ENVIRONMENTAL AND SCOCIAL MANAGEMENT PLAN

FOR THE PROPOSED ESTABLISHMENT OF AN ISLAND WASTE AND RESOURCE MANAGEMENT CENTRE IN TH. MADIFUSHI

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DECLARATION OF THE AUTHOR

I hereby declare that the information provided in this ESMP are true, complete and accurate to the best of my knowledge and is based on the information available at the time of writing.

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NON-TECHNICAL SUMMARY

The proposed project for the established of an Island Waste and Resource Management Centre (IWRMC) in Th. Madifushi, is funded by the World Bank and executed through the Maldives Clean Environment Project (MCEP). The aim of the project is to construct a proper IWRMC in the island, with in-vessel composting technology to treat the organic waste generated, coupled with creating adequate waste processing and storage facilities to facilitate volume reduction of inorganic waste. The IWRMC will also have administrative buildings such as an office, store, locker, toilet and resting areas, while provisions will be made to install fire safety equipment.

Th. Madifushi has a demarcated area for dumping waste where waste can be segregated and stockpiled. This 3000 sqft dumpsite has been operational for the past 2 years and has now reached its capacity due to lack of volume reduction machinery and transportation of waste. Green waste is burnt on site, and kitchen waste is dumped into the lagoon area. Th. Madifushi Council has formulated an Island Waste Management Plan which is yet to be approved by the EPA.

The proposed IWRMC under the current project is located in the southern end of the island at the newly reclaimed area. No vegetation clearing is required for this plot, and the plot is easily accessible.

The main activities involving the construction of the IWRMC include shallow excavation, substructure and superstructure works as well as masonry works. The proposed design of the IWRMC requires a shallow foundation due to the structure being a single-storey structure. After the structural works are done, masonry, plastering, roofing works are completed prior to the addition of the services components such as electricity, fire-fighting and plumbing. The construction phase of the project is expected to be completed within 12-24 weeks.

The operational phase of the project would mainly include waste collection from households, institutions, and public spaces, sorting, volume reduction and stockpiling of re-usable, recyclables, composting of organics, and storage of hazardous waste.

This ESMP will cover both the construction and operational aspects of the IWRMC.

Key Impacts

Environmental and Social Impacts of the project was evaluated using a modified Leopold matrix. It was found that the project will result in certain minor and moderate impacts both during the construction and the operational phase of the project. The main project activities which may result in impacts during the construction phase include; influx and settlement of workers for the project construction activities, transportation of materials, impacts from construction works, terrestrial pollution from construction waste generation and impacts from resource use. However, irreversible permanent negative impacts are not envisaged, as the project does not involve removal of any vegetation.

The main project activities during the operational phase which may have a significant impact on the environment include waste collection and transportation, waste management activities, waste generation - terrestrial pollution, groundwater contamination and resource consumption.

The major socioeconomic impact is found to be positive. The reduced volume of solid waste accumulated will have public health benefits for the residents of Th. Madifushi.

Impacts and Mitigation Measure

An Environmental and Social Management Plan has been proposed with mitigation measures and estimated cost for implementing the proposed mitigation measures.

Alternative Technology and Energy Sources

Alternative technologies for managing organic waste has been analysed. The technologies compared include manual composting (open windrow system), anaerobic digestion system (bio-gas generation) and aerobic OWC technology (in-vessel composting). From the analysis, the aerobic OWC technology was found to be most appropriate for the IWRMC in Th. Madifushi, due the simplicity of the technology, being less labour intensive, taking comparatively less land area for installation of the machine and significantly reducing processing time, thereby increasing avenue for making the IWRMC self-sustainable.

Similarly, alternative energy sources were analysed in terms of installing solar and a diesel generator specific to the IWRMC. These alternatives were compared with the proposed option of connecting electricity from the existing power grid of Madifushi. Although solar is the most beneficial from an environmental and social perspective, the proposed option is found to be the most advantages due to the high cost of installing solar, coupled with budgetary limitations.

Environmental Management and Monitoring

A monitoring regime of environmental and social safeguards has been proposed taking into consideration the impacts and mitigation measures to be implemented. The important elements that require checks such as implementation of mitigation measures, groundwater quality and spillage assessment at the project site will be monitored according to the developed monitoring program during construction and operation period.

Although the project involves inevitable negative environmental impacts, such impacts are not serving as to not undertake the project. Mitigation measures have been proposed to adequately minimize the significant impacts. Hence, the project is justifiable in light of the socioeconomic conditions and anticipated benefits from the project which clearly outweigh the negative environmental impacts.

Overall, the project is expected to provide significant socio-economic and environmental benefits for the local community.

ސާރާ ހުލާސާ

ރ. މަޑުއްވަރީ ކަނޑު މެދުކަރާ މަތިކަޅު އިމާރާތްކުރުމުގެ މަޝްރޫއަކީ ވޯލްޑް ބޭންކުގެ ހިލޭ އެހީއާއި ދިވެހި ސަރުކާރުގެ ބަޖެޓުން ހަރަދުކުރެވޭގެން ކުރިއަށް ގެންދާ މޯލްޑިވްސް ކްލީން އެންވަޔަރަންމަންޓް ޕްރޮޖެކްޓުގެ (އެމް.ސީ.އީ.ޕީ) ގެ ދަށުން ކުރިއަށް ގެންދާ މަޝްރޫއެކެވެ. މި މަޝްރޫއުގެ މައިގަނޑު މަގްސަދަކީ ޖަޒީރާ ފެންބޮޑުވުމުގެ ކަނޑު މެދުކަރާ މަތިކަޅުގައެވެ. ރ. މަޑުއްވަރީގައި ގެއިމުކުރުން، އުތުރުކަރާ ބޮޑުރާޅުތަކުގެ ފާރާގެ ހިމާޔަތް ދޭ ކަނޑު 4 މަހާއި 6 މަހުގެ މުއްދަތުގައި ގެންގުޅޭ ވަސީލަތްތަކާއި، ކުރު މުއްދަތުގައި ގުޅުންހުރި ބޮޑުބޮޑު ރާޅުތަކުގެ ފާރާގެ ކަންކަން ބެލެހެއްޓުމާއި، މި މަތިކަޅު ހަރުދަނާކުރުމެވެ. މީގެ އިތުރުން މިމަތިކަޅުގައި މަތިކަޅު އިމާރާތްކުރާ މުއައްސަސާ ހިމަނައިގެން ކޮންސަލްޓޭޝަން، އޮފީސް އިމާރާތްތަކާއި، ފާރާއިންސާނުންގެ މަސައްކަތުގެ ގޮތުގައި އެތެރެކުރާ ތަކެތި ހިފެހެއްޓުމުގެ ރައްކާކުރުމަށް މި މަޝްރޫއުގެ ދަށުން އިތުރު ވަސީލަތްތައް ފޯރުކޮށްދޭ މަތިކަޅުގައި ގެއިމުކުރެވޭނެއެވެ.

އަދި ހަތަރު ބަރުދުން، ރ. މަޑުއްވަރީ ކަނޑުމެދުކަރާ އެކަށީގެން ނިމުމުގެ ގެއިމުކަމަށް ނިމޭނެއެވެ. މިހާރު ކަނޑު އެތަކުރެއްވި އެކަމަކު ހެއްސަކާރުކުރެވޭ 3000 އަކަފޫޓުގެ ސަރަހައްދެއްގައި ކަމުގައި ވިސްނާލެވޭ ކަނޑު ބިމުގައި ހާލަތު އެއްލޭ ހުރަހެއް ނެތި ބަހައްޓާނުގެންދާނީ، ވާރޭ މޫސުމުގައި، ފެނާއި އެކުވެގެން ކަނޑުން ފައިބާ ދިޔަ (ވޭވްސް) ބިމަށް ފޯރިގެން ގާސް ރަށުގެ ވެލިގަނޑާއި ފެންފަރަތަށް ނަގާލާ އަސަރުތަކެއް ކުރިމަތިވެ ފަރަތް ގެއްލިގެންދެއެވެ. މީގެ އިތުރުން އެކަށީގެންވާ މި ސަރަހައްދަށް ބިލެއް ހިއްޕުމުގެ ނުތަނާގެ ސަރަހައްދެން، ކަނޑު އަޑީސަރަހައްދު މިހާރު ވަނީ ދޮރުން ކައިރިވެފައެވެ. ފެނާއި ކުނޑީގެ ކޮންޓެއް މިދިހާރު އަސަރުކުރަމުންދާ ގޮތެއް ފެނުން އެއްކަލަ ގާތުވެގެން ބަލަން ކަނޑުގެ ގާތް އަށެވެ. ރަށު ގޮތުގެ ވަގުތުގައި ކަނޑުގެ ކަތި ބޭރު ފެންބޮޑުވުމުގެ ބައިގައި ކަނޑުގެ ބޭރު ފާރުބަދުވެ ފަހަތަށް ގެއްލުމެއް ނުވާނެ ގޮތަށް ފުރުސަތު ދޭނެ ގޮތަށް އާއި ބީ.ޕީ ބޯޓުތަކަށް ފުރުސަތު ފަހިވެއެވެ.

މި މަޝްރޫއުގެ ދަށުން އަރަން އިމާރާތްކުރުމަށް ކަނޑު އަޅާއިރު ކަނޑު ކަނޑުމެދުކަރާ މަތިކަޅު އިމާރާތްކުރުމަށް ހަމަޖެހިފައިވާނީ، ރޮކް ރިވެޓްމަންޓް ބޮޑެތި ކަތުރަކަށެވެ. އަދި މިސަރަހައްދަށް ބޭރުން އެއްޗެހި ސަރުކާރު ރޮކްރިވެޓްމަންޓް ހުރަހަށްވުރެ ވާލްގެރަށް ފާރުވުމަށް ސަރަހައްދުތަކެއް ހުރުމަށް މިސަރަހައްދަށް ބަލާ ރޮއްވާ އެރޮހިހުރި ފަރުގެ އިތުރުން ބިމަށް ފާރަގެރި ސަރަހައްދު ފާރު މިސަރަހައްދުގައި އެއްކޮށް ގެންދާ ކުރެހުމެއް އެކުލެވިފައިވާނެއެވެ.

މަޝްރޫއުގެ އިމާރާތްކުރުމުގެ ފުރަތަމަ ހާލަތުގައި ޓެކްނިކަލް ފުރަތަމަ މަރުހަލާގައި ބިމަށް ބަރަބޯއްޗާއި އިންޖިނިއަރިން ކުންފުނިތަކެއް ވަކިކުރުމަށް އަސަރުކުރާނެ ތިމާވެށީގެ ކަންތައްތައް ވަކިވަކިން ބަލައި ދިރާސާކުރެވޭނެއެވެ. މިހެން ކުރާއިރު މަސައްކަތް ކުރުމަށް ކުރިމަތިލާ އަސަރުތަކަށް ހުރި ގޮންޖެހުންތައް ނަގައި މުއައްސަސާތަކާއި ތިމާވެށި ވަސީލަތްތައް ބޭނުން ކުރުމުގެ ބޮޑުވިސްނުން ކަނޑާ ގުޅޭ އެކިއެކި އަސަރުތަކުގެ ދިރާސާތަކުގައި ބަލާނެއެވެ. އަދި މަޝްރޫއުގެ ފުރަތަމަ ގެއްލުމަކީ އަސަރުތަކަށް ވަގުތުގެ މަސައްކަތު ސަބަބުން ގެއްލުމެއް ނުވާނެ ގޮތަށް ފާރާ ބަރާބަރު ކުރުމުގެ ގޮތުން އަސަރުކުރާ ގޮތް ފަދަ ކަންތައްތަކަށް ނަތީޖާތަކެއް ލިބިދާނެ ގޮތުގެ ތިމާވެށި ކަނޑު ރޮއްވާ އަސަރުތަކާއި ކުރުމުގެ ފަދަ މަސައްކަތްތައް ތިމާވެށީގެ ކަނޑުގެ ރަށުގެ މަސައްކަތްތަކުގެ އިމާރާތްކުރުމުގެ ފުރަތަމަ ސަބަބުން ކަނޑުގެ ދިރުން ސިފަވުން ތިމާވެށިން ބަލާ ބަލައި ކަނޑު ވަކިކުރެވޭނެއެވެ. މީގެ އިތުރުން މަޝްރޫއުގެ ސަރަހައްދަށް ހުރި ބިމެއް ކަނޑުގެ ތިމާވެށި އަސަރުކުރާނެ ވަގުތީ އެއްޗެހި ގެންދިޔުން މަޝްރޫއިން ފާރަވެރި ކަމެއް ނިމިދެވޭނެއެވެ.

މިމަޝްރޫއުގެ ސަބަބުން ރ. މަޑުއްވަރީ ކަނޑުމެދުކަރާ މިހާރު ދިމާވެފައިވާ ދަތިތަކަށް އެކަށީގެންވާ ހައްލެއް ލިބިގެންދާނެކަމަށް ބެލެވެއެވެ.

މިގޮތުން މިމަޝްރޫއުގެ ތެރޭގައި، މަސައްކަތު ދަށުން ހުރަސްއެޅުމާއި ކަނޑު ގުޅުންހުރި ގޮތްތަކާއި، ބިލޭ އަދި ގާތް ފަދަ ބޮޑުކަމަށް ނުފޫޒުގޯސްކުރާ އެއްވެސް ކަރަންޓް ކަމެއްގައި، އަދިވެސް ނުވާ ނިޔާލާ ބަރާބަރު ބޭރުފޮޅުމާއި، ވަކިވެސް ގޮތްގޮތުން ކަނޑު ބޮޑުވެސް ކުރާނެ ކަމެއް ނެތް އެކަމަށް ހަމަޖެހިފައި ވާނެއެވެ.

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CHAPTER 1 INTRODUCTION

1.1. Project Background

Solid Waste Management (SWM) is a priority sector for the Maldives due to the fact of high economic and social dependence on a healthy marine environment. In recent years there has been a significant increase in the magnitude of waste management problems throughout the country for a number of reasons, including but not limited to population increase, changing lifestyle, dependence on importation, coupled with the environmental challenges brought about by the growing tourism. The worsening waste management situation is increasingly resulting in pollution of the environment and the generation of conditions prejudicial to public health. Practices vary from community to community, but at most islands waste is building up into many open dump sites spreading across islands and disposed of either in the sea or by open burning. Predicting the threats to the economic development, the Government of Maldives (GoM) took a decision to invest heavily in the waste sector with the support of various donors and international agencies to build the necessary infrastructure to develop an integrated and sustainable solid waste management system throughout the country on a Zonal approach.

This process has started 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 Environmental Management Project (MEMP). This project has been completed in 2015, by developing SWM systems at the island's level and a regional waste treatment facility for final disposal of residual wastes from Zone 2 islands.

Following the completion of the MEMP and the design implemented, the GoM received another grant from the IDA for another regional waste management project under the title "Maldives Clean Environment Project" (MCEP). The project includes providing support to establish and operate SWM systems in Zones IV and V, including island waste management systems, based on a detailed feasibility study that will be completed under the project.

Phase 1 of the technical and financial feasibility study (FS) for the regional waste management of Zone 4&5 was completed and cleared by the World Bank on September 2019. Upon completion of phase one and delivery of partially completed Island Waste Management Systems report which informs the preliminary requirements for island level component, the project has received go ahead from the World Bank to commence construction of IWRMCs. Based on the population and the size of the islands, 2 distinguished types of technologies are proposed to deal with the organic component of the island waste stream, namely, anaerobic digestion and mechanical aerobic technology (using a mechanized compost machine / in-vessel composting).

To facilitate systematic implementation of the island level subcomponents, 36 of the subproject islands in Zone 4&5 were grouped into batches, depending on the respective size, population and waste generation estimates of the islands coupled with the level and scope of works to be carried out. This includes:

- 8 Pilot Projects proposed to determine the feasibility of Anaerobic Digestion and Mechanical Composting in a country specific context;
- Establishing 14 new IWRMCs with mechanical composting technology; and
- Upgrading of 14 IWRMCs to facilitate mechanical composting or anaerobic digestion.

Batch 1 of the Island Waste Management Systems includes developing full-fledged IWRMCs in the following 6 sub-project islands;

1. M. Mulah
2. Th. Buruni
3. Th. Omadhoo
4. Th. Madifushi
5. Th. Kinbidhoo
6. Th. Thimarafushi

The proposed project for the establishment of IWRMC in Th. Madifushi falls in Batch 1.

ESMP reports were initially prepared for the aforementioned 6 subprojects in 2018, which was subsequently cleared by the World Bank and the EPA. These reports were prepared by Environmental Consultant, Mr. Ahmed Saleem, hired by MCEP. However, due to delays in the delivery of the feasibility study, construction of these 6 IWRMCs were put on hold. The technology reflected in these 6 ESMPs are open windrow composting, which is now to be changed to mechanical composting (also known as in vessel composting) based on the findings of the FS, including certain design variations brought to the overall design of the IWRMCs. Therefore, these 6 ESMPs will need to be updated and resubmitted to the World Bank and the EPA for further clearance.

1.2. The Project Island

This report is focused on Th. Madifushi, which is one of the inhabited islands of Thaa atoll located at 02°21’20”N and 73°21’10”E. Situated on the eastern side of the atoll the island covers an area of about 19.5 ha naturally. The island is undergoing reclamation which is in its final stages. The reclamation adds an addition 20 ha which makes the island’s total area into approximately 40 ha. Along with this, construction of the new harbour works is also underway. The newly constructed harbour is 800 x 300 ft in size. The island has a population of 1340 people and was one of the islands severely devastated during the 2004 tsunami. The nearest inhabited island is Dhiyamigili on the southwestern side of Madifushi and is roughly 2.65 km away. The nearest uninhabited island is Ufuriyaa just 0.28 km away. COMO Maalifushi in Maalifushi is the closest resort to the island 9.16 km away. Moreover, the closest airport is in Thimarafushi located on the southern region of the atoll.

The island has 24-hour electricity service and a central sewerage system. The island has a health centre and education provided up to grade 10.

1.3. Environmental and Social Management Plan and Environmental Permits

The Maldives national requirements for Environmental Impact Assessment are set out in the Environmental Impact Assessment (EIA) Regulations, 2012. Part III of this regulation includes a description of the Screening Process applied to development proposals. Schedule D of the Regulations provides a screening list of all development types for which full EIA is mandatory. According to Schedule D included in Amendment 2 to the EIA regulations 2012, waste management practices that require preparation of an EIA are:

1. Projects involving operation of large incinerators with a capacity of more than 10 tons per day.

2. Development of large waste management centres that treats more than 10 tons of waste per day.

3. Projects that involve development of a landfill by using waste.

Proposed developments that do not fall within Schedule D are subject to manual screening by the Environmental Protection Agency (EPA), for which a Screening Form must be submitted providing relevant development details. Within 10 days, the EPA will decide whether the proposed development is approved, or needs further study, which may be required in the form of an EIA or Environmental Management Plan (EMP) (Ministry of Environment [ME], 2012).

The proposed development is small scale and therefore is not listed under the Schedule D of the EIA Regulation. A screening process was followed for the initial project, where the screening decision from EPA was to prepare an EMP for the project and to submit for review and approval. The screening decision from EPA is provided in **Annex 1** of this report.

It is mentioned in the Environmental and Social Assessment and Management Framework (ESAMF) of MCEP that prior to the approval of disbursement of funds for project sub-components, International Development Association (IDA) will have to clear all safeguards documentation. Therefore, although an EMP is required as per the local regulation, an Environmental and Social Management Plan (ESMP) was developed for the initial project and simultaneously submitted to the World Bank for approval.

Following this, an ESMP report was prepared as per the original scope of the project, and subsequently cleared by the EPA and the World Bank. The Decision Statement (DS) and clearance note issued in this regard are provided in **Annex 2**.

Both the implementing and funding agencies were later consulted regarding the change in scope of the original project, where the decision received from both the institutions were to update the previously cleared ESMP to reflect the revision in scope of works and resubmit for further review and clearance. Supporting evidence confirming this is provided in **Annex 3**.

A separate site selection process was not followed for the proposed project since the project site remains unchanged as originally proposed. The site approval attained from the Maldives Land and Survey Authority (MLSA) is provided in **Annex 4**.

Other major laws, regulations and policies applicable to this project (both national and the World Bank) are reflected in **Table 1.**

Table 1 Laws applicable to the project

#	Relevant laws, regulations, policies and guidelines	Requirement	Application specific to project
1	National Waste Management Policy 2015	National	The establishment of an IWRMC is prerequisite to facilitate waste management at island level.
2	Waste Management Regulation	National	• The regulation reflects the following: - Sets standards for waste collection, transfer, treatment, storage, waste site management, landfills and managing hazardous waste. - Defines approval procedures for waste sites and waste transfer. - Standards and permits required for waste transport on land and sea, including transboundary movements. - Defines reporting and monitoring requirements and procedures. - Defines procedures to implement WMR and penalties for non-compliance. • The IWRMC was designed conforming to the provisions of Waste Management Regulation.
3	National Policy on Health Care Waste Management	National	• Stipulates that all health facilities have to be responsible for the safe management of health care waste in an environmentally sound manner that minimizes risk to the community and the staff involved in its management. • The IWRMC should not accept healthcare waste as it has to be managed separate from the general waste directly at the health centre.
4	The Land Act (1/2002)	National	• All transactions concerning the issuing, receiving, owning, selling, lease, utilizing and using Maldivian land shall be conducted in compliance with this Act.
5	Land Use Planning Regulations and Guidelines (2005)	National	• A draft Land Use Plan (LUP) was done for Madifushi. • The LUP of islands are reviewed by MNPHI in consultation with MLSA and EPA. • Site approval was further attained from MLSA for the draft LUP proposed location for carryout waste management, which falls in the recently reclaimed area.
6	Environmental Guidelines for Site Selection of Waste Management Centres (2017)	National	• Provides recommendation for optimum zoning of IWRMC sites. • No environmentally or socially sensitive areas are present within a 30m boundary from the IWRMC.
7	Coral mining regulation	National	Coral mining from house reef and atoll rim is banned.

8	Sand mining regulation	National	Sand should not be mined from any part of an inhabited island, beach or the newly reclaimed island beach. Sand should also not be mined from within 100 ft. of the shoreline.
9	Law on Cultural and Historical Places and Objects of the Maldives (27/79) WB PS8 (2012)	National World Bank	Requires client to develop provisions for managing chance finds through 'a chance find procedure' which will be applied in the event that cultural heritage is subsequently discovered. The client shall not disturb any chance find further until an assessment by competent professionals is made.
10	World Bank Group Environmental Health and Safety Guidelines for SWM Facilities	World Bank	Sets procedures to reduce the risk of accidents and injuries, minimize dust and air quality related impacts, reduce the probability spillage of oil and hazardous substances and leachate on site due to stormwater run-off during operations of waste management facilities.
11	Employment Act (02/08)	National	• Worker shall not be forced to work for more than 48 hours per week. • Workers shall not be made to work for more than 6 days a week consecutively without providing 24 hours for rest. • Workers shall not be made to work continuously for more than 5 hours without providing a break for at least 30 minutes. • Salary should be paid to all permanent contract workers once a month. • Minimum 03 meals shall be provided to construction staff per day or appropriate meal break time shall be provided.
12	Immigration Act (01/07)	National	• All expatriate workers must have proper work visas and work permit cards.
13	Utility Regulation Authority Act (2020)	National	• The regulatory works for waste management has been transferred to newly established Utility Regulation Authority (URA).

1.4. Objective of the ESMP

The objective of the ESMP study is:

a) To provide the ways by which the proponent will manage and control the works associated with the construction and operation of the IWRMC;
b) to provide an assessment of the potential environmental and social effects of the proposal and determine which of these, if any are likely to result in a significant effect on the

environment and to propose ways and means of avoiding, mitigating, and or compensating the perceived negative effects of the project;

c) enhance project benefits; and
d) to provide necessary information to EPA and the World Bank applicable to the proposed development in line with the EIA Regulations and the ESAMF.

1.5. ESMP Implementing Process

In general, the objective of an ESMP report is to address the environmental and social concerns of the developmental project. The ESMP report will also help to promote informed environmental and sound decision making during the development of the project.

The aim of the ESMP is to identify, describe and assess in an appropriate manner, proposed development, in accordance with the provisions of guidelines and regulations of the GoM, the direct, indirect and residual effects of the project on the physical, biological and social environment of project. The ESMP would also provide the ways by which the proponent and the island council will manage and control the works associated with the construction and operation of the IWRMC.

This ESMP has been developed within the framework outlined in the EIA regulations 2012 (in addition to the Environmental and Social Assessment and Management Framework (ESAMF) of MCEP and the TOR cleared by the World Bank. This ESMP establishes the environmental management controls to be followed by the contractor, its employees, subcontractors and sub consultants in carrying out the construction and operation of the IWRMC.

Once the decision notes are issued from EPA and the World Bank the proponent is obligated to implement the ESMP and matters highlighted in these documents.

1.6. Desk Study Review

A literature review was conducted to acquire background information related to the site and the general environment of the island, as well as to identify possible environmental impacts of projects of similar settings. In this context, the following documents were reviewed:

- ESMP for the establishment of Island Waste Management Centre in Th. Madifushi (Saleem, 2018).
- ESMP for the proposed upgrading of Island Waste Management Centre in N. Holhudhoo (Zuhair, 2019a).
- EMP for the proposed development of Island Waste Management Centre in R. Maakurathu (Zuhair, 2019b).
- Draft Updated ESMP for Establishment of IWRMC in M. Mulah (Hamdhoon, 2021).
- EMP for upgrading Island Waste Management Centre in Fuvahmulah (Zuhair, 2016a).
- EMP for upgrading Island Waste Management Centre in Hulhudhoo-Meedhoo (Zuhair, 2016b).

- Maldives Clean Environment Project Environmental and Social Assessment and Management Framework (ESAMF) & Resettlement Policy Framework (RPF) (Ministry of Environment [ME], 2016).
- Draft Island Waste Management Plan of Th. Madifushi (Madifushi Council, 2020).
- Environmental, Health, and Safety Guidelines for Waste Management Facilities (World Bank Group [WBG], 2007).
- Operational Environmental and Social Management Plan for RWMF – Zone 2, Vandhoo, Raa Atoll (Zuhair, 2018).

1.7. Report Preparation and Acknowledgement

This report is prepared by Mr. Ahmed Hassaan Zuhair, the Environmental and Social Safeguards Specialist of MCEP. According to the second and third amendments to EIA regulations 2012, ESMP reports can be prepared by anyone with a minimum educational qualification of first degree in a field related to environment and do not necessarily have to be an EIA consultant registered in EPA. The educational certificates and curriculum vitae of the author is provided in **Annex 5**.

The following parts of the ESMP report were updated;

- The Project Description chapter was completely revised to reflect the new design and the proposed aerobic system using composting machine (Chapter 2).
- Further community consultations to seek public opinion on the project such as the adequacy of the location, feasibility of the proposed design and technology, staff requirement, health and safety considerations etc. were undertaken and the concerns they have raised regarding any risks/impacts linked to the proposed changes, especially on vulnerable groups etc. has been adequately reflected.
- Additional consultations with the island council, designated waste management focal point, MLSA and MNPHI were undertaken.
- GRM establishment were checked and updated.
- Additional impacts and corresponding mitigation measures were incorporated to the respective chapters to reflect revisions to the project design and technology, with special consideration given to workers' Health and Safety due to COVID19 situation. Measures for labour management and Hazardous waste management were also added.
- Summary tables were provided for construction and operational phase mitigation measures.
- Project alternative chapter was strengthened. Manual composting and anaerobic digestion technology options were evaluated as alternative technologies, while solar energy and installing a diesel generator were evaluated as an alternative source of electricity.
- Include sections on communication and community mobilization including actions to encourage women's participation and address any gender issues identified during consultations.

- A section on Training Recommendations and Contingency Plans was included.
- Reporting procedures, ESMP implementation schedule, contractual measures and cost estimates for ESMP implementation were added to the Monitoring and Reporting Chapter, while the monitoring plan was revised.
- Executive Summary, Introduction and Conclusions were revised accordingly. Dhivehi translations of the executive summary was provided.

Some sections have been retained from the original report. This primarily includes the existing environment chapter and parts of the impact identification chapter, specifically the methodology used for impact intensification and assigning significance level. However, more impacts were added to the matrix.

In preparing the report the author was assisted by a multi-disciplinary team of experts and wish to acknowledge their invaluable input in preparing the report. The author would also like to acknowledge the consultant of the original report, Mr. Ahmed Saleem, who had produced a quite compressive report initially, where parts of this reports are used in this revision as stated above. The team members, their respective field of expertise and areas of contribution to the assessment is given in **Table 2**.

Table 2 The ESMP Team

Name	Qualification	Designation/Field of Expertise	Contributing Area
Mr. Ahmed Hassaan Zuhair	Master of Urban & Environmental Planning, Griffith University.	Author, ESMP Consultant	• Overall administration of the ESMP preparation and writing of the report. • Chapter revisions. • Preparation and finalization of the online pubic survey, including obtaining clearance from the World Bank for the survey from. • Report compilation.
Mr. Ismail Ajmal	BSc (Hons) in Environmental Technology, Abertay Dundee	Stakeholder Consultations	• Analysis of survey results and writing of the stakeholder consultation chapter. • Proof reading of the report.
Mr. Eyman Ismail	Master of Business Administration (MBA), University of West of England	Support Staff	• Liaise with the Island Council to collect background information. • Provide assistance to execute the public survey.

CHAPTER 2 PROJECT DESCRIPTION

2.1. Project Setting

Th. Madifushi is located at 02°21'20"N and 73°21'10"E. Situated on the eastern side of the atoll the island covers an area of about 19.5 ha naturally. The nearest inhabited island is Dhiyamigili on the southwestern side of Madifushi and is roughly 2.65 km away. The nearest uninhabited island is Ufuriyaa just 0.28 km away. COMO Maalifushi in Maalifushi is the closest resort to the island 9.16 km away. Moreover, the closest airport is in Thimarafushi located on the southern region of the atoll.

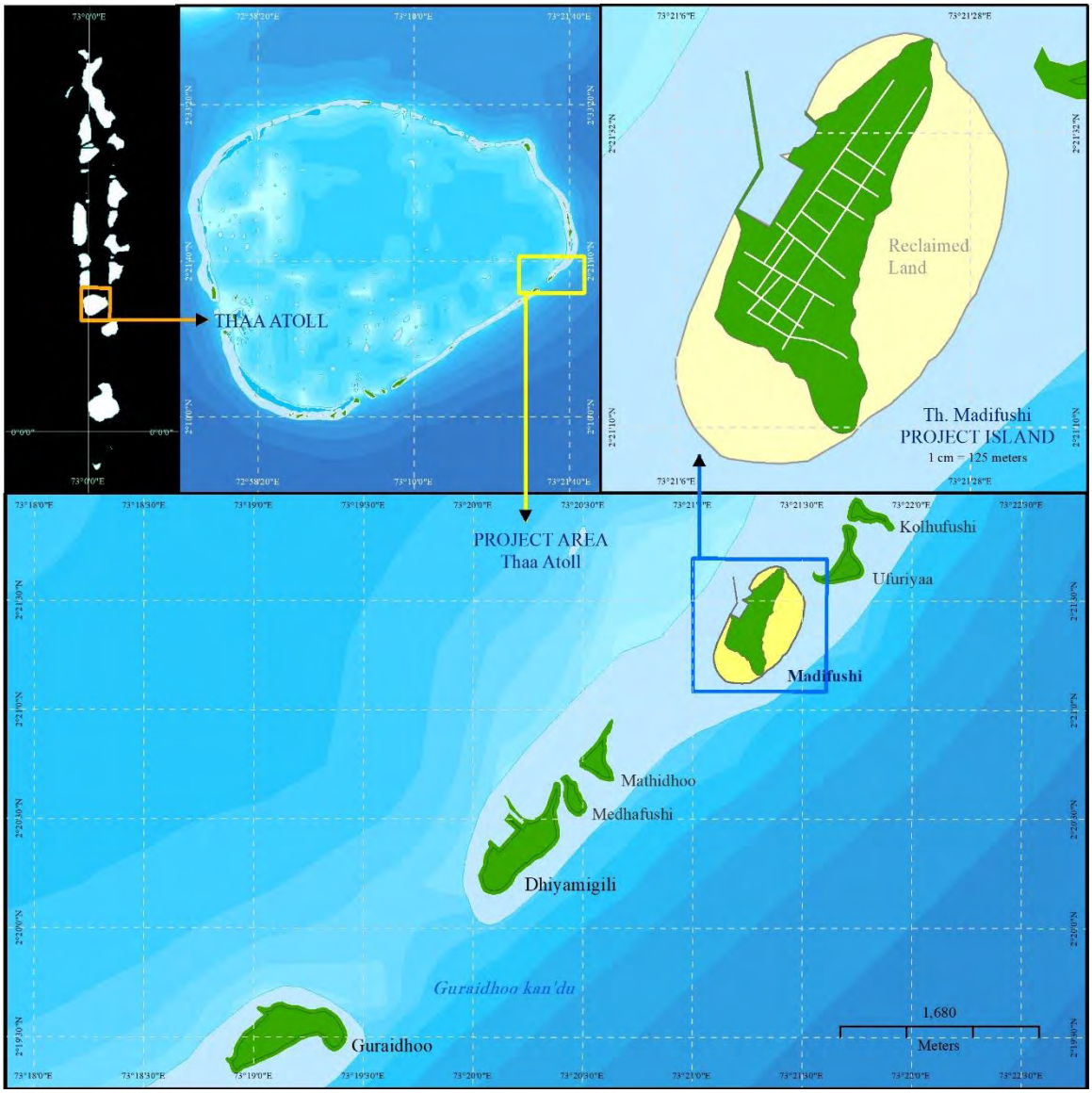


Figure 1 Project Setting

2.2. Site Location

The proposed Island Waste and Resource Management Centre (IWRMC) is located at the southern side of the island. The land has been recently reclaimed. There is no vegetation at the site. The site is easily accessible.

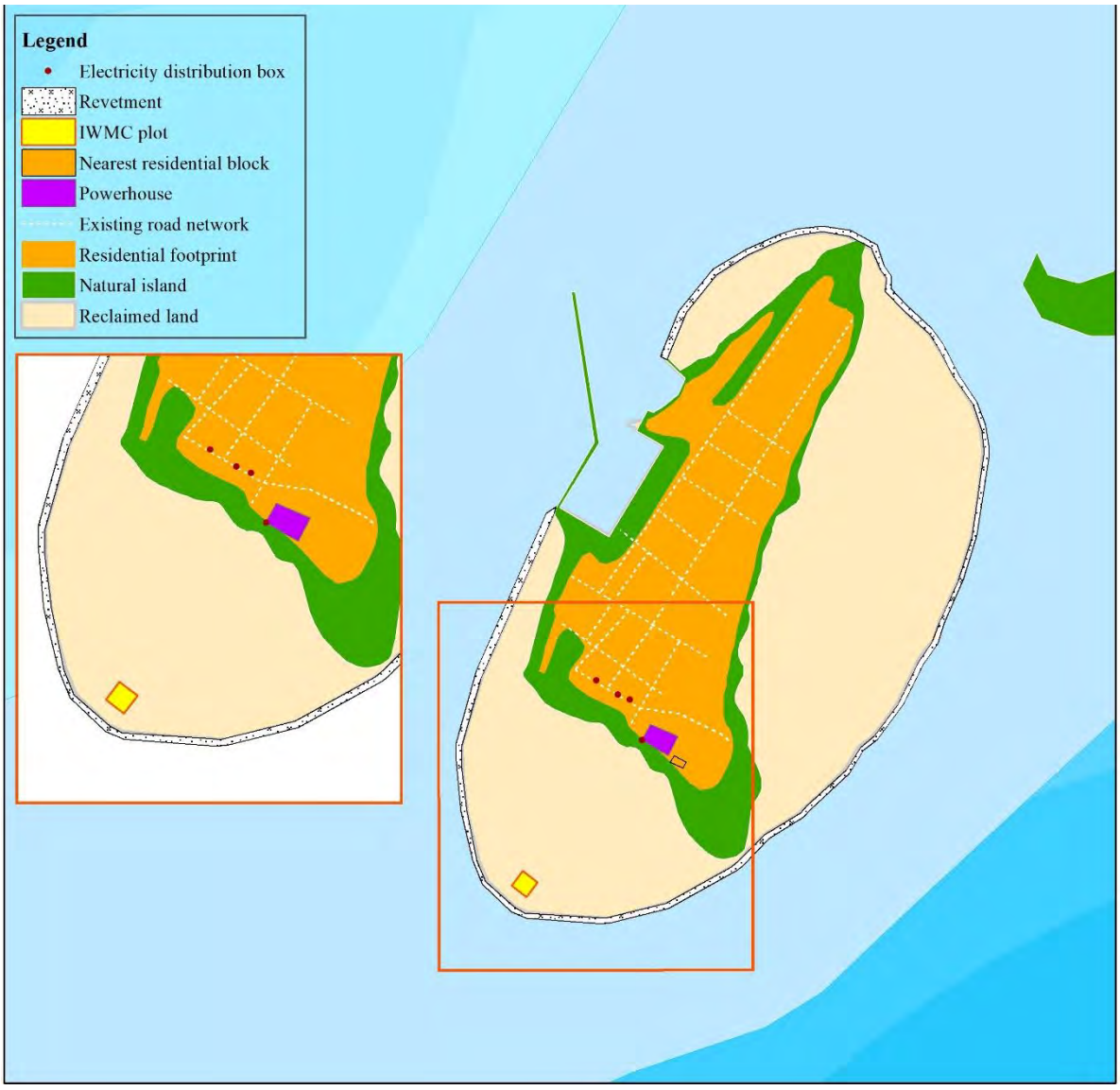


Figure 2 Proposed location for the waste management site on Th. Madifushi

2.3. The Proponent

The Proponent of the project is Ministry of Environment (ME) of the government of the Maldives. The proposed activity is part of a greater project titled "Saafu Raajje – Maldives Clean Environment Project for Zone IV and V" financed by the World Bank.

2.4. Project Duration and Schedule

The construction works of the proposed project is expected to be carried out in 12-24 weeks. A tentative schedule of the shortest work duration is found in **Table 3**.

Table 3 Tentative work plan for IWRMC

		Weeks											
#	Activity	1	2	3	4	5	6	7	8	9	10	11	12
1	Mobilization												
2	Site clearing												
3	Excavation works												
4	Substructure and superstructure work												
5	Masonry works												
6	Plastering works												
7	Roofing works												
8	Structural steel works												
9	Electrical works												
10	Plumbing works												
11	Doors and windows												
12	Demobilization												

2.5. Project Description

A-3 sized layout of the IWRMC is provided in **Annex 6**, with a scaled down version presented in **Figure 3.**

The development of the IWRMC consists initially of site selection, site approval, mobilization, followed by site construction. Site clearance is not required since the site is located in a newly reclaimed land devoid of any vegetation or undergrowth. The works include shallow excavation, substructure and superstructure works as well as masonry works. The proposed design of the IWRMC requires a shallow foundation due to the structure being a single storey structure. After the structural works are done, masonry, plastering, roofing works are completed prior to the addition of the services components such as electricity and plumbing.

The operational phase of the project will include the daily collection of waste from the households and institutions, in addition to waste management works in the IWRMC, which include;

- Sorting of waste;
- Storing of hazardous waste;
- Volume reduction of plastics, glass and metals;
- Stockpiling of sorted waste; and
- Composting of organic waste.

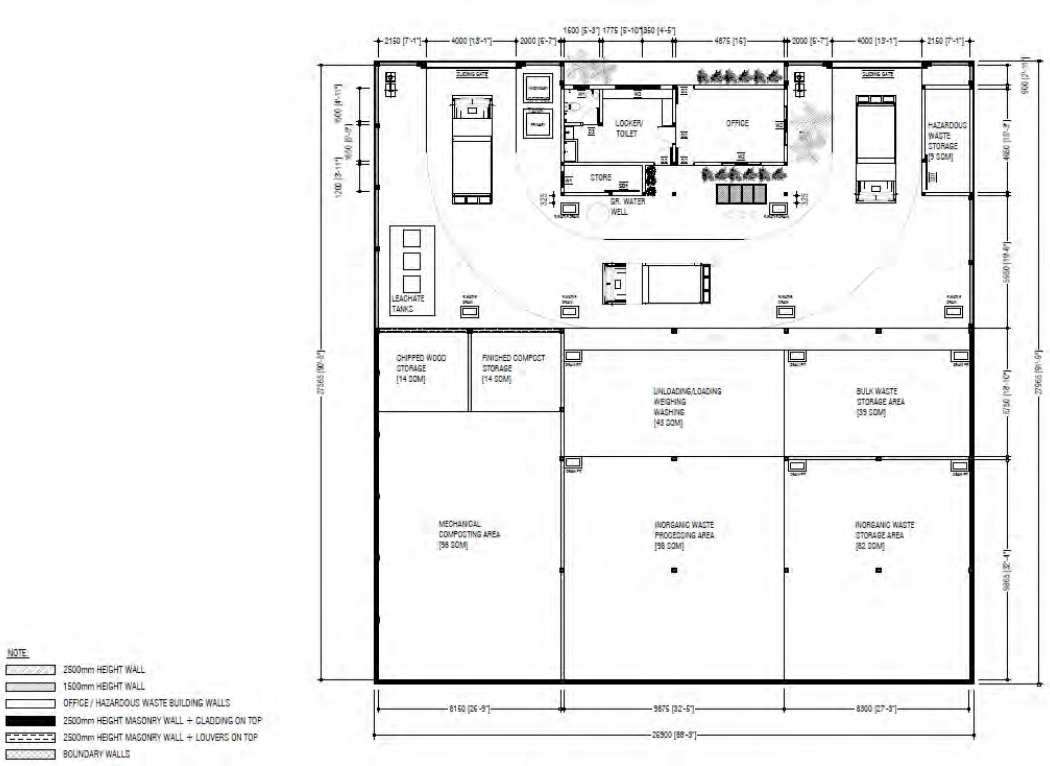


Figure 3 Proposed Layout of the IWRMC

2.5.1 Construction Phase

Construction phase of the proposed IWRMC includes the following:

a) Machinery

The following plants and equipment will be mobilized specifically for the project during construction phase.

- Vibratory plate compactor;
- Concrete mixer;
- Concrete supply pump and piping; and
- Daily 4" pump.

b) Mobilization

As the amount of input materials are relatively minor, the construction materials shall be stored inside the demarcated site throughout the construction period. The workers if sourced from outside the island can be accommodated in the existing houses with a small rent. This is expected to eliminate the need for putting up a labour quarter and can be cost effective.

c) Demarcation

Prior to beginning construction works, a survey shall be done by the contractor to demarcate the limits of the site. The site shall be fenced off and work shall be conducted within these limits.

The site in the project island requires no removal of vegetation as this site is located in the newly reclaimed area of the island.

d) Foundation

The foundation for the proposed IWRMC consists concrete footing and concrete foundation beams.

Excavation: Excavation will be undertaken to the required width, depths and dimensions of footings. Excavations will be done manually to receive the ground beams.

Concreting Materials: Cement used will be Ordinary Portland Cement. All cement will be transported in watertight containers and will be protected from moisture until used. Caked or lumpy cement will not be used.

e) Construction of Slab

Reinforced concrete slabs will be cast over the ground beams. Thickness of the slabs will differ at different locations of the IWRMC. 75mm thickness will be used in the office area, 100mm in the hazardous waste storage area, bulk waste storage area and mechanical composting area, and 150mm thickness for rest of the waste processing areas.

f) Construction of Parameter Wall

A parameter wall will be constructed surrounding the IWRMC except the gate area. The parameter wall will have a height of 2500mm (2.5m).

g) Construction of Superstructure

The superstructure of the IWRMC consists of the following:

- Waste unloading and loading area for weighing and sorting of incoming waste to organic and inorganic fractions.
- Mechanical composting area where in-vessel composting will be carried out.
- Area for storage of finished compost and chipped wood.
- Inorganic waste processing area where waste will be further segregated into plastic, metal, glass etc. and processed via baling, compaction or crushing.

- Inorganic waste storage area where the processed waste will be stored. The design considers storage of such waste for 4 – 6 months, which will then have to be transferred to the subject RWMF.
- Bulk waste storage area to store bulk waste such as old furniture, roofing sheets etc.
- Hazardous waste storage area

The superstructure of the IWRMC are roofed areas with concrete slab and brick walls. The height of the boundary wall will be 5900mm (5.9m), while the hazardous waste storage area will be 3500mm (3.5m) high.

h) Construction of Office, Toilet and Locker

An office and a toilet will be constructed towards the main entrance of the IWRMC. A 12000 BTU air-condition, lights, ceiling fans and sockets will be installed at the office. The toilet will have adequate ventilation. A wash area and a locker will adjoin the toilet. The structure will consist of 3500mm (3.5m) high walls.

i) Construction of Leachate Tank

The leachate collection tanks will be constructed close to the mechanical composting area as shown in the drawing. Excavation required for the construction of these tanks can be done manually and the excavated material is recommended to be stored on the side of plot. The drain at the mechanical composting area will be connected to these tanks.

j) Construction of Septic Tank

Construction of a septic tank is proposed to manage the sewage generated during the operational phase since a sewer connection point do not exist close to the proposed site. The tank will be constructed to ensure water tightness. Waterproof paint will be used on the masonry wall.

The septic tank consists of a primary tank of 1.3 m by 1.3 m made of 150 mm brick wall, covered with 75 mm thick concrete with 6 mm reinforcing steel placed at 150 mm centre to centre. The primary tank is 2 m deep. The primary tank is connected by a 100 mm diameter PVC pipe to a secondary tank of the same dimensions filled with 1 m of coral stone and white sand filling. The bottom 1 m of this secondary tank is perforated with 25 mm equally distributed holes to allow for discharge of treated effluent.

k) Installation of Drains

Several rainwater drains will be constructed at the open areas of the IWRMC as shown in the drawing. These drains will be connected to the septic tank. In addition to these, drains will also be installed at

the mechanical composting and inorganic waste processing areas for dealing with wastewater produced during washing of floors. The drain at the mechanical composting area will be connected to the adjacent leachate well, while the drain at the inorganic waste processing area will be connected to the septic tank. The drain at the toilet will also be connected to the septic tank.

l) Construction of Groundwater Well

A groundwater well be constructed for non-portable use with water pump installed to connect water to the different parts of the IWRMC. Water will be connected to the toilet and wash area. Water taps will be installed at waste sorting (loading / unloading / weighing), mechanical composting and inorganic waste processing areas for washing the floors.

Excavations will be done to a depth depending on the depth of the water table. After the excavation, the well base and body is fitted into the pit, and the top cover is laid on top of it.

m) Connecting Electricity

3 phase electricity required for the operations of the IWRMC will be sourced from the island power house. A 4-core power cable will be laid from the nearest distribution box which is located 400m from the proposed site.

n) Plumbing Works

Internal water piping will be laid to connect water to the different parts of the IWRMC. A water pump will be installed to connect water to the toilet, wash area, waste sorting / processing areas and the mechanical composting area from the groundwater well.

o) Installation of Firefighting Equipment

The contractor will supply and install the following firefighting equipment as part of the contract.

- 50KG DCP Trolley for collection bay (nos 2)
- 50LTR Foam Trolley for collection bay (nos 1)
- Wet Chemical 6Ltr with Cabinet for hazardous waste area (nos 1)
- Water 9Ltr with Cabinet for Office Area – Outside (nos 1)
- CO2 2KG with Cabinet for Office Area – Outside (nos 1)

p) Inspection of concrete works

Inspection of foundation, formwork and reinforcement will be made by the Proponent before concrete pouring is commenced.

q) Labour Requirements and Availability

A 10-person workforce would be involved in the construction. It is encouraged to choose workers from within the island, to reduce the impacts of influx of non-local workers. If no such arrangements are made, labour accommodation will be arranged for the 10-person workforce from existing houses.

r) Waste Management

Construction waste, which would mainly be excavated earth, nylon cement bags and general construction debris shall be collected and temporarily stockpiled in the project site. The small amounts of waste oil that may be generated from vehicles shall be contained in closed containers and shall not be allowed to leak into the ground.

A description of how various types of wastes generated from the project will be managed is given below.

- *Biodegradable waste*

Wastes such as leaves, branches, paper, and materials collected from the general cleaning of the site areas will be stored as described in **Figure 4.**

- *Non-biodegradable waste*

Materials such as plastics and glass will have to be collected separately and transported to nearest waste management facility at the end of the project construction period. These will most likely be nylon cement bags, wrappings, steel/glass leftovers and other municipal waste generated at the construction site.

- *Kitchen waste*

Food wastes and other biodegradable wastes generated in food preparation shall disposed through the existing arrangements at the island.

- *Hazardous waste*

During construction phase, hazardous waste generated from machineries such as oils, solvents, batteries etc. shall be sealed in labelled containers and shall be stored on paved hard surface before being transported to the nearest regional waste management facility. They shall be stored at the designated areas illustrated in **Figure 4**. It is essential to ensure that hazardous waste is fully contained and transported out of the island to nearest regional waste manage facility as quickly as possible. It is recommended to install signs in the designated temporary storage area.

Figure 4 Transportation route and storage area

s) Pollution and Control Measures

The following measures will be taken to control pollution during construction stage.

- Machinery to be properly tuned and maintained to reduce emissions/spills/leaks;
- fuel storage, paint, lubricants will be stored securely and bunded;
- spill kits would be made available on site to control any liquid spills;
- construction site will be wetted regularly to minimize impacts of dust; and
- all vehicles used for the project must have up to date road worthiness license.

t) Health and Safety Measures

The project involves many activities that can put workers as well as the general public to risk of injuries and accidents. However, with careful precautionary measures and good practices during the works can eliminate or reduce many of these risks. Health and safety measures for the construction phase include and are not limited to:

- Undertaking all relevant safety measure during construction works shall be part of the legal contract to undertake the works. The contractor shall be made to bear the responsibility to protect the workers as well as the general public from activities related to the project.;

- Strict supervisor shall take place during construction and decommissioning phase of the project;
- Only experienced and licensed operators will be allowed to operate heavy machines;
- First aid kit should be made available at the work site;
- PPE should be provided to all workers and the work force would be required to use safety gears as appropriate;
- Fire extinguishing equipment would be available at the site;
- Operation of any heavy machinery will need the assistance of a banksman as all times;
- All heavy lifts must be supervised and slings inspected; and
- Appropriate safety signs shall be placed at the work site.

u) Demobilization

The demobilization plan will commence in the last week of the contract. This would involve removing all items and personnel belonging to the contractor and handing over of the site to ME. Prior to demobilization and site handover site inspection by the officials of the ME will take place to ensure that project has been completed to the full satisfaction of ME and scope of work fully competed. The demobilization shall also involve removal of all residual waste generated from the project and repairing of any public property damaged during the project. These will be the responsibility of the contractor.

2.5.2. Operational phase

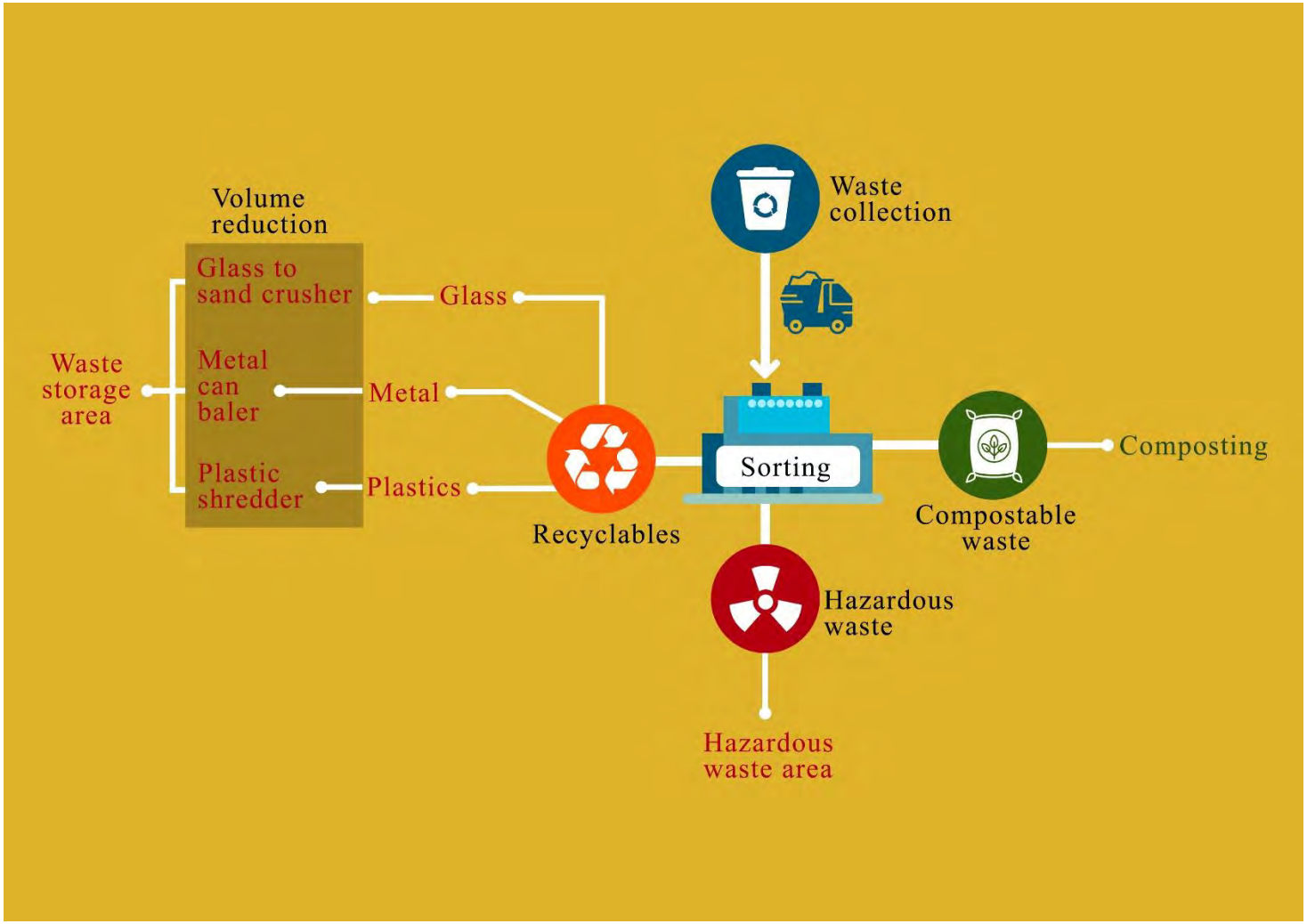


Figure 5 Operational Phase Flow Chart

The following section will briefly highlight the operational aspects of the IWRMC. This includes the machinery and equipment proposed to be used in the IWRMC, in addition to the main activities to be carried out at the IWRMC and within the island. The IWRMC activities begin from collecting waste generated at source and transporting it to the IWRMC. This collected waste will be pre-sorted into categories such as compostable waste, recyclable waste, bulky waste and hazardous waste. Compostable waste is used in making compost while glass, plastics and metals undergo volume reduction processes before being stored in their respective compartments. The hazardous waste is stored in the hazardous waste store.

a) Machinery and equipment proposed

The main machinery proposed to be used in the operations of the IWRMC is the in-vessel composting machine that will be used to treat organic waste. In addition to this, the IWRMC will require general equipment and tools needed to handle the waste. These include wheelbarrows, garden hoes, shovels, buckets and cultivators. This equipment will be used during the IWRMC operation for handling as well as composting operations.

Other equipment required includes waste volume reduction equipment such as a plastic shredder, metal can baler, wood chipper, and glass to sand crusher. Typical equipment required is detailed below.

Table 3 Typical equipment proposed for waste management works

Waste Management Equipment
Chainsaw
Wheelbarrow
Heavy Duty Gumboots
Heavy Duty Hand Safety Gloves
Long Handled Flathead Steel Rake
Long Handled Cultivator
Garden Hoe
Round Point Shovel
Square Point Shovel
20L Bucket
40L Bucket
Polypropylene Surgical Mask
Weighing Bench Scale
Wheelie Bins
Glass to Sand Crusher
Plastic Shredder
Metal Can Baler
Wood Chipper
In-vessel composting machine

b) Waste Collection

During the consultation held with the Council during the preparation of the original ESMP, it was learnt that the IWRMC operational works will be conducted by the Council. The waste will be collected from source using a vehicle.

c) Sorting, Processing and Storage of Incoming Waste

Incoming waste is required to be sorted to separate biodegradable and non-biodegradable waste. The separation of kitchen waste, yard waste and other types of waste at household level can streamline this process.

Table 4 Domestic Waste Categories

Incoming Domestic Waste			
Biodegradable materials	**Hazardous materials**	**Others**	**Recyclables**
Organics • Food waste • Garden waste • Animal waste Paper & Cardboard • Printed paper • Cardboard	• Paints & Solvents • Batteries • Cleaners • Expired medicine • Medical waste • Pesticides • Special (Nappies, tampons)	• Textiles • Wood • Inert (Dust/Dirt/Ash/Rock) • Liquid container	• Metal • Plastic • Glass

As per the IWRMC site layout plan, further segregation of the received waste will be undertaken at the 43sqm area proposed for Waste Unloading, Weighing and Washing. Here, the collected waste will be kept, further sorted into their respective categories and weighed. Inorganic waste will then be set for processing to the 98sqm Inorganic Waste Processing Area. This will be achieved via crushing of glass, shredding or plastics and baling of metal cans. The processed waste will then be stored in 82sqm Inorganic Waste Processing Area for 4 – 6 months until transfer to the subject Regional Waste Management Facility (RWMF) is achieved. Hazardous waste will be taken to the hazardous waste store and stored separately. Likewise, bulky waste such as old furniture, roofing sheets etc. will be stored in the 39sqm Bulk Waste Storage Area.

Organic waste will be sent to the proposed Mechanical Composting Area (a 98sqm area) to undergo in-vessel composting, while received wood will be chipped outside at the compound or at the mechanical composting area using a wood chipper and stored in the respective 14sqm Chipped Wood Storage. The compost produced will be stored in the 14sqm Finished Compost Storage.

d) Composting

One of the main operations that will be conducted in the IWRMC is the composting of the organic waste such as kitchen waste and green waste. Composting uses the process of the slow decomposition of the organic matter by various microorganisms, in an optimized and controlled process. The process is controlled in terms of parameters such as input materials, temperature, moisture and pH. The finished product of composting can be sold as fertilizer, thus enabling the reuse of the waste collected within the island.

The In-Vessel Composting Process:

The in-vessel composting machine will be supplied at a later stage after the completion of the civil works required for its installation and hence is considered as an associated activity of the subject project. As per the current project implementation schedule, the machine is expected to be supplied, installed and commissioned within the last quarter of 2021. The proposed technology is more advantageous and convenient than the traditional windrow-based composting, which many of the islands are struggling to effectively implement due it being highly labour intensive.

Unlike a normal windrow-based system, the technology involves initial 'in-vessel' processing of the waste in the "Organic Waste Converter [OWC]" machine. The bio-degradable waste is chopped to the desired size; moisture is adjusted to 40-45%, using an organic absorbent (typically sawdust or shredded leaves), if required, and treated with Bioculum OWC^{TM} [a formulation with 5 different Bacillus species] @ 1-2gm per kg of waste. The OWC machine has a running time of 15 – 30 minutes per batch, depending on unit and batch size. The treated waste is kept for composting and curing. This system has been designed for south Asian conditions as experienced in India and the Maldives.

It is claimed *"that treatment, composting and curing is achieved within a short time of 10 to 12 days. Processing of waste through the OWC machine overcomes the problems of odour, leachate generation and ground water contamination associated with traditional methods of waste disposal. It converts unsightly and odorous garbage into a beneficial material devoid of foul odours and unsightly appearance. It is an innovative method for the bio-stabilization and beneficial conversion of organic waste. The organic material produced by this method not only provides nutrients to the plants, it also improves the organic-carbon content and moisture retaining capacity of the soil."*

Advantages claimed for the OWC include:

- *Simple and convenient to operate without the need for constant attention;*
- *Short processing times ensures economic in use with low energy consumption;*
- *Requires minimal maintenance;*
- *Beneficial to the environment.*

The OWC Process:

Pic 1: Segregate the waste

Pic 2: Input wet waste into OWC with Bioculum and Absorbent

Pic 3: After 15 minutes collect raw compost from OWC

Pic 4: Place raw compost in the curing system for 10-day maturation cycle

The pictures give an overview of the CWC process. If required, as shown in ***pic 1***, waste can be further sorted and segregated. The waste is then added to the OWC unit, ***pic 2***, together with the Bioculum, which is a bacterial powder that enhances the natural aerobic process. The Bioculum is added at the rate of 1 gm/kg of raw waste. Also added at this stage, if required, is the absorbent at a rate of up to 2 kg per batch. The OWC unit is operated for a period of 15 – 30 minutes, depending on size of unit and batch size, during which the waste, Bioculum and absorbent are mixed to achieve a homogenous consistency. The raw compost is discharged into crates of 25kg capacity, ***pic 3***. The crates are then placed in curing racks for a period of 10 to 12 days, ***pic 4***. The curing racks are equipped with an automatic fogging device that maintains moisture content at the correct level thereby ensuring curing is completed.

At the end of the curing period, the crates can be emptied with the cured compost ready for use; however, after emptying the crate, leaving the cured compost for a further seven days enhances the composts maturity, providing a higher quality product. Typically, the cured compost amounts to some 25 – 35%, by weight, of the raw waste input.

It is worth noting that the amount of waste that can be processed through the OWC each day is determined by the operating hours. This provides flexibility during times of unexpectedly high inputs or following unanticipated outages. It also allows increasing throughputs to be accommodated at minimal cost. The critical sizing and potential pinch point is the curing system; however, additional racks and/or crates require only small areas of land and modest capital expenditure.

e) Sewage Management

The 'primary tank' facilitates 'primary treatment'. The separation of liquids and solids by gravity - to take place. Raw sewage flows into the tank and the heavy solids, 'sludge', sink to the bottom, lighter solids, grease and oils or 'scum' float to the surface. Some of the sludge is degraded by naturally occurring anaerobic (without oxygen) bacteria. The liquid effluent flows to the secondary tank which is filled up to 1 m with coral stone and white sand layer. This tank is perforated at the bottom 1 m to allow for discharge of liquid effluent into the land.

The most environmentally sound method for disposing the domestic sludge is allowing it for drying in a sludge drying bed. The dry sludge can be used following appropriate treatment, as part of compost. Sludge will be dried on a sludge drying bed.

f) Waste Transport to a Regional Facility

The proposed IWMC is planned to manage a portion of the waste produced at the island level, with the unmanaged waste (approximately 30% of waste generated within the island to be transported to a central waste management facility). The projected capacity for 1 month's waste for the island of Madifushi is shown below.

Organic wastes make up the bulk of the waste stream in Madifushi, which can be managed within the island itself via composting. The proposed technology for composting (in-vessel composting using a compost machine) ensures that organic waste generated in the island is treated and managed effectively at the shortest possible time. The inorganic waste received will be subjected to volume reduction via shredding, crushing, baling and compacting and subsequently stored in the respective areas designated for their storage within the IWRMC. The IWRMC is designed to carter for the storage of such wastes for up to 4 – 6 months, which would then need to be transported to a RWMF for further treatment and disposal. Hence it is imperative that waste from the island is routinely transported to a RWMF quarterly or bi-annually.

The subject RWMF for Zone 4&5 is the Zone 3 RWMF (Thilafushi), which is currently in the process of being developed into a contemporary facility via the Greater Male' Environmental Improvement and Waste Management Project funded by the ADB. This regional facility will primarily use 2 waste to energy (WtE) plants of 250 tons per day capacity and ancillary facilities for treating the residual waste coming from the islands. The project is expected to be completed and the regional facility made fully operational by the year 2024. Since the IWRMC will be made operational prior to this, intermediary storage agreements may require to be facilitated in Zone 3 RWMF, via MCEP.

2.6. Project Inputs and Outputs

The table below elaborates the approximate amount of resources that will be required for the project. These include workers, fuel, water, and construction materials.

Table 6 Project Inputs

	Input Resource	Type and Amount	Means of obtaining the resource
CONSTRUCTION PHASE	Workers	10	Around 10 workers. Contractor is encouraged to use local or regional workers as much as possible. If expatriate workers are used, they must carry valid work permits. Construction workers are expected to be accommodated in local houses and / or guesthouses. No temporary site setup is required for this project. Contractor will make arrangements with the local council regarding accommodation arrangements.
	Site Supervisor	1	The site supervisor should ideally be local as he/she should be able to regularly communicate with the island council and the community over matters related to the project. It is important for the supervisor to have a fairly good undertesting of social and cultural norms of the society.
	Site Engineer	1	The site engineer shall not necessarily be based in the project island but should visit frequently during construction.
	Water for Construction	150 litres per day	Groundwater wells present in the island.
	Construction Materials	Concrete, cement, flood lights, G.I. pipes, metal sliding doors, emulsion paint, Lysaght Roofing Sheet, 3 phase power sockets, ceiling fan and Timber	Imported or purchased where available locally. Contractor will make arrangements to import or purchase these materials and transport to the island.
	Construction Machinery	Pickups, trucks or wheelbarrows (for land transport of construction material), transfer vessel, cement mixing machine.	Responsibility of the contractor. Local resources such as pickups for hire will be utilized as much as possible. If not available locally the contractor will import these machineries.
	Fuel	Diesel	Local suppliers
	Portable Fire Extinguisher	1 Extinguisher	Responsibility of the contractor. Imported or purchased locally and to be brought to the site during mobilization.
OPERATIONAL PHASE	Equipment	• 1 In-vessel composting machine • 1 Glass crusher, 1 Metal Can Baler • 1 Plastic Shredder • 1 Wood Chipper • 1 Waste Collection Vehicle	Responsibility of the Proponent (Capital Investment) and Island Council (O&M). Purchased locally or imported.
	Firefighting Equipment	• 50KG DCP Trolley for collection bay (nos 2) • 50LTR Foam Trolley for collection bay (nos 1)	Responsibility of the Proponent (Capital Investment) and Island Council (O&M). Purchased locally or imported.

		• Wet Chemical 6Ltr with Cabinet for hazardous waste area (nos 1) • Water 9Ltr with Cabinet for Office Area – Outside (nos 1) • CO2 2KG with Cabinet for Office Area – Outside (nos 1)	
	Water for non-portal use	Groundwater	Groundwater well within the IWRMC
	Power	3-phase power for operation of waste management equipment.	From the existing 25sqmm 4 core power supply cable laid from the nearest distribution box to the waste yard distribution board.
	Labour	About 3 workers to manage waste in the IWRMC and 3 workers to provide collection services to the community.	Responsibility of the Island Council. From the local community or expatriate workers. Island council or the outsourced third party will make accommodation arrangements within local houses and guesthouses if expatriate workers are recruited.
	Fuel	Diesel	Local suppliers.
	Waste	Waste generated within the island. Approximately 1.4 ton of waste per day.	Waste will be collected from households and businesses within the island.

Table 7 Project Outputs

	Output Resource	Type and Amount	Means of managing
CONSTRUCTIOPHASE	General Construction and Demolition Waste	Moderate amount of Solid Waste	Construction and demolition waste generated will be reused as much as possible. Any remaining waste will be transferred to the nearest regional facility by the contractor.
	Municipal Waste	Small quantity	Removed to the disposal site designated by the council.
	Soil	Excavation for substructure	To be used as backfilling during construction.
	Dust	Moderate amount during cement mixing and excavation	Wet the construction site regularly.
	Waste oil and diesel	Small quantity	Barrelled and kept at the temporary C&D waste storage area and transfer to the nearest regional waste management facility for disposal during demobilisation.
	Greenhouse Gas Emissions	Small quantity. Emissions from construction material transporting vehicles and construction machinery.	All vehicles and machinery must be well tuned.

OPERATIONAL PHASE	Compost	In-vessel composting.	Used locally for agricultural purposes or sold to nearby resorts.
	Inorganic Waste	Crushed glass, compacted metal, shredded plastic.	Reused within the community as much as possible. Remaining waste stored in their respective area within the IWRMC and transferred to the subject RWMF quarterly or bi-annually
	Greenhouse Gas Emissions	Electricity usage. Minute quantity.	N/A

CHAPTER 3 EXISTING ENVIRONMENT

3.1. Description of the Environment

Th. Madifushi has a natural land area of 20 ha. An additional 29.32 ha of land has been reclaimed. The island's community of 1336 people has a settlement footprint of 15 ha. This is 75% of the natural island's total land area. The land reclamation project at Madifushi is in its final stages. Harbour expansion works are ongoing at the island. Land allocated for construction of the IWRMC is located in the newly reclaimed area.

Figure 6 (A) Newly reclaimed area and coconut palms of the islands natural vegetation line (B) Boat building work (C) Area being developed as an artificial beach (D) Coastal protection of newly reclaimed area

The coastal area close to the project site has a protective revetment built during land reclamation. The revetment should provide sufficient protection, however, there have been reports of large swells breaching through the revetment and causing damage to its structure. As the land has been recently reclaimed and reclamation works in its final stages; there is no vegetation line or a protective vegetation belt present at the site.

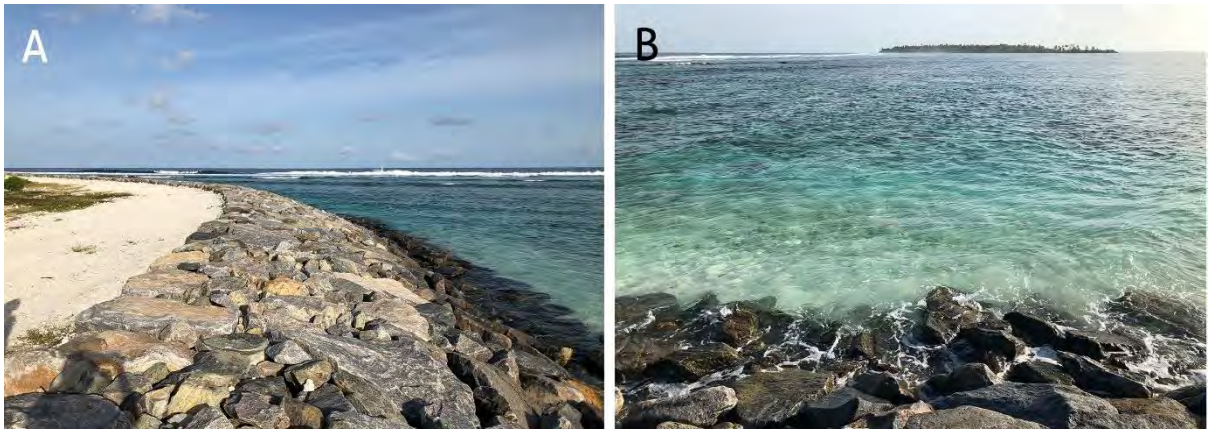


Figure 7 (A) and (B) Revetment close to the project area

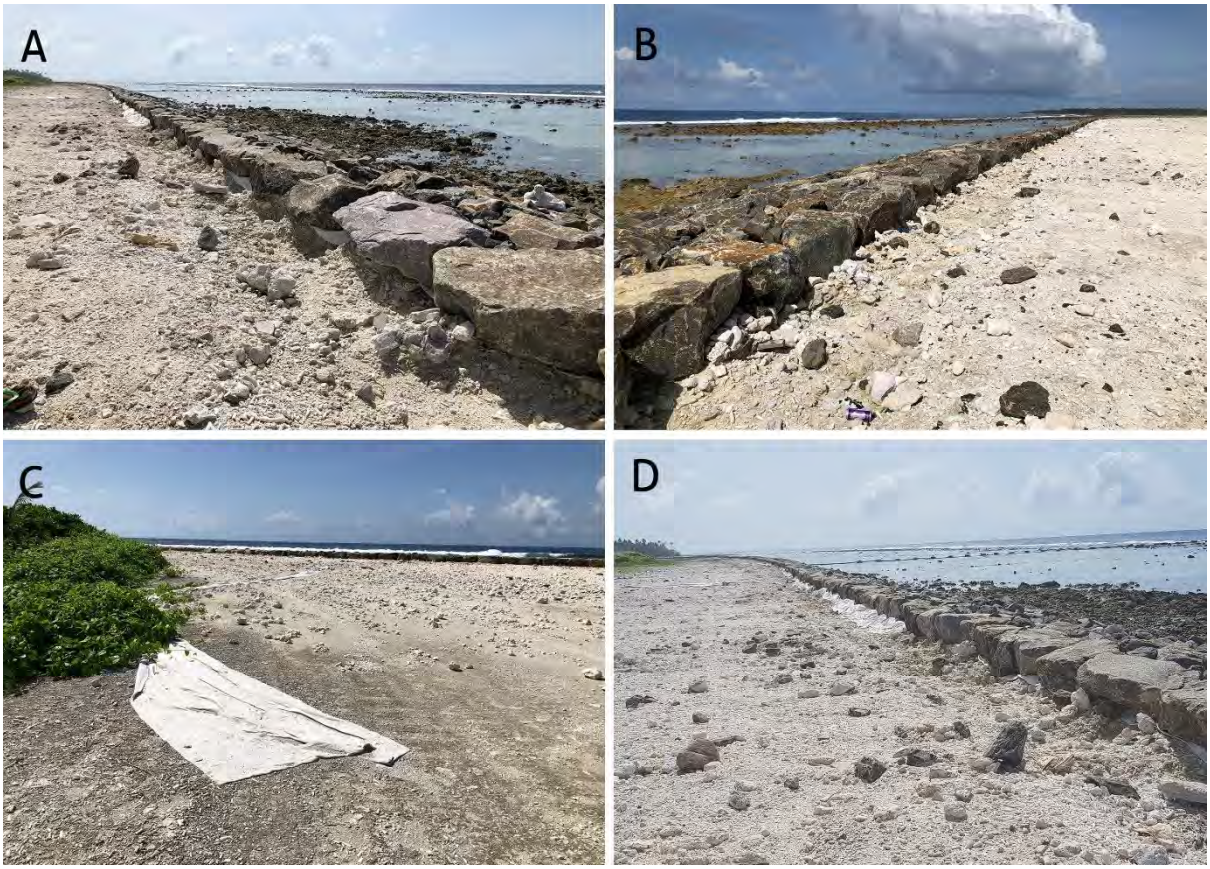


Figure 8 (A) to (D) Damage caused to the revetment and geotextile in recent 'udha' incident

3.2. Project Site

The proposed Island Waste and Resource Management Centre (IWRMC) is located at the southern side of the island. The land has been recently reclaimed. There is no vegetation at the site. The site is easily accessible. The project site was selected by a process involving the Maldives Land and Survey Authority

(MLSA). EPA's "Environmental Guideline for Site Selection of Waste Management Centers (Sep 2017) is referred to during the site selection process.

Figure 9 A, B, & C: Vegetation at the proposed site

3.2.1. Site zoning guidelines by EPA & MLSA

The EPA has provided recommendations for the optimum zoning of the IWRMC site. The distances include, the site being at least 10-15 m from the revetment, at least 30 m from the nearest freshwater well, at least 40 m from the nearest recreational area. The field surveys done on the island recorded the locations of the aforementioned categories and the comparison table for the actual distances and EPA guidelines are provided below:

Table 8 Comparison between the proposed site location and EPA guideline distances

Location	Distance from site (m)	EPA Recommended Distance (m)
Revetment	21.69	10-15
Freshwater well	265.24	30
Recreational area	40+	40
Residential area	263.9	30

As seen on **Table 8**, the site meets all the recommendations of the EPA

3.3. Current State of Waste Generation

The rate of solid waste production depends on the socio-economic situation, the level of industrialization, type and numbers of industries, climate, and land use and therefore can vary from island to island. However, such variations are not expected to be significantly different from island to island and therefore in making estimates waste audits conducted for similar islands can be safely applied. Hence, past waste audits had been used to estimate waste composition and quantities for Madifushi.

According to the waste audit conducted in 2016 for Zone 1 (which includes HA, HDh, and Sh.) an average per capita waste generation was found to be 1.30 kg/person/day. The study also finds that, by far the most significant proportion of the waste is green and compostable (75%), plastics comprising of 6%, paper and cardboard making 5% of the waste, 1% metals, 6% hazardous waste, 1% glass and 6% attributed to all other types of waste.

In another waste audit study conducted by the Ministry of Environment in 2011 under the Maldives Environmental Management Project (MEMP) for five inhabited islands in the north central region of the Maldives (Hinnavaru, Naifaru, Eydhafushi, Maalhos, Lhohi), it was determined that 0.83 Kg of waste was generated/person/day. Similar to the above study it was revealed that organics was the largest component making 65% of the household waste stream, plastics comprising of 5%, paper and cardboard making 5% of the waste, 1% metals, 8% hazardous waste, 2% glass and 8% attributed to all other types of waste.

The estimated percentage of organic waste as well as the sum of the plastics, glass and metals for both zones were found to be very similar hence the averages of the two studies were taken and considered to be the estimated percentages of various types of waste generated in Madifushi Island as shown in **Figure 10**. Similarly, per capita waste generation for the island had been determined by taking the average per capita in the two studies above which is 1.07 Kg/person/day. This finding is expected, since the lifestyle and food habits are similar for most of the inhabited islands across Maldives with the exception of Male' and few other cities.

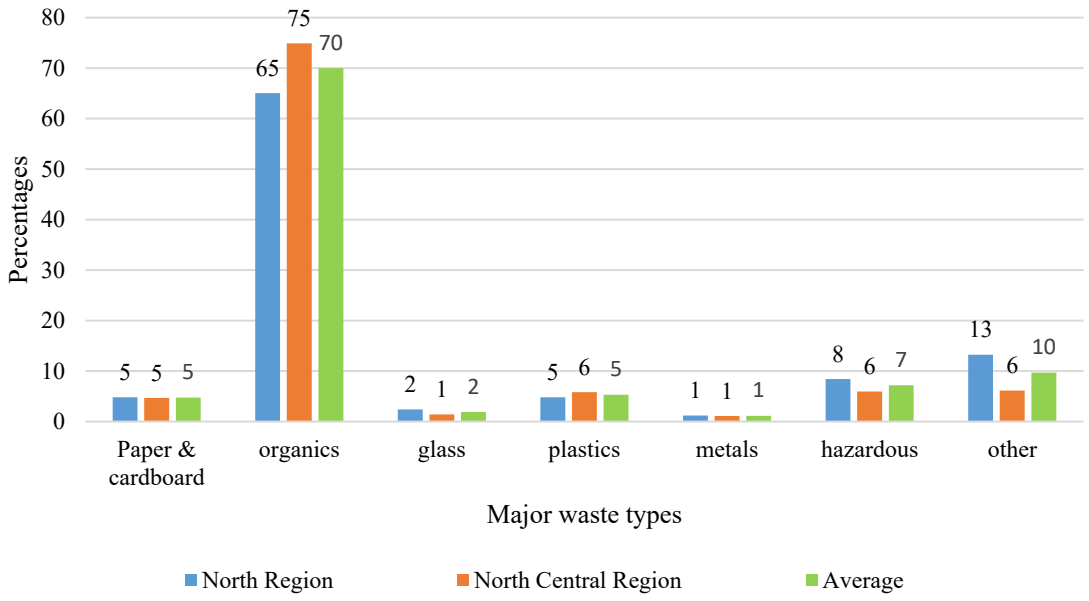


Figure 10 Waste composition comparison in two separate regions of the Maldives

Hence it is expected that the majority of the waste generated in the island to be organic wastes at 70%, which include kitchen and green wastes or compostable waste. Paper and cardboard wastes is estimated at 5% of the total waste generated. Recyclable materials such as plastic, metals, and glass make up 8% of the composition. Approximately 7% of the total waste generated is chemicals and hazardous waste and all other types are expected to be at 10%. Using these estimates and considering the current population of Th. Madifushi, the daily waste generation was determined as shown in **Table 9**.

Table 9 Estimated waste generation quantities of Th. Madifushi households

Waste Type	Average (%)	Waste Generation (Kg/Person/Day)	Total (Kg/Day)
Organic (kitchen & green waste)	70	0.75	1004
Paper / cardboard	5	0.05	72
Glass	2	0.02	29
Plastic	5	0.05	72
Metals	1	0.01	14
Chemicals / Hazardous	7	0.07	100
Others	10	0.11	143
Total	**100**	**1.07**	**1434**

Hence it is estimated that a total of **1434 Kg** of solid waste will be generated daily at Madifushi.

3.4. Current state of waste management in Th. Madifushi

The majority of waste sources in Th. Madifushi is households. Boat building is one of the notable commercial activities observed in the island. As far as institutions are concerned, typical institutions that are commonly found in an average island were found. These include School, Health Centre, Secretariat of Island Council and magistrate court. Agriculture is not practiced at a large scale. The island has two cafés' currently in operation

Madifushi Council allocated a 3000 sqft area as the island's designated dumpsite (see Error! Reference s ource not found.). This area is demarcated with compartments for separated metals, glass and plastics. During the site investigations it was observed that this area was completely filled up during the two years of its operation. The operation of the dumpsite as well as cleaning of the public spaces is being conducted by the Women's Development Committee (WDC). The council stated that the dumpsite has filled up due to there being no way to reduce the volume of the waste, nor there being any way to transport the waste out of the island. As the dumpsite has been filled, waste is now being dumped in the open area next to the demarcated dump (see Error! Reference source not found.). Green waste is regularly burned here. K itchen waste is dumped into the lagoon. The island council stated that waste is separated at household level. There are three battery powered mini pickups that operate on the island to provide waste transportation service for approximately 100 – 150 MVR per month. These vehicles are operated by private parties, according to the Island Council.

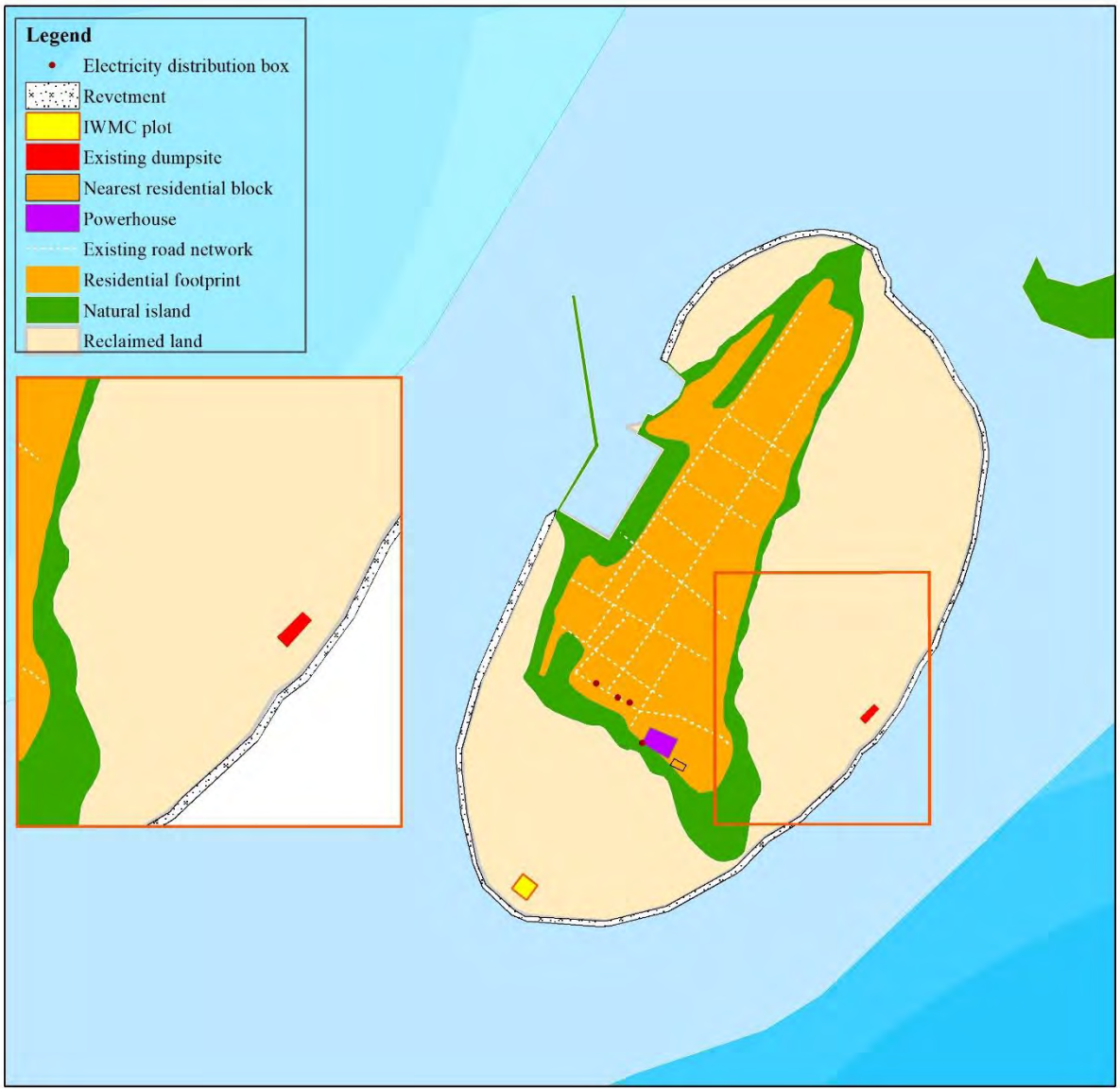


Figure 11 Areas where waste is currently disposed at Th. Madifushi

The current state of waste management on the island is summarised in **Table 10.**

Table 10 Current waste management status of the island

Parameter	Yes	No	Number	Description
Harbour (accessibility)			-	• Determined to be accessible. Ramp provided
Waste transportation			-	• Waste collection services are provided by private parties
Vehicles for waste transportation			-	• Three mini pickups belonging to private parties. No such vehicles belong to the Council
Waste management equipment			-	• No waste management equipment
Presence of dumpsites			1	• 1 dumpsite is present
Dump site demarcated				• Site is demarcated
Separation of waste at dumpsite			-	• Waste is separated into metal, plastic, glass, green waste
Burning waste			-	• Green waste is burnt regularly
Burying waste			-	• Waste is buried to reduce volume
Dumping waste into the beach/sea			-	• Kitchen waste is dumped into the lagoon
Presence of large waste piles			-	• Dumpsite has filled up during the two years with no means of reducing volume of transporting the waste out of the island
Pollution of inland/other areas			-	• Terrestrial pollution of inland areas is controlled
Clinical waste management			-	• Clinical waste is managed at the Health Centre
Public area waste collection			-	• Council contracts Women's Committee to clean and collect waste from public areas.
Presence of waste bins			-	• No
Presence of workers			-	• Women's committee is contracted to operate the dumpsite
Electric connection at the dumpsite			-	• No

Figure 12 Current state of waste disposal in the island. (A) and (B) Mixed waste outside current dumpsite (C) Metal waste accumulated at the current dumpsite (D)Construction waste accumulated.

Table 11 Type of waste separated, burnt, buried and dumped at the island (Highlighted cells show which waste type is managed in the stated way)

Types of waste separated	Types of waste burnt	Types of waste buried	Type of waste dumped into beach/sea
Plastics	Plastics	Plastics	Plastics
Metals	Metals	Metals	Metals
Construction	Construction	Construction	Construction
Yard/Organic	Yard/Organic	Yard/Organic	Yard/Organic
Kitchen	Kitchen	Kitchen	Kitchen
Hazardous	Hazardous	Hazardous	Hazardous
Diapers	Diapers	Diapers	Diapers
Paper/cardboard	Paper/cardboard	Paper/cardboard	Paper/cardboard
Partial separation of mixed Waste	Mixed Waste	Mixed Waste	Mixed Waste
All	All	All	All

3.5. Island Waste Management Plan

According to the Waste Management Regulation of the Maldives, Island Councils are required to formulate Island Waste Management Plans (IMWP) in coordination with the Atoll Councils and get subsequent approval from EPA. Th. Madifushi has a draft IWMP which has not been approved by the EPA at the time of report preparation. According to EPA the latest revision was submitted by the Island Council on September 2020, but it was not approved since minor revisions are still required. The IWMP sets objectives, goals, user fees and activities on waste management for the next 5 years.

During the initial consultation with the Island Council, it was stated that the Council plans to conduct the operational activities of the IWRMC themselves by hiring staff for waste collection and IWRMC management. A fee of 150 MVR per household is planned to be taken monthly to conduct the operation sustainably.

Goals and Objectives

The overarching objective of the IWMP is to sustainably manage waste in Th. Madifushi in an environmentally friendly manner and thereby resolve the difficulties faced by the community including public health concerns.

Specific objectives of the plan are:

1. Formulate and enforce comprehensive regulations and principles on waste management;
2. Inform the community and increase public awareness on the advantages and benefits of keeping the island clean;
3. Make a community transition towards waste reduction and recycling practices;
4. Procure waste management equipment and provide the required trainings;
5. Establish systematic mechanisms to collect waste from households and other places, and bring to the IWRMC;
6. Proper segregation, storage and management of waste in the IWRMC;
7. Manage waste in a financially sustainable model by taking user fees from households and other places;
8. Maintain cleanliness of public places; and
9. Formulate and enforce island level regulations to manage priority waste.

Activities and Programs

The following programs and activities are planned to achieve the objectives of the plan

Object 1*: Formulate and enforce comprehensive regulations and principles on waste management*

- Formulate island waste management committee;
- Develop an island level waste management regulation and publish it in gazette; and
- Make the public aware of the regulation and properly enforce it.

Objective 2: *Inform the community and increase public awareness on the advantages and benefits of keeping the island clean*

- General public awareness programs; and
- Awareness programs targeted for school children.

Objective 3: *Make a community transition towards waste reduction and recycling practices*

- Conduct a campaign to encourage reduction in single use plastic usage;
- Provide information to school children on how certain waste materials can be used to prepare recyclable items; and
- Exhibition for school children to showcase and display recycling practices.

Objective 4: *Procure waste management equipment and provide the required trainings;*

- Procure equipment needed for IWRMC operations;
- Establish mechanisms to install the procured equipment at the IWRMC; and
- Train staff on O&M of the equipment.

Objective 5: *Establish systematic mechanisms to collect waste from households and other places, and bring to the IWRMC*

- Collect waste from households at a designated time each day.

Objective 6: *Proper segregation, storage and management of waste in the IWRMC*

- Segregate waste into 5 parts at household level and during collection;
- Prepare compost using biodegradable waste;
- Resale of reusable items such as metals;
- Compact inorganic waste that cannot be reused and transfer to a RWMF; and
- Place dustbins in public places such as parks and harbor area.

Objective 7: *Proper segregation, storage and management of waste in the IWRMC*

- Formulate the monthly fee structure for waste collection and management;
- Consult the public regarding the proposed fee structure; and
- Finalize and implement the fee structure.

Objective 8: *Maintain cleanliness of public places*

- Place dustbins in public areas.

Objective 9: *Formulate and enforce island level regulations to manage priority waste.*

- Introduce provisions to implement extended producer responsibility (EPR) in the land agreements leased to private parties for industrial purpose;
- Establish island level guidelines or procedures in line with health policies to deal with healthcare waste;

- Facilitate storage of hazardous and priority waste at the IWRMC and organize its subsequent transfer to a RWMF; and
- Hazardous waste and priority waste to collected, handled and stored according to the WMR, where lidded contactors with warning signs shall be used for its transport.

User Fees

The IWMP states the following monthly user fees for providing Waste Management Services and corresponding revenue expected to be generated from it.

Table 12 WM user fees and expected income

#		Fee (MVR)	Quantity	Total (MVR)
1	Households	100.00	182	18200.00
2	Small Businesses	130.00	14	1820.00
3	Restaurants and Cafes	150.00	3	450.00
4	Carpentries	120.00	2	240.00
5	Workshops / Vehicle Repair Garages	130.00	0	0
6	Government Offices	150.00	11	1650.00
7	Boatbuilding huts	150.00	3	450.00
8	Large Businesses	130.00	2	260.00
	TOTAL			**23070.00**

Stakeholder Consultation

The IWMP was prepared in consultation with relevant stakeholders. Details of this consultation is provided in **Chapter 6** (Stakeholder Consultations) including the list of stakeholders met and the main outcomes of the discussions held.

3.6. Unassigned Waste Dumping

The roads of the island generally appeared clean. Unassigned waste dumping was not observed during the site visit.

3.7. Vegetation Removal

The proposed project does not involve removal of any vegetation as the site is located in a newly reclaimed area, devoid of any significant vegetation or undergrowth.

3.8. Environmentally Protected Areas and Sensitive Areas

Environmentally protected or sensitive areas are not present in Madifushi, while no sensitive areas exist at a 10km radius from the island.

The nearest sensitive areas to the Madifushi are Kanimeedhoo beach and Veymandoo mangrove area both located at a distance of approximately 34km from the island, at the southern parts of the atoll, while the island maintains distances of 41km and 43km to the sensitive areas located west of Thaa atoll, namely Fondhoo and Kafidhoo respectively. The proposed project is not envisaged to bring any negative impacts to these sites due to the long distances coupled with being separated by sea.

Table 13 Environmentally sensitive areas in Thaa Atoll

#	Sensitive Area	Description	Distance from Madifushi (km)
1	Kanimeedhoo Beach	Nesting place for turtles and the reef around the island is habitat for turtles	34
2	Veymandoo Mangrove Area	Mangrove area	34
3	Fondhoo	Nesting place for sea birds Kirudhooni and valla. Representative marine environment.	41
4	Kafidhoo	Nesting place for sea birds Kirudhooni and valla	43

3.9. Areas of Historic and Cultural Significance

There are 2 mosques and 1 cemetery on the island. However, there are no mosques of cultural significance. The project site maintains a sufficient distance from both the cemetery and the mosques. The cemetery is located behind the powerhouse, approximately 300m from the project site, while one mosque is the mosque of the cemetery, with the other mosque located 243m from the site.

3.10. Socio-Economic Environment

3.10.1. Population

The total population of Madifushi estimated in 2014 census is 801 corresponding to 391 males and 410 females. The 2014 census reports the total residential population of the island to be 741 and foreigners to be 60 (National Bureau of Statistic [NBS], 2014). The table below depicts comparison of total population with 2006 census.

Table 14 Average Annual Growth Rate, Th. Madifushi

	Census 2006	Census 2014	Percentage change in population (2006 – 2014)
Total	720	801	11.3%
Male	357	391	9.5%
Female	363	410	13.0%

According to the census, from 2006 to 2014, the total population of Madifushi had increased by 11.3%.

The information provided by the Council indicates the present total population of Madifushi to be 1300. This corresponds to a further increase in the total population by 62.3 % from 2014 to 2021.

Based on the census data of 2014, and the land area of the island at that time (20ha), the population density of Madifushi is at 40.4, which represents the second highest density in the atoll. However, the current population density has decreased to 32.5 considering the increase in land area to 40ha and present population of 1300 people.

3.10.2. Households

There are 180 households in Madifushi representing houses, flats and apartments.

3.10.3. Education and Literacy Level

Primary and secondary education is provided at Madifushi School which conducts classes from grade 1 to 10. At present there are 204 students enrolled in the school; 104 females and 100 males.

According to Census 2014, 97.7% of the resident population in Madifushi is literate in mother tongue and 68.6% literate in English language. Literacy in both languages were determined by the person's ability to read and write, with understanding of the language (NBS, 2014).

3.10.4. Health

Medical services at the island is provided at the health centre. The health centre functions under a doctor, 3 nurses, laboratory technicians and administrative staff.

3.10.5. Employment, Economic Activities and Business Establishments

Similar to other inhabited islands of similar nature, 57.1% of the population of *Madifushi above* the age of 15 is economically active with 90.2% being employed and 9.8% unemployed (NBS, 2014).

Majority of the people in Madifushi are employed in fishing and ferry operations, while the women mostly practice weaving using coconut palm leaves. Boat building is also practiced to some extent with 3 huts currently in operations.

3.10.6. Non-Governmental Organizations

There are 3 registered NGOs in the island. Names of the NGOs, there current status and associated activities or main area of focus is reflected in the **Table 15** below.

Table 15 NGOs in Madifushi

#	Name of NGO	Status	Focus Area
1	Madifushi Zuvaanunge Jameeyaa	Active	Youth empowerment and sports
2	Al Kifaah	Active	Religious awareness
3	Real Madifushi	Inactive	N/A

3.10.7. Council Secretariat

According to the 6th Amendment to the Decentralization Act of the Maldives, 3 members constitute the island councils of islands with a population of less than 3000, while 5 members are elected for island councils of islands with more than 3000 in population. In the Act, the tenure of the council is specified as 3 years from the date of election. It also states that a new council shall be elected 30 days prior to the end of the current council's term.

As the island of Madifushi has a registered population of 1330, the Island Council is comprised of 3 members, namely, President Mr. Ismail Hilmee, Vice President Mr. Abbas Ahmed and Member Mr. Ali Haseen. The council took oath on 4 June 2017. The present term of the local councils was extended due to COVID19 pandemic with the new election dates currently set for April 2021.

The President and Vice President of the island council are elected by a secret ballot held among the elected members of the island council. If a member's post is vacated before the end of the tenure, another member shall be elected within 45 days through a bi-election. The elected member in a bi-election will remain in the post till the end of the term of that council.

The President and Vice-President of the Councils are responsible for day to day operational management of the Council. The responsibility of Council members includes attending official meetings of the Council, discussion and reaching resolutions on the agenda items for the meetings, and participation in the making of policies needed to achieve the objectives of the Council.

Specific duties of the Council President are as follows:

(a) Conduct council meetings and preside over these meetings;

(b) Administer and direct the council towards achieving its objectives;

(c) Publish and implement the decisions of the council through the Council's Administrative Office;

(d) Oversee the compilation of the council reports and ensure that the reports are submitted on time to the relevant authorities;

(e) Foster and maintain good relations and cooperation between the council and Government authorities, associations and groups;

(f) Monitor to see if the council's finances are managed by the Council's Administrative Office, according to the decisions made by the council;

(g) Facilitate a mechanism to keep records of the Council's revenue and expenditures;

(h) Perform other work assigned by the atoll council and the island council.

Specific duties of the Council Vice President are as follows:

(a) Assist the President of the council in performing council's work;

(b) Perform the duties of the President of the island council, during such times as when the President of the island council is incapacitated or is excused or if the post is vacant. In addition to this, undertake responsibilities assigned by the president of the council;

(c) Perform other work assigned by the island council.

Specific duties of the Island Council Members are as follows:

(a) Work towards achieving the objectives of the island council.
(b) Carryout any work assigned by the council as per the procedures of the island council.

The island council is responsible for providing the following municipal services to the people of the island:

(a) Build and maintain roads of the island;

(b) Dispose waste in a reasonably safe manner at the island level as it does not create any inconvenience to the community;

(c) Maintain the jetty of the island, build and maintain wharf, and operate the ferry terminal of the island;

(d) In accordance with the Law of the Maldives, take necessary measures to alleviate the land erosion problem and maintain the jetty and the breakwater of the island;

(e) In accordance with the law of the Maldives, provide and maintain public facilities such as water, electricity, and sewage system;

(f) In accordance with the Law of the Maldives, provide primary health care and other basic health security services;

(g) In accordance with the Law of the Maldives, provide preschool education and organize and conduct educational and vocational programs to train adults;

(h) Administer the island library, archive official documents, preserve old and historical documents of the island in the library and with the help of modern facilities, provide access to information;

(i) Maintain social centres, play grounds or sports fields and provide sporting facilities, public parks and entertainment services;

(j) In accordance with the Law of the Maldives, run a centre to provide social security services, take measures to stop domestic violence and provide the victims of such violence with security and assistance and put in place a system to help senior citizens and people with special needs;

(k) In accordance with the Land Law of the Maldives and in a manner which does not contravene the island's Land Use Plan, allocate land and register land and buildings, and monitor if all building work undertaken is in accordance with the building regulations of the Maldives and other regulations by relevant Government ministries, and in accordance with the Land Laws and other such Laws of the Maldives, keep record of all dealings undertaken by parties in regards to matters of land;

(l) Maintain a land registry of the island and provide information required for the national land registration authority;

(m) Maintain mosques;

(n) Maintain cemeteries, establish burial service mechanism and organize for burial services;

(o) Maintain historical places and promote and revive culture;

(p) Commemorate religious and national days of importance and hold religious and national functions;

(q) Organise to sweep and clean the roads, maintain cleanliness of the island and its beauty;

(r) Provide the island with adequate lighting at night;

(s) Pest controlling;

(t) Establish a mechanism that provides assistance in an event of emergency;

(u) Monitor and check if shops, tea boutiques, restaurants, café's, guest houses and public markets comply with standards, rules and regulations set by the law of the Maldives and take corrective measures;

(v) Organize and manage for pedestrians, motor vehicles and non-motor vehicles to use the roads as according to the standards set by the statutes of the Maldives, and organize and manage public land and sea transport services which levy a fee to operate in compliance with the standards set by the relevant Government authority;

(w) Assist the Courts of Law and Government authorities to execute the sentences passed by the Courts of Law.

(x) Issuing and cancellation of permits and registries; that Government ministries provide through the island councils, and on matters that fall within the jurisdiction of the island council, and on matters that have been assigned to the island council under various laws;

(y) Manage the birth and death registry of the island, and gather and maintain the statistical records of the island, maintain a registry of citizen and noncitizen of the island, and maintain a registry of foreigners living on the island;

(z) Provide other services that are prescribed by Laws.

3.10.8. Electricity

Electricity is provided by FENAKA Corporation 24 hours a day. The power house is located north of the island at a close proximity to the cemetery. The distance between the IWRMC and the power house is approximately 243m. The existing powerhouse is planned to be relocated to the utility area, adjacent to the proposed IWRMC site in the near future.

FENAKA uses diesel generators to provide electricity to the island community.

3.10.9. Sewerage

The island has an established sewer network which is managed by the utility company FENAKA. It is a conventional gravity collection system with two pump stations, one of which is an outfall pump station. The connection chamber of each of the registered household is connected to this network. The sewerage is discharged from the main pumping station to the sea through a sea outfall laid using anchor blocks.

3.10.10. Water Supply

Rainwater is the primary source of freshwater in Madifushi. However, works are currently underway to establish a proper water supply system in Madifushi, with a project already being formulated and a party selected to execute the works.

The proposed water supply system will primarily include the following:

- Reverse Osmosis Plants;
- Rainwater Collection System;
- Rainwater Treatment;
- Storage Tanks; and
- Distribution Network.

The project is expected to be completed and commissioned by end of 2021.

3.10.11. Fuel used for cooking

For cooking purposes, most of the households use gas (80%) while 14% use oil, 5% use fire wood, and 1% had not stated.

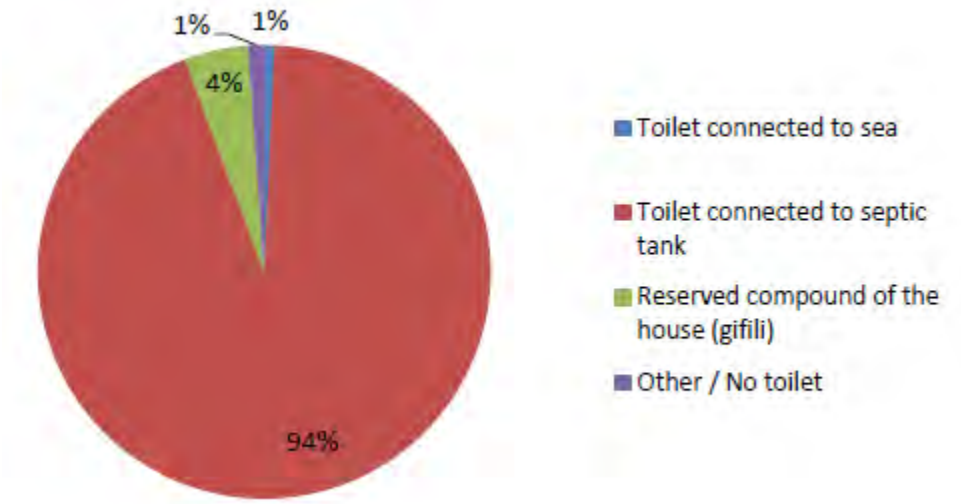


Figure 13 Fuel used for cooking (NBS, 2006)

CHAPTER 4 ASSESSING THE LIKELY IMPACTS AND MITIGATION MEASURES

This chapter describes the key adverse and beneficial impacts envisaged for both construction and operational phase of the project and the methodology used for impact prediction.

4.1. Identifying Impacts and Analysis

As this is an update of a previous ESMP, the impact identification methodology is adopted from the previous ESMP (Saleem, 2018), where full credit is given to the previous consultant. However, more impacts are added to the matrix to reflect the associated further impacts envisaged with the change in scope brought to the project. The impact identification methodology is described below.

Impact definition used in the report has been adapted from the United Nations Environment Program (UNEP, 2002). Accordingly, an impact or effect used in the current assessment implies the change in an environmental parameter, which results from a particular activity or intervention relating to the proposed Project. Thus, the change or the impact is the difference between the environmental parameter with the Project compared without the Project (baseline) measured over a specified period and within the Project location (UNEP, 2002). In identifying and predicting impacts 'best estimates', past experiences, professional judgments, references, and information collected from stakeholder discussions were the main methods used.

As explained, understanding the baseline condition of the Project environment and determining the extent of an impact were critical initial steps in impacts. The overall methodology applied in studying the baseline conditions included collecting information from the field and review of available relevant literature including reports, other related studies and data source. In addition, information obtained from discussions with the stakeholders was also used to characterize specific aspects of the study area. Spatial extent of the affected area/study area was determined by relevant guidance obtained during the scoping meeting, discussions with the stakeholders and professional judgment of the consultant's team.

A modified Leopold matrix was applied in evaluating the impacts identified. The Leopold matrix, which is widely applicable in carrying out an EIA for different types of projects has been chosen as a suitable method for predicting impacts of the proposed project. A clear advantage of using the matrix 'as a checklist or reminder' of the large scope of actions and impacts on the environment that can relate to the proposed actions (Leopold et al., 1971). According to the Leopold matrix method, EIA should consist of three basic elements: a) a listing of the effects on the environment that the proposed development may induce, including the estimate of the magnitude of each of the effects; b) an evaluation of the importance of each of listed effects (e.g., regional vs. local); and c) a summary evaluation, which is a combination of magnitude and importance estimates.

In order to achieve higher efficiency of the matrix, a starting point is to check each significant action listed in a horizontal axis. The experience often proves that 'only about a dozen actions will be important'

(Leopold et al; 1971). Each checked action is evaluated in terms of magnitude of effect on environmental factors that are listed in the vertical axis. In the matrix, across each box where significant interaction is expected, a slash (/) is placed diagonally from upper right to lower left angle of the block. In the text which accompanies the Leopold matrix, the evaluator has to indicate whether the assessment is for short-term or long-term impacts. Then, in the upper left-hand angle of each box with a slash, the evaluator should place a number from 1 to 10, which indicates the magnitude of the possible impact, where 10 represents the greatest magnitude of impact and 1 the least (no zeros should be assigned). The scale of importance (placed in the lower right-hand angle of each box with a slash) may also range from 1 to 10, with the same principle applied – the higher the value, the higher the importance. Assignment of numerical value for importance is based on subjective judgment of a multi-disciplinary team working in the EIA. In addition to assigning the numerical values to each marked box, plus (+) or minus (-) sign can be used to show whether an impact is beneficial or adverse.

In this regard, for the analysis of possible impacts of certain activities and procedures during the construction and operation of the IWRMC, 11 possible activities on the realization of the proposed project, have been identified from a wider list of potential factors of impacts that can be expected for such type of interventions in the environment. Although it is possible to partially determine aggregate, i.e. average assessment of impact factors for each of these components, it is sufficiently appropriate and functional to present them as a whole. The fact is that some of them are synergistic ones, mutually reinforcing their effects, so that this matching of information should be maintained in the analysis. A synthetic presentation of endangering factors is given through mean values and not through aggregate assessment, which will be later scaled.

Furthermore, physical, biological and socio-cultural environmental characteristics of the subject location have been separated and, within them, 14 environmental components have been defined.

The significance of impacts is based on the calculated magnitude score for total impact area and impact activity. The significance is assigned based on the following total impact magnitude ranges. For ease of identification these ranges have been colour coded as shown in the (***Table***)**.**

The steps involved are briefly summarised below:

- All Project related actions identified;
- associated environmental characteristics for each action identified;
- the magnitude of the impact was then determined by applying a number from 1 to 10 (1 is the minimum and 10 the maximum). This number is placed in the upper left-hand corner in the corresponding box of the matrix, representing the scale of the action and its theoretical extent. A plus (+) was used for positive impacts and a minus (-) was used for negative impacts; in the lower right-hand corner of each cell a number from 1 (least) to 10 (most) to indicate the importance of the impact was placed. It then gives an evaluation of the extent of the environmental impact according to the judgement of the EIA team; and
- the significance was then determined by the joint consideration of its magnitude and the importance (or value).

These two factors have been applied as per the definitions given below.

Importance

In comparing relative importance of environmental impacts, the impacts have been characterised by considering the following;

- Duration over which the impact is likely to occur (temporary, short term, long term, permanent);
- timing or when the impact is likely to occur;
- spatial extent of the impact (such as on-site, local, regional, or national);
- frequency or how often the impact is predicted to occur;
- intensity (negligible, low, medium, high); and
- likelihood (certain, likely, unlikely, likely or very unlikely).

Magnitude

Magnitude of the impact was expressed in terms of relative severity, such as major, moderate or minor/negligible. In determining severity other aspects of impact magnitude, notably whether or not an impact is reversible and the likely rate of recovery are also considered. Hence, the following equation was used to determine the impact significance (UNEP, 2002).

$$Impact\ characteristics\ (magnitude)\ \times\ Importance\ (value) = Impact\ significance$$

The scores obtained for the magnitude of each of the impacts (both positive and negative) were categorized as given in **Table 16.**

Table 16 Categorization of the significance

Total magnitude score	Category
> 40	Major positive
20 to 39	Moderate positive
1 to 19	Minor positive
0	Negligible
-1 to - 19	Minor negative
-20 to - 39	Moderate negative
>- 40	Major negative

Significance categories given in **Table 16** is defined as explained in **Table 17.**

Table 17 Impact characterization matrix

Significance	Characteristics	
Major	An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. A goal of the EIA process is to get to a position where the Project does not have any major residual impacts that would endure into the long term or extend over a large area.	Requiring appropriate mitigation measures
Moderate	An impact of moderate significance is one within accepted limits or standards. The emphasis for moderate impacts is on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable.	
Minor	An impact of minor significance is one where an effect will be experienced, but the impact magnitude is sufficiently small (with and without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.	

Different colour codes have been used in the impact matrix to distinguish between positive and negative impacts as depicted in **Table 18.**

Table 18 Colour codes used for distinguishing positive and negative impacts

Significance categories	Colour code
Major positive	
Major negative	
Moderately positive	
Moderately negative	
Minor positive	
Minor negative	
Negligible	

Cumulative Impacts

Cumulative impacts which may be defined as impacts that result from incremental changes caused by other past, present or reasonably foreseeable activities together with the project are generally considered in the impact assessment studies. The environment where the proposed IWRMC will be situated is relatively undeveloped area and no projects have been planned for the immediate future. Hence the proposed approach for assessing cumulative impacts was to consider those that had already been

completed. In this regard, the only foreseeable cumulative impact of the project had been identified to be in relation to the electricity consumption. Power needed for the IWRMC will be sourced from the island's existing power network. Considering the equipment that will require electricity at the IWRMC, it is envisaged that it would not have a significant impact on the island's power system. Long term additional power usage will have a cumulative impact on the greenhouse gas emissions which can contribute to climate change. However, such cumulative impacts on climate system are believed to be insignificant.

Impact Mitigation

EIA regulation requires practical and appropriate mitigation measures for significant impacts identified to be proposed in the ESMP. The Proponent is required to submit a letter of commitment in the ESMP report stating that all the mitigation measures proposed in the report will be implemented during all phases of the Project. Hence full implementation of the mitigation measures is considered an important condition for issuing the ESMP decision statement to proceed with the project. For each identified significant negative impact in proposing mitigation measures the priority was given to avoidance of a predicted impact by taking measures such as bringing changes to the design and/or work methodology. In cases where avoidance of an impact was not possible practical and cost-effective measures have been proposed to reduce the impacts and enhancing positive impacts. Practical experience and lessons learnt by the ESMP team from projects of similar nature played a key role in proposing mitigation measures.

In addition to predicting impact of the project on the environment, impacts of the environment on the project components for ensuring sustainability of the project was also considered.

Proponent's commitment letter confirming implementation of mitigation measures and monitoring responsibilities is provided in **Annex 7.**

Gaps in Baseline Information

Accurate impact assessment demands accurate baseline information collected over a reasonable period of time. However, even with the best effort to collect all relevant primary data required, inherent challenges make it almost impossible to have all such information collected within a relatively short period of time available to complete the assessment within the contract period to complete the study. Hence in certain cases it becomes necessary to make assumptions when limited or no information is available.

Understanding of the baseline conditions in studying existing environment was limited to a short period of time. Collecting all necessary environmental information is rarely possible due to time and cost constraints and therefore, the data captured is representative of the conditions at the time of the surveys. In the case of the present study, the data gaps have been adequately filled by experiences and lessons learnt from similar projects carried out in the Maldives.

Gaps in Understanding Impacts

Impact identification, characterization as well as significance analysis also involved uncertainties as ideally such an exercise should take place against a framework of criteria and measures established for the purpose in the relevant legislation which is not the case in the Maldives at present. Specified criteria necessary for impact evaluation such as environmental standards and thresholds are yet to develop in

order to strengthen the EIA process in the country. In order to address these gaps, where impact magnitude cannot be predicted with certainty professional experience and scientific literature was used and adapting criteria and measures from elsewhere that are relevant to local circumstances was used. In cases where a greater degree of uncertainty is believed to exist precautionary approach had been adopted in which likely maximum impact was considered.

Lack of compressive baseline information on all aspects of the Project environment was a critical setback in predicting impacts. However, developing and operating island level waste management centres is not uncommon in the Maldives and a lot of experiences have been gained in terms of actual impacts associated. Hence, in the case of present project uncertainties associated with the most significant impacts could be considered relatively small.

4.2. Potential Impacts and Mitigation Measures for Key Impacts

For every minor to moderate to major impact identified, a mitigation measure has been proposed and discussed below. The mitigation measures proposed would be strictly adhered to eliminate environmental impacts arising from the project, even before it occurs. The impacts and mitigation measures are detailed in the two stages, construction and operational stages as explained below.

The possible mitigation measures include:

a) Changes in work practices and increasing awareness;

b) Provision of environmental protection and health safety equipment; and

c) Environmental monitoring during construction phase and operational.

Mitigation measures suggested in the report will focus on the existing environmental conditions as well as impacts that may rise during operation of the IWRMC.

4.2.1. Impacts and Mitigation from Construction Phase

Table 19 Impact Matrix for Construction Phase

	Envisaged impact factors	C1 Worker Influx and Settlement	C2 Transportation of materials	C3 Site Demarcation & Fencing	C4 Construction	C5 Waste Generation	C6 Resource Consumption (Water, Electricity)	Total (Impact Area)
Physical Components	Seawater	-2	-4			-5		-11
		1	3			5		9
	Ground water	-2			-4	-4	-5	-15
		1			4	4	5	14
	Air	-3	-4	-1	-3	-5	-3	-19
		2	4	2	3	4	3	18
	Noise	-2		-1	-3	-2		-8
		1		2	3	2		8
	Coastal Zone						-1	-1
							1	1
Biological Components	Flora	-1	-1		-1	-1	-3	-7
		1	2		1	2	2	8
	Endangered species/protected areas							0
								0
	Coral Reef					-3		-3
						4		4
	Fauna		-2		-1	-3		-6
			2		1	3		6
Socio-Cultural Component	Aesthetics	-2	-3		-7			-12
		2	3		5			10
	Accidents	-1	-6	-1	-6	-2	-1	-17
		1	5	1	4	2	1	14
	Landscape				-7		-7	-14
					7		8	15
	Health/Well being	-1	-6	-1	-5	-5		-18
		1	4	2	3	6		16
	Local economy	4	4	1	7		-2	14
		1	4	2	5		2	14
Total (Construction Activity/Risk)		-10	-22	-3	-30	-30	-22	
		11	27	9	36	32	22	

Summary of the multi-criteria analysis is given in **Table 20.**

Table 20 Summary of multi-criteria analysis for construction phase

Activity	Impact Score	Overall Impact
C4 **Construction**	**-30**	**Moderately negative**
C5 **Waste generation**	**-30**	**Moderately negative**
C6 **Resource consumption**	**-22**	**Moderately negative**
C2 **Transportation of materials**	**-22**	**Moderately negative**
C1 **Worker influx & settlement**	**-10**	**Minor negative**
C3 **Site demarcation & fencing**	**-3**	**Minor negative**

a) C4 Construction

There are a number of sub-activities that can affect the environment related to construction of the IWRMC. Overall, the multi-criteria impact magnitude for this activity was -30, which meant that it will have a moderately negative impact.

Material Storage

At the initial stage all resources required for the construction of the site will have to be procured and stored. These include construction materials, vehicles, machineries, fuels, and tools required for IWRMC construction. Due to the nature of the project, even though a large volume of construction materials is not required care must be taken in storing materials to avoid any potential damages to the environment. The improper siting of stockpiles and storage of sand, gravel, cement, fuel, etc., at the construction sites could lead to fine materials being lost, damaged during heavy rainfall events. This would not only represent a waste of resources but could also be a cause of project delays. Hazardous and flammable materials (e.g. fuel, paints, thinner, solvents, etc.) improperly stored and handled on the site are potential health hazards for construction workers and spilled chemicals would have the potential to contaminate soil and inhibit plant growth in localized areas.

Mitigation for material storage impacts

- Safe storage area should be identified and retaining structures put in place prior to the arrival and placement of material;
- the stockpiling of construction materials should be done in a such a way that the materials are not exposed to weather conditions and are properly controlled and managed by the site supervisors; and
- hazardous chemicals (e.g. fuels) should be properly stored in appropriate containers and these should be safely locked away. Conspicuous warning signs (e.g. 'No Smoking') should also be posted around hazardous waste storage and handling facilities.
- equipment shall be stored in fenced areas and maintained appropriately during the course of the project and no new such facilities shall be developed for the purpose of the project;

- National Fire Code (NFC) shall be strictly followed while handling, transporting and storing fuel. Inflammable goods such as fuel drums, portable fuel containers and cleaning solvents and chemicals will be closed off from public access.
- portable extinguishers placed to be readily available when someone finds a fire;
- fuel should be stored in well contained barrels and place over a concrete. This is to contain oil spills during storage and to prevent infiltration of oil into soil; and
- tool shed shall be locked and all the equipment, vehicles and tools must be accounted for.

Noise and vibration

It is important to identify the sources of noise and vibrations and the intensity of such impacts on the project island. The noise and vibration impacts are expected to be minor as the nearest residential area to the project site is more than 264 m away.

The main source of noise from the construction phase of the project will be from the engines used in the machinery and vehicles. No high impact works such as pile driving or demolishing structures are part of the proposed construction, therefore the impact noise is not a major source of noise pollution for this project. Typical noise level of construction equipment is detailed below:

Table 21 Typical construction equipment and their noise levels 50ft from the source

Equipment	Typical Noise Level (dBA) 50ft from source
Concrete mixer	85
Concrete pump	82
Concrete vibrator	76
Pump	76
Saw	76
Shovel	82
Tie Cutter	84
Truck	88

Assuming the highest noise produced during construction is at 85 dBA, a noise decay calculation was done using initial assumptions without factoring for dampening effects due to obstacles and vegetation. From the initial calculations, the noise levels are projected to decrease down to less than 59 dBA at the nearest residential area.

Noise during construction is determined to be a short-term negative impact. Due to the distance of the project site it is identified that noise impacts will be minimal to the residential zones, while the construction workers will be most affected by the noise impacts.

Mitigation Measures

- Confine construction activities to day time, from 8 am to 6 pm. Ensure no construction activities occur during night time; and
- Use of hearing protection by workers during the operation of heavy machinery.

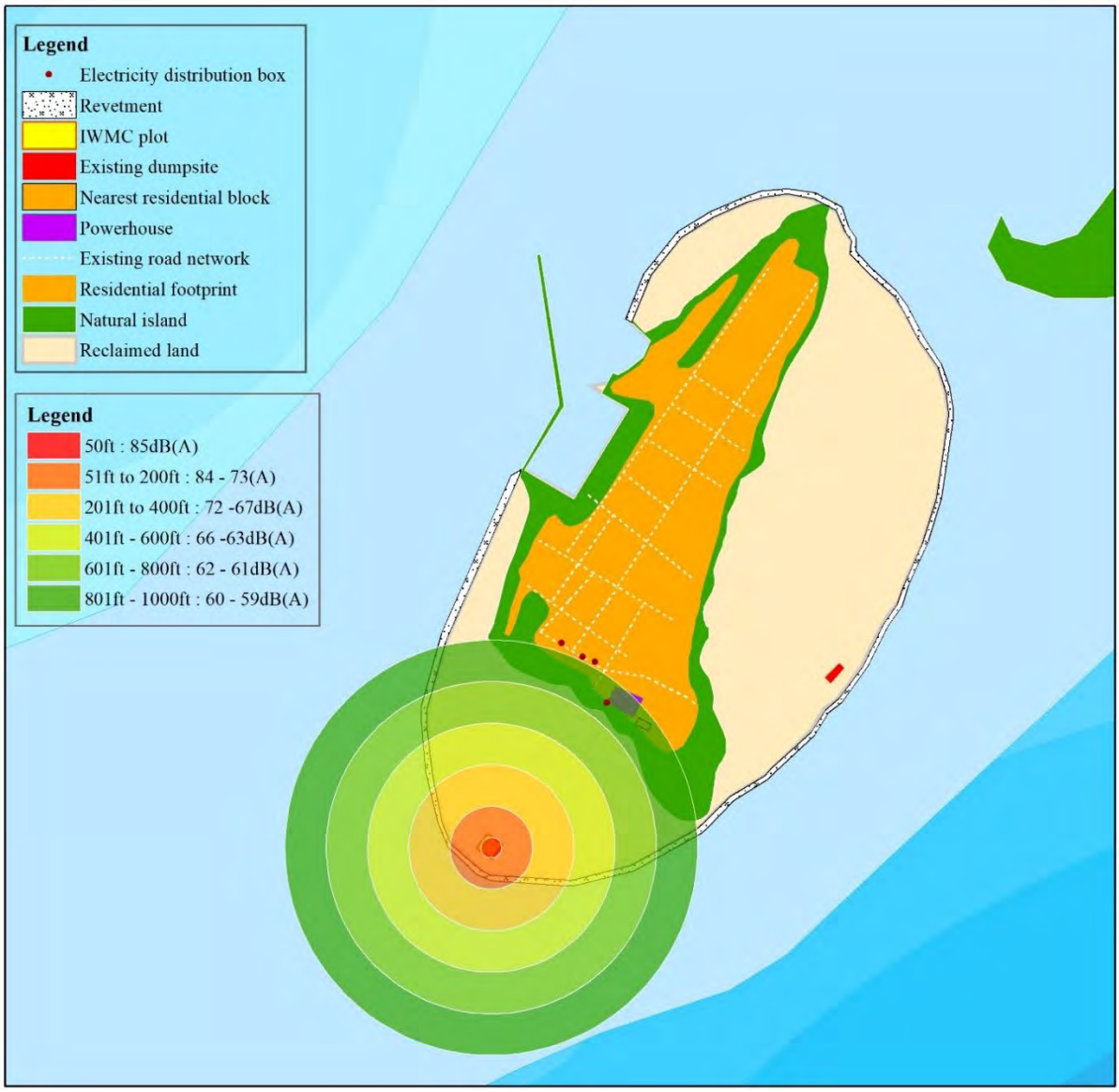


Figure 14 Noise range map for Th. Madifushi

Impact on vegetation

No vegetation is to be removed as part of this project. Careless workmanship may result in damages to the vegetation during movement of materials and other project related activities during the construction phase.

Mitigation Measures

- Workers shall be informed to avoid damaging trees and disturbance to animals and to generally avoid engaging in destructive activities to the environment intentional or unintentional.

Accidents and injuries

For a construction project of this nature there can be a number of causes that can result in accidents and injuries to workers. Hence it is imperative to identify and put in measures to avoid accidents and injuries to workers during construction phase. Some of the likely causes include:

- inhalation of cement during the site cast and pre-casting of concrete: inhaling high levels of cement dust during construction can be irritating to the nose and throat. Prolonged exposure to cement dust can result in silicosis (CSAO, 2001);
- contact with concrete mix: concrete has caustic, abrasive and drying properties and prolonged contact with concrete allows the alkaline compounds such as calcium oxide to burn the skin;
- wet concrete trapped against the skin can cause first, second, or third-degree burns;
- falling of heavy objects: constructions sites are prone to falling of heavy objects which can be fatal to workers;
- falls: workers may be under the risk of falling into open pits, trenches and seriously injuring themselves;
- Bodily injuries due to manual lifting of heavy items; and
- being struck by moving equipment and vehicles.

Mitigation measures

For all works the following safety measures will be required during the construction phase.

- Appropriate PPE will be worn at all times. This will typically include hard hats, eye protection, gloves and reflective clothing, hearing protection, safety harnesses, masks and wet weather clothing as appropriate;
- first aid kit will be on site at all times;
- all machineries will be operated by competent certified operators;
- manual lifting operations will be kept to minimum by the use of mechanical means;
- site visitors should not be generally allowed to work site except when its essential in such cases shall be accompanied at all times and required PPE shall be provided;
- proper signage and site demarcation should be provided around the site;
- carry out works during good weather;
- well trained personnel to use machinery and vehicles;
- avoid transportation during night; and
- securing any loads on vehicles during transportation.

b) C5 Waste Generation during Construction

Solid waste generated during IWRMC construction work would negatively impact the site and surrounding environment if not properly managed and disposed of at an approved dumpsite. Overall, the multi-criteria impact magnitude for waste generation was -30, implying that it will have a moderately negative impact. Waste burned onsite would generate smoke, possibly impacting negatively on ambient air quality and human health. Solid waste, if allowed to accumulate, could cause localised conditions conducive to the breeding of nuisance

and health-threatening pests such as mosquitoes. Poor construction waste management constitutes a short-term, possibly long-term, negative impact.

Vehicle, equipment and tools maintenance works will likely be the primary source of chemical wastes during the construction period. The majority of chemical waste produced is therefore expected to consist of waste oils, solvents and used batteries. Typical wastes may include the following:

- Solid wastes (Empty fuel/lubricant drums, used oil/air filters, scrap batteries, vehicle parts); and
- Liquid wastes (waste oils/grease, spent solvents/detergents and possibly spent acid/alkali from batteries maintenance).

However, the amount of chemical and hazardous waste produced will not be significant. Other construction waste includes, packaging, concrete, wood and steel in minor quantities.

Municipal wastes are also expected to be generated during the construction phase by the workers comprising of food wastes, packaging wastes and waste paper.

The amount of human waste generated per person is approximately 125 g/day, which means 1.9 kg will be produced daily if approximately 15 workers were active which equates to discharge of approximately 2,550 l/day of waste water. Sewage will be managed through existing septic tank systems that have been installed in the island.

Since there is no existing waste management system in the atoll and since there is no waste management practice in the island to accommodate the construction waste generated, the environmental receptors will have a significant burden from construction waste. Some of the hazardous oils if not disposed properly may cause health implications to the people and vegetation.

Mitigation Measures

- Ensure to manage waste as described in **Section 2.5.1 r** of the report;
- avoiding cooking and eating at work site to eliminate food waste and kitchen waste. Hence food for workers can be arranged with existing services on the island;
- reusable inorganic waste (e.g. excavated sand) should be stockpiled away from drainage features and used for in filling where necessary;
- regular sweeping of the of the worksite to collect litter, empty cans etc. which could become breeding ground for mosquitoes and other pests;
- open defecation whether it's on land or on the beach shall be prohibited;
- appropriate general site cleanliness related signboards could be placed on the worksite to give workers reminders on good waste management practices;
- ensure to reduce waste by following the 3R steps; and
- waste collected shall be transported to nearest waste management facility after the construction works have ended.

c) C6 Resource Consumption

Various types of construction related resources are required for the project. Consumption of goods impacts the environment in many different ways. For instance, materials used for the project would contribute, directly or indirectly through the product lifecycle, to climate change, pollution, and biodiversity loss and resource depletion locally or elsewhere in the world. The most important resource as far as the current project is concerned would be the allocation of land for the site. For the purpose of developing the waste management centre at least 735 m^2 of land would be required which represent 0.16% of the existing area. Allotting a plot of land for waste management with permanent concrete structures developed would essentially will result in a loss of the options for alternative land use and thus represents an irreversible commitment of land resources. The loss of optional uses for the allocated land although is inevitable is considered a negative impact. Other resources required would include sand, water, power and construction materials required for the IWRMC development. Since the resource utilization is considered to be relatively small, and that it is not expected to significantly contribute to deplete the natural resources and would be a major source of GHG emission, the multi-criteria impact magnitude for this activity was -22, which meant that it will have a moderately negative impact.

Since it would be very difficult to precisely determine by how much exactly the current project would contribute to the depletion of each type of various natural resources required for the project at local and global levels and by how much it would have contributed to global climate change, general impacts that are normally associated with natural resource use can be applied in relative terms for the project.

Mitigation

- Resource conservation shall be given a high priority in all stages of project development through bulk purchasing, putting in place measures to avoid wastage, encouraging reuse and recycling;
- initiate rainwater collection and storage as early as possible into the project construction;
- careful store management and record keeping on use of materials;
- reduce idle time for vehicles and equipment and switching off after use;
- use well maintained, energy efficient equipment and lights;
- sand shall not be mined from beaches and lagoons of the island for construction purposes, if coral sand is used it should be obtained from a government approved location;
- materials that are locally available shall be obtained as such instead of opting to bring those after a long haulage;
- materials shall be procured in bulk as much as possible;
- utilize day time hours for the construction when plenty of light is available; and
- FENAKA power supply will be used for electricity generating purposes.

d) C2 Transportation of Materials

Transportation of construction materials from the source to the project island is identified as an activity with climate impacts, through the transportation of sea vessels, as well the transportation of the materials on land. The use of vessels and vehicles would require burning of fossil fuels which result in the release of greenhouse gases (GHG) into the atmosphere. The fuel usage of a supply barge is estimated at 1.3 kWh /t. As a general rule the longer distance would mean more fuel burnt and more GHGs produced. As the resource sourcing hierarchy in **Figure 15** shows, the greatest importance shall be placed on sourcing any available materials from within the island, with the next option being from within the atoll, from islands such as Th. Thimarafushi. Next in the hierarchy is Male' and the industrial areas in the zone, from where majority of the remaining materials can be sourced. Lastly, in cases where a proposed material cannot be obtained from within the country, only shall the contractor procure the material from a neighbouring country which is not likely due to relatively small volume of material requirement and commonly available nature of those. The multi-criteria impact magnitude for this activity was -22, which meant that it will have a moderately negative impact.

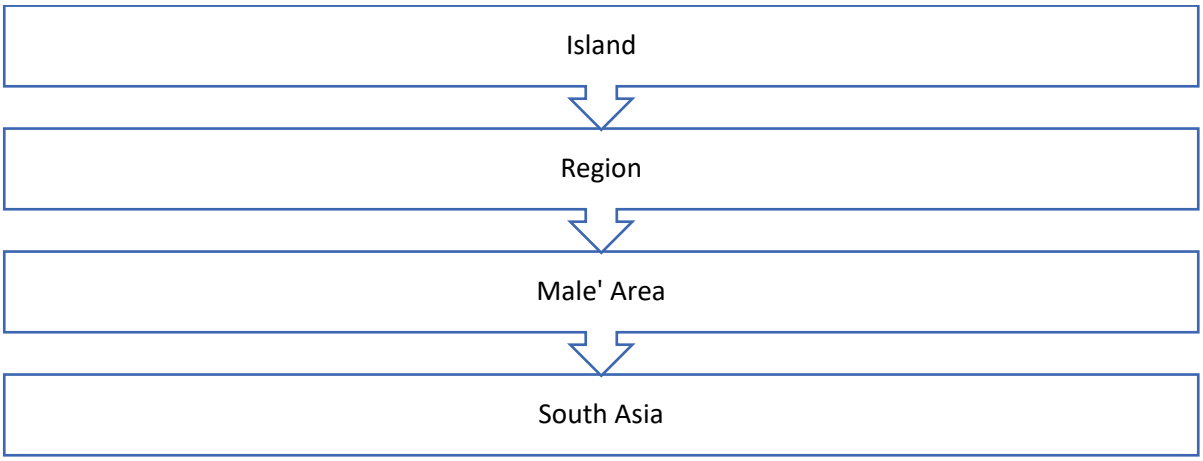


Figure 15 Material sourcing hierarchy proposed for the project

Along with the reduction in travel distances by choosing a close source, the number of trips to be made can magnify the distances travelled. The Proponent has produced the Bill of Quantities (BoQ) for the project works, which enables the contractor to purchase the required amount of materials in bulk, reducing the number of trips and wastage of materials. While the sea transport is expected to have the greatest impact of released GHG, the transport on land is expected to be minor, due to the short inland travel distances within the island.

The inputs of the project elaborated in the **Section 2.6** show the estimated amount of resources that will be used for the project. The use of resources for the project can have indirect impacts of GHG emissions from the production process. The main materials used in this project include concrete, reinforcing steel, structural steel, in addition to PVC pipes. Defra / DECC (2012) states that for every tonne of concrete casted, 135 kg of indirect CO_2 emissions result. Due to the small scale of the construction, the estimated indirect CO_2 emissions from material usage are minimal for this project.

The use of heavy vehicles on unpaved roads can cause compaction of the soil by the force applied by the tires of the vehicles. This can lead to the destruction of the soil structure, reduction of porosity, and thus reducing

the water and air infiltration into the soil. The resulting soil is dense with few large pores and poor internal drainage (Wolkowski & Lowery, nd.). Roads impacted with the traffic from heavy vehicles can thus result in undulations and puddling.

Figure 16 Impact on roads from heavy vehicle transport in an island in Maldives

For the purpose of construction, no heavy vehicles are proposed. Although this is the case, a pickup truck will be used to transport the construction materials to the site, in addition to yard waste and construction waste from the site. The vehicle is not expected to cause major impacts on the road, force applied by the pickup truck is expected to be lower than heavy vehicles and plant. The number of trips required are also reduced in the case of the proposed project, due to the small scale of construction.

Other impacts on roads due to transportation include the generation of dust during transportation, which can lead to impacts on the local air quality especially during dry weather. In addition to this, littering of construction materials from uncovered transportation vehicles can cause terrestrial pollution and amenity impacts.

Mitigation for climate impacts

- Sourcing of materials shall be done according to the hierarchy presented in **Figure 15.** Materials shall be obtained from the closest source;
- The materials shall be bought in bulk and transported to the island within a single trip where possible;
- Detailed BOQ produced by the Proponent shall be followed by the contractor when purchasing materials in order to reduce wastage of materials as well as the number of trips;
- The materials shall be stored on the project site to eliminate transportation of vehicles within the island throughout the construction phase;
- Idle time of the vehicles shall be avoided in order to reduce emissions;

- contractor shall emphasise on using vehicles hired from the island, instead of bringing their own vehicles, which would be beneficial to the community as well.
- contractor shall use serviced vehicles and plant equipment for the project;
- contractor shall only use the needed amount of vehicles and plant for project; and
- vehicle used for the purpose should comply with the roadworthiness requirements of the Transport Authority and display the compliance stickers.

Mitigation for impacts on roads

- The contractor shall only bring in the necessary number of vehicles and plant to the island for the project;
- it shall be stated in the contract that any damages to the roads from transportation of construction materials and machinery shall be assessed after the civil works are completed, and the damages shall be repaired by the contractor;
- use the closest route from the harbour area to the site;
- cover the materials being transported to and from the site; and
- spray water on the road surface during dry periods to suppress dust.

Mitigation for accidents and injuries

- Vehicle drivers shall be licensed and competent;
- loads being transferred shall be fully secured; and
- transportation shall be done during day time as far as possible; and
- speed limits shall be observed when operating vehicles especially in residential areas.

Mitigation for marine and terrestrial pollution

- contractor shall clean any littering on the terrestrial or marine environment caused during transportation; and
- contractor shall enforce strict policy against littering and appropriate penalties; and

e) C1 Worker Influx and Settlement

A large number of work force is not expected for the project. An estimated 10-15 workers will be required for this project. Since resource consumption, waste generation and behaviour related impacts on the environment are likely to have an incremental increase with additional people to the island. However, even though minor workers related negative impacts can range from damage to flora and fauna of the island, impacts associated with resource utilization, waste generation and potentially negative social impacts. On the other hand, even though small, more people to the island could have a positive effect on the local economy. Multi-criteria impact analysis shows that this activity will have a overall minor negative impact with a score of -10.

For the duration of the project, the workers related waste output is detailed in **Section 2.5.1 r**. For this project, worker related impacts can be reduced through the following mitigation measures.

Mitigation for impacts on flora and fauna

- The contractor is required to keep the workforce as minimum as possible, and to not bring in any surplus workers for the project;
- the project island currently has vacant properties as well as rooms to let in houses, which can easily house the influx of 10-15 workers. Therefore, no new facilities will be made for the accommodation of the workers in order to avoid clearing of land or spending resources unnecessarily for making worker quarters;
- all construction workers and persons on site must be given specific instructions not to catch or harm birds and animals allow them to retreat into undisturbed areas and prohibit damaging vegetation that are not;
- rules shall be formulated by the contractor and workers shall be oriented on the rules and conduct during the project works;
- enclosed containers shall be provided to dispose of waste oil and other hazardous waste;
- workers shall be given instruction not to catch or harm any birds or animals present on the island, and not to damage any vegetation that is not already sanctioned for removal within the demarcated site bounds;
- littering shall be prohibited; and
- waste bins shall be placed within the site.

Mitigation for impacts on resource use

- Reducing, reusing and recycling of resources shall be encouraged through proper monitoring of worker activities and awareness; and
- Keep workforce to the minimum required.

Mitigation for sociocultural impacts

- hire local workers where possible;
- orient foreign workers on communication, personal hygiene and sanitation and infectious diseases; and
- ensure all foreign workers have their legal permits.

f) Labour Related Impacts

Impacts related to interactions between the workforce and the local community may include:

- Transmission of HIV/AIDS and other sexually transmitted infections (STIs) and other vector borne communicable diseases;
- Tension and conflict between communities and employees of contractor;

- Delays in payment of rent and/or equipment hired from the island; and
- Health and safety accidents and incidents associated with project activities, such as increased vehicle movement on public roads etc.

Other labour related impacts during construction phase may include:

- Exposure of workforce to potential harm, injury, ill-heath and to enjoyment of human rights etc.; and
- Exposure of workforce to poor accommodation standards. Exposure of workforce to inadequate OHS standards;

Mitigation measures

During construction the management of impacts related to labour and accommodation conditions and OHS for the workforce will focus on the establishment of relevant policies and monitoring systems and corrective actions. These will include:

- The development of an OHS management system and OHS monitoring and surveillance program;
- Fitness-for-work health screening;
- The development of a worker health awareness program;
- The development of worker engagement procedures;
- Development of a worker feedback mechanism;
- The development of relevant Human Resource (HR) policies and procedures;
- The development of a worker code of conduct;
- Accessibility to water and sanitary facilities where the contractor must identify a toilet accessible to the workers within 5 minutes from the site. This could be facilitated via renting a toilet from a nearby area (such as a utility office building / a house), installing a portable toilet at the site, making transport readily available to the accommodation building (via providing a vehicle) etc.; and
- Onsite resting area shall be provided for the workers, where they can rest between breaks and have snacks. This can be achieved by constructing a temporary shed and provide chair.

g) C3 Site Demarcation & Fencing

Site demarcation and preparation involves surveying and setting the extents of the IWRMC. This activity is considered to have minor environmental impacts with multi-criteria impact analysis score of – 3 as it is largely non-invasive.

However, improper or inaccurate demarcation could result in the IWRMC plot being set outside the limits as proposed by the EPA. It is important to ensure that the buffers proposed by the EPA are followed during site demarcation.

With proper planning, engaging qualified people and use of proper equipment, and with proper protective measures these impacts can be avoided. This activity is expected to have a minor impact overall.

Mitigation measures

- Ensure that the surveyors and helpers engaged in site demarcation properly understand the scope of works and recommendations of this report;
- qualified surveyors shall be engaged in site demarcation;
- accurate and reliable equipment shall be used to minimize errors; and
- carrying out the works during the day time.

Summary of Construction Phase Impacts and Mitigation measures

The table below provides a summary of the mitigation actions recommended to mitigate significant impacts during construction phase.

Table 22 Summary of ESMP for Construction Phase

Environmental Management Plan			
Impact	Mitigation Measure	Responsible Party	Cost of Mitigation
Management of Impacts during Construction Phase			
1. Physical / Chemical			
Note: All construction activities should be undertaken in the presence of an experienced supervisor.			
Contamination of groundwater and soil due to chemical spillage and seepage	Hazardous waste such as waste oil and diesel should be stored in sealed containers and placed on an impermeable surface and transferred to the nearest regional waste management facility for final disposal. Stored containers should be regularly inspected to identify any leakages. Conspicuous warning signs (e.g. 'No Smoking') should also be posted around hazardous waste storage and handling facilities. Temporary area for storage of such waste is illustrated in the figure below.	P: Contractor S: IC Supervisor	Cost associated with purchasing of containers and transport to RWMF

			
Noise pollution due to construction activities and use of machinery	Ensure construction activities occur between 8 am and 6 pm. Construction workers should wear ear muffs when using machinery that produce significant noise and while undertaking welding and drilling activities.	P: Contractor	Cost associated with purchasing ear muffs
Negative impact on air quality during transfer of construction	During transport of construction materials from the harbour to the site, all sand and aggregate should be transported in covered vehicles or wheelbarrows and vehicle movement should be via roots that are well away from community roads where possible. Transportation should be at low vehicular speeds and loading and unloading should be conducted within the site.	P: Contractor	No cost involved.

materials and progression of works	All vehicles used in the project should have an up to date road worthiness certificate. All vehicles and machinery should be well tuned. Machines should be switched off when not in use. Ensure that construction site is regularly wetted to minimize impact of dust as a result of the project. Materials that are stockpiled at the location for long period of time should be covered to minimize impact of dust generation due to windy conditions. The contractor should not burn any waste.		
Coastal erosion and loss of beach aesthetics due to sand mining	Ensure that all construction materials including sand are sourced in compliance with the national laws and regulation. Sand should not be sourced from the beach or lagoon of an inhabited island, tourist resort, or any protected island. This includes the area of the island designated by EPA for sand mining of local public use.	P: Contractor	Cost associated with purchasing sand from a reputable source (hardware shops) and transporting to the island.
Waste Management	Construction waste produced should be reused for the construction of the IWRMC as much as possible. The remaining reusable materials such as (metal bars and roofing sheets) should be given to the island community or the island council free of cost. Leaves of felled vegetation is to be sundried and left at the forest area for natural degradation. Any remaining C&D waste shall be disposed at the area designated by the council for C&D waste disposal.	P: Contractor S: Island Council	Cost associated with transport to RWMF
Littering and general waste generated by construction workers	Place a bin at the site to dispose general waste generated by the workers. Establish procedures for general waste disposal which should include actions to be taken if the procedures are breached.	P: Contractor	Cost associated with purchasing a bin
2. Biological			
Negative impacts to vegetation due to improper	Workers will be informed to avoid damaging trees and disturbances to animals and to generally avoid engaging in destructive activities to the environment intentional or unintentional. Avoid roads with significant vegetation during transportation within the island.	P: Contractor	No cost involved

handling and driving during material transportation.	Avoid bringing heavy vehicles to the island where possible.		
Negative impact on fauna during material transport	Workers will be informed to avoid damaging trees and disturbances to animals and to generally avoid engaging in destructive activities to the environment intentional or unintentional. Materials shall be obtained from the closest source. Refer to **Figure 15** for the recommended hierarchy. The materials shall be brought in bulk and transported to the island within a single trip where possible. The materials shall be stored at the project site or in a close proximity to avoid unnecessary movement of vehicles within the island through the construction phase. Ensure that all construction materials imported to the island are free of any alien species or pests. Ensure that oils and paints are properly sealed prior to transportation. Ensure that materials are not kept beyond the height of the sides of the vessels and are properly covered, when transporting via sea.	P: Contractor	Cost associated with purchasing of containers designed for storing hazardous substances.
3. Health and Safety			
Occupational Health and Safety	All workers should be provided with safety gear and should ensure that safety gear is utilized at all times. This includes: safety hats, boots, glasses, masks and gloves. Ear muffs shall be provided where equipment or machinery that emit significant amount of noise is used (welding, drilling etc.). Chemical-Liquid protective gloves should be used when handling any chemicals, waste oil or other liquid waste. First aid kit must be purchased and kept on site at all times No open electrical wiring or cables should be kept on site. Health and Safety briefing should be given to all construction workers. A safety inspection checklist should be prepared taking into consideration what the workers are supposed to be wearing and monitored monthly and recorded in the monitoring.	P: Contractor	Cost associated with purchasing safety materials.

Working Conditions and Labour	The maximum working hours of all construction workers should be 48 hours per week as per the Employment Act of Maldives. Meals should be provided to construction workers 3 times a day. Safe drinking water should be supplied to construction workers and must be made available at the work site and the labour camp. Appropriate sleeping arrangements shall be made for the construction workers. Accessibility of workers to water and sanitary must be ensured the contractor. As such, a toilet accessible to the workers within 5 minutes from the site must be identified and facilitated through renting a toilet from a nearby area (such as a utility office building / a house), installing a portable toilet at the site, making transport readily available to the accommodation building (via providing a vehicle) etc Onsite resting area shall be provided for the workers, where they can rest between breaks and have snacks. This can be achieved by constructing a temporary shed and provide chair.	P: Contractor	
Management of COVID19	Travel permit must be taken from HPA for the workers if traveling from Male' or an island placed under COVID19 monitoring. The standard quarantine procedure must be followed as instructed by the authorities. Workers must be briefed about the safety protocols and social distancing measures that has to be enforced. The workers must perform frequent hand hygiene. All workers must wear face masks. The movement of workers must be restricted between the labour camp and work site as much as possible. Daily body temperature of all the workers should be taken and log records maintained. If a worker is having a temperature of 37.8C or above or symptoms of flu that person must not report to work and should be self-isolated and respective authorities notified. Handwashing or hand sanitizing facilities must be established at the work site and the labour camp. Labour camp should facilitate social distancing. The beds should be kept at least 3 – 6 fts apart. COVID19 awareness materials should be displayed in the worksite and the labour camp.	P: Contractor	Cost associated with purchasing soap, hand sanitizers etc. and printing of awareness materials.

	Construction tools should be cleaned using disinfecting solution (1:9 bleach solution) at the end of each day or when changing shifts (if shift-based work methodology is adopted).		
Health and safety of public	Demarcate the site boundary through taping, hoarding or fencing. Place sign boards to indicate that only authorized personnel are allowed entry. Make sure that the general public do not have access to the site and its vicinity. Regularly monitor for entrance of residents. Make sure that public chairs are not found at the vicinity of the site.	P: Contractor S: Island Council	Cost associated with designing and printing sign boards.
Fire hazard	Ensure that electrical wires are installed properly by a certified person. Ensure that portable extinguishers are readily available in case of an emergency fire. Flammable hazardous waste such as used oil and diesel must be labelled with hazardous waste and fire hazard signage and regularly inspected to identify any leakages. Conspicuous warning signs (e.g. 'No Smoking') should also be posted around hazardous waste storage and handling facilities. National Fire Code (NFC) shall be strictly followed while handling, transporting and storing fuel. Inflammable goods such as fuel drums, portable fuel containers and cleaning solvents and chemicals will be closed off from public access.	P: Contractor	Cost associated with hiring an expert electrician and purchasing of fire extinguishers
4. Sociological and Cultural			
Legal Issues	All expatriate workers must hold valid work permits	P: Contractor	Work Permit fees
Handling Environmental and Social Issues during Construction	The contractor will appoint a suitably qualified Environmental Officer following the award of the contract. The Environmental Officer will be the primary point of contact for assistance with all environmental issues during the pre-construction and construction phases. He/ She shall be responsible for ensuring the implementation of ESMP. The contractor shall appoint a person responsible for community liaison and to handle public complaints regarding environmental/social related matters. All public complaints will be entered into the Complaints Register. The Environmental Officer will promptly investigate and review environmental complaints and implement the appropriate corrective actions to arrest or mitigate the cause of the complaints. A register of all complaints is to be passed to the Engineer within 24 hrs. They are received, with the action taken by the Environmental Officer on complains thereof; and The site supervisor may assume the on-site responsibility of the environment officer and community liaison officer, subject to being adequately trained and having thorough knowledge of the ESMP.	P: Contractor	Cost associated with hiring of staff.

	Contractor shall prepare detailed Environmental Method Statement (EMS) clearly stating the approach, actions and manner in which the ESMP is implemented.		
Sociocultural conflict due to arrival of expatriate workers	Ensure that local workers are used as much as possible. If expatriate workers are used ensure that they respect the local culture. The contractor in collaboration with the Island Council shall undertake a training to sensitize the labour to the local context and customs. This training should also cover topics related to Gender-based violence. To mitigate conflict that may arise due to the arrival of expatriate workers, the consultant should develop a "Code of Conduct" outlining the set of rules that that the workers have to follow to persevere the social norms and religious values of the society. The Code of Conduct should also specify penalties for breaching these rules and should be thoroughly communicated to workers prior to mobilization.	P: Contractor S: Island Council	Cost associated with hiring staff
Code of Conduct and Communication	The "Code of Conduct" developed should also cover good environmental governance and responsibilities workers have to follow to safeguard the environment. Though the number may be minimal, code of conduct and awareness in HIV related issues need to be considered. The contractor should ensure that all communications to the workers are presented in the local language. If expatriate workers are employed communications should be made in a language that they understand. Information on the project and the GRM should be displayed in the project site board, council noticed board as well as other communal place as much as possible.	P: Contractor P: Island Council S: MCEP	Cost associated with developing materials.
Loss of source of sand for local public use due to sand mining from the area of the lagoon permitted for local public sand mining	Ensure that sand is not taken from the lagoon of the island.	P: Contractor	Cost associated with purchasing sand from a reputable source (hardware shops) and transporting to the island.

Grievance Redress Mechanism	The GRM established by the proponent should be implemented at the construction phase. Contact details of focal points of the contactor, Island Council and the proponent should be displayed at the project site in the project board, the Council Office and common places frequented by the public (such as schools, health centre etc.). It is recommended to change the first point of contact to the contractor, followed by Island Council and the proponent. The community liaison officer of the contractor must maintain log records of the complains received and subsequent actions taken.	P: Contractor S: Island Council T: Proponent	Cost associated with printing of the GRM board and posters.
5. Economic			
Benefit to local economy	Ensure that construction materials are purchased from the island as much as possible. Preference shall be given to hire local construction workers from the island and the atoll or region.	P: Contractor	Cost associated with material purchase

4.2.2. Impacts and Mitigation from Operational Phase

Table 23 Impact Identification Matrix for Operational Phase

	Envisaged impact factors	O1 Waste collection and transportation	O2 Waste sorting, separating and composting	O3 Waste generation	O4 Resource consumption	O5 Operational Staff Influx / Settlement	Total (Impact Area)
Physical Components	Seawater	9					9
		9					9
	Ground water	8	-2	-1	-3	-2	0
		5	2	5	2	1	15
	Air	-3	-2	-2	-3		-10
		5	3	2	4		14
	Noise	-3	-1				-4
		4	2				6
	Coastal Zone						0
							0
Biological Components	Flora	6	7	-1	-3	-1	8
		2	6	1	3	1	13
	Fauna	5	5	-1	-3	-1	5
		5	5	1	3	1	15
Socio-Cultural Component	Aesthetics	9	8			-2	15
		9	6			2	17
	Accidents	-4	-4		-4	-1	-13
		4	4		5	1	14
	Landscape	9	6	-1			12
		6	5	2			13
	Health/Well being	9	-5	-2	-4	-2	-7
		6	5	2	7	1	21
	Cultural heritage					-1	-1
						1	1
	Local economy	-3	8	-2	-1	2	4
		9	5	4	1	1	20
Total (operational Phase Activity/Risk)		**42**	20	-10	-21	-8	
		64	43	17	25	9	

Since the overall objective of the project is to establish economic viability and environmental sustainability of the proposed waste collection, transfer and disposal systems to prevent impacts on human health and environment through approaches that are sustainable and locally appropriate, the operational phase of the project is expected to yield overall positive outcomes. In this regard, the proper management of waste sorting, collection, transport and disposal in the new system will reduce potential environmental and health impacts from waste. Furthermore, a safer and better environment will promote business, especially tourism, in the area and create better livelihood conditions. However, as summarised in **Table 24**, the operation of the waste management system itself will result in certain negative environmental impacts which will have to be managed properly through appropriate mitigation measures to ensure that those negative impacts are kept at an acceptable level. The paragraphs below briefly discuss the likely impacts and proposed mitigation measures.

Table 24 Summary of multi-criteria analysis for operational phase

Activity	Impact Score	Overall Impact
O1 **Waste Collection & Transport**	**42**	**Major positive**
O2 **Waste sorting, separation, and composting**	**20**	**Moderately positive**
O4 **Resource consumption**	**-21**	**Moderately negative**
O3 **Waste generation**	**-10**	**Minor negative**
O5 **Operational Staff Influx / Settlement**	**-8**	**Minor negative**

a) O1 Waste Collection and Transportation

As stated in this report, a demarcated area has been built in Madifushi with compartments for separated metals, glass and plastics. During the visit it was observed that this area was completely filled up during the two years of its operation. The operation of the dumpsite as well as cleaning of the public spaces is being conducted by the Women's Development Committee. The council stated that the dumpsite has filled up due to there being no way to reduce the volume of the waste, nor there being any way to transport the waste out of the island. As the dumpsite has been filled, waste is now being dumped in the open area next to the demarcated area. The practice of open burning of waste also takes place resulting to potential respiratory issues from the inhalation of smoke. Hence a reliable, affordable and locally appropriate transport system is critical to collecting waste from houses, businesses and institutions. Equally important is an arrangement for marine transport to remove residual waste from the island in order to make the system complete and effective. The successful implementation of the IWRMC together with land and marine transfer arrangement are two important aspects to implement Waste Management Plan to make the island cleaner and healthier for the people to put a stop to littering and burning of waste in the island. This will lead to the improved health and psychological well-being of the residents and

visitors of Madifushi. It has been identified as a long-term positive impact on the residents and visitors of Madifushi.

A vehicle will be obtained for the purpose of collecting and transporting the waste within the island daily, at a set schedule. At the moment there is no specific arrangement for marine transfer of residual waste from the island although by the time IWRMC is complete it is expected to have this arrangement in place. The multi-criteria analysis shows waste transport arrangement will have a major positive impact with an overall score of 42.

While both land transport and marine transfer of waste are expected to have significant positive impacts, unregulated transport arrangements can result to environmental issues. If not properly managed, likely environmental impacts include, noise, hardening of road surface, creation of puddles during wet season, and littering on the roads, bad odour during transport, and health issues to workers, vehicular emission, dust generation as a result. In the case of marine transport, there can be chances of dumping of waste intentional or unintentional en-route to the final disposal site in addition to engine emissions. However, these impacts can be effectively managed and negative impacts can be kept at an acceptable level.

Measures to ensure and enhance the positive impacts

- Island Council shall follow the management plan provided with the ESMP in order to monitor the operations of the IWRMC, and bring about any necessary changes to the operations and policies, in addition to providing any needed technical assistance for the island;
- Proponent shall review the waste management operations within the island regularly and update the National Waste Database;
- Island Council shall review and update the IWMP by consulting relevant stakeholders and get it subsequently approved from EPA;
- Island Council shall conduct awareness programs to the residents of the island regarding the best practices in waste management, as well as conduct programs to familiarize the residents with the gazetted regulations and guidelines to manage the waste within the island;
- regular awareness programs conducted to minimise waste generation and Polluter pays principle established in order to reduce the waste generation within the island;
- Proponent shall provide resources in terms of required equipment, machinery, and technical expertise to ensure the operation of the IWRMC; and
- Proponent shall assist in creating markets / avenues where the IWRMC can generate income through selling compost and recycled metals, plastics and glass.

Mitigation for terrestrial pollution

- Implement rules within the IWRMC workers to impose penalties for any littering within the island due to improper handling of the waste and improper transport practices;
- the status of the vehicles used shall conform to the Waste Management Regulations 2013/R-58 and provide cover to the waste being transported in order to avoid littering;

- during waste collection instead of stopping the vehicle at every house, the residential area can be divided into blocks and vehicle stops can be pre-determined and from where waste containers can be hand carried by the workers from respective houses to be loaded to the vehicle.

Mitigation for accidents and injuries

- Waste collecting workers shall wear appropriate clothing and PPE to avoid injuries in handling waste;
- vehicles should be driven by licensed drivers;
- records of the vehicle trips shall be properly maintained;
- speed limits shall be observed; and
- a strict schedule shall be stated in the IWMP and followed in order to reduce the transportation frequency thus reducing the probability of accidents.

Mitigation for air quality impacts

- Vehicle speed shall be kept appropriately to suppress dust;
- vehicles used shall be regularly washed and kept clean; and
- The waste being transported shall be covered to minimise the impact of odour on the public.

Mitigation for climate impacts

- Regular servicing of vehicles used to transport waste;
- ensuring the vehicle has roadworthiness certification from the Transport Authority;
- restricting the use of the vehicle only for the stated time in the IWMP;

Measures to prevent marine pollution

- Wastes destined to the nearest waste management facility will require to keep logs of waste being loaded from the island and unloaded at the nearest waste management facility. The records to be signed by the vessel captain and a copy returned to the waste management supervisor;
- vessels used shall have a certified captain and vessel should have valid seaworthiness certificate;
- vessels shall not be overloaded and waste containers shall be kept closed and shall not be allowed to flyaway due to wind and sea conditions; and
- Waste shall not be transferred during extreme weather conditions.

b) O2 Waste Management Activities

Assuming that operations of the IWRMC will be properly resourced and functioning properly, the waste sorting, separating storing and composting will have an overall positive impact as shown by the multi-criteria impact assessment with a score of 20. On top of reducing the volume of waste, these activities,

will make resource recovery and ultimately a significant proportion of the waste becoming a valuable resource. These activities will be carried out in the IWRMC where employees will be trained to undertake these activities.

In general, the operational phase of the project will greatly improve the existing waste management condition of the island preventing pollution and spread of diseases. These activities would prevent pollution of groundwater, coastal areas and forested areas which would prevent impacts to biodiversity, health and wellbeing of the public.

However, if these activities are not properly implemented there is a risk of IWRMC being deteriorated into a dump site where mixed waste are disposed, burned and buried. This means without proper mitigation measures and regular transportation of waste out of the island to a central facility, there is a greater risk of IWRMC being overfilled. This entails a loss of investment and a greater impact to environmental receptors as some sites are moderately close to public areas. Propensity of these impacts are greater for the following environmental receptors:

- Groundwater;
- Climate/air; and
- Health and wellbeing: noise, odour and accidents/injuries

The following Sections describes the factors influencing these impacts and proposes measures to mitigate negative impacts and to ensure the overall positive impact of the IWRMC during operational phase.

Impacts on health

Overall positive impacts on public heath are identified from this project, while the in-vessel composting method will ensure that some of the negative impacts associated with manual windrow composting are eradicated by:

- significantly reducing the level of exposure of the workers to raw organic waste that has the potential to transmit air borne pathogens;
- shortening the time required for compost production, thereby reducing the workload and manual labour, and;
- the end product being completely odourless.

Mitigation for health impacts

- A distance of 264m is available between the IWRMC and the nearest residential area, which is greater than the buffer zone proposed by Herr et al (2004) and Wheeler et al (2001), it is expected that bio aerosol concentrations will reduce to background level at the stated distance;
- site is located in such a way that winds from both monsoons blows the airborne particles from the IWRMC away from the residential zone; and

- workers will wear appropriate safety clothing, follow the workplace safety mechanisms and guidelines set by the contractor and practice safety and personal hygiene when handling the compost.

Impacts on groundwater

Sorting and processing of all type of waste received at the IWMRC will be carried out in fully enclosed paved areas, with adequate drainage systems installed, thereby effectively minimising any potential for groundwater pollution as a result of leachate generated from waste processing and handling during unprecedented weather. In addition to this, rainwater drains are installed at the open areas of the IWRMC. All the drains within the IWMRC are connected to either the leachate collection tanks or the septic tank. Therefore, the operation of the IWRMC is identified to have an overall positive impact of the groundwater of the island.

At present, waste has been dumped throughout the island without any measures, enabling the pollution of the groundwater with the leachate. Therefore, the proper operation of the IWRMC and the proper management of the collected waste will result in the reduction of the pollution of the groundwater from waste sources, thus improving the status of the groundwater in the island.

Mitigation for impacts on groundwater

- Ensure that waste is not being kept in the open areas of the IWRMC; and
- Ensure that the composting machine is being operated daily.

GHG emissions

The waste management activities will require power consumption for operation of the machines, lighting and pumping. Since the island's power system is fossil fuel based incremental increase in electrical energy consumption at the IWRMC will result in GHG emissions. However, the power consumption at IWRMC is expected to be small and therefore is not considered a significant issue.

Some amount of GHG will be released during the operations of the waste collection and transfer vehicle, which would be quite insignificant when considered cumulatively.

Amenity impacts

All waste processing area of the IWRMC will be fully enclosed, while the only open area of the IWRMC corresponds to a significantly minor proportion designated for the movement of the collection vehicle. Additionally, adopting the in-vessel composting method and designating a storage room exclusive to finished compost means that any potential negative amenity impacts associated with manual windrow composting such as huge piles of compost and untreated raw waste being visible is completely removed.

Therefore, no negative amenity impacts are envisaged during the operations of the project. In contrast, a fully functional IWRMC will contribute to the overall cleanliness of the island, by reducing potential for littering and unorganised dumping of waste to different parts of the island.

Mitigation for impacts on amenity

- Ensure that waste is not being kept in the open areas of the IWRMC.
- Ensure that the composting machine and the other operations of the IWRMC are being carried out daily or in a system manner, in order to avoid creating deposition of huge piles of untreated waste.

Air quality impacts

Odour

During traditional windrow composting, odours can originate from sulphur compounds, nitrogen compounds and volatile organic compounds. Ammonia is also commonly associated with unpleasant odour resulting from composting. If the composting is done under aerobic conditions, the main gaseous product is carbon dioxide. Gas compounds contributing to the odours of composting organics containing bio solids include dimethyl sulphide, dimethyl disulphide, dimethyl trisulphide, carbon disulphide and benzothiazole.

The proposed in-vessel composting method, will eliminate such potentials foul odours associated with manual windrow composting. It converts unsightly and odorous garbage into a beneficial material devoid of foul odours and unsightly appearance.

Furthermore, the proposed site is 264m away from the nearest residential area, therefore the impact of odour (even if generated) on the residential areas are deemed minimal.

Mitigation for impacts on odour

- Ensure that stock pile of raw organic waste is kept low and is not left untreated for longer durations.
- Ensure that staff involved in sorting of received waste and operations of the compost machine are wearing appropriate PPE including masks to mitigate any undesirable impacts of foul smell coming from raw organic waste.

Fire hazards

There is a possibility of fire hazards at the IWRMC coming from human activities. Fires can pose a risk to the workers through explosions and suffocation from smoke, in addition to damage to equipment.
Possible fire hazards are caused by the following (DCE NSW, 2004)

- Spontaneous combustion;
- Lightning strikes;
- Cigarettes; and

- Arson

The most common causes of fire during waste management activities are reported to be cigarettes and spontaneous combustion (Rynk 2000). The cause of spontaneous combustion is when the decomposing organics self-heat to ignitable temperatures (DCE NSW, 2004). As compost will not be stored in the open but in the proposed 14sqm ventilated area, such an event is extremely unlikely, although it is important to limit the storage of organic within the IWRMC. If the production exceeds the demand and the storage capacity of the IWRMC, excessive compost can be disposed in forested areas of the island which would ultimately enrich the soil condition of the island. The organic material produced by the proposed in-vessel composting method not only provides nutrients to the plants, it also improves the organic-carbon content and moisture retaining capacity of the soil

Potential for such fire hazards can further be mitigated by closely monitoring the waste management operations of the centre. CCTV cameras can be installed to ensure that best practice is followed and prohibited activities like smoking are not carried out inside the IWRMC. Furthermore, no smoking sign boards will be installed in the IWRMC and firefighting equipment will be supplied as part of the civil works contracts.

Mitigation for impacts on fire hazard

- A fire management plan shall be developed by the IWRMC operator;
- Adequate firefighting equipment shall be provided at the IWRMC, and placed at locations easy to access. The current design of the IWRMC includes firefighting equipment;
- Dispose excessive compost in forested areas, if production exceeds demand and storage capacity;
- Closely monitor the operational activities of the IWRMC to ensure that the rules and protocols established are being well followed by operational staffs, which could be further augmented by the installation of CCTV cameras;
- Signs shall be kept on the premises stating that open flames are not permitted on site. Install no-smoking sign boards in places where flammable waste such as paper / cardboard and compost are being stored; and
- Training and awareness raising on firefighting shall be conducted on a regular basis for the workers.

<u>Noise and vibration impacts</u>

The main sources of noise from the operation of waste management centres come from the material recovery machineries used and the operation of vehicles. According to the Health and Safety Executive UK, most material recovery facilities have noise levels exceeding 80 dBA and 85 dBA. Assuming a maximum noise level of 85 dBA, the noise decay map in **Figure 14** can be used for this purpose too. From the initial calculations, the noise levels are projected to decrease down to less than 59 dBA at the nearest residential area. Therefore, the long-term negative impacts of noise would be borne by the employees of the IWRMC, and the effects of noise to the residential areas are minimal.

Mitigation for noise impacts

- Obtain noise data from supplier prior to purchase of machinery;
- enclose the noisy machinery with sound insulating enclosure;
- reduce duration of exposure by implementing job rotation; and
- provide employees with hearing protection if required.

Workplace safety and accidents

The group of people most likely to be impacted by the IWRMC operations are the workers at the site. The various operations such as transportation, collection, handling, sorting and storing of the wastes, in addition to the composting and volume reduction operations all pose different risks to the worker onsite. The impacts discussed above and their proposed mitigation measures can provide a level of safety to the workers. Even with these mitigation measures put in place, a proper workplace safety guideline shall be formulated by the operator for all workers onsite to follow.

In addition to the impacts discussed above, other work-related safety issues include falling stock or during lifting activities, moving vehicles and falls from height. The accidents can result in injuries of varying nature.

Mitigation for workplace accidents

- The IWRMC occupier shall be required to develop occupational safety management plan, and safety guidelines shall be displayed in the work site at all times;
- provide clear instructions to the workers on:
    - The possible risks
    - Measures in place to control risks
    - Follow emergency procedures;
- provide proper training including manufacturer's safety instructions to employees on how to operate machinery;
- conduct proper and regular maintenance of machinery used;
- prior to maintenance, make sure the equipment is made safe and prevent access to dangerous parts. Make sure others are aware that maintenance is being carried out;
- machinery and vehicles should only be handled by employees with the proper credentials and training; and
- proper PPE should be provided at work. PPE should be used after all possible risks have been eliminated as much as possible and to manage any remaining risks.

c) O3 Waste Generation

Not considering the waste collected from the island, waste generated as a direct result of operations at IWRMC during the operational phase of the IWRMC will be relatively low. These will include waste oil/batteries for waste management equipment, yard cleaning waste, used spare parts, used clothes, etc. Since eating and cooking inside the IWRMC will be prohibited, no mixed municipal waste will be generated during the operational phase of the project. Hence overall impact for this activity would have a minor negative impact on environmental receptors. The multi-criteria impact analysis shows it would have a minor negative impact with an overall score of -10.

Mitigation Measures

- All wastes generated as a direct result of the waste management activities shall enter the waste management stream and managed as prescribed for different waste types; and
- prohibit eating/cooking in the IWRMC.

d) O4 Resource Consumption

Electricity, fuel and water will be directly required for the operation of the IWRMC. Water will be mainly sourced from the ground while electricity will be obtained from the island's mains.

Water will be mostly required for cleaning purposes and volume of water required for these will be relatively small. The curing system of Excel's compost machine, where the output from the compost machine is kept for 10 – 12 days for making final compost, has an automatic fogging system, thereby reducing the volume of waster required for compost production compared to traditional methods. It is estimated that approximately 200 -300 l/day of ground water will be required during the operational phase of the project. Since the volume of water required is relatively low, it is not expected to have a significant impact on groundwater.

A compactor and shredder/crusher can be used to reduce the volume of waste streams. The waste weight will remain the same so there will be no savings from the total amount of waste produced. However, savings will occur because waste volume will be reduced by approximately 80% which will decrease the number of times the storage area is required to be emptied, therefore resulting in lower transportation costs.

Depending on the type of equipment's used such as chainsaws will require small volumes of fuel for operations. Most of these equipment's, however, are run very infrequently when enough waste has been separated and stored and are relatively efficient when run, meaning the amount of energy consumed by the compactor will be low. The running wattage mid-range compactors and shredders may range from 700 – 2000 watts, which means approximately 30-60 kW will be required to power all equipment simultaneously. However, this will not be the case since many of this equipment don't need to be switched

on daily and at the same time. There may be periods where the only electricity required will be for switching on the lights at the IWRMC. Therefore. Electricity consumption of the IWRMC during the operational phase will be relatively low. The activity would have a minor negative impact on environmental receptors.

However, the following mitigation measures shall be implemented to reduce water and electricity consumption.

Mitigation Measures

- It is strongly encouraged to install solar panels on the IWRMC roof to generate required power for the IWRMC;
- use solar lights in the premises;
- work shall be planned to be carried out during day times;
- ensure that the curing system is purchased along with the compost machine;
- ensure that stock of bioculum is maintained to cover for a period of 1 year;
- ensure that all equipment is serviced and kept clean daily, to reduce the amount of water required for cleaning;
- prepare a plan to switch on the compactors and shredders depending on the incoming waste stream to conserve electricity; and
- make sure all equipment are properly serviced and maintained.

e) O5 Operational Staff Influx / Settlement

If expatriate workers are selected for operations of the centre, social and labour related impacts identified for the construction phase will prevail in the operational phase as well.

Impacts related to interactions between operational staff and the local community may include:

- Transmission of HIV/AIDS and other sexually transmitted infections (STIs) and other vector borne communicable diseases;
- Tension and conflict between communities and employees of contractor;
- Delays in payment of rent and/or equipment hired from the island; and
- Health and safety accidents and incidents associated with project activities, such as increased vehicle movement on public roads etc.

Other labour related impacts during construction phase may include:

- Exposure of workforce to potential harm, injury, ill-heath and to enjoyment of human rights etc.; and
- Exposure of workforce to poor accommodation standards. Exposure of workforce to inadequate OHS standards.

Mitigation measures

The following mitigation measures are recommended to be adopted

- Hire local staff where possible;
- Orient foreign workers on communication, personal hygiene and sanitation and infectious diseases;
- Ensure all foreign workers have their legal permits;
- The development of an OHS management system and OHS monitoring and surveillance program;
- Fitness-for-work health screening;
- The development of a worker health awareness program;
- The development of worker engagement procedures;
- Development of a worker feedback mechanism;
- The development of relevant Human Resource (HR) policies and procedures; and
- The development of a worker code of conduct.

Summary of Construction Phase Impacts and Mitigation measures

The table below provides a summary of the mitigation actions recommended to mitigate significant impacts during operational phase.

Table 25 Summary of ESMP for Operational Phase

Environmental Management Plan			
Impact	**Mitigation Measure**	**Responsible Party**	**Cost of Mitigation**
Management of Impacts during Operational Phase			
1. Physical / Chemical			
Waste processing and storage. **Litter, odour and vector nuisance.**	Ensure that intra island waste collection services are provided at least daily. Secondary transfer to a regional facility shall be arranged every 4 – 6 months. Waste collection vehicles and transfer vessels must be secured from all sides to prevent spillage. The status of the vehicles used shall conform to the Waste Management Regulations 2013/R-58 and provide cover to the waste being transported in order to avoid littering; During waste collection instead of stopping the vehicle at every house, the residential area can be divided into blocks and vehicle stops can be pre-determined and from where waste containers can be hand carried by the workers from respective houses to be loaded to the vehicle. Adequate bins with closures must be provided at the drop off locations if the IWMP has demarcated them. Provide adequate training to all laborers involved in operating the waste management equipment / machineries. Undertake regular maintenance of the waste management equipment. Control of the incoming waste stream is necessary to ensure safe and effective processing, treatment, and disposal of the Waste and the quality of end products (e.g., quality compost).	P: Island Council/ IWRMC Operator S: MCEP (for delivery of training on WM equipment / machineries)	Cost associated with IWRMC operation Cost of providing training Cost associated with purchasing jumbo bags and/or containers

	• Visually evaluate, weigh, and document incoming waste loads; • Conduct visual inspection of the incoming waste, along with sorting and removal procedures, can minimize this potential hazard; • Analyse suspected hazardous materials before acceptance so that they are segregated relative to compatibility and so that they can be adequately treated and disposed of; • Separate recoverable secondary materials for recycling and organic waste for composting to the extent practical. • Waste that cannot be managed at island level must be processed (chipped, crushed or compacted) and stored in the inorganic storage area and packed / labelled according to the guidelines of the regional collector. • Maintain log records of all outgoing waste either in terms of weight or volume of jumbo bags and/or containers. The log sheets must be provided to the regional collection supervise or vessel caption.		
Hazardous Waste Management and Transportation	Do not accept medical hazardous waste as it has to be managed by the island health centre and incinerated separately. Types of hazardous waste managed at the health centre mainly include needles, syringes, expired medicine and contaminated materials (cloth/gauze/disposable gloves). Other types of hazardous wastes generated within the households including small batteries, solvents, paints, used oils, pharmaceuticals and old lights which use mercury shall be managed at the IWRMC. Incoming hazardous waste to the IWRMC should be stored in the hazardous waste storage room in containers or barrels and regularly checked for any leakage. The following measures must be taken during transportation of hazardous waste: • Use containers appropriate for the wastes they are intended to carry; • If drums or other containers are used to transport waste, containers should be in good condition and compatible with the waste and are adequately secured in the transport vehicle;	P: Island Council /IWRMC Operator	Cost associated with purchasing containers designed to store hazardous waste and printing of labels.

	• Adequately label all transport tanks and containers to identify the contents, hazards, and actions required in various emergency situations.   Tampons and nappies, while indicated as hazardous wastes in the ESMP, are biodegradable and can be composted. The high temperature of the composting process has been documented to eradicate any harmful pathogens containing potential biohazards.		
Marine Water Pollution and associated impacts to marine organisms due to potential spillage of waste to the sea during transfer of waste from the IWRMC to the RWMF (loading and unloading)	The IWRMC operators and the island council should ensure implementation of the following measures prior to regional transfer: • All outgoing waste from the IWRMC shall be stored in bins or jumbo bags and properly labelled to indicate the type of waste. Below are some examples of the signages that can be used to label bins and jumbo bags:	P: Island Council /IWRMC Operator	Cost associated with printing the labels.

	 • Maintain log records of all outgoing waste from the IWRMC either in terms of weight or volume of jumbo bags and bins and provide to regional collector. The regional collector should make sure that the following measures are implemented during loading and unloading of waste into the collection vessel (landing craft): • Prepare a collection manual that gives instructions related to storage of waste for regional collection and share with the councils. The manual should clearly specify the types of waste that are accepted and not accepted for regional collection, categories to which waste has to be sorted and packaged by the councils (plastics, glass, nappies, metals, hazardous etc.) and any special requirements for packaging waste such as hazardous waste (sealed containers, proper signage etc.). • Prepare a schedule for regional collection and share with the respective councils. In addition to this, it is recommended to inform the exact date of regional collection to the respective council 3 days prior to arrival of the transfer vessel (landing craft).	P: Regional Waste Collator / RWMF Manager / Supervisor / Vessel Captain	Cost of printing manual, posters and billboards Cost of purchasing safety equipment Cost of purchasing whaler

	• Properly label the jumbo bags, containers or bins to reflect the type of waste (if this has not been done by the councils). • Record data of all loaded waste in terms of weight or jumbo bags, containers and bins (volume of the bags and bins must be specified). • Waste must not be kept in the open in any circumstance during transfer. • Hazardous waste (such as batteries, paint, thinner, fibre glass etc.) should be kept in the landing craft in sealed containers. The containers should be properly labelled with appropriate signs (for example hazardous, flammable, toxic etc.). Hazardous waste should be kept away from flammable waste such as wood, plastic and paper. • All waste loaded to the transfer vessel should be covered from the top to minimize potential for spillage during transport. • The height of loaded waste should not exceed the height of sides of the landing craft. In circumstances where excessive waste is absolutely necessary to be loaded, the sides should be lifted to meet this requirement. • Log records of all unloaded waste (incoming waste to the RWMF) should be recorded either in terms of unloaded weight or volume of bins and jumbo bags for different categories of waste. • Maintaining log records of loaded and unloaded waste quantities are critical and compulsory as it can indicate the amount of waste lost to the sea during transfer (if any). • Give proper instructions and training to the staffs involved in regional collection. • Loading shall be undertaken under the direct supervision of a qualified responsible staff. This staff or supervisor will monitor all activities related to regional collection and transfer and ensure that environmental compliance is achieved.		

	• The waste transfer vessel must be equipped with firefighting equipment and smoke detectors. • The waste transfer vessel should be equipped with navigational safety equipment such as life vests. • The landing craft should be accompanied by a whaler to be used for accessing islands that do not have harbours.		
Noise pollution during waste management	Depending on availability, battery operated vehicles can be used to provide collection services. Waste handling works involving operation of machinery shall be undertaken during day time. Obtain noise data from supplier prior to purchase of machinery. Enclose the noisy machinery with sound insulating enclosure. Reduce duration of exposure by implementing job rotation. Provide employees with hearing protection if required.	P: Island Council / IWRMC Operator S: MCEP (for vehicle and equipment / machinery)	Cost associated with purchasing collection vehicles
Air emissions from MSW collection and transport	Emissions from on-road vehicles shall be regulated through national and regional programs. All waste transport vehicles must have up to date road worthiness licenses. Optimize waste collection routes to minimize distance travelled and overall fuel use and emissions. Drivers shall be instructed on the benefits of driving practices which reduce both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits.	P: Island Council / IWRMC Operator S: EPA	Cost of training drivers

	When the IWRMC and becomes operational no open burning shall be practiced.		
Odor Impacts during IWRMC operations	Ensure that stock pile of raw organic waste is kept low and is not left untreated for longer durations. Ensure that staff involved in sorting of received waste and operations of the compost machine are wearing appropriate PPE including masks to mitigate any undesirable impacts of foul smell coming from raw organic waste.	P: Island Council / IWRMC Operator	Cost associated with purchasing PPEs
Amenity Impacts	Ensure that waste is not being kept in the open areas of the IWRMC. Ensure that the composting machine and the other operations of the IWRMC are being carried out daily or in a system manner, in order to avoid creating deposition of huge piles of untreated waste.	P: Island Council / IWRMC Operator	No cost involved
Impacts on Groundwater	Ensure that waste is not being kept in the open areas of the IWRMC. Ensure that the composting machine is being operated daily.	P: Island Council / IWRMC Operator	No cost involved
Waste Generated with the IWRMC during the operational activities	All wastes generated as a direct result of the waste management activities shall enter the waste management stream and managed as prescribed for different waste types; and Prohibit eating/cooking in the IWRMC	P: Island Council / IWRMC Operator	No cost involved
Impacts due to Resource Consumption	It is strongly encouraged to install solar panels on the IWRMC roof to generate required power for the IWRMC. Use solar lights in the premises. Work shall be planned to be carried out during day times. Ensure that the curing system is purchased along with the compost machine. Ensure that stock of bioculum is maintained to cover for a period of 1 year. Ensure that all equipment is serviced and kept clean daily, to reduce the amount of water required for cleaning.	P: Island Council / IWRMC Operator S: Ministry of Environment (for potential Installation of Solar)	Cost associated with purchasing bioculum and servicing equipment. Cost associated with installation of solar panels.

	Prepare a plan to switch on the compactors and shredders depending on the incoming waste stream to conserve electricity. Make sure all equipment are properly serviced and maintained.		
2. Sociological and Cultural			
Occupational Health and Safety Impacts	The IWRMC operator shall be required to develop occupational safety management plan, and safety guidelines shall be displayed in the work site at all times; • provide clear instructions to the workers on: o The possible risks o Measures in place to control risks o Follow emergency procedures; • provide proper training including manufacturer's safety instructions to employees on how to operate machinery; • conduct proper and regular maintenance of machinery used; • prior to maintenance, make sure the equipment is made safe and prevent access to dangerous parts. Make sure others are aware that maintenance is being carried out; • machinery and vehicles should only be handled by employees with the proper credentials and training; and • proper PPE should be provided at work. PPE should be used after all possible risks have been eliminated as much as possible and to manage any remaining risks. • protective clothing, gloves, respiratory face masks and slip-resistant shoes are recommended for waste transport workers and hard-soled safety shoes for all workers to avoid puncture wounds to the feet. • for workers near loud equipment, include noise protection such as ear muffs. • for workers near heavy mobile equipment, and at the discharge location for collection trucks, include provision of hard hats.	P: Island Council	Cost of purchasing safety materials
Fire hazard	Burning of waste at the IWRMC should never be practiced under any circumstances. Naked flames shall not be allowed at the IWRMC.	P: Island Council	Cost of purchasing equipment

	Smoking should be prohibited inside the premise of the IWRMC, placing awareness signs in the premise. Adequate firefighting equipment shall be provided at the IWRMC, and placed at locations easy to access. The current design of the IWRMC includes firefighting equipment. Dispose excessive compost in forested areas, if production exceeds demand and storage capacity. Highly flammable areas such as those area allocated for the storage of paper, wood and cardboards, should be clearly marked with appropriate sign boards indicating the flammable nature of the waste. Installation of cameras, fire alarm system and hiring of security guard for 24hrs surveillance. Ensure that waste management staffs are briefed of fire hazard management. Fire safety training on how to use the installed equipment and act in case of an emergency fire should be provided to the security guard and all the waste management staffs of the IWRMC	S: MCEP (for firefighting equipment and sign boards)	Cost of printing and placing sign boards included with the overall project budget. Cost of purchasing cameras, alarms. MVR 10,000.00 Salary of security guard (approximately MVR 4000.00 per month)
Sociocultural conflict	Ensure that waste handling staffs are selected from the local community as much as possible. If expatriate workers are used ensure that they respect the local culture. Conduct a training to sensitize the labour to the local context and customs. This training should also cover topics related to Gender-based violence. Develop a "Code of Conduct" outlining the set of rules that that the workers have to follow to persevere the social norms and religious values of the society. The Code of Conduct should also specify penalties for breaching these rules and should be thoroughly communicated to workers prior to mobilization.	P: Island Council	Cost associated with hiring staffs
Grievance Redress Mechanism	The Island Council should device a GRM for the operational phase. The contact details (email and phone number) of the council's focal point shall be	P: Island Council S: URA / EPA	Cost of printing GRM board and posters

	displayed in the IWRMC as well as the council notice board and other public places. If the complaints are not resolved to at Island level, the aggrieved party may submit complaints to the Utility Regulatory Authority (URA) and the EPA.		
3. Economic			
Collection Fee	Ensure that the collection fees are feasible for the community. Undertake consultation meetings with stakeholders and set a suitable collection fee acceptable to the community.	P: Island Council	Cost associated with conducing stakeholder sessions
Employment Opportunities	Ensure that waste handling staffs are selected from the local community as much as possible.	P: Island Council	Cost associated with hiring staffs

CHAPTER 5 PROJECT ALTERNATIVES

This section explores alternatives for the proposed project. The proposed options are compared with alternatives in detail. When comparing the alternatives, environmental, economic and social considerations were considered.

5.1. No Development Option

In the case of no project option, all foreseeable negative impacts as a result of the construction and operation of the IWRMC can be avoided. However, no project option would also mean continuation of the current state of waste management in the island. The people would continue to engage in unsustainable waste management practices. The island would not have an approved demarcated waste management area, waste would continue to be burned in open areas, and kitchen waste would continue to be dumped on beaches, lagoons and reefs. Allowing existing practices to continue would also mean no resource recovery and ultimately all resources getting lost in the "waste". Allowing open dumping waste with no management would also mean increasing risks to human health, lowering aesthetic qualities and lowered quality of life. The aspiration of the people to move in the path of sustainable development would also be compromised. The positive effects of proceeding with the project far outweighs negative impacts associated with the project which can be managed and kept at an acceptable level. Hence, no development option of the project is rejected. The table below shows comparison of no development option with the development option at Th. Madifushi.

Table 26 Comparison of the no development option with development option

Option	Environmental	Social	Economic
No Project Alternative	All negative impacts associated with project avoided, however, the island environment may continue to slowly deteriorate due to pollution as a result of inadequate waste management. Land area will be rendered unusable or will be polluted by the residual waste remaining after burning and burying waste. Seepage of leachate into groundwater film as a result of burying waste in excavated pits. Risk of waste piles sliding as a result of heavy rain or flooding events. Increased pollution of beaches, lowered aesthetic values, pollution of the lagoon and coral reef.	Benefit to the society by the project will be missed and chances of polluting the island is high which could lead to health implications as well as visual negative impacts. Risk of waste coming into direct contact with children. Without a proper waste management system there is a risk of the island turning into a slum as a result of population increase and economic development.	No significant improvement to the local and regional economy. Jobs and income earning opportunities expected as a result of the project will not realize.
Project Alternative	The project will result in loss of alternative land use potential for the proposed site All impacts due to construction can be managed and maintained at acceptable level. The project will control and prevent further pollution of the environment, and thereby promote sustainable development of the island.	Increased direct and indirect employment opportunities for the locals during the construction phase in addition to when the IWRMC and waste management system becomes operational. Knowledge transfer and development of technical capacity with regard to waste management and compost making.	Enhanced opportunity for locals to start and diversify tourism related services, since a safe and clean island would facilitate attracting visitors to island. Creation of job opportunities and development of skills. Potential to get income by selling compost etc. which would develop the island's economy.

		More resources and manpower to manage the island would become available as a result of the project. The aesthetic qualities of the island would improve and thereby promote healthy and more enjoyable life on the island. During the operational phase of the project, smell, dust and particulate matter especially from composting activities may be emitted from the IWRMC. However due to the isolated nature of the site to the populated area of the island such impacts are not expected to be significant.	

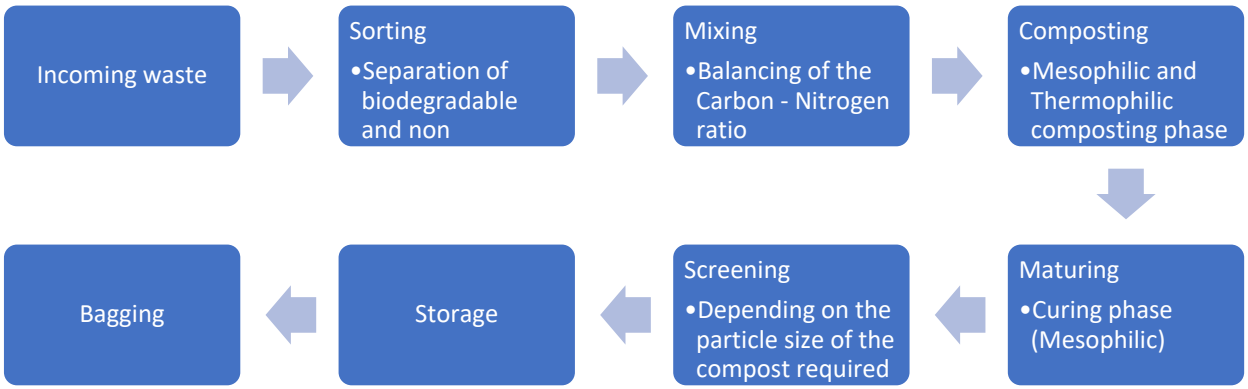
5.2. Alternative technology for treating organic waste

The proposed technology for treating organic waste is in-vessel composting. Alternatives to this could be manual open windrow composting and anaerobic digestion. Each option is discussed separately below.

5.2.1. Manual (Open) Windrow Composting

The main constituents of a compost heap include kitchen and garden waste, along with water and air in the pore spaces between the constituent.

After the incoming waste is properly sorted into compostable wastes and other wastes, mixing of the compostable waste is done. This mixing is done to provide an optimum Carbon-Nitrogen ratio for the process to occur. Prior to mixing, if the waste contains branches, twigs and such, they are fed into a wood chipper to reduce their size. After the mixing is completed, composting process begins on the composting slab as an open windrow compost. After the compost matures, screening is done depending on the particle size of the compost required. This compost is bagged and stored. These steps will be elaborated below.



Thermophilic composting is the process of composting using thermophilic (heat-loving) bacteria. Thermophilic composting consists of three phases;

Table 27 The phases of composting

Stage	Temperature	Duration	Organisms
Mesophilic	Moderate, up to 40 °C	2 days	Initial decomposition is done by mesophilic organisms that thrive at moderate temperatures
Thermophilic	High, over 40 °C	Few days to several months	Mesophilic organisms become less competitive and replaced by thermophilic heat loving microbes. High temperatures break down proteins, fats, and complex carbs like cellulose and hemicellulose (major structural molecules in plants)
Mesophilic (curing or maturation phase)	Moderate, up to 40 °C	Several months	As the compounds decrease, compost temperature gradually decreases and mesophilic organisms take over again for the final curing of the remaining organic matter.

As seen from the **Table 27**, the composting process can prolong to several months.

As the process of composting occurs, leachate will be produced from the organic waste within the compost pile. The composting will be done on the specially constructed compost slab. The bottom of the slab and ground beams in this area have an HDPE membrane between the reinforced concrete and the ground.

5.2.2. Anaerobic Digestion (AD) System - Plug Flow Reactor (PFR) Anaerobic Digester

The Plug Flow Reactor or PFR technology is based on a sealed tank that contains a given quantity of water inoculated with a bacterial component. During the construction and commissioning phase, the water and bacterium inoculum require a 30-day activation period to produce the digester liquid, following which no additional water or inoculum is required as the system is self-sustaining.

With activation and commissioning completed, feeding of waste can be started. The process has a 30-day retention time at the end of which biogas, a digestate and digester liquid are released.

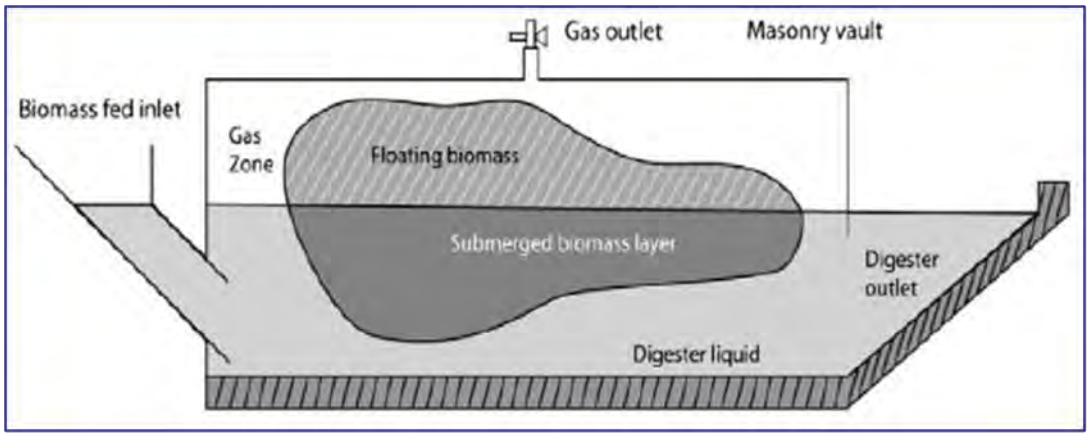


Figure 17 Design of Plug flow type biogas plant

The Plug Flow Reactor (PFR), as shown in the sketch, is a sealed tank that can be constructed from either:

- Fibre Reinforced Plastic (FRP) – with a 20-year life expectancy and guarantee
- Stainless steel – with a 15-year life expectancy and guarantee; or
- Masonry – with a potential 25-year life. (NB: details of the materials used are needed!)

Having been filled with the required quantity of water, the bacterial inoculum is added and the activation is allowed to complete. Waste can then be added through the inlet. The plant can accept food waste and green waste.

If the waste is predominantly food waste, up to 20% green waste can be added. It should be noted that this does not work in reverse.

If the waste stream is mainly green waste, food waste cannot be added so the plant becomes suitable only for 100 % green waste.

Also, because of the bacterial sensitivity, over-feeding of waste can stop the reaction. Thereafter, the unit will need to be re-set, including being cleaned out and a fresh supply of water and bacterial inoculum added, with 30 days to re-activate the process.

It is claimed the system can cope with 15 - 20% non-segregated waste contaminated with glass, plastic and metal (although, it is accepted that metal can destroy the bacteria?).

The system relies on the majority of waste floating within the digester liquid, allowing the bacterial decomposition reaction, thereby liberating the biogas. The system maintains a pH of 6.8 to ensure decomposition. “In BIOEN’s Bio-methanation technology one ton of bio-waste is reduced to less than 100kg in a 30-day retention time.”

Biogas production is claimed at up 60m3/TPD, depending on the particular waste stream.

“Around 5-10% of the biodegradable waste fed into the bio-methanation plant comes out as compost in case of food waste/MSW/cow dung and 30-40% of the material comes out undigested in case of agro-residues.” (NB: this rather contradicts . . . “one ton of bio-waste is reduced to less than 100kg in a 30-day retention time”)

“The agro-residues and leafy material containing lignin does not get digested completely and comes out of the digester at the end of 30-day retention time. This material can be pulled out of the digester and dried to obtain compost of high nutrient value.” (further lessening the reduction? And how long for drying and maturing as compost [NB moving from anaerobic process to aerobic process]?)

From 1TPD of biodegradable waste fed into a biogas plant around 30-40kg of wet compost (6-10kg dry) compost can be achieved. The wet compost has to extracted from the vessel with the digester liquid and then requires secondary processing under aerobic conditions.

“The digester liquid (600 - 700L/TPD) is also high in nutrients and can be used as fertilizer.” The process assumes that the moisture content of the raw waste feed is sufficient to maintain the liquid level in the reactor vessel (how is this monitored?), thereby allowing digester liquid to be drawn-off for use as a liquid fertiliser.

“The biogas produced can be used directly for cooking or can be converted to electricity. Using our highly efficient IR biogas stoves along with a biogas compressor (2-5Kg/cm2) the biogas can be efficiently used as a substitute for LPG. The excess biogas produced can also be converted to electricity through a biogas generator. For each m3 of biogas generated 1-1.5kW of electricity can be generated.”
It should be noted that not all food waste – eg: bones, egg shells – decompose in the reactor but sink to the bottom and remain there. This necessitates shutting down the system at 3 – 4-year intervals to clean out the reactor and refresh the system, followed by 30-day re-activation.

The reactor has limited flexibility. It can operate at below its rated capacity without damaging the process, but outputs will be reduced, correspondingly. It cannot operate above its rated capacity. At the point at which a small increase in throughput is required, an additional reactor will be required.

5.2.3. Analysis

The table below shows comparison of organic waste treatment options with the proposed in-vessel composting method.

Table 28 Analysis of technology options

Option	Environmental	Social	Economic
Manual (Open) Windrow Composting	Limited process control increases environmental risks such as odour and leachate, which in turn increases the potential for groundwater pollution and occupational health hazards due to odour. Not suitable during rainy seasons as the problem of leachate will escalate, if proper mitigatory measures are not adopted. The materials subject for composting should be turned on a regular basis, taking up to 16 weeks. The compost that is produced must then be graded and screened to remove any remaining contaminants. Thus, longer processing time, increases the duration to which workers are exposed to raw organic waste. Green waste and food waste can be treated mixed. The issues of vectors such as flies and rats exists, which needs to be controlled.	Compared to other processing options, windrow composting has a relatively low throughput per unit surface area, which means demand for land is relatively high. No automatic curing system means that the piles have to be turned manually at least every 5 days. Therefore, the process is highly labour intensive. .	Initial investment and operating costs are relatively low. O&M cost is relatively low as no machines or raw materials (bioculum) are required. Indirect economic disadvantage due to high land requirement that may result in high compensation rates. Due to longer processing time, production may not meet demand to realise an economic benefit or to even make return, self-sustaining to operate the IWRMC.
Anaerobic Digestion (AD) System	Energy can be recovered from organic residues in the form of methane rich	Land required for the installation of the anaerobic system is high	The by-product of anaerobic digestion, i.e., digestate, looks as

	biogas, which can be used to generate renewable power and/or heat. Hence, if a bio-generator can be included with the system, the power requirement to operate the IWRMC can be made self-sustainable, which will in turn reduce the reliance on the island power system that uses diesel generators to produce electricity. This will contribute in reducing GHG emissions, although it will be quite insignificant when compared at a national or global scale. Biogas can also be used as a substitute for LPG. But IR biogas stoves and a biogas compressor (2-5Kg/cm2) will be required. The plant allows waste to be fed in partially segregated manner (80 – 90% segregation). Waste can be fed without pulverisation. The potential inclusion of a bio-generator or biogas stoves and compressor increases associated risks such as fire hazards. Additionally, if piping is to be laid to supply gas to restaurants or houses, the risks of leakage from the pipes would exist, thereby increasing the potential for soil and groundwater pollution. Limited potential for treating food waste and	compared to in-vessel composting. Additional land is likely to be required if a bio-generator / IR stoves and a biogas compressor is associated with the system.	a reliable material for agricultural uses. Additional jobs will be created in the operations of the AD plant as well as associated biogas generator and LPG gas supply and distribution systems (if included as a part of the project). This method is the most expensive option out of the three and will require the highest level of technical expertise to operate it properly. Capital investment is extremely high. The plant itself costs around MVR 462,000.00 (USD 30,000.00) excluding civil works, while the inclusion of any associated bio-generator for electricity production or IR biogas stoves and compressor for LPG gas production will escalate the capital investment even further. Can assist to make the IWRMC self-sustainable, if associated with a bio-generator or IR biogas stoves and compressor. The O&M cost is high. The system is complex

	green waste mixed. Only 20% of green waste can be added if food waste is the majority to be treated.		to operate and requires high level of technical expertise and training. An adequate stock of inoculum needs to be kept.
In-vessel Composting (Proposed Method)	No odour and very little leachate are produced. High potential for treating both food waste and green waste in mixed form. It can convert organic waste such as kitchen waste, garden waste, food processing waste etc. into compost. Remove the problem of vectors such as flies and rats. Electricity is required for the operations of the composting machine, which contributes indirectly to the release of greenhouses gases and greenhouse effect, if power is sourced from the island powerhouse as proposed. However, the contrition is quite insignificant when compared nationally and internationally.	Requires significantly less land and manual labour than windrow composting and AD systems, as it comes with automatic curing system, which maintain perfect moisture and keep track of the compost as it cures. Land requirement for the machine including the curing system is very low compared to both the AD system and the open windrow composting method.	This method is more expensive than open windrow composting, but significantly less expensive than the AD system. The price of the proposed system is approximately MVR 55,000.00 (USD 3,500.00) excluding accessories and shipping cost. It is extremely simple to operate and requires minimal training and is not as complex as the AD system. The O&M cost is slightly higher than open windrow composting as an adequate stock of bioculum and absorbents needs to be kept. However, only 1g of bioculum has to be added per kg of waste fed, coupled with 2 kg of absorbent (if required) per each batch treated. Hence, as per the rate of organic waste generation in Madifushi (1004 kg per day) only 1g of bioculum per day equal to 30g per month

			and 361g per year is required for the operations. According to the current market price, a 1kg packet of bioculum costs roughly MVR 50 (USD 3), which would suffice for a yearly treatment of organic waste in Madifushi. Increased market potential, due to shortened production time (10 – 12 days) and the quality of the compost. The quality of compost produced meets stringent international standards. It can treat upto100 - 3000 KG of waste /day, which has to be then put in the curing system for 10-12 days.

Based on the above discussed options, the proposed method of in-vessel composting is determined as the most viable option for treating organic waste generated in Madifushi, due to it being the least labour intensive, most economically feasible and least harmful to the environment.

Although certain environmental benefits are envisaged for the AD system option, such as its potential to utilise the bio-gas for electricity generation or LPG gas production, thereby indirectly contributing to reduce GHG emissions and global warming, it's associated risks such as increased potential for fire and groundwater / soil pollution diminishes this benefit. Moreover, such benefits can only be realised if the required accessories are included as part of the system / the project, whereas this option will not be viable and would be considered as a wastage of resources, if the system does not come equipped with a way to utilise the bio-gas generated, while instead the gas is only flared. The high capital investment and O&M cost compounds the viability of this options even further from an economic perspective, while the large land requirement to establish the system and its associated systems can potently cause negative social impacts.

The open windrow composting method is the least favourable option out of the 3 options proposed, as it has the highest negative environmental and social impacts. Although this option has the lowest capital

and O&M cost, it has the least potential for generating a profit or making the IWRMC self-sustainable, due to comparatively low quality of the compost produced and the high production time. This option is also highly labour intensive, where the piles have to be turned manually at least every 5 days.

5.2.4. Mitigation Measures for Alternative Organic Waste Treatment Options

The current proposed in-vessel composting technology should only be changed to AD systems or open windrow composting subject to full implementation of the following proposed mitigation measures.

a) Manual Open Windrow Composting

- The composting shall be done on a specially constructed compost slab. The bottom of the slab and ground beams in this area should have an HDPE membrane between the reinforced concrete and the ground.
- Adequate provisions need to be made for leachate collection and treatment / disposal. Leachate collection tanks should be constructed.
- Regular turning the piles should be practiced, as it can help minimise the quantity of leachate produced.
- The piles should be kept well aerated, which promotes free airspace and results in aerobic respiration. However, if sulfur-containing materials are composted, it is advisable to minimise the amount of water added to compost (e.g., by covering compost material), so as to avoid anaerobic conditions that can cause hydrogen sulfide odours.
- The leachate collected shall be reused to provide moisture to the compost heaps.
- Windrow covers should be used during raining seasons. Alternatively, the compost pad can be partially covered with a roof so the piles can be moved to the shaded area during rainy season.
- In rainy seasons, the shapes of the pile can also be adjusted so that water runs off the top of the pile rather than being absorbed into the pile.
- Design and maintain the slope and orientation of windrows and/or leachate drains such that free drainage of leachate to a collection tank is facilitated and ponding of leachate is avoided.
- Turning equipment should be purchased as part of the project and used to turn the piles to reduce manual labour.
- A manual compost rotatory screen is recommended to be purchased.
- Carbon: Nitrogen (C:N) ratio shall be maintained between 25:1 and 35:1.
- pH should be maintained between 6 and 8.
- Avoid conditions that can lead to spontaneous combustion (e.g., moisture between 25 – 45 percent and temperatures above about 93ºC. This can be achieved for example by keeping windrows less than about 3m high and turning them when the temperature exceeds 60ºC).
- Consult the public and the Island Council regarding the change in scope of the project.
- Provide adequate training to the operators.

b) Anaerobic Digestion (AD) System

- Acquire land approval from the Maldives Land and Survey Authority, if additional land area is required for the civil works of the AD plant.
- If vegetation belonging to any individual falls in the additional land, compensation needs to be given prior to commencement of civil works.
- 2:1 replantation must be carried out for each vegetation removed from the additional land (if required).
- Consult the public and the Island Council regarding the change in scope of the project.
- Ensure that a mechanism is included to utilise the biogas generated.
- Provide a fire alarm system, including temperature sensors in the waste being treated. Ensure fire-alarm systems and firefighting equipment are installed at/or close to the AD plant and associated equipment or facilities.
- If biogas is to be utilised for cooking, bottling method should be adopted instead of laying pipes to supply gas. Flammable hazard signs shall be installed at the gas bottles.
- Adequate training should be provided in the operations of the AD plant, bio-generator or gas extraction and bottling.
- Maximize recycling of wastewater to the reactor.
- Measure total organic carbon (TOC), chemical oxygen demand (COD), nitrogen (N), phosphorus (P) and chlorine (Cl) levels in the inlet and outlet flows from an anaerobic digester. When a better control of the process is required, or a better quality of the waste output, monitoring of additional parameters may be necessary.
- Operate the anaerobic digester under thermophilic digestion conditions, in order to increase the pathogen destruction, biogas production rate (hence higher energy recovery) and the retention time
- Emissions from digestate storage should be minimized since they are one of the major sources. Either the digestate tank should be covered (gas tight with gas utilisation) or the degradation of the substrate should minimize the possibility of emissions.
- Any aerobic post-treatment should include a sufficient oxygen supply in order to avoid methanogenic activity. The monitoring of oxygen supply (or methanogenic activity) within the process is recommended.
- The biogas containing components should be frequently monitored to identify leakages. This could include surveys with leakage detection systems such as methane cameras and handheld lasers. Such a survey is recommended to be carried out every 1 to 3 years, depending on the status (age and number of leaks found) of the plant. Monitoring for elevated methane concentrations within the off-gas streams from air inflated double membrane roofs should also be included in routine measures.
- Plant management should aim at avoidance of PRV releases (and flaring events) in order to minimize emissions and losses in general.
- Pressure and vacuum relief valves with flame arresters should be installed on digester covers. When foam clogs the flame arresters, it may prevent the pressure and vacuum relief valves from

properly relieving pressure or vacuum accumulation which could cause damage to the digester and the digester roof.

- Emergency pressure or vacuum relief can be accomplished by installing emergency relief valves. Installing a foam separator immediately downstream of the digester will prevent foam from entering downstream of the digester.
- Flame arresters is recommended be installed between ignition sources and vital equipment. In addition, thermal shut-off valves should be used along with all in-line arresters. Flame arresters should be installed along with all pressure and vacuum relief valves on the digester roof to prevent external flames from igniting gas inside the tank.
- Provide adequate training to the operators in terms of operating the machine as well as maintenance and repair.
- Always keep one-year stock of spare parts.

5.3. Alternative Energy Sources

The proposed method for supplying electricity to the IWRMC is through the island power grid by laying a cable from the nearest distribution box to the IWRMC main electricity board. Alternative options are discussed in terms of installing a solar PV system and a diesel generator.

5.3.1. Analysis

Table 29 Analysis of alternative energy options

Option	Environmental	Social	Economic
Solar PV system	Emissions from fossil fuel burning will be completely avoided, thereby contributing to minimise GHG emissions and assist in the works to make the country carbon neutral. Potential for groundwater / soil contamination due to oil spillage during fuel transport and storage will not exist.	Additional land is not required for installing solar PV as the roof area of the IWRMC will be utilised and is more than sufficient. The entire roof area of the IWRMC (corresponding to about 80% of the centre) is not likely to be required for the installation of a solar PV system to supply electricity to cater for the operational requirements of the centre. Hence, the remaining roof area of the IWRMC can potentially be utilised	High capital investment (5-10 times higher than a diesel generator), but very low running cost. Washing the panels, replacing the inverter and some standard electrical maintenance is generally all that is required. High durability with a lifetime of 20 – 25 years. Output decreasing to around 80% of the original yield after this time. The reason for this longevity is that solar panels have no moving parts. It is only the slow

		for future expansion of the solar PV system to supply electricity to wider community. Excessive electricity generated through solar can be supplied to the island power grid which in turn can contribute to reduce the cost of electricity and electricity bills. Risk of potential accidents during handling of flammable liquid that may result in occupational health hazards and property damage (to the infrastructure and equipment) will be avoided. The surface of solar PV is smooth and reflective and can reflect light the neighbouring building based on the tilt of the panel and time of day. If such a reflection affects nearby buildings and neighbours it is likely to become a source of grievance.	degrading effects of UV that wear the panels down.
Installing a Diesel Generator within the IWRMC			
	Fossil fuel combustion releases GHGs to the atmosphere, which contributes to global warming. Burning fossil fuels emits a number of air pollutants such as SO2, NOx, and	Additional space is required for the installation and operations of the generator, which ultimately takes up land that can otherwise be reserved for future	Low initial cost than solar, but higher than establishing a connection from the island power grid. However, an additional building (a power house) will have to be incorporated into the

	particulate matter that are harmful to both environment and the public health. There is potential for groundwater / soil contamination due to oil spillage during fuel transport and storage. Air filters, flue gas cleaning system and emission monitoring system needs to be installed, to meet the requirements of the international and local standards.	needs of the community. Occupation health risks and property damage associated with improper handling of fuel will exist. Indirect benefits to the community through reduction in the cost of energy bills cannot be realised. Public health implications associated with burning of fossil fuels will exist especially if proper filtration and emission control systems are not being installed. SO2 emissions can exacerbate respiratory ailments, including asthma, nasal congestion, and pulmonary inflammation. NOx emissions led acid rains can result in burning of lung tissue and making people more susceptible to asthma, bronchitis, and other chronic respiratory diseases. Particulate matter (soot) emissions produce haze and can cause chronic bronchitis, aggravated asthma, and elevated occurrence of	design, which will in turn increase the overall cost of civil works. Constant running cost due to the need for fuel, cleaning and filter changes. Diesel generators are unreliable and often require expensive overhauls to be repaired. Long term cost is more expensive than solar.

		premature death, while is also known to cause heart attacks.	
Connection from Island Power House (proposed method)			
	Environmental impacts associated with fossil fuel burning such as release of harmful gases to atmosphere, contributing to global warming, would still exist as an indirect impact since diesel generators are used in the island power house. However, this impact would not be localised, in contrast to installing a separate generator for the IWRMC. Potential for groundwater / soil contamination due to oil spillage during fuel transport and storage will be minimised, since diesel generators and fuel storage will not be included as part of the project. Damage to the power house generators can compromise the operations of the IWRMC, which may result in the increase in littering and dumping of waste to unassigned areas, if the generators have to be shut down for longer durations.	Additional space will not be required. Occupational health and safety risk associated with handling and transportation of fuel will be avoided. Would indirectly contribute to public health implications associated with fossil fuel burning. However, it will reduce the percentage of community being exposed to such gases, as emissions would not happen on two different locations, but would rather be confined to the area close to the power houses. Indirect benefits to the community through reduction in the cost of energy bills cannot be realised.	Low capital cost and no operational cost. Moderate indirect running cost, as electricity bills would need to be paid to FENAKA on a monthly basis.

Based on the above discussed options, the proposed option of establishing a connection from the local power houses is determined as the most feasible option, due to the low capital cost involved and the potential for keeping environmental and social impacts minimised, in comparison to installing a sperate diesel generator in the IWRMC. However, a solar PV system is found to be the most beneficial since significant positive environmental and social impacts are envisaged, while it would result in cost savings

in the longer run. Hence, if the initial investment cost can be covered through the project, it is recommended to adopt this option.

5.3.2. Mitigation Measures for Alternative Energy Sources

a) Solar PV System

- Minimize the tilt of the solar PV slope to rectify the potential issue of light reflection. This could be further enhanced by installing screen, although no major impacts are envisaged as the nearest residential house is 134 m away from the site.
- Establish mechanism to supply excessive electricity to the island power grid.
- Make the remaining roof areas accessible for future investments to expand the solar PV system that could potentially service a wider community.

b) Installation of a diesel generator within the IWRMC

Social Measures

- Acquire land approval from the Maldives Land and Survey Authority, if additional land area is required for the civil works of generator installation.
- If vegetation belonging to any individual falls in the additional land, compensation needs to be given prior to commencement of civil works.
- 2:1 replantation must be carried out for each vegetation removed from the additional land (if required).
- Consult the public and the Island Council regarding the change in scope of the project.

Emission Control

- Air filters, flue gas cleaning system and emission monitoring system should be installed, to meet the requirements of the international and local standards.
- The exhaust pipe should be fitted with filters and according to Maldives Energy Authority (MEA) standards.
- The generator exhaust must discharge vertically for maximum dispersion modelling.
- The rain cap shall fully open without impeding the vertical discharge while the generator is operating.
- Design the stack heights according to Good International Industry Practice (GIIP) to avoid excessive ground level concentrations and minimize impacts, including acid deposition. The stack height should be raised above the canopy of the island
- Ensure the exhaust is clear of trees, combustible materials and pedestrian traffic to avoid fires and burn hazards.
- Use fuels with a lower content of sulfur where economically feasible. Use the cleanest fuel economically available (natural gas is preferable to oil, which is preferable to coal).

Noise

- The power house building should be made sound proof.
- Restrict working hours to day time where possible.
- Generator operators should wear noise cancelling headphones.

Operational Health and Safety

- Acquire additional PPEs required for the generator operators and ensure than at least a month's stock is maintained in advance.

Spill Control / Fuel Storage / Fire Prevention

- Generator locations must be equipped with a spill kit, which must be inspected at least annually and after use. The spill kit must be housed in an area that is in near proximity to the generator and protected from the weather.
- Fuel shall be stored in appropriate containers/ storage tanks such as syntax HBP tanks, metal storage tanks, metal barrels and plastic barrels.
- The fuel storage tanks shall be properly bunded in a concrete chamber to prevent oil leachate into the soil and groundwater in case of leakage or oil spills.
- The main switch of the storage room shall be installed outside the room.
- The cleanliness of the storage room shall be strictly maintained.
- If there are more than 1 storage tank, a gap of at least 1 m between the storage tanks shall be maintained;
- There shall be enough space between the bund wall and the storage tank to allow for pressure release and the tank shall be designed with auto pressure release systems in case of fire.
- Containers shall be tested at least once every 5 years, on suspicion of leakage or after every maintenance. These tests shall only be done by technical experts only after making the containers gas free and in accordance with the NFPA 30 "Flammable and Combustible Liquid Code.
- Fuel storage rooms as well as engine rooms and control room shall be installed with an appropriate number of fire extinguishers as per section haa of article 4 of the fuel use, storage and handling regulation of the Maldives.
- At least 2 DCP fire extinguishers of 9 kg shall be located near fuel storage areas of and be of a suitable type and size to permit the evacuation of workers during a fire.
- Smoking shall not be permitted in the area of the fuel storage tank and "NO SMOKING" signs in both English and local script shall be posted. Smoking shall not be permitted during any fuelling operation. "No Smoking" signs are to be maintained in good condition.
- In addition to no smoking signs, the storage tanks shall have the following signs posted both in English and local script:
    i. NO NAKED LIGHTS
    ii. FLAMMABLE LIQUID
- Waste oils, lubricants, greasy or oily rags, or any other materials subject to spontaneous combustion shall be retained in a labelled container used for that purpose exclusively and shall be disposed of at frequent intervals to a RWMF, until then, they shall be stored safely in appropriate containers, for e.g., metal barrel.

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

Operations and Maintenance

- Provide adequate training to the generator operators in terms of operating the generator as well as maintenance and repair.
- Always keep one-year stock of spare parts.
- Undertake regular maintenance and servicing of the generator.

CHAPTER 6 MONITORING AND REPORTING

6.1. Scope

This chapter would present in detail the management measures put in place by the Proponent and the contractor to mitigate the environmental and social impacts that would arise from the project activities. The assessment of impacts and mitigation measures that would be put in place had been discussed in detail in the previous chapter. The main scope or objectives of the Environmental and Social Management Plan are to:

a) Produce a framework for anticipated impacts, including practicable and achievable performance requirements and systems for monitoring, reporting and implementing corrective actions during pre-construction, construction and operational phase; and
b) Provide evidence of conformity to laws and regulations and requirements of enforcement agencies.

6.2. Environmental Management System

The environmental management framework for the proposed project is based on the standards and policies set out by the Environmental Protection Agency of the Maldives under EIA Regulation 2012, as well as the ESAMF by MCEP.

a) Environmental Management Planning and establishment of key performance indicators: The ESMP specifies environmental management measures and required performance standards;
b) IWRMC construction and operations: The aspects of the construction and operation will be established and operated according with the ESMP;
c) Monitoring and corrective action: The implementation of ESMP measures will be monitored during operational stage and will be reported. Any inconsistencies between the ESMP and its on-site implementation will be identified and addressed through corrective actions; and
d) Auditing, reviews and enhancement: The ESMP will be reviewed. Improvements to the ESMP will be made as necessary to achieve desired environmental outcomes.

6.3. Environmental Management Structure

This Sections detail the various parties involved in the implementation of the environmental plan and their responsibilities.

a) The Proponent, Ministry of Environment

ME will be responsible for the execution of the project activities within the required timeframe. ME is also responsible of policy level decisions and provision of support regarding the waste management works undergone in the island as well as the regional level. ME will also be responsible for leading the discussions with the Island Council and other relevant organisations on capacity development, training and facilitating

resource acquisition for the sustainable management of the IWRMC. In addition, ME will be responsible for the following:

- Environmental monitoring according to the proposed framework; and
- Management of grievances received at tier 2 (those that are not resolved at tier 1 by the Island Council). See **Table 36** for details.

b) Island Council

During the construction phase the Island Council will be primarily responsible for the following:

- Facilitating all activities related to the Project at island level;
- Implementation of the Island Waste Management Plan (IWMP) for a period of 5 years.
- Implementation waste Management Regulations for the island;
- Implementation of Waste Management Guidelines for the island; and
- Overseeing the operations of the IWRMC.
- The Island Council is responsible to ensure the progress of the Island Waste Management Plan and achievement of the set goals through implementing the plan. The island council is also responsible for the compilation of the IWRMC reports submitted by the occupier as well as producing an IWRMC monitoring report as well as reporting of public grievances. These reports shall be submitted to the MEE bi-annually for review. This also includes management of grievances at tier 1. See **Table** for details.

c) The Contractor

The contractor will undertake the project in accordance with the ESMP and will report to the Proponent and environment consultant about any unexpected environmental impact or health and hazard issues. During the construction stages, the contractor will follow all mitigation and management measures proposed in the report, mainly waste management, pollution control, accident prevention and work methodology proposed. The contractor will submit monthly ESMP monitoring reports to the PMU during the construction period.

d) Environmental Consultant

The environmental consultant would prepare the ESMP based on field visits and surveys and based on past project experiences in similar settings. If there are any modifications to be made to the ESMP during any stages of the project, the consultant would do the modification. The consultant for this ESMP is the ESS Specialist of MCEP.

e) Environmental Protection Agency

The Environmental Protection Agency would review the monitoring reports submitted by the Proponent and would continue with regulatory monitoring visits to the project site upon their needs.

f) IWRMC Operator

The IWRMC operator will be responsible in running the operations in accordance with the guidelines set by this ESMP and the approved IWMP of Madifushi Council. The responsibilities of the IWRMC operator include producing the IWRMC operations reports and submitting the reports to the Island Council at the proposed regularities.

6.4. Reporting Procedures

The reporting procedures presented in **Table 30** have been developed in order to ensure that the proponent is able to receive feedback from the implementation of the ESMP on an ongoing basis and to take rapid corrective actions if there are issues of non-conformance.

Table 30 Reporting Procedures

Phase	Responsibility	Deliverables	Accountability
Construction	Contractor	Monthly monitoring progress reports (3 to 6) prepared consistent to the template provide by the Safeguards Specialist of MCEP. These reports should indicate the level of implementation of mitigation measures and must be accompanied by photographic evidence.	Contractor. To be attached with interim payment claims made by the contractor. Payments to be released subject to timely submission of the monitoring reports.
	APCs	Two (2) interim reports prepared consistent to the template provide by the Safeguards Specialist of MCEP. Verification of accuracy of the monthly progress reports submitted by the contractors.	MCEP / ME APC should submit report to Safeguards Specialist for review and verification.
Completion of construction and demobilization of contractor from site	Safeguards Specialist	Final monitoring report including all monitoring activities throughout project implementation.	MCEP. Report to be submitted to the World Bank and EPA.
6 months after commencement of operations	Island Council	Operational phase monitoring report including activities implemented during operations of the IWRMC.	Island Council. Report to be submitted to EPA.

6.5. Implementation schedule

The activities related to environmental management and monitoring have to be integrated in the overall construction schedule. The project implementation phase is estimated to be completed in 6 months. The implementation schedule is presented in **Table 31**.

Table 31 Tentative ESMP Implementation Schedule

#	Activity Description	Responsible	Preconstruction (Week)						Construction (Months)						Operation (Months)					
			1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
1	Clearance and formal disclosure of ESMP	MCEP																		
2	Inclusion of ESMP in bid document	MCEP																		
3	Finalization of Engineering Designs	MCEP																		
4	Inclusion of ESMP in the contract document	MCEP																		
5	Disclosure of GRM in project sites	MCEP Island Council																		
6	ESMP briefing to Contractor at kickoff meeting	MCEP																		
7	Contractor's ESMP monitoring reports	Contractor																		
8	Compliance check / Interim monitoring reports (2 nos)	MCEP																		
9	Preparation and submission of consolidated monitoring report	MCEP																		
10	Preparation and submission of operational phase ESMP report	Island Council																		

6.6. Contractual measures

Implementing the mitigation measures are an obligation of the contractor during the construction phase of the project. The EPA and World Bank approved ESMP should form part of the contract and the mitigation matrix shall be extracted from the ESMP and reflected as an appendix to the contract. In addition to this, the following clauses should be incorporated in to the contract document of the selected contractor as condition of the contract to ensure effective, timely and stringent implementation of the ESMP.

1. Retention payment will be released after defects are rectified and compensating for any significant environmental and social safeguards violations.

2. Payment claims made by the Contractor should be accompanied by progress reports that reflect works completed and Environmental and Social mitigation measures implemented. Payments will only be released after verifying the authenticity of these reports.

3. The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract. Fundamental breaches of Contract shall include, but shall not be limited to, the following:
    - If the Contractor fails to implement the mitigation measures proposed in the ESMP of the project.
    - If the Contractor fails to submit staff list and valid work permits of the expatriate staffs within 10 days of signing the agreement.

6.7. Cost estimate for ESMP implementation

To effectively implement the mitigation and monitoring measures recommended in this ESMP, necessary provision will have to be made. The cost of these measures has been estimated in consultation with the Civil Engineer and Project Coordinator of MCEP, separately for construction and operational phase and presented in **Table 32** and **Table 33**. The BOQ will reflect the items specified in **Table 32** and the bidders should consider these costs while preparing bid documents. The overall project budget should consider the cost estimates presented in both the tables. The total estimated cost for the ESMP implementation is MVR 68,200.00 for construction phase and MVR 1,237,500.00 for operational phase.

Table 32 Estimated Cost for ESMP implementation during Construction Phase

#	Item	Responsibility	Cost Estimate (MVR)
1	PPEs required for construction such as hard hats, gloves, safety shoes and safety harness.	Contractor	10,000.00
2	PPEs to mitigate COVID19 such as face masks, antibacterial soap, hand sanitizers, disinfectant cleaning liquid (bleach) and printing of awareness materials etc.	Contractor	5,000.00
3	Portable fire extinguisher for site	Contractor	2,000.00
4	Firefighting Equipment for the IWRMC (item included in BOQ): • 50KG DCP Trolley (nos 2) • 50LTR Foam Trolley (nos 1) • Wet Chemical 6Ltr with Cabinet for hazardous waste area (nos 1) • Water 9Ltr with Cabinet for Office Area – Outside (nos 1) • CO2 2KG with Cabinet for Office Area – Outside (nos 1)	Contractor	35,000.00
5	Project board and Construction Safety sign board	Contractor	3,000.00
6	IWRMC name board, cell labels and fire safety sign boards	Contractor	5,000.00
7	Bin for placing general waste	Contractor	1000.00
8	Site demarcation through hoarding	Contractor	1000.00

	Subtotal		**62,000.00**
	Contingency	10% of Sub-Total	6,200.00
	Total		**68,200.00**

Table 33 Estimated Cost for ESMP implementation during Operational Phase

#	Item	Responsibility	Cost Estimate (MVR)
1	Composting Machine and Curing System	MCEP / ME	500,000.00
2	Glass crusher, metal can baler, plastic shredder and wood chipper	MCEP / ME	500,000.00
3	PPEs required for operations such as gloves, safety shoes and masks.	Island Council	10,000.00
4	Fire safety Training	Island Council	10,000.00
5	Yearly servicing of the firefighting equipment	Island Council	5,000.00
6	Community Mobilization and Awareness	MCEP	100,000.00
	Subtotal		**1,125,000.00**
	Contingency	10% of Sub-Total	112,500.00
	Total		**1,237,500.00**

6.8. Environmental and social monitoring plan

The Environmental and Social Monitoring Plan has the following objectives;

- To ensure that the environmental and social mitigation and enhancement schemes, are well understood and communicated to all involved parties.
- To evaluate the effectiveness of environmental and social remedial measures and procedures.
- To evaluate if the intended benefit of the project is realised

The intended positive impacts of the project can only be accurately determined by the post-project monitoring scheme. In order to ensure effectiveness of the proposed project it is essential to monitor, collect information, evaluate the information collected and information disseminated. The monitoring plan for the ESMP is presented in **Table 34**. Monitoring results shall be documented with preventive/corrective actions to be implemented.

Table 34 Environmental and Social Monitoring Plan

Aspect	Parameter	Frequency	Responsible Party	Cost of Monitoring (MVR)
Construction Phase				
Implementation of mitigation measures during construction	Records of successful implementation of mitigation measures	Monthly during construction period	Contractor MCEP	18,000 cost of traveling to the island
Groundwater Quality	Visual observations and perceptions of nearby residents. Salinity, smell, colour of water of the groundwater well within the IWRMC	Twice during construction phase	Contractor MCEP	9,000 Cost of traveling to the island
Grievance	Log records of number of complaints received and actions taken during construction phase	Throughout the construction phase	Island Council MCEP	9,000
Operational Phase				
Implementation of mitigation measures during operations of the IWRMCs	Records of successful implementation of mitigation measures.	6 months after commencement of operations	Island Council / IWRMC Operator	Included in Operational Cost
Spillage Assessment	Waste Collection Arrangements Littering around the island (Beach, harbor area and other public areas) Spillage during transfer to IWRMC Any Spillage within the IWRMC Proper use of IWRMC Spillage during transfer to regional waste facility	Once when the project is completed and one year after project completion	Island Council / IWRMC Operator RWMF Operator	Included in Operational Cost

Groundwater Quality	Visual observations and perceptions of nearby residents. Salinity, smell, colour of water of the groundwater well within the IWRMC.	6 months after commencement of operations	Island Council, IWRMC Operator	Included in Operational Cost
Grievance	Log records of number of complaints received and actions taken during operational phase	Throughout the operational phase	Island Council	Included in Operational Cost

6.8.1. Monitoring Report

Reporting will be carried out by the ESS Specialist assigned for the purpose by the Proponent.
The report will include among other information;

- Details of what was being monitored;
- Methodology of data collection and data analysis;
- Major findings;
- Effectiveness of the mitigation measures in place and
- Recommendations and conclusions.

A detailed environmental monitoring and management report is required to be compiled and submitted to the EPA. In addition to this, regular site monitoring would be carried out by the Proponent that requires maintaining logs of events as explained in this report. Enforcement officers from EPA may also visit the site for inspection from time to time.

6.9. Monitoring Report Format

The environmental monitoring report outlined in Error! Reference source not found. below will be used i n reporting environmental monitoring to be carried out as given in the monitoring plan.

Table 35 Monitoring report format

Project Title:

Name of the Island:

Monitoring Date:

Period Covered:

Prepared by:

Contributions:

A. Introduction
Give a brief introduction about the project and the monitoring carried out

B. Methodology
Brief detail of the methodology applied for undertaking the monitoring assessment

C. Environmental Monitoring

a. Groundwater quality
Parameters given in the monitoring plan need to be assessed

b. Waste generation and management at IWRMC
These include monitoring for pests and diseases as described.

D. Risks and Mitigations
Please indicate any critical unresolved risks that affect the course of the system operation, analyse the cause, assessing the potential impacts on the environment providing the proposed mitigation strategy

E. Problems Encountered
Indicate any problem areas encountered and any corrective measures that will have to be taken.

F. Recommendations and Adaptations as Solution
If specific recommendation is noted during the monitoring phase, specify it in the report

G. Conclusions
Reference

Appendix

6.10. Grievance Redress Mechanism

Based on the ESAMF, MCEP has formulated a Grievance Redress Mechanism (GRM). GRM is established to receive and facilitate grievances of the affected persons during the implementation of the project.

Island Councils were consulted on the progress regarding setting of focal points and availability of the GRM forms at the Council. Madifushi Council stated that the Council would make the forms available physically at its office as well as publicly displayed. The Council has nominated a waste management focal point for this purpose (Shinan, 7926566). The Council does not have a website, although work is underway on creating a Facebook page, in which a link to the GRM forms will also be provided.

Following are the details of the GRM developed by the MCEP. GRM at tier 2 will be managed by the ESS Officer of MCEP. Tier 2 GRM forms will be made accessible from the respective council office and MEE front office and is published in MEE website. Below are the links.

English page:
http://www.environment.gov.mv/v2/en/download/7189

Dhivehi page:
http://www.environment.gov.mv/v2/dv/download/7191

Table 36 Details of the Grievance Redress Mechanism developed by the MCEP

Tier of Grievance Mechanism	Nodal Person for Contact	Contact Communication and other facilitation by the project	Timeframe to address grievance
First Tier: Island Council	Island Council will be the first point of contact for any grievances. The staff designated as the waste management focal point by the island council will manage grievances on behalf of the council.	GRM should be publicly displayed in the construction site as well as the council office. GRM should also be outlined in official website and/or social media pages of Council, MEE (and/or the project), including contact details of the nodal person in each tier. Grievances can be addressed informally by contacting the council through email / telephone / in person. If the grievance cannot be resolved informally, an aggrieved party must submit a complaint on the Tier I Complaint Form. A copy of the form (with the council seal) should be provided to the aggrieved party as evidence of receipt.	15 working days

		Electronic version of the complaint form should be available from the websites and/or social media pages of MEE and the council. Physical copies of the form should be available from the council front office. Council will provide assistance to fill the form for those who cannot write. The council should keep separate registries for informal and formal complaints and maintain records of all complaints received. The council will discuss the matter with the Women's Development Committee and other relevant stakeholders (Farmers, Fishermen, School, Health Center etc.), where deemed necessary and attain views of them. If such meetings are arranged, the date, time, location or venue, list of participants (with contact details) and a summary of the main outcome of the consultation must be annexed to the written decision issued by the council. If the complaint is resolved within 15 working days, the council must communicate the decision 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 within this period, then the decision will be considered as accepted. 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.	

		The staff designated as the waste management focal point by the island council will manage and provide feedback for grievances submitted to the council.	
Second Tier: Ministry of Environment and Energy (MEE)	Environmental and Social Safeguards officer 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 issue is outside the jurisdiction of the council (issues related to RWMF), an aggrieved party may submit a complaint on the Tier 2 Complaint Form. A copy of the form (with MEE seal) should be provided to the aggrieved party as evidence of receipt. Electronic version of the complaint form should be available from the websites and/or social media pages of MEE and the council. Physical copies of the form should be available from the council and MEE front office. A copy of the Tier 1 Complaint Form should be submitted with the Tier 2 Complaint Form. MEE will forward the grievance to PMU. PMU screens 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. Environment and Social Safeguards Officer at the PMU will be the contact person in processing a grievance through the Second Tier. PMU will discuss the matter with 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	15 working days

		person, due to the grievance mechanism at the second tier. If the complaint is resolved within 15 working days, the PMU must communicate the decision 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. 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 MEE, 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	As per established Judicial Procedure

		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, and disadvantaged for ethnic or social reasons, an orphan, a widow, a person above sixty years of age, or a woman heading a household.

CHAPTER 7 TRAINING RECOMMENDATIONS

Training is essential for ensuring that the ESMP provisions are implemented efficiently and effectively. MCEP shall therefore ensure that all persons that have roles to play in the implementation of the ESMP are competent with appropriate education, training or experience. Similarly, the contractors shall be required to undertake general HSE awareness for their project workforce and specific training for those whose work may significantly have impact on the environment. The Island Council in collaboration with the MCEP shall also devise and execute training programs targeted for staffs of IWRMC to facilitate effective and sound management of waste during household collection and operations of the centre. Furthermore, MCEP and the Island Council shall conduct community mobilization and public awareness programs to enhance knowledge of the community on good waste management practices and to promote implementation of 3R concept.

Table 37 Training program for the Implementation of ESMP

Training Activity	Participants	Type of Training and Content	Responsibility	Scheduling	Cost Estimates
Strengthening capacity of contractor on reporting and implementation of ESMP	Managing Director and Site Supervisor of Contractor	Meeting Reporting Template	Safeguards Specialist of MCEP	Pre-bid meeting Kick-off meeting	NA
Strengthening PMU's capacity on compliance monitoring	APCs	Briefing Reporting Template	Safeguards Specialist of MCEP	Construction Phase	NA
General Awareness Health, Safety and Environment (HSE)	Worker on Site	HSE Introduction / Orientation (site safety rules, PPE, Emergency response etc.) Daily tool box talk for workers at the start of each day's job.	Site Supervisor of Contractor	Pre-construction phase. Construction phase	NA
Community Mobilization	Waste Management Committee	Introduction to WM Policy Introduction to WM Regulation Roles of WMC	Communications Specialist of MCEP	During construction phase	Travel cost of facilitators. Designing and printing of training materials and flyers to be used for door to door campaign

		Implementation of IWMP Household waste segregation Door to Door campaign			
Compost Training (Training on the composting process using compost machine, including its operations, maintenance and servicing)	IWRMC staffs	Introduction to compost preparation using organic waste Step by step guidance using OWC machine for composting	Zone-4&5 Project Coordinator of MCEP WMPCD Island Council Communications Specialist of MCEP	Prior to commencement of operations	Travel cost of trainer Developing and printing of Training Manual
Fire safety training and drills	IWRMC staffs Nearby Residents	Introduction to Fire safety Hands on training of the equipment installed at IWRMC Details of safety procedures and evacuation plan during a fire	Maldives National Defence Force (MNDF) Fire and Rescue Island Council through retired firefighter	Prior to commencement of operations	Cost associated with training hall and refreshments Travel cost of trainer
Women Leadership in SWM training	Women Development Committee (WDC)	Enhancing women's participation in Solid Waste Management (SWM)	Island Council Communications Specialist of MCEP Zone 4&5 Project Coordinator of MCEP MCEP Project Manager	Throughout IWRMC operations	Travelling cost of trainers

CHAPTER 8: STAKEHOLDER CONSULTATIONS

8.1. Introduction

The stakeholder consultations with the island council were carried on two occasions. Furthermore, a public perception study was attempted to deduce the social dynamics linked to this project and waste management in general. The responses received indicates satisfaction towards the project and its respective components, although it is of note that only 4 households responded to the set of online survey queries. It should be noted that the sample size falls short to be deemed representative to the resident population.

Individual consultations conducted by the Island Council during the formulation of the Island Waste Management Plan indicates that lack of awareness and stewardship towards the environment hinders the sound functioning of the existing waste management setup of the island. Also, it is of note that islanders expressed that a sufficient Island Waste and Resource Management Centre is essential in managing the waste generated on the island. Further, dissatisfaction was expressed towards the lack of urban greenery.

8.2. Summary of consultation with the Island Council and the IWRMC Operators

The island council was consulted twice for this project of establishing an IRWMC, at the island. Initial consultation dates back to June 2018, where then consultants led by Mr Saleem, met with the island council representatives, along with representatives from the proponent. The key points of this consultation are stated below in **Table 38.**

Table 38 Summary of first consultation with the Island Council

Item	Description
Date	June 2018
Venue	Th. Madifushi Council Office
Name of Stakeholders	Th. Madifushi Council representatives: • Abbas Ahmed P: 678-0034, E: madifushi@thaa.gov.mv • Hussain Riza P: 678-0034, E: madifushi@thaa.gov.mv • Mohamed Shinan P: 7926566, E: madifushi@thaa.gov.mv
Language of communication	Dhivehi

Summary	**Waste Collection and household level arrangements:** • Waste segregation is practiced at the household level • A monthly fee is charged for the waste collection service • 3 Mini pickup trucks are utilized for waste collection **Waste Management arrangements** • Kitchen waste is disposed into the sea • Sanitary waste is buried at the waste management site • Waste Management site is operated by the women's committee of the island • Communal areas are cleaned by the women's committee of the island • Metal, glass, and plastic wastes are segregated at the designated waste management site • The main challenges noted by the Island Council regarding waste management are accumulation of unmanaged waste, inadequate financial capacity, challenges in the transport of waste, and limitations in land resources • The island waste management plan is at the drafting stage **Environment** • The council noted that the newly reclaimed area of the island was affected by tidal swells (locally referred as *Udha*) causing damage to the revetment at the south eastern side. **Grievance Mechanism** • The Island Council has set a GRM focal point, whose contact details will be displayed at both the Island Council Office, and at the IRWMC site as well. • Hardcopies of the grievance form will be made available from the Island Council Office.

A second meeting with the Island Council was held virtually on 11th August 2020. The meeting focussed on updating the island council regarding the planned works in establishing the IWRMC, and setting up the necessary arrangements between the project proponent and the Island Council.

Table 39 Summary of second consultation with the Island Council

Item	Description
Date and Time	11th August 2020 at 10:30am
Venue	Virtual meeting. Platform used: Google Meet
Name of Stakeholders	Th. Madifushi Island Council • Mr. Ismail Hilmy, President P: 7747750, E: madifushi@thaa.gov.mv • Mr. Abbas Riza, Director P: 678-0034, E: madifushi@thaa.gov.mv • Mr. Mohamed Shinaan, Economic Officer P: 7926566, E: madifushi@thaa.gov.mv
Participants from MCEP	• Mr. Ahmed Nizam, Project Manager • Mr. Mohamed Afraaz, Civil Engineer • Mr. Ibrahim Rishad, Project Coordinator • Mr. Eyman Ismail, Assistant Project Coordinator

	• Mr. Hassan Zuhair, Environment and Safeguards Specialist • Mr. Ahmed Saleem, Assistant Project Coordinator • Mrs. Aishath Ajfaan Jawaadh, Assistant Project Coordinator
Language of communication	Dhivehi
Summary	**Planned Works** • Mr. Rishad (MCEP) briefed upon the scheduled works to establish the IRWMC at the island, which includes o Updating of the previously formulated Environmental and Social Management Plan o Design modifications to the IRWMC layout to cater the proposed mechanical composting system o Land approval for probable future expansions of the IRWMC o Provision of essential equipment and vehicles for the functioning of the island level waste management system **Land area for IRWMC expansion** • Mr. Ismail (Council), stated that the land is available with regard to the land use plan of the island, and sees no issue in case of expanding the IRWMC. **Waste Management: Environment and socio-economics** • Mr. Ismail (Council), stated that the establishment of the IRWMC will be a milestone achievement to address the issue of waste in the island. • Mr. Sinan (Council), enquired • Mr. Hassan (MCEP) highlighted

8.3. Summary of Individual Consultations with the Island Community

Furthermore, individual consultations were carried by the Island Council during the formulation of the Island Waste Management Plan (IWMP). The highlights are stated in the **Table 40.**

Table 40 Summary of Consultation with the Island Community

Item	Description
Date and Time	20 January 2020 at 8:30pm
Venue	Th. Madifushi Conference Hall
Name of Stakeholders	Residents of the island
Participants	• Ismail Hilmy • Abbas Ahmed • Ali Haseen • Mohamed Shinan • Hassan Thasneem • Mohamed Shaafiu • Maryam Naasira • Hassan Faaiz • Mohamed Shifaz • Hassan Saajidh • Moosa Muneer • Ali Mukhthar • Aaishath Naseera

Language of communication	Dhivehi
Summary	• Hassan Faaiz stressed on the importance of conducting programs to foster awareness amongst the residents. Furthermore, he emphasized on the importance of greening the island, to reduce the urban air temperature of the island and also to make the island more pleasing to its residents. • Similar perspectives were conveyed by Ali Mukhthar as well. He underlined on the lack of huge trees and further expressed his concern over the lack of interest given to conserving nature. Moreover, he stated that proper waste management is hindered due to the lack of awareness amongst the residents. • Moosa Muneer, highlighted the importance of establishing an adequate Island Waste and Resource Management Centre. He expressed dissatisfaction on the current waste management mechanism of the island. Also, he pointed out the lack of environmental and urban stewardship of some inhabitants as littering is observed to some extent.

8.4. Household Perception Survey

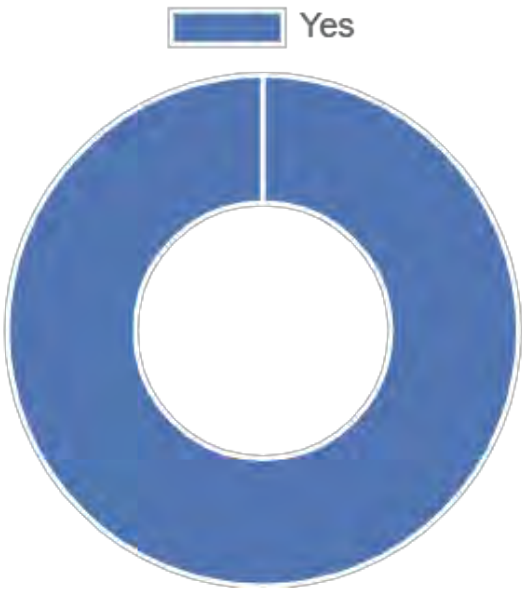
A study was carried to assess the respective perception of the households regarding the proposed waste management project. It is of note that out of the 180 households, only 4 responses were received for the survey. The low number of responses cannot be deemed as a representative sample size for the whole island community. The survey was carried online through the data collection platform *'KoboToolbox'*. The following are the survey responses.

Several attempts were made to get further public opinion on the proposed project, which included requesting the Island Council for contact details of random community members (as no houses existed close to the proposed site) and trying to facilitate a virtual public meeting. However, adequate support was not received on this end. Furthermore, it was not possible to organise a public meeting to explain the details of the project, due to the ongoing pandemic situation, restricting public gatherings.

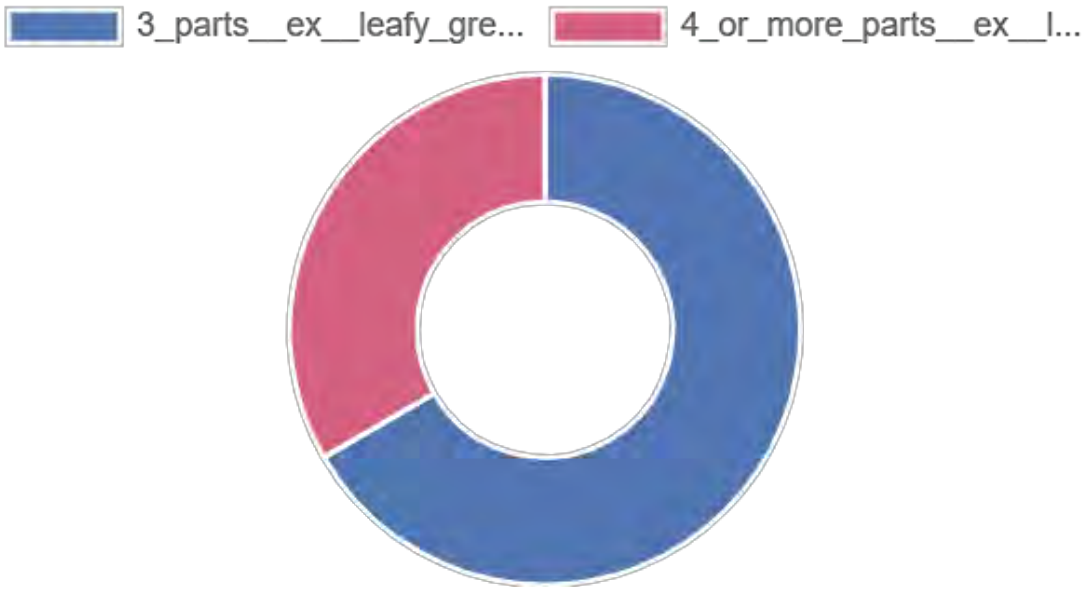
Depending on the COVID19 situation, it is recommended that further public perception regarding the project is sort during the construction phase of the project, via project monitoring.

a) Waste Segregation:

Upon the query of whether or not waste segregation is practised at the household level; 3 out of the 4 households stated that they do segregate waste, while no response was received from 1 household.

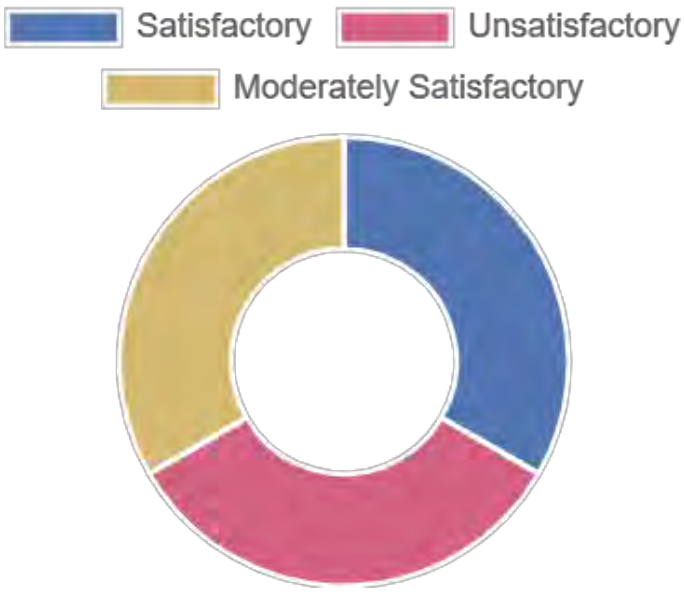


Furthermore, from the responses received on the query of the level of household waste segregation; it was found that out of the total responses; 2 households segregates waste to 3 categories, while 1 household stated that waste is segregated into 4 or more categories. It is of note, that 1 respondent was without any data.



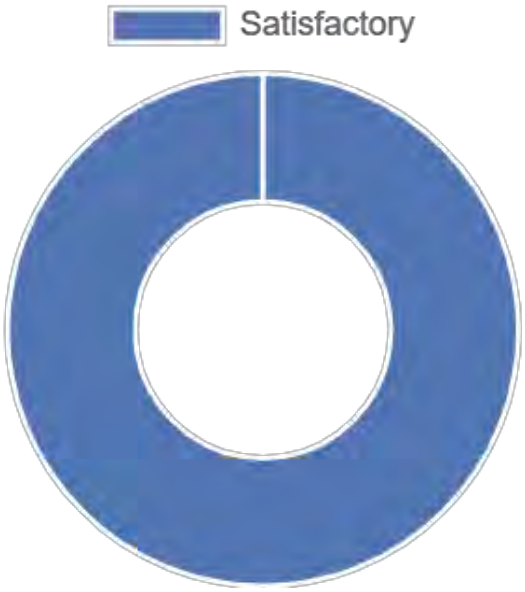
b) Waste Collection Fee:

Regarding the proposed monthly waste collection fee for the island waste management; an equal distribution of responses were received. 1 household expressed satisfaction, and another felt moderately satisfied, while 1 household expressed dissatisfaction to the proposed collection fee.



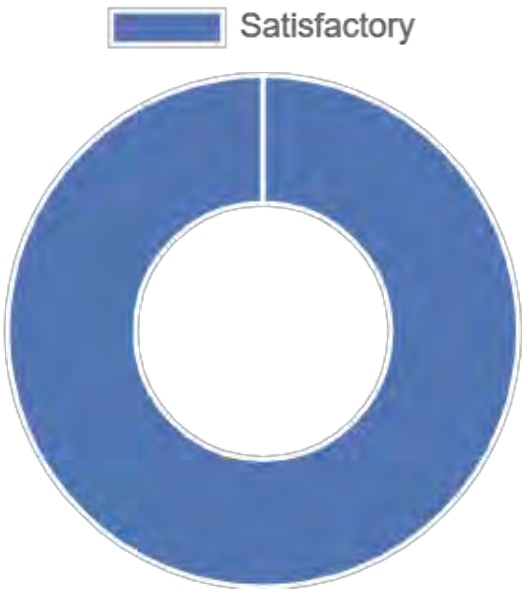
c) Location of the proposed Island Waste and Resource Management Centre:

It was found that all the households who responded to the study, expressed satisfaction to the proposed location of the Island Waste and Resource Management Centre.

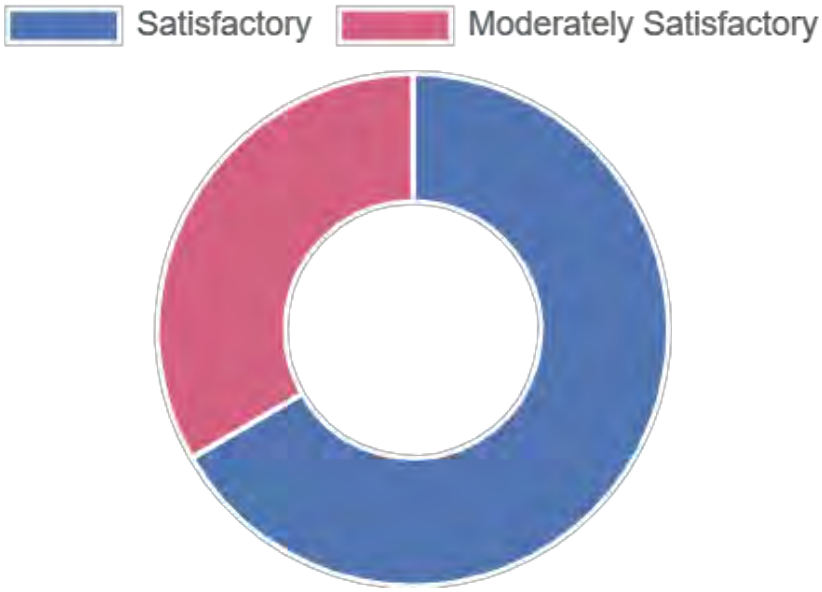


d) Design and Features of the proposed Island Waste and Resource Management Centre:

Similarly, all of the respondents expressed satisfaction to the design and features of the proposed Island Waste and Resource Management Centre.



Furthermore, perception regarding the proposed technology for treating organic waste was queried. It was found that 2 households felt satisfied with the planned system, while 1 household expressed moderate satisfaction.



8.5. Summary of Consultations with Maldives Land and Survey Authority (MLSA)

Maldives Land and Survey Authority (MLSA) was consulted regarding the proposed site for the construction of the IWRMC.

Table 41 Summary of Consultation with MLSA

Item	Description
Date and Time	6 January 2021 at 10:30am
Venue	Telephone Consultation
Name of Stakeholders	• Fathimath Shanna, Director, Land Section, MLSA M: 7969699 E: fathimath.shanna@housing.gov.mv
Participants from MCEP	Ahmed Hassaan Zuhair, ESS Specialist, MCEP
Language of communication	Dhivehi
Summary	• Since the IWRMC is to be constructed at the approved location by MLSA they do not have any objection • Highlighted that there is no need to consult MLSA further during the EIA process, if no deviations are proposed to be brought to the approved site.

8.6. Summary of Consultations with Ministry of National Planning Housing and Infrastructure (MNPHI)

MNPI was consulted regarding the IWRMC site and Land Use Plan of the Th. Madifushi.

Table 42 Summary of Consultation with MNPI

Item	Description
Date and Time	5 January 2021 at 11:30am
Venue	Telephone Consultation
Name of Stakeholders	• Nihaaza Anees, Director, Urban Planning Department, MNPI M: 9551992 E: nihaaza.anees@housing.gov.mv
Participants from MCEP	Ahmed Hassaan Zuhair, ESS Specialist, MCEP
Language of communication	Dhivehi
Summary	• A draft LUP was prepared for Madifushi which includes the recently reclaimed area. • The proposed site is the site demarcated for waste management in the draft LUP and exists within the proposed utility area. • The plan is to bring all the utilities of the island into one location with the proposed site for power house relocation also existing near the proposed IWRMC site.

CHAPTER 9 GENDER ANALYSIS AND GENDER ACTION PLAN

This section of the report will describe the gender analysis and main barriers which may prevent women getting the intended benefits of the proposed project. Due to lack of site-specific data from Th. Madifushi, general data for Maldives is used for the analysis.

9.1. Gender Analysis and Barrier faced by Women

The prime legislature which is aimed to ensure the gender equality and women's empowerment in the country is Gender Equality Act (2016) which came into force in 2017. The main aim of this legislation is to eliminate discrimination based on sex or gender, including ending violence against women. The Act promoted gender equality in all aspects of public and family life. It also outlined duties and responsibilities on State and private parties, prohibited victimization and introduced remedies for gender-based discrimination. A national gender policy was developed in 2019 which includes five strategic goals; 1) Leadership and Governance; 2) Economic Empowerment, 3) Institutional Gender Mainstreaming 4) Gender Based Violence and 5) Access to Justice (Ministry of Gender, Family and Social Services 2020). The Strategic Action Plan (SAP) 2019-2023 included a "Gender Equality" subsector under the "Good Governance" sector. It recognized that "despite advancements in legal and policy framework including the passage of a domestic violence, a sexual harassment act and gender equality law, administrative, budgetary and human resource constraints restrict the implementation of these laws to achieve gender equality". The policy priorities of the Gender Equality subsector focused on "increasing women's representation in decision-making, minimizing sexual harassment, domestic violence, eliminating barriers for women to participate in economic activity including cultural barriers by promoting shared care work and household responsibilities.

Maldives is a signatory to the Convention on the Elimination of all forms of Discrimination Against Women (CEDAW) which was ratified in 1993. In a Global Ranking on gender gap issues, the Maldives is ranked number 113 out of a total of 149 countries, according to the World Economic Forum's Global Gender Gap Report 2018.

In the Maldives, the labour force participation rate of women was 42.2% when compared with men (75.1%) in 2019 (National Beuarea of Statistics 2019) The women's share in wage employment was 39% and majority of the women work as employees (69%) and entrepreneurs (26%). In 2018, the Gender Parity Index (GPI) for found to be 0.93 for pre-primary level enrolment, 0.95 for primary level enrolment, 1.19 for upper secondary level enrolment and 0.89 for lower secondary level enrolment indicating a disparity in the favour of boys in all enrolment level except for the upper secondary level enrolment. However, one in every four women has experienced some form of violence in Maldives indicating gender-based violence is prevalent in the country.

The ESMF of MCEP consist an Gender Development Plan which identifies the following Gender Issues, Strategies and Proposed activities relevant to the project. The following **Table 43** provides the Gender Development Plan for MCEP.

Table 43 Gender Development Plan of MCEP

Gender issues	Strategy	Proposed Activities
Lack of awareness	Awareness campaign about the project for the community focusing on the vulnerable group including women.	Formation of women groups around specific project areas. Share information about the project benefits with local community.
Low Level of literacy	Support functional literacy campaign and develop extension programs to take the benefits from the project as per the needs of illiterates.	Undertake literacy programs as built- in activities coordinated with literacy programs. Develop the implementing strategies to communicate real time information specifically for economically weaker section. Develop audio-visual aids and documentary for training programs about the project for illiterate women groups.
Excluded from Opportunities and because of social boundaries as a result low level of participation in decision making process	Rapport building with Women Development Office at District or local level involving them in Program. Gender sensitization to all stakeholders including project entities. Ensure Women‘s participation during meetings, project implementation and monitoring.	Carry out meetings and interaction program with and orientation to women in the community. Conduct leadership training for women members of commodity groups.
Lack of knowledge / access to technical knowhow	Promote need based technical awareness and support services.	Organize training on technologies. Provide opportunities of exposure or study visit to women's group to develop their leadership capacity.
Disparity in Wages	Accord Priority Employment to women in project generated construction activities. Promote equal wages for equal	Inform women groups regarding proposed construction works. Identify women interested to

	work.	Work; assess their skills and involve them as per their capabilities. Monitor women wage rate and do the needful to ensure wage equality for similar type of construction works. Inclusion of the above elements in the contractors' document.

9.2. Gender Action Plan

The following gender action plan presented in **Table 44** has been proposed based on the gender development plan of the MCEP. All the cost involved in implementation of Gender Action Plan has been considered in the cost estimates for the trainings.

Table 44 Gender action plan for the operations of the proposed IWRMC

Gender Activities/ Action	Indicators/Targets	Responsible Agency for implementation	Timeline
Ensure that women benefit from expanded and improved SWM collection, transfer and disposal services	Ensure 410 women in the island (census 2014) have access to the improved SWM facility.	MCEP PMU	Operational Phase
Carry out meetings and interaction program with and orientation to women in the community. Inform women groups regarding proposed construction works.	05% of the female population of the island are consulted.	Communications Specialist of MCEP	Pre-construction Phase
Develop audio-visual aids and documentary for training programs about the project for illiterate women groups.	Two audio-visual aids developed for compost and fire safety training.	Communication Specialist of MCEP PMU	Monitoring trips
Conduct leadership training for women	One leadership training conducted for WDC on SWM.	Communications Specialist of MCEP	Monitoring trips

members of community groups.			
Identify women interested to work; assess their skills and involve them as per their capabilities.	Involve at least 20% of women in the implementation of the IWMP.	Island Council	Operational Phase

CHAPTER 10 RECOMMENDATIONS AND CONCLUSION

The construction and development of the IWRMC at Th. Madifushi is a much-needed project to provide waste management services to the island. The IWRMC will be an improvement to the current waste disposal practices conducted in the island, while reducing the environmental pollution and providing health and economic benefits to the island.

The introduction of mechanical in vessel composting technique is perceived to expedite the compost production time considerably, while alleviating the labour intensiveness of the traditional open windrow composting method. Although the project is perceived to yield significant environmental and human health benefits and contribute towards achieving sustainable development goals, it should be understood that these benefits as outcomes would depend on smooth operations of the waste management system as a whole. In order for the system to function sustainably adequate resources in particular financial resources shall be made available. Part of the required funding could be obtained through introducing a fee structure for the service and sale of metals and compost. However, these revenue sources are not likely to be adequate enough for the entire operation. Hence, support from the government will be critical to maintain the system functional. Unavailability of the funds could mean breakdown of the transport system which could ultimately collapse the waste management service. Regular removal of residual waste from the island will have to be ensured as a key aspect of the project implementation. A regional collection and transport system in Zone 4&5 will be established under MCEP. The subject RWMF for Zone 4&5 will be Thilafushi, which is currently in the process of being developed to a full-fledged facility under the ADB financing.

Based on past experiences gained from projects of similar nature, it is also important to undertake a one-off clean-up activity of the island that includes removal of existing stockpile of waste. Failing to undertake this could lead to overloading of the waste management centre resulting failure to carry out the operational activities in the planned manner.

The construction and operational impacts that might arise from the project should be managed, mitigated and monitored on a continuous basis and should adhere to the EIA regulation all throughout the construction and operation of the project. Strict considerations are to be given to the pollution control as well as health and safety measures

The consultant's recommendations for the project include:

- Plan a one off clean up activity prior to the official opening of the waste management centre;
- plan and have in place a sea transfer arrangement to remove residual waste from the site on a regular basis;
- carryout necessary training for the waste management personnel in particular in the area of operating and maintaining the composting machine;
- adequate awareness raising of the general public on the operation and functioning of the new waste and resource management centre and sensitising the public on the rules and procedures that would come into effect with regards to the new waste management system;

- implementing fee for service system;
- strengthening enforcement capacity of the local authorities;
- provision of adequate financial and technical support at least for the initial 3 years into the project implementation to the island council;
- determine an operational plan for the centre that considers details of all aspects of operating, managing and sustaining the service;
- conduct supervision and monitoring of the project works by the Proponent;
- enforcement agency to make an effort to make at least one visit to the project site during the construction phase to ensure environmental compliance of the project activities; and
- proponent appoints a focal point to coordinate activities relating to monitoring and reporting.

This ESMP has looked into the key factors that need to be considered during construction and operational stage and identified all likely environmental impacts. Among other temporary and highly localised minor negative environmental impacts, the study has identified the following unavoidable moderately negative terrestrial impacts due to proposed development works:

- Almost an irreversible change the overall terrestrial environment as a result of the placement of the IWRMC footprint;
- generation of construction waste as a result of construction works.

The study also found that through the implementation of the proposed practical and cost-effective mitigation measures almost all identified impacts can be brought to an acceptable level. The study found no evidence of the project resulting loss of endangered or protected species or habitat.

Thus, based on the findings, it is concluded that the benefits on the environment and human health greatly outweighs the negative effects resulting from the implementation of the project.

REFERENCES

Agosi, A., Liebetrau, J., Linke, B. & Reinelt, T (2017). Methane Emissions from Biogas Plants; Methods for measurement, results and effect on greenhouse gas balance of electricity produced. IEA Bioenergy.

ALS Scandanavia AB (2015). Analysis of solid sample (top soil and bottom soil) – Zone One RSWMF, s.l.:s.n.

Berad, R. & Bourion, A (2002). Truck widths and paths, s.l.:s.n.

Blue Peace Maldives (2017). Neykurendhoo Conserving Mangroves through the development of an informative website and community advocacy.

Broschat, T.K. & Meerow, A. W. (1997). Transplanting Palms. Florida: Environmental Horticulture Department.

Bunger, J., B. Schappler-Scheele, R. Hilgers, and E. Hallier (2006). A 5-Year Follow-Up Study on Respiratory Disorders and Lung Function in Workers Exposed to Organic Dust from Composting Plants. International Archives of Occupational and Environmental Health. Online: http://www.springerlink.com/content/82u23r2371414873/fulltext.pdfEnvironmental Protection Agency [EPA]. (2017). Environmental Guidelines for Site Selection of Waste Management Centers (2017). Male', Maldives: EPA.

Cecinato, A., Paolini, V., Petracchini, F., Segreto, M., Tomassetti, L., & Naja, N. (2018). Environmental impact of biogas: A short review of current knowledge, Journal of Environmental Science and Health, Part A, 53:10, 899-906, DOI: 10.1080/10934529.2018.1459076

Chan, E. & Elevitch, C. R., (2006). Cocos nucifera (coconut). Species profile for Pacific Island Agroforestry, 2(1), pp. 2-12.

Deparment of Environment and Conservation [NSW] (2004). Environmental Guidelines: Composting and related organics processing facilities.

Faisal, H., (2013). Coconut sector development in the Maldives. s.l., Ministry of Fisheries and Agriculture.

Department of Sustainability, Environment, Water, Population and Communities (2012). Food and Garden Organics Best Practice Collection Manual. Australian Government.

Goldstein N (2002). Getting to Know the Odour Compounds, Biocycle, July, pp 42-44.

Halliburton (2002). Strategy for Solid Wasre Manamegent in Vaavu and Baa Atolls, Maldives. Conservation and Sustainable Use of Biodiversity Associated with Coral Reefs of Maldives

Hamdhoon, M., (2021). Updated Environment and Social Management Plan for Establishment of Island Waste and Resource Management center (IWRMC) in M. Mulah

Health and Safety Executive UK (2017). "Noise In Material Recovery Facilities (Mrfs)". Hse.gov.uk. N.p., 2017. Web. 5 June 2017.

Herr, C. E. W., A. zur Nieden, H. Seitz, S. Harpel, D. Stinner, N. I. Stilianakis, and T. F. Eikmann (2004). Bioaerosols in Outdoor air - Statement of Environmental Medical Assessment Criteria on the Basis of an Epidemiological Cross Sectional Study. Gefahrstoffe Reinhaltung Der Luft. 64(4):143-152.

Herr, C. E. W., A. zur Nieden, N. I. Stilianakis, and T. F.Eikmann (2004). Health Effects Associated With Exposure to Residential Organic Dust. American Journal of Industrial Medicine. 46:381-385.

International Renewable Energy Agency [IRENA] (2017). Biogas for Domestic Cooking Technology Brief. www.irena.org.

Janas, M. & Zawadzka, A (2018). Assessment of Environmental Impact of Agricultural Biogas Plant. Faculty of Process and Environmental Engineering, Lodz University of Technology, 90-924 Lodz, Wolczanska 213

Jayasekara, C. & Jayasekara, K. S., (1995). Photosynthetic characteristics of tropical tree species with special reference to palms. Energy Conservation and Management. Energy Conservation and Management, Volume 36, p. 919 - 922.

Ma, F., Sha, A., Yang, P., 1 and Huang Y. (2016). The Greenhouse Gas Emission from Portland Cement Concrete Pavement Construction in China, International Journal of Environmental Research and Public Health.

Madifushi Council (2020). *Island Waste Management Plan of Thaa Madifushi.* Madifushi, Maldives.

Meerow, A. & Broschat, T. K., (2003). Transplanting Palms, s.l.: University of Florida

Ministry of Environment [ME] (2012). *Environmental Impact Assessment Regulations*. Male', Maldives: Ministry of Environment.

Ministry of Environment [ME] (2015). *National Policy on Waste Management*. Male', Maldives: Ministry of Environment.

Ministry of Environment [ME] (2016). Maldives Clean Environment Project Environmental and Social Assessment and Management Framework (ESAMF) & Resettlement Policy Framework (RPF). Male', Maldives: Ministry of Environment.

Muller, T., R. A. Jorres, E. M. Scharrer, H. Hessel, D. Nowak, and K. Radon. 2006. Acute Blood Neutrophilia Induced by Short-Term Compost Dust Exposure in Previously Unexposed Healthy Individuals. International Archives of Occupational and Environmental Health. 79:477-482.

National Bureau of Statistics [NBS] (2014). *Maldives Population and Housing Census 2014: Statistical Release 1 Population and Households.* Male', Maldives: National Bureau of Statistics.

National Bureau of Statistics [NBS] (2006). *Population and Housing Census of Maldives 2006: Summary Tables.* Male', Maldives: National Bureau of Statistics.

Ohler, J., (1999). Modern coconut management; palm cultivation and products. s.l.:EcoPort.

Peterson, C. (2013). Assessment of solid waste management practices and its vulnerability to climate risks in Maldives Tourism Sector. *Report submitted to Ministry of Tourism, Arts and Culture*.

Ranasinghe, C. S. & Silva, L. R., (2007). Photosynthetic assimilation, carbohydrates in vegetative organs and carbon removal in nut-producing and sap-producing coconut palms. COCOS, Volume 18, p. 45-57.

Ranasinghe, C. S. & Thimothias, K. S., (2012). Estimation of carbon sequestration potential in coconut plantations under different agro-ecological regions and land suitability classes. J.Natn.Sci.Foundation Sri Lanka, 40(1), pp. 77-93.

Rynk R (2000). Fires at composting facilities: causes and conditions, Biocycle, January pp 55-58.

SAE International (2001). The Engineering Society for Advancing Mobility Land Sea Air and Space lnternational - Surface vehicle reccomended practice, Warrendale: s.n.

Saleem, A., (2018). *Environmental and Social Management Plan for the establishment of Island Waste Management Center in Th. Madifushi. Male', Maldives.*

Saleem, A., Hartman, M., Hammad, A., Kawsar, S., Hoogduin, L. (2016). Environmental Impact Assessment for the proposed coastal protection at Gn. Fuvahmulah.

United States Environmental Protection Agency (2020). Types of Composting and Understanding the Process. Washington, D.C., United States

Wheeler, P. A., I. Stewart, P. Dumitrean, and B. Donavan. (2001). Health Effects of Composting - A Study of Three Compost Sites and Review of Past Data. Technical Report P1-315. UK Environment Agency.

World Bank Group [WBG] (2007). *Environmental, Health, and Safety Guidelines for Waste Management Facilities.* Washington, D.C., United States

Wouters, I. M., S. Spaan, J. Douwes, G. Doekes, and D.Heederik. (2006). Overview of Personal Occupational Exposure Levels to Inhalable Dust, Endotoxin, β(1-3)-Glucan and Fungal Extracellular Polysaccharides in the Waste Management Chain. Annuals of Occupational Hygiene. 50(1):39-53.

Zuhair, A.H., (2019a). *Environmental and Social Management Plan for the proposed upgrading of Island Waste Management Center in N. Holhudhoo.* Male', Maldives: Ministry of Environment.

Zuhair, A.H., (2019b). *Environmental Management Plan for the proposed development of Island Waste Management Center in R. Maakurathu.* Male', Maldives: Ministry of Environment.

Zuhair, A.H., (2017). Operational Environmental and Social Management Plan for Regional Waste Management Facility – Zone 2, Vandhoo, Raa Atoll. Male', Maldives: Ministry of Environment.

Zuhair, M.H., (2016a). Environmental and Social Management Plan for the proposed upgrade of the IWMC at the Fuvahmulah. Male', Maldives: Ministry of Environment.

Zuhair, M.H., (2016b). Environmental and Social Management Plan for the proposed upgrade of the IWMC at the Hulhudhoo-Meedhoo. Male', Maldives: Ministry of Environment.

ANNEXES

ANNEX 1

EIA Screening Decision from EPA

بسم الله الرحمن الرحيم

Environmental Protection Agency

ތަފާތުކުރުމުގެ ދާއިރާ

203-EIARES/438/2018/14 :ނަންބަރ

ގާތްގަނޑު ކުންފުނިތަކުގެ ލިސްޓް

ދިވެ ހ. ކަނޑުމަތީގައި ކާއިން ދަތުރުކުރާ ކަންތައްތަކާ ގުޅިގެން ގާތްގަނޑު ކުންފުނިތަކުގެ ލިސްޓް ތަފާތުކުރުމުގެ ދާއިރާއަށް ލިބިގެންވާ ތަކެއް ތަފާތުކުރުމުގެ ދާއިރާ ވަކިން ދަންނަވައިދެއެވެ.

	ދ ގަނޑުތެރެއަށް ސަލާމަތާ ދިމާއަށް ދާ ދަތުރުތަކުގައި ކާ ދުވަސް ހަތަރު ގެ ތެރޭގައި ކާ ހަނގުރާ ކުރުމަށް ކުންފުނިތަކަށް ދަންނަވައިދެއެވެ.
	ދ ގަނޑުތެރެއަށް ދަތުރުކުރާ ކާ ތަކުގައި ދުވަހަކު ކާ ހަނގުރާ ކުރުމަށް ދަންނަވައިދެއެވެ.
✓	ދ ގަނޑުތެރެއަށް ދަތުރުކުރާ ކާ ތަކުގައި ދުވަހަކު ކާ ހަނގުރާ ކުރުމަށް ދަންނަވައިދެއެވެ.
	ދ ގަނޑުތެރެއަށް ސަލާމަތާ ދިމާއަށް ދާ ދަތުރުތަކުގައި ކާ ހަނގުރާ ކުރުމަށް ދަންނަވައިދެއެވެ. ވީ، ދަތުރުގައި ދަތުރުކުރާ ދުވަސްތަކުގެ ތެރެއިން ދުވަހަކު ތަކެއް ހަނގުރާ ކުރަންވާނެ ކަމަށް ދަންނަވައިދެއެވެ.
	ދ ގަނޑުތެރެއަށް ސަލާމަތާ ދިމާއަށް ދާ ދަތުރުތަކުގައި ކާ ހަނގުރާ ކުރުމަށް ކުންފުނިތަކަށް ދަންނަވައިދެއެވެ.

ދިވެ ތަފާތުކުރުމުގެ ގޮތުން ކާއިން ދަތުރުކުރާ ކަންތައްތަކާ ގުޅިގެން ވީ، ދ ގަނޑުތެރެއަށް ދާ ދަތުރުތަކުގައި ކާ ހަނގުރާ ކުރުމަށް ދަންނަވައިދެއެވެ. ކާ ހަނގުރާ ކުރުމުގެ ގޮތުގައި ކާ ތަކުގެ ކާ ހަނގުރާ ކުރާ ގޮތް ދަންނަވައިދިނުމަށް ކާ ހަނގުރާ ކުރާ ފަރާތަށް ދަންނަވައިދެއެވެ.

ކާ ތަފާތުކުރުމުގެ ދާއިރާ ވަކިން ދަންނަވައިދެއެވެ.

ނަން: ޢާއިޝަތު ފަހުމީދު

ވަޒީފާ: ކާ ތަފާތުކުރާ ފަރާތާ

ސޮއި:

ތާރީޚް 10 ފެބްރުއަރީ 2018

ANNEX 2

Decision Statement and Clearance Note Issue for the Previous ESMP

بسم الله الرحمن الرحيم

އެންވަޔަރަންމަންޓަލް ޕްރޮޓެކްޝަން އޭޖެންސީ
Environmental Protection Agency EPA

ނަންބަރު: 203-EIARES/438/2018/142

މިނިސްޓަރ އޮފް އެންވަޔަރަންމަންޓް އެންޑް އެނަރޖީ އަލްފާޟިލް ތޯރިގް އިބްރާހީމް އަށް،

ވަރަށް ސަލާމަތުން ދަންނަވަމެވެ.

ތ. މަޑިފުށީގައި ކުނި މެނޭޖްކުރާ މަރުކަޒެއް ގާއިމްކުރުމުގެ މަޝްރޫޢުއަށް ހުށަހަޅާފައިވާ އެންވަޔަރަންމަންޓަލް މެނޭޖްމަންޓް ޕްލޭނާ ގުޅޭ

ތ. މަޑިފުށީގައި ކުނި މެނޭޖްކުރާ މަރުކަޒެއް ގާއިމްކުރުމަށް ތިޔަ މިނިސްޓްރީއިން 25 ޖުލައި 2018 ގައި ހުށަހަޅުއްވާފައިވާ އެންވަޔަރަންމަންޓަލް މެނޭޖްމަންޓް ޕްލޭން މުރާޖަޢާކުރުމަށްފަހު އެ ރިޕޯޓުގައިވާގޮތަށް މަސައްކަތް ކުރުމާމެދު މި އޭޖެންސީގެ އިޢުތިރާޒެއް ނެތް ކަމުގައި ދަންނަވަމެވެ. އަދި މަސައްކަތްތަކުން ތިމާވެއްޓަށް ލިބޭ ގެއްލުންތައް ކުޑަ ކުރުމަށް އަޅާނެކަމަށް ފާހަގަކޮށްފައިވާ ފިޔަވަޅުތަކާއި ވެއްޓަށް އަންނަމުންދާ ބަދަލުތައް ދެނެގަތުމުގެ ގޮތުން އެންވަޔަރަންމަންޓަލް މޮނިޓަރިންގ ޕްރޮގްރާމް ކުރިއަށްދާ ގޮތަށް މަސައްކަތް ކުރިއަށް ގެންދަންޖެހޭނެއެވެ. އަދި ވެއްޓަށް އަންނަމުންދާ ބަދަލުތައް ދެނެގަތުމަށް [illegible] ރިޕޯޓު [illegible] އެންވަޔަރަންމަންޓަލް މޮނިޓަރިންގ ރިޕޯޓުތައް ބަޔާންކޮށްފައިވާ ޝެޑިއުލްގައިވާ ގޮތުގެ މަތިން މި އޭޖެންސީއަށް ހުށަހަޅުއްވަންޖެހޭނެކަން ފާހަގަކޮށް މަޢުލޫމާތަށްޓަކައި ދަންނަވަމެވެ.

އަދި މި މަސައްކަތްތަކަށް ފެއްޓެވި ތާރީޚު މި އޭޖެންސީއަށް އެންގެވުމަށް ދަންނަވަމެވެ.

އިޚްލާޞްތެރި ޚިދުމަތުގައި އުޅެމެވެ.

20 ޛުލްޤަޢިދާ 1439
02 އޮގަސްޓް 2018

ޚާދިމްކުމް

އިބްރާހީމް ނަޢީމް
ޑިރެކްޓަރ ޖެނެރަލް

މިނިސްޓްރީ އޮފް އެންވަޔަރަންމަންޓް އެންޑް އެނަރޖީ،
މާލެ، ދިވެހިރާއްޖެ

305

Ministry of Environment and Energy Maldives

Ahmed Hassaan Zuhair <ahmed.hassaan@environment.gov.mv>

CLEARANCE: ESMPs M Mulah, Th Kinibidhoo, Th Madifushi

Mokshana Nerandika Wijeyeratne <mwijeyeratne@worldbank.org> Tue, Aug 28, 2018 at 3:29 PM
To: Ahmed Hassaan Zuhair <ahmed.hassaan@environment.gov.mv>, Susrutha Goonasekera <sgoonasekera@worldbank.org>
Cc: "Ahmed Nizam (ahmed.nizam@environment.gov.mv)" <ahmed.nizam@environment.gov.mv>, "Ahmed Murthaza (ahmed.murthaza@epa.gov.mv)" <ahmed.murthaza@epa.gov.mv>, James Orehmie Monday <jmonday@worldbank.org>, Darshani De Silva <ddesilva4@worldbank.org>, "Gaurav D. Joshi" <gjoshi1@worldbank.org>

Dear Hassan,

The ESMPs for M. Mulah, Th. Kinbidhoo and Th. Madifushi are cleared. You may proceed with the next steps.

Thank you for ensuring that the comments provided at conditional clearance are adequately incorporated.

Best Wishes

Mokshana

Mokshana Nerandika Wijeyeratne

Environmental Specialist

Environment & Natural Resources

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73/5, Galle Road, Colombo 03, Sri Lanka

WORLD BANK GROUP
Environment & Natural Resources

ANNEX 3

Letter from EPA informing to update the ESMP to reflect change in scope

އެންވަޔަރަމަންޓަލް ޕްރޮޓެކްޝަން އޭޖެންސީ
Environmental Protection Agency

ނަންބަރު:203-ECA/438/2020/51

މިނިސްޓަރ އޮފް އެންވަޔަރަމަންޓް ޑރ. ހުސައިން ރަޝީދު ހަސަން،

ވޮޑިގެން ސަލާމަށް ފަހު ދަންނަވަމެވެ.

މ. މުލައް، ތ. ބުރުނި، ތ. މަޑިފުށި، ތ. ކިނބިދޫ، ތ. އޯމަދޫ އަދި ތ. ތިމަރަފުށިގައި ކުނި މެނޭޖުކުރާ މަރުކަޒު ޤާއިމުކުރުމުގެ މަޝްރޫޢުގެ ތިމާވެށީގެ މެނޭޖްމަންޓް ޕްލޭނާއި ބެހޭ:

ތިޔަ މިނިސްޓްރީގެ 438-WMPC/203/2020/53 (18 އޮގަސްޓް 2020) ނަންބަރު ސިޓީއަށް ހަވާލާދީ ދަންނަވަމެވެ.

އެންވަޔަރަމަންޓަލް [illegible] ތިމާވެއްޓަށް އަސަރު ކުރާ މިންވަރު ދިރާސާ ކުރުމާ ބެހޭ ގަވާއިދު 2012 ގެ 14 ވަނަ މާއްދާގެ ބ ގައިވާ ގޮތުން ތިމާވެށީގެ ގޮތުން ނިންމި ގޮތުގެ ލިޔުން ދޫކުރި ތާރީޚުން ފެށިގެން 1 (އެކެއް) އަހަރު ދުވަހުގެ ތެރޭގައި މަޝްރޫޢުގެ އަމަލީ މަސައްކަތް ނުފެށިއްޖެ ނަމަ، ތިމާވެށީގެ ގޮތުން ނިންމި ގޮތުގެ ލިޔުން ބާތިލުވާނެއެވެ. އެހެންކަމުން، ހަވާލާދީފައިވާ ސިޓީގައިވާ ރަށްތަކުގައި ކުނި މެނޭޖުކުރާ މަރުކަޒުތައް ޤާއިމުކުރުމުގެ މަސައްކަތަށް އަލުން ތިމާވެށީގެ މެނޭޖްމަންޓް ޕްލޭނެއް ތައްޔާރުކުރައްވަމުން ދަންނަވަމެވެ.

އިޙްތިރާމް ޤަބޫލުކުރެއްވުން އެދެމެވެ.

92 ޛުލްޙިއްޖާ 4114
42 އޮގަސްޓް 9292

ޚާދިމްކުމް

އިބްރާހިމް ނައީމް
ޑިރެކްޓަރ ޖެނެރަލް

މިނިސްޓްރީ އޮފް އެންވަޔަރަމަންޓް،
މާލެ، ދިވެހިރާއްޖެ

ANNEX 4

Land Approval Documents Issued by MLSA

بسم الله الرحمن الرحيم

Maldives Land and Survey Authority
Ministry of Housing and Infrastructure
Male', Republic of Maldives.

ގެނެވެލޮސް ބޮޑެ ތަރައްޤީ ތަކެއް
ފިނިހުއްޓެވި ތަކެ ހަމަކޮށް ތަންކަން ހިންގުމަށް ދަތިވާ ތަކެ
ގާއި، ދިވެހިރާއްޖެ.

ތިމާވެށީގެ ފުރުޞަތުތަކާ - ތިމާވެށީގެ ހަދާދޭ

431-VR/384/2017/8 :ނަންބަރ

ކުއްލިއަށް ދެ ފުރާ ކަންކަމުގެ ތަފާސް ހަވާލުކުރުން،
ފުރިހަމަކުރުމަށް ފަހަރު ދެވުނު.

ތިއަށް ހިނގާ ކަންކަމުގެ ނަންބަރ:(LET)384-A/2017/337 (28 ނޮވެމްބަރ 2017) ގެ ދަށުން ދެ ފުރާ ކަންކަމުގެ ފަހަރު ދެވުނު.
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14 ޑިސެމްބަރ 2017

ދ.ދެ ފުރާ، ދިވެހިރާއްޖެ.
ކ.ތިމާވެށީ، ތިމާވެށީގެ ހަދާދޭ ތަކެ

Ameenee Magu,
Maafannu,
Male', 20392,
Republic of Maldives.

Tel: +(960) 300 4 2 59 ފޯނު:
Fax: +(960) 300 4 254 ފެކްސް:
Email: mlsa@housing.gov.mv ލިޔުމަށް:
Website: www.surveyofmaldives.gov.mv ވެބްސައިޓް:

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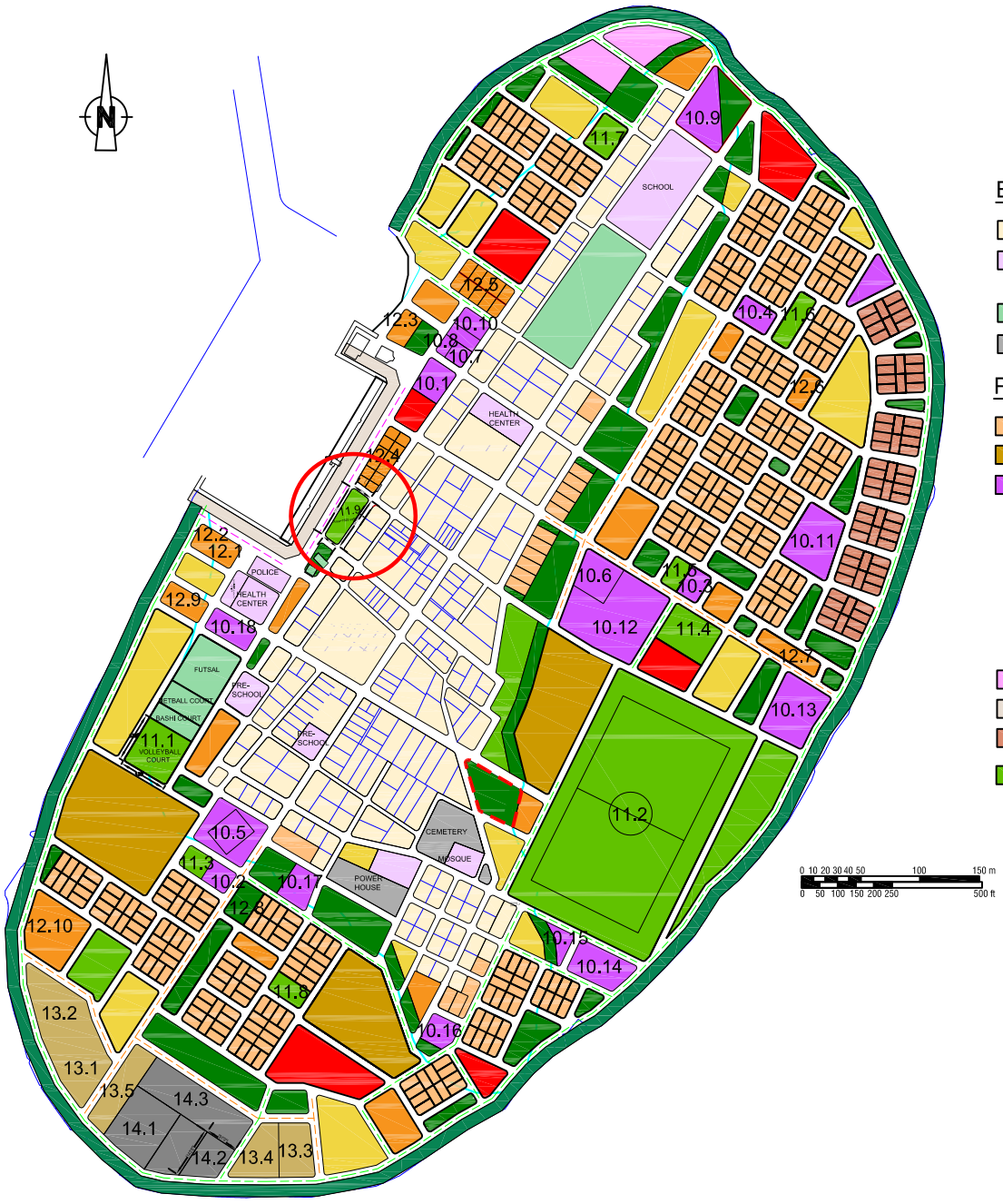
ފ.ބ.ނ.
ފ.ކ. 20392،
ދ.ދ.ދ.



EXISTING LAND USES

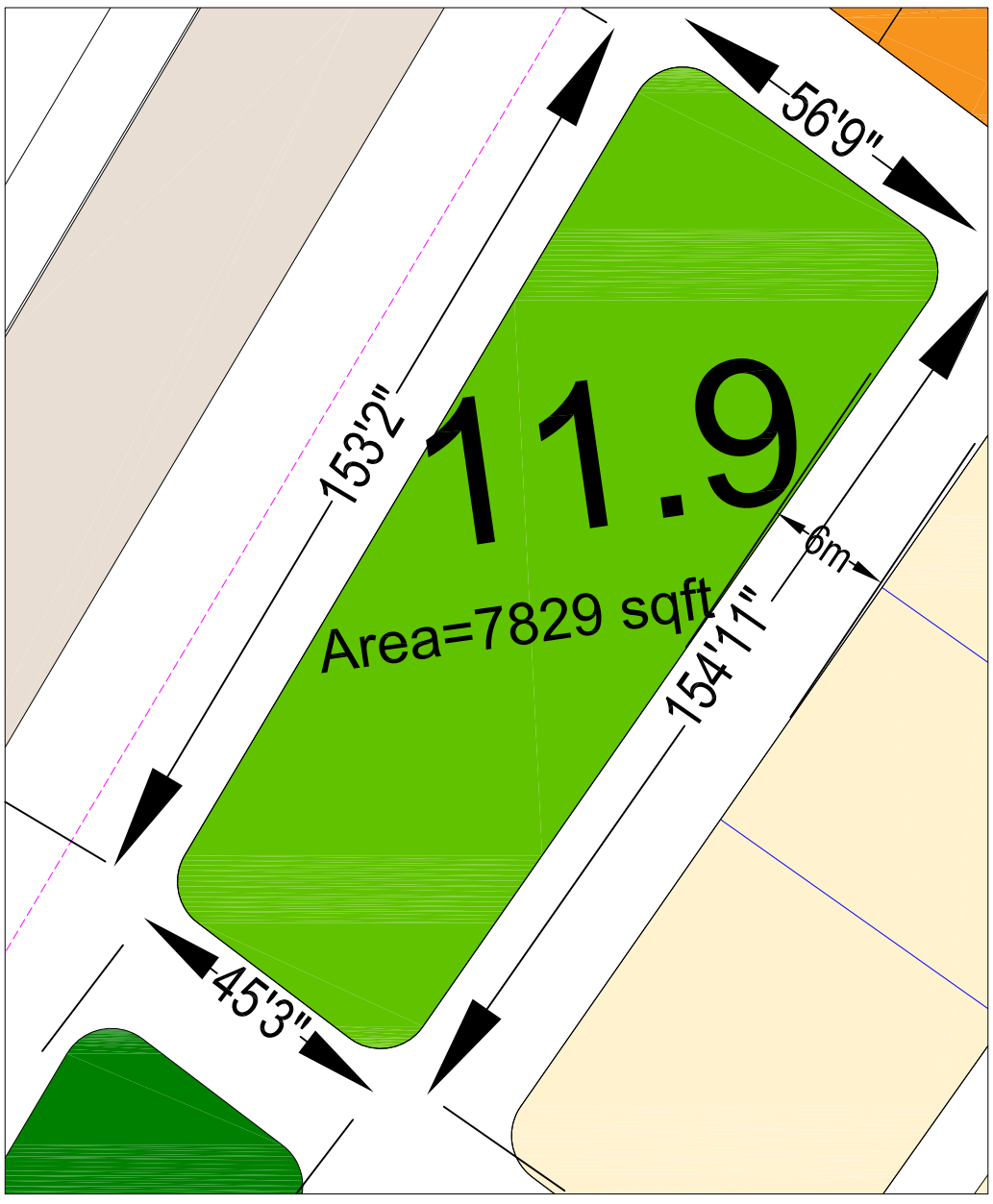
- RESIDENTIAL AREA
- INSTITUTIONAL & COMMUNITY FACILITIES
- SPORTS & RECREATION
- UTILITY & MUNICIPAL SERVICES

PROPOSED LAND USES

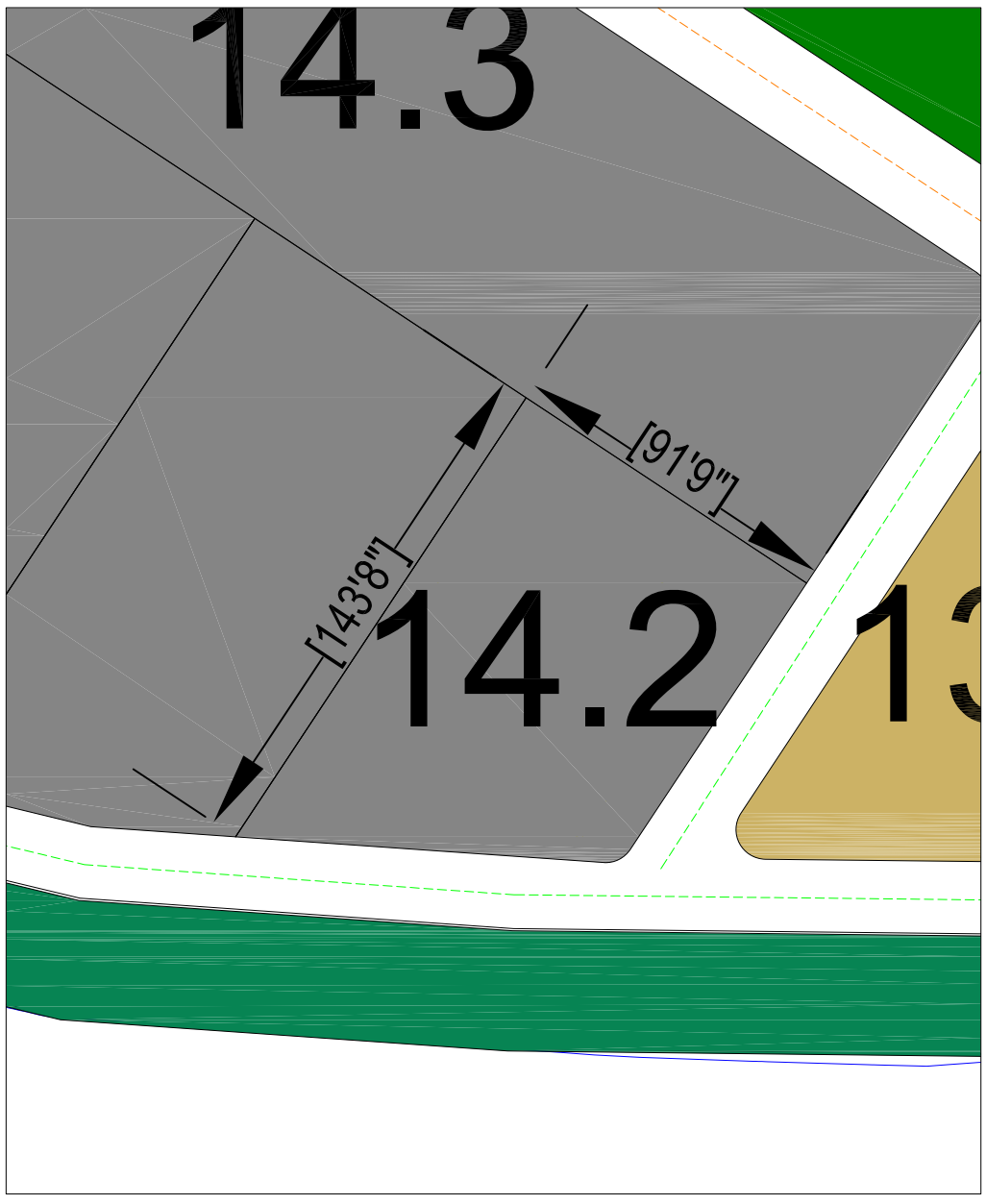
- RESIDENTIAL AREA (1400 sqft, 426 Plots)
- PUBLIC HOUSING UNITS
- INSTITUTIONAL & COMMUNITY FACILITIES
  - 10.1 - Proposed site for Island Council
  - 10.2-10.4 - Pre-school
  - 10.5 - Mosque
  - 10.6 - Magistrate court
  - 10.7 - Bank
  - 10.8 - Post Office
  - 20.9 - 20.18 - Reserved for future Institutional Use
- TOURISM USES (29,613.46 sqft)
- HARBOR LOADING / UNLOADING (10m wide)
- REAL ESTATE (1400 sqft, 100 Plots)
- SPORTS & RECREATION
  - 11.1 - Volley Ball Court
  - 11.2 - Football Ground
  - 11.3-11.11.5 - Safe Play areas
  - 11.6-11.9 - Parks
- COMMERCIAL USE
  - 12.1- Fish Market
  - 12.2 - Local Market
  - 12.3 - Ice Plant
  - 12.4-12.8 - Shops, Cafe' & Restaurant
  - 12.9-12.10 - Reserved land for commercial use
- INDUSTRIAL ZONE
  - 13.1 - Slipway
  - 13.2 - Godown / Storage facilities
  - 13.3 - Fish Processing
  - 13.4-13.5 - Reserved for future Light industrial uses
- UTILITY & MUNICIPAL SERVICES
  - 14.1 - Power House
  - 14.2 - Waste Management Center
  - 14.3 - Reserved for future Utilities uses
- MIXED USE ZONE
- RESERVED FOR FUTURE NON-RESIDENTIAL USE
- OPEN / GREEN / BUFFER AREAS
- ENVIRONMENTAL PROTECTION ZONE (E.P.Z) (10m wide)
- PROPOSED CONSERVATION AREA

LINE TYPE	ROAD HIERARCHY
	10m ROAD
	7.5m ROAD
	6m ROAD

TOTAL RECLAMATION AREA : 29.25 Ha



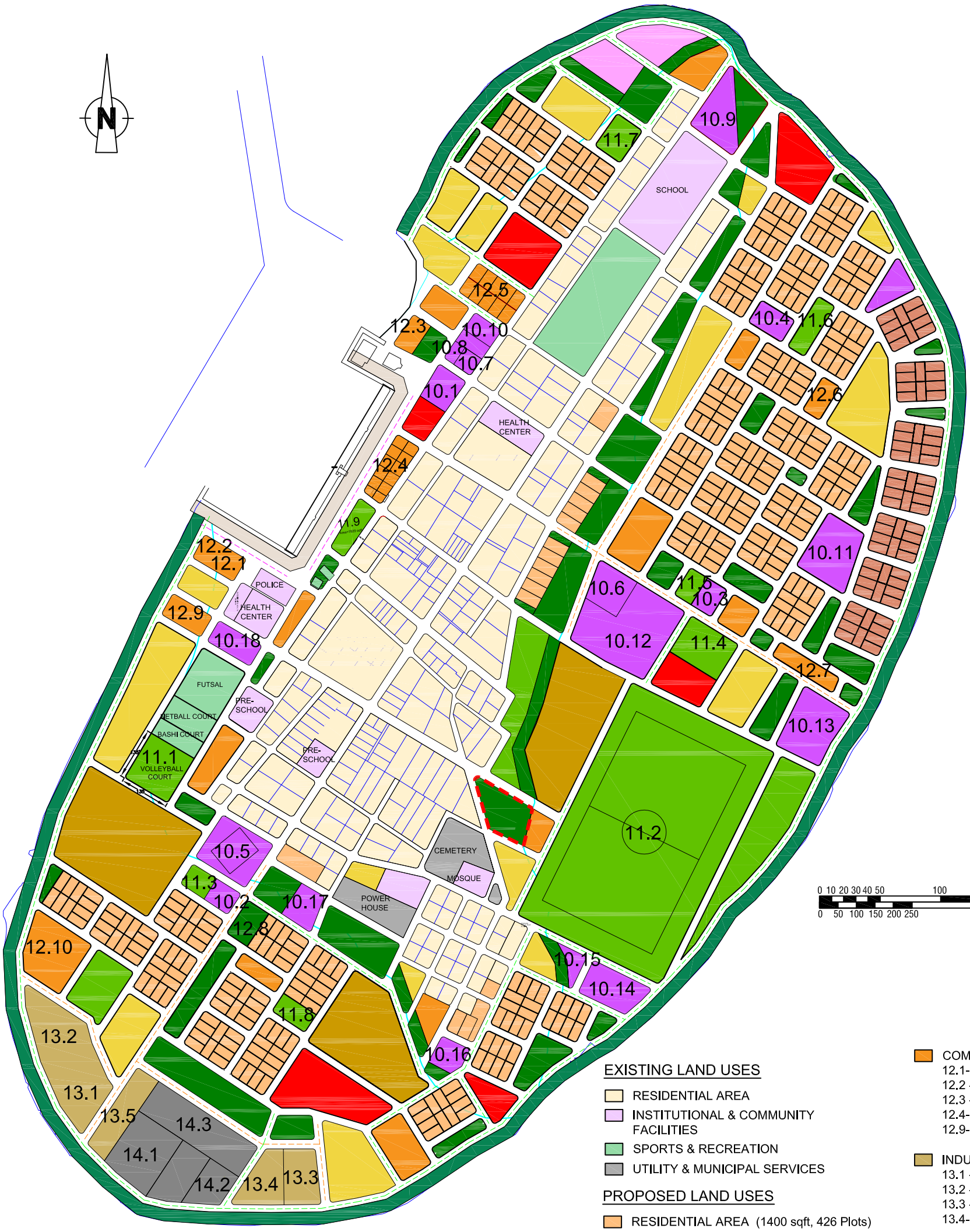
11.9 - PROPOSED LAND FOR PARK AREA= 7,829 sqft



14.2 - PROPOSED LAND FOR WASTE MANAGEMENT CENTRE AREA= 10,782 sqft

MINISTRY OF HOUSING AND INFRASTRUCTURE
AMEENEE MAGU, MAAFANNU 20392, MALE', REPUBLIC OF MALDIVES
TEL: 3004300 FAX: 3004301 email: planning@housing.gov.mv

TITLE: PROPOSED LAND FOR PARK AND WMC	**PROJECT:** TH. MADIFUSHI LAND USE PLAN	**DRAWN BY:** NAA/AG/NA	**SURVEYED BY:**
		CHECKED BY: HR	**SCALE:**
			DATE: 13 DECEMBER 2017



EXISTING LAND USES

- RESIDENTIAL AREA
- INSTITUTIONAL & COMMUNITY FACILITIES
- SPORTS & RECREATION
- UTILITY & MUNICIPAL SERVICES

PROPOSED LAND USES

- RESIDENTIAL AREA (1400 sqft, 426 Plots)
- PUBLIC HOUSING UNITS
- INSTITUTIONAL & COMMUNITY FACILITIES
  - 10.1 - Proposed site for Island Council
  - 10.2-10.4 - Pre-school
  - 10.5 - Mosque
  - 10.6 - Magistrate court
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  - 10.8 - Post Office
  - 20.9 - 20.18 - Reserved for future Institutional Use
- TOURISM USES (29,613.46 sqft)
- HARBOR LOADING / UNLOADING (10m wide)
- REAL ESTATE (1400 sqft, 100 Plots)
- SPORTS & RECREATION
  - 11.1 - Volley Ball Court
  - 11.2 - Football Ground
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- COMMERCIAL USE
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  - 12.4-12.8 - Shops, Cafe' & Restaurant
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- INDUSTRIAL ZONE
  - 13.1 - Slipway
  - 13.2 - Godown / Storage facilities
  - 13.3 - Fish Processing
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  - 14.1 - Power House
  - 14.2 - Waste Management Center
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- MIXED USE ZONE
- RESERVED FOR FUTURE NON-RESIDENTIAL USE
- OPEN / GREEN / BUFFER AREAS
- ENVIRONMENTAL PROTECTION ZONE (E.P.Z) (10m wide)
- PROPOSED CONSERVATION AREA

LINE TYPE ROAD HIERARCHY

- 10m ROAD
- 7.5m ROAD
- 6m ROAD

TOTAL RECLAMATION AREA : 29.25 Ha

MINISTRY OF HOUSING AND INFRASTRUCTURE
AMEENEE MAGU, MAAFANNU 20392, MALE', REPUBLIC OF MALDIVES
TEL: 3004300 FAX: 3004301 email: planning@housing.gov.mv

TITLE: TH.MADIFUSHI LAND USE PLAN

PROJECT: TH. MADIFUSHI LAND USE PLAN

DRAWN BY: NAA/AG/NA

CHECKED BY: HR

SURVEYED BY:

SCALE:

DATE: 13 DECEMBER 2017

ANNEX 5

Educational Certificates and CV of the ESMP Consultant

CURRICULUM VITAE *Ahmed Hassaan Zuhair*

PERSONAL DETAILS

- Full name: Ahmed Hassaan Zuhair
- Date of birth: 02 Aug 1985
- Mailing address: H. Maaniga (5th Floor), Sikka Goalh, Male' 20082, Maldives
- Residential address: G.Vehi, Male', Maldives
- Mobile telephone number: (+960)7886707
- Email address: hassaan.zuhair@gmail.com

WORK EXPERIENCE

ENVIRONMENTAL AND SOCIAL SAFEGUARDS SPECIALIST

- Name of Employer: Maldives Clean Environmental Project (MCEP)
  World Bank
  Ministry of Environment and Energy, Male', Maldives
- Position title: Environmental and Social Safeguards Specialist
- Period of work: July 2018 to present
- Major Responsibilities:
  - Ensure environmental and social safeguard measures are adequately implemented in MCEP administered by the MCEP PMU/MEE.
  - Educate project affected families on the relevant environmental and social safeguards issues and relevant policies.
  - Where applicable, develop information, education and communication (IEC) materials and facilitate workshops on good environmental and social practices relevant to all projects administered by the PMU/MEE.
  - Co-ordinate with the various island administration offices on periodic basis on environmental issues.
  - Assist GoM in ensuring environmental responsibilities of the project, such as compliance with the environmental protection laws and regulations of the country.
  - Assist GoM in ensuring social responsibilities of the project, such as compliance with the labour laws, prohibition of child labour, HIV/AIDS and gender issues.
  - Ensure safeguard measures are adequately implemented.
  - Establish a grievance redress system and assist community in the redress of their grievances through the system.'

ENVIRONMENTAL AND SOCIAL SAFEGUARDS OFFICER

- Name of Employer: Maldives Clean Environmental Project (MCEP)
  World Bank
  Ministry of Environment and Energy, Male', Maldives
- Position title: Environmental and Social Safeguards Officer
- Period of work: June 2017 to June 2018
- Major Responsibilities:
  - Ensure environmental and social safeguard measures are adequately implemented in MCEP administered by the MCEP PMU/MEE.
  - Educate project affected families on the relevant environmental and social safeguards issues and relevant policies.
  - Where applicable, develop information, education and communication (IEC) materials and facilitate workshops on good environmental and social practices relevant to all projects administered by the PMU/MEE.
  - Co-ordinate with the various island administration offices on periodic basis on environmental issues.
  - Assist GoM in ensuring environmental responsibilities of the project, such as compliance with the environmental protection laws and regulations of the country.
  - Assist GoM in ensuring social responsibilities of the project, such as compliance with the labour laws, prohibition of child labour, HIV/AIDS and gender issues.
  - Ensure safeguard measures are adequately implemented.
  - Establish a grievance redress system and assist community in the redress of their grievances through the system.

ENVIRONMENT ANALYST

- Name of Employer: Ministry of Environment and Energy, Male', Maldives
- Position title: Environment Analyst (Coastal Unit)
- Period of work: March 2016 to May 2017
- Major Responsibilities:
  - Managing Coastal PSIP projects and donor assisted projects (ORIO and KAFED).
  - Ensuring the implementation of the project components are in line with the government policies and/or donor requirements.
  - Interacting with the financial, procurement and technical staff of the Ministry and EPA to enable smooth implementation of the project components.
  - Coordination among the stakeholders including the atoll/island councils, contractors and engineers in resolving various issues that come up during the implementation.
  - Processing bills raised by contractors.
  - Preparing and compilation of the project progress reports, quarterly reports and updates in a timely manner.
  - Providing information, monthly progress reports and other documentation requested by the Project Director for review and/or for presentation to Steering/Technical committees, donor review missions or by other relevant authorities of the Government in a timely manner.
  - Preparation of Terms of Reference, Tender Documents and Evaluation of Bids and Proposals.
  - Preparing Contract Documents and Contract Amendments.

- Monitoring the progress of project activities on a regular basis.
- Visiting project sites periodically and reporting back on the status of on-site activities to the management.
- Participating in EIA scoping meetings related to the project and guiding contractors in the EIA application process.
- Ensuring that the projects are formulated in an environmentally friendly and sustainable manner by consulting EPA and other relevant parties.

ENVIRONMENT ANALYST

- Name of Employer: Ministry of Environment and Energy, Male', Maldives
- Position title: Environment Analyst (Awareness Unit)
- Period of work: July 2010 to December 2013
- Major Responsibilities:
  - Conducting regional environmental awareness sessions in different atolls.
  - Conducting waste management workshops in different regions of Maldives.
  - Organizing and celebrating major environmental significant days at national level.
  - Preparing booklets, broachers and newsletters in view to increase public knowledge on existing environmental issues in Maldives.
  - Creating Environmental Awareness through Media.
  - Provided assistance to legal unit in drafting sold waste management regulation, standards on biodegradable plastic bags and Environmental impact assessment regulation.

ENVRIONMENT OFFICER (T)

- Name of Employer: Ministry of Environment, Energy and Water , Male', Maldives
- Position held: Environment Officer (Trainee)
- Period of work: February 2005 – July 2007
- Major Responsibilities:
  - Provide assistance in facilitating and carrying out various works in relation to environmental awareness and community mobilization.
  - Writing and publishing 2005 World Environment Day Awareness handbook.
  - Conducting a weekly environmental awareness raising radio program on national radio.

Additional Experience

- Registered EIA Reviewer in EPA (since April 2016)

• ISWA Beacon Conference	13 – 15 Dec 2019 *Singapore*
• Training on Geo- Enabling Method for Monitoring and Supervision (GEMS)	15 – 20 Sept 2019 *Chennai, India*
• TESTO Mobile Stack Emissions Monitoring Training	6 Feb 2019 *Male', Maldives*
• Introduction to Mapping with Drones Geoinformatics Center, Asian Institute of Technology (AIT)	10 – 14 Sept 2018 *Pathumthani, Thailand*
• World Bank Procurement Training	2-4 Oct 2017 *Colombo, Sri Lanka*
• Training Program for Environmental Regulators	19-30 Nov 2012 *New Delhi, India*
• Consultation for the Asia-Pacific Region in preparation for the fifth session of the intergovernmental negotiating committee on mercury	31 Oct - 1 Nov 2012 *Bangkok, Thailand*
• Tbilisi+35: Intergovernmental conference on Environmental Education for Sustainable Development	6-7 Sept 2012 *Tbilisi, Georgia*
• Third Asia Pacific Regional Meeting on SAICM	8-9 Sep 2011 *Beijing, China*
• UNITAR Regional Workshop on Nanotechnology and Manufactured Nanomaterials	6-7 Sep 2011 *Beijing, China*
• UNEP/OECD Workshop on Perfluorinated Chemicals and transition to safer alternatives	5 Sep 2011 *Beijing, China*
• Seminar on Integrated Coastal Management for Developing Countries	Oct/Nov 2010 *Xiamen, China*
• Capacity building in ecosystem-based management approaches for the Coastal areas in the Maldives	18 – 20 June 2007 *The University of Queensland*

- Training on preparation and interpretation of Climate Risk profile for the Maldives — 20 – 21 Feb 2006, *Ministry of Environment, Maldives*

ACADEMIC RECORD

Name and address of institution	Degree obtained (Master and Bachelor only)	Study period from - to	Medium of instruction
Griffith University *170 Kessels Rd, Nathan QLD 4122, Australia*	Master of Urban and Environmental Planning	2 March 2014 – 15 December 2015	English
University of Mysore *Mysore, Karnataka, India*	Bachelor of Science	1 Jul 2007 – 30 Jun 2010	English
Centre for Higher Secondary Education *Male', Maldives*	London GCE Advanced Level	1 Jun 2002 -30 Jun 2004	English
Majeediyya School *Male', Maldives*	London GCE Ordinary Level	1 Jan 1999 – 31 Jan 2002	English

AWARDS / HONOURS/ COMMENDATIONS

- PIA (Planning Institute of Australia) Awards for Planning Excellence 2015 - Commendation for Outstanding Student Project "Connected with Water: Integrated and Adaptive Water Management Framework" – University Sponsored by Queensland Government.
- Griffith Award for Academic Excellence 2015.
- Griffith Award for Academic Excellence 2014.
- Australia Awards Scholarship 2014.
- Certificate of Acknowledgement in recognition of outstanding contribution to Earth Hour campaign 2013.
- Certificate of Achievement (Discipline Prize), Majeediyya School.
- Certificate of Achievement (Passed in all curriculum subjects), Majeediyya School.

RESEARCH EXPERIENCE AND PUBLICATIONS

- Co-Author of Environmental and Social Management Framework (ESMF) of Maldives COVID19 Emergency Response and Health Systems Preparedness Project (April, 2020).
- Author of Environmental and Social Management Plan for the proposed upgrading of Island Waste Management Center in R. Maakurathu (December 2019).
- Author of Environmental and Social Management Plan for the proposed upgrading of Island Waste Management Center in N. Holhudhoo (October 2019).
- Author of Environmental and Social Management Plan for the proposed upgrading of Island Waste Management Center in R. Ungoofaaru (February 2019).
- Author of Environmental and Social Management Plan for the proposed upgrading of Island Waste Management Center in Lh. Kurendhoo (November 2018).
- Author of Operational Environmental and Social Management Plan for Regional Waste Management Facility –Zone 2, Vandhoo, Raa Atoll (September 2018).
- Coauthor of Environmental Impact Assessment Report for the proposed tourist jetty at Hulhumale' (June 2018).
- Author of Environmental Management Plan for the proposed development of Island Waste Management Center in Dh. Rinbudhoo (January 2018).
- Author of Environmental Management Plan for the proposed development of Island Waste Management Center in F. Magoodhoo (December 2017).

- Author of Environmental Management Plan for the proposed development of Island Waste Management Center in Th. Vandhoo (September 2017).
- Coauthor of Environmental Impact Assessment Report for the proposed agricultural project at R. Ungulu.
- Coauthor of Environmental Impact Assessment Report for the proposed 10 storey residential development at H. Sandhaleege.
- Connected with Water: Integrated and Adaptive Water Management Framework for South East Queensland (Studio Project, Griffith University).
- Urban Analysis of Brisbane CBD – Case Study (Studio Project, Griffith University).
- Feasibility Study for Low Density Residential Development in Park Ridge Queensland (Studio Project, Griffith University).
- Effects of leachates on the quality of ground water (Bachelor of Science Dissertation, University of Mysore).
- Pemphis Newsletter Issue number 22 – 40 (Publication of Ministry of Environment and Energy).
- Environment Impact Assessment Regulations 2012 (Publication of Ministry of Environment and Energy).
- Standards on Biodegradable Plastic Bags 2012 (Publication of Ministry of Environment and Energy).
- State of the Environment of Maldives 2011 (Publication of Ministry of Environment and Energy).

REFEREES

- Professor Darryl LOW CHOY
  Professor – Environment and Landscape Planning
  Urban Research Program

  Head of Discipline (Planning)
  School of Environment
  Griffith University
  Brisbane, QLD 4111 Australia

  Program Co-Leader
  Program B: Waster Sensitive Urbanism
  Cooperative Research Centre for Water Sensitive Cities
  E: d.lowchoy@griffith.edu.au

- Dr Tooran Alizadeh
  Lecturer, Urban & Environmental Planning
  Griffith School of Environment
  Griffith University
  Brisbane, QLD 4111 Australia
  E: t.alizadeh@griffith.edu.au

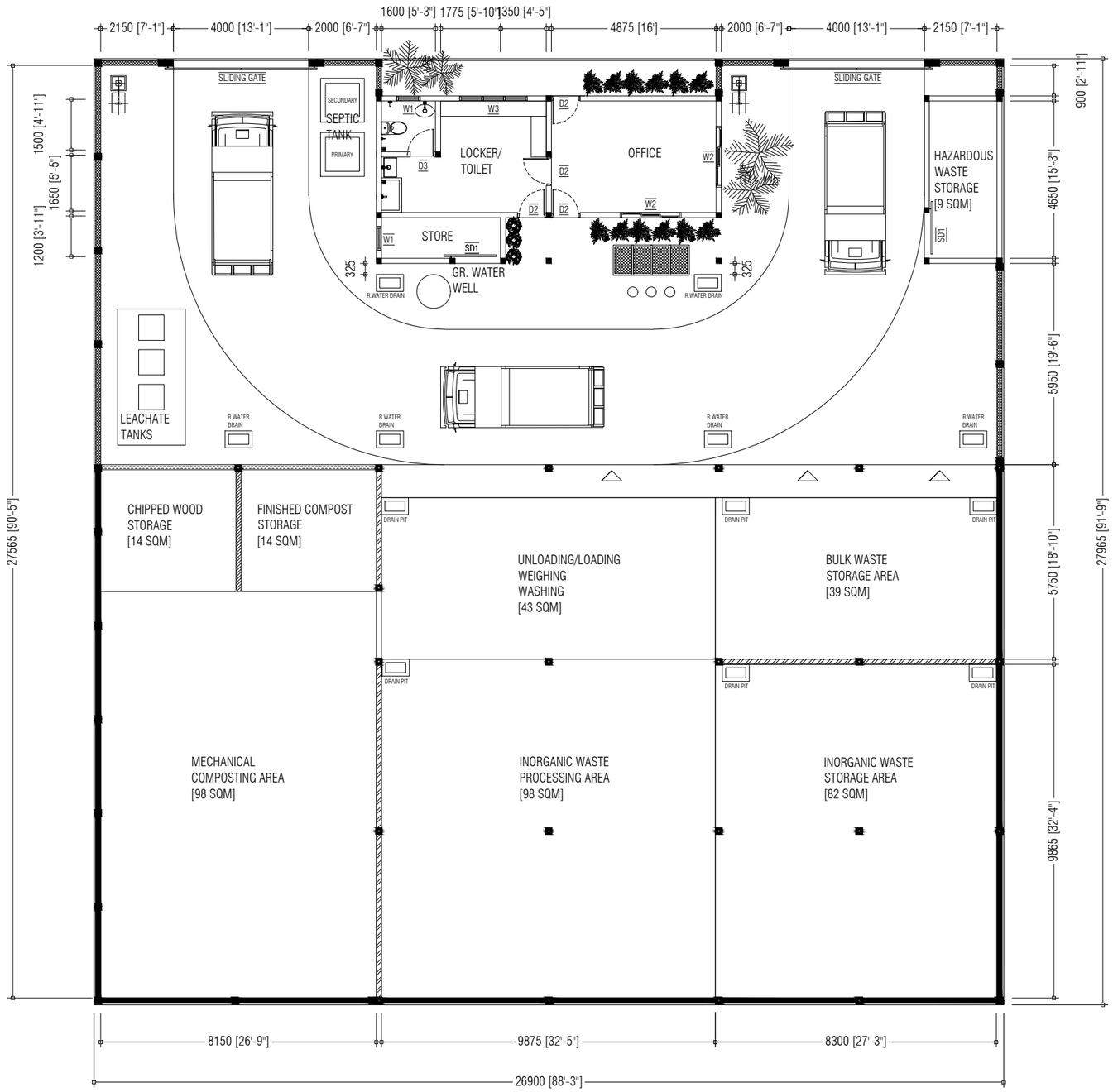
- Ahmed Murthaza
  Director General, Waste and Pollution Control Department
  Ministry of Environment & Energy, Male', Maldives
  Work: (+960) 3004315 / Mobile: (+960)7771504

Sincerely,

Ahmed Hassaan Zuhair

APPENDIX 6

Layout of the Proposed IWRMC



NOTE:

- 2500mm HEIGHT WALL
- 1500mm HEIGHT WALL
- OFFICE / HAZARDOUS WASTE BUILDING WALLS
- 2500mm HEIGHT MASONRY WALL + CLADDING ON TOP
- 2500mm HEIGHT MASONRY WALL + LOUVERS ON TOP
- BOUNDARY WALLS

PREPARED BY

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

PROJECT	CONSTRUCTION OF ISLAND WASTE MANAGEMENT CENTRE TH.MADIFUSHI	DESIGN BY	AFRAZ
TITLE	FLOOR PLAN	STRUCTURE BY	AFRAZ
CLIENT DEPARTMENT	WMPC DEPARTMENT	DRAWN BY	AFRAZ
PAPER SIZE	A3	SCALE	1:150
PAGE NO.	02	DWG NO.	MADI-A1-02
		DATE	19.10.2020

NOTES / AMENDMENTS

MECHANICAL COMPOSTING FOR ORGANIC WASTE MANAGEMENT

ANNEX 7

Commitment for Mitigation and Monitoring

بسم الله الرحمن الرحيم

Ministry of Environment
Male', Republic of Maldives.

ފަރުވާ ދިވެހިރާއްޖެ

ފަރުވާ، ބިލްޑިންގ ހަނޑުވަރީ ހިންގުން - ދިގު ދިއްދޫ ހަދަފަތް

Date: 18 January 2021

No: 438-WMPC/203/2021/13

Mr. Ibrahim Naeem,
Director General,
Environmental Protection Agency,
Green Building, Handhuvaree Hingun, Maafannu,
Male', 20392, Maldives.

Dear Sir,

Sub: Commitment to undertake Mitigation and Environmental Monitoring

The Environmental and Social Management Plan (ESMP) prepared for the proposed establishment of the Island Waste and Resource Management Centre (IWRMC) in Th. Madifushi has been prepared in accordance with the EIA Regulations 2012 and its amendments, issued by the Ministry of Environment.

We would like to confirm our commitment to the proposed mitigation measures and the monitoring programme that has been highlighted in the ESMP report prepared for the above referenced project.

Sincerely,

Amru Adam,
Assistant Director

Green Building, Handhuvaree Hingun,
Maafannu, Male', 20392, Republic of Maldives.
+(960) 301 8300
www.environment.gov.mv

ފަރުވާ، ބިލްޑިންގ ހަނޑުވަރީ ހިންގުން،
ފަރުވާ، 20392، ދިވެހިރާއްޖެ
secretariat@environment.gov.mv
www.twitter.com/ENVgovMV
www.facebook.com/environment.gov.mv

ANNEX 8

Additional Information Requested by the World Bank

WB Supplementary ESMP

ADDITIONAL INFORMATION FOR THE WORLD BANK

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN FOR THE PROPOSED ESTABLISHMENT OF AN ISLAND WASTE AND RESOURCE MANAGEMENT CENTRE IN TH. MADIFUSHI

PREPARED FOR

MINISTRY OF ENVIRONMENT

PREPARED BY

AHMED HASSAAN ZUHAIR

FEBRUARY 2021

Contents

INTRODUCTION

This supplementary ESMP produced for the proposed establishment of an IWRMC in Th. Madifushi address comments received from the World Bank's Social Safeguards Specialist for the original ESMP report. As such, the following sections of the report are supplemented with the requested additional information.

The report is prepared by the consultant of the original report, Mr. Ahmed Hassaan Zuhair, the ESS Specialist of the MCEP-PMU.

CHAPTER 4: ASSESSING THE LIKELY IMPACTS AND THE MITIGATION MEASURES

4.2.1. Impacts and Mitigation from Construction Phase

The interventions do not create any resettlement impacts such as loss of lands, assets and livelihoods to households, since project does not involve removal of any large trees from the project site or access road.

CHAPTER 11: LABOUR MANAGEMENT PLAN

The project anticipates some environmental and social impacts due to influx of labor hence, the following Table 45 prescribes the labor management guidelines for the contractor. However, the anticipated number of the labor for the project is approximately 15 – 20 workers.

A sample contractor's code of conduct is provided in Annex 8, which the contractor can adopt by customizing to the local context.

Table 45 labour management plan

Aspect	Prescribed Guidelines	Implementation Responsibility	Monitoring Responsibility
Terms and Conditions	• List of workers to be utilized in relation to the project, with proof of employment will be required to be submitted to PMU by all investors/contractors. • Construction work can only commence once the following conditions are met: o Toolbox training completed by all staff employed by the contractor o All the required Personal Protective Equipment are acquired by the contractor for all workers •Any newly employed party by the contractor will be required to complete the toolbox prior to commencing any physical work. •As per the provisions of the employment, all parties employed by any contracted party will be above 16 years of age. For those between 16 to 18 years of age, consent of the parent will be required as per the Employment Act. In addition, all other provisions of the act highlighted previously regarding employment of a minor will apply. • All contractors and investors will be required to provide document evidence (passport, identity card or birth certificate) confirming age of employees to MCEP PMU prior to involving them on activities of the project. In addition, for minors consent of the parent will be provided in writing together with evidence of legal guardianship. • Maximum working hours for staff will not exceed the maximum limit set in the employment act, i.e. 48 hours a week. To confirm this, monthly attendance and duty sheets need to be submitted to PMU during the construction phase.	P: Contractor	MCEP PMU

	• An internal transparent and accountable system will be established within the company to tackle issues of sexual harassment, physical and psychological harassment and workplace bullying. Details of this system will be shared with PMU prior to signing any contracts or agreements. • The leave policy of the company will be shared and confirmed that it is in line with national laws and regulations. • All foreign parties employed by all contractors/investors will have valid work permit. The work permit details will be shared with MCEP PMU. •All vehicles used by any contractor/investor for the purpose of the project will have valid registration, insurance and road worthiness. •All contracted staff will be made aware of grievance redress mechanism available for the staff specified under this LMP.		
Working and Living Condition	• Entry and exit from site/workplace will be strictly controlled. • Separate male and female toilet facilities will be provided at all project offices, field/construction sites. • Potable drinking water and handwashing facilities will be available at all project offices and field/construction sites. • All provisions that are required under Health and Safety Regulation for Construction Industry (2019/R156) will be strictly adhered to. • Working environment will be clean, hygienic and safe. All project offices will be free of pests. Where pests are detected pest control measures will be taken immediately. o Fire detection and firefighting equipment will be available at all project offices. o Emergency evacuation plan will be established for all project offices and staff will be made aware of the plan and periodic simulation exercises that needs to be implemented. o Adequate safety signs will be installed at the work site giving clear direction. These will be provided in addition to English in the language of the workforce.	P: Contractor	Island Council

	• Construction work site will be demarcated & fenced, and warning signs will be displayed both in English and Dhivehi. • When procuring sea-vessels for travelling, in addition to cost, safety considerations will be given a priority, including the size of the vessels, and only sea-vessels that have lifejackets available, will be procured. o Some form of identification will be there identifying the staff belonging to project when attending meetings and sites. o Work tasks will be rearranged or numbers of workers on the worksite will be reduced to allow social/physical distancing, or rotating workers through a 24-hour schedule o		
COVID19 Impacts	• Adequate PPE will be provided to workers, including: o Facemasks, gloves, etc., if possible, to prevent COVID-19 spread o Lifejackets to workers when travelling by sea. o Hard hats (through contractors, investors or project directly) o Enclosed shoes will be worn by all staff (safety shoes are preferable). o Safety harness will be provided (through contractors, investors or project directly) when climbing heights at project sites.	P: Contractor	COVID19 Taskforce of Island
Worker Accommodation	• Accommodation arrangements will be reviewed, to see if they are adequate and designed to reduce contact with the community • Male and Female workforce will be housed separately • Constant and reliable electricity supply will be made available. In addition, sufficient lighting and cooling systems will be established • Shower and toilet facilities will be available at the accommodation site. A minimum ratio of 01 toilet/shower per 20 workers will be maintained. Separate facilities will be provided for men and women.	P: Contractor	Island Council

	• Toilet and drainage will be connected to local sewer system, where not available septic tanks will be used for treatment prior to disposal. • Individual bedding will be provided to all workers. o Storage space for individual belongings will be provided for all workers. • Designated locations for waste disposal with clearly marked bins will be established. Bins will be emptied daily and the site will be cleaned daily. • Meals to the site will be prepared from a Health Protection Agency (HPA) certified facility (whether food is prepared on site or offsite) o Monthly inspection to determine pest infestation on the site will be carried out.		

ANNEX 8

Sample Code of Conduct for the Contractor

Company Code of Conduct
Implementing ESHS and OHS Standards
Preventing Gender Based Violence

The company is committed to ensuring that the project is implemented in such a way which minimizes any negative impacts on the local environment, communities, and its workers. This will be done by respecting the environmental, social, health and safety (ESHS) standards, and ensuring appropriate occupational health and safety (OHS) standards are met. The company is also committed to creating and maintaining an environment where children under the age of 18 will be protected, and where Sexual Exploitation and Abuse (SEA) and sexual harassment have no place. Improper actions towards children, SEA and sexual harassment are acts of Gender Based Violence (GBV) and as such will not be tolerated by any employee, sub-contractors, supplier, associate, or representative of the company.

Therefore, to ensure that all those engaged in the project are aware of this commitment, the company commits to the following core principles and minimum standards of behavior that will apply to all company employees, associates, and representatives, including sub-contractors and suppliers, without exception:

General

1. The company—and therefore all employees, associates, representatives, sub-contractors and suppliers—commits to complying with all relevant national laws, rules and regulations.
2. The company commits to full implementing its 'Contractors Environmental and Social Management Plan' (C-ESMP) as approved by the client.
3. The company commits to treating women, children (persons under the age of 18), and men with respect regardless of race, color, language, religion, political or other opinion, national, ethnic or social origin, property, disability, birth or other status. Acts of GBV are in violation of this commitment.
4. The company shall ensure that interactions with local community members are done with respect and non-discrimination.
5. Demeaning, threatening, harassing, abusive, culturally inappropriate, or sexually provocative language and behavior are prohibited among all company employees, associates, and its representatives, including sub-contractors and suppliers.
6. The company will follow all reasonable work instructions (including regarding environmental and social norms).
7. The company will protect and ensure proper use of property (for example, to prohibit theft, carelessness or waste).

Health and Safety

8. The company will ensure that the project's OHS Management Plan is effectively implemented by company's staff, as well as sub-contractors and suppliers.
9. The company will ensure that all persons on-site wear prescribed and appropriate personal protective equipment, preventing avoidable accidents, and reporting conditions or practices that pose a safety hazard or threaten the environment.
10. The company will:
    i. prohibit the use of alcohol during work activities.
    ii. prohibit the use of narcotics or other substances which can impair faculties at all times.
11. The company will ensure that adequate sanitation facilities are available on site and at any worker accommodations provided to those working on the project.
12. The company will not hire children under the age of 18 for construction work, or allow them on the work site, due to the hazardous nature of construction sites.

Gender Based Violence

13. Acts of GBV constitute gross misconduct and are therefore grounds for sanctions, which may include penalties and/or termination of employment and, if appropriate, referral to the Police for further action.
14. All forms of GBV, are unacceptable, regardless of whether they take place on the work site, the work site surroundings, at worker's camps or within the local community.
15. Sexual harassment of work personnel and staff (e.g. making unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature) are acts of GBV and are prohibited.
16. Sexual favors (e.g. making promises of favorable treatment such as promotions, threats of unfavorable treatment such as losing a job, payments in kind or in cash dependent on sexual acts) and any form of humiliating, degrading or exploitative behavior are prohibited.
17. The use of prostitution in any form at any time is strictly prohibited.

Sexual contact or activity with children under 18—including through digital media—is prohibited. Mistaken belief regarding the age of a child is not a defense. Consent from the child is also not a defense or excuse.

Unless there is full consent[1] by all parties involved in the sexual act, sexual interactions between the company's employees (at any level) and members of the communities surrounding the work place are prohibited. This includes relationships involving the withholding/promise of actual provision of benefit (monetary or non-monetary) to community members in exchange for sex (including prostitution). Such sexual activity is considered "non-consensual" within the scope of this Code.

[1] **Consent:** refers to when an adult makes an informed choice to agree freely and voluntarily to do something. There is **no** consent when agreement is obtained through the use of threats, force or other forms of coercion, abduction, fraud, manipulation, deception, or misrepresentation; the use of a threat to withhold a benefit to which the person is already entitled, or; a promise made to the person to provide a benefit. In accordance with the United Nations Convention on the Rights of the Child, the World Bank considers that consent cannot be given by children under the age of 18, even if national legislation of the country into which the Code of Conduct is introduced has a lower age. Mistaken belief regarding the age of the child and consent from the child is not a defense.

In addition to company sanctions, legal prosecution of those who commit acts of GBV will be pursued if appropriate.

All employees, including volunteers and sub-contractors are highly encouraged to report suspected or actual acts of GBV by a fellow worker, whether in the same company or not. Reports must be made in accordance with project's GBV Allegation Procedures.

18. Managers are required to report and act to address suspected or actual acts of GBV as they have a responsibility to uphold company commitments and hold their direct reports responsible.

Implementation

To ensure that the above principles are implemented effectively the company commits to:

19. Ensuring that all managers sign the project's 'Manager's Code of Conduct' detailing their responsibilities for implementing the company's commitments and enforcing the responsibilities in the 'Individual Code of Conduct'.

Ensuring that all employees sign the project's 'Individual Code of Conduct' confirming their agreement to comply with ESHS and OHS standards, and not to engage in activities resulting in GBV, child endangerment or abuse, or sexual harassment.

Displaying the Company and Individual Codes of Conduct prominently and in clear view at workers' camps, offices, and in in public areas of the work space. Examples of areas include waiting, rest and lobby areas of sites, canteen areas and health clinics.

Ensuring that posted and distributed copies of the Company and Individual Codes of Conduct are translated into the appropriate language of use in the work site areas as well as for any international staff in their native language.

Ensuring that an appropriate person is nominated as the company's 'Focal Point' for addressing GBV issues, including representing the company on the GBV Complaints Team (GCT) which is comprised of representatives from the client, contractor(s), the supervision consultant, and local GBV Service Provider.

Ensuring that an effective GBV Action Plan is developed in consultation with the GCT which includes as a minimum:

i. **GBV Allegation Procedure** to report GBV issues through the project Grievance Redress Mechanism (Section 4.3 Action Plan);
ii. **Accountability Measures** to protect confidentiality of all involved (Section 4.4 Action Plan); and,
iii. **Response Protocol** applicable to GBV survivors and perpetrators (Section 4.7 Action Plan).

Ensuring that the company effectively implements the agreed final GBV Action Plan, providing feedback to the GCT for improvements and updates as appropriate.

Ensuring that all employees attend an induction training course prior to commencing work on site to ensure they are familiar with the company's commitments to ESHS and OHS standards, and the project's GBV Codes of Conduct.

Ensuring that all employees attend a mandatory training course once a month for the duration of the contract starting from the first induction training prior to commencement of work to reinforce the understanding of the project's ESHS and OHS standards and the GBV Code of Conduct.

I do hereby acknowledge that I have read the foregoing Company Code of Conduct, and on behalf of the company agree to comply with the standards contained therein. I understand my role and responsibilities to support the project's OHS and ESHS standards, and to prevent and respond to GBV. I understand that any action inconsistent with this Company Code of Conduct or failure to act mandated by this Company Code of Conduct may result in disciplinary action.

Company name: _____

Signature: _____

Printed Name: _____

Title: _____

Date: _____

Manager's Code of Conduct

Implementing ESHS and OHS Standards

Preventing Gender Based Violence

The company is committed to ensuring that the project is implemented in such a way which minimizes any negative impacts on the local environment, communities, and its workers. This will be done by respecting the environmental, social, health and safety (ESHS) standards, and ensuring appropriate occupational health and safety (OHS) standards are met. The company is also committed to creating and maintaining an environment where children under the age of 18 will be protected, and where Sexual Exploitation and Abuse (SEA) and sexual harassment have no place. Improper actions towards children, SEA and sexual harassment are acts of Gender Based Violence (GBV) and as such will not be tolerated by any employee, sub-contractors, supplier, associate, or representative of the company.

Managers at all levels have a responsibility to uphold the company's commitment. Managers need to support and promote the implementation of the Company Code of Conduct. To that end, managers must adhere to this Manager's Code of Conduct and also to sign the Individual Code of Conduct. This commits them to supporting the implementation of the Contractor's Environmental and Social Management Plan (C-ESMP), the OHS Management Plan, and developing systems that facilitate the implementation of the GBV Action Plan.

Managers need to maintain a safe workplace, as well as a GBV-free environment at the workplace and in the local community. Their responsibilities to achieve this include but are not limited to:

Implementation

1. To ensure maximum effectiveness of the Company and Individual Codes of Conduct:
    i. Prominently displaying the Company and Individual Codes of Conduct in clear view at workers' camps, offices, and in public areas of the work space. Examples of areas include waiting, rest and lobby areas of sites, canteen areas and health clinics.
    ii. Ensuring all posted and distributed copies of the Company and Individual Codes of Conduct are translated into the appropriate language of use in the work site areas as well as for any international staff in their native language.
2. Verbally and in writing explain the Company and Individual Codes of Conduct to all staff.
3. Ensure that:
    i. All direct reports sign the 'Individual Code of Conduct', including acknowledgment that they have read and agree with the Code of Conduct.
    ii. Staff lists and signed copies of the Individual Code of Conduct are provided to the OHS Manager, the GBV Complaints Team (GCT), and the client.

iii. Participate in training and ensure that staff also participate as outlined below.
iv. Put in place a mechanism for staff to:
    (a) report concerns on ESHS or OHS compliance; and,
    (b) confidentially report GBV incidents through the Grievance Redress Mechanism (GRM)
v. Staff are encouraged to report suspected or actual ESHS, OHS, GBV issues, emphasizing the staff's responsibility to the Company and the country hosting their employment, and emphasizing the respect for confidentiality.

4. In compliance with applicable laws and to the best of your abilities, prevent perpetrators of sexual exploitation and abuse from being hired, re-hired or deployed. Use background and criminal reference checks for all employees nor ordinarily resident in the country where the works are taking place.
5. Ensure that when engaging in partnership, sub-contractor, supplier or similar agreements, these agreements:
    i. Incorporate the ESHS, OHS, GBV Codes of Conduct as an attachment.
    ii. Include the appropriate language requiring such contracting entities and individuals, and their employees and volunteers, to comply with the Individual Codes of Conduct.
    iii. Expressly state that the failure of those entities or individuals, as appropriate, to ensure compliance with the ESHS and OHS standards, take preventive measures against GBV, to investigate allegations thereof, or to take corrective actions when GBV has occurred, shall not only constitute grounds for sanctions and penalties in accordance with the Individual Codes of Conduct but also termination of agreements to work on or supply the project.
6. Provide support and resources to the GCT to create and disseminate internal sensitization initiatives through the awareness-raising strategy under the GBV Action Plan.
7. Ensure that any GBV complaint warranting Police action is reported to the Police, the client and the World Bank immediately.
8. Report and act in accordance with the agreed response protocol any suspected or actual acts of GBV.
9. Ensure that any major ESHS or OHS incidents are reported to the client and the supervision engineer immediately, non-major issues in accordance with the agreed reporting protocol.
10. Ensure that children under the age of 18 are not present at the construction site, or engaged in any hazardous activities.

Training

11. The managers are responsible to:
    i. Ensure that the OHS Management Plan is implemented, with suitable training required for all staff, including sub-contractors and suppliers; and,
    ii. Ensure that staff have a suitable understanding of the C-ESMP and are trained as appropriate to implement the C-ESMP requirements.
12. All managers are required to attend an induction manager training course prior to commencing work on site to ensure that they are familiar with their roles and responsibilities in upholding the GBV elements of these Codes of Conduct. This training will be separate from the induction training course required of all employees and will provide managers with the necessary understanding and technical support needed to begin to develop the GBV Action Plan for addressing GBV issues.
13. Managers are required to attend and assist with the project facilitated monthly training courses for all employees. Managers will be required to introduce the trainings and announce the self-

evaluations, including collecting satisfaction surveys to evaluate training experiences and provide advice on improving the effectiveness of training.

14. Ensure that time is provided during work hours and that staff prior to commencing work on site attend the mandatory project facilitated induction training on:
    i. OHS and ESHS; and,
    ii. GBV required of all employees.
15. During civil works, ensure that staff attend ongoing OHS and ESHS training, as well as the monthly mandatory refresher training course required of all employees to on GBV.

Response

16. Managers will be required to take appropriate actions to address any ESHS or OHS incidents.
17. Regarding GBV:
    i. Provide input to the GBV Allegation Procedures and Response Protocol developed by the GCT as part of the final cleared GBV Action Plan.
    ii. Once adopted by the Company, managers will uphold the Accountability Measures set forth in the GBV Action Plan to maintain the confidentiality of all employees who report or (allegedly) perpetrate incidences of GBV (unless a breach of confidentiality is required to protect persons or property from serious harm or where required by law).
    iii. If a manager develops concerns or suspicions regarding any form of GBV by one of his/her direct reports, or by an employee working for another contractor on the same work site, s/he is required to report the case using the GRM.
    iv. Once a sanction has been determined, the relevant manager(s) is/are expected to be personally responsible for ensuring that the measure is effectively enforced, within a maximum timeframe of 14 days from the date on which the decision to sanction was made by the GCT.
    v. If a Manager has a conflict of interest due to personal or familial relationships with the survivor and/or perpetrator, he/she must notify the Company and the GCT. The Company will be required to appoint another manager without a conflict of interest to respond to complaints.
    vi. Ensure that any GBV issue warranting Police action is reported to the Police, the client and the World Bank immediately
18. Managers failing address ESHS or OHS incidents, or failing to report or comply with the GBV provisions may be subject to disciplinary measures, to be determined and enacted by the cCmpany's CEO, Managing Director or equivalent highest-ranking manager. Those measures may include:
    i. Informal warning.
    ii. Formal warning.
    iii. Additional Training.
    iv. Loss of up to one week's salary.
    v. Suspension of employment (without payment of salary), for a minimum period of 1 month up to a maximum of 6 months.
    vi. Termination of employment.
19. Ultimately, failure to effectively respond to ESHS, OHS, and GBV cases on the work site by the company's managers or CEO may provide grounds for legal actions by authorities.

I do hereby acknowledge that I have read the foregoing Manager's Code of Conduct, do agree to comply with the standards contained therein and understand my roles and responsibilities to prevent and respond to ESHS, OHS, and GBV requirements. I understand that any action inconsistent with this Manager's Code of Conduct or failure to act mandated by this Manager's Code of Conduct may result in disciplinary action.

Signature: _____

Printed Name: _____

Title: _____

Date: _____

Individual Code of Conduct
Implementing ESHS and OHS Standards
Preventing Gender Based Violence

I, _____, acknowledge that adhering to environmental, social, health and safety (ESHS) standards, following the project's occupational health and safety (OHS) requirements, and preventing Gender Based Violence (GBV) is important.

The Company considers that failure to follow ESHS and OHS standards, or to partake in activities constituting GBV—be it on the work site, the work site surroundings, at workers' camps, or the surrounding communities—constitute acts of gross misconduct and are therefore grounds for sanctions, penalties or potential termination of employment. Prosecution by the Police of those who commit GBV may be pursued if appropriate.

I agree that while working on the project I will:

1. Consent to Police background check.
2. Attend and actively partake in training courses related to ESHS, OHS, and GBV as requested by my employer.
3. Will wear my personal protective equipment (PPE) at all times when at the work site or engaged in project related activities.
4. Take all practical steps to implement the contractor's environmental and social management plan (C-ESMP).
5. Implement the OHS Management Plan.
6. Adhere to a zero-alcohol policy during work activities, and refrain from the use of narcotics or other substances which can impair faculties at all times.
7. Treat women, children (persons under the age of 18), and men with respect regardless of race, color, language, religion, political or other opinion, national, ethnic or social origin, property, disability, birth or other status.
8. Not use language or behavior towards women, children or men that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate.
9. Not sexually exploit or abuse project beneficiaries and members of the surrounding communities.
10. Not engage in sexual harassment of work personnel and staff —for instance, making unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature is prohibited. E.g. looking somebody up and down; kissing, howling or smacking sounds; hanging around somebody; whistling and catcalls; in some instances, giving personal gifts.
11. Not engage in sexual favors —for instance, making promises of favorable treatment (e.g. promotion), threats of unfavorable treatment (e.g. loss of job) or payments in kind or in cash, dependent on sexual acts—or other forms of humiliating, degrading or exploitative behavior.

12. Not use prostitution in any form at any time.
13. Not participate in sexual contact or activity with children under the age of 18—including grooming, or contact through digital media. Mistaken belief regarding the age of a child is not a defense. Consent from the child is also not a defense or excuse.
14. Unless there is the full consent[2] by all parties involved, I will not have sexual interactions with members of the surrounding communities. This includes relationships involving the withholding or promise of actual provision of benefit (monetary or non-monetary) to community members in exchange for sex (including prostitution). Such sexual activity is considered "non-consensual" within the scope of this Code.
15. Consider reporting through the GRM or to my manager any suspected or actual GBV by a fellow worker, whether employed by my company or not, or any breaches of this Code of Conduct.

With regard to children under the age of 18:

16. Bring to the attention of my manager the presence of any children on the construction site or engaged in hazardous activities.
17. Wherever possible, ensure that another adult is present when working in the proximity of children.
18. Not invite unaccompanied children unrelated to my family into my home, unless they are at immediate risk of injury or in physical danger.
19. Not use any computers, mobile phones, video and digital cameras or any other medium to exploit or harass children or to access child pornography (see also "Use of children's images for work related purposes" below).
20. Refrain from physical punishment or discipline of children.
21. Refrain from hiring children for domestic or other labor below the minimum age of 14 unless national law specifies a higher age, or which places them at significant risk of injury.
22. Comply with all relevant local legislation, including labor laws in relation to child labor and World Bank's safeguard policies on child labor and minimum age.
23. Take appropriate caution when photographing or filming children (See Annex 2 for details).

Use of children's images for work related purposes

When photographing or filming a child for work related purposes, I must:

24. Before photographing or filming a child, assess and endeavor to comply with local traditions or restrictions for reproducing personal images.
25. Before photographing or filming a child, obtain informed consent from the child and a parent or guardian of the child. As part of this I must explain how the photograph or film will be used.

[2] **Consent** is defined as the informed choice underlying an individual's free and voluntary intention, acceptance or agreement to do something. No consent can be found when such acceptance or agreement is obtained using threats, force or other forms of coercion, abduction, fraud, deception, or misrepresentation. In accordance with the United Nations Convention on the Rights of the Child, the World Bank considers that consent cannot be given by children under the age of 18, even if national legislation of the country into which the Code of Conduct is introduced has a lower age. Mistaken belief regarding the age of the child and consent from the child is not a defense.

26. Ensure photographs, films, videos and DVDs present children in a dignified and respectful manner and not in a vulnerable or submissive manner. Children should be adequately clothed and not in poses that could be seen as sexually suggestive.
27. Ensure images are honest representations of the context and the facts.
28. Ensure file labels do not reveal identifying information about a child when sending images electronically.

Sanctions

I understand that if I breach this Individual Code of Conduct, my employer will take disciplinary action which could include:

1. Informal warning.
2. Formal warning.
3. Additional Training.
4. Loss of up to one week's salary.
5. Suspension of employment (without payment of salary), for a minimum period of 1 month up to a maximum of 6 months.
6. Termination of employment.
7. Report to the Police if warranted.

I understand that it is my responsibility to ensure that the environmental, social, health and safety standards are met. That I will adhere to the occupational health and safety management plan. That I will avoid actions or behaviors that could be construed as GBV. Any such actions will be a breach this Individual Code of Conduct. I do hereby acknowledge that I have read the foregoing Individual Code of Conduct, do agree to comply with the standards contained therein and understand my roles and responsibilities to prevent and respond to ESHS, OHS, GBV issues. I understand that any action inconsistent with this Individual Code of Conduct or failure to act mandated by this Individual Code of Conduct may result in disciplinary action and may affect my ongoing employment.

Signature: _____

Printed Name: _____

Title: _____

Date: _____

ANNEX 9

Additional Information Requested by the EPA

EPA Supplementary ESMP

ADDITIONAL INFORMATION FOR EPA

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN FOR THE PROPOSED ESTABLISHMENT OF AN ISLAND WASTE AND RESOURCE MANAGEMENT CENTRE IN TH. MADIFUSHI

PREPARED FOR

MINISTRY OF ENVIRONMENT

PREPARED BY

AHMED HASSAAN ZUHAIR

FEBRUARY 2021

INTRODUCTION

This supplementary ESMP produced for the proposed establishment of an IWRMC in Th. Madifushi address comments received from the EPA to the subject ESMP report, requested through letter 203-ECA/438/2021/29 (dated: 14 February 2021)

The report is prepared by the consultant of the original report, Mr. Ahmed Hassaan Zuhair, the ESS Specialist of the MCEP-PMU.

1. **In section 2.5.2 e, (sewerage management, page 33), the consultant mentions "Tank is perforated at the bottom 1 m to allow for discharge of liquid effluent into the land". Kindly please confirm if the effluent discharge is on par with the standards specified in the EPA's National wastewater guideline. Moreover, as this is an environmentally significant activity, it would be a good alternative to connect this line to the existing central sewer system**

   Standards specified in the National Waste Water Quality Guideline for discharging effluents in to the sea and to the land (as a mean to recharge the groundwater lensed) are exclusive to treated waste water from a sewerage treatment plants and do not apply to septic tanks. The proposed septic tank is designed specifically to deal with the waste water generated from operational workers (the toilet), while sperate arrangements are made to deal with storm water via rainwater pits, and leachate collection tanks will be developed to address any potential waste water generated from the mechanical composting room through cleaning of floors.

   Details of the septic tank are provided in page 23 of the report. The septic tank will be constructed to ensure water tightness. Waterproof paint will be used on the masonry wall. It consists of a primary tank of 1.3 m by 1.3 m made of 150 mm brick wall, covered with 75 mm thick concrete with 6 mm reinforcing steel placed at 150 mm centre to centre. The primary tank is 2 m deep. The primary tank is connected by a 100 mm diameter PVC pipe to a secondary tank of the same dimensions filled with 1 m of coral stone and white sand filling. The bottom 1 m of this secondary tank is perforated with 25 mm equally distributed holes to allow for discharge of treated effluent.

   The island sewerage network has not yet been established at the newly reclaimed area at which the proposed site is located. However, according to the Water and Sanitation Department of the Ministry of Environment, future expansion of the network will be planned once the newly reclaimed area gets populated with new houses and other infrastructure developments. Thus, provision will be made to the septic tank design for future connect of the septic tank to the sewerage network via a pipe section with a cap, so that the pipe can be connected to the sewer catch pit once sewerage network reaches this area. Afsal Hussain (P: 7862959, E: afsal.hussain@environment.gov.mv), Director of Water and Sanitation Department of the Ministry of Environment was consulted regarding this matter via telephone on 21 February 2021.

2. **In table 6, (project inputs), the consultant mentions that the water for construction (150 liters per day) will be obtained by island groundwater. Firstly, please inform how the demand requirement was calculated. Secondly, please confirm whether groundwater could be utilized for construction projects as per Water and Sewerage Act (Law No: 8/2020).**

The anticipated water demand for the construction phase is 150 litres per day and will be only used only for concrete mixing on during the concrete works which is expected to be the initial construction period corresponding to 90 days.

The Clause 19 (c) of the Water and Sewerage Act prohibits utilization of groundwater for any industrial use hence, the water required for construction will be obtained by the contractor by purchasing the desalinated water generated by the existing piped water network in the island.

3. **Please provide estimated costs of proposed mitigation measures (very few estimated costings have been provided in the current report)**

Cost estimates for ESMP implementation at both construction and operational phase have been given separately in section 6.7 (page 128 – 129) in addition to what has been included in the mitigation matrix, while the cost of the compost machine, waste management equipment and firefighting equipment has also been given, which is reiterated below.

To effectively implement the mitigation and monitoring measures recommended in this ESMP, necessary provision will have to be made. The cost of these measures has been estimated in consultation with the Civil Engineer and Project Coordinator of MCEP, separately for construction and operational phase and presented in **Table 32** and **Table 33**. The BOQ will reflect the items specified in **Table 32** and the bidders should consider these costs while preparing bid documents. The overall project budget should consider the cost estimates presented in both the tables. The total estimated cost for the ESMP implementation is MVR 68,200.00 for construction phase and MVR 1,237,500.00 for operational phase.

Table 32 Estimated Cost for ESMP implementation during Construction Phase

#	Item	Responsibility	Cost Estimate (MVR)
1	PPEs required for construction such as hard hats, gloves, safety shoes and safety harness.	Contractor	10,000.00
2	PPEs to mitigate COVID19 such as face masks, antibacterial soap, hand sanitizers, disinfectant cleaning liquid (bleach) and printing of awareness materials etc.	Contractor	5,000.00
3	Portable fire extinguisher for site	Contractor	2,000.00

4	Firefighting Equipment for the IWRMC (item included in BOQ): • 50KG DCP Trolley (nos 2) • 50LTR Foam Trolley (nos 1) • Wet Chemical 6Ltr with Cabinet for hazardous waste area (nos 1) • Water 9Ltr with Cabinet for Office Area – Outside (nos 1) • CO2 2KG with Cabinet for Office Area – Outside (nos 1)	Contractor	35,000.00
5	Project board and Construction Safety sign board	Contractor	3,000.00
6	IWRMC name board, cell labels and fire safety sign boards	Contractor	5,000.00
7	Bin for placing general waste	Contractor	1000.00
8	Site demarcation through hoarding	Contractor	1000.00
	Subtotal		**62,000.00**
	Contingency	10% of Sub-Total	6,200.00
	Total		**68,200.00**

Table 33 Estimated Cost for ESMP implementation during Operational Phase

#	Item	Responsibility	Cost Estimate (MVR)
1	Composting Machine and Curing System	MCEP / ME	500,000.00
2	Glass crusher, metal can baler, plastic shredder and wood chipper	MCEP / ME	500,000.00
3	PPEs required for operations such as gloves, safety shoes and masks.	Island Council	10,000.00
4	Fire safety Training	Island Council	10,000.00
5	Yearly servicing of the firefighting equipment	Island Council	5,000.00
6	Community Mobilization and Awareness	MCEP	100,000.00
	Subtotal		**1,125,000.00**
	Contingency	10% of Sub-Total	112,500.00
	Total		**1,237,500.00**

ANNEX 10

Decision Statement and Clearance Notes Issued for the ESMP

بسم الله الرحمن الرحيم

Environmental Protection Agency
އެންވަޔަރަންމަންޓަލް ޕްރޮޓެކްޝަން އެޖެންސީ

DECISION STATEMENT

ތިމާވެށީގެ މެނޭޖްމަންޓް ޕްލޭން ގަބޫލުކުރުން

APPROVAL OF THE ENVIRONMENTAL MANAGEMENT PLAN

Number: 203-ECA/438/2021/46 ނަންބަރު:

ތިމާވެށީގެ ގޮތުން ނިންމި ގޮތުގެ މިލިޔުން ދޫކުރީ ތ.މަޑިފުށީގައި އައިލެންޑް ވޭސްޓް އެންޑް ރިސޯސް މެނޭޖްމަންޓް ސެންޓަރެއް ޤާއިމްކުރުމުގެ މަޝްރޫޢުގެ މަސައްކަތްކުރުމާއި ގުޅޭ ގޮތުން މިނިސްޓްރީ އޮފް އެންވަޔަރަންމަންޓް ގެ ފަރާތުން **19** ޖެނުއަރީ **2021** ގައި މުރާޖަޢާކުރުމަށް ހުށަހަޅުއްވާ އަދި **21** ފެބްރުއަރީ **2021** ގައި އިތުރު މައުލޫމާތު ހުށަހަޅުއްވާފައިވާ ތިމާވެށި އަދި ސޯޝަލް މެނޭޖްމަންޓް ޕްލޭން ބަލާ ގޮތުން ނިންމިގޮތް އެންގުމަށްޓަކައެވެ. މި މަޝްރޫޢުގެ ތިމާވެށީގެ ކޮންސަލްޓަންޓަކީ އަޙްމަދު ހަސަން ޒުހައިރު އެވެ.

This Environmental Decision Statement is issued for the purpose of communicating the decision regarding the ***Environmental and Social Management Plan for the Proposed*** **Establishment of an IWRMC at Madifushi, Thaa Atoll,** *which was submitted for evaluation on* ***09th January 2021*** *and submitted additional information on* ***21st February 2021*** by **Ministry of Environment.** *The environmental consultant of this project is* ***Mr. Ahmed Hassan Zuhair.***

1. This Environmental Decision Statement has been issued on behalf of the Environmental Protection Agency (hereinafter referred to as the Ministry) pursuant to the Environmental Impact Assessment Regulations 2012 (2012/R-27) to advise that the Ministry has decided that the proposed project can proceed according to the Environmental Management Plan.

1. ތިމާވެށްޓަށް އަސަރު ފޯރާނެ މިންވަރު ބަޔާންކުރާ ރިޕޯޓު ހެދުމާއިބެހޭ ގަވާއިދު 2012 ގެ ދަށުން (މި ލިޔުމުގައި މިގެ ފަހުން މިނިސްޓްރީ ކަމަށް ބުނާން ކޮންފަރާތަކާ) މިގަވާއިދުގެ ތަންފީޒު އިދާރާ، އެންވަޔަރަންމަންޓަލް ޕްރޮޓެކްޝަން އެޖެންސީގެ ފަރާތުން މި ތިމާވެށީގެގޮތުން ނިންމިގޮތުގެ ލިޔުން ދޫކުރަނީ މަތީގައި ބައްޓަންކޮށްފައިވާ މަޝްރޫޢު ތިމާވެށީގެ މެނޭޖްމަންޓް ޕްލޭންގައި ބައްޓަންކޮށްފައިވާ ގޮތަށް ކުރިއަށް ގެންދިއުމުގެ ހުއްދަ ދިނުމަށެވެ.

2. The decision has been made by the Ministry on the following conditions:

2. މި ހުއްދަ މިނިސްޓްރީން ދީފައިވަނީ ތިރީގައި މިވާ ޝަރުތުތަކާގެ މަތީންނެވެ:

   i. In the event the project activity has not commenced **within one (1) year** from the date of issue, or if the duration of this Environmental Decision Statement has not been extended, this Environmental Decision Statement shall be considered null and void.

   i. ތިމާވެށިގެ ގޮތުން ނިންމިގޮތުގެ ލިޔުން ދޫކުރި ތާރީޚުން ފެށިގެން **1 (އެކެއް)** އަހަރު ދުވަހުގެ ތެރޭގައި މަޝްރޫޢުގެ އަމަލީ މަސައްކަތް ނުފެށިއްޖެ ނަމަ ނުވަތަ ތިމާވެށީގެ ގޮތުން ނިންމިގޮތުގެ ލިޔުމުގެ މުއްދަތު އިތުރުނުކުރެވިނަމަ، މި ތިމާވެށީގެ ގޮތުން ނިންމިގޮތުގެ ލިޔުމާއި އަދި މި ލިޔުމުގެ 1 ވަނަ ނަންބަރުގައި ދީފައިވާ ހުއްދަ ބާތިލުވާނެއެވެ.

   ii. In the event the project activities have been delayed for more than one (1) year due to unforeseen circumstances, the Ministry shall have the discretion to extend the duration of the Environmental Decision Statement, or to terminate it. In such circumstances the proponent shall write to the Minister for an extension clearly stating out the reasons for the delay.

   ii. 1 ވަނަ ނަންބަރުގައިވާ ހުއްދައިގެ ދަށުން މަޝްރޫޢުގެ އަމަލީ މަސައްކަތް ނުފެށި 1 (އެކެއް) އަހަރަށްވުރެ ލަސްވީ ކުރިއަށް ލަފާކުރަން ނޭނގޭ ކަހަލަ ކަމެއް ދިމާވެގެން ކަމަށްވާނަމަ، މުއްދަތު އިތުރުކުރުމުގެ އިޚްތިޔާރު ނުވަތަ ހުއްޓުވާލުމުގެ އިޚްތިޔާރު މިނިސްޓްރީއަށް ލިބިގެންވެއެވެ. މިފަދަ ހާލަތްތަކުގައި މުއްދަތު ހަމަވުމުގެ ކުރިން ސަބަބު ސާފުކޮށް ބަޔާންކޮށް އެދިއާރު ގެ ފަރާތުން މިނިސްޓްރީއަށް ލިޔުން ފޮނުވާނެއެވެ.

iii. The Minister, or his designate, may issue a cessation order requiring persons working on a Development Proposal to cease working until the order is withdrawn, if:

a) This Environmental Decision Statement has been withdrawn or;

b) There has been a breach of the conditions of this Environmental Decision Statement.

.iii ތިރީގައި މިބަޔާން ކުރާފަދަ ކަމެއް ދިމާވެއްޖެނަމަ، މިނިސްޓަރ ނުވަތަ އޭނާ އައްޔަން ކުރާފަރާތަކުން، ހިނގުމުންދާ ތަރައްޤީގެ މަޝްރޫޢުއް ކުރިއަށް ގެންދާ ބަޔަކަށް އެމަސައްކަތް އަލުން ފަށަން އަންގަންދެން ހުއްޓުވަން އެންގިދާނެއެވެ.

ހ) މި ތިމާވެށީގެގޮތުން ނިންމިގޮތުގެ ލިޔުން ބާޠިލުކުރުން ނުވަތަ

ށ) މި ތިމާވެށީގެ ގޮތުން ނިންމިގޮތުގެ ލިޔުމުގެ ޝަރުތުތަކާއި ޚިލާފުވުން

iv. It is the Developer's responsibility to undertake all project activities in accordance with the relevant laws and regulations of the Maldives.

.iv މަޝްރޫޢު ހިންގާއި ގެންގުޅުމީ، ރާއްޖޭގައި އަމަލުކުރަމުންދާ ޤާނޫނުތަކާއި ގަވާއިދުތަކާއި އެއްގޮތަށް މަސައްކަތް ކުރަމުން ގެންދިއުމަކީ ޑިވެލޮޕަރުގެ ޒިންމާއެކެވެ.

v. The Developer is aware that under the National Environment Protection Act (Law no. 4/93) and the Environmental Impact Assessment Regulations the Ministry reserves the right to terminate any activity without compensation if found that such an activity has caused significant, irreversible impacts on the environment.

.v ޑިވެލޮޕަރާއްޗޭގެ ތިމާވެށި ރައްކާތެރިކޮށް ދަމަހައްޓުމާބެހޭ ޤާނޫނު (ނަންބަރު 4/93) އާއި ތިމާވެށްޓަށް އަސަރު ފޯރާނެ މިންވަރު ބަލާނެގޮތް ދިރާސާ ކުރުމާއިބެހޭ ގަވާއިދު 2012 ގެ ދަށުން ރާއްޖޭގެ ތިމާވެށްޓަށް އަނބުރާ އިއާދަ ނުކުރެވޭ ފަދަ ބަދަލެއް އަތުވެދާން ކަމެއް ކޮށްފި ހާލަތެއްގައި ކުރެވިފައިވާ މަސައްކަތްތަކުގެ ބަދަލެއް ދިނުމަކާ ނުލައި މަސައްކަތް ހުއްޓުވާ މަޝްރޫޢު ކުރިއަށް ގެންދިއުމަށް ދޫކޮށްފައިވާ ހުއްދަ ބާޠިލުކުރެވިދާނެކަން އިޤްރާރުވަން އެނގޭއެވެ.

vi. All mitigation measures proposed in the EMP report for all the phases of the project shall be fully implemented.

vi· ތިމާވެށީގެ މެނޭޖްމަންޓް ޕްލޭން ރިޕޯޓުގައި މަޝްރޫޢުގެ ހުރިހާ ފިޔަވަޅުތަކުގައި ތިމާވެށްޓަށް ކުރާނޭ އަސަރުތައް ކުޑަކުރުމަށް އަޅަންޖެހޭ ހުރިހާ ފިޔަވަޅެއް ރިޕޯޓުގައި ބަޔާންކޮށްފައިވާ ގޮތަށް އަޅަންވާނެއެވެ.

vii. The date of expiry stated in this Environmental Decision Statement is the duration given to commence the project activities approved under this Environmental Decision Statement.

vii· މިތިމާވެށީގެ ނިންމުމުގެ ލިޔުމުގައި މުއްދަތު ހަމަވާ ތާރީޚް ކަމަށް ބަޔާންކުރެވިފައިވަނީ މިހުއްދަ ދޫކުރުމަށްފަހު މަސައްކަތް ފެށުމަށް ދެވޭ މުއްދަތެވެ.

viii. Once the project activities have started, the Proponent must inform the Environmental Protection Agency, the date of commencement of project activities.

viii· މަޝްރޫޢުގެ މަސައްކަތް ފެއްޓުމަށްފަހު، ފެށި ތާރީޚް އެންވަޔަރަމަންޓަލް ޕްރޮޓެކްޝަން އޭޖެންސީއަށް ލިޔުމުން އަންގަންވާނެއެވެ.

Date of initial Issue: 24th February 2021

ދޫކުރި ތާރީޚް : 24 ފެބްރުއަރީ 2021

Date of expiry: 24th February 2022

މުއްދަތު ހަމަވާ ތާރީޚް: 24 ފެބްރުއަރީ 2022

Name: Mr. Ibrahim Naeem

ނަން: އަލްފާޟިލް އިބްރާހީމް ނައީމް

Designation: Director General

މަޤާމް: ޑިރެކްޓަރ ޖެނެރަލް

Signature:

ސޮއި:

Ministry of Environment and Energy Maldives

Ahmed Hassaan Zuhair <ahmed.hassaan@environment.gov.mv>

CLEARANCE ENV: ESMP of Th. Madifushi IWRMC

Mokshana Nerandika Wijeyeratne <mwijeyeratne@worldbank.org> Mon, Jan 25, 2021 at 12:14 PM
To: Ahmed Hassaan Zuhair <ahmed.hassaan@environment.gov.mv>, Shanek Mario Fernando <sfernando6@worldbank.org>
Cc: "Maldives Clean Environment Project | Min. of Environment" <mcep@environment.gov.mv>, Karin Shepardson <kshepardson@worldbank.org>, Nadeera Rajapakse <nrajapakse@worldbank.org>, Gangadari Ranawaka <granawaka@worldbank.org>

Dear Hassan,

The **ESMPs for Th. Madifushi is CLEARED from the ENVIRONMENT SIDE.** It has been prepared in line with the agreed TOR C and updated accordingly.

Please make sure the ESMP once cleared from Social also is disclosed by the project, including in due procurement processes and also the Kobo tool box monitoring process is used to monitor works when it commences.

Please confirm the disclosure to us so that we may proceed also with Bank disclosure then.

Thanks for the comprehensive and timely submission as always.

Best

Mokshana

Mokshana Nerandika Wijeyeratne

Environmental Specialist

Environment, Natural Resources and Blue Economy

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mwijeyeratne@worldbank.org

Hilton Colombo, 6th Floor,

No: 2 Chittampalam A Gardiner Mawatha

Colombo, Sri Lanka

From: Ahmed Hassaan Zuhair <ahmed.hassaan@environment.gov.mv>
Sent: Tuesday, January 19, 2021 2:16 PM
To: Mokshana Nerandika Wijeyeratne <mwijeyeratne@worldbank.org>; Shanek Mario Fernando <sfernando6@worldbank.org>
Cc: Maldives Clean Environment Project | Min. of Environment <mcep@environment.gov.mv>
Subject: ESMP of Th. Madifushi IWRMC

[External]

Dear Mokshana and Shanek,

The following ESMP is submitted for your review and clearance.

1. ESMP for the proposed establishment of Island Waste and Resource Management Center (IWRMC) in Th. Madifushi.

The report is an update of the previously cleared ESMP (prepared in 2018 by consultant Ahmed Saleem), reflecting the change in scope of the project from windrow composting to in-vessel composting and is prepared consistent with the attached TOR C, cleared by WB SG on 6 August 2020.

The report is prepared internally by me, with support from 1 PMU and 1 WMPCD staff.

Kindly acknowledge the receipt of this email.

Best Regards,

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Ahmed Hassaan Zuhair

Environmental and Social Safeguards Specialist

Maldives Clean Environment Project

- Ministry of Environment, Green Building, Handhuvaree Hingun, Maafannu, Male', 20392, Maldives.

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ESMP_Th. Madifushi IWRMC.pdf
7160K

Ministry of Environment and Energy Maldives

Ahmed Hassaan Zuhair <ahmed.hassaan@environment.gov.mv>

Supplementary ESMPs: M. Mulah, Th. Madifushi, Th. Thimarafushi, Th. Kinbidhoo & Th. Omadhoo IWRMCs

Shanek Mario Fernando <sfernando6@worldbank.org> Sun, Feb 21, 2021 at 11:32 PM
To: Ahmed Hassaan Zuhair <ahmed.hassaan@environment.gov.mv>
Cc: Mokshana Nerandika Wijeyeratne <mwijeyeratne@worldbank.org>, "Maldives Clean Environment Project | Min. of Environment" <mcep@environment.gov.mv>, Karin Shepardson <kshepardson@worldbank.org>, Bandita Sijapati <bsijapati@worldbank.org>

Dear Hassaan

These are okay & cleared as I see the previous comments have been incorporated including additional labour management measures, code of conduct etc.

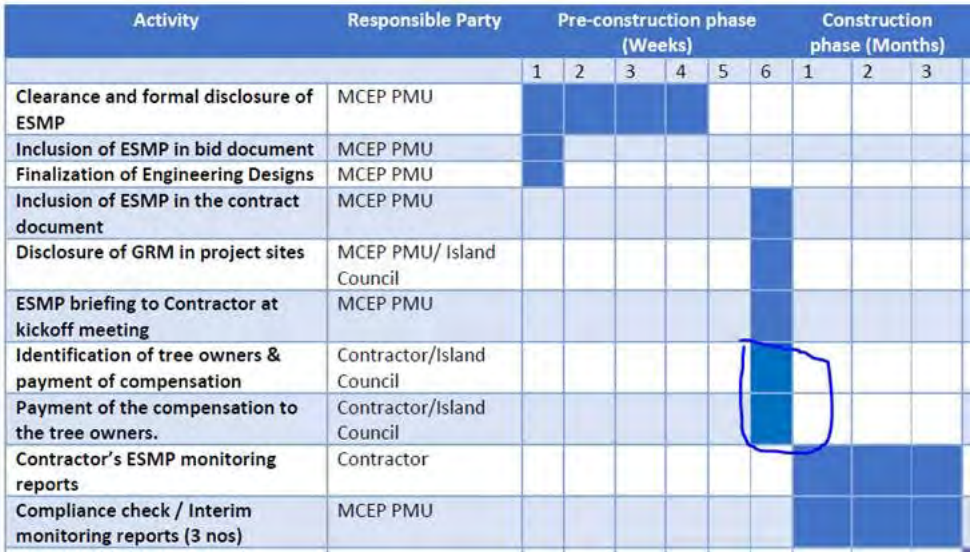
But just one more comment - I am wondering in the work plans, if they have given just 1 week or 1 month for identification and payment of compensation?

- Not sure even 1 month will be enough, so would recommend the Island Councils to immediately start the identification of tree owners establishing and disclosing the cut-off date to start the process – pls refer p193 in the ESMF/RPF.
- So earlier you start the process the better, i.e. in parallel with the bidding process, because no tree can be cut to start work until compensation is paid.

Pls call if any calcifications.

Best

Shanek



Activity	Responsible Party	Pre-construction phase (Weeks)						Construction phase (Months)		
		1	2	3	4	5	6	1	2	3
Clearance and formal disclosure of ESMP	MCEP PMU									
Inclusion of ESMP in bid document	MCEP PMU									
Finalization of Engineering Designs	MCEP PMU									
Inclusion of ESMP in the contract document	MCEP PMU									
Disclosure of GRM in project sites	MCEP PMU/ Island Council									
ESMP briefing to Contractor at kickoff meeting	MCEP PMU									
Identification of tree owners & payment of compensation	Contractor/Island Council									
Payment of the compensation to the tree owners.	Contractor/Island Council									
Contractor's ESMP monitoring reports	Contractor									
Compliance check / Interim monitoring reports (3 nos)	MCEP PMU									

Shanek Fernando

Social Development Specialist

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From: Ahmed Hassaan Zuhair <ahmed.hassaan@environment.gov.mv>
Sent: Wednesday, February 10, 2021 12:09 PM
To: Shanek Mario Fernando <sfernando6@worldbank.org>
Cc: Mokshana Nerandika Wijeyeratne <mwijeyeratne@worldbank.org>; Maldives Clean Environment Project | Min. of Environment <mcep@environment.gov.mv>; Karin Shepardson <kshepardson@worldbank.org>
Subject: Supplementary ESMPs: M. Mulah, Th. Madifushi, Th. Thimarafushi, Th. Kinbidhoo & Th. Omadhoo IWRMCs

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