofitting of berthing facility and fuel storage capacity at K. Funadhoo, Maldives
Location: K. Funadhoo
Year : 2016
Client: State Trading Organization Plc. (STO)
Position Held: Environment Officer
Duties Rendered: The study involved identification of potential environmental impacts expected to arise from the project and proposing the most cost effective and environmentally less destructive methodologies of implementing the project.

Environment Impact Assessment report for development of sewerage system at Lh. Naifaru, Maldives
Location: Lh. Naifaru
Year : 2016
Client: Ministry of Environment and Energy
Position Held: Environment Officer
Duties Rendered: Preparation of the EIA report based on baseline data, survey data and design methodology as well as proposing the mitigation plan to minimize the identified environmental impacts.

Environment Impact Assessment report for reclamation of Enboodhoo Lagoon to artificially create islands for resort development, Maldives
Location: Enboodhoo Lagoon
Year : 2016
Client: Dream islands development Pvt. Ltd.
Position Held: Environment Officer
Duties Rendered: The study involved thorough surveying of the Lagoon to identify potential reclamation and burrow areas for the creation of new islands using the bathymetric data as well as proposing the most suitable dredging methodologies based on the depths of burrow areas. Identifying methodologies with the least adverse impacts on the environment in addition to being the most cost effective were major components of this study.

Environmental consultancy for reclamation of Enboodhoo Lagoon to artificially create islands for resort development, Maldives
Location: Enboodhoo Lagoon
Year : 2016-2017
Client: Dream islands development Pvt. Ltd.
Position Held: Environment Officer
Duties Rendered: Part of the project management team to advice the client on island design and coastal protection based on existing oceanographic conditions, island modeling and bathymetry as well as to ensure ways of least environmental impacts and that the design conforms to EPA guidelines.

Environment Impact Assessment report for relocation of powerhouses at Th. Omadhoo, Sh. Lhaimagu, Dh. Hulhudheli, R. Rasmaadhoo, HA. Maarandhoo, HA. Uligamu and Sh. Bileffahi, Maldives.
Location: Th. Omadhoo, Sh. Lhaimagu, Dh. Hulhudheli, R. Rasmaadhoo, HA. Maarandhoo, HA. Uligamu and Sh. Bileffahi.
Year : 2016
Client: FENAKA Corporation Ltd.
Position Held: EIA Consultant (Deputy Manager)
Duties Rendered: Preparation of the EIA report based on baseline data, survey data and design methodology as well as proposing the mitigation plan to minimize the identified environmental impacts.

Environment Impact Assessment report for water production and distribution facility at HA. Hoarafushi, HDh. Hanimaadhoo, R. Ungoofaaru, Lh. naifaru, Dh. Kudahuvadhoo. Sh. Milandhoo, Th. Guraidhoo and GA. Villingili, Maldives.
Location: HA. Hoarafushi, HDh. Hanimaadhoo, R. Ungoofaaru, Lh. naifaru, Dh. Kudahuvadhoo. Sh. Milandhoo, Th. Guraidhoo and GA. Villingili.
Year : 2016
Client: Ministry of Environment and Energy
Position Held: EIA Consultant

Duties Rendered: Preparation of the EIA report based on baseline data, survey data and design methodology as well as proposing the mitigation plan to minimize the identified environmental impacts.

Environment Management Plan for the proposed bottling plant at HDh. Kulhudhuffushi.
Location: HDh. Kulhudhuffushi.
Year : 2017
Client: Island Beverages Maldives Pvt. Ltd.
Position Held: EIA Consultant
Duties Rendered: Conduct environmental and social surveys to ensure environmental and social values are preserved during the construction and operation of the project. Preparation of the EMP report based on baseline data, survey data and design methodology as well as proposing the mitigation plan to minimize the identified environmental and social impacts.

Environment Impact Assessment report for Constuction and Operation of Maniyafushi Field Station.
Location: K. Maniyafushi.
Year : 2017
Client: Ministry of Fisheries and Agriculture
Position Held: EIA Consultant
Duties Rendered: Preparation of the EIA report based on baseline data, survey data and design methodology as well as proposing the mitigation plan to minimize the identified environmental impacts.

CURRICULUM VITAE

1. **POSITION:** Environment Analyst
2. **NAME OF FIRM:** LaMER Group Pvt.Ltd
3. **NAME:** Azim Musthag
4. **DATE OF BIRTH:** 13th December 1985
5. **NATIONALITY:** Maldivian
6. **PERSONAL ADDRESS:** M. Anthias, Fulooniya Magu, Malé, Maldives
7. **EDUCATION** Bachelor of Marine Science (Majoring in Marine Ecology), Griffith University, Queensland, Australia.

   DELF (Diplôme d'études en langue française) Level A1 and Level A2

8. **MEMBERSHIP OF PROFESSIONAL SOCIETIES:** Master Instructor with the Scuba Schools International (SSI).
9. **OTHER TRAINING:** Fish Watch Training Workshop conducted by Darwin Reef Fish Project initiated by the Marine Research Centre of Maldives in collaboration with Marine Conservation Society (UK) in 2009.

   IUCN Manta Ray Workshop in 2013.

   National Coral Reef Monitoring Framework monitoring protocols training in 2014 conducted by IUCN Maldives.

10. **COUNTRIES OF WORK EXPERIENCE:** Maldives and Australia
11. **LANGUAGE AND DEGREE OF PROFICIENCY:**
    English - Native or bilingual proficiency
    Dhivehi - Native or bilingual proficiency
    French - Limited working proficiency
12. **EMPLOYMENT RECORD:**

2005 - 2011	Dive Instructor, Maldivers Diving Centre, Malé.
2012 – 2014	Dive Instructor, Diveoceanus Dive Centre at Paradise Island Resort
2017 - 2017	Research Assistant Griffith University, Gold Coast, Australia.
2018 (Present)	Environmental Analyst Lamer Pvt Ltd

13. **DETAILED TASKS ASSIGNED:** **WORK UNDERTAKEN THAT BEST ILLUSTRATES CAPABILITY TO HANDLE TASKS:**

Project: Ecological surveys for the proposed, potential UNESCO biosphere reserves.
Year: 2018

Location: Maldives
Client: IUCN Maldives
Main project features: Surveying of 5 reefs and 3 islands.
Position: Consultant.
Activities performed:
Conducted ecological (marine and terrestrial) surveys at the proposed sites
Data compilation and analysis
Assisted in the final report development.

Project: Environmental Monitoring Report for resort development
Year: 2018
Location: Maldives
Client: Pearl Atoll Pvt Ltd
Main project features: Survey for the Environmental Monitoring Report
Position: Environmental Analyst
Activities performed:
Conducted the marine component of the survey. The seawater quality analysis, sedimentation analysis, reef benthic surveys, and fish surveys.

Project: Environmental Impact Assessment Report for resort development
Year: 2018
Location: Bodufushi, Raa Atoll.
Client: Alibey Maldives Pvt Ltd
Main project features: EIA Survey for an addendum
Position: Environmental Analyst
Activities performed:
Conducted the marine component of the survey. The seawater quality analysis, reef benthic surveys, and fish surveys.

Project: Environmental Impact Assessment for Coastal Protection and Entrance Clearance.
Year: 2018
Location: Bandos Island Resort, Kaafu Atoll.
Client: Bandos Island Resort.
Main project features: EIA Survey
Position: Environmental Analyst
Activities performed:
Conducted the marine component of the survey. The seawater quality analysis, reef benthic surveys, and fish surveys.

Project: Third Addendum to the Environmental Impact Assessment Report
Year: 2018
Location: Enboodhoo Finolhu Lagoon
Client: Dream Islands Development Pvt Ltd
Main project features: Reclamation of Islands for Resort Development at Enboodhoo Finolhu Falhu, South Malé Atoll
Position: Environmental Analyst
Activities performed:
Conducted the marine component of the survey. The seawater quality analysis, reef benthic surveys, and fish surveys.

14. Certification:

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes myself, my qualifications, and my experience. I understand that any wilful misstatement described herein may lead to my disqualification or dismissal, if engaged.

____ Date: 05th August 2018
[*Signature of staff member or authorized representative of the staff]* *Day/Month/Year*

Full name of staff member: Azim Musthag

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Appendices

Appendix 1 List of abbreviations

BPOE - Best Practicable Environmental Options
CPCe - Coral Point Count with Excel extension
DGPS - Differential Global Positioning System
DO – Dissolved oxygen
EPA - Environment Protection Agency
EPPA - Environmental Protection and Preservation Act
ESAMF - Environmental and Social Assessment and Management Framework
ESIA - Environmental and Social Impact Assessment
ESIA - Environmental Impact Assessment
ESMP - Environmental and Social Management Program
ESP - Electrostatic Precipitator
GPS - Global Positioning System
IDA - Development Association
IFD - Intensity Frequency Duration
IWMC - Island Waste Management Centers
MCEP - Maldives Clean Environment Project
ME - Ministry of Environment
MEMP – Maldives Environment Management Project
MNDF - Maldives National Defense Force
MSL – Mean Sea Level
PET - polyethylene terephthalate
RIAM - Rapid Impact Assessment Method
RO - Reverse Osmosis
RTK - Real Time Kinematic
RWMF - Regional Waste Management Facility
SWM - Solid Waste Management
TDS - Total Dissolved Solids
TOR - Terms of Reference
TSS – Total Suspended Solids
UTM - Universal Transverse Mercator
WAMCO - Waste Management Corporation

Appendix 2 Terms of Reference (ToR)

بسم الله الرحمن الرحيم

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Environmental Protection Agency EPA

NO: 203-EIARES/438/2018/201

Terms of Reference for Environmental Impact Assessment Report for Upgrading of Infrastructure Regional Waste management Facility Zone 2, Raa Vandhoo

Background

The Regional Waste Management Facility (RWMF) at Vandhoo has been designed to provide long term environmentally sustainable solution for waste management in the North Province. The design of the RWMF has been done considering factors such as waste composition, quantity reaching RWMF, applicability in the local condition and regulatory compliance. Limitations of scarcity of land and the requirement to protect the fragile eco-system have also been considered during the design of RWMF.

The initial area allocated for the Regional Waste Management Facility is 15 hectares. Within these 15 hectares RWMF facility shall comprise of following components: Waste unloading and primary segregation platform, Temporary storage for recyclables, Incinération plant, Landfill cell, Leachate collection and management system, Coastal protection structure, Fencing, Berth and access channel, Administration building; and, Roads and storm water drains.

As major component of the facility, Incineration of the municipal waste, after recovery of recyclables and removal of inert materials, is proposed at the RWMF. Incineration will not only destroy the potentially harmful substances in the waste, but also reduce the volume of the waste for disposal in landfill. Incineration is also the most suitable processing technology for management of heterogeneous mixed waste, transported from islands and resorts.

The incinerator design capacity has been derived based on combustible fraction available in the waste. Primary level segregation / presorting has been proposed to avoid the incineration of wastes that contain metals and metalloids, have potential to volatilize and are difficult to control through air emission technology (e.g., mercury and arsenic).

The incinerator is designed considering an average of 10 years of incoming waste quantities, with an operational life of 20 years. An incinerator of 40 TPD installed capacity have been proposed for managing the waste from 2012-2032.

This project was completed in 2015 and follow-up application for additional grant from WB under 'Maldives Clean Environment Project' became effective in September 2017. This project supports investment activities on going in Vandhoo as part of Zone 2 development activities.

The following is the terms of Reference for EIA for **Upgrading of Infrastructure Regional Waste Management Facility Zone 2, Raa Vandhoo**. This ToR is prepared on the basis of the scoping meeting held at EPA on **03/12/2018** in consultation with representatives from the proponent, **Ministry of Environment** and representatives from other institutions. The EIA consultant of the project is **Mr. Hussain Zahir (P04/2007).**

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.

The components of the EIA report would be based on the discussion during the scoping meeting as follows:

1. **Introduction and rationale:** Description of the purpose of the project including the rational giving a brief history of the project describing how the project will improve waste management in the region.

Provide details of the proponent and institutional arrangements for the successful implementation of the project. Describe how the proposed project will improve waste management in the area.

2. Study area: Submit a scaled plan with indications of all the proposed. Specify the boundaries of the study area for the environmental impact assessment highlighting the proposed development location and size. The study area should include:

- Location map (at a suitable scale) of the proposed development sites;
- Adjacent or remote areas including relevant developments and nearby environmentally sensitive sites (e.g. coral reef, mangroves, marine protected areas, turtle nesting area, bird nesting or roosting areas etc.); Relevant developments in the nearest areas and adjacent islands including residential areas, all economic ventures and cultural sites (if any in the immediate project area).
- Map delineating the waste catchment area of the facility.

3. Scope of work: the following components will be assessed and described as part of the scope of work.

Task 1. Description of the Proposed Project

Describe the RWMF infrastructure (fuel storage, water tanks etc.) proposed to be installed or upgraded including location, plant layout and its position in relation to surrounding land uses using maps and drawings where appropriate. Maps should also show the setting and precise location in relation to the relevant aspects of the project area, in particular:

- the location and boundaries of current or proposed land tenures that the project area will be subject to,
- the location and boundaries of the project footprint, including easement widths and access requirements,
- the location of any proposed buffers surrounding the working areas (for construction and operation),
- the location of natural features such as wetlands etc.
- Description of existing waste management arrangements in the RWMF should be outlined giving reference to the estimated type and quantity of waste received and processed at the facility, the present method of waste collection and management and the condition of existing

facilities such as the incinerator, leachate collection pond, waste storage cells / bunkers, fuel storage tanks, RO plant etc. Challenges and issues current faced by the waste operator should be also highlighted and corrective measures should be proposed.

- Identification of the emissions likely to be of concern and the environmental aspects of the project area which may potentially be impacted by the project.

Provide a full description and justification of the relevant parts of the proposed upgrading works, using maps at appropriate scale where necessary. All inputs and outputs related to the proposed activities shall be justified. The following should be provided.

- Construction of water tanks with extension of distribution network
  - Number of tanks, location and size, and the materials proposed for the construction of water tanks and network pipes.
  - Describe equipment needed and construction methods for laying the pipeline including handlining and transportation.
  - The route of the pipeline should be clearly indicated and marked on a map.
  - Details of vegetation clearance if any.
- Construction of new fuel storage tanks and relocation of existing fuel storage tanks
  - Number of fuel storage tanks, location and size.
  - Method and equipment used for tank construction.
  - The type of fuel that will be stored in the tank.
  - Location of inlet and outlet pipes.
  - Justification for the selected location and material from a fire safety perspective (such as not located close to highly flammable waste management areas, use of fireproof materials, firefighting equipment soured near tanks etc.)
  - Details of vegetation clearance if any.
- Rehabilitation of the existing ash disposal landfill and leachate pond (with pumps).
  - Proposed method for landfill rehabilitation and equipment to be used.
  - Details of the ash disposal cells including capacity, dimensions, design specifications and phased development plans.
  - Type and specifications of pumps proposed for leachate ponds.
- Upgrading / upscaling of the existing fire protection system
  - Type of firefighting equipment or system and locations.

- Upscaling of the existing RO plant (with borehole)
  - Location and capacity of RO plant.
  - Details of water production process from intake treatment to distribution.
  - Details of product water storage from RO.
  - Method of feed water intake for RO process, their advantages and justification.
  - Disposal of concentrated brine, selection of location and reason for choosing the location and justification.
  - Properties of product water quality and method for monitoring the water quality during operational stage.
  - Details of vegetation clearance if any.
- Construction of Dirt Roads
  - Types and quantity of vegetation to be removed.
  - Details of vehicles and machinery proposed for vegetation clearance and levelling works.
- Construction of new infrastructure (accommodation block, recycling facility, bulk waste storage facility, hazardous waste storage facility, new waste storage bunker, store room 3, and incinerator maintenance room) and upgrading of infrastructure (extension of existing waste processing bunker and extension of existing utility building)
  - Location and size of each proposed infrastructure.
  - Details of vegetation clearance if any.

- Project phasing; project schedule and life span;
- Employment implications;
- Number of construction workers;
- Recruitment process for workers;
- Accommodation facilities;
- Food;
- Services and facilities for workers;
- Construction equipment and machineries and materials;
- Changes to materials and resource use, such as energy consumption;
- Electricity needs and utility providers during construction and operation stage;
- Sewage generation and sewage management;

- Backup arrangement for utilities;
- Solid waste production, storage, disposal and recycling; and
- Describe the health and safety measures;
- Provide a summary of all the project inputs and outputs;

Task 2 Description of the environment

Assemble, evaluate and present the environmental baseline data on the project area and relevant boundaries. Identify baseline data gaps and identify studies and the level of detail to be carried out by consultant. As such all baseline data must be presented in such a way that they can be usefully applied to future monitoring. The report should outline detailed methodology of data collection utilized.

All data must be collected as per the requirements of the EPA Data Collection Guideline (published on www.epa.gov.mv).

The baseline data shall be collected before proposed new development and from all benchmarks established in the first phase of the project, with additional baseline data as required. All survey locations shall be referenced with Geographic Positioning System (GPS) including water sampling points, reef surveys, and vegetation surveys and terrestrial fauna surveys where applicable and appropriate. Information should be divided into the categories shown below:

Physical environment

- General description of geomorphology of the formation of coral islands, information on climatic data such as wind, rainfall and tide, currents and near-shore sediment transport
- Shoreline survey of the entire island including low tide line (beach toe), high tide line (beach berm), vegetation line and other significant features of the shoreline (e.g. beach rock formation, erosion scarps in appropriately scaled map (compare with the survey carried in association with project preparatory works).
- Determination of the elevation of the island with respect to mean sea level (MSL) with at least two benchmarks established on the island.
- Beach profiles from locations where profiles have been taken previously (if any)

An indication of the quality and quantity of water resources in the vicinity of the project site should be given including spatial and temporal monitoring to accurately characterize baseline groundwater characteristics and present water use. If the project is likely to use or affect local sources of groundwater, provide a description of groundwater resources in the area in terms of:

- geology
- aquifer type - such as confined, unconfined
- depth to and thickness of the aquifers
- depth to water level and seasonal changes in levels
- interaction with surface water o sources of recharge
- current access (bores) to groundwater resources
- likely quantitative groundwater yield.
- Groundwater assessment pH, salinity, Electrical Conductivity, Dissolved ammonia, phosphate, sulfate, zinc, TSS. (from at least three locations of the island)

Biological environment

- Terrestrial habitat description in general to include categorization of major and significant vegetation types.
- Soil quality assessment including general characterization of the soil structure, drainage, soil and, phosphorous adsorption capacity and permeability,
- A list of description of terrestrial flora and fauna to include residential and migratory birds, mammals and reptiles where applicable,
- Qualitative and quantitative assessment of the reef with appropriate reference locations (3) to include types of corals, major types of invertebrates, and major fish species, grouped at major trophic levels,
- Seawater quality around the island including pH, salinity, TDS, turbidity, dissolved oxygen, phosphate, ammonia and TSS (from all locations from which baseline data was taken and also from all outfall locations).

- Identify marine and terrestrial environmentally sensitive sites such as breeding or roosting grounds for (e. g. sea turtles and sea birds) within and boundary area of the project development site.

Air quality

- Describe the topography and climate of the air shed. Parameters should include air temperature, wind speed and direction, atmospheric stability, mixing depth and other parameters necessary for input to the models. Describe the existing air quality within the air shed and at the nearest and adjacent inhabited islands and on the nearest and adjacent resorts

Noise Amenity

- Describe noise sources contributing to ambient noise levels (day/night) at the nearest and adjacent inhabited islands and ambient noise levels (day/night) on the nearest and adjacent uninhabited[1]. Sensitive noise receptors adjacent to all project components should be identified and typical background noise estimated based on surveys at representative sites. A justification for an ambient noise baseline (dbA) at the nearest and adjacent inhabited islands should be provided.

Socio-economic environment

- Describe the natural features and landscapes of the project site which may have a cultural significance (day and night).
- Describe the visual amenity from the nearest and adjacent uninhabited islands
- Describe any structures on the project site which may have cultural or religious significance.

4. Legislative and Regulatory Considerations

Outline the project's consistency with the existing national, state, regional and local planning that apply to the project include reference to relevant statutory and non-statutory plans, planning policies, guidelines, strategies and agreements as appropriate. Outline the pertinent policies, regulations and standards governing project location, land use, environmental quality, and public health and safety. This should cover information on legal requirements specific to the project, such as permits to be taken under the Environmental Impact Regulations (2012) and other relevant institutions. There should be a brief

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description on the process (and law) pertaining to the allocation of land to development projects, in general, and to the RWMF, in particular. Issues related to land acquisition and resettlement should be addressed, stating no impact or minimal impact. The report also should indicate whether a study or public consultation has been (or should be) undertaken to assess willingness / ability to pay.

5. Stakeholder Consultation

The consultation process should provide opportunities for stakeholders and community involvement and education. It may include interviews with individuals, government institutions, public communication activities, interest group meetings, production of regular summary information and updates (i.e. newsletters), and other consultation mechanisms to encourage and facilitate active public consultation. Stakeholder consultation processes for all parts of the ESIA should be integrated. Sufficient information about the development and the consultation process should be provided to the stakeholders and the community at an early stage and in accessible and culturally appropriate ways. Information about the development should inform the community about the benefits, disadvantages, trade-offs, potential issues and implications as required, enabling them to formulate their views. The following stakeholders must be consulted:

- Ministry of Environment and Energy (MEE)
- Environmental Protection Agency (EPA)
- Waste Management Corporation (WAMCO)
- Raa Atoll Council, Lhaviyani Atoll Council, Baa Atoll Council, Noonu Atoll Council
- Island Council of Inamaadhoo (the nearest inhabited island).

Information about the consultation processes conducted and their results should be provided including:

- the methodology adopted, a list of the stakeholders consulted during the program and how their involvement was facilitated,
- the processes conducted to date and the future consultation strategies and programs including those during the operational phase of the project,
- indicate how consultation involvement and outcomes were integrated into the ESIA,
- recommendations on how the project might address concerns raised during public consultation.

6. Determination of Potential Impacts

Identify the major issues of environmental and social concern and indicate their relative importance to the design of the project. Distinguish construction and post-construction phase impacts, significant positive and negative impacts, and direct and indirect impacts. Identify impacts that are cumulative, unavoidable or irreversible. Special attention should be paid to:

Site preparation, construction and commissioning: Site clearing impacts including the area to be cleared (m^2), how waste from land clearing would be managed, measures that would be taken to comply with the *Regulation on Cutting Down, Uprooting, Digging Out and Export of Trees and Palms from One Island to Another* including locations for relocating trees, source of obtaining new plants to comply with planting two or more trees for each mature tree cut down, compensation plan if any trees owned by the local community needs to be cut down.

The impacts associated with the proposed development including a full description of the relevant parts and nature of the works, an indicative construction timetable, including expected commissioning and start-up dates and hours of operation, and a description of major work programs for the construction phase, including an outline of construction methodologies. If fill material is required, the quantity and sourcing of borrow materials, and transport and storage, construction site management, noise, fugitive dust, solid waste disposal, traffic and employment.

Commissioning impacts: including a description of the regional waste management facility commissioning process.

RWMF operation: Describe solid waste management activities during operations, with particular reference to waste collection, transport, sorting, incinerator loading, and disposal of incinerator ash. Characteristics of any hazardous materials resulting from or involved in the project, indicating appropriate management strategies (e.g. handling, storage, treatment, disposal).
Impacts associated with bulk storage in the fuel storage tanks and distribution of petroleum or petroleum-related products should also be emphasized.

Air Quality: Characterize the nature of emissions to air likely to be produced during the construction and operations of the upgraded infrastructure at the RWMF, including emissions during operation of heavy machinery and equipment.

Water Resources: Provide details of potential impacts on the quality of groundwaters and seawater. Particular reference must be made to potential groundwater and seawater pollution during fuel storage and transportation. Additionally, chemical and physical properties of wastewater including leachate from ash disposal, the potential of wastewater to contaminate groundwater resources, and impact on current and future potential groundwater usage from the proposed development shall be highlighted. Describe the pollution control equipment and design features of the proposed development for prevention and minimization of contamination of groundwater resources.

Natural Environment: The proximity of the facility to any sensitive areas should be described. Describe measures to be taken to avoid and minimize potential adverse impacts of the proposal on sensitive terrestrial and aquatic environments. Describe potential issues relevant to sensitive areas, or areas which may have low resilience to environmental change arising from the construction, operation of the project including clearing, salvaging or removal of vegetation. Areas of special sensitivity include wetlands, wildlife breeding or roosting areas, and habitat of threatened plants, animals and communities. The capacity of the environment to assimilate discharges/emissions should be assessed. Short-term and long-term effects should be considered with comment on whether the impacts are reversible or irreversible. The discussion should cover all likely direct and indirect environmental harm due to the project on flora and fauna particularly sensitive areas. If construction and operation of the project are likely to cause adverse impacts on sensitive areas or areas which may have low resilience to environmental change describe environmental offsets that would counterbalance the impact on these values.

Noise Amenity: Describe the impacts of noise generated during the construction and operation of the proposed facility on RWMF operators, nearest and adjacent inhabited islands and nearest and adjacent resorts or uninhabited islands with potential future use for resort development. An analysis of noise impacts should include the estimated noise levels generated by the proposed development assessed against typical background levels on the islands, and the impact of noise at all potentially sensitive receivers compared with the *World Bank General Environmental, Health, and Safety (EHS) Guidelines*. If noise is likely to cause an adverse impact propose measures to minimize or eliminate these effects, including details of any screening, lining, enclosing or bunding of facilities, or timing schedules for construction and operations.

Socio-cultural: Describe the impacts of the proposed development on the natural features and landscapes of the project site which may have cultural significance and which may impact on nearest and adjacent islands with potential future use for resort development. Use sketches, diagrams, elevation drawings to portray the near views and far views of the completed structures and their surroundings from visually sensitive locations.

- Describe measures to be taken to avoid and minimize potential adverse impacts of the proposal on visual amenity. Justify the land clearing activities with particular reference to potential for minimizing intrusion of the visual amenity of the proposed development activities.
- Describe the impact of the proposed development on any structures which may have cultural or religious significance. Describe measures to be taken to avoid, manage or mitigate potential impacts on these structures during construction and operation of the proposed development.

7. Alternatives to proposed project

Indicate project alternatives and examine alternative ways of doing things (in terms of process) and compare and contrast the possible locations for the development site (list alternatives sites) with particular reference to the "do nothing" option which represents current conditions, and Options as described in the Best Practical Environmental Options Final Report. This section must include a comparison of the technologies and methods for management and control of contaminants which may potentially impact on the environment including alternatives for ash disposal.

8. Develop an Environmental Management Plan (mitigation /monitoring)

The Project's environmental management plan (EMP) should consists of the set of mitigation, monitoring, and institutional measures to be taken during implementation and operation to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels. The plan also includes the actions needed to implement these measures. The EMP should be presented in matrix form in line with World Bank Group General Health and Safety Guidelines. More specifically, the EMP includes the following components:

Mitigation: The EMP should identify feasible and cost-effective measures that may reduce potentially significant adverse environmental impacts to acceptable levels. The plan should include offset measures if mitigation measures are not feasible, cost-effective, or sufficient. Specifically, the Plan should:

- identify and summarizes all anticipated significant adverse environmental impacts
- (air, groundwater and physical cultural resources (as applicable);

- describe each mitigation measure, including the type of impact to which it relates and the conditions under which it is required (e.g., continuously or in the event of contingencies), together with designs, equipment descriptions, and operating procedures, including:
    - general operating procedures for managing and mitigation risks to the environment from general facility operations including waste collection, transport, incinerator loading, hazardous waste handling, fuel transfer and storage, litter management disposal of incinerator ash and residues.
    - manufacturer's operational guidelines specifically outlining safety and emission control procedures as well as recommended maintenance practices.
    - general operating procedures for implementing back-up measures that will act in the event of failure of primary measures to minimize the likelihood of adverse air impacts.
    - general operating procedures for implementing backup measures that will act in the event of uncontrolled release to waters due to system or catastrophic failure, or from unforeseen unpredicted weather conditions (abnormal rainfall).
    - estimate any potential environmental impacts of these measures; and
    - provide linkage with any other mitigation plans required for the project.

Monitoring: Provide (a) a specific description, and technical details, of monitoring measures, including the parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits (where appropriate), and definition of thresholds that will signal the need for corrective actions; and (b) monitoring and reporting procedures to (i) ensure early detection of conditions that necessitate particular mitigation measures, and (ii) furnish information on the progress and results of mitigation. Specifically, the plan should address physical groundwater quality, air emissions; and physical cultural resources (as applicable).

Capacity Development and Training: Specifically, the ESMP should provide a specific description of institutional arrangements-who is responsible for carrying out the mitigation and monitoring measures (e.g., for operation, supervision, enforcement, monitoring of implementation, remedial action, financing, reporting, and staff training). To strengthen environmental management capability in the agencies responsible for implementation, most ESMPs cover one or more of the following additional topics: (a) technical assistance programs, (b) procurement of equipment and supplies, and (c) organizational changes.

9. REPORTING

The ESIA report will be concise and limited to significant environmental issues. The main text will focus on findings, conclusions and recommended actions supported by summaries of the data collected. The ESIA report will be organized according to the outline below.

- Executive Summary
- Introduction to Assignment
- Description of Proposed Project
- Methodology Used
- Policy, Legal and Administrative Framework
- Description of the Environment/Social (Baseline Assessment)
- Significant Environmental and Social Impacts (Impact Assessment)
- Analysis of Project Alternatives
- Environmental and Social Management Plans (mitigation and monitoring)
- Conclusions and recommendations

Timeframe for Submitting the Addendum – The developer must submit the completed Addendum to the Environmental Impact Assessment within 6 months.

………………………………………………………

16th December 2018

Appendix 3 Land Acquisition Letter

بسم الله الرحمن الرحيم

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ފުދުން ސަލާމަށްފަހު ދަންނަވަމެވެ.

ތިޔަ މިނިސްޓްރީގެ ނަންބަރު 438-WMPC/1/2017/27 (6 މާރިޗު 2017) ސިޓީއާއި، މި އޮފީހުގެ ނަންބަރު 1-ED/438/2017/26 (26 ފެބްރުއަރީ 2017) ސިޓީއާ ހަވާލާދީ ދަންނަވަމެވެ.

ޒޯން 1 (ހއ، ހދ، ށ) އަދި ޒޯން 2 (ނ، ރ، ބ، ޅ) ހިމެނޭ ސަރަހައްދުގައި ޤާއިމުކުރެވޭ ސަރަހައްދީ ކުނި މެނޭޖްކުރާ 2 ސިސްޓަމްގެ ރީޖަނަލް ސެންޓަރަކީ މާސްޓަރޕްލޭނުގައި އުތުރުބުރީ (ރ) ވަންދޫކަމަށާއި، ރ.ވަންދޫއިން ރީޖަނަލް ވޭސްޓް މެނޭޖްމަންޓް ފެސިލިޓީ ޤާއިމުކުރުމަށް ދޫކުރެވިފައިވާ ބިމުގެ އިތުރުން އަތޮޅުގައި ބާކީ އޮތް ބިމަކީ ރީޖަނަލް ވޭސްޓް މެނޭޖްމަންޓް ސިސްޓަމްގެ މަސައްކަތަށް ބޭނުންވާ ބިމެއް ކަމުގައިވާތީ، މިކަމުގައި ތަފާތުވެގެން އުފެދިދާނެ ޚިޔާލުތަކާއި ގުޅޭގޮތުން ފާހަގަކޮށްލަމުން ދަންނަވަމެވެ.

ޒޯން 1 (ހއ، ހދ، ށ) ގައި އިތުރު ސަރަހައްދީ މަރުކަޒެއް ޤާއިމުކުރެއްވުމުގެ ބަދަލުގައި ޒޯން 2 (ނ، ރ، ބ، ޅ) ގައި ޤާއިމުކުރުމަށް އިންވެސްޓްމަންޓަށް ބޭނުންކުރެވޭނެ ރ.ވަންދޫގައި އެސަރަހައްދުގެ ރީޖަނަލް ސެންޓަރ ޤާއިމުކުރެއްވުމަށް ހަރަދު ކުޑަ އަދި އެންމެ އެކަށީގެންވާ ގޮތް ކަމުގައި ފާހަގަކުރެއްވިފައިވާތީއާއި، މި ދެ ސަރަހައްދުގެ ރީޖަނަލް ވޭސްޓް މެނޭޖްމަންޓް ސިސްޓަމްގެ މަސައްކަތް ކުރިއަށް ގެންދާނެ ހިނދަކު އެމަސައްކަތަށް މި ބިން ބޭނުންވާނެކަމަށް ފާހަގަކުރައްވާފައިވާތީ، މި ބިން ކުނި މެނޭޖްކުރުމުގެ މަސައްކަތަށް ބޭނުންކުރުމުގައި އެއްވެސް ހުރަހެއް ނެތްކަމުގައި ދަންނަވަން ރައީސުލްޖުމްހޫރިއްޔާ ވިދާޅުވިއެވެ.

އިޙްތިރާމް ގަބޫލުކުރެއްވުން އެދެމެވެ.

9 ޖުމާދަލްއާޚިރު 1438
8 މާރިޗު 2017

ޚާދިމުކުމް

މުޙައްމަދު ޝުނައިފް
އަންޑަރ ސެކްރެޓަރީ

މިނިސްޓްރީ އޮފް އެންވަޔަރަންމަންޓް އެންޑް އެނަރޖީ
މާލެ،
ދިވެހިރާއްޖެ
ކޮޕީ: މިނިސްޓްރީ އޮފް ފިނޭންސް އެންޑް ޓްރެޜަރީ

[illegible]

Appendix 4 Master Plan of RWMF at Vandhoo

Facilities proposed to be developed under this ESIA are marked with an asterisk

WASTE MANAGEMENT FACILITIES

01. HARBOUR
02. GUARD HOUSE AND WEIGH BRIDGE*
03. VEHICLE SHED EXTENSION BUILDING*
04. STORAGE EXTENSION BUILDING*
05. FUEL FARM*
06. WATER STORAGE TANKS*
07. MECHANICAL STORAGE*
08A. POWER HOUSE*
08B. DESALINATION BUILDING*
09. WASTE SORTING SHED EXTENSION*
09A. SORTING SHED TO INCINERATOR SHADING*
10. BUNKERS
    10A – ADMIN TRAINING
    10B – RECEIVING (NON–RECYCLING)
    10C – RECEIVING (E–WASTE)
    10D – RECEIVING (PLASTICS)
    10E – RECEIVING (PAPER ITEMS)
    10F – RECEIVING (REJECTS)
    10G – RECEIVING (ORGANIC WASTE)
    10H – RECEIVING (MEDICAL WASTE)
    10I – RECEIVING (METALS)
    10J – RECEIVING (NON–RECYCLING)
    10K – RECEIVING (FOR EXPANSION)
    10L – RECEIVING (FOR EXPANSION)
11. WASTE MANAGEMENT FACILITIES*
    11B – RECYCLABLES
    11C – RECYCLING (WITH COMPACTION
        AND BAILING PLANT
    11D – E–WASTE
    11E – BULK WASTE
    11F – COMPOST
    11G – HAZARDOUS WASTE
12. UNPROCESSED WASTE BUNKER*
13. FIRE PUMP ROOM*
14 PROPOSED LANDFILL
    14A – C&D WASTE
    14B – GENERAL WASTE
15. PROPOSED LEACHATE COLLECTION

FUTURE DEVELOPEMENT

F1. FUTURE INCINERATOR LOCATION
F2. FUTURE WASTE MANAGEMENT FACILITIES
F3. FUTURE FOOTBALL FIELD
F4. TRAINING FACILITY & HR BUILDING

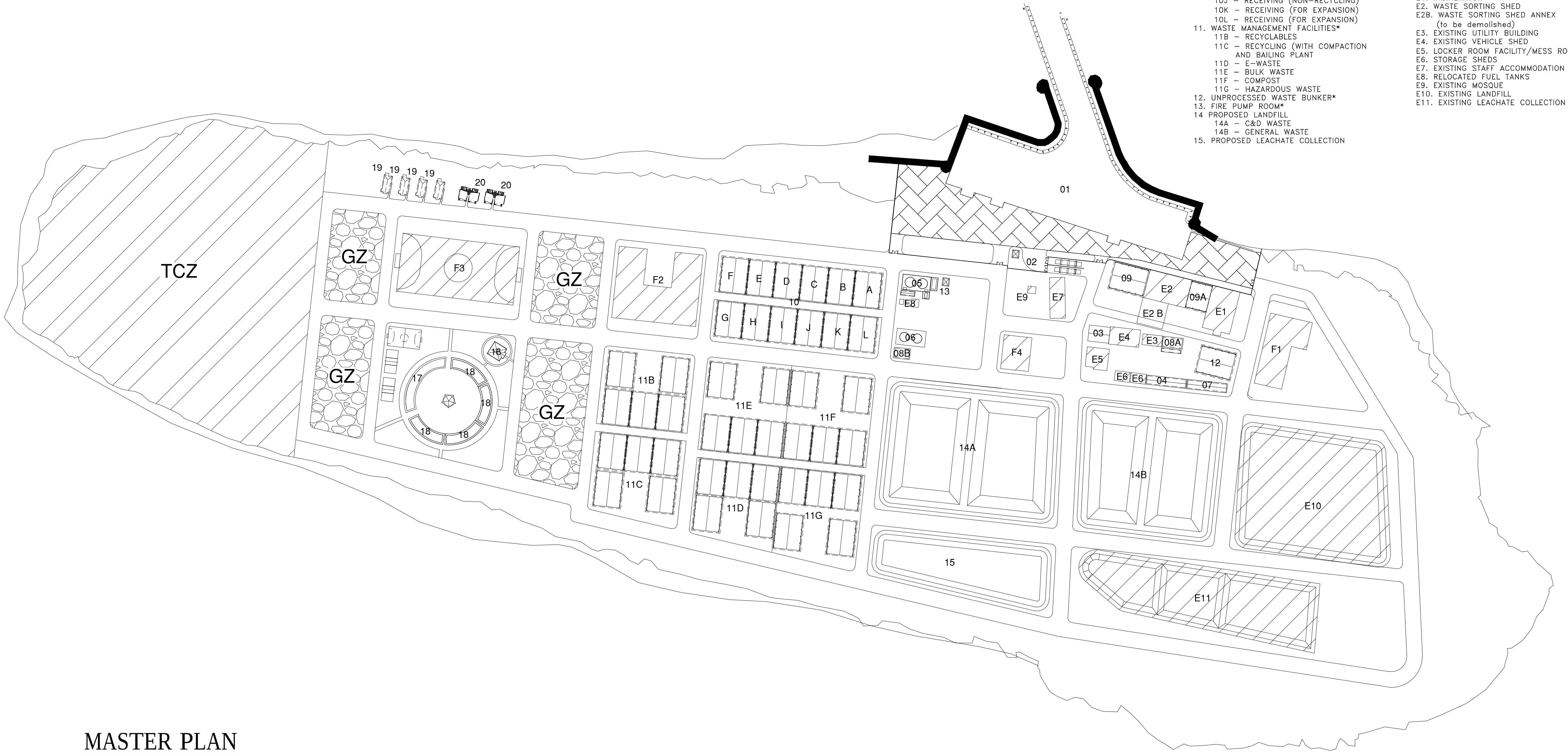
STAFF VILLAGE

16. MOSQUE
17. STAFF BUILDING*
    –STAFF KITCHEN
    –CAFETERIA
    –LAUNDRY
    –RECREATION
    –GYM
18. STAFF ACCOMMODATION* X4
19. GUEST ACCOMMODATION X4
20. CONSULTANTS ACCOMMODATION* X2

G. GREEN ZONE

EXISTING BUILDINGS

E1. INCINERATOR
E2. WASTE SORTING SHED
E2B. WASTE SORTING SHED ANNEX
    (to be demolished)
E3. EXISTING UTILITY BUILDING
E4. EXISTING VEHICLE SHED
E5. LOCKER ROOM FACILITY/MESS ROOM
E6. STORAGE SHEDS
E7. EXISTING STAFF ACCOMMODATION
E8. RELOCATED FUEL TANKS
E9. EXISTING MOSQUE
E10. EXISTING LANDFILL
E11. EXISTING LEACHATE COLLECTION



MASTER PLAN

SCALE 1:3500

0 1 2 3 4 5

NOTE: –
GZ = GREEN ZONE
TCZ = TURTLE CONSERVATION ZONE

PROJECT :
R. VANDHOO
PROJECT: SOLID WASTE
MANAGEMENT FACILITY

CLIENT : MINISTRY OF ENVIRONMENT AND ENERGY

CONSULTANT : **HUSSAIN SHAHEED**

DRAWN BY : LEEN
CHECKED BY : HUSSAIN SHAHEED
TITLE : AS GIVEN
SCALE : AS GIVEN DATE: 29.12.18

PG NO.

DWG NO: VAN-PD-MP-AR-01-R2
REV. NO: R2-291205/01
REV. NOTES
-
-
-
-
-
-

APPROVED BY:

APPROVED DATE:

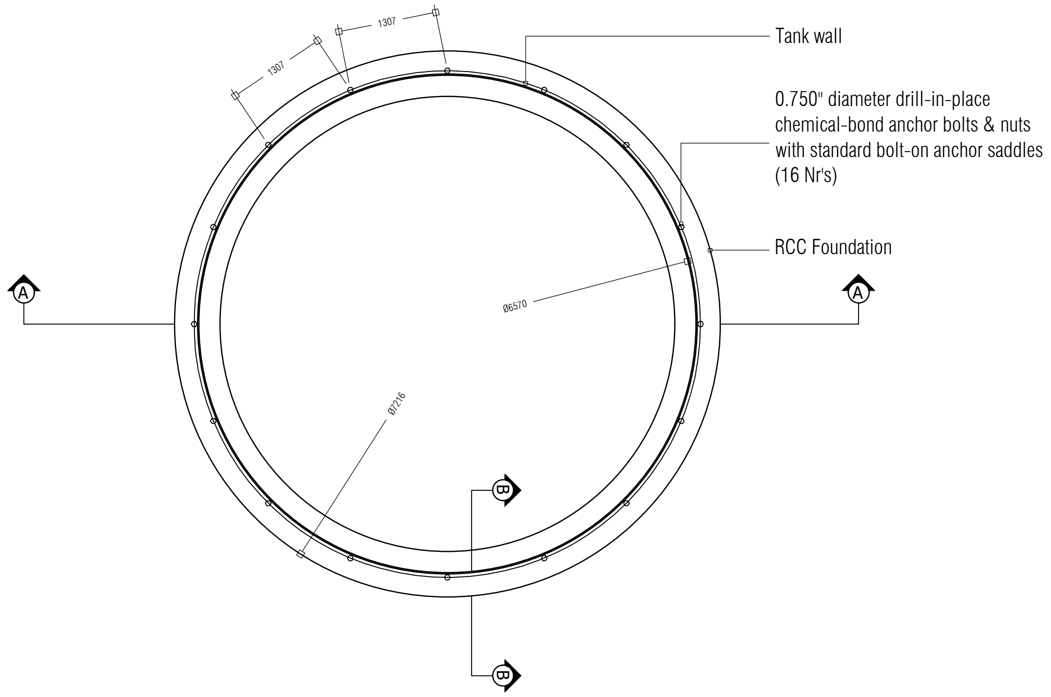
Appendix 5 Details of Water Storage Tanks

CONSTRUCTION OF 2NOS OF 200 CBM WATER STORAGE TANKS
R. VANDHOO

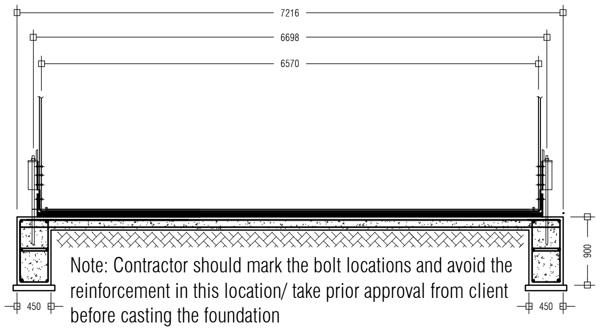
PREPARED BY:

MALDIVES CLEAN ENVIRONMENT PROJECT
MINISTRY OF ENVIRONMENT AND ENERGY

2018


Tank wall
0.750" diameter drill-in-place chemical-bond anchor bolts & nuts with standard bolt-on anchor saddles (16 Nr's)
RCC Foundation
1307
1307
Ø6570
Ø7216
A
A
B
B

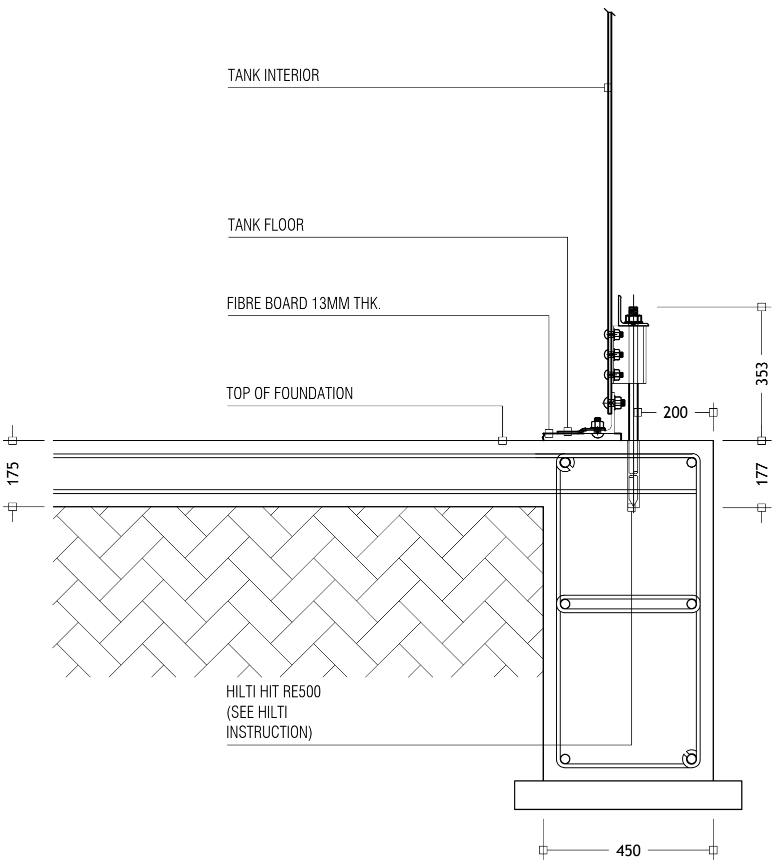
A
A-01
Plan
SCALE 1:100


7216
6698
6570
900
450
450

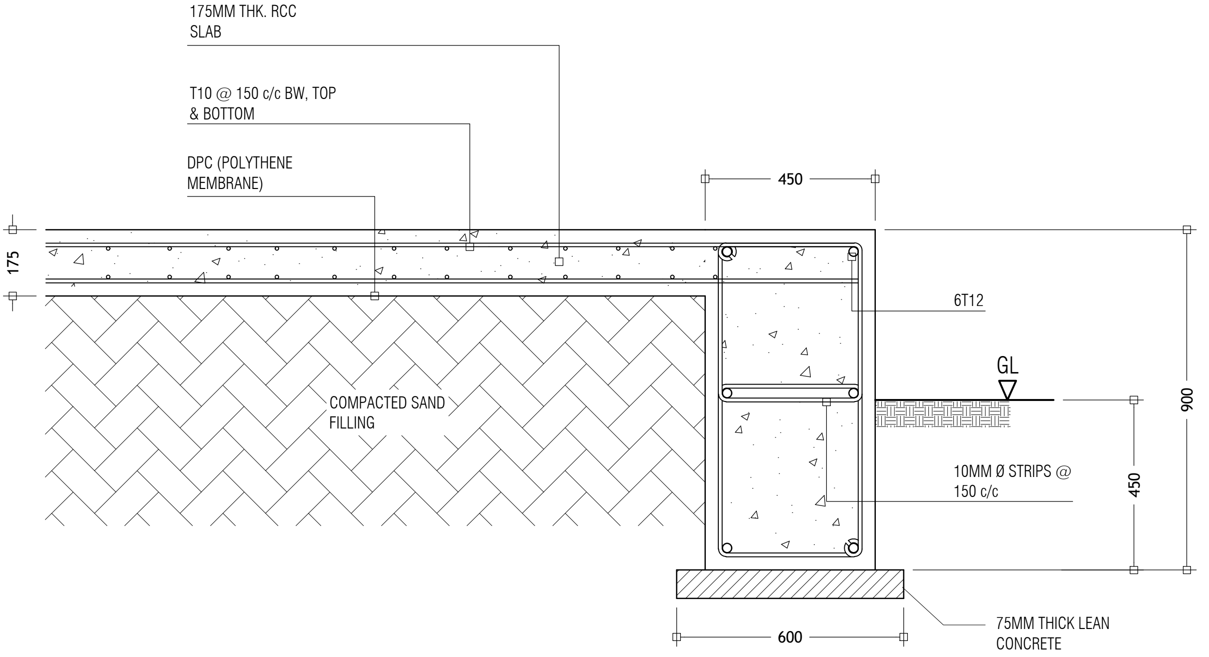
Note: Contractor should mark the bolt locations and avoid the reinforcement in this location/ take prior approval from client before casting the foundation

A
A-02
Section A-A
SCALE 1:100

APPROVED BY	**PROJECT**	**DESIGN BY**	**AMENDMENTS**
MCEP MINISTRY OF ENVIROMENT AND ENERGY GREEN BUILDING, HANDHUVAREE HIGUN, MAAFANNU, MALE' (20392), REPUBLIC OF MALDIVES, TEL: +960-3018431, +960-3018300, FAX: +960-328301	CONSTRUCTION OF 02NOS OF 200 CBM WATER STORAGE TANKS R. VANDHOO	AFRAZ	
	TITLE	**STRUCTURE BY**	
	PLAN AND SECTION	AFRAZ	
	CLIENT DEPARTMENT	**DRAWN BY**	
	WMPC DEPARTMENT	AFRAZ	
	PAPER SIZE A4	**SCALE** 1:100	
	PAGE NO. 01	**DWG NO.** VNDADWATER A1-01	
		DATE 14.11.2018	


TANK INTERIOR
TANK FLOOR
FIBRE BOARD 13MM THK.
TOP OF FOUNDATION
353
200
175
177
HILTI HIT RE500 (SEE HILTI INSTRUCTION)
450

S
S-01
Section B-B/ Tank erection
SCALE 1:20


175MM THK. RCC SLAB
T10 @ 150 c/c BW, TOP & BOTTOM
DPC (POLYTHENE MEMBRANE)
450
175
6T12
GL
900
COMPACTED SAND FILLING
10MM Ø STRIPS @ 150 c/c
450
600
75MM THICK LEAN CONCRETE

S
S-02
Section B-B/Foundation
SCALE 1:20

APPROVED BY

MCEP
MINISTRY OF ENVIROMENT AND ENERGY
GREEN BUILDING, HANDHUVAREE HIGUN,
MAAFANNU, MALE' (20392), REPUBLIC OF MALDIVES,
TEL: +960-3018431, +960-3018300, FAX: +960-328301

PROJECT
CONSTRUCTION OF 02NOS OF 200 CBM WATER STORAGE TANKS
R. VANDHOO

TITLE
DETAILS

CLIENT DEPARTMENT
WMPC DEPARTMENT

PAPER SIZE A4

PAGE NO. 02

DESIGN BY
AFRAZ

STRUCTURE BY
AFRAZ

DRAWN BY
AFRAZ

SCALE 1:100

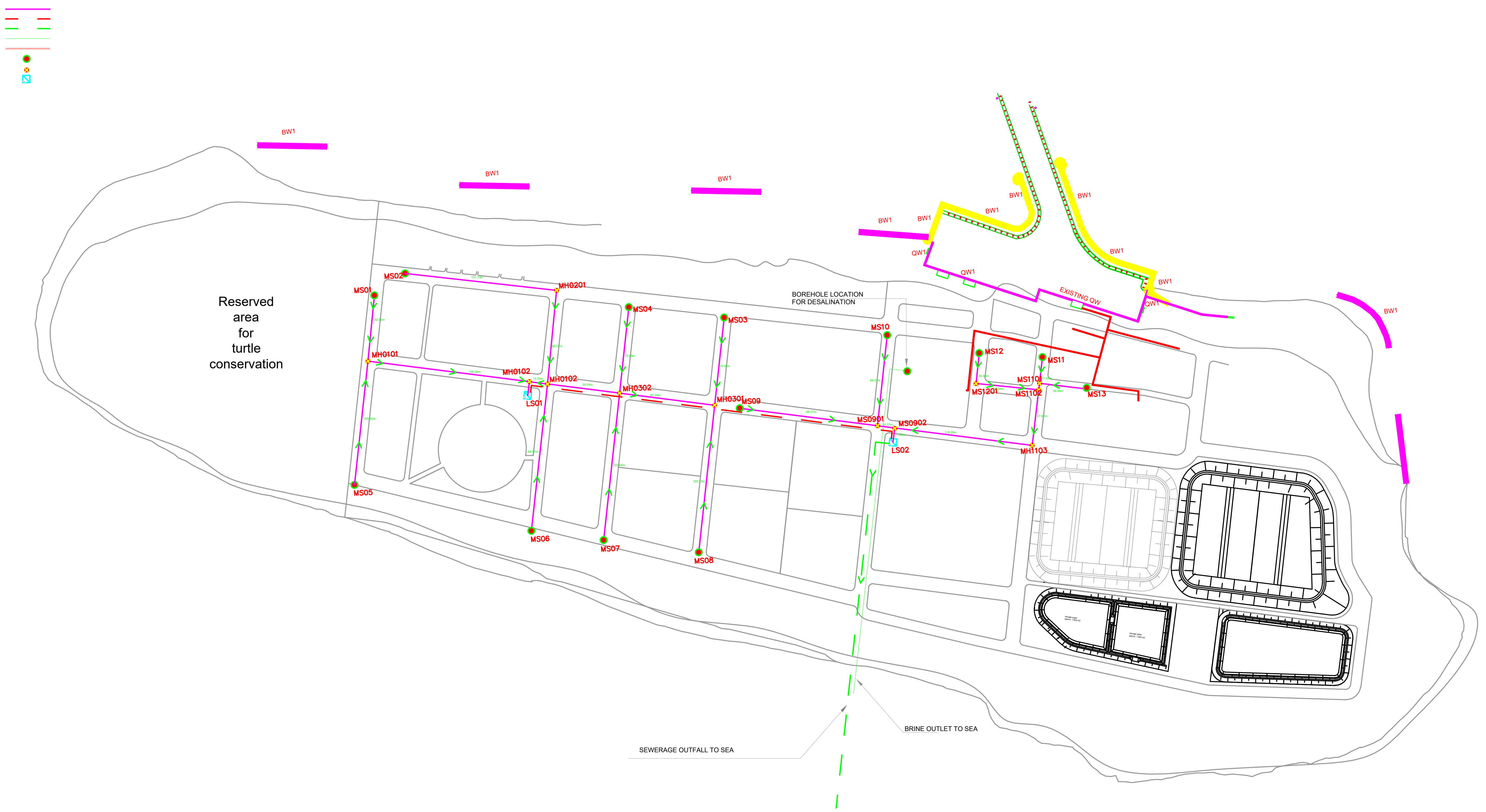
DWG NO. VNDADWATER A1-02

DATE 14.11.2018

AMENDMENTS

Appendix 6 Map of Sewer, Water & Fuel Network

SEWERAGE LAYOUT


BW1
BW1
BW1
BW1
BW1
BW1
BW1
BW1
BW1
BW1
QW1
QW1
QW1
EXISTING QW
Reserved area for turtle conservation
BOREHOLE LOCATION FOR DESALINATION
MS01
MS02
MH0201
MS04
MS03
MS10
MS12
MS11
MS1101
MS1201
MS1102
MS13
MH0101
MH0102
MH0102
LS01
MH0302
MH0301
MS09
MS0901
MS0902
LS02
MH1103
MS05
MS06
MS07
MS08
68.57m
24.96m
21.59m
39.56m
27.62m
14.37m
118.00m
SEWERAGE OUTFALL TO SEA
BRINE OUTLET TO SEA

PROJECT :
RAA. VANDHOO
PROJECT: COASTAL PROTECTION
WORKS DESIGN
CLIENT : MINISTRY OF ENVIRONMENT AND ENERGY

CONSULTANT :
HUSSAIN SHAHEED
DRAWN BY : LEEN
CHECKED BY : HUSSAIN SHAHEED

TITLE :AS GIVEN
SCALE AS GIVEN
PROJECT NO:
DATE:3 NOV 2018

PG NO.

Appendix 7 Specifications of Diesel Storage Tanks

GEOMETRY / DESCRIPTION – ITEM 1 – Diesel Tanks		
Tank Quantity:	2	
Construction Method:	TC Rolled Tapered Panel (RTP) Bolted Design	
Material of Construction:	Carbon Steel	
Nominal Inside Diameter:	21.54 feet	6.57 meters
Nominal Eave Height:	20.69 feet	6.30 meters
Note: Nominal eave height is measured from bottom of base angle to top of eave angle.		
Bottom Style:	**Flat Steel Floor** for placement on concrete foundation – Floor materials supplied by Tank Connection. Concrete foundation designed, supplied, & installed by others.	
Roof Style:	Steel cone with 2" rise to 12" run (9.46º slope)	
Roof Support Style:	Self-supported with internal rafters	
Freeboard:	12 inches	305 millimeters
Usable Capacity:	53,656 US gallons	203 cubic meters
Empty Weight (each tank):	16,596 pounds	7,528 kilograms

TANK COMPONENTS / ACCESSORIES (per tank, unless noted)	
Qty:	**Description**
1	Tank Connection logo (installed on top ring)
1	Liquid tank nameplate
1	Set of plastic push caps to cover hardware on exterior tank shell and deck
-----	Anchor bolts are not required by design
1	20" Diameter mushroom ventilator with aluminum bird screen
1	20" Diameter combination manway / pressure relief valve
1	24" Diameter shell manway with bolt-on hinged cover
3	2" Diameter 150# RFSO single flanged nozzle
1	4" Diameter internal 90-degree mitered elbow w/ weir cone & external 150# RFSO flanged nozzle for overflow
1	Full deck perimeter guardrail – NON-OSHA – HDG (TC Standard Construction)
1	External caged ladder with lockable hoop – NON-OSHA – HDG – Intermediate rest platforms excluded – Includes safety chain at entrance point(s) (TC Standard Construction)
1	Liquid level indicator w/ gauge board & high visibility target – Full travel – Metric display (mechanical, float-type)
1	Lot of ½" thick asphalt impregnated fiberboard between tank bottom & concrete foundation
1	Lot of 4 mil polyethylene sheeting between foundation & fiberboard / tank bottom
1	Set of tank drawings shown in both imperial & metric dimensions (1 hardcopy, 1 pdf electronic format)
1 ONLY	Assembly Kit – including (3) Drift Pins, (3) Standard Adhesive Applicators, (2) Small Adhesive Applicators, (4) Small Adhesive Applicator Tips, (3) 9/16" Reamers, (2) Paint Roller Handles, (3) Paint Roller Pads, & (4) Plastic Spatulas

SEALANTS / GASKETS / HARDWARE – ITEM 1	
Roof Gasket:	Buna Nitrile
Sidewall Sealant:	Sika 201
Bottom Sealant:	Sika 201
Hardware:	Grade 8 bolts with flat washers & hex nuts. Hardware is factory coated with plating technology designed for long life and superior corrosion protection.

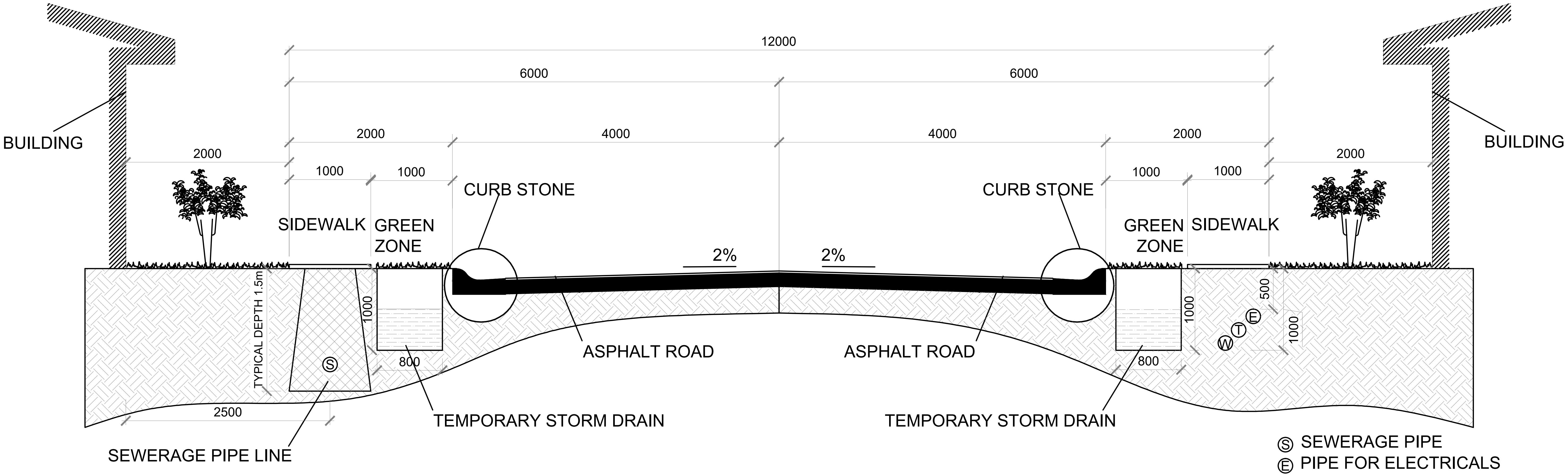
GEOMETRY / DESCRIPTION – ITEM 2 – Water Tanks		
Tank Quantity:	2	
Construction Method:	TC Rolled Tapered Panel (RTP) Bolted Design	
Material of Construction:	Carbon Steel	
Nominal Inside Diameter:	21.54 feet	6.57 meters
Nominal Eave Height:	20.69 feet	6.30 meters
Note: Nominal eave height is measured from bottom of base angle to top of eave angle.		
Bottom Style:	**Flat Steel Floor** for placement on concrete foundation – Floor materials supplied by Tank Connection. Concrete foundation designed, supplied, & installed by others.	
Roof Style:	Steel cone with 2" rise to 12" run (9.46° slope)	
Roof Support Style:	Self-supported with internal rafters	
Freeboard:	12 inches	305 millimeters
Usable Capacity:	53,656 US gallons	203 cubic meters
Empty Weight (each tank):	16,659 pounds	7,556 kilograms

TANK COMPONENTS / ACCESSORIES (per tank, unless noted)	
Qty:	**Description**
1	Tank Connection logo (installed on top ring)
1	Liquid tank nameplate
1	Set of plastic push caps to cover hardware on exterior tank shell and deck
-----	Anchor bolts are not required by design
1	20" Diameter mushroom ventilator with aluminum bird screen
1	24" Square roof manway with lockable hinged cover
1	24" Diameter shell manway with bolt-on hinged cover
3	2" Diameter 150# RFSO single flanged nozzle
1	4" Diameter internal 90-degree mitered elbow w/ weir cone & external 150# RFSO flanged nozzle for overflow
1	Full deck perimeter guardrail – NON-OSHA – HDG (TC Standard Construction)
1	External caged ladder with lockable hoop – NON-OSHA – HDG – Intermediate rest platforms excluded – Includes safety chain at entrance point(s) (TC Standard Construction)
1	Liquid level indicator w/ gauge board & high visibility target – Full travel – Metric display (mechanical, float-type)
1	Lot of ½" thick asphalt impregnated fiberboard between tank bottom & concrete foundation
1	Lot of 4 mil polyethylene sheeting between foundation & fiberboard / tank bottom
1	Set of tank drawings shown in both imperial & metric dimensions (1 hardcopy, 1 pdf electronic format)
1 ONLY	Assembly Kit – including (3) Drift Pins, (3) Standard Adhesive Applicators, (2) Small Adhesive Applicators, (4) Small Adhesive Applicator Tips, (3) 9/16" Reamers, (2) Paint Roller Handles, (3) Paint Roller Pads, & (4) Plastic Spatulas

SEALANTS / GASKETS / HARDWARE – ITEM 2	
Roof Gasket:	White EPDM strip gasket – 3/32" thick
Sidewall Sealant:	High performance moisture-cured elastomeric sealant
Bottom Sealant:	High performance moisture-cured elastomeric sealant
Hardware:	Plastic encapsulated grade 8 bolts with flat washers & hex nuts. Hardware is factory coated with plating technology designed for long life and superior corrosion protection. Tank bottom hardware includes plastic encapsulated nuts.

Appendix 8 Typical Road Section & Cross Section of Paving Details

TYPICAL ROAD SECTION


12000
6000
6000
2000
4000
4000
2000
2000
2000
1000
1000
1000
1000
BUILDING
BUILDING
CURB STONE
CURB STONE
SIDEWALK
GREEN ZONE
GREEN ZONE
SIDEWALK
2%
2%
TYPICAL DEPTH 1.5m
1000
1000
500
1000
S
W
T
E
800
800
ASPHALT ROAD
ASPHALT ROAD
2500
TEMPORARY STORM DRAIN
TEMPORARY STORM DRAIN
SEWERAGE PIPE LINE

Ⓢ SEWERAGE PIPE
Ⓔ PIPE FOR ELECTRICALS
Ⓣ PIPE FOR TELECOM LINE
Ⓦ PORTABLE WATER PIPE

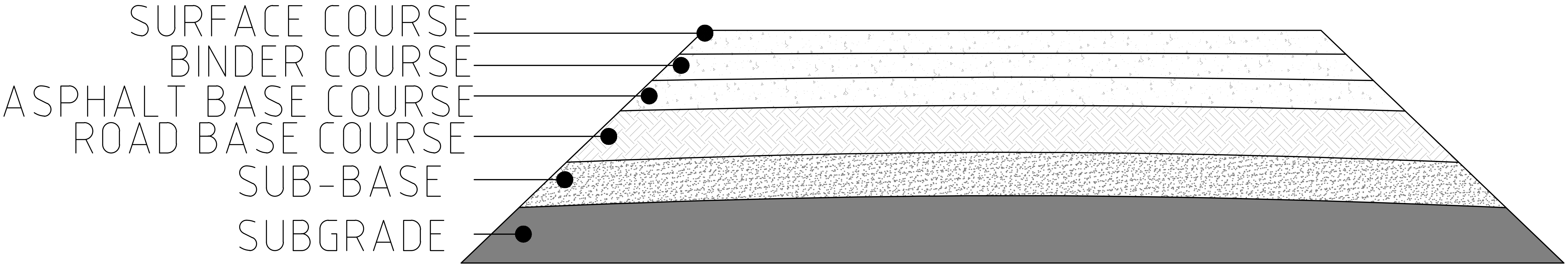
TYPICAL ASPHALT ROAD SECTION (12m)

PROJECT :
RAA. VANDHOO
PROJECT: COASTAL PROTECTION
WORKS DESIGN
CLIENT : MINISTRY OF ENVIRONMENT AND ENERGY

CONSULTANT :
HUSSAIN SHAHEED
DRAWN BY : LEEN
CHECKED BY : HUSSAIN SHAHEED

TITLE : AS GIVEN
SCALE : AS GIVEN
PROJECT NO:
DATE: 3 NOV 2018
PG NO.

ASPHALT ROAD PAVING DETAIL


SURFACE COURSE
BINDER COURSE
ASPHALT BASE COURSE
ROAD BASE COURSE
SUB-BASE
SUBGRADE

ASPHALT ROAD PAVING DETAIL

PROJECT :
RAA. VANDHOO
PROJECT: COASTAL PROTECTION
WORKS DESIGN
CLIENT : MINISTRY OF ENVIRONMENT AND ENERGY

CONSULTANT :
HUSSAIN SHAHEED
DRAWN BY : LEEN
CHECKED BY : HUSSAIN SHAHEED

TITLE : AS GIVEN
SCALE : AS GIVEN
PROJECT NO:
DATE: 3 NOV 2018
PG NO.

Appendix 9 Project Work Schedule

R.VANDHOO UPGRADING WORKS - PHASE 01											
DRAFT SCHEDULE OF WORKS											
Serial No.	PARTICULARS	QUANTITY	Bidding document completed	Publish IFB in National Gazzette and UNDB	Deadline for Submission of bids	Evaluation Completed	Intention to Award	Contract Award	Sign Contract	Completion Date
1	Extension of existing waste processing bunker 1	1	17 01 2019	20 01 2019	3 02 2019	10 02 2019	13 02 2019	25 02 2019	4 03 2019	26 05 2019
2	Construction of additional waste storage bunker	1	17 01 2019	20 01 2019	3 02 2019	10 02 2019	13 02 2019	25 02 2019	4 03 2019	26 05 2019
3	Bulk waste storage facility	1	24 01 2019	27 01 2019	10 02 2019	17 02 2019	20 02 2019	4 03 2019	11 03 2019	2 06 2019
4	Hazardous waste storage facility	1	24 01 2019	27 01 2019	10 02 2019	17 02 2019	20 02 2019	4 03 2019	11 03 2019	2 06 2019
5	Proposed recycling facility with storage for recyclables	1	24 01 2019	27 01 2019	10 02 2019	17 02 2019	20 02 2019	4 03 2019	11 03 2019	2 06 2019
6	New staff quarters (accomodation) with mess	1	24 01 2019	27 01 2019	10 02 2019	17 02 2019	20 02 2019	4 03 2019	11 03 2019	2 06 2019
7	Extension of Utility Building (to accommodate additional genset)	1	17 01 2019	20 01 2019	3 02 2019	10 02 2019	13 02 2019	25 02 2019	4 03 2019	26 05 2019
8	Construction of Incinerator maintenance room (for tools and critical spares)	1	24 01 2019	27 01 2019	10 02 2019	17 02 2019	20 02 2019	4 03 2019	11 03 2019	2 06 2019
9	Construction of Store Room 3 (for spares)	1	17 01 2019	19 01 2019	2 02 2019	9 02 2019	12 02 2019	24 02 2019	3 03 2019	25 05 2019
10	Construction of additional water tanks (250m3 x 2 nos) with distribution network	1	17 01 2019	18 01 2019	1 02 2019	8 02 2019	11 02 2019	23 02 2019	2 03 2019	24 05 2019
11	Relocation and upgrading of fuel storage (100m3 x2 nos)	1	17 01 2019	18 01 2019	1 02 2019	8 02 2019	11 02 2019	23 02 2019	2 03 2019	24 05 2019
12	Rehabilitation of the existing landfill and leachate pond (with pumps)	1	31 01 2019	3 02 2019	17 02 2019	24 02 2019	27 02 2019	11 03 2019	18 03 2019	25 05 2019
13	Upgrading/upscaling of the existing fire protection system (include additional buildings)	1	31 01 2019	3 02 2019	17 02 2019	24 02 2019	27 02 2019	11 03 2019	18 03 2019	9 06 2019
14	Guest Accommodation	2	28 02 2019	3 03 2019	17 03 2019	24 03 2019	27 03 2019	8 04 2019	15 04 2019	7 07 2019

Appendix 10 Occupational Health & Safety Procedure

Extracted from the O&M procedure of WAMCO for the RWMF at Vandhoo.

CHAPTER 6 - OCCUPATIONAL HEALTH AND SAFETY

6.1. OVERVIEW

RWMF treats health and safety of its employees as its number one priority. All management and employees are thoroughly instructed and integrated into the comprehensive safety philosophy when first hired. Each employee is fully responsible to fully understand their job and responsibility to never place themselves or their coworker in harm’s way.

Employees will receive further policy instructions and safety training through monthly facility meetings which includes not only operation related matters but also health and safety. Advanced training will be issued to employees assigned specific tasks. Employees should direct any questions, inquires or accidents to their direct supervisor or plant manager's attention immediately. Emergency telephone numbers will be placed near all telephones and at the various facilities and plants.

6.2. FACILITIES HAZARDS

RWMF receive hazardous wastes generated from households and medical establishments. Although the quantities of hazardous wastes are small, yet hazardous in nature and requires special handling to avoid toxic exposure that can cause harm to employees as a result of direct contact. Normal facility operations can, however, at times produce potential safety hazards to employees working in the vicinity of certain equipment. These hazards include but not limited to:

1- Noise from the various vehicles such as loaders, bulldozers, etc., as well as parts of plants / facilities including MRF, incinerator and balers;
2- High temperatures at vicinity of certain areas of the incineration plant, or exposure to direct sunlight in a hot day for extended period of time, etc.;
3- Loading of certain types of “sharp” recyclables such as aluminum cans or glass in processing lines at MRF or bailers.
4- Toxic emissions / vapors emitted due to heat, decomposition, etc.
5- Potentially dangerous situations can also occur around any processing equipment that is made up of moving parts.

Accordingly, the goals of the facility management in regards to personnel health and safety include the following:

1. To describe all types of health and safety hazards that exists at various facilities to employees;
2. To familiarize the employees with the safety measures and equipment to be used;
3. To explain all safety procedures;
4. To explain Occupational Safety and Health guidelines as per GOM policies and relevant programs in that regards that are designed to limit hazards to employees; and
5. To explain Fire Fighting Procedures, Explosion Prevention Procedures in the event an accident occurs.

6.3. EMPLOYEE SAFETY STANDARDS

RWMF regards the safety of its employees to be of paramount importance. Therefore, it is the policy of WAMCO/RWMF to assure the personal safety and health of each employee. The prevention of occupational induced injuries and illnesses is given precedence over operating productivity whenever necessary.

A safety and health program conforming to the best practices for the waste sector shall be adopted. To be successful such a program must embody the proper attitudes toward injury and illness prevention on the part of supervisors and employees. It also requires cooperation in all safety and health matters, not only between supervisor and employee, but also between each employee and his / her co-workers. Only through such a cooperative attitude can a safety program be established and preserved.

RWMF objective is an Occupational Health and Safety centered program that will reduce the number of injuries and work-related illnesses to an absolute minimum. The goal is zero accidents and injuries. Every practical step is taken to provide safe working conditions and to encourage safe working practices in addition to meeting all legal requirements.

To achieve these goals, hazardous conditions in all work areas that can produce injuries shall be identified and communicated to employees, with the corresponding measures to avoid such injuries.

Cooperation in detecting hazards and, in turn, controlling them is essential. Supervisors / plant managers must be informed immediately of any hazardous situation beyond the employee's ability to correct.

All employees are required to do the following:

1. Report all injuries, no matter how minor it is to your supervisor immediately;
2. Get first aid promptly;
3. Do not attempt to administer first aid unless supervisor is present;
4. Report any unsafe condition or practice to your supervisor;
7. Keep all aisles, passageways, platform, and stairways clear of all obstructions;
8. Keep your work area clean and orderly;
9. Perform all work in a safe and orderly manner as per procedures and policies;
10. Materials must be properly stacked to avoid creating hazards;
11. At recyclables storage warehouses, bales are to be stacked not more than four (4) high;
12. Do not fail to stop, look and listen before you step into a trucking aisle;
13. Use only marked aisles when walking through facilities;
14. Do not take short cuts through departments or process areas;
15. Do not climb conveyors, railings or balers;
16. Drivers of motor vehicles must stop and sound the horn at cross aisles and where vision is obstructed;
17. Sound horn when backing up;
18. Only the authorized / assigned operator rides on a vehicle and no passengers allowed;
19. Only licensed personnel may operate motorized vehicles and equipment;
20. Work within prescribed weight limitations when lifting or pushing;

21. Do not wear ties, loose clothing, jewelry, or other items which could "catch" in moving equipment and create a hazard;
22. Do not block access to fire extinguishers or fire hoses with equipment or materials;
23. Do not interfere with firefighting operations;
24. All combustible, flammable materials or liquids must be stored in approved safety containers and in designated storage areas;
25. Use assigned tools and follow prescribed methods for each job;
26. Do not use defective tools or equipment;
27. Guards are placed on moving machinery for your protection;
28. Do not operate unless all guards are in place and machinery is cleared of objects and people;
29. Never clean, oil, or adjust any machinery while in motion unless that’s the process;
30. Observe all Danger, Safety, and no Smoking signs; and
31. Smoking is prohibited within all facilities and is only allowed in areas that have “smoking areas” posters.

6.4. FACILITY SAFETY RULES AND REGULATIONS

The following is prohibited:

1. Endangering the safety and health of other employees;
2. Engaging in sabotage, espionage or restricting of operation;
3. Damage to or theft of equipment, facility, etc. or that of another employee as well as the operation of any machine except by an authorized employee is prohibited;
4. Bringing weapons into the facility;
5. The use, possession, promotion, purchase, transfer, sale, distribution, manufacture of unauthorized or illegal drugs, or the misuse of any legal drugs, alcohol, or other chemical substances or any combination thereof on any WAMCO premises or sites is strictly prohibited;
6. Sexual Harassment;
7. Failure to wear eye safety protection at all times in all facility areas;
8. Failure to wear proper footwear or failure to wear prescribed safety equipment;
9. Employees are expected to wear proper dress;
10. Habitual tardiness, unexcused absences, or leaving the facility without permission;
11. Smoking is prohibited inside the facility;
12. Violation of any criminal law; and
13. Failure to adhere to MEE / WAMCO policies and procedures.

6.5. SAFETY MANAGEMENT

The RWMF Manager are responsible for directing the overall safety program for each of their respective facilities.

Safety Program Functions include but not limited to the following:

1. Advise management on steps to improve the safety and fire prevention programs;
2. Assist supervision in accomplishing facility safety responsibilities;
3. Collaborate with relevant agencies on safety and health and fire protection matters;
4. Supervise the operation of the first aid;
5. Maintain records of safety performance and costs; and
6. WAMCO's Head of Operations shall assist the facility manager(s) by inspecting and advising on safety features of proposed purchases on new machines, new processes, new material, new or altered building facilities, and personal protective equipment.

Daily Safety Checklist shall include but not limited to the following:

1. Each morning the plant manager or responsible staff shall conduct a safety inspection of all facility equipment passage ways, fire extinguishers, first aid kits, and storage areas, using the Safety Checklist prepared for each facility / plant at RWMF.
2. If there are no problems with an item on the list, the "OK" column is checked. If there is a problem the "Needs Action" column is checked. Any problem is noted and the proper personnel is notified for immediate action.
3. Along with preventative and emergency maintenance the maintenance employee is responsible for assisting in the inspection of mechanical equipment.
4. Prior to startup, the plant manager will also make sure that all proper safety equipment is being worn by employees.
5. The maintenance manager will promptly review, assess, repair, or recommend alternatives to the operators' concerns as pointed out on the daily logs.

Machine Operator Safety:

1- All machine operators should be trained and have a copy of the equipment's safety features. This outlines the do's and don'ts of the machine. It will also address where all emergency shut-offs are and safety limit switches.
2- If any equipment does not have an operating manual or safety information on it, operators are responsible to inform Facility Operations Manager who will contact and request it immediately from the manufacturer.
3- Copies of all the facility's equipment safety items should be posted or placed near the equipment. Additionally, this information shall be kept in the facility safety book. This book is to be stored in an easily accessible area and made available to anyone entering the facility. Some equipment operators are required to have an additional specialized form of training. A copy of proof of this training shall be kept in the employees file and a master list for all equipment shall be kept in the Plant Safety book. Machine operators should be instructed not to operate their equipment without the proper guards being in place.
4- Mechanics may be required to operate equipment without the guards on, since they understand safety needs and have been trained to perform their jobs safely.
5- Only WAMCO trained and certified operators will be allowed to operate equipment. Each operator should study, know and, above all, follow all guidelines. No employee is to operate any equipment without the

supervisor's knowledge and approval. The following are minimum standards of safety in the operation of equipment.

a. Check equipment to see that it is in safe operating condition. If in doubt, contact your supervisor and do not operate until approval is given;
b. Do not speed, and do not stop suddenly;
c. Slow down at intersections;
d. Be on the alert for fellowmen / pedestrians (in case of Islands waste management systems);
e. Do not attempt to exceed the capacity of your equipment by carrying loads which are too heavy or unbalanced;
f. Operators should face their destination. If unable to see over the load the vehicle should be driven backwards;
g. Never leave a vehicle unattended;
h. When parked buckets or blades will be flat to the ground, shift levers in neutral, and the brakes set; and
1. Never allow anyone to ride in buckets or blade.

Employee Responsibilities:

1. Know and observe all rules and regulations relating to occupational safety and health;
2. Know and follow all standard operating procedures, including Job Safety Analysis for each occupation;
3. Properly use prescribed protective equipment;
4. Maintain protective equipment in acceptable conditions;
5. Report to your supervisor conditions or procedures which are considered a hazard to health or safety;
6. Practice good personal hygiene habits;
7. Report ALL injuries immediately to your supervisor; and
8. Report sickness or injury occurring while on duty to Supervisor before leaving for the day.

Accidents/Injuries

Procedures followed in the event of an accidental injury in the facility are naturally dependent on the type and severity of the injury. Listed below are the procedures to follow for two scenarios:

a- Major Injuries - Outside Medical Attention

Required: CALL emergency and Supervisor & Facility Manager notification

- The injured employee or an employee nearby will either alert the Supervisor or Plant Manager using a facility or cellular phone.

- As the injury necessitates first aid shall be administered immediately. The supervisor will notify immediately the Plant Manager, and a speed boat will be called to transfer the injured employee to nearest hospital for treatment.

- In parallel the supervisor / plant manager will contact the injured employee’s designated emergency contact person.

- Once the injured employee has been transported to the hospital, the reporting and investigation procedures will begin.

b- Minor Injuries – In Plant Medical Attention Necessary:

Required: Supervisor or Manager Notification

- Either the injured employee or an employee nearby will alert the supervisor who will then perform first aid if necessary. After first aid is performed the employee will be instructed to go to the break room.

- If hospitalization is required the supervisor or assignee will order speed boat to transport injured employee to the nearest hospital.

- Should the employee's injury require to go home however, are incapable of transporting themselves a supervisor or assignee will transport the employee. An employee injured on the job is entitled to all benefits following employment contract / GOM regulations in that regards.

First Aid

The first aid kit in the First Aid area is equipped to cover basic first aid needs. All first aid cases must be referred to facility management.

The Plant Manager is responsible for:

1. All in-house first aid treatment;
2. The maintenance of adequate first aid equipment;
3. Decisions concerning case referral to the hospital in coordination with the facility personnel; and
4. Ensuring that emergency calls are made immediately when required.

Accident Reports

- Immediately following a work-related injury requiring more than first aid, or a work-related illness, Occupational Injuries and Illnesses form is completed. This form lists the name of the employee, department and description of the illness or injury.

- Whenever there is an injury which requires medical attention a WAMCO Accident Report is completed. The report includes accident description, preventative actions taken, witnesses, equipment involved, unsafe conditions which led to the accident, other factors which contributed to the accident, and recommendations and comments to avoid similar accidents to happen again. A copy of the Accident Report will be sent to the MEE's focal point / project manager within 24 hours of the incident.

- Unsafe conditions which lead to any accident in the facility are to be immediately corrected to prevent further accidents / injuries. The administration of first aid will be recorded and maintained for all incidents.

- After an accident occurs and reports are completed an investigation by the plant manager will follow.

Occupational Health & Safety Committee

It is highly recommended the establishment of Occupational Health and Safety Committee (OHSC). The HSC main objective is to ensure facilities are safe and healthy working conditions for the staff. The main functions of the Committee include but not limited to the following:

- Research and analyze hazards;
- Make suggestions to eliminate hazards;
- Accident investigations and suggest preventative measures;
- Provide safety training and maintain training records;

During the monthly facility meetings held, health and safety committee members (if different from facility meetings members) shall be invited to discuss related issues. Frequency of addressing these issues can vary according to facility size and needs and can be as frequent as weekly. It is recommended to have it weekly at the Regional Facility level and on monthly basis at Islands level.

Personal Protective Equipment (PPE) Policy

PPE policy is one of the most important policies that have to be in place, given it protects staff from injuries / hazards at work. Rule of thumb, the best way to avoid hazards and minimize injuries at waste management facilities in general, is by wearing at all times the PEE gear.

WAMCO requires all employees to wear PPE at all times while in facilities areas. Specific PPE and training will be issued for non-routine, maintenance, or specific work / tasks identified as hazardous by WAMCO.

PPE gear includes the following:

1. Hard Hats;
2. Safety Glasses/Goggles;
3. Ear Plugs/Muffs;
4. Dust Masks;
6. Gloves; and
7. Safety Footwear

Operator's Licenses

No employee shall be allowed to operate any equipment, plant, vehicle or machinery without prior specialized training conducted by licensed operator (national or international). Such trained staff shall be utilized by WAMCO as specialized trainers who will carry out / conduct training to other Colleagues / staff throughout the Country.

Periodical training shall be given to those trained operators as recommended by Manufacturers in case of new developments, updates, etc. to ensure the trained operators are up to date with new information, procedures, processes, etc.

Blood-borne Pathogens Policy

WAMCO shall have in place blood borne pathogens policy which mandates all staff working in close proximity to waste to have all necessary vaccinations, which are renewed as needed at WAMCO's cost.

Fire Fighting

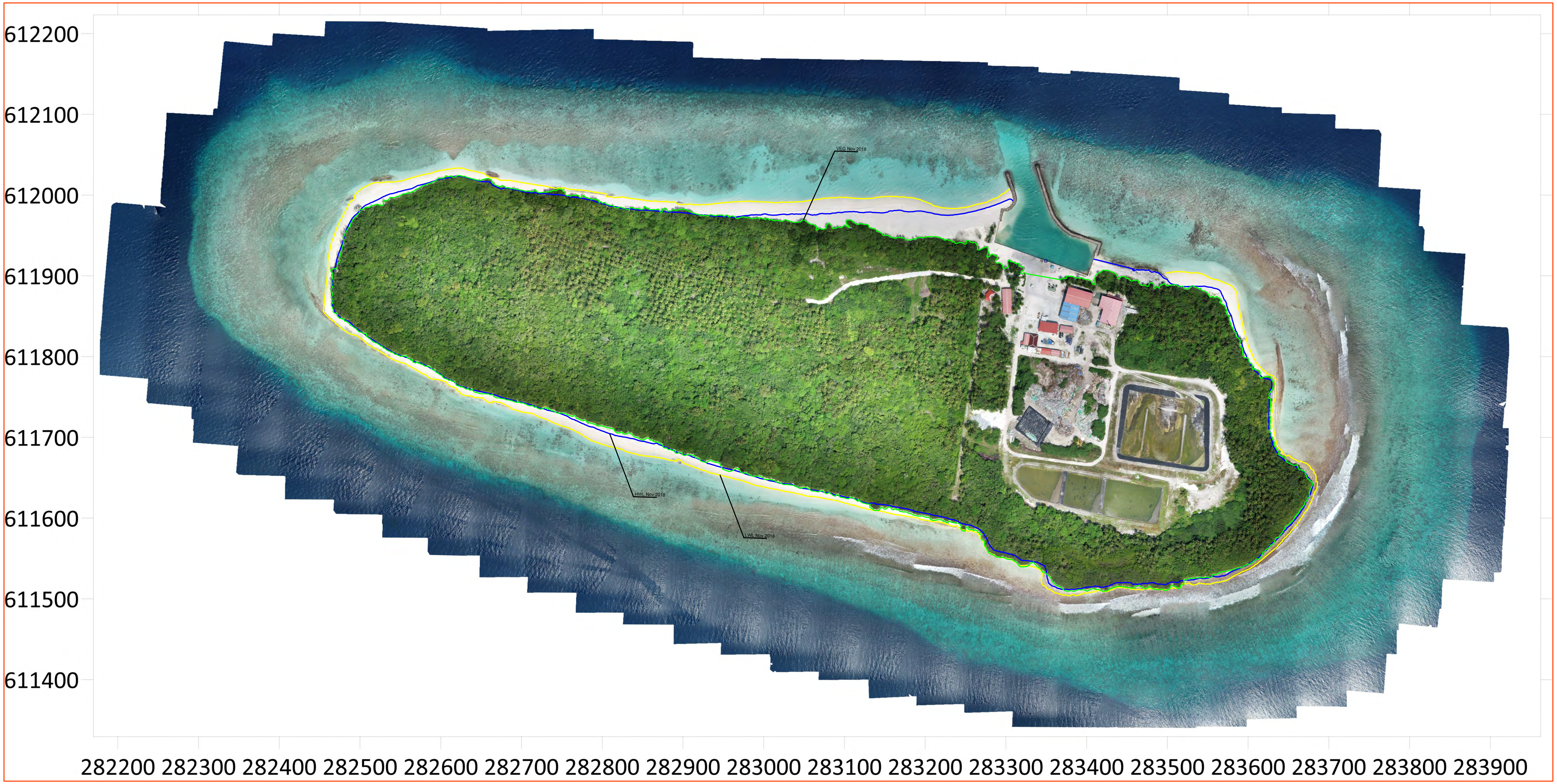
1- Every employee is responsible for reporting a fire. A fire witnessed inside the facility or any buildings on WAMCO managed facility must be reported immediately to a supervisor. If the fire is located in the employee's work area it should be reported to his immediate supervisor. The supervisor is responsible for calling emergency and notifying the Plant / facility Manager.

2- Only under the plant manager, or facility manager's discretion, will trained personnel proceed to extinguish and control the fire. This procedure will continue until the fire is extinguished, fire personnel arrive or fire becomes uncontrollable. If, in the opinion of management, the fire is beyond safety limits all personnel will be evacuated from the facility.

3- Given that this subject is of utmost importance, a thorough report needs to be prepared, policy and standard operating procedure developed and required training is given. These will include but not limited to the following:

  a. Fire Alarm and Evacuation Procedures
  b. Firefighting Equipment
  c. Firefighting equipment Inspection
  d. Plant-Wide Training Program
  e. Fire Evacuation Safety Plan
  f. Fire Equipment Location Log
  g. Portable Fire Extinguishers Inspection and maintenance Guidelines
  h. Automatic Fire Detector Requirements
  i. Responsibility staff
  j. Fire Alarm Inspection Procedures
  k. Emergency Evacuation Procedures

Appendix 11 Survey Maps of Bathymetry, Vegetation Line, Shoreline & Drone Map


612200
612100
612000
611900
611800
611700
611600
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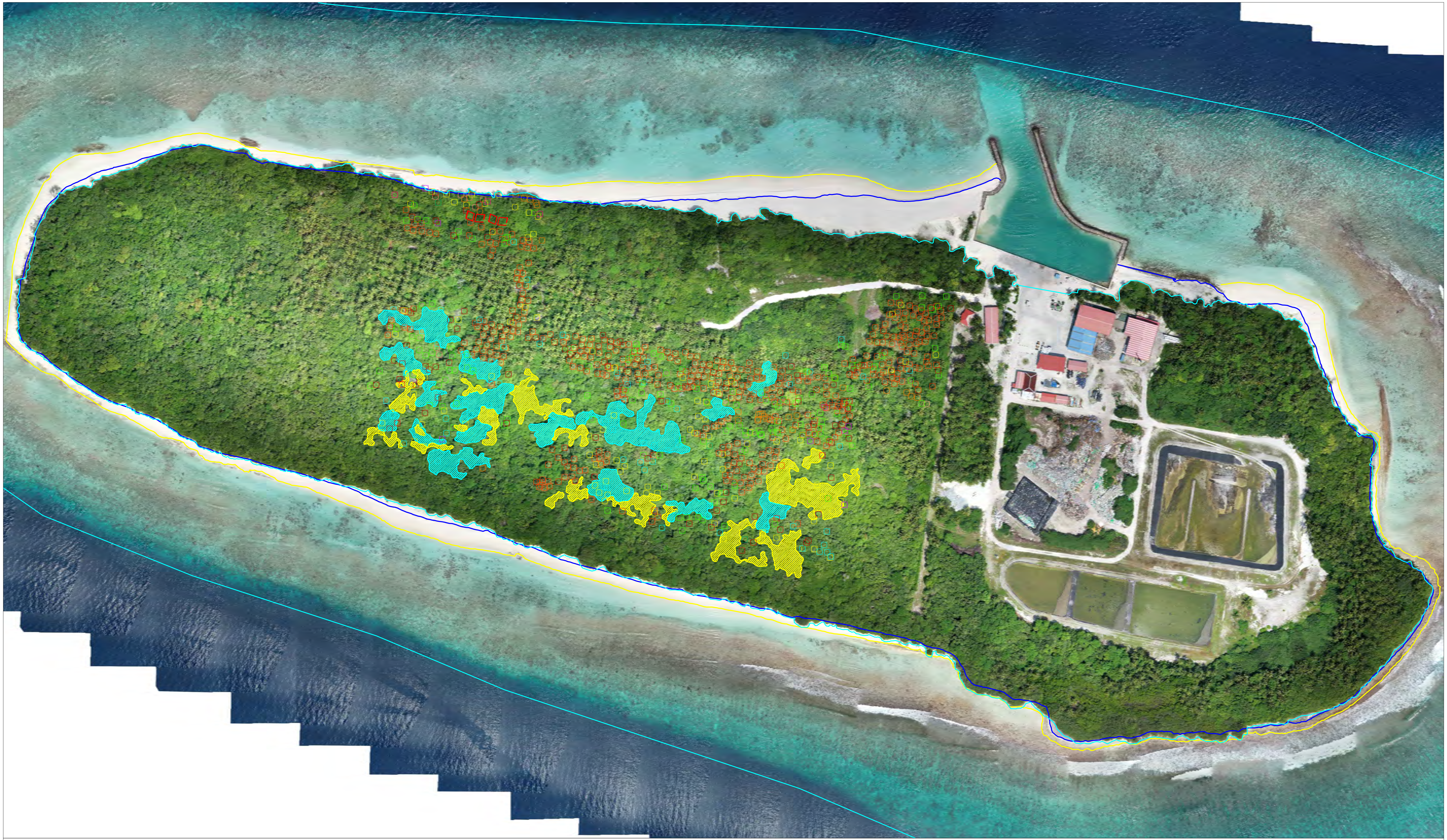
VEG Nov 2018
HWL Nov 2018
LWL Nov 2018
282200 282300 282400 282500 282600 282700 282800 282900 283000 283100 283200 283300 283400 283500 283600 283700 283800 283900

R.VANDHOO SHORELINE SURVEY AND GEO-REFERENCED DRONE IMAGE

ADMINISTRATIVE INFORMATION

ATOLL NAME	RAA
ISLAND NAME	R.VANDHOO
PLACE NAME	VANDHOO WASTE MANAGEMENT FACILITIES

La Mer
GROUP



R.VANDHOO TREE SURVEY

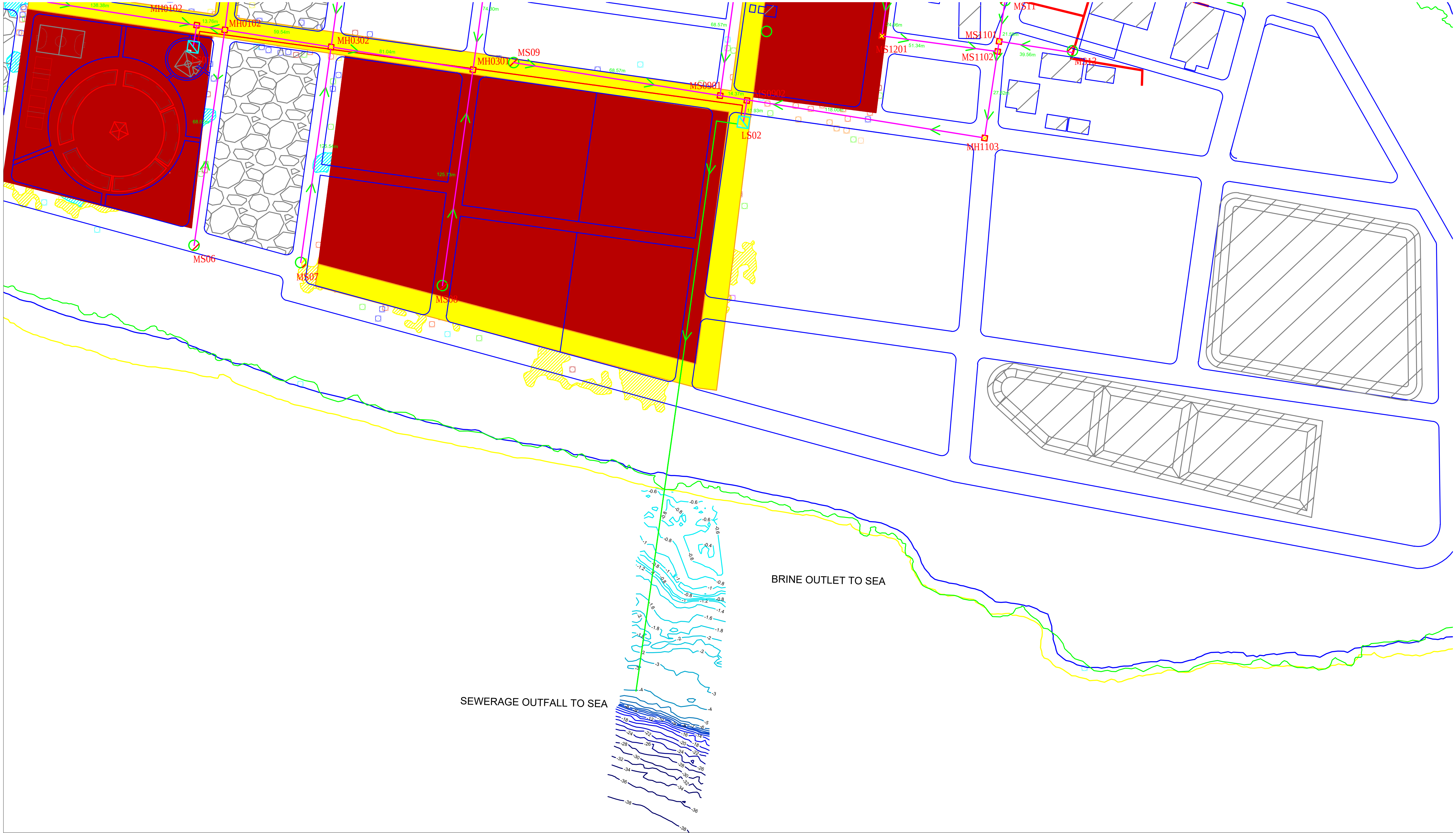
ADMINISTRATIVE INFORMATION

ATOLL NAME	RAA
ISLAND NAME	R.VANDHOO
PLACE NAME	VANDHOO WASTE MANAGEMENT FACILITIES

LEGEND:-

- □ Pandanus tree
- □ Coconut palm
- □ Sea hibiscus
- □ Corkwood
- □ Sea lettuce
- □ Country Almond
- □ Nit pitcha
- □ False Elder
- □ Alexander laurelwood
- □ Banyan tree

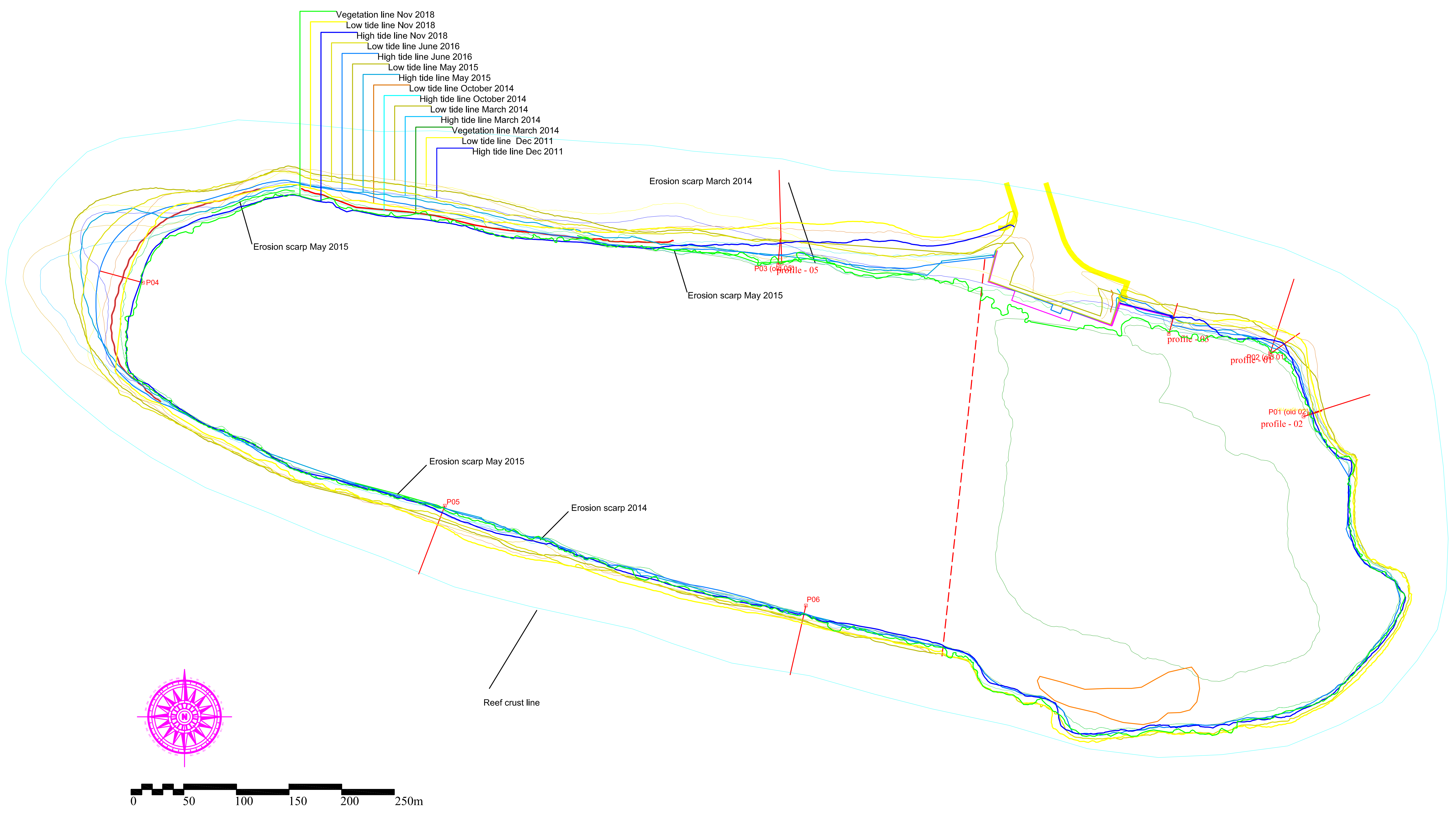
La Mer
GROUP


MH0102
MH0102
MH0302
MH0301
MS09
MS0901
MS0902
MS11
MS1101
MS1102
MS12
MS1201
MH1103
LS02
MS06
MS07
MS08
BRINE OUTLET TO SEA
SEWERAGE OUTFALL TO SEA

R.VANDHOO SEA OUTFALL BATHYMETRY SURVEY

ADMINISTRATIVE INFORMATION

ATOLL NAME	RAA
ISLAND NAME	R.VANDHOO
PLACE NAME	VANDHOO WASTE MANAGEMENT FACILITIES


Vegetation line Nov 2018
Low tide line Nov 2018
High tide line Nov 2018
Low tide line June 2016
High tide line June 2016
Low tide line May 2015
High tide line May 2015
Low tide line October 2014
High tide line October 2014
Low tide line March 2014
High tide line March 2014
Vegetation line March 2014
Low tide line Dec 2011
High tide line Dec 2011
Erosion scarp March 2014
Erosion scarp May 2015
P03 (old 05)
profile - 05
Erosion scarp May 2015
P04
profile - 03
P02 (old 01)
profile - 01
Old profile point
P01 (old 02)
profile - 02
Erosion scarp May 2015
P05
Erosion scarp 2014
P06
Reef crust line
N
0
50
100
150
200
250m

R.VANDHOO SHORELINE COMPARISON MAP

ADMINISTRATIVE INFORMATION

ATOLL NAME	RAA
ISLAND NAME	R.VANDHOO
PLACE NAME	VANDHOO WASTE MANAGEMENT FACILITIES

—	Low tide line October 2014	—	High tide line May 2015
—	High tide line October 2014	—	Low tide line May 2015
—	Low tide line March 2014	—	High tide line June 2016
—	High tide line March 2014	—	Low tide line June 2016
—	Vegetation line March 2014	—	High tide line Nov 2018
—	Low tide line Dec 2011	—	Low tide line Nov 2018
—	High tide line Dec 2011	—	Vegetation line Nov 2018

NORTH

Geodetic Parameter :
Zone : UTM Zone 43
Spheroid : WGS 1984
Vertical Datum : MEAN SEA LEVEL

La Mer GROUP

Appendix 12 Complete List of Coral Species Observed During Survey Period

Complete list of coral species observed during the surveys done for the 2014 monitoring survey and the 2018 ESIA survey, across all reef sites.

Coral Genus	**RS1**		**RS2**		**RS3**
	2014	**2018**	**2014**	**2018**	**2018**
Acropora (Digitate)	0	0	0.26	0.25	0.50
Astreopora	1.80	0	0	0	0.13
Echinopora	0.78	0	0	0	0
Favia	5.90	0.38	0.26	0.88	0.25
Favites	1.01	0.63	1.54	0.63	1.13
Fungia	0	0.13	0	0	0.25
Galaxea	0.26	0	0	0.13	0.38
Goniastrea	2.05	0.50	2.30	0.13	0.88
Goniopora	0	0.13	0	0	0
Leptastrea	0.51	0	0	0	0
Leptoria	2.05	0	0	0	0
Lobophyllia	0.26	0	0	0	0
Montipora	2.06	0	0.25	0	0
Oxypora	0.26	0	0	0	0
Pavona	1.54	0	0	0	0
Platygyra	0	0	0.79	0	0
Pocillopora	5.88	0.38	1.55	0.38	1.00
Poritres (Branching)	0	2.88	0	0.38	0
Poritres (Massive)	35.71	49.75	34.68	29.13	7.25
Psammacora	0	0.13	0	0	0
Symphyllia	0	0	0	0	0.38
Turbinaria	0	0.13	0	0	0

Appendix 13 Water test Reports of MWSC

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

LB-167-TEST

WATER QUALITY TEST REPORT

Report No: 500181055

Customer Information:
Land & Marine Environment Resources
H.Azum
Ameeneemagu
Male' MALE

Report date: **27/11/2018**
Test Requisition Form No: **900186412**
Sample(s) Recieved Date: **22/11/2018**
Date of Analysis: **22/11/2018 - 26/11/2018**

Sample Description	Vandhoo R1	Vandhoo R2	Vandhoo R3	**TEST METHOD**	**UNIT**
Sample Type	Sea Water	Sea Water	Sea Water		
Sample No	83201918	83201919	83201920		
Sampled Date	16/11/2018	16/11/2018	16/11/2018		
PARAMETER	**ANALYSIS RESULT**				
Physical Appearance	Clear with particles	Clear with particles	Clear with particles		
Total Suspended Solids	<5 (LoQ 5 mg/L)	<5 (LoQ 5 mg/L)	<5 (LoQ 5 mg/L)	Method 8006 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
Turbidity *	0.162	0.156	0.165	HACH Nephelometric Method (adapted from HACH 2100N Turbidimeter User Manual)	NTU
Nitrogen Ammonia	<0.02 (LoQ 0.02 mg/L)	0.03	0.03	Method 8038 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
Sulphate *	3550	3400	2850	Method 8051 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
Phosphate *	0.26	0.10	0.08	Method 8048 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L

Keys: mg/L : Milligram Per Liter, **NTU** : Nephelometric Turbidity Unit

Checked by

Aminath Shahidha
Senior Laboratory Technician

Approved by

Mohamed Eyman
Assistant Manager, Quality

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 provided by the customer
*Parametres accredited by DAC under ISO / IEC 17025:2005

************************ END OF REPORT ************************

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

LB-167-TEST

WATER QUALITY TEST REPORT
Report No: 500181056

Customer Information:
Land & Marine Environment Resources
H.Azum
Ameeneemagu
Male' MALE

Report date: **27/11/2018**
Test Requisition Form No: **900186412**
Sample(s) Recieved Date: **22/11/2018**
Date of Analysis: **22/11/2018 - 26/11/2018**

Sample Description	Vandhoo BE	Vandhoo BW	Vandhoo W	**TEST METHOD**	**UNIT**
Sample Type	Ground Water	Ground Water	Ground Water		
Sample No	83201921	83201922	83201923		
Sampled Date	16/11/2018	16/11/2018	16/11/2018		
PARAMETER	**ANALYSIS RESULT**				
Physical Appearance	Pale yellow with particles	Pale yellow with particles	Pale yellow with particles		
Total Suspended Solids	285	82	<5 (LoQ 5 mg/L)	Method 8006 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
Nitrogen Ammonia	0.03	0.46	0.06	Method 8038 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
Sulphate *	<10 (LoQ 10 mg/L)	<10 (LoQ 10 mg/L)	270	Method 8051 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
Phosphate *	0.10	0.12	0.22	Method 8048 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
Zinc	0.05	0.02	0.04	Method 8009 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L

Keys: mg/L : Milligram Per Liter

Checked by

Aminath Shahidha
Senior Laboratory Technician

Approved by

Mohamed Eyman
Assistant Manager, Quality

Notes: Sampling Authority: Sampling was not done by MWSC Laboratory
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************************* END OF REPORT *************************

Appendix 14 List of Stakeholders Consulted

Ministry of Environment
Maldives Clean Environment Project

Meeting Attendance Sheet

Subject: **R.Vandhoo ESIA Consultation Meeting**
Date: **19th December 2018** **Time: 10:30**
Venue: **Green Building, Ministry of Environment** **Room: Auditorium**

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14							
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Environmental Impact Assessment Report for upgrading of Infrastructure at Regional Waste Management Facility Zone 2, Raa Vandhoo

Stakeholder Consultation Meeting

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23rd December 2018

Lead Consultant: Hussein Zahir

Participants:

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Environmental Impact Assessment Report for upgrading of Infrastructure at Regional Waste Management Facility Zone 2, Raa Vandhoo

Stakeholder Consultation Meeting

EPA

31st December 2018

Lead Consultant: Hussein Zahir

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Environmental Impact Assessment Report for upgrading of Infrastructure at Regional Waste Management Facility Zone 2, Raa Vandhoo

Stakeholder Consultation Meeting

MEE

6th January 2019

Lead Consultant: Hussein Zahir

Participants:

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Environmental Impact Assessment Report for upgrading of Infrastructure at Regional Waste Management Facility Zone 2, Raa Vandhoo

Stakeholder Consultation Meeting

MEE

6th January 2019

Lead Consultant: Hussein Zahir

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Environmental Impact Assessment Report for upgrading of Infrastructure at Regional Waste Management Facility Zone 2, Raa Vandhoo

Stakeholder Consultation Meeting

WAMCO

6th January 2019

Lead Consultant: Hussein Zahir

Participants:

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Appendix 15- Turtle Management Plan

Prepared by the Maldives Environmental Management Project (PMU) of the Ministry of Environment.

DRAFT

Sea Turtle Management Plan

Regional Waste management Facility at Vandhoo, Raa atoll

July 2014

Prepared Maldives Environmental Management Project (PMU)
Ministry of Environment and Energy

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Introduction

This management plan is developed in order to provide a clear strategy and an action plan protecting turtle nesting beach at Vandhoo that has been declared as protected since 2006 under the Presidential Decree protecting all five species of sea turtles in the Maldives. It is the intent of this management plan to provide a balance between the needs of residents and visitors and threatened and endangered sea turtles.

Five of the world's eight remaining sea turtle species--the Green, Hawksbill Loggerhead, Leatherback, , and Olive Ridley are found in coastal waters of Maldives. Two of these species, Green and Hawksbill nest in the Maldives.

Sea turtles spend most of their lives in the ocean, feeding in sea grass beds, and other shallow coastal areas. Almost all the islands, where there is less human interference are reported with some level of nesting. Several types of human activities can interfere with nesting activity and the ability of hatchlings to find their way into the islands. Despite the protection of sea turtle in various forms from export ban to harvesting ban has been imposed long time ago, as early as 1980s. Despite this harvesting of adults and collection of eggs for local consumption is ongoing. Vandhoo has been historically regarded as an important nesting ground for hawksbill turtle nesting. A Regional Waste Management Facility construction project has been approved by the Government of Maldives with IDA financing by WB despite the island beach has been declared as protected by Ministry of Fisheries and Agriculture. The developments especially coastal developments at Vandhoo are likely to cause impact on turtle nesting. Increased human activity due to operation of the facility is also likely to cause some impacts.

To address these problems a turtle management plan has been proposed in the ESIA report that has been approved by EPA of Maldives and environmental safeguard division of WB.

The objective of this management plan is to provide a framework for implementing management action as follows

1. Protection and preservation of the beach within the boundary of the project area
2. Control access to the beach
3. Total stop on egg harvesting
4. Provide public education and outreach programs to nearby community and public in general
5. Strict enforcement of existing legislations of turtle protection
6. Control beachfront lighting

This plan addresses light management measures, public outreach, enforcement and additional activities which impact sea turtle nesting. The purpose is to prevent interference with sea turtle nesting habitat while addressing public safety concerns.

Status and Distribution

Of the eight species of sea turtles, five are known to occur in the Maldives. They are:

- Green turtle (*Chelonia mydas*);

- Hawksbill turtle (Eretmochelys imbricata*);*
- *Olive Ridley turtle (*Lepidochelys olivacea);
- Loggerhead turtle (*Caretta caretta*) and
- Leatherback turtle (*Dermochelys coriacea*).

Green turtle (*Chelonia mydas*)

Green turtles (velaa) are found throughout the archipelago. Confirmed nesting from several atolls of Maldives was reported by Frazier et al (1984). Adults as well as immature turtles are found throughout the archipelago.

It is difficult to estimate the population size due to the dispersed nature of nesting beaches. The islands are relatively small, scattered and isolated, making them difficult to monitor. There are very scanty data relevant to nesting in the country. Nesting spoors observed indicated several hundred turtles nest yearly (Frazier et al., 1984). Turtle statistics compiled by MOFA (1988-2008) provide an annual summary of turtles nesting and caught in the country. The data are incomplete, and where Olive Ridleys occur they are likely to be lumped with Green turtles.

Available information indicates more nesting in the north and eastern side of the archipelago (Frazier et al., 1984). Evidently there are more reported nesting islands in the north than south of the country. Analysis of incomplete turtle data indicates that in terms of the number of islands used for nesting the north of the archipelago is the most important region. However the numbers of nesting females and egg counts (reproductive activity) are much greater in the south.

Hawksbill turtle (*Eretmochelys imbricata*)

Hawksbill turtles forage and nest throughout the Maldives. Turtles of all sizes are found throughout the archipelago As for Chelonia mydas, data available for Eretmochelys imbricata are inadequate. Nesting evidently occurs in all atolls. The number of nesting reported was over 18,400 between 1988 and 1995 (EPCS/MOFA, 1996). The number of turtles caught for the same period was over 14,500. Total numbers are believed to have decreased in recent years (Frazier et al., 1984; Didi, 1993).

Nesting occurs throughout the archipelago. Nests are made in the same areas as those of *C. mydas*, and are concentrated on the narrow stretches of beaches from the beach crest to approximately 10m inland.

Olive Ridley (*Lepidochelys olivacea*)

No nesting has been reported, nor have any gravid females been seen (Frazier et al., 1984). No particular season has been reported for these turtles to be more frequently observed. However, within the Maldives as a whole they appear to be commonest offshore (Anderson and Waheed, 1990; Ballance et al., 1996). They also appear to be much more common in the north of Maldives than in the south.

In summary, within the Maldives, Olive Ridleys are not known to nest; they are commonest offshore and in the north; and (from the only four specimens measured) they are sub-adults. It seems likely therefore that the Olive Ridleys that do occur in the Maldives may be migrants from the major nesting areas in the northern Indian Ocean, such as India (Orissa) and/or Pakistan.

Loggerhead turtle (*Caretta caretta*)

This species is very rare in the Maldives. There is only one confirmed record of the Loggerhead turtle in the Maldives: a female specimen with a carapace length of 76cm, photographed by Hassan Didi in 1981 (Frazier et al., 1984).

No information is available on population structure, population size, breeding or feeding biology in the Maldives.

Leatherback turtle (*Dermochelys coriacea*)

This species is rare in Maldives. However, it is recognized locally as a distinct species and is known as "musimbi." The descriptions given by local people who have seen it are distinctive: large size (>1m length) with ridges down the back.

On local accounts, sightings of this turtle are rare. A person of more than 60 years of age who lived on Gaadhoo (Laamu Atoll), one of the best turtle nesting islands, had never seen a musimbi (Frazier et al., 1984). Each of the few people who have seen this turtle has seen no more than one.

No quantitative data are available for population structure, population size, breeding and feeding biology.

Legislation

The Ministry of Fisheries and Agriculture has statutory responsibility for the rational and sustainable management of all living marine resources within the Exclusive Economic Zone (EEZ) of the Maldives.

A number of legislative actions in the Maldives have been undertaken specifically for marine turtle conservation. The parliament passed the first such bill (No. 24/78) on 6 February 1978, prohibiting the capture of Hawksbill turtles under two feet (61cm) in carapace length and other turtles less than two and half feet (76cm) carapace length. Bill no. 31/79 prohibited the export of any unprocessed product of Hawksbill turtles; while the export of processed ornamental jewelry made from tortoiseshell was permitted. In conjunction with the Bill no. 24/78, the then Ministry of Fisheries released a circular (by-law) banning the sale and display of turtles below the size limit specified in the Bill. This regulation became effective from 1 April 1980.

The most recent legislative measure to conserve turtles came into effect from January 2006, as an extension of a previous 10 year moratorium which ended in June 2005. This decree came into effect under section 10 of Fisheries Law no. 5/87.

Management Strategies

At present there are three major controls on the exploitation of sea turtles in the Maldives:

1. A ten-year ban on the catching or killing of sea turtles in the country, from June 1995.

2. Extension of first moratorium (1995-2005) for another 10 years (2006 -2016)
3. 14 priority nesting beaches protected under 2006 to 2016 moratorium (see below)
4. A ban on the importation of turtles and turtle products into the country, starting August 1995.
5. A ban on the sale of turtle and turtle products in the country, starting January 1996.

Institutional arrangements

The Ministry of Fisheries and Agriculture (MOFA) is legally responsible for the conservation of sea turtles in the Maldives. The present level of trained people available in the Marine Research Centre (MRC) of MOFA is inadequate to carry out a countrywide conservation and awareness programs.

International collaborations

Maldives has been engaged in sea turtle conservation and management efforts in the international community and multilateral organization. As such Maldives has been engaged with FAO and IUCN with their regional efforts (Indian Ocean) on conservation and management of Turtles. The most important effort is Maldives becoming a signatory to IOSEA MOU in 2010 as 31st member to the group. IOSEA MOU though legally not binding is an effort by member countries to reverse the negative impacts faced by sea turtle species in the Indian Ocean and South East Asia Region. Maldives is not yet party to Convention on Migratory Species (CMS) with also cover sea turtles.

Habitat protection

The recent ban on catching of sea turtles for 10 years does not include a ban on collection of turtle eggs from all nesting beaches. The exploitation of eggs still continues.

The Maldives as yet has few marine reserves as conservation areas except a few protected dive sites. It is important to protect the already identified nesting beaches from exploitation. It is therefore important to develop management plans for the protected nesting beaches for management and conservation measures to be effective. To that end, efforts are made from the relevant institutions to impose a nation-wide ban on egg harvesting.

Important nesting sites

Although turtle egg harvesting is legal generally in the Maldives, 14 islands are legally protected under the 10 year moratorium that became effective from January 2006 (Table 1). Eleven islands are designated as protected beaches effective January 2006. Protection of three islands, Gan, Gaadhoo and Kandoodhoo became effective January 2007.

Table 1 Egg harvesting (take) banned islands in the Maldives since 2006.

Island	Atoll	Status
Gan	Gaaf Dhaal	Uninhabited/Agricultural
Kandoodhoo	Tnaa	Inhabited
Gaadhoo	Laam	Inhabited
Miriyandhoo	Baa	Uninhabited
Muiree	Haa Dhaal	Uninhabited/Agricultural
Maamaduvvaree	Baa	Uninhabited/agriculture
Funaddoo	Thaa	Industrial
Vaikaramuraidhoo	Haa Dhaal	Uninhabited/Agriculture
Maaddoo	Baa	Uninhabited
Kanimeedhoo	Thaa	Uninhabited/Agriculture
Furaveri	Raa	Resort
Mulidhoo	Haa Alif	Uninhabited/Agriculture
Olhugiri	Baa	Uninhabited/ Protected Area
Vandhoo	Raa	Industrial/Regional Waste Management Facility

National level threats to sea turtles

Direct take of eggs and turtles

Despite the ban on harvesting oh sea turtles in 1995 (nation wide) and harvesting of eggs from specific islands (see table 1) under a moratorium for 10 years that became effective in 2006 there is little effort on enforcement. Hence, considered as a delicacy and also a traditional food eggs and turtles are readily taken on nesting beaches. Nesting seasons and sites, as well as feeding areas, are well known to the local fishermen and other folks.

Increased Human Presence

All the islands in the Maldives are state owned. Traditionally, islands that are not inhabited (no permanent settlement) are ‘leased’ (a traditional form locally called ‘varuvaa’) to local people where only coconut harvesting, crop farming and turtle egg harvesting etc. However, human populations are growing rapidly and this expansion is exerting increasing pressure on island resources. Although there are over thousand islands in the archipelago increased lease of islands for recreational and commercial use (tourism and non tourism purpose) are posing pressure on beaches.

Coastal Construction

Due to the small size of the islands, tourist hotel development and some infrastructure are often on the beach affecting nesting habitat to such activities (e.g., beach and shoreline control activities such as breakwater, revetments and groynes), beach recreation, an and other forms of disturbance to turtles.

Construction-related threats to sea turtle nesting beaches, from beach armoring activities can result in lack of access to such areas, in the erosion of adjacent sandy beaches. Clearing and stabilizing beach sediments and beach vegetation (which accelerates erosion); and the use of heavy construction equipment on the beach, which can cause sand compaction or beach erosion are other impact areas negatively affecting sea turtle nesting.

Beach nourishment is becoming a common requirement in one island, one hotel resort concept tourism development in the Maldives. The nourishment or replacement of beaches diminished by seawalls, storms, or coastal development can reduce sea turtle hatching success by deeply burying incubating eggs, depositing substrate often not the same on the beach change sediment characteristics affecting the incubation of sea turtle eggs. Obstruction to females coming ashore to nest by machinery, pipeline may also be a potential problem

Nest Predation

There are no large predators of turtles from landside as there are no such animals in the Maldives Therefore; loss of eggs to non-human predators is not problem in the islands of Maldives. Domestic animals, such as cats, as well as wild species such as rats, birds, and crabs can be a problem.

Artificial Lighting

Artificial lighting on the beaches especially tourist resort islands are of the increase and have potential problem to both nesting adults and hatchlings. Hatchling sea turtles find their way to the sea using a sophisticated suite of cues primarily associated with ambient light levels. Hatchlings become disoriented and misdirected in the presence of artificial lights behind their hatching site. These lights cause the hatchlings to orient inland, whereupon they fall prey to predators and die of exhaustion or exposure in the morning sun. Nesting adults are also sensitive to light and can become disoriented after nesting, heading inland and then dying in the heat.

Beach Mining

Sand and coral rubble use to be removed from beaches of inhabited islands for construction purposes. Beach sand mining is currently banned mainly due to the vulnerability of island shorelines to erosion from changing climate and associated effects. The extraction of sand from beaches has the potential to destabilize the coastline (e.g., reduces protection from storms), removes beach vegetation through extraction or flooding and, in severe cases, eliminates the beach completely. When mining occurs on or behind a nesting beach, the result can be the degradation or complete loss of nesting beach.

Exotic Vegetation

Non-native vegetation has the potential to overgrow and displace native beach vegetation through shading and/or chemical inhibition. Dense new vegetation shades nests, potentially altering natural hatchling sex ratios as temperature of the sediment where the nesting pits are located determines sex. Thick root masses can also entangle eggs and hatchlings.

Disease and Parasites

There are no data to understand extent to which disease or parasites affects the sea turtles ior eggs in either wild or captive. It is noteworthy to know only a couple of captive hatching and grow out (head start) efforts to rehabilitate sea turtles in the country.

Fisheries related mortality

There use to be active fishing of sea turtles some 50 years back by using lead sinkers with hook. This Practice is now rare and few. Accidental catch in fisheries is virtually nil. The dominant fisheries by gear are pole and line and hand lines. Long line fisheries for tuna are limited to license offshore fishing. There are no data available if any are accidentally caught (direct eating of bait targeted for tuna). Mortality associated with entanglement in active and abandoned fishing gear has not been documented. Incidental entanglement of Olive Ridley turtles on net attachments associated with Fish Aggregating Devices (FAD) deployed by Ministry of Fisheries has been reported. But the numbers and frequencies of such incidents are not appropriate reported and documented. Significant numbers of Olive Ridley turtles entangled in 'ghost nets' have been reported from the Maldives indicating the level of threat to sea turtles due to presence of these nets in the coastal water of Maldives that's are not locally sourced but from coastal margin countries of Indian Ocean.

Predation from sea

Marine predators are of large sharks, can consume a full-size sea turtle. Predation on hatchlings is can be relatively high and, the animals most often implicated are coastal and sharks, pelagic fish and seabirds.

Extreme weather events

There are no extreme weather events such as hurricanes and cyclones recorded in the Maldives. However, strong weather events such as tropical storms, and associated waves can play a role in changing the shape and size of the beaches. In addition, Indian monsoon related seasonal changes in current patterns could change beaches, degrading turtle nesting habitat, and change adult and hatchling turtle movements on affected beaches.

Threats at Vandhoo

Vandhoo has been identified as an important nesting beach among other several beaches after review od sea turtle egg harvesting data collected by MOFA. As a result Vandhoo was included among 14 islands where egg harvesting is formally banned since 2006. However, lack of appropriate enforcement, monitoring and surveillance it is believed egg harvesting continued.

15 hectares of land including beach from Vandhoo (38 hectares) has been officially allocated for setting up a Waste Management Facility for the region where Vandhoo is located. The rest of the island (23 hectares) is allocated for industrial used and outside of the control of Waste Management Facility. The entire beach of the island has been surveyed in February 2012 to estimate the nesting intensity. Although there was evidence of past nesting in the upper shoreline there was not very much nesting of recent times. Recent nesting was recorded on the northern side beach of the island. It was estimated that less than 10 individuals nest annually. This survey revealed and visual observation lead to conclude there is still egg harvesting going on whenever there is nesting. This is also verified by the information collected through the discussion with community members of nearby island who visit Vandhoo to collect eggs. According their feedback Vandhoo used to be a popular egg-harvesting site several years back but the number of eggs and nesting they see currently has significantly reduced.

With this information and direct observation it is safe to say that direct take of eggs despite the small amount they can take still continue to be the most important threat to the existing nesting turtles at Vandhoo. There is anecdotal information that direct take of adults can also be a significant threat.

Environmental awareness and education is an integral part of this management plan. It is evident that there is little public awareness of the local community in terms of the need for turtle conservation. Informed public can be a powerful force in promoting the protection of sea turtles, and in endorsing and seeking to support sustainable choices made by the RWMF.

Implementation of the plan

Outlined activities of the management plan are given in Tables 2. The table provide specific focus areas of the management plan, their conservation requirement and specific management action that shall be taken with their priority level, responsibility agency and scheduled time/

Table 2. Detailed action plan proposed for protection of beach and nesting adults and eggs.

Focus area	Conservation requirement	Management Actions		Priority	Responsibility	Timeline
1. Nesting environment	1.1 Protect and manage turtles and eggs on nesting beaches of the island especially beach within the boundary of RWMF	1.1.1 Eliminate directed take of turtles and their eggs	1.1.1.1 Reduce direct take of eggs and adults through monitoring and surveillance since WMF will not have direct public access (controlled by security).	High	RWMF, MEE and MoFA to monitor	From construction phase and continued through during the entire operation phase
			1.1.1.2 Reduce directed take of turtles through public education and information - Education of the public as to the value of conserving sea turtles is a very effective way of sustaining recovery efforts and providing support for enforcement of management regulations. Raise awareness of the nearby island (e.g. Innamaadho, Rasmaadhoo) as they frequent to the rest of Vandhoo. Advocate to follow the management direction proposed for RWMF	High	MEE, MoFA to prepare	Priority awareness in 2015-2015 and continuous
		1.1.2 Increase enforcement of laws protecting turtles by	1.1.2.1 Increase enforcement of protective laws protecting turtles by law enforcement and the courts. - Lack of	High	MEE and MoFA working in association	Priority awareness in 2015-2015 and

Focus area	Conservation requirement	Management Actions		Priority	Responsibility	Timeline
		law enforcement by the courts.	adequate support for law-enforcement activities, which protect sea turtle populations, is common, yet it must be understood that enforcement is as important as any other resource management activities. Enforcement, judicial, and prosecutorial personnel must receive instruction about sea turtles and the importance of protecting turtle populations.		with prosecutors and island mgistrates	continuous
		1.1.3 Ensure that coastal construction activities avoid disruption of nesting and hatching activities - Coastal construction must be monitored to minimize impact on turtle beaches, both during construction, particularly during the nesting and hatching season and in the long-term.	1.1.3.1 Construction equipment must not be allowed to operate on the beach, remove sand from the beach, or in any way degrade nesting habitat. Nighttime lighting of construction areas should be prohibited during nesting and hatching seasons or a non-intrusive lighting system should be put in place. In the long-term, structures should not block the turtle's access to the beach, change beach dynamics, or encourage human activities that might interfere with the nesting process. Monitoring their activities as well as putting a physical barrier such as a fence containing them within the facility area should manage movement by facility workers.	Medium (no beach construction except harbour basin)	EPA and MoFA to monitor	Should be completed by end 2014

Focus area	Conservation requirement	Management Actions		Priority	Responsibility	Timeline
			Ensure that no beach lights are erected on the beach. Harbor front lights shall be appropriately designed and set			
		1.1.4 Reduce effects of artificial lighting on hatchlings and nesting females - Because sea turtles (especially hatchlings) are strongly attracted to artificial lighting, lighting near nesting beaches should be placed in such a manner that light does not shine on the beach. If not, turtles may become disoriented and stray from their course.	1.1.4.1 Implement, enforce, evaluate lighting regulations or other lighting control measures where appropriate - Shielding of the light source, screening with vegetation, placing lights at lowered elevations and in some cases the use of limited spectrum low wavelength lighting (e.g. low pressure sodium vapor lights) are possible solutions to beach lighting problems.	High	EPA and MoFA to monitor Project engineer to ensure the requirements in place by the contractor during construction Facility manager to ensure implementation of actions during operations	2014 and Continuous
		1.1.5 Collect biological information on nesting turtle populations - The collection of basic biological information on nesting is critical for	1.1.5.1 Monitor nesting activity to determine number of nesting females, and determine population size Nesting beaches identified by standardized surveys during the nesting season.	High	MEE and MoFA to monitor using experts	Initially 5 years as priority (to establish status and trends. If there is rehabilitation

Focus area	Conservation requirement	Management Actions		Priority	Responsibility	Timeline
		making intelligent management decisions. Monitoring nesting success can help to identify problems at the nesting beach or elucidate important areas for protection. Analyzing population recruitment can help in understanding population status.	Establish long-term monitoring of annual nesting on the beach using standard methodology. Because of long maturity times for turtles, quantifying trends in population sizes and effectiveness of any program may take a generation time to be reflected in the annual numbers of nesters. Monitoring should thus be recognized as a long-term undertaking.			potential biological monitoring shall be continuous.
			1.1.5.2 Evaluate nest success and implement appropriate nest-protection measures. One of the simplest means to enhance populations is by increasing hatchling production at the nesting beach. The first step to such an enhancement program is to determine the nesting / hatching success and to characterize factors which may limit that success. Once those limiting factors are determined, protection or mitigation measures can be implemented. If nests must be moved to prevent loss from erosion or other threats, natural rather than artificial incubation should be employed.	High	MEE and MoFA to monitor and take actions using experts	Initially 5 years as priority (to establish status and trends. If there is rehabilitation potential biological monitoring shall be continuous.
	1.2 Protect and manage nesting habitats - The nesting habitat must be	1.2.1 Prevent the degradation of nesting habitats caused by sea	1.2.1.1 Eliminate sand and coral rubble removal and mining practices on nesting beaches - Beach mining severely affects a	Medium (No sand mining anticipated)	EPA and MoFA to monitor MEE to	NA

Focus area	Conservation requirement	Management Actions		Priority	Responsibility	Timeline
	protected to ensure future generations of the species. Increased human presence and coastal construction can damage nesting habitat resulting in reduced nest success or reduced hatchling survival. Once key nesting beaches are identified, they may be secured on a long-term basis in an assortment of ways. These may include conservation easements or agreements, lease of beaches, and in some cases, fee acquisition. Certain beaches may be designated as natural preserves. In some cases education of island users may serve to adequately secure nesting beaches.	walls, revetments, sand bags, other erosion-control measures, jetties and breakwaters - Beach armoring techniques to protect beachfront from wave action may actually degrade nesting habitats by eroding beaches and preventing nesting by preventing access to nesting sites or preventing digging of the nest on the site. Guidelines on the proper placement of such structures must be proposed. Jetties and breakwaters impede the natural movement of sand and add to erosion problems in neighboring beaches. Regulations regarding	nesting beach by reducing protection from storms, destroying native vegetation directly or indirectly and may completely destroy a nesting beach. Protective legislation and public education must be used to protect the substrate of the beaches.		conduction education programs	
			1.2.1.2 Develop beach-landscaping guidelines which recommend planting of only native vegetation, not clearing stabilizing beach vegetation and evaluating the effects as appropriate - Non-native vegetation may prevent access to nesting sites, prevent adequate nest digging, exacerbate erosion or affect hatchling sex ratios by altering incubation temperatures. Native vegetation, however, plays an important role in stabilizing the beach and creating the proper microclimate for nests.	Medium (No non native vegetation are included as part of landscaping. Natural Vegetation buffer (50m wide) around the facility is maintained	RWMF operator, MoFA with MEE	NA
			1.2.1.3 Ensure that beach replenishment is compatible with maintaining good quality nesting habitat - Sand on sea turtle beaches has particular properties, which affect hatching success (ie. compaction, gas diffusion, temperature). Any addition or replacement of sand may change these	Low (no beach replenishment is planned, natural shoreline is maintained except	MoFA	NA

Focus area	Conservation requirement	Management Actions		Priority	Responsibility	Timeline
		beach construction and beach armoring should be reviewed to ensure that such measures are restricted if adverse impacts to nesting are anticipated.	properties and make it more difficult for females to nest or reduce hatchling success. As such, beach replenishment should be carefully considered, use materials similar to the native sands and be carried out outside the nesting season.	harbour basin and associated revetments.		
			1.2.1.4 Implement non-mechanical beach cleaning alternatives - Hand raking of beach debris, rather than using heavy machinery, should be encouraged on nesting beaches where cleaning is done for aesthetic reasons. The use of heavy machinery can adversely affect hatchlings directly and their nesting habitat.	Low (no beach cleaning is planned). Any debris associated with construction cleared as it is produced. No operational debris is anticipated.	EPA and MoFA to monitor Implemented by the construction contractor and facility operator	NA
			1.2.1.5 Prevent vehicular driving on nesting beaches - Driving on active nesting beaches should be forbidden. Vehicles cause destabilization of beaches, threaten incubating nests and leave tire ruts that hatchlings have difficulty crossing. The facility areas should be demarcated with a fence.	Low (No vehicle driving is anticipated on the beach. Vehicle operation shall be restricted to	EPA and MoFA to monitor Construction engineer to ensure it is part of the designs and facility operator	NA

Focus area	Conservation requirement	Management Actions		Priority	Responsibility	Timeline
				daytime.	should ensure maintenance of the fence	
2. Marine environment	2.1 Protect and manage turtle populations in the marine habitat - Protection of turtles in the marine environment is a priority that is often overlooked as enforcement is difficult and quantification of the issues are generally problematic. However, 99% of a turtle's life is spent at sea; thus, conservation and management must include significant efforts to protect turtles at that time.	2.1.1 Eliminate directed take of turtles	2.1.1.1 Reduce directed take of turtles through public education and information - While increased law enforcement will be effective in the short term, without support of the local populace, regulations will become ineffective. Education of the public as to the value of conserving sea turtles is a very effective way of sustaining recovery efforts and providing support for enforcement of management regulations.	High	MoFA with MEE to conduct education programs	Continuous
			2.1.1.2 Maintain the enforcement of protective laws on the part of law enforcement and the courts - One of the major threats identified for turtle populations is the illegal harvest of turtles both on the nesting beach and in the water. Rigorous efforts in law enforcement should be undertaken immediately to reduce this source of mortality. Such efforts need to include training of enforcement personnel in the importance of protecting turtles, as well as supplying such personnel with adequate logistical support (boats,	High	MoFA	Continuous

Focus area	Conservation requirement	Management Actions		Priority	Responsibility	Timeline
			communication and surveillance equipment etc.). Judges and prosecutors must also be educated in the importance of these matters.			
		2.1.2 Determine distribution, abundance, and status in the marine environment - Lack of accurate information on distribution and abundance was one of the greatest threats to sea turtle populations. Most existing information is anecdotal or obsolete and where new information is available, it uniformly indicates that populations are vastly smaller than commonly believed. Therefore, gathering of basic information on distribution and	2.1.2.1 Determine the distribution and abundance of post-hatchlings, juveniles and adults - While little is known about the distribution of nesting beaches for the turtles across Maldives, even less is understood about distribution of foraging adult and juvenile populations. Quantitative surveys of foraging areas to determine abundance, and to identify essential habitat are of significant importance for restoration of populations.		MoFA	2014-2020 and continuous
			2.1.2.2 Determine growth rates and survivorship of hatchlings, juveniles, and adults, and age at sexual maturity - Understanding the rates of growth and survivorship of turtle populations is crucial to the development of appropriate population models. Such models are important in understanding population status and how best to efficiently apply management efforts, in restoring depleted populations.		MoFA	NA (no hatchery planned at the facility)
			2.1.2.3 Identify current or potential		MoFA	2014-2020

Focus area	Conservation requirement	Management Actions		Priority	Responsibility	Timeline
		abundance should take a very high priority in the long-term conservation of the turtles.	threats to adults and juveniles on foraging grounds - Little is known about threats to foraging populations.			
		2.1.3 Reduce the effects of entanglement and ingestion of marine debris - Entanglement due to abandoned or unmonitored fishing gear, as well as the ingestion of man-made debris such as solid waste is a significant problem in the marine environment.	2.1.3.1 Evaluate the extent to which turtles ingest persistent debris and become entangled - Once the problem of marine debris has been identified and quantified, it is important to implement (and enforce) a program to reduce the amount of debris in the marine environment,. The MEMP solid waste management program in the Northern Province once is full operation is expected to remove this problem		EPA, MoFA and MEE to monitor	NA (part of long term program beyond the scope and funds available for this project)
		2.1.4 Protect and manage marine habitat, including foraging habitats – Hawksbills are primarily pelagic, although they often enter nearshore waters. Human activities, which	2.1.4.1 Identify important marine habitats - These areas are unknown for this species and represent a high priority research need.		MoFA	Continuous
			2.1.4.2 Ensure the long-term protection of marine habitat - Once marine habitats are identified, sea turtle range, refugia and foraging habitats need to be protected to ensure longterm survival for the species.	High	MoFA	Continuous

Focus area	Conservation requirement	Management Actions		Priority	Responsibility	Timeline
		degrade important habitat, must be limited.	Habitats identified as important or critical should be designated as marine sanctuaries or reserves, while others may require close monitoring. The public needs to be educated on the importance of preserving these habitats.			
			2.1.4.3 Prevent the degradation of marine habitat caused by environmental contaminants such as sewage and other pollutants - The effect of such pollution on turtles has not been evaluated. However, turtles are likely prone to concentrating such contaminants within their tissues because of their position in the food web.	High	MoFA	Continuous
			2.1.4.4 Prevent the degradation or destruction of important habitats caused by coastal erosion and siltation - These processes, often made worse by large coastal construction, disrupt vital trophic processes, reducing productivity and reducing species diversity. Minimum water standards entering the sea must be maintained. Land-use decisions must take this into account and associated projects where erosion and siltation occur must be monitored.	High	MoFA with the support of EPA	Continuous

Control access to the beach

With the current operation setup the island is accessible to the general public. Access to the island is restricted where facility security personnel will seek access to the island. Staff and facility operator will have access to the beach. Top restrict aces to the beach the management of the facility shall set boundaries (restricted) to the beach as given in Figure 1. The primary area marked in the figure is most important areas where access the beach shall be strictly controlled. Vegetation buffer can act as a natural fence restricting aces to the beach. Secondary area is less important with less access restriction.

Total stop on egg harvesting

Stopping harvesting of eggs where there are any nesting in this area shall be a priority. If nesting occur the nest shall be demarcated or marked for monitoring purpose. Information on emerging hatchlings, hatching success shall be documented as given in Table 2.

Public education and outreach programs

Public involvement ranges from influencing legislation and policy to volunteering (monitor and protect nests, report sightings or infractions, etc.) and donating to conservation causes. Raising public awareness of the plight of sea turtles is crucial to sea turtle survival. Perhaps the most important aspect of public education and outreach is that informed community are likely t and specific timelines are o be more responsive to and accepting of the various conservation actions taken by the project and various elements of turtle conservation efforts.

Ministry of Fisheries and Agriculture in association with Ministry of Environment and Energy and Environmental Protection Agency can develop a variety of informative programs on sea turtles and the local environment for the enjoyment and intellectual stimulation of the community especially adolescents and school children. These programs can be tailored to meet the needs and desires of the community including child-friendly activities. In addition printed material, audio visuals on turtle biology, laws, and other management action interested groups from the community such as members of environmental clubs, school children can even experience direct encounters with sea turtles on turtle nesting, turtle tracks" which availability of such opportunity when it a raises in Vandhoo in partnership with trained local experts (conservation groups, government environmental officers. Such field visits can even focus on nesting turtles and can focus on nesting turtles or emerging hatchlings. In the case of hatchlings, students may be asked to participate directly in hatching survival by forming a line that shields the tiny turtles from disorienting.

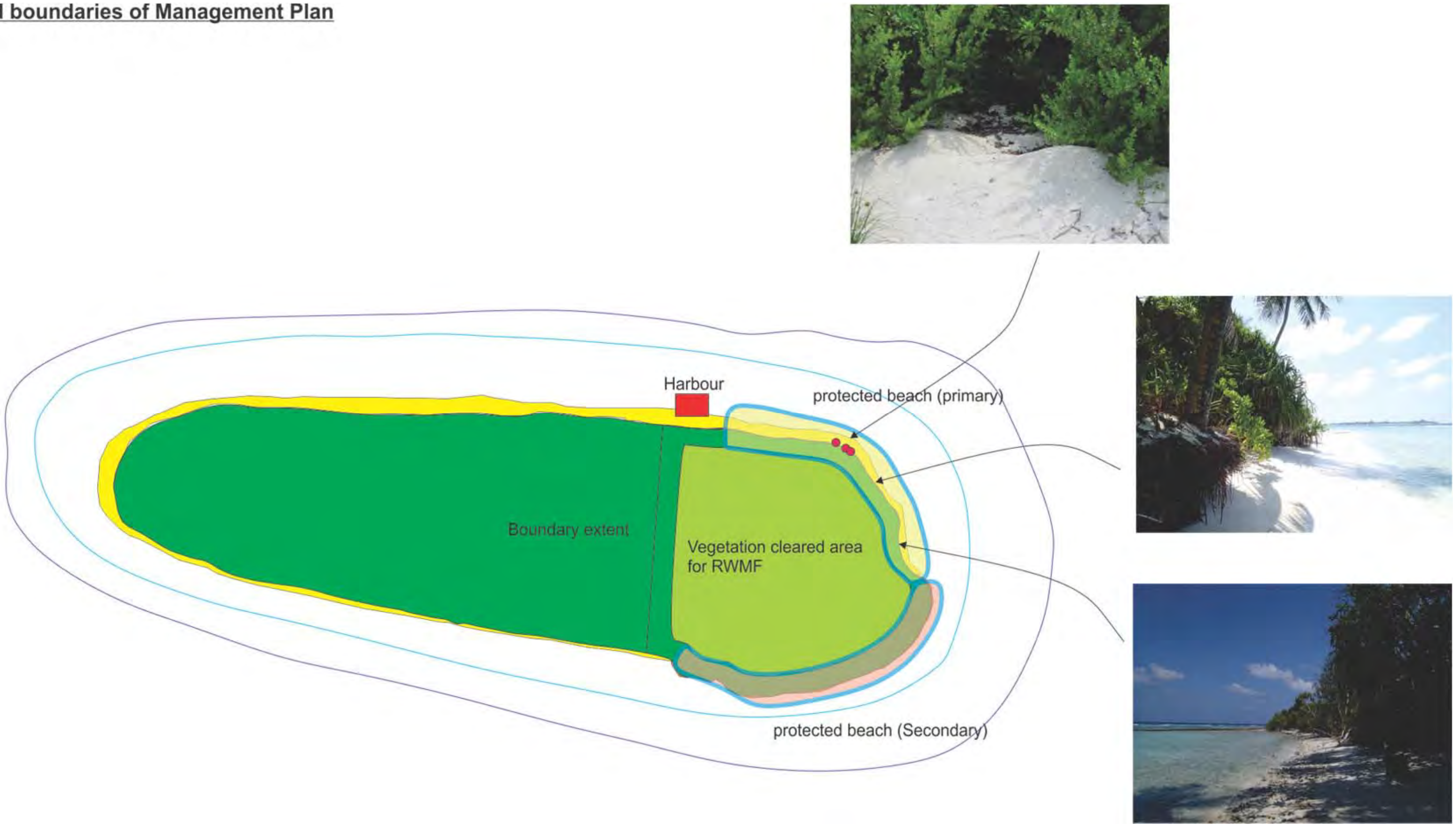
Enforcement of existing legislations of turtle protection

This is a general but an important requirement for management program to be a success. Although part of Vandhoo is restricted to public under its current operation (RWMF area) the rest of the island and beach has public access. It is important egg harvesting (violation at Vandhoo) if it happens if if there is evidence the law is enforced provided there is evidence that can be proved at court of law. Police and magistrates at local level should support and be proactive in enforcement of conservation related laws.

Control beachfront lighting

Beach lighting is already limited to the harbor area. Management should identify that existing harbor lights are set as turtle friendly.

Proposed boundaries of Management Plan


Harbour
protected beach (primary)
Boundary extent
Vegetation cleared area for RWMF
protected beach (Secondary)

Additional information for ESIA report for upgrading of infrastructure at regional waste management facility zone II, Raa Vandhoo

ENVIRONMENT – Comments from Task Team

1. The ESIA has identified the need for management of the buffer zone and designation of additional areas as part of the Vandhoo Turtle Management Plan, these recommendations need to be incorporated in to the management plan and updated according and implemented in parallel by WAMCO under the supervision of the MEE and EPA, this includes the installation of appropriate signage as per the plan and monitoring over time.
   PMU- This is already on-going. A Turtle Conservation sign board has been prepared and installed in Vandhoo RWMF. Similar boards will be developed and placed to demarcate the green buffer zones as well as the wetland area.

2. All recommendations on RWMC operations, along with ancillary facility operations need to be used to update the Vandhoo RWMC operational ESMP and this should be resubmitted to the Bank for review.
   PMU- This will be done as confirmed by the PMU.

3. The Bank strongly agrees with the recommendations made by the EPA to redesign the ancillary facilities within the existing facilities to ensure the buffer areas along the island and managed as much as possible. For all site clearances adequate compensatory planning in other parts of the Island must be undertaken. The PMU has confirmed that the recommendations have been taken up by WAMCO and the MEE already and redesigning has taken place, these should be included in the final ESIA once comments are addressed.
   PMU - It is not possible to undertake all of the 2:1 replantation in Vandhoo due to limited availability of barren land. However, road sides will be utilized for this purpose as much as possible.
   Consultant - The consultant has recommended to replant removed coconut palms to the buffer area, on either sides of the roads as well as at the barren area shown on Fig 44 of the report as a mitigation measure. Additionally, relocation of palms to nearby inhabited islands was also recommended. Potential inhabited islands include R. Dhuvaafaru and B. Eydhafushi. The minimum height of palms which could be relocated is 6 m, there is no maximum specified height, however, it is highly recommended to relocate younger palms.

4. While the ESIA indicates that the existing sewage and waste water management system will suffice for the construction influx, it has not been evaluated in detail the need for a sewage treatment and management system on site, it is not clear how the current treatment will be able to suffice with are larger influx of workers to the site during expanded operations and this will be essential and needs to be part of the proposed activities. It is recommended the team explores options such as composting toilets and other such environmental sound management options available which will be suitable for the site as it may be more cost

effective and the ESIA needs to detail out the current mechanisms of treatment and if it is suitable as well.

PMU- The contractors will not be based in R. Vandhoo. They will be accommodated in neighboring Innamaadhoo and Rasmaadhoo island. Daily transport to and from these islands will be arranged by the PMU. On site temporary huts will be developed by the contractors to be utilized as resting areas and storage of construction materials in a space shown by ME and WAMCO. Current proposed location for this is the area between the existing accommodation block and the Dhiraagu antenna. The existing toilets and showers in the facility will be made accessible to the contractor for daily use.

5. It is recommended that the ESMP be worded in a compliance and action-oriented manner to facilitate the contractor and operator to ensure sound implementation. The guidance provided in the World Bank Group Environmental Health and Safety Guidelines for SWM Facilities (WBG EHS) guidelines presented in Annex 12, Annex 10 and the attached Generic EMPs shared with the PMU, on 8th June 2018 on construction of ancillary need to be used as the main sources of guidance to outline mitigation measures for specific operational impacts that will be identified for the ancillary constructions. These should be used when the ESMPs are being updated and the ESMP.

PMU - The mitigation table presented in Table 29 of the Report is already in table format and done in an action-oriented matter. The PMU will however, recommend the consultant to distinguish between primary and secondary responsible parties as several parties have been mentioned specific to each activity.

Consultant - Revised mitigation table (Table 1) with defined primary and secondary responsible parties is presented in Appendix 1 of this report.

6. The ESMP needs to present mitigation measures and recommendations for onsite traffic management in order to ensure that the construction works, and any associated vehicular movements do not clash with the operations of the facility as both will happen in parallel. While the PMU has confirmed that overall safety signage will be procured for the site the ESMP should recommend the required signage and provide examples of best practice safety and vehicular movement standards to be used.

Consultant- Mitigation measures for road traffic is given in revised Table 29 in Appendix 1 of this document (Table 1)

7. An onsite traffic management plan for construction must be prepared and the staff on site should be briefed of its content. There should be clearly defined and non-conflicting plans for works to be conducted during operations set up, construction areas should be fenced out to operational staff and proper safety signage should be used.

PMU - Refer to comment number 4 for site setup arrangement. The PMU will also hire a site supervisor to oversee the works undertaken by contractors and manage potential conflicts. The supervisor will also be assigned the responsibility to ensure contractors implement the ESMP.

Consultant - Mitigation measures for road traffic is given on revised Table 29 on Appendix 1 of this report.

8. The ESMP appears to miss some of the key social elements while focusing more on the environmental aspects.
   PMU- This is a general statement made. Social issues relevant to the project are discussed in the report. Environmental safeguards are emphasized as they directly impact the outcome of the project.

ENVIRONMENT- Comments from RSA

9. Executive Summary: this section should contain the summary main elements of ESIA such as ESMP, impact analysis, institutional arrangement, project components, stakeholder consultation etc. they are currently missing in the section.
   Consultant- Please refer to Appendix 2 for revised Executive Summary

10. Condition of existing facility is analysed in Section 2.4. Please explain how the identified issues will be addressed in the project or outside of the project by PIU, WAMCO or Ministry of Environment.

PMU- The issues will be addressed as follows:

- *Lack of offloading facility – The capacity of the harbour will be increased and upgraded through government funds. ME has received funding for this from the local government budget and will be initiated after taking the required environmental permits from EPA. The ESIA addendum will be shared with World Bank since this will be a linked project.*
- *Temporary storage capacity is too low - this will be addressed through the current upgrading project through the extension of waste processing bunker 1, construction of additional waste storage bunkers etc.*
- *Lack of component storage space- this will be addressed through the current project as mentioned above.*
- *Technical issues - this has not been addressed at the time of the preparation of the referenced report (Mostafa, 2018). However, a qualified site engineer is now in Vandhoo, trained by Michealis, so this issue has been resolved.*
- *Shortage of staff - new staff have been recently recruited to Vandhoo including 10 laborers and 2 utility officers, while recruitment process has been initiated for 2 engineers and 3 drivers. These staff are sourced from neighboring islands, Inamaadhoo and Rasmaadhoo to which daily ferry services are provided by WAMCO. The issue of limited availability of on-site accommodation will be addressed through the current project.*

- *Delay in waste collection - WAMCO has temporarily suspended receiving waste from Zone 2 islands until the end of April 2019, to manage the stockpiled waste at the facility as well as to make the island communities aware of the standard for packaging waste that are accepted at the RWMF. The guideline developed by WAMCO specifies the type of waste accepted and not accepted at Vandhoo RWMF and gives information on how it has to be packed / processed at island level prior to regional transfer. A copy of this is given in Appendix 3 for reference.*

11. Upscaling of the existing RO plant is planned in the project. Please explain how to reduce, treat and discharge RO concentrate to mitigate the impacts associated with concentrate discharge into ocean.
    PMU- This has already been covered in the report. Please refer to page 7-105 which mentions that sewer outfall will be extended beyond the reef edge and the area where outfalls are constructed is a high mixing zone therefore it is classified as a minimal negative change and BE1 of page 9-113.

12. Please include a section to explain the Safeguard Policies triggered for the project. Section 3.10 should be World Bank requirement not IFC.
    PMU and Consultant - Refer to page 39 of the ESAMF that covers safeguards policies triggered for MCEP and reflect this in the supplementary document. Section 3.10 is revised to align with WB requirement.

Revision of section 3.10

3.10 WB Safeguard Requirements

The World Bank has a number of Operational Policies (OPs) and Bank Procedures (BPs) concerning environmental and social issues, which together are referred to as the Bank's Safeguard Policies'. If, during the development of a project, it is considered that it is possible that a proposed project activity could be the subject of one of the safeguard policies, that policy is considered to have been "triggered"(ESAMF, 2016). As such, WB Safeguard Policies triggered for this project are summarized below:-

3.10.1 Environmental Assessment (OP/BP 4.01)

As per the scope of the MCMP, the project is categorized as an Environmental Category A in relation to environmental assessment (EA) requirements, and the project triggers the Environmental Assessment safeguard policy (OP/BP 4.01)(ESAMF, 2016).

While the overall project is environmentally beneficial, physical interventions to establish a sound SWM system will lead to significant environmental impacts and need to be stringently mitigated and managed within the context of the project (ESAMF, 2016).

An Environmental and Social Assessment and Management Framework (ESAMF) will serve as a roadmap outlining the prerequisite environmental and social screening and assessments that will need to be undertaken for all project activities, as per the national environmental *legislations of the Maldives and the Bank's OP4.01 and other triggered safeguards policies. The ESAMF will apply to all components of the project. All subsequent individual assessments ESIAs/ESMPs will be prepared by the client and submitted for bank approval before any civil works and/or land take (ESAMF, 2016).*

3.10.2 Natural Habitats (OB/BP 4.04)

OP/BP 4.04 – Natural Habitats was triggered because all of the country's islands are surrounded by coral reefs which are significant natural habitats. The overall project will not conduct any activities within designated protected areas and project interventions will facilitate in mitigating pollution and degradation of such ecosystems due to inappropriate SWM. Adequate measure to screen, identify and mitigate any potential impacts to coral reefs, island vegetation and associated fauna and flora will be included in the ESAMF. As the current practices of SWM are detrimental to natural habitats, the proposed actions will help the project islands manage solid waste better and reduce the negative impacts associated with waste generation (ESAMF, 2016).

3.10.3 Involuntary Resettlement (OP/BP 4.12)

OP/BP 4.12 – Involuntary Resettlement was triggered because it was considered that some of the potential investments, for example the construction and expansion of IWMCs, could lead to future chance find of involuntary loss of crop, land taking as a small percentage of communities rely on surrounding land for agriculture and livelihood. These issues have been taken into consideration whilst developing the ESAMF. The screening protocols and mitigation guidelines outlined will ensure that any interventions considered in future will not cause involuntary resettlement. As an 'insurance' for this issue, an outline Resettlement Policy Framework (RPF) has been provided in the ESAMF, so that if any resettlement issues should arise they can be resolved satisfactorily. All subsequent individual social assessments, including ESIAs/ESMPs, will be prepared and by the client and submitted for bank approval before any civil works and/or land take (ESAMF, 2016).

13. According to a turtle nesting site survey, the nesting pits were observed all around the island rather than confined in the turtle conservation area specified in the Masterplan. Please give the analysis on the loss of turtle nesting sites and propose the concrete measures to minimize, reduce, mitigate and compensate such habitat loss.

    PMU - This ESIA should be read like an addendum or supplement to the ESIA of R. Vandhoo RWMF (NIRAS, 2012), which was approved by the World Bank and the Maldives EPA prior to establishment of the facility through World Bank funded MEMP project. The only reason for preparing a separate ESIA for the upgrading works was because 5 years has passed since the approval of original ESIA which is the permissible limit for application to an Addendum as per local EIA regulation of the Maldives. The issues highlighted here is addressed in the 2012 ESIA and reflected in the STMP which is actually a part of the original ESIA, but has been referenced here also for further information.

14. Please explain the operational flow from receiving the wastes to waste disposal and how to treat and discharge leachate from the landfill. Please also clarify the emission/discharge

standards to be applicable to the emission from incineration and leachate discharge, and ambient quality for air, surface water, soil and groundwater etc.

PMU - Refer to what has been stated in response number 13. Incinerator and other associated facilities have already been developed (completed in 2015) through MEMP and is extensively discussed and covered in the ESIA of R. Vandhoo RWMF (NIRAS, 2012) including emissions standards and ambient air quality of neighboring islands. Filters and scrubbers were incorporated into the system design. Please refer to the original ESIA. It is also covered in Operational ESMP of Vandhoo RWMF (Zuhair, 2018), also approved by the World Bank.

15. Consultation: There are many concerns raised through consultation meetings. Please add the response to each issue raised to explain how to address them. Section 6.6 notes that the most of these issues will be addressed but please clarify which issues will be addressed through the project and through the ministry of environment, WAMCO or other parties, and which issues would remain unresolved.

Consultant - Refer to Appendix 4 for recommended solutions to issues raised during consultations.

16. Through the consultation, the potential livelihood impacts due to the loss of access to forest resources in Vandhoo were also identified. Please explain how the potential livelihood impacts will be mitigated/compensated.

PMU - The site was decided during the time of MEMP and not through the current project. The livelihood issue mentioned would have been discovered during the initial project as well. This was revisited and discussed with ME and WAMCO during stakeholder consultation through the current ESIA, however, both parties recommended not to allow islanders to freely access the facility-based island due to security concerns as well as concerns of potential increase in illegal harvesting of hawksbill turtles and their eggs.

Consultant - As identified in Table 2 (Appendix 4) It is recommended to make Vandhoo accessible to the women of neighboring islands on a certain day of the week decided by WAMCO or fortnightly at a designated time for collecting coconut leaves. Alternatively, WAMCO can collect coconut leaves and bring it to the harbour on a certain day of the week / fortnightly so that interested parties from neighboring islands can come at their own boats to collect.

17. As suggested in the comments from EPA, A contingency plan for the project should be prepared to respond to the potential emergency situation. The key requirements of a contingency plan should be explained in ESIA, and more detailed plan should be prepared by the contractor and operator.

PMU-

As mentioned in the ESIA, the contingency plan is included in the Operations and Management plan of WAMCO prepared in 2018 for Vandhoo RWMF.

The master plan has been revised according to the comments from EPA as well to incorporate the issues highlighted by the consultant in the ESIA. The updated master plan is attached in Appendix 7 of this report. The changes are detailed below:-

1. *Guest and consultant accommodation block have been relocated to southwest side of the island adjacent to the proposed staff accommodation area. Only a 2.4m wide walkway will provide access from the staff accommodation area to the guest and consultant accommodation block.*
2. *The width of the road is reduced to 10m by taking out the proposed green zone and side walk from one side of the road.*
3. *Route of the roads have been revised consistent to figure 43 of the ESIA report. As such, the main road will not extend up to the staff accommodation area, instead a 3m narrow connecting road will provide access to this area.*
4. *The connecting road to 11F and 14A where a banyan tree is located will be deviated in future to protect this tree. The banyan tree has been clearly marked in the MP, while the subject road will not be developed during this phase of the project.*

18. Sea Turtle Management Plan is attached to ESIA. Please explain in the ESIA main text who is the owner of the plan and how to implement the plan and monitor implementation. Multiple parties such as MoFA, EPA, RWMF and MEE are responsible for the management measures. The plan was agreed among those responsible parties? Please include the budget to implement the plan and how the budget will be secured. Implementation, coordination and monitoring mechanism should be also explained.
PMU - As explained before, this plan is not a new thing, it's part of the original Vandhoo ESIA (NIRAS, 2012), as such, the recommended buffers etc have already been maintained. As the operator of the facility STMP will be implemented by WAMCO. ME and the project will assist to further strengthen implementation of STMP like preparing sign boards for the extension areas and conducting awareness session for staffs.

19. Mitigation measures (Table 29)- Please add the potential impacts and mitigation measures etc. for the following aspects:
    - Soil erosion and ocean pollution due to the construction activities
    - Air pollution and noise generation because of the incinerator and landfill operation.

- *Soil erosion was not identified as a potential impact due to the proposed upgrades to RWMF at Vandhoo since no shoreline developments are proposed.*
- *Ocean pollution is expected to be negligible as the only possibility of ocean pollution is during material transfer. Since no construction activities will be conducted near the shoreline, construction waste is not expected to make its way into the ocean. Moreover, as the facility is a waste management facility, all waste generated during construction*

will be handled within the island itself. Nevertheless, mitigation table on Appendix 1 of this report is updated to reflect this.

- *As mentioned above, the incinerator is already developed and air quality issues are extensively discussed and covered through the original Vandhoo ESIA (NIRAS, 2012). The incinerator is not a part of the upgrading works and hence is not included in the scope of works of this ESIA.*

20. The budget to implement ESMP (Proposed measures in table 29) should be costed and included in the project cost.
PMU - The ESMP will be implemented by different contractors. The bidders will be requested to consider implementation of the ESMP during cost calculations when preparing bid documents. The PMU would like to highlight that this is outside the scope of the works of the consultant. As mentioned, the TOR of the ESIA was approved by the safeguards team of the world bank, in addition to EPA. Hence, we feel that bringing this at this stage is not practical.

21. Institutional arrangement, and supervision and reporting mechanism are missing in the document. Please explain.
PMU- Requested WB for further clarification on this.

22. **Environmental issues of existing facilities.** The ESIA has identified several environmental and health issues associated with existing operation of Regional Waste Management Facility such as improper segregation of waste, incompatibility of waste with the incinerator, leachate ponds filled with rainwater, etc. it is not clear whether these issues will be addressed through the proposed Project and ESMP is silent on these issues.
PMU - Refer to response number 10. In addition to this, a sorting line will be purchased through the project. Once the international incinerator specialist is selected (process already initiated according to PM), the specification for sorting line will be developed and advertised.

23. **Respiratory diseases in workers associated with the incinerator.** Currently, the ESMP is mainly focused on the proposed project facilities but not on the issues related to the existing facilities such as incinerator. For example, it is written that the health of the workers was affected by the operation of the incinerator, however "since any works related to the incinerator is not in the scope of the proposed upgrade, these will not be discussed in further detail" (Section 7.3.2). This is not the correct approach. The ESMP should also discuss the issues associated with the existing operation of incinerator.
PMU - As explained earlier this document should be read as an addendum to the original Vandhoo ESIA (NIRAS, 2012). The impacts associated with the incinerator has already been covered through the original ESIA. The proposed works are for the extension of the facility to cater for the limitations identified in operations such as increasing the waste storage capacity and on-site accommodation capacity of the facility. Health and safety measure have also been covered further in the operational ESMP (Zuhair, 2018).

24. Air Pollution Control System for the incinerator. The ESIA has predicted that the operation of the incinerator will cause significant air pollution on the Innamaadhoo island that is located about 1.7 km to the north of Vandhoo. The ESIA suggested installing a system with a proper Air Pollution Control system which includes Electrostatic Precipitator and multiple scrubbers, spray – dryer and baghouse or other similar combinations. But none of these recommendations are reflected in the proposed project design and the ESMP.
    PMU - This has already been covered through the original ESIA (NIRAS, 2012). All the mitigation measures mentioned have been already implemented. The incinerator has proper air filtration and wet scrubber systems installed through the original project.

25. **Concerns of the communities of nearby islands.** During consultations, the communities have expressed several concerns with the ongoing waste management practices. It is not clear how these concerns are related to the proposed project, and they will be addressed. Please present these concerns in a tabular form and mention how they will be addressed.
    The upgrading project is designed to specifically address these issues. For instance, regular waste collection is not happening due to the RWMF not having adequate capacity to store waste. Other community related concerns raised during stakeholder consultation meetings are addressed under point no. 15 and given in Appendix 4 of this document.

26. **Ecosystem services of the Vandhoo island.** Vandhoo island provides several ecosystem services to the nearby island communities through coconut plantations, forestry and recreation. ESMP should propose adequate measures to address the impacts on these ecosystem services.
    The RWMF is not accessible to island communities since the commencement of the operations of the facility. Most of the coconut palms that has to be removed for the proposed extension works will be relocated to a nearby inhabited islands like R. Dhuvaafaru and thereby these ecosystem services will be preserved to a certain degree.
    In order to still facilitate use of ecosystem services Vandhoo, Vandhoo could be made accessible to the women of neighboring islands on a certain day of the week decided by WAMCO or fortnightly at a designated time for collecting coconut leaves.
    Alternatively, WAMCO can collect coconut leaves and bring it to the harbor on a certain day of the week/fortnightly so that interested parties from neighboring islands can come at their own boats to collect.

27. **Standards for Wastewater Discharges (Brine) from the RO Plant.** Please include relevant national or international standards on the quality of wastewater discharges to be maintained from the RO plant. Wastewater discharges shall be monitored to ensure compliance with these standards. Also please refer to the World Bank Group Environmental Health and Safety Guidelines for the relevant standards.
    Consultant - There is no standard specified by EPA for discharge water quality for brine (wastewater) from RO plant. However, RO wastewater can be only discharged to the marine environment (seawater) away from reef proper. Moreover, the proposed project proposes a

very small-scale RO plant (50 tons/day), and as water is discharged to an open waterbody at a high mixing zone, it is not expected to have a significant impact on the marine environment. Nevertheless, environmental monitoring plan (Table 30 of Addendum) specifies bi-annual monitoring of seawater quality from different locations around the island, SW4 of which coincides the brine outfall location.

28. **Budget for ESMP implementation.** ESMP has proposed measures such as green belts around the project facilities, the buffer zone around the beaches, fencing around the turtle nesting pits, fencing around the harbour to prevent waste spills moving into the sea, and so on. These are all seems to be high-cost items. Please include the budget for these measures in the ESMP and in the Project to ensure that they can be implemented under the project.

PMU and Consultant - Green belts and buffer zones are already maintained on Vandhoo. The estimated cost of fencing around the harbour is approximately USD 10,000.

29. **Capacity building.** Please include capacity building programs on environmental, health and safety awareness to the project workers.

PMU and Consultant - Capacity building programs have been included as a mitigation measure during operational phase of the project (Table 1 given in Appendix 1 shows the. Revised mitigation table).

30. **Monitoring. Please strengthen the monitoring program.** It should cover all the environmental, health and safety issues identified it in the ESMP matrix.

Consultant- A monitoring component for verifying the level of implementation of the mitigation measures during construction and operational phase, which would cover the health and safety measures, are included in the revised monitoring table (Table 3) in Appendix 5 of this document.

31. **Monitoring Reports**. An annual monitoring report is proposed in the ESMP. The monitoring report should be prepared monthly during the construction period. Please note that the proposed project activities will be constructed over only six months. The monitoring reports should include environmental issues associated with construction activities.

PMU- Monitoring will be done every month during the construction phase and the implementation of the mitigation measures recorded in interim reports, but the final monitoring report of construction phase will be produced at the end of the construction phase as proposed in the ESIA. The interim monitoring sheets can be shared with the bank monthly if required.

SOCIAL- Comments from Task Team

1. 2.2 Land ownership – Last sentence – Shouldn't it be a transfer letter (as opposed to land acquisition)?
   PMU- The term "land acquisition" has been used as this was how the process was referred to in the TOR provided to the Consultant. The initial report discusses in detail, how the process is undertaken.

2. 3.10 and 3.10.1 Refers to IFC requirements.
   PMU and Consultant- The section has been updated. Please refer to response 12 of environment section of this report.

3. 6.1 Outcomes from previous consultations – Any possibility of summarizing the findings in this report?
   PMU - A summary is already provided!

4. 6.2.1 and 6.2.2 Consultations with Atoll Council and adjoining island – Serious issues raised pertaining to lack of consultation or awareness prior to taking over of land that historically belonged to them. Another issue is the loss of income as claimed by the women of the adjoining island.
   PMU - This is not applicable to the scope of this project.

5. MITIGATION MEASURES? Section 6.6 seem to indicate that the recommended mitigation measures for the above issues will be described under section 11 of this report. However, the report concludes in Chapter 10. Regardless of the Chapters, mitigation measures for the above issues seem to be missing and should NOT BE CLEARED pending revision.
   Consultant- The mitigation of all identified impacts is thoroughly discussed under section 9.1 of the Addendum report. The incorrect Section number was giving due to a typing error.

6. Also, a translation of the land acquisition (or transfer) letter should be attached.
   Consultant- Translation of the land acquisition/transfer letter is provided in Appendix 8 of this report.

7. Chapter 9 presents an environmental management plan but not a social management plan – No mitigation measures proposed, for example, to deal with the influx of labor as a result of the expansion (of activities), GRM, facilities for potential women workers – leading to GBV, etc, etc.
   PMU and Consultant- Mitigation measures for the social issues are addressed in the revised mitigation table (Table 1 of this document) on Appendix 1. The proposed GRM is provided in Appendix 6.

SOCIAL-Comments from RSA

1. 2.2 Land acquisition. Please clarify the terms of handing the island over to the Ministry of Environment (ME), in particular, timing and access.
   PMU- Please refer to the date of the letter. Initially 15 hectares of land from Vandhoo was approved for developing the RWMF (on August 2010), which is the existing footprint of the facility. Later the entire island was handed over to ME for Waste Management activities by the President's Office on 8 March 2017. An English translation of this letter is provided as requested. See Appendix 8.

2. 2.6.2 Workforce during the construction phase. Are workers likely local (within Raa Atoll) or external? Do you have an indication of the number of labor requirement?
   PMU- We do not know this at this stage since it depends on the selected contractors.

3. 2.7.2 Human resource plan (during the operation phase). Are the workers likely local or external? Are the skills available locally? Do you plan to train locals to hire as staff?
   PMU- We do not know this at this stage since it depends on the selected contractors. There is no issue of local skill shortage in the construction sector. Operation of the facility will be carried out by WAMCO, who employ both locals and foreigners, although their focus is on hiring locals, who will then be trained by them.

4. 3.4 Leasing of Uninhabited Island. What is the handover arrangement for Raa Atoll vis a vis the Law on Uninhabited Island? Will the Council be given an amount equivalent to 2 years worth of payment for lease? Or will it be given back balance of its payment for remaining part of the lease (or Varuvaa) agreement?
   PMU and Consultant - The island of Raa Vandhoo is state-owned and is not owned by the Atoll Council even though it is indicated in the report that the island was previously leased to them by MoFT. It is a decision made by the President's Office in 2017 and is outside the scope of this project. The island was allocated free of charge, therefore, compensation will not be required.

5. 4.6 Socio-economic environment or baseline. ESIA should include overall socio-economic baseline of Raa Atoll. Please including overall populations, breakdown by gender, age, and ethnicity, level of education, vulnerable groups, livelihoods, incomes, Raa Atoll council structure and capacity, other local institutions/associations, on-going conflicts (if any), local conflict resolution mechanism, etc. Does the population include migrant workers? If so, how many? Also, indicate gender and sectors in which they are employed.
   PMU - As mentioned earlier, a comprehensive ESIA and a Social Assessment was conducted for the original Vandhoo RWMF project, which covers most of what has been mentioned here. As this is only an extension to the original project, we do not think that this has to be again studied and extensively covered in the current ESIA which should be read as an addendum to the original ESIA (NIRAS, 2012). Please refer to the aforementioned documents.

6. 5.7 Socio-economic environment. ESIA needs to discuss the access and use of Vandhoo by Raa Atoll Council residents. It appears the Raa Atoll residents have had access to Vandhoo. What are (or were, since the consultation seems to indicate the residents no longer have access) their access rights, including use of resources (such as coconut leaves, according to stakeholder consultations), fishery (land for boat yard, according to the consultations), leisure (picnic, according to the consultations), etc.? What have been their access rights, and how will (or did) it change after the handover?
   PMU- The facility cannot be allowed to use for picnics due to safety and security concerns.
   As suggested in response number 16 of Environment Section it can be recommended to give limited access to women for the purpose of collecting coconut leaves or WAMCO can collect coconut leaves and bring it to the harbour on a certain day of the week / fortnightly so that interested parties from neighboring islands can come at their own boats to collect.
   A possible alternative boat building yard is recommended to be developed in Vandhoo RWMF and leased to the boat builders of nearby islands on need basis.

7. 7. Impact assessment. This section also needs to assess the negative social impact, i.e., on loss of livelihoods. What is the income loss? Are there mitigation measures? What are potential alternative arrangements or livelihoods for the loss of resource or land use. How do you monitor the implementation? What are the costs for the implementation of alternative arrangements/livelihoods and monitoring?
   Although the decision by the government to hand over the entire island to ME for waste management purpose is outside the scope of this project, we will request the consultant to suggest some social mitigation measures. It is to be noted that not only World Bank funded projects will take place in Vandhoo, and the government plans to implement the masterplan through various funding agencies as well Government funds.
   Also see response to comment 6 above.

8. Grievance redress mechanism. There is no section on grievance redressal. Please include.
   A GRM similar to the bank approved GRM for MCEP specific for this project is attached on Appendix 6 of this report.

9. Appendix 3. Land Acquisition Letter. Can you also include translation in English?
   An English translation is provided as requested. See Appendix 8 of this document.

ENVIRONMENT- Comments from RSA (10 June 2019)

1. Executive Summary: Please include ESMP table in Appendix 2

   Normally the entire ESMP mitigation matrix is not included in the Executive Summary.

2. Turtle nesting site: The only information provided in the original EIA prepared in 2012 is the following paragraph: "The beach was reported (Turtle nesting reports, MOFA 2006) as a nesting location for hawksbill turtles (Eretmochelys imbricata), none observed. It is rumoured that turtle eggs are still collected and consumed in the Maldives, even if forbidden by law." Since the ESIA for upgrading of Vandhoo RWMF prepared in 2018 recognizes the existence of nesting pits all around the island, the proper analysis on the potential impacts on turtle nesting and necessary mitigation measures should be included in ESIA documents. The information is currently missing.

   Please refer to Appendix 15 (page 10-145) of the ESIA 2019 for the Turtle Management Plan. The Turtle Management Plan was originally proposed as part of the Environmental Monitoring Report for the RWMF at Vandhoo, Raa Atoll (Zahir, 2014).

3. Please explain the operational flow from receiving the wastes to waste disposal and how to treat and discharge leachate from the landfill. This information is not found in the original EIA (NIRAS, 2012). The original EIA also states that "chemical treatment is mentioned, and the treated effluent is required to comply with 'Effluent Standards for Landfill in the US – MSW Landfills." The details of the chemical treatment process and applicable standards should be provided.

   The operational flow of waste management activities is provided in Appendix 9.
   Bi-annual testing of effluents at the landfill cells for pH; TSS; Ammonia; Zinc Benzoic acid; Phenols are included in the monitoring programme. Please refer to this.

   The standard used for comparison will be "Effluent Standards for Landfill in the US – MSW Landfills" as reflected in table 4 of the WBG EHS Guideline for WM facilities.

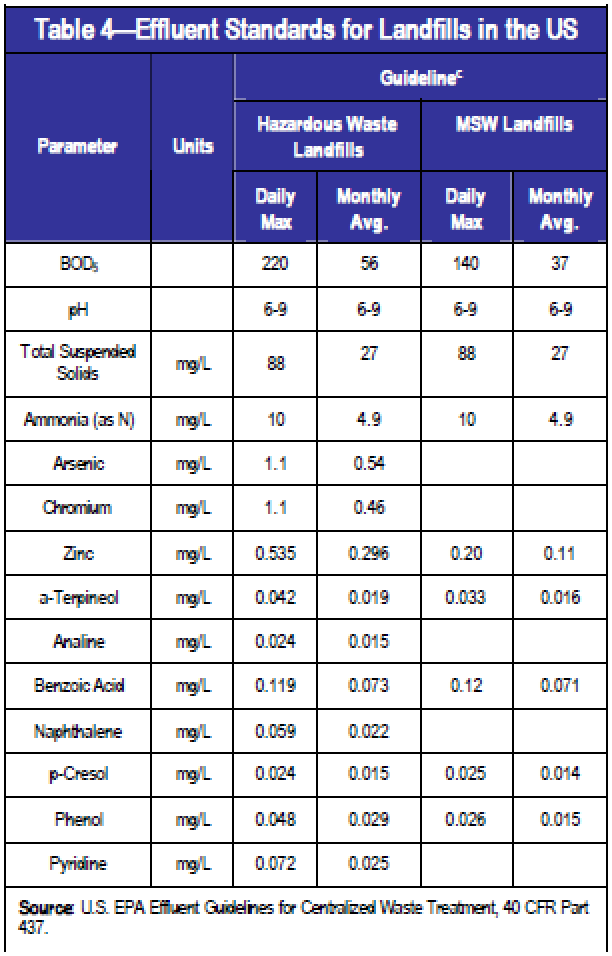


Table 4—Effluent Standards for Landfills in the US

Parameter	Units	Guideline[c]			
		Hazardous Waste Landfills		MSW Landfills	
		Daily Max	Monthly Avg.	Daily Max	Monthly Avg.
BOD_5		220	56	140	37
pH		6-9	6-9	6-9	6-9
Total Suspended Solids	mg/L	88	27	88	27
Ammonia (as N)	mg/L	10	4.9	10	4.9
Arsenic	mg/L	1.1	0.54		
Chromium	mg/L	1.1	0.46		
Zinc	mg/L	0.535	0.296	0.20	0.11
a-Terpineol	mg/L	0.042	0.019	0.033	0.016
Analine	mg/L	0.024	0.015		
Benzoic Acid	mg/L	0.119	0.073	0.12	0.071
Naphthalene	mg/L	0.059	0.022		
p-Cresol	mg/L	0.024	0.015	0.025	0.014
Phenol	mg/L	0.048	0.029	0.026	0.015
Pyridine	mg/L	0.072	0.025		

Source: U.S. EPA Effluent Guidelines for Centralized Waste Treatment, 40 CFR Part 437.

As many air pollution control devices use water for gas cleaning, and generate wastewater that contains the pollutants removed from the flue gas, the following treatment methods are recommended to prevent, minimize, and control water effluents:

- *Minimize discharge of process wastewater to the extent possible while maintaining required air emission control;*
- *Treat wastewater before discharge (e.g., using settling, precipitation of metals, and neutralization).*

4. The potential livelihood impacts due to the loss of access to forest resources in Vandhoo: Two options are “recommended”. However, mitigation measures should be determined and clearly proposed with costs, schedule and responsibility.

The cost for relocating the coconut palms that falls in the proposed roads and accommodation / guest consultant blocks are included within the scope of works of road *construction. As such, palms below 30ft in length that cannot be replanted in Vandhoo will be removed and translocated to the nearby island of Raa Dhuvaafaru for replantation. The estimated cost for road construction including translocation of palms is USD 95,000.*

5. The contingency plan is NOT included in the Operations and Management Plan prepared by WAMCO in Semptember2018. The key requirements of a contingency plan should be explained in ESIA, and the more detailed plan should be prepared by the contractor and operator.

   Provided in Appendix 11

6. The adequate response was not provided. Please explain in the ESIA main text the owner of the Sea Turtle Management plan, and how to implement the plan and monitor implementation. Multiple parties such as MoFA, EPA, RWMF and MEE are responsible for the management measures. The plan was agreed among those responsible parties? Please include the budget to implement the plan and how the budget will be secured. Implementation, coordination and monitoring mechanism should be also explained. Original EIA does not include Sea Turtle Management Plan.

   The primary responsible party for the implementation of the STMP during the operational phase will be WAMCO as they are the operators of the RMWF. However, the Ministry of Environment (ME) will be responsible for its implementation during the construction phase of the upgrading of infrastructure project, which is covered through MCEP project. In addition to this the project will facilitate in designing and printing of awareness materials such as billboards, flyers, leaflets etc. as well as conducting awareness sessions targeted for the staffs of the facility on turtle nesting sites and conservation through out the cause of the project. A part of the budget allocated for IEC campaign (overall USD 500,000.00) will be utilised for this purpose.

   An updated version of the STMP exclusive to the current project is provided in Appendix 10.

7. If all the cost for ESMP implementation should be part of project/engineering cost and the bidder will need to propose such cost for proper ESMP implementation, this should be clarified in the document. PMU has to secure the budged required to the ESMP implementation. In terms of capacity building, in order to maintain the sufficient level of capacity building activities, the cost required for capacity building activities should be indicated.

Implementation of ESMP will be included in the BOQs and subsequently costed in the Bids submitted by the contractors. This is the standard procedure followed by MCEP for all the contracts.

Capacity building for solid waste management is covered through MCEP under component 1.2 for which a total budget of USD 1.97 million has been proposed for both Zone 2 and Zone 4&5. This component has programmes targeted for building the capacity of WAMCO, EPA, ME and Island Councils in waste management. USD 175,000.00 is specifically proposed for increasing waste management capacity at island level, which includes vocational training programmes and training for waste management staffs of the island councils.

8. This comment was not addressed. Please clarify the organizational structure/arrangement responsible for ESMP implementation, monitoring and supervision. Please also clarify what kinds of and how often monitoring/supervision reports will be prepared and submitted to whom.

   Primary responsible party and secondary responsible parties, as well as reporting frequencies have been identified for each activity proposed in the mitigation matrix. Please refer to Appendix 1. Revised mitigation table.

9. As proposed in our response in 16, compensation should be given to the affected people for the ecosystem services provided by the Vandhoo island. Compensation methodology should be clarified and finalized.

   Please note that the vegetation found at Raa Vandhoo do not belong to any particular individual and is state owned. Therefore, compensation is not required. As specified several times, the ecosystem services will be conserved as much as possible through the translocation of coconut palms to the nearby island of Raa Dhuvaafaru. The estimated number of vegetation for translocation is 70 coconut palms.

SOCIAL-Comments from RSA (10 June 2019)

1. Consultations: appendix 4 has a table showing the issues emerging from consultations and recommendations to address those as well as the responsible authority. Please clarify if these recommendations have been discussed with the relevant parties and as such are the recommendations going to be implemented in practice, since there is not budget or timeline?

   Yes. The recommendations given in appendix 4 has been discussed with the relevant people. As mentioned, consultations were undertaken with the boat building communities of Inamaadhoo and Inguraidhoo island.

   In regards to budget for implementation such as "providing facilities and equipment required to facilitate proper waste management at island levels by the proponent ME" please note that procurement is already on-going and will be completed before the end of 2019. USD 1 million has been allocated in MCEP for providing equipment to the IWMCs of Zone 2 islands, including waste management equipment, weighing scales and waste collection vehicles.

   Likewise, the limitations in operations of the RWMF is also being address through MCEP, which itself is the primary purpose of this infrastructure upgrading project. A budget of USD 3.37 million has been allocated for upgrading the infrastructure at the facility and purchasing additional equipment needed for operations. The storage capacity of the facility will be increased through the project, while the limitations in operations would be resolved through purchasing of a mechanised sorting line, cranes for landing crafts, heavy vehicles for loading and unloading waste, an additional landing craft and a whaler for accessing islands without harbours or with shallow lagoons. The entire project is expected to be completed within a period of 1 year. The equipment will be purchased and delivered before the end of 2019.

   An additional column has been added to table 2 given in Appendix 4 to indicated associated cost / budget.

2. Chapter 6 mentions that recommendations were discussed with project unit, but no other parties? For instance, there is a recommendation to ensure women can access the island to gather coconut leaves and husks, which is important for maintaining their livelihood.

   The recommendations were discussed with the PMU, WAMCO, the boat building communities and the island councils of the neighbouring islands and has been reflected in the additional information document. Please refer again to the additional information document.

3. Change in resource use is mentioned in table 27 as an impact during operations phase, and revised mitigation table 1 in appendix table 29 only proposes as mitigation that WAMCO collects and sells the resources to people instead of letting them come to the island to do the collection themselves – will this not lower their ability to earn an income when they need to pay for the resources? This activity should also be monitored to ensure livelihoods are not adversely affected by this arrangement.

   The revised mitigation table suggests that the coconut leaves are given free of cost to the communities rather than selling. Please refer again.

4. Another livelihood issue is related to plots for boat building or the recommendation to develop such a yard; who will finance/construct this? According to the revised mitigation table 1 in appendix 1, it seems the two communities affected by this are not fully in agreement on where this yard should be located.

   The Green Fund of the GoM will finance this. Yes, so based on the consultation only Inamaadhoo community will be given the land for boatbuilding from Vandhoo as Inguraidhoo community wants to continue with what they have been practicing at island at present.

5. Workforce numbers estimates, can you please clarify if the workers are expected to be local or foreign?

   This cannot be deduced at this stage. Please note that we will acquire letters from the selected contractors stating that staffs recruited for the project will be employed as per the Employment Act of the Maldives and proof of valid work permits for expatriate workers will be submitted within 10 days of awarding the contract and acknowledging that failure to adhere to these terms will result in the termination of the contract. This will also be reflected in the contract document under conditions of the contract.

6. GRM: in general, a person does not have to exhaust all the tiers of the GRM to access the national judicial system.

   This is true.

7. Editorial note: Recommend removing consultants' CVs from the document.

   The EIA regulation of the Maldives requires this.

Appendix 1. Revised mitigations table (Table 29 of the Addendum) is provided below. The revised components are in *blue italics.*

Table 1. Measures to mitigate/monitor potential impacts and occupational health risks during the construction and operational phase of the project

Activity	**No.**	**Potential impacts**	**Mitigation Measures**	**Location/ Time frame**	**Monitoring***	***Responsibility*** ***P:Primary*** ***S:Secondary***
CONSTRUCTION PHASE						
Fuel storage and fuel dispersal to vehicles	PC2	Accidental spills of hydrocarbon on the island due to storage facility leaks	Construct concrete berms around the tank and fueling areas, install sumps to pump out spilled products, emergency warning spill alert equipment.	Fuel storage tank site/ Prior, during and after construction phase	Groundwater quality as specified in Table	*P:RWMF supervisor* *S: ME, WAMCO*
Maintenance and refueling of project support vehicles	PC3	Accidental spills of hydrocarbon on and under the island associated with motorized support-vehicles	Construct concrete line maintenance areas with capacity to collect and use-recycle used hydrocarbons. Ensure proper maintenance of machinery, appropriate workshop facilities, appropriate handling of all waste (store in a safe place for later removal / incineration in the incinerator).	Maintenance areas/ Prior, during and after construction phase	Groundwater quality as specified in Table	*P:Construction supervisor* *S:WAMCO, RWMF supervisor*
Laying of brine and sewer outfalls	BE1	Changes in live coral cover and contamination of seawater	Avoid trampling on areas outside of project boundary. Outfall pipes should be properly anchored to prevent pipeline movement, especially to prevent the pipes from drifting to the turtle conservation area.	Reef flat on southside/ during construction phase	Marine environment and seawater quality as specified in Table	*P:Construction supervisor* *S:WAMCO, RWMF supervisor*
Construction activities	EO4 EO5	Air pollution and noise impacts	Avoid unnecessary operation of machinery and equipment. Limit use of heavy machinery to project site only. Regular maintenance of machinery	Whole islands/ during construction phase		*P:Construction supervisor* *S:WAMCO, RWMF supervisor*
Clearing of vegetation in the project area and guest accommodation	BE5	Vegetation removed from most of the site	Erosion and dust control devices in place prior to construction. Ensure protection of the vegetation buffer zone along the coast (50 m wide) and around the wetland. The buffer should be 70 m in the area where the wetland is found. Coconut palms, if possible, to be moved from the cleared area to the buffer area. Vegetation falling outside project boundary shall not be	RWMF site/ During construction	None	*P:ME* *S:Construction supervisor*

	🟥		harmed in any way. Coconut palms removed from the construction sites, if not replanted, should be taken to a nearby island and rehabilitated. An alternative option for road widths are described in section 8 in order to minimize the no. of coconut palms to be removed. Plant some of the cleared vegetation on either side of the roads as well as the areas shown on Fig 44 of the report. Beach front guest accommodation blocks are not recommended, instead, allocate guest rooms at the proposed staff accommodation block as discussed under project alternatives section. Few protected banyan trees were identified, one of which falls on a construction plot (Fig 44 of the report). It is recommended to shift the block to avoid the banyan tree. All banyan should be conserved during and operation of the facility.			
Overall construction and operation of the project	BE6	Changes in turtle nesting patterns due to changes in beach areas due to construction, noise and lights	Document the relative importance of the beaches as nesting areas for each turtle species, if considered important, take measures such as infrared lights at night, turtle protection measures. No trespassing signs shall be enacted at the turtle conservation area and the area should not be disturbed by any means. Any exploitation, if reported shall be punished.	Turtle conservation area	None	*P:ME* *S:EPA, Construction supervisor*
Road traffic		*Risk of accidents as construction works and current operational works will happen simultaneously*	*Enact traffic signage on the roads where lanes cross over. Set the speed limit at 25 km/hour. Assign different lanes for construction vehicles and operational vehicles. Construction areas should be fenced out to operational staff with proper safety signage. Prior to commencement of construction works, proper onsite traffic management plan shall be prepared and staff on site shall be briefed on its content. Proponent (ME) shall hire a site*	*Construction site/ During construction phase*	*None*	*P:Construction supervisor* *S:WAMCO, RWMF supervisor*

			supervisor to oversee the undertaken by contractors and manage potential conflicts. The supervisor shall ensure contractors implement the ESMP.			
Material transfer		*Ocean pollution*	*Ensure any construction material does not make its way into the ocean. Keep the material properly and securely stocked on the supply vessel/barge.*	*Ocean transfer route/ During construction*	*None*	*Construction supervisor*
Influx of laborers (especially foreign) for construction activities to neighboring islands Rasmaadhoo and Innamaadhoo		*Social issues*	*Allocate a staff/ HR manager on each island.* *Brief the foreigners about the Maldivian culture.* *Encourage hire of local construction workers from the islands.*	*During construction*	*None*	*HR Manager of contractor*
OCCUPATIONAL HEALTH AND SAFETY RISKS DURING CONSTRUCTION						
Dust generated during construction		Worker's health may be affected	Provide masks to the worker where dust is prone in the work area	Site specific	During construction	*Construction supervisor*
Noise from machinery / construction		Worker's health may be affected	Workers should have protective gear including earmuffs.	Site specific	During construction	*Construction supervisor*
Work accidents		Worker's health may be affected	Establish and enforce appropriate safety rules and work routines and compulsory use of safety equipment (helmets, protective wear). First aid kit accessible on site, routines for emergencies established and known to all.	Site specific	During construction	*Construction supervisor*
OPERATIONAL PHASE						
Fuel storage and fuel dispersal to vehicles	PC5	Changes in hydrocarbon concentrations on the island due to possible leaks from storage facilities during operational phase	Construct concrete berms around the tank and fueling areas, install sumps to pump out spilled products, emergency warning spill alert equipment to alert o	Fuel storage tank site/ Prior to, and during operational phase		*P:EPA* *S:WAMCO* *RWMF supervisor*
Maintenance and refueling of project support vehicles	PC5	Changes in hydrocarbon concentrations on the island due to possible motor vehicle leaks and maintenance during operational phase	Construct concrete line maintenance areas with capacity to collect and use-recycle used hydrocarbons. Ensure proper maintenance of machinery, appropriate workshop facilities, appropriate handling of all waste /store in a safe place for later removal / incineration in the incinerator	Maintenance areas/ prior to, and during operational phase		*WAMCO RWMF supervisor*

Leaching from landfill to ground water and / or the marine environment	PC4	Changes in groundwater chemistry due to leachates from the waste facility; Impact to the soil and potential groundwater/coastal water contamination	Adhere to the regular monitoring of soil and groundwater for leachates	Soil, groundwater and coastal waters/ During operation		*WAMCO*
Leakage / overflows from wastewater treatment	BE8	Changes in groundwater chemistry/ flora and fauna due to leachates and effluents from the waste facility	Maintain sufficient storage capacity; Regular monitoring of soil and groundwater for leachates, emergency procedures pre-defined in case of leakage. Maintain scrubbers of the RWMF	Soil, groundwater and coastal waters/ During operation		*WAMCO*
Wastewater treatment. Leakage from plant or insufficient cleaning of wastewater.	BE8	Contamination of soil, groundwater, seawater causing harm to people, flora, fauna.	Wastewater treatment plant designed to treat sanitary and other waste.	Soil, groundwater and coastal waters/ During operation		*WAMCO*
Release of brine and sewer wastewater into the lagoon	BE9	Loss of marine habitat, contamination of seawater quality	Treatment of wastewater prior to releasing into the lagoon. Ensure outfall pipes are intact and in place with rigid anchoring. Monitor water quality at the outfall areas and check for optimal range of parameters	During operation	Marine environment and seawater quality as specified in Table	*P:WAMCO* *S:EPA*
Operation of fuel farm and power house	PC5	Changes in groundwater chemistry. Risk of accidents.	Construct concrete berms around the tank and fueling areas, install sumps to pump out spilled products, emergency warning spill alert equipment. Follow MNDF's fuel handling procedure. Have emergency oil spill cleanup equipment available.	During operation	Groundwater quality as specified in Table	*P:WAMCO* *S:EPA*
Bulk storage of oils and waste oils	EO3	Changes in groundwater chemistry. Risk of accidents.	Construct concrete berms around the tank and fueling areas, install sumps to pump out spilled products, emergency warning spill alert equipment. Follow MNDF's fuel handling procedure. Have emergency oil spill cleanup equipment available.	During operation	Groundwater quality as specified in Table	*P:WAMCO* *S:EPA*
Changes in resource use from Vandhoo by neighboring islands	SC6	Impacts on livelihood of locals as an income generating facility was no longer available	Make Vandhoo accessible to the women of neighboring islands on a certain day of the week decided by WAMCO or fortnightly at a designated time for collecting coconut leaves. Alternatively, WAMCO can collect coconut leaves and bring it to the harbor	During operation	NONE	*WAMCO*

	🟨		on a certain day of the week/fortnightly so that interested parties from neighboring islands can come at their own boats to collect. A possible alternative boat building yard is recommended to be developed in Vandhoo RWMF and leased to the boat builders of nearby islands on need basis. NOTE: Initial consultations with the boat building community of Inamaadhoo and Inguraidhoo were held by ME on 23 May 2019 to find out the support from these communities to the proposed. These consultations were lead by the Minster of Environment, Dr. Hussain Rasheed Hassan. The boat building community of Inguraidhoo is not in favour of this as they do not want to stay away from their families for long durations. Inamaadhoo community supports this idea as they do not want their families to get exposed to fiber and associated health risks.			
Overall operation of the project	BE6	Changes in turtle nesting patterns due to changes in beach areas due to construction, noise and lights	Implement turtle management plan attached on Appendix 15 of this report. Restrict entry to turtle conservation area indicated through clear sign boards. Demarcate boundaries through fencing. Conduct regular briefing sessions to the staff at the facility. Regular monitoring through environmental officer recruited by the operator, WAMCO. Any exploitation, if reported shall be punished.	Turtle conservation area	NONE	*WAMCO*
Waste lost into the sea during transport		Visual impact (affecting tourism, people in general); impact on marine flora/fauna	Custom-built vessels with protective shields, preventing movement of light fractions. Vessels to follow existing regulations regarding transport vessels. Compulsory logbooks of all waste loaded and unloaded	Marine environment / sea- During transport	NONE	*P:Vessel operators* *S:WAMCO*
Waste lost into the sea during loading / unloading of waste		Visual impact (affecting tourism, people in general); impact on marine flora/fauna	Mesh fence and green belt towards the seaside, preventing movement of light fractions.	Transfer area between facility and sea/ During operation	NONE	*P:Vessel operators* *S:WAMCO*

			Custom-built vessels such as landing crafts, truck loads and compactors ensuring effective operation of the facility			
Visual impact of facility		Visual impact affecting tourist impression	Replanting and green belts, camouflaging the facility from distance, comply with the recommendation for vegetation buffer-zone, ensure area light is concealed (as far as possible) from the surroundings.	Surroundings of Vandhoo Island/throughout operation	NONE	*P:Design engineers* *S:WAMCO*
Operation of RO plant		Risk of distribution of improperly treated water	Properties of product water quality produced from the RO plant should be in compliance with EPA's guideline for drinking water quality. Prior to RO plant becoming operational, RO plant shall be registered at EPA and monitoring of product water shall be carried out as per the operating license. EPA to monitor whether reporting is being done by the operator.	During operation	As per operating license	*P:WAMCO* *S:EPA*
OCCUPATIONAL HEALTH AND SAFETY RISKS DURING OPERATION						
Waste unload and waste storage		Workers health may be affected	Reduce speed of vehicles, provide masks to the worker where dust is prone in the work area	Site specific	During operation	*P:Facility operator* *S:Safety officer*
Waste recycling activities (removing recyclables, toxic and hazardous waste)		Workers health may be affected	Workers should have protective gear including earmuffs.	Site specific	During operation	*P:Facility operator* *S:Safety officer*
Waste handling (from storage to incinerator)		Workers health may be affected	Establish and enforce appropriate safety rules and work routines and compulsory use of safety equipment (helmets, protective wear). First aid kit accessible on site, routines for emergencies established and known to all.	Site specific	During operation	*P:Facility operator* *S:Safety officer*
Landfill		Unpleasant working environment, potentially harmful (pathogens, toxics)	Protective equipment that ensures no direct contact between workers and waste	On site	During operation	*Facility operators*
Noise from operation of machinery for waste handling and power house		Unpleasant working environment	Appropriate earmuffs, protecting against noise	On site	During operation	*Facility operators*
Handling of waste (sorting of waste, handling for		Health hazard to the workers (pathogens, toxic / hazardous waste)	Protective equipment that ensures no direct contact between workers and waste.	On site	During operation	*P:Facility operator* *S:Safety officer*

recyclables and hazardous materials, work on the landfill)						
Accidents in the processes. *Environmental, health and safety awareness*		Injury due to poor handling or malfunctioning machinery and equipment. *Environmental pollution due to accidents.*	*Develop a Health and Safety Manual which includes well-developed and well enforced safety guidelines and streamlined processes for operation; compulsory safety training for all employees; compulsory use of adequate protective equipment. Access to first aid kit on site.* *Conduct routine capacity building programs to all staff working at Vandhoo RWMF.*	On site	During operation	*P:Facility operator* *S:Safety officer*
Influx of labor as a result of the expansion (of activities)		*Social issues*	*Have rigid HR management policy in place.*	*On site*	*During operation*	*P:Facility operator* *S:Safety officer*

Appendix 2. Revised Executive summary

PROJECT DESCRIPTION

The following Environmental and Social Impact Assessment (ESIA) is formulated to address the proposed upgrades to the existing Regional Waste Management Facility (RWMF) located on the island of Vandhoo in the Republic of the Maldives. The ESIA has been developed in accordance with the Environmental and Social Assessment Framework (ESAF) of the Maldives Environmental Impact Assessment Regulations (2012) and the World Bank requirement for a full Environmental Assessment to be undertaken for Category 'A' projects, which require a full ESIA. The ESIA contained herein aims to address those requirements.

The overall objective of the Environmental & Social Impact Assessment (ESIA) presented herein is to determine whether the project is feasible in terms of the non-mitigable social and environmental impacts that would offset positive contributions from the RWMF. The process used to develop this ESIA study follows the environmental reporting requirements for the proposed development of the RWMF on Vandhoo Island, Raa Atoll. A baseline for the most components of the proposed development had already been set by the initial ESIA process. Therefore, this report mainly aims to analyse the deviation from the baseline conditions through comparison of current conditions with that of the baseline conditions.

The main objective of the RWMF was to provide an alternative for the islands in the Northern Province to reduce the volume of waste that must be burned and dumped in an unsustainable manner by providing a RWMF that puts into practice the concept of waste separation and recycling, composting, and incineration of solid waste from islands in the Northern Province of the Maldives. However, the established facility at Vandhoo has failed to meet its ultimate goal due to lack of several facilities. As a result, upgrades to the existing facilities are proposed which are addressed in this ESIA.

PROJECT COMPONENTS

The proposed project is an upgrade of the existing waste management facility. Scope of work includes the following: -

1. *Extension of existing waste processing bunker 1;*
2. *Construction of additional waste storage bunker;*
3. *Construction of hazardous waste storage facility;*
4. *Construction of proposed recycling facility with storage for recyclables;*
5. *Construction of new staff quarters (accommodation) with mess;*

6. *Extension of utility building (to accommodate additional genset);*
7. *Construction of incinerator maintenance room (for tools and critical spares);*
8. *Construction of store room 3 (for spares);*
9. *Construction of additional water tanks (250 m^3 x 2 nos.);*
10. *Relocation and upgrade of fuel storage (100 m^3 x 2 nos.);*
11. *Rehabilitation of the existing landfill and leachate pond (with pumps);*
12. *Upgrading/upscaling of existing fire protection system (include additional buildings);*
13. *Upscaling of existing RO plant (with borehole); and*
14. *Upscaling of the existing RO plant (with borehole).*
15. *Establishment of water and sewer network to the accommodation blocks.*

INSTITUTIONAL ARRANGEMENT

The proponent of the proposed project is the Government of Maldives, who will implement the project through the ME. Overall operating agency as well as the party enforcing environmental standards and regulations during operational phase for the project will be WAMCO. Financing of the project has already been secured through grant money from the World Bank.

STAKEHOLDER CONSULTATION

A stakeholder analysis was carried out during the scoping meeting to identify the relevant stakeholders of the proposed project. It was decided that all the Atoll Councils of Zone 2, the Ministry of Environment, EPA and the closest inhabited island to the RWMF shall be consulted regarding the project.

Major outcomes of the stakeholder consultation meetings are summarized below:-

- *The challenges of not fully being able to operate the system was highlighted by all parties.*
- *Lack of waste collection, handling and management at island levels were raised during Atoll Consultations. These include, lack of waste collecting vehicles and capacity, fee system not being feasible for smaller populations, issue of composting in islands, just one landing craft serving the whole region.*
- *R. Innamaadhoo and R. Rasmaadho raised concerns regarding livelihood impacts due to the loss of access to forest resources in Vandhoo.*
- *Comments from the implementing authority, ME and operator, WAMCO were mainly focused on the challenges faced up to date in operation of the current facility as it lacks many basic facilities required by a waste management facility.*

IMPACT ASSESSMENT

The ESIA examined two possible scenarios, namely, the potential impacts associated with:

- **Scenario 1**: *proposed upgrades to RWMF are established;*
- **Scenario 2:** *proposed upgrades to RWMF are not established and the facility is used as it is.*

The analysis of Scenario 2, the situation without the proposed project, indicates that there are 10 potentially significant negative changes that would seriously affect the Maldives and its people. Only 1 positive change were identified for Scenario 2. Although it should be evident that no construction impacts would be expected if the RWMF is not built, it is noteworthy that the RIAM analysis identified a total of 10 significant negative changes both inside and outside of the immediate project area if the RWMF is not built and made operational. The results of the analysis highlight the critical situation that is developing without immediate solutions to the solid waste issues facing the Maldives.

There are 16 potentially negative changes expected to occur if the RWMF is upgraded and operated. However, only one of the impacts are identified as a significant negative change (-D) and it is associated with extensive vegetation clearance. However, all of the negative changes associated with the construction and operation of the RWMF can either be reduced or considerably eliminated, provided that the Proponent and its contractors apply the best practice measures described in the Environmental and Social Monitoring Program (ESMP). The permanent elimination of vegetation on the building and road development areas is unavoidable and alternatives are proposed as a mitigation measure.

This notwithstanding, it is worth highlighting that there are 12 significantly positive changes associated with proposed upgrade to the existing RWMF at Vandhoo. Each potential change requires a corresponding baseline and mitigation measures, which are presented in Sections 6 and 7 respectively.

CONCLUSION

Based on the impact analysis, the ESIA concludes that the project is environmentally and socially viable, provided that the mitigation measures presented in Section 7 are closely followed. Additionally, monitoring is required for the priority impacts that are identified in Section 6.

Appendix 3. Waste collection, sorting and packaging guideline developed by WAMCO

GUIDELINES FOR TYPES OF WASTE ACCEPTED AT R. VANDHOO REGIONAL WASTE MANAGEMENT FACILITY

Waste Management Corporation Ltd.
(WAMCO)

Combustible waste

This includes materials that are not made of metal, glass, or fiber glass, such as paper, plastic, nappies, wood, leaves, etc. Combustible waste must be kept separate from sand, and also metal, glass, or fiber glass.

Tar

If tar, kept in closed containers, is brought to the facility, it will be accepted.

Metal

Products made of metal must be kept in a way that is easy to be picked up. It must also be kept separate from other types of waste.

Fiber

Products made of fiber such as mats, carpets, or resin products must be kept separate from sand and other waste types.

Heavy paper material

Heavy paper material such as cardboard boxes must be kept separate from other types of waste.

Wood waste

This waste includes wood such as palm trees without leaves. This type of waste must be chopped as much as possible, kept in a way that is easy to be picked up. It must also be kept separate from sand and other types of waste.

Plastic

Plastic waste includes plastic bottles, plastic containers, regiform boxes, etc. Plastic waste must be separated in a way that it is easy to pick up, and must be kept separate from sand and other types of waste.

Glass

Including bottles and other products made of glass, this type of waste must be kept separate from other types of waste.

Construction & Demolition (C&D)

Construction and demolition (C&D) waste will not be accepted at this facility.

INFORMATION

All waste that is brought to R. Vandhoo Regional Waste Management Facility (RWMF) must be separated as per the guidelines outlined in this pamphlet.

Please note that waste brought to R. Vandhoo RWMF that does not adhere to the guidelines will not be accepted at this facility.

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Website:	www.wamco.com.mv

WAMCO
WASTE MANAGEMENT CORPORATION LIMITED

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- HDPE ފުޅި (ޝެމްޕޫ، ޑިޓަރޖަންޓް، ކޮސްމެޓިކްސް އަޅާފައި ހުންނަ ފުޅި، ބާލިދީ، ކާޓު ސްޓޫލް)
- PVC (ފެންވަޔަރު ކުރުމަށް ބޭނުންކުރާ ހޮޅި، ކޮށި ފަދަ ތަކެތި)

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Appendix 4. Recommended solutions to issues raised during Consultations

Table 2. The issues raised during consultation meetings and the recommended solutions

Stakeholder	***Issue***	***Recommendation***	***Responsible Authority***	***Implementation Cost / Budget***
R. Rasmaadhoo and R. Innamaadhoo	• *Livelihood impacts including loss of forest resources in Vandhoo.* • *Not being be able to get land for boat yard by Innamaadhoo people which was already given by the atoll councils before it was decided to develop the whole island.* • *Loss of a picnic island for Rasmaadhoo and Innamaadhoo.*	• *Make Vandhoo accessible to the women of neighboring islands on a certain day of the week decided by WAMCO or fortnightly at a designated time for collecting coconut leaves. Alternatively, WAMCO can collect coconut leaves and bring it to the harbor on a certain day of the week / fortnightly so that interested parties from neighboring islands can come at their own boats to collect.* • *A possible alternative boat building yard is recommended to be developed in Vandhoo RWMF and leased to the boat builders of nearby islands on need basis.* *NOTE: Initial consultations with the boat building community of Inamaadhoo and Inguraidhoo were held by ME on 23 May 2019 to find out the support from these communities to the proposed. These consultations were lead by the Minster of Environment, Dr. Hussain*	• *WAMCO / Ministry of Environment*	• *No cost involved.* • *The Green Fund of Maldives is proposed to be utilized.*

		Rasheed Hassan. The boat building community of Inguraidhoo is not in favour of this as they do not want to stay away from their families for long durations. Inamaadhoo community supports this idea as they do not want their families to get exposed to fiber and associated health risks.		
R. Atoll council	*Communication gaps, information sharing gaps.*	*ME shall inform the Atoll councils prior to any development activities which may affect the livelihood of the islanders.*	*Ministry of Environment*	- *No cost involved.*
All atoll councils of Zone II	*Lack facilities such as waste collecting vessels, capacity, a proper waste management system, lack of enough landing crafts.*	*Provide the facilities and equipment required to facilitate proper waste management at island levels by the proponent, ME.*	*Ministry of Environment*	- *MCEP will finance this component. USD 1 million has been proposed.*
	Fee system not being feasible for smaller islands.	*Provide a subsidy by the government to smaller island councils for waste collection, as it will not be fair on the locals of smaller islands to raise the price of waste collection than bigger islands.*	*Govt. of Maldives / Ministry of Environment*	- *Should be proposed in the approved GoM budget for each year.*
	The frequency at which waste needs to be collected from the islands are not met as well as dissatisfaction over how WAMCO is running the existing process/ facility.	*It is noted that this frequency cannot be met by WAMCO due to inadequacies in the current waste management system. It is predicted that this will be resolved once the proposed upgrades are brought to the existing facility.*	*WAMCO*	- *Upgrading of infrastructure at the facility and purchase additional equipment required for operations will be*

				financed by MCEP. A total of USD 3.37 million has been allocated for this.

Appendix 5. Revised environmental monitoring program is provided in Table 3 below. The revised components are in *blue italics.*

Table 3. Environmental monitoring program proposed for the waste management facility at Vandhoo (Revision of Table 30 of Addendum).

Component	Parameter	Monitoring location	Frequency	Responsible agency	Estimated yearly cost (USD)
Air quality	Particulate Matter (PM_{10}), Carbon Monoxide (CO), NOx, SO2	Direct emission measurement at powerhouse chimney	3 months after the start-up of powerhouse. Hereafter annually.	WAMCO	5,000
Effluents (Leachates)	BOD5; pH; TSS Ammonia; Zinc Benzoic acid; Phenols	At the landfill cells	Bi annually	WAMCO	1000
Ground-water	Temperature; pH; Electrical conductivity; TDS; TSS; DO; Ammonia; Phosphate; Sulfate; Zinc; Benzoic acid, Phenols, hydrocarbons	Borewell east Borewell west Well	quarterly	WAMCO	500.00
Reef	Coral cover (diversity) Algal cover Fish community (abundance and trophic groups)	SW1 SW2 SW3 SW4	Bi annual	WAMCO	1200.00
Seawater	Temperature; pH; Salinity Electrical conductivity; TDS; TSS; Turbidity Ammonia; Phosphate; Sulfate	SW1 SW2 SW3 SW4	Bi annual	WAMCO	500.00
Shoreline	High tideline; Low tideline Vegetation line	Shoreline of the island	Bi annual	WAMCO	1000.00
Human health	Vectors; Noise; Dust	At the facility, Systematic records according to the monitoring plans	As in the monitoring plans	Operator staff/ safety officer	NA
Waste	Waste loaded (from sources) and unloaded (at Vandhoo)	Tonnes of waste	Continuous	Waste provider; facility operator EPA controlling (samples)	

Environmental safeguards, health and safety measures	*Level of implementation of the mitigation measures suggested in this ESIA, especially implementation of guidelines given in Health and Safety Manual*	*At the facility during construction and operational phases*	*Continuous monitoring* *Submit Annual Audit*	*WAMCO*	NA

Appendix 6. Grievance Redress Mechanism

بسم الله الرحمن الرحيم

Ministry of Environment
Male', Republic of Maldives.

މިނިސްޓްރީ އޮފް އެންވަޔަރަންމަންޓް
މާލެ، ދިވެހިރާއްޖެ.

Grievance Redress Mechanism

Upgrading of Zone 2 Regional Waste Management Facility – R. Vandhoo

The table below provides details of grievance redress mechanism (GRM) developed for Zone 2 Regional Waste Management Facility located in Raa Atoll Vandhoo of the Republic of Maldives. The facility was initially developed under the World Bank funded Maldives Environment Management Project (MEMP) and is being operated by Waste Management Corporation Limited (WAMCO), a state-owned enterprise. However, certain limitations were identified during the operations of the facility and to address these issues the RWMF is proposed to be upgraded through the on-going Maldives Clean Environment Project (MCEP). The proposed GRM is, thus, based on the Environmental and Social Assessment and Management Framework (ESAMF) of MCEP and highlights the grievance redress procedure in place, identifying nodal point of contact, facilitation by the project and timeframes to address grievances.

Tiers of Grievance Mechanism	Nodal Person for Contact	Contact Communication and other facilitation by the project	Timeframe to address grievance
Construction Phase			
First Tier: Site Supervisor	The first point of contact for construction related grievances will be the site supervisor assigned by ME.	The contact details (phone and email) of the person to contact to file a complaint (site supervisor) must be displayed in the project site board. The project board should also provide the QR code or link for downloading the GRM. Grievances can be addressed either through telephone, email or in person. The site supervisor should maintain log records of all complaints received, including date and time of the complaint and a summary highlighting the main issue and how the issue was resolved. The site supervisor should discuss the matter with the contractors and other concerned parties such as WAMCO and ME, where deemed necessary and attain views of them. If such discussions are held	15 working days

		the details of people consulted should be maintained.	
Second Tier: Ministry of Environment (ME)	Environmental and Social Safeguards Specialist at the Project Management Unit (PMU) will be the focal point.	If the grievance cannot be resolved through Tier 1 to the satisfaction of the aggrieved party, or if the grievance was not resolved during the designed time period, the aggrieved party may submit a complaint at tier 2. Tier 2 complaints shall be submitted via the designated complaint form (provide in Annex 1) which should give information about how the issue was addressed at tier 1. The form should be submitted via email to mcep@environment.gov.mv. The contact details (phone and email) of the nodal person at tier 2 should be displayed in the project site board. The project board should provide the QR code or link for downloading the complaint form. PMU will screen the grievance and determine if its related to MCEP. If it is unrelated, the aggrieved party must be notified in writing and the way forward must be outlined to them including the necessary government institutions to follow up. PMU will discuss the matter with WAMCO, EPA and other relevant institutions, where deemed necessary and attains views of them. PMU will also arrange site visits and hold onsite discussions and meetings if necessary. The PMU will be responsible to ensure that there is no cost imposed on the aggrieved person, due to the grievance mechanism at the second tier. If the complaint is resolved within 15 working days, the decision must be communicated to the aggrieved party in writing. The aggrieved party must acknowledge the receipt of decision and submit their agreement or disagreement with the decision within 10 working days. If no acknowledgement is submitted from the aggrieved party, then the decision will be considered as accepted.	15 working days

		If a complaint requires more time to address, this requirement must be communicated to the aggrieved party in writing and the aggrieved party must consent and sign-off the request for the extension to take effect. An extension can be made to an additional 15 working days. If the grievance is not resolved to the satisfaction of the aggrieved party within 15 working days of submission of the grievance to tier 2 then the aggrieved party may notify the ME, in writing, of the intention to move to tier 3.	
Third Tier: Judiciary Power / Assistance to Vulnerable Persons beyond the Project's Grievance Redress Mechanism	Judiciary system is an option for an aggrieved person and/or community in case that the other tiers have not been effective	The legal system is accessible to all aggrieved persons. Assistance from the PMU of MCEP is available only for vulnerable person(s)* as per this grievance mechanism. In cases where vulnerable person(s) are unable to access the legal system, the Attorney General´s office will provide legal support to the vulnerable person(s). The PMU must assist the vulnerable person(s) in getting this support from Attorney General´s Office. PMU must also ensure that there is no cost imposed on the aggrieved person if the person belongs to the vulnerable groups. The list of vulnerable groups is as defined in the footnote but may be further defined by MEE. The verdict of the Courts will be final.	As per established Judicial Procedure
Operational Phase			
First Tier: WAMCO	Call center staffs, supervisors and Vandhoo RWMF Management	The main grievances related to island level collection and operation of the facility during operational phase will be addressed through WAMCOs official helpline. Grievances can be address informally through phone (by dialing to 1666) or formally via email (1666@wamco.com.mv). All technical queries have to be addressed via email. The call center staff will provide appropriate guidance to the aggrieved party on how to submit technical queries. The call center staff will forward technical queries to the respective department within 24 hours of receiving the mail. The aggrieved party will also be	As per the SOPS of WAMCO

		notified of the receipt of the mail within 24 hours. The call center staff will regularly follow up with the department on the complaint and issue. Replies for non-technical queries will be drafted by the call center staff attending the matter and subsequently approved by the respective supervisor before being sent to the aggrieved party. Log records of all complaints will be maintained in the complaint's sheet of 1666 hotline. Further details of WAMCO's call center SOPS are provided in Annex 2.	
Second Tier: EPA	Environmental Compliance and Assessment Department	The aggrieved party can file a complaint to EPA, if grievances related to environmental compliance (issues such as waste spillage, stack emissions / air quality and turtle conservation), were not resolved to the satisfaction of the aggrieved party at tier 1. Grievances can be addressed either through EPA's hotline, Facebook page or in writing. Phone calls and messages received at the hotline will be logged into the online compliance system. If a complaint requires technical discussions, the subject issue will be immediately uploaded to the EPA viber group and discussed among relevant staffs. The rooted division or section will be referred in the online compliance system. Matters requiring assistance of environmental police will be discussed with them through their hotline. Senior staffs of EPA should be consulted when preparing written responses, where required. Further details of EPA's GRM system provided in Annex 3.	As per SOP of EPA
Third Tier: Judiciary Power / Assistance to Vulnerable Persons beyond the	Judiciary system is an option for an aggrieved person and/or community in case that the other tiers have	The legal system is accessible to all aggrieved persons. Assistance from the PMU of MCEP is available only for vulnerable person(s)* as per this grievance mechanism.	As per established Judicial Procedure

Project's Grievance Redress Mechanism	not been effective	In cases where vulnerable person(s) are unable to access the legal system, the Attorney General´s office will provide legal support to the vulnerable person(s). The PMU must assist the vulnerable person(s) in getting this support from Attorney General´s Office. PMU must also ensure that there is no cost imposed on the aggrieved person if the person belongs to the vulnerable groups. The list of vulnerable groups is as defined in the footnote but may be further defined by MEE. The verdict of the Courts will be final.	

*Vulnerable person(s): A vulnerable person(s) for the purpose of this project is a person who is poor, physically or mentally disabled/handicapped, destitute, disadvantaged for ethnic or social reasons, an orphan, a widow, a person above sixty years of age, or a woman heading a household.

APPENDIX 1

Tier 2 Complaint Form (Construction Phase)

بسم الله الرحمن الرحيم

Ministry of Environment

Male’, Republic of Maldives.

މިނިސްޓްރީ އޮފް އެންވަޔަރަންމަންޓް

މާލެ، ދިވެހިރާއްޖެ.

އިޤްތިޞާދީ ފުދުންތެރިކަން - އިޖުތިމާޢީ ހަމަޖެހުން

Maldives Clean Environment Project

Complaint Form – Tier 2

Project Name: Upgrading of Zone 2 RWMF R. Vandhoo

Part 1: Applicant’s Information

a. Name: …………………..................................
b. National Identity Card No: ………………………
c. Address: ……………………………………………..
d. Mobile No: ……………………….........
e. Email Address: ……………………………………….

Signature: ………………………………

Part 2: Reason for Submitting the Form

a. Not Satisfied with the decision received at Tier 1 GRM ☐
b. Did not receive a response within the designated time-frame ☐

Part 3: Summary of GRM at Tier 1

a. Date of filing the complaint:

b. Mode of submission: Phone ☐ Email ☐

c. Received a Response / Decision: Yes ☐ No ☐

specify date ☐

If Yes provide a summary of the decision received:

………
………
………
………
………
………

d. Satisfied with the Response Received: Yes ☐ No☐

If No specify:

i. Reason, and;

………

………

………

………

………

ii. Proposed solution:

………

………

………

………

………

Note: Attach Additional Sheets where necessary

Part 4: For Office Use Only

Received by

Name: ………………………………………………………… Designation: …………………………………………………………

Signature: ………………………………….

Date of Receiving the Complaint: …………………………. Time of Receiving the Complaint: ……………………

Stamp ☐

Note:

1. This is the Tire 2 of the Grievance Redress Mechanism of Zone 2 RWMF. After submitting a grievance at tier 1, if the aggrieved party is not satisfied with the decision by the Site Supervisor or if the complaint is not resolved within 15 working days, the aggrieved party can submit a complaint on the Tier 2 complaint form. Details of GRM and tier 2 complaint form will be made accessible from the QR code provided in project site board.

2. The form should be submitted via email, addressed to:

   Maldives Clean Environment Project
   Ministry of Environment, Green Building, Handhuvaree Hingun, Maafannu, Male', 20392, Maldives.
   Office (Direct): +(960) 3018442 | Office (PABX): +(960) 3018300
   Email: mcep@environment.gov.mv | Web: www.environment.gov.mv

3. If the aggrieved party is not satisfied with the written decision issued by ME at tier 2, then the aggrieved party has the option to address the issue at tier 3.

بسم الله الرحمن الرحيم

މިނިސްޓްރީ އޮފް އެންވަޔަރަމަންޓް
މާލެ، ދިވެހިރާއްޖެ

ފޯމް ނަންބަރު (އޮފީހުގެ ބޭނުމަށް)..........................

ޝަކުވާ ހުށަހަޅާ ފޯމް – މަރުހަލާ-2

މަސްޢޫލުގެ ނަން: ޒޯން 2 ސަރަހައްދީ ކުނި މެނޭޖްކުރާ މަރުކަޒު އޮޕަރޭޓްކުރުން

ފުރަތަމަ ބައި: ޝަކުވާ ހުށަހަޅާ ފަރާތުގެ މައުލޫމާތު

ހުށަހަޅާ ފަރާތުގެ ނަން: .... ހުށަހަޅާ ފަރާތުގެ އައިޑީ ނަންބަރު:..........................

ހުށަހަޅާ ފަރާތުގެ އެޑްރެސް: .... ފޯން ނަންބަރު:..........................

އީ-މެއިލް އެޑްރެސް:.. ސޮއި:

ދެވަނަ ބައި: ފޯމު ހުށަހަޅާ ސަބަބު

☐ ފުރަތަމަ މަރުހަލާއިން ނިންމިގޮތާއި ގުޅޭ ހިތްހަމަނުޖެހުން   ☐ ކަނޑައަޅާފައިވާ މުއްދަތުގައި ޖަވާބު ނުލިބުން

ތިންވަނަ ބައި: މިފޯމާއިއެކު ހުށަހަޅުއްވާ މައުލޫމާތު

ހ. މައްސަލަ ހުށަހެޅި ތާރީޚް

ށ. މައްސަލަ ހުށަހެޅި ގޮތް: ☐ ފޯން ☐ އީމެއިލް

ނ. މައްސަލަ ނިންމިގޮތް ލިބިފަ: ☐ އާން ☐ ނޫން

ތާރީޚް

ޖަވާބުގައި އާން ޖެއްސެވާފައިވާނަމަ ފުރަތަމަ މަރުހަލާގައި ނިންމިގޮތުގެ ހުލާސާއެއް މިތާގައި ލިޔުއްވާ

....

....

....

ށ. ފުރަތަމަ މަރުޙަލާއިން ލިބުނު ޖަވާބާ މެދު ހިތްހަމަޖެހޭތޯ: ☐ އާން ☐ ނޫން

ޖަވާބުގައި ނޫން ޖައްސަވާފައިވާނަމަ ތިރީގައިވާ ބައި ފުރިހަމަ ކުރައްވާ

1. ހިތްހަމަނުޖެހޭ ސަބަބު:

....

....

....

....

2. ހުށަހަޅާ ހައްލު:

....

....

....

....

- ނޯޓް: ފޯމު ފުރިހަމަ ކުރުމަށް އިތުރު ޖާގަ ބޭނުންވާނަމަ އިތުރު ކަރުދާސް ފޯމާއި އެޓޭޗުކުރައްވާ

އޮފީހުގެ ބޭނުމަށް

މައްސަލަ ބަލައިގަތީ:

ނަން: ....

މަޤާމު:.. ސޮއި: ....

މައްސަލަ ބަލައިގަތް ތާރީޚް:.............................. މައްސަލަ ބަލައިގަތް ގަޑި:.......................... ސްޓޭމްޕް

ނޯޓް:

1. މިއީ މިމަޝްރޫޢުއަށް ޝަކުވާ ހުށަހެޅުމަށް ކަނޑައަޅާފައިވާ އުސޫލުގައި ހިމެނޭ ތިން މަރުޙަލާގެ ތެރެއިން ދެވަނަ މަރުޙަލާގެ ފޯމެވެ. މިފޯމު ހުށަހަޅާނީ ޝަކުވާ ހުށަހެޅުމުގެ ފުރަތަމަ މަރުޙަލާއިން ލިބުނު ޖަވާބާއިމެދު ހިތްހަމަނުޖެހޭނަމަ ނުވަތަ 15 ދުވަހުގެ މުއްދަތުގައި އެއްވެސް ޖަވާބެއް ނުލިބުނަމައެވެ.

2. މިފޯމު ހުށަހަޅާނީ:

މިނިސްޓްރީ އޮފް އެންވަޔަރަމަންޓް އެންޑް އެނާރޖީ
ހަނދުވަރީ ހިނގުން
މާލެ، ދިވެހިރާއްޖެ.
ނަންބަރު: 3018442
އީ.މެއިލް: mcep@environment·gov·mv

3. މިފޯމު ހުށަހެޅުމަށްފަހު، މިނިސްޓްރީ އޮފް އެންވަޔަރަމަންޓް އިން މިކަމާއި ގުޅޭ ލިޔުމުން ދޭ ޖަވާބާއި ގުޅޭ ހިތްހަމަނުޖެހޭނަމަ ނުވަތަ 15 ދުވަހުގެ މުއްދަތުގައި އެއްވެސް ޖަވާބެއް ނުލިބުނަމަ ޝަކުވާ ހުށަހެޅުމުގެ ތިންވަނަ މަރުޙަލާއަށް (ޝަރުޢީ މަރުޙަލާއަށް) ދެވިދާނެއެވެ. ޝަކުވާ ހުށަހެޅުމަށް ކަނޑައަޅާފައިވާ އުސޫލު އަދި ފޯމު ޕްރޮޖެކްޓް ސައިޓް ބޯޑުގައިވާ ކިއޮސްކް ކޮޕީން ލިބެން ހުންނާނެއެވެ.

APPENDIX 2

WAMCO Call Center SOPS

WAMCO
WASTE MANAGEMENT
CORPORATION LIMITED

Standard Operating Procedures

Department: Customer Service

Responsible Section: Call center

Dealing with 1666 calls

SOP Number:	CSD-001
Effective Date:	26 September 2018
Version:	1
Revised Date:	-
Approved by:	Fathimath Rasha

Purpose

This standard operating procedure describes the process that should be followed to deal with 1666 phone queries in a standardized manner, while building the knowledge base.

Procedure

Assigned staff from Call Center must carry out the following tasks.

Phone Queries

- Calls to the call centre must be answered within 3 rings.
- Always answer the call with a smile, with the Islamic greeting and identify yourself.
- Call should be answered immediately after picking up the phone.
- Listen to the query of the customer, patiently and politely.
- Answer should be given politely and patiently and information should be given free of factual errors.
- When speaking in Dhivehi, should use the politest form of the Dhivehi Language.
- Smile when talking to the customer.
- In case of an abusive caller, bring it to the attention of the supervisor immediately.
- Ask for ID card number/ Account number or registered phone number for verification before providing specific details about a customer.
- Use WAMCO's internal software to gather information about the customer. These software's include;
    - Veshifaara
- Give information only related to the caller.
- If the query requires clarification or assistance of staff from other departments, clarify the query from other departments before replying to the customer.
- Whenever a call is being put on hold, inform the **caller that the call is being put on hold** first.

- If the caller wants to speak to a specific staff or regarding a specific case**, inform the caller that you are forwarding the call** before putting it on hold. Give a brief summary of the call to the staff before transferring it. If the relevant staff is unavailable at the time, get caller's detail and mail the issue to the relevant staff or follow up later.
- Where an immediate response cannot be provided, note the contact details of the customer and inform him that he will be contacted with the details. Maintain a log of calls requiring follow up as per Attachment 1. Complete follow up within 1 hour.
- If the query is technical, request the customer to email to *1666@wamco.com.mv*
- End the call with a Thank You.
- Before answering the next call, complete the log.
- The log should be complete, free of factual, grammatical, typographical and formatting errors.

Attachments

1. Follow-up Log

Attachment 1: Follow-up log

Account Number	Name	Contact	Query	Dept. to be contacted	Status

WAMCO
WASTE MANAGEMENT
CORPORATION LIMITED

Standard Operating Procedures

Department: Customer Service

Responsible Section: Call Center

Dealing with 1666 Email Queries

SOP Number:	CSD-002
Effective Date:	26 September 2018
Version:	1
Revised Date:	-
Approved by:	Fathimath Rasha

Purpose

This standard operating procedure describes the process that should be followed to deal with queries regarding WAMCO products and services received through 1666 mail and other mails including letters in a standardized manner.

Procedure

Assigned staff from Customer service must carry out the following tasks.

- Check the mail at 08:30, 10:30, 13:00 and 15:30 hours. Log the emails to ‘Email tracker log’ as per format in Attachment 1. Log the letter/mails received through the entree the same. Codes are listed in Attachment 2.
- The log should be free of factual, grammatical, typographical and formatting errors.
- Urgent mails should be brought to Supervisors attention immediately.
- Supervisor or the appointed staff should assign the mails to individual staff. It should be done every day at 08:30hrs, 13:30hrs and 15:30hrs.
- Email tracker log should be saved under;
  Z:\Call Center\1666 Email
- Before replying to the mail, check if the query is understandable. If not request the customer to provide further details. This should be done within 24 hours of receiving the mail. If contact number is available, call via Veshifaara and log the call. If not send a mail as below:
  “Kindly provide us with your contact phone number as further clarification is required regarding the query.”
- For technical queries, forward the mail to the relevant department for assistance. This should be done within 24 hours of receiving the mail. And this should be communicated to the customer within 24 hours. The mail can state;
  “We would like to acknowledge that we have received your query.

> *Since there are certain issues to be addressed, we are currently examining them. We will get back to you as soon as possible. We apologize for any inconvenience that may cause due to this delay. If we need further details regarding your query, we will contact you."*

- For non-technical queries, draft a reply to the customer's query with reference to the regulation and other policies/practices of WAMCO (where applicable) and get it approved by the Supervisor.
- Replies should attempt to answer the specific query instead of giving a general standard answer.
- All replies should be polite, and free of factual, typographical and grammatical errors.

All replies should be properly addressed, should contain the statements *"A/C No: A170000XXX"* and "*Thank you for your query*" at the beginning and *"Hope that answers your query. Should you require further clarification, you may email us or call our hotline:* ***1666*** *during office hours (08:00 – 00:00hrs)"* and "*Thank You"* at the very end (Attachment 3).

- If attachments are required, should ensure that the right documents are attached.
- Unless the reply is complicated, all mails received before 10:30 should be drafted and sent to the supervisor before 12:00hrs. All mails received before 15:00 should be drafted and forwarded to the supervisor by 17:00hrs.
- All mails send before 12:00hrs to the supervisor should be approved by 14:00hrs. And all mails send after that should be approved by 09:00hrs the following day.
- Once the draft is approved, send the reply to the customer within 1 hour of receiving the approval.
- Attention should be given to ensure that all internal communications are deleted before replying to the customer.
- The replied mail should be sent through webmail and ensure that it is saved under '*replies*' in the 1666 mail inbox.
- The signature of the staff answering the mail should be included in the reply.
- The replies sent should be logged in Veshifaara.
- Bcc the replies to the relevant Supervisors and Managers/Directors.

Attachments

1. Email Log
2. Codes
3. Email Reply

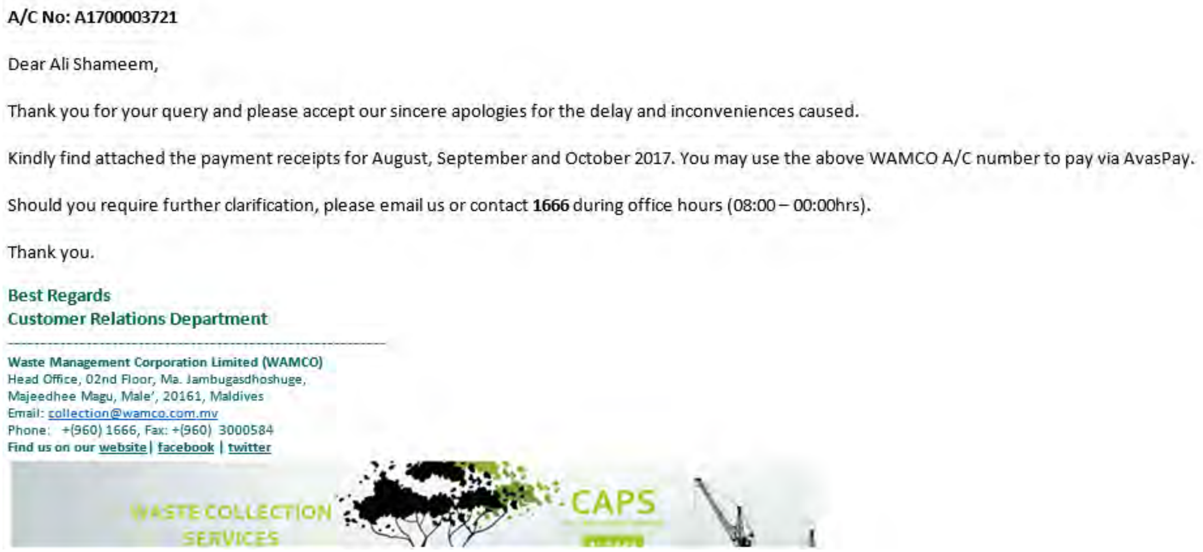
Attachment 1: Email log

Reference Number	Email Received Date	Assigned Date	Sender	Issue	Assigned to	Forwarded to	Forwarded Date	Status (Replied/ Done/ Pending)	Date Replied to Customer	Method of reply (Email/ Phone)	Remarks
Email/Sep/ 2018/081	Sun 02-Sep-18 15:07	02-09-18	Mohamed Azim <axim2020@gmail.com>	Cancellation of household waste collection	Registration Department	CC to Rasha, BCC to Muna & Saleem	02-09-18	**Done**			

Attachment 2: Codes

Category	**Code**
Registration	RG
Household complaints	HC
Commercial complaints	CC
CAPS service	CS
General inquiries	GI
Calls being forwarded	CF

Attachment 3: Email Reply



A/C No: A1700003721

Dear Ali Shameem,

Thank you for your query and please accept our sincere apologies for the delay and inconveniences caused.

Kindly find attached the payment receipts for August, September and October 2017. You may use the above WAMCO A/C number to pay via AvasPay.

Should you require further clarification, please email us or contact **1666** during office hours (08:00 – 00:00hrs).

Thank you.

Best Regards
Customer Relations Department

Waste Management Corporation Limited (WAMCO)
Head Office, 02nd Floor, Ma. Jambugasdhoshuge,
Majeedhee Magu, Male', 20161, Maldives
Email: collection@wamco.com.mv
Phone: +(960) 1666, Fax: +(960) 3000584
Find us on our website | facebook | twitter

WAMCO
WASTE MANAGEMENT
CORPORATION LIMITED

Standard Operating Procedures

Department: Customer Service

Responsible Section: Call center

Dealing with complaints

SOP Number:	CSD-003
Effective Date:	26 September 2018
Version:	1
Revised Date:	-
Approved by:	Fathimath Rasha

Purpose

This standard operating procedure describes the process that should be followed to deal with complaints to the ‘1666’ hotline and email in a standardized manner.

Procedure

Assigned staff from Customer service must carry out the following tasks.

Complaints

- Complaints and compliance issues received through mail or call centre should be logged in “Veshifaara” and the respective log.
- Once a complaint or compliance issue is received, enter the complaint in the relevant log. Urgent complaints should be brought to the attention of the supervisor.
- Before entering the details to the log, customer details should be verified. (*eg:- ask for the registered customer name, contact number, Address, floor etc. for further verification*). All fields in the log should be completed.
- All complaints entered should be free of factual, typographical and grammatical errors.
- Tablet reports will be saved everyday by supervisors in 1666 tablet folder *(Z:\Tablet Report).* Once the daily report has been saved, the tablet status column in the complaint sheet should be updated.
- Where necessary, get back to the caller or ask the specific department to do so.
- Where an answer is required to be given to the customer, follow up with the department on the complaint/ issue – through email.
- Once the collection status has been updated to ‘attended’ from complaint sheet, call center staff should call back the customers for verification (within 1 hour) – previous days’ sheet should be completed the next morning.
- Save all complaints received to 1666 mail under the “*complaints*” folder in the 1666 inbox.

- By 09:00 each Sunday, prepare a log of the complaints (from the calls and from emails) of the previous week and email it to Supervisors, Manager and Department Head by including it in the weekly summary.
- The complaint log should be saved under;
  Z:\1666 hotline\Complaints sheet

Attachments

1. Log

Attachment 1:

Log (Household)

#	ENTERED BY	TIME	ADRESS	STREET	CUSTOMER NAME	CONTACT	BL	ZO	FL	APT	DETAILS	HOUSEHOLD	TIME	CALL CENTRE	TIME	TABLET (25th Sep report)
1	Sheereen	11:06	M Fehige	Miriyaas Magu	Ahmed Rasheed	7751511	296	5	4			ATTENDED	8:30	Attended	11:11	collected

Log (Commercial)

NO	Entered by	Time-In	Date	Customer Name	Road	Phone No	Survey (Y/N)	Collection days	Complaint	Status	Attended Time/Date	Remarks
01.09.2018												
1	Samiyya	11:15	01.09.2018	H.A.W Shop	Kalhu huraa magu	9777324	Y		3 days not collected	**Collected**		

APPENDIX 3

EPA Hotline SOP

Hotline Procedure of EPA

1. Hotline number will be managed by staffs on a weekly (7 days) rotation.
2. Hotline will be operated as follows:
    - Call receiving: 8 am to 8 pm
    - Messaging: 24hrs. Confirmation of the message should be sent to the sender for the messages received before 10 pm
3. Staff managing the hotline can attend the complaints received via message until 10 pm. Messages received after 10 pm should be attended next day – The same staff should attend the case even if the duty of hotline number is rotated to another staff.
4. The staff managing the hotline for the week will be tasked to log the messages and call received into to online compliance system.
5. EPA official viber group should be used to communicate if assistance from other sections are required. This should be recorded in the online compliance system.
6. Cases which require assistance from police should be immediately informed via police hotline. Environment police hotline: 9465619 Duty Officer number: 9888999
7. If required, letters should be drafted as advised by heads. For the complaints received after office hrs, letter should be written on the upcoming official day and this job should be handled by the staffs incharge of the hotline
8. The staff on call should record over time details (14:00 to 19:00)
9. If the on call staff is on sick leave or FRL it is the responsibility of the on call staff to handover the hotline phone to another staff.

Appendix 7. Updated Master Plan

WASTE MANAGEMENT FACILITIES

01. HARBOUR EXTENSION
02. GUARD HOUSE AND WEIGH BRIDGE
03. VEHICLE SHED EXTENSION BUILDING
04. STORAGE EXTENSION BUILDING
05. FUEL FARM
06. WATER STORAGE TANKS
07. MECHANICAL STORAGE
08A. POWER HOUSE
08B. DESALINATION BUILDING
09A/09B. WASTE SORTING SHED EXTENSION
10. RECEIVING BUNKERS
11. WASTE MANAGEMENT FACILITIES
    11A - RESERVED FOR FUTURE USE
    11B - RECYCLABLES
    11C - RECYCLING (WITH COMPACTION AND BALING PLANT
    11D - E-WASTE
    11E - BULK WASTE
    11F - COMPOST PACKAING AND STORAGE
    11G - HAZARDOUS WASTE
12. UNPROCESSED WASTE BUNKER
13. PUMP HOUSE
14 PROPOSED LANDFILL
    14A - C&D WASTE
    14B - GENERAL WASTE
15. PROPOSED LEACHATE COLLECTION

FUTURE DEVELOPEMENT

F1. FUTURE INCINERATOR LOCATION
F2. FUTURE WASTE MANAGEMENT FACILITIES
F3. FUTURE FOOTBALL FIELD
F4. TRAINING FACILITY & HR BUILDING

STAFF VILLAGE

S1. MOSQUE
S2. STAFF FACILITIES BUILDING
    -STAFF KITCHEN
    -CAFETERIA
    -LAUNDRY
    -RECREATION
    -GYM

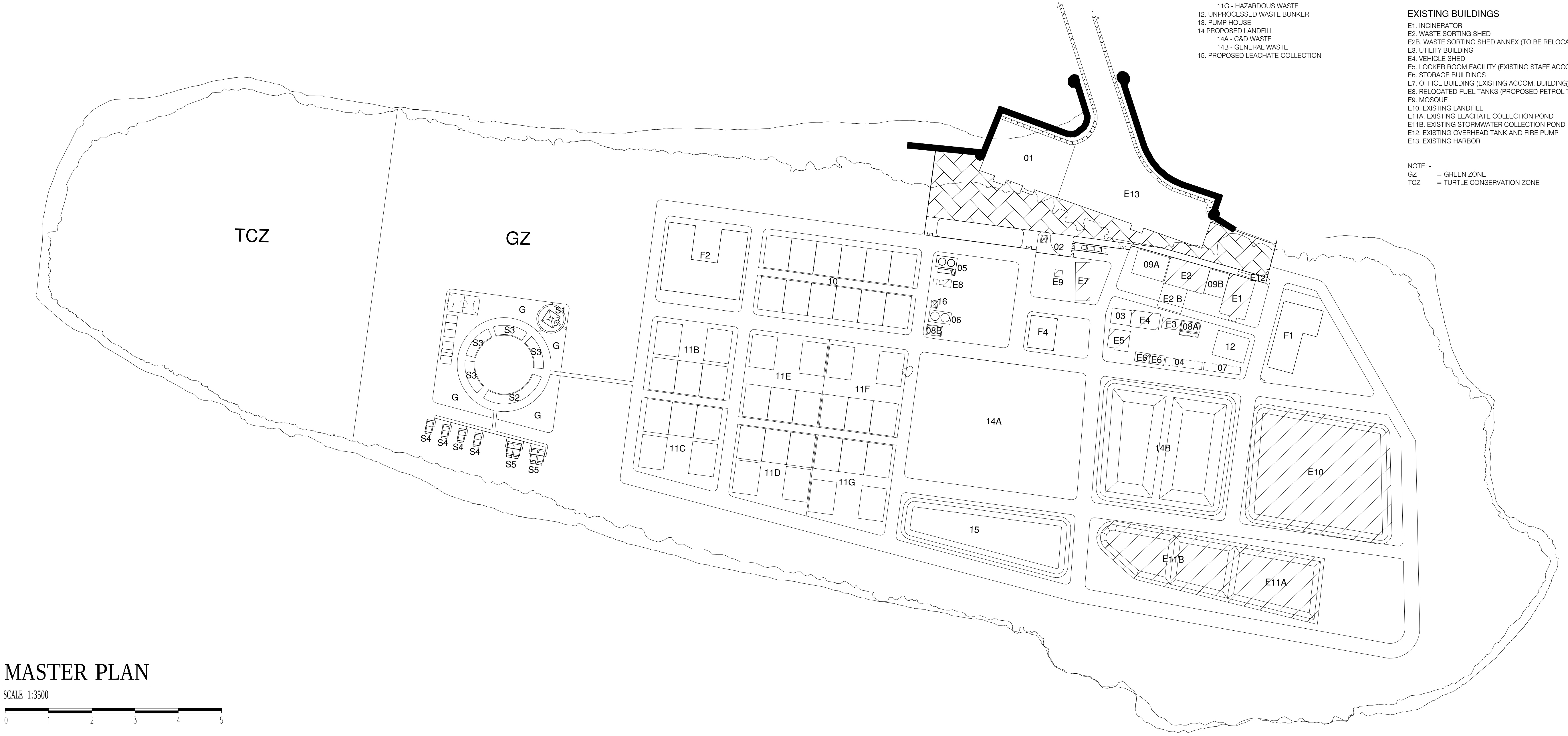
S3. STAFF ACCOMMODATION	X4
S4. GUEST ACCOMMODATION	X4
S5. CONSULTANTS ACCOMMODATION	X2

G. GREEN AREAS

EXISTING BUILDINGS

E1. INCINERATOR
E2. WASTE SORTING SHED
E2B. WASTE SORTING SHED ANNEX (TO BE RELOCATED)
E3. UTILITY BUILDING
E4. VEHICLE SHED
E5. LOCKER ROOM FACILITY (EXISTING STAFF ACCOM.)
E6. STORAGE BUILDINGS
E7. OFFICE BUILDING (EXISTING ACCOM. BUILDING)
E8. RELOCATED FUEL TANKS (PROPOSED PETROL TANK)
E9. MOSQUE
E10. EXISTING LANDFILL
E11A. EXISTING LEACHATE COLLECTION POND
E11B. EXISTING STORMWATER COLLECTION POND
E12. EXISTING OVERHEAD TANK AND FIRE PUMP
E13. EXISTING HARBOR

NOTE: -
GZ = GREEN ZONE
TCZ = TURTLE CONSERVATION ZONE

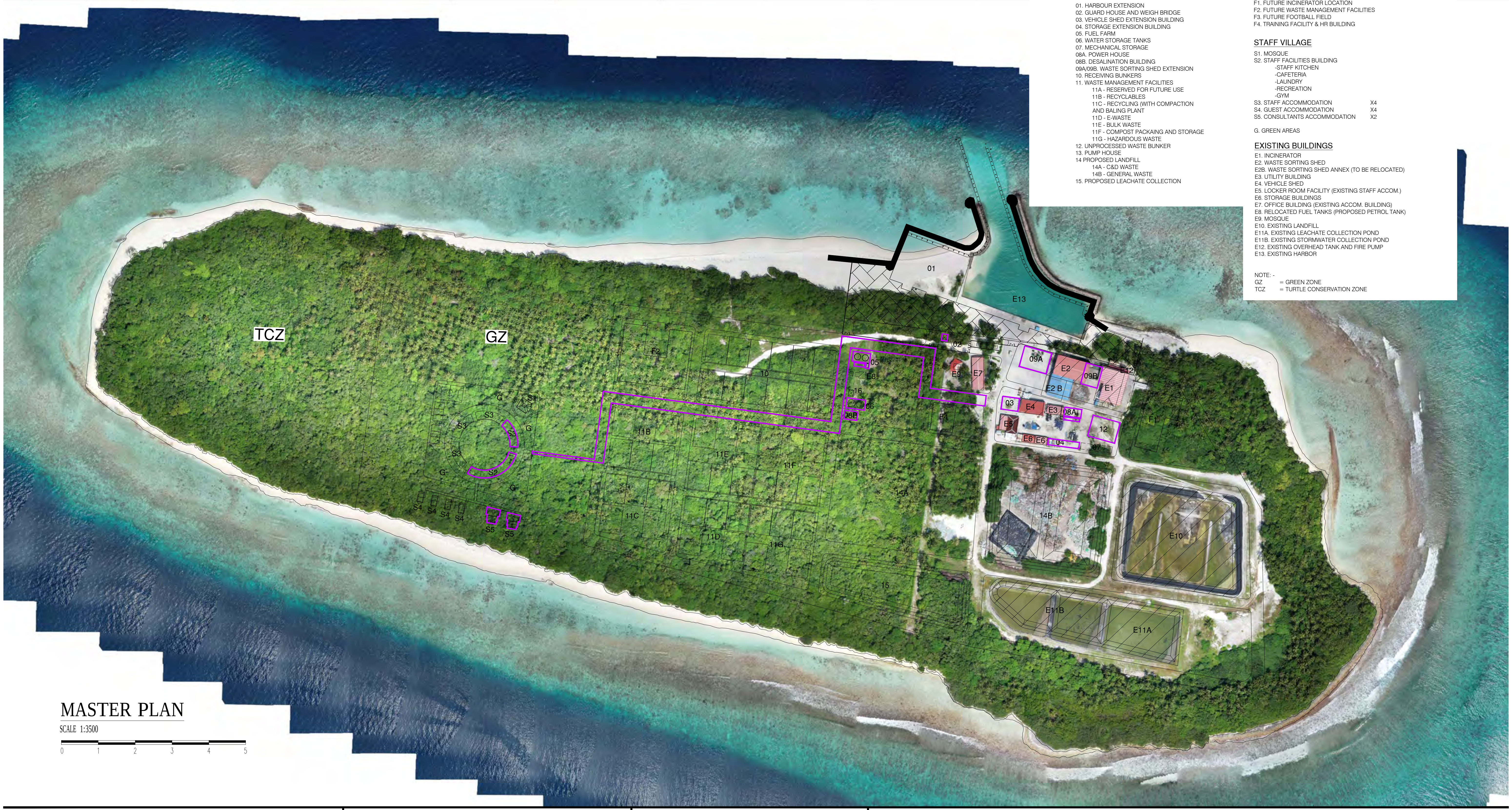


MASTER PLAN

SCALE 1:3500

0 1 2 3 4 5

MCEP MINISTRY OF ENVIROMENT GREEN BUILDING, HANDHUVAREE HIGUN, MAAFANNU, MALE' (20392), REPUBLIC OF MALDIVES, TEL: +960-3018431, +960-3018300, FAX: +960-328301	PROJECT	DESIGN BY	AMENDMENTS
	REGIONAL WASTE MANAGEMENT FACILITY R. VANDHOO		REVISED AS PER EPA DECISION STATEMENT
	TITLE	STRUCTURE BY	
	MASTER PLAN		
	CLIENT DEPARTMENT	DRAWN BY	
	WMPC DEPARTMENT	AFRAZ	
	PAPER SIZE A3	SCALE 1:3500	
	PAGE NO. 01	DWG NO. VANDMPC-A1-01	
		DATE 08.05.2019	



WASTE MANAGEMENT FACILITIES

01. HARBOUR EXTENSION
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STAFF VILLAGE

S1. MOSQUE	
S2. STAFF FACILITIES BUILDING -STAFF KITCHEN -CAFETERIA -LAUNDRY -RECREATION -GYM	
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G. GREEN AREAS

EXISTING BUILDINGS

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NOTE: -
GZ = GREEN ZONE
TCZ = TURTLE CONSERVATION ZONE

MASTER PLAN

SCALE 1:3500

0 1 2 3 4 5

MCEP
MINISTRY OF ENVIROMENT
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PROJECT	DESIGN BY
REGIONAL WASTE MANAGEMENT FACILITY R. VANDHOO	
TITLE	STRUCTURE BY
MASTER PLAN (CURRENT PHASE DEVELOPMENTS IN MAGENTA)	
CLIENT DEPARTMENT	DRAWN BY
WMPC DEPARTMENT	AFRAZ
PAPER SIZE A3	SCALE 1:3500
PAGE NO. 01	DWG NO. VANDMPC-A1-03
	DATE 08.05.2019

AMENDMENTS

REVISED AS PER EPA DECISION STATEMENT

Appendix 8. English Translation of Land Acquisition Letter

Unofficial translation of the Land Acquisition Letter from the Office of the President
(Letter No.: 1-ED/438/2017/35, dated 8 March 2017)

Minister of Environment and Energy Hon. Thoriq Ibrahim,

With reference to the letter number 438-WMPC/1/2017/27 (dated 6th March 2017) from your Ministry and letter number 1-ED/438/2017/26 (dated 26th February 2017) from the President's Office;

Given that Vandhoo in Raa Atoll has been leased to be developed as the Regional Waste Management Centre for Zone 1 (Haa Alifu, Haa Dhaalu and Shaviyani Atolls) and Zone 2 (Noonu, Raa, Baa and Lhaviyani Atolls), and given that in addition to the land already leased for this purpose, remaining area is also required for the functioning of the Regional Waste Management Facility, please find below, our response to your request for our advice regarding this matter.

As specified in your letter, use of the infrastructure at the RWMF at R. Vandhoo for management of waste from both Zones 1 and 2 would be the most feasible and most cost effective option, as opposed to development of a separate RWMF for Zone 1. The President has thus approved the use of the remaining part of land on Vandhoo, for the RWMF for management of waste from both Zones 1 and 2 and instructed to advise your Ministry to this effect.

9 Jumaadul Aakhir 1438

8 March 2017

Yours sincerely

Signed by:

Mohamed Hunaif

Undersecretary

Appendix 9. Operational Flow of Waste Management Activities

The operational flow of waste management activities for Zone 2 RWMF is proposed in the Operations and Management Plan of the facility (Mostafa, 2018). These activities start from the collection of waste from the IWMCs and ends with the final disposal or treatment at the regional facility. The following sections are extracted from the report.

2.3. Transfer from IWMCs to RSWMF

2.3.1. OMP for Islands with Accessible Harbor

The process for transfer from IWMCs to RSWMF for Islands with accessible harbor shall be as follows:

1. Recyclables (aluminum cans, paper / cardboard, plastics and glass) and final compost stored in 4-wheel 660 litre bins shall be mounted on the trolley which is towed using the three-wheeler electric motorcycles and transferred to the harbor mounting bay.
2. Once a month trip by the 80 to 120 tons medium size ship shall serve each Island.
3. The medium size vessel shall be equipped with the following:
    a. Four static compactors (one compactor for each plastic, paper / cardboard, glass and aluminum cans);
    b. Two static open containers for compost and bulk waste equipped with roll on/off plastic cover;
    c. One static open container for E-waste;
    d. Two static open containers for hazardous and medical waste equipped with roll on/off plastic cover; and
    e. Fixed crane.
4. Crane lifts the 4-wheel bins and empty it's content in the assigned compactor / container using the mobile bin lifter in the vessel.
5. After loading onto the vessel all bins are emptied in their respective containers. The vessel then starts heading to next Island to be served, and the same process are followed until the vessel reaches its full capacity.
6. Once the medium size vessel is full, two alternatives are available, and the selection will depend primarily on engineering design of Saafu 1, logistics and costings, which are as follows:
    - **Alternative 1:** Medium size vessel will meet Saafu 1 vessel at a harbor, were the containers will be transferred to Saafu 1 using reach staker. In that case Saafu 1 will act as a transfer ship as well as to maximize the use and benefit from Saafu 1. The possibility of two containers on top of each other shall be examined since Saafu 1 has 250 tons capacity, which is ideal for "transfer station" concept. Such concept of two containers on top of each other has to be in consultation with Vessel's Manufacturer and Design Engineer to ensure safety and appropriateness.
    - **Alternative 2:** Direct the medium size vessel to the RSWMF.
7. Regarding bulk waste, E-waste and C&D waste, transfer will be done based on call service once the provided containers by WAMCO are full. Collection shall be done with the medium sized vessel equipped with a reach staker in that case and 6 to 8 empty containers (depending on the size and design of the vessel and layout of various components on board), in order to serve few Islands per trip only for other wastes such as bulk, E-waste and C&D waste depending on the number of containers at the Islands to be serviced. Again logistical planning by WAMCO will direct this task.

8. Excess green waste that cannot be fully utilized by the Islands shall be transported to Islands lacking green waste, to support in their composting process, during their periodical monthly waste collection visit. WAMCO will organize and plan such logistical transportation trips within its regular plan in order not to increase operational cost.

2.3.2. OMP for Islands without Accessible Harbor

The process for transfer from IWMCs to RSWMF for Islands without accessible harbor shall be as follows:

1- Stored recyclables (aluminum cans, paper / cardboard, plastics and glass) in the 2-wheel 120 liter bins (liftable manually by two labors), and final compost either bagged in reusable 20 kgs sacks or loaded into the 2-wheel 120 liter bins (Islands and WAMCO shall decide which is more operationally easier) shall be transferred to as close to the shore as possible by mounting them on the trolley which is towed using the three-wheeler electric motorcycles.

2- Each Island shall be served once a month by the **flat bottom whaler** which shall be loaded with empty 2-wheel 120 liter bins, which shall be unloaded to the shore and one bin at a time, and in case compost bags are more favorable, shall be lifted by two labors and loaded onto the flat bottom whaler. The bins shall be pushed on the steel ramp connecting the shore to the whaler. In case the steel ramp cannot be used, two labors will lift one container at a time from the shore and onto the whaler.

3- The flat bottom whaler will be directed to nearest location to meet with the medium size boat at a harbor. The bins are emptied onto the medium size boat using the crane, emptied into their relevant container using bin lifting equipment, and reloaded back empty into the whaler. The whaler continues its journey to the next Island or towed behind the medium size vessel to the next Atoll scheduled for service.

4- The flat bottom whaler will be towed behind the medium size vessel to arrive to the Zone / Atoll its serving and will be running between Islands without accessible harbor to serve them.

5- Once full, the whaler will be directed to the medium size vessel in order to unload onto the medium size vessel using the crane. The vessel then starts heading to next Island to be served, and the same process is followed until the vessel reaches its full capacity.

6- Once the medium size vessel is full, two alternatives are available, and the selection will depend primarily on engineering design of Saafu 1, logistics and costings, which are as follows:
  - Alternative 1: Medium size vessel will meet Saafu 1 vessel at a harbor, were the containers will be transferred to Saafu 1 using reach staker. In that case Saafu 1 will act as a transfer ship as well as to maximize the use and benefit from Saafu 1. The possibility of two containers on top of each other shall be examined since Saafu 1 has 250 tons capacity, which is ideal for "transfer station" concept. Such concept of two containers on top of each other has to be in consultation with Vessel's Manufacturer and Design Engineer to ensure safety and appropriateness.
  - Alternative 2: Direct the medium size vessel to the RSWMF.

7- Regarding bulk waste, E-waste and C&D waste, Islands will store bulk waste and E-waste separately in either jumbo bags or 2 wheel 120 liter bins (depending on the quantities and size). For those Islands that a steel ramp can be used, will be provided with 4 wheel bins to be used to easily roll on / off onto the whaler which will be as close as possible to the shore. If ramp cannot be used, then jumbo bags shall be used and the load per bag should not exceed 50 kgs to be liftable by two to three labors. Collection will be done based on call service and not regular service or collection with other types of wastes (recyclables and compost).

8- Excess green waste that cannot be fully utilized by the Islands shall be transported to Islands lacking green waste, to support in their composting process, during their periodical monthly waste collection service. WAMCO will organize and plan such logistical transportation trips within its regular plan in order not to increase operational cost.

2.4. Regional Solid Waste Management Facility

This section is developed on the basis that the recommended additional facilities, machinery / equipment, and complete concept proposed in the field investigation report shall be implemented.

At the RSWMF, the following operation and management plan shall be followed:

1- Before arrival of the vessel at the RSWMF harbor, hook lift vehicles shall transfer empty and washed containers / compactors from their storage areas onto the harbor loading area in preparation for loading to the vessel for serving the Islands.
2- Saafu 1 vessel arrives at the RSWMF and the containers are unloaded onto the platform using the reach stacker. In case medium size vessel is used to transport the waste containers to the RSWMF, same equipment, namely reach staker shall be used to unload the containers onto the platform.
3- RSWMF shall be equipped with mobile crane by the harbor area which shall load the vessel with empty and washed containers / compactors, in preparation for the next transportation trip to the Islands.
4- The loaded containers are then lifted from the harbor platform by the hook lift vehicle and transferred and emptied at the assigned area within the RSWMF.
5- **Material Recovery Facility (MRF)**: Typical MRFs are operated 6 days a week, 8 hrs a day or two shifts if needed. All containers (except containers carrying hazardous, compost and green waste shall be directed to their respective areas as presented in this section below) shall be transferred to the tipping floor area of the MRF. The details of the operation of the MRF shall be provided by the MRF's manufacturer / supplier given that numerous designs are available in the market, however, a general description of the operation process shall be presented in this section.
a- **Registration, inspection and weighing:** This shall be under the manifestation system, however until manifest system is developed, registration (source and type of waste), visual inspection to confirm waste type and any contamination, and weighing shall to be documented.
b- **Materials receiving area / tipping floor:** design, layout and operations are dependent on the type and quantity of materials received at the facility and how those materials are delivered to the facility. Given that segregated / pre-sorted waste shall be delivered to the MRF, there are several design options for the tipping floor, which may include one tipping area for wastes arriving in jumbo bags and containers (single-stream collection and delivery), two separate tipping areas on the tipping floor, one for recyclables and one for all other wastes (dual-stream collection and delivery), or up to three or more separate tipping areas / bunkers for recyclables, rejects and bulk wastes. Whatever the delivery mechanism (single-stream, dual-stream, or more) the major considerations in running an efficient receiving and staging operation include:
    1- Move delivery containers in and out of the tipping area as quickly as possible. This will lessen tipping floor congestion, maintain a safer working environment for the operators and drivers on the tipping floor as well as allow for quicker and more efficient movement of materials from receiving to staging to processing;
    2- Provide sufficient segregation between the various delivered materials streams to avoid or minimize cross-contamination. By minimizing cross-contamination of material streams

from the beginning less time and cost will be spent on sorting and processing materials, as well as minimize loading the incineration plant unnecessarily.

3- Move materials off the tipping floor and into sorting/processing in a direct and timely manner. This prevents backlogs of materials that increase the sorting and processing inefficiencies (increases in burden depths on the sorting line, decreased recovery of materials and increased production of residues, overtime labor in sorting and processing functions). Additionally, if there is an issue with dirt, mud and other such contaminants getting mixed in with materials sitting on the tipping floor or in pre-processing storage, material revenues could be negatively impacted.

4- Provide enough incoming materials storage space (at least two days) in the vicinity of the MRF while at the same time not close to the incineration plant for avoiding fire hazard to the incineration plant. This will allow for extended storage over weekends/holidays or during planned / unplanned maintenance of equipment and accordingly shut down of the processing line.

c- Sorting stage: The sorting of materials at a MRF is the heart of the MRF. Sorting process can be accomplished manually, mechanically or a combination of the two, it is usually the operational component of the MRF that is the largest cost center and offers the greatest potential for both short-term and long-term savings. These savings include increased revenue for higher quality material, cost savings from reduced residue disposal costs and decreased labor costs. The sorting process is also the component where quality control becomes an important consideration. RSWMFs shall have small MRFs (2 to 4 tons / hr.), which typically follow manual or semi-automated sorting techniques. Though there are opportunities in these types of operations to add equipment that will improve overall sorting efficiencies and offer long-term savings, due to the lower throughput of materials at small MRFs, the application of several mechanical sorting techniques need to be assessed from cost perspective in terms of CAPEX and OPEX. During the first 6 to 12 months of the operation, quality control by WAMCO operation team is crucial in order to monitor each received container, its destination and percentage of incompatible / unsorted material. Feedback shall be given to Islands that do not provide 100% segregated waste or contaminated waste, as this will greatly affect the operation and revenues at the RSWMF level for WAMCO.

- At the tipping floor manual presorting is carried out before the disk screens to remove troublesome materials. Large and heavy items such as tree logs, scrap metal sheets, cartoon boxes, etc. can damage disks. Shredded paper, film plastics, hangers and wire many become tangled in and clog disk screens.
- Separate broken glass and other fines by running incoming material through a trommel before the disc screen.
- Adjust disc spacing, deck inclination angle, and feed velocity to accommodate the various conditions of incoming containers to give time for staff to carry out sorting.
- After manual sorting at tipping floor, the loader transfers the pre-sorted waste onto the conveyor belt for manual sorting by labors. Each type of material should be processed at a time, in order to avoid any contamination as described in above points.
- Sorted material shall be collected in 660 liter bins, which shall be transferred to the bailing plant / station either manually or using forklifts, or mounted on trolley which shall have several bins mounted at a time.

5- **Bailing station / plant**: Records of the amount of incoming and outgoing waste must be kept for monitoring purposes and for regular validation of the facility mass balance.

6- Bailing plant shall be operated on batch basis. The same materials bins are lined up and loaded to the bailing plant, which shall compact and bail the recyclables, including plastics, paper and aluminum cans.
7- Glass shall be directed to its storage bay within the storage warehouse.
8- After compaction and bailing process, the forklifts transfer the bails for storage in its assigned storage area within the recyclables warehouse.
9- **Compost** containers are transferred to the refining, screening and bagging plant. The compost is loaded onto the loader which is then transferred to the conveyor belt onto screening followed by bagging. Bags are then stacked onto wooden pallets and transferred using forklifts to final compost storage areas within storage warehouse.
10- **Excess green waste** containers shall be directed to shredder area for shredding. Shredded green waste shall be loaded onto 660 liter or open containers, for temporary storage, followed by distribution from the RSWMF to the Islands that lack green areas, during the periodical monthly service visits.
11- **Incineration**: Incinerable inert / rejected recyclables / municipal hazardous / medical hazardous / shredded incinerable bulk waste shall be incinerated. Those materials shall be stored until quantity is sufficient for 24/7 incineration operation for at least 3 months period (unless the incinerable material is contaminated with organic / food waste, then it requires incineration within 2 to 3 days maximum, but such contamination should be avoided at all costs). The incinerable stored material shall be shredded and mixed well (hazardous material is excluded from such process) at the incineration plant's reception area in order to provide homogenous feedstock to the incineration plant.
12- **Hazardous municipal and medical wastes:** those materials shall be safely stored in red bags and its completely prohibited opening or shredding the bags. This material shall be stored in 660 liter bins, and fed to the incinerator in the middle of other mixed wastes in order to avoid lower calorific values of wastes fed to the plant.
13- After continuous operational period of the incineration plant, it's shutdown for regular maintenance and cleaning for few months (depending on incinerable quantities accumulation rate).
14- **Bulk waste**: shall be directed to bulk waste management and storage covered facility. Two processes are mainly carried out, namely sorting and storage. Materials that have a market such as old furniture, appliances, etc. should be considered for auctioning. Other incinerable materials that have no value / market shall be stored for shredding and incineration.
15- **Construction and demolition waste**: shall be directed to C&D area for sorting and storage. C & D waste need to be processed for construction material, but that requires a detailed stand-alone study and shall be done on the medium term as it requires planning. Until then storage will be the only viable solution.
16- **E-waste**: shall be directed to e-waste management and storage covered facility for sorting and storage. Sorting of precious metals verses plastics and other materials is generally carried out. This type of waste requires a stand-alone study and shall be done on the medium term. Until then storage will be the only viable solution. It is prohibited to dismantle any e-waste parts due to the hazardous nature of certain parts.
17- One year worth of bailed recyclables shall be auctioned / tendered.
18- Fly ash shall be bagged for final disposal at landfill cell. It will be mounted on wooden pallets, which shall be transported to the landfill cell using forklift and laid on the cells manually.
19- Bottom ash shall be bagged for either storage until processing later, or send to the sanitary landfill for final disposal. Within 6 to 12 month period WAMCO shall plan for utilizing the bottom ash in

construction bricks and additional source of revenue and / or among CSR activities to Inhabited Islands.

20- Records of the amount of incoming and outgoing waste must be kept for monitoring purposes and for regular validation of the facility mass balance. This will be carried out at entry to MRF facility, entry at bailing station / plant, entry at warehouses, and exit from warehouses to final destination (recyclables and compost to traders, incinerable material for incineration and fly & bottom ash for landfilling). This task is crucial to control incoming and outgoing movement of material within the facility, and ultimately out of the facility and final treatment. This task should be carried out by Quality control team. Manifestation system shall include such information.

21- **Leachate Collection and Treatment:** Leachate generated at the ash disposal landfill cell should be treated through the existing system which includes aerated lagoons, re-circulation, membrane filtration and sand filters. The exposed working face of the cell should be minimized, and perimeter drains and landfill cell compaction, slopes and daily cover materials should be used to reduce infiltration into the deposited waste.

Appendix 10. Updated Matrix for Sea Turtle Management

Following is a revised matrix of the Sea Turtle Management Plan exclusive to the current project derived from the Environmental Monitoring Report for the RWMF at Vandhoo, Raa Atoll (Zahir, 2014).

Activity and Associated Impacts	Protection and Preventive Action	Implementation Responsibility	Implementing Cost
Turtle Management Plan	• Construction equipment must not be allowed to operate on the beach, remove sand from the beach, or in any way degrade nesting habitat.	ME / Construction Site Supervisor	Included as part of the contract
	• Night time lighting of the beach other than the harbor area should be prohibited during nesting and hatching seasons or a non-intrusive lighting system should be put in place.	Environmental Officer / RWMF Manager	Included with the O&M cost
	• Ensure that no beach lights are erected on the beach. Harbor front lights shall be appropriately designed and set.	ME / Project Managers	
	• Implement, enforce, evaluate lighting regulations or other lighting control measures where appropriate - Shielding of the light source, screening with vegetation, placing lights at lowered elevations and in some cases the use of limited spectrum low wavelength lighting (e.g. low-pressure sodium vapor lights) are possible solutions to beach lighting problems.	ME / Project Managers	
	• Ensure that structures do not block the turtle's access to the beach, change beach dynamics, or encourage human activities that might interfere with the nesting process.	Environmental Officer	Included with the O&M cost
	• Monitoring their activities as well as putting a physical barrier such as a fence containing them within the facility area should manage movement by facility workers.	Environmental Officer	
	• Identify nesting sites through seasonal monitoring and appropriately demarcate these areas. Place sign boards to indicate protected nature of the	Environmental Officer	Covered through MCEP

	beach. These sign boards should provide information on the prohibited activities and penalties for penalizing. • Ensure that vehicular driving on nesting beaches are prohibited. • Maintain the required vegetation buffers adjacent to the protected beach through appropriate signages. • Ensure that only non-mechanical beach cleaning is undertaken. • Reduce directed take of turtles and harvesting turtle eggs through conducting public education and information sessions to the staffs of the facility and vessel operators.	RWMF Manager Environmental Officer RWMF Manager Environmental Officer	No cost involved. Included with the O&M cost No cost involved. Included with the O&M cost

Appendix 11. Emergency Plan

An emergency plan should be developed for the facility taking into account emergencies in waste handling and emergency control and response procedures. Following sections are recommended to be included in such a plan.

1. **Emergency Waste Handling**

   The RWMF should establish Emergency Procedures for handling waste, considering circumstances where the incinerator and its associated WTE system is required to be shut-down for maintenance or due to a fault, and collection sea-vessels and vehicles operating at ground being grounded. In this regard, following actions are recommended.

   - Maintain sufficient stock of critical spare parts required for the incinerator, WTE system, baling machine, CEMS and filters at all times.
   - A stock of spare parts for vehicles and sea vessels must be made available at the facility at all times to be utilized when and where required. This is critical to ensure that the operational flow of the facility is not significantly impacted.
   - In case of a major damage to operating vehicles and/or sea vessels, procedures must be in place for short-term renting of vehicles and/or vessels.
   - If the plant is required to be kept shut down for long durations (for more than 5 consecutive days), the clients (in this case the island councils of Zone 2 region) must be briefed in writing about the case, providing the expected duration where services will be suspended and anticipated date for resuming services.
   - If the plant requires emergency shutting down, incoming waste should be baled using the baling machine available at the facility.
   - Establish procedures to undertake manual pre-sorting if the mechanized sorting line is damaged, until it can be repaired and brought back to operating conditions. In such cases, the work force assigned for sorting should be increased by temporarily transferring staffs from other departments.

2. **Emergency Control and Response Procedures**

2.1. Emergency Contacts

The telephone numbers of the emergency contacts must be displayed at different locations of the facility.

2.2. Fire

- Every employee is responsible for reporting a fire. A fire witnessed inside the facility or any buildings on WAMCO managed facility must be reported immediately to a supervisor. If the fire is located in the employee's work area it should be reported to his immediate supervisor. The supervisor is responsible for calling emergency and notifying the Plant / facility Manager.
- Only under the plant manager, or facility manager's discretion, will trained personnel proceed to extinguish and control the fire. This procedure will continue until the fire is extinguished, fire personnel arrive or fire becomes uncontrollable. If, in the opinion of management, the fire is beyond safety limits all personnel will be evacuated from the facility.
- Given that this subject is of utmost importance, a thorough report needs to be prepared, policy and standard operating procedure developed and required training is given. These will include but not limited to the following:
  a. Fire Alarm and Evacuation Procedures
  b. Firefighting Equipment
  c. Firefighting equipment Inspection
  d. Plant-Wide Training Program
  e. Fire Evacuation Safety Plan
  f. Fire Equipment Location Log
  g. Portable Fire Extinguishers Inspection and maintenance Guidelines
  h. Automatic Fire Detector Requirements
  i. Responsibility staff
  j. Fire Alarm Inspection Procedures
  k. Emergency Evacuation Procedures

2.3. Explosions

Fires and explosions are closely related. One can easily be the cause or the result of the other. Explosions are most likely to occur in enclosed areas.

In the event of explosion, the Shift Supervisor, or designee, must do the following:

- Administer first aid if required;
- Call the Fire Department, CRRA and the Insurance Company;
- Alert Plant personnel;
- Locate and shut down possible sources of combustion (e.g. fuel and gas lines, flammable materials, etc.);

- Assess damage to property and mechanical equipment and file a report in written form.

Plant personnel must make every effort to minimize the possibility of explosion. Precautions are taken to prevent potentially explosive materials from entering the plant processing lines. Plant waste review and processing procedures minimize the likelihood of an explosion by segregating explosive materials from further processing.

Additionally, the following practices are in place to minimize the possibility of explosion:

- Strictly enforce no-smoking rules;
- Post signs indicating potential explosion hazard areas;
- Use positive mechanical ventilation prior to entering or when working in a potentially explosive or suspected oxygen deficient area.

2.4. Accidents and Injuries

Procedures followed in the event of an accidental injury in the facility are naturally dependent on the type and severity of the injury. Listed below are the procedures to follow for two scenarios:

a- Major Injuries - Outside Medical Attention

Required: CALL emergency and Supervisor & Facility Manager notification

- The injured employee or an employee nearby will either alert the Supervisor or Plant Manager using a facility or cellular phone.
- As the injury necessitates first aid shall be administered immediately. The supervisor will notify immediately the Plant Manager, and a speed boat will be called to transfer the injured employee to nearest hospital for treatment.
- In parallel the supervisor / plant manager will contact the injured employee’s designated emergency contact person.
- Once the injured employee has been transported to the hospital, the reporting and investigation procedures will begin.

b- Minor Injuries – In Plant Medical Attention Necessary:

Required: Supervisor or Manager Notification

- Either the injured employee or an employee nearby will alert the supervisor who will then perform first aid if necessary. After first aid is performed the employee will be instructed to go to the break room.

- If hospitalization is required the supervisor or assignee will order speed boat to transport injured employee to the nearest hospital.
- Should the employee's injury require to go home however, are incapable of transporting themselves a supervisor or assignee will transport the employee. An employee injured on the job is entitled to all benefits following employment contract / GOM regulations in that regards.

c- First Aid

The first aid kit in the First Aid area is equipped to cover basic first aid needs. All first aid cases must be referred to facility management.

The Plant Manager is responsible for:

1. All in-house first aid treatment;

2. The maintenance of adequate first aid equipment;

3. Decisions concerning case referral to the hospital in coordination with the facility personnel; and

4. Ensuring that emergency calls are made immediately when required.

d- Accident Reports

- Immediately following a work-related injury requiring more than first aid, or a work-related illness, Occupational Injuries and Illnesses form is completed. This form lists the name of the employee, department and description of the illness or injury.
- Whenever there is an injury which requires medical attention a WAMCO Accident Report is completed. The report includes accident description, preventative actions taken, witnesses, equipment involved, unsafe conditions which led to the accident, other factors which contributed to the accident, and recommendations and comments to avoid similar accidents to happen again. A copy of the Accident Report will be sent to the MEE's focal point / project manager within 24 hours of the incident.
- Unsafe conditions which lead to any accident in the facility are to be immediately corrected to prevent further accidents / injuries. The administration of first aid will be recorded and maintained for all incidents.
- After an accident occurs and reports are completed an investigation by the plant manager will follow.

2.5. Hazardous Waste Management

RWMF receive hazardous wastes generated from households and medical establishments. Although the quantities of hazardous wastes are small, yet hazardous in nature and requires special handling to avoid toxic exposure that can cause harm to employees as a result of direct contact. Normal facility operations can, however, at times produce potential safety hazards to employees working in the vicinity of certain equipment. These hazards include but not limited to:

- Noise from the various vehicles such as loaders, bulldozers, etc., as well as parts of plants / facilities including MRF, incinerator and balers;
- High temperatures at vicinity of certain areas of the incineration plant, or exposure to direct sunlight in a hot day for extended period of time, etc.;
- Loading of certain types of “sharp” recyclables such as aluminum cans or glass in processing lines at MRF or bailers.
- Toxic emissions / vapors emitted due to heat, decomposition, etc.
- Potentially dangerous situations can also occur around any processing equipment that is made up of moving parts.

Accordingly, the goals of the facility management in regards to personnel health and safety include the following:

- To describe all types of health and safety hazards that exists at various facilities to employees;
- To familiarize the employees with the safety measures and equipment to be used;
- To explain all safety procedures;
- To explain Occupational Safety and Health guidelines as per GOM policies and relevant programs in that regards that are designed to limit hazards to employees; and
- To explain Fire Fighting Procedures, Explosion Prevention Procedures in the event an accident occurs.