

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

Upgrading of Island Waste and Resource Management Centre at Vandhoo Thaa Atoll



Report Prepared by LAMER Group Pvt Ltd

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January 2021

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Consultants Declaration

I certify that to best of my knowledge the statements made in this Environmental and Social Management Plan for the upgrading of the Island and Waste Resource Management Centre with Aerobic technology using composting machine at Vandhoo, Thaa Atoll, are true, complete and correct.

Name: Hussein Zahir

Consultant Registration Number: EIA P04-07



Signature:

Company Name: Land and Marine Environmental Resource Group Pvt Ltd

Date: 31st January 2021

Proponent's Declaration



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Ministry of Environment
Male', Republic of Maldives.

Date: 25 January 2021

No: 438-WMPC/203/2021/20

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.Vandhoo 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,

Ahmed Murthaza,
Director General



1 Executive Summary

Background

Vandhoo is one of the 13 inhabited islands in Thaa atoll in the central Maldives. Similar to almost all island of Maldives, the island is vulnerable to environmental and economic development variables such as rising sea level, coastal erosion, pollution/depletion of groundwater and unmanaged waste. A project to construct a 500m² waste management centre on the island was commenced in 2017, through government funding. However, less than a quarter of the civil work required for construction of the Centre was completed at the time. Hence, the Ministry of Environment, being the proponent of the project, through the World Bank funded Maldives Clean Environment Project (MCEP), intends to establish a full-fledged Island Waste Resource Management Centre (IWRMC) and facilitate piloting of in-vessel composting in Vandhoo based on the findings of the technical and financial feasibility study for establishing a regional solid waste management system in Zone 4 & 5, phase 1 of which was completed in the last quarter of 2019. At present waste disposal is at an area about 50m north of project site, which is on the southeastern side of the island.

The project will include construction of new infrastructure inclusive of a mechanical composting area. Once the infrastructure is in place, an Organic Waste Converter (OWC) machine will be set up at the facility to facilitate mechanical composting of the waste using aerobic technology. Upon completion of the project, the operations of the facility will be handed over to the Island Council. Training needs for the proper operation of the facility will be identified through the assessment and will also be incorporated into the report.

Key impacts

Impacts on the environment during construction and operation of the facility have been identified through interviews with the project management team, field data collection and surveys. Assessment of the environmental impacts associated with project components has been carried out using the Rapid Impact Assessment Matrix (RIAM) which allows both subjective and quantitative assessment of the project components and natural environment to understand various impacts that may arise from the project. The environmental components of the project are categorized into physical/chemical, biological/ecological, social/cultural and economic including operational aspects. The outcome of the matrix based on the project components against environmental components showed positive and negative outcomes. Significant negative impacts of the project are:

- Impacts due to sorting and storage of hazardous waste
- Health and safety risks to the workers during construction and operational work
- Air pollution due to emissions associated with construction machinery

Lesser negative impacts from the project includes impacts on the environment due to accidental spills during transfers and material handling.

Significant positive impacts and benefits of the project are:

1. Benefits to the island community (both social and economic) due to improved waste management practices and operation of the facility,
2. Changes to the environment due to improved waste processing methods

Mitigation measures, monitoring and alternatives

The ESMP identified in this document gives mitigation measures for all significant impacts due to the project. Mitigation measures such as the following have been identified in the ESMP:

- Provision of adequate training in proper method of handling of machinery and materials during both construction and operational phase.
- Provision of adequate training in proper method of handling of waste during collection and disposal during operational phase.
- Provision of all protective gear to workers during both construction and operations.
- Implementation of the Grievance Redress Mechanism which has been formulated by the proponent, both during construction and operations.

Monitoring programme identified in the report will enable the proponent to assess whether the mitigation measures which have been identified in the report are effective. Early identification of negative impacts will enable the proponent to rectify the issue.

Alternatives have also been discussed for the method of composting and source of power generation. After consideration of all alternatives, the proposed components have been selected for both.

To conclude, with due consideration to the environmental components identified and the extent of the project activities and their likely and predicted impacts identified, with proposed mitigation measures and monitoring followed, it is concluded that the project is feasible and justified. Furthermore, the positive benefits due to the project, both to the environment and island community outweigh the negative effects on the environment during the project. The Consultant further recommends the following:

1. Adherence to all relevant legislations, regulations, guidelines and standards during construction and operation of the IWRMC;
2. Establish environmental and occupational health and safety procedures for all relevant components;

3. Installation of renewable energy sources at IWRMC, such as solar panels to source power for operations;
4. Carryout awareness raising campaigns to increase awareness of the public regarding proposed work;
5. Ensure all trainings identified under the Training programme of this report are properly implemented to ensure proper implementation of the project at all phases;
6. Encourage greater participation of women, especially during operational stage;
7. Ensure proper supervision and inspection of the IWRMC at regular intervals.

2 Introduction

2.1 Background and justification

Vandhoo is one of the 13 inhabited islands in Kolhumadulu (Thaa atoll) in the central Maldives. Vandhoo is located at geographic coordinates N 02°17'25"; E 72°56'30". The length and width of the Vandhoo is approximately 752m and 470m respectively with a land area of 26.1 hectares (ha). The resident population of the island was estimated at 293 (National Population Census 2014 (NBS 2015)), which has increased to 310 in 2020. The island is approximately 218 km south of Male' (capital of Maldives). The island has an approximate elevation of 0.75m to 1.00m above Mean Sea Level (MSL).

Similar to almost all island of Maldives, the island is vulnerable to environmental and economic development variables such as rising sea level, coastal erosion, pollution/depletion of groundwater and unmanaged waste. Erosion is most prevalent on the north side of the island where at present a buffer of only 10m exists between the shoreline and houses. Previously, waste was being disposed to an area very close to the school and health center, and as a result, a large part of the community that attains services from these places were getting continually exposed to the smoke arising from opening burning. Moreover, a substantial amount of waste enters the beach and lagoon, leading to pollution of coastal areas. Hence, improper waste management became a major concern that needed immediate remedial measures to prevent further degradation of the environment and safeguard the wellbeing of the island community. With the implementation of the Island Waste Management plan, disposal location was changed to an area on the southeast side of the island (close to proposed project site). Waste collection and disposal was undertaken through Council.

In October 2017, a project in Vandhoo was initiated for the establishment of a 500m² waste management site as Island Waste and Resource Management Centre (IWRMC), to develop a well-equipped modern island waste and resource management center. As per the plan then, once the construction of IWRMC was completed, operation of the IWRMC was to be facilitated under the Island Waste Management Plan (IWMP) devised by the Island Council and approved by the Environmental Protection Agency (EPA). This project was funded by the Public Sector Investment Programme (PSIP) of the Government of Maldives (GoM) and was executed by the Waste Management and Pollution Control Department (WMPCD) of Ministry of Environment. However, less than a quarter of the civil work required for construction of the Centre was completed at the time. This included establishment of the boundary fence and the excavation of footings in 3 cells of the collection bays.

Hence, the Ministry of Environment, being the proponent of the project, through the Maldives Clean Environment Project (MCEP) intends to establish a full-fledged IWRMC and facilitate piloting of in-vessel composting in Vandhoo based on the findings of the technical and financial feasibility study for the establishment of a regional solid waste management system in Zone 4&5.

. This project plans to bring several changes to the layout of the 2017 project, but the size of the IWRMC will remain the same, where all the civil works will be confined to the previously demarcated boundary. New infrastructure to be constructed as part of the project include:

- Waste unloading, loading and weighing area
- Inorganic waste processing area
- Processed inorganic waste storage area
- Bulk waste storage area
- Hazardous waste storage area
- Mechanical composting area
- Office / Store / Toilet
- Septic Tank
- Groundwater Well
- Water and electricity connections
- Drains installation
- Rainwater pits
- Fire safety equipment
- Resting Area

Additional details of these structures are given in Chapter 4. Once the infrastructure is in place, an Organic Waste Converter (OWC) machine will be set up at the facility to facilitate mechanical composting of the waste using aerobic technology. Detailed description of this technology is also given in Chapter 4 of this ESMP.

The proponent of this project is the Ministry of Environment through the World Bank funded Maldives Clean Environment Project. Upon completion of the civil works and set up of mechanical composting at the facility, the operations of the facility will be handed over to the Island Council. Training needs for the proper operation of the facility will be identified through the assessment and will also be incorporated into the report.

The Island Council has formulated and published in the government gazette a Regulation on waste management and disposal for the island (2013/R-1809). As per the Regulation, waste management and disposal areas have to be demarcated, based on the Land use plan of the island and within 3 months of the implementation of the Regulation. Furthermore, all plans and guidelines to ensure proper implementation of the Regulation should be formulated and publicized within 3 months of the implementation of the Regulation. In this aspect the Island Waste Management Plan (IWMP) for 2016 – 2020 was implemented in December of 2016. Major components of the IWMP are as given below.

2.1.1 Island Waste Management Plan (IWMP) of Vandhoo

The main objectives of the IWMP is to establish a waste disposal site on the island, so as to stop the practice of disposal at different areas of the island, establish measures to manage the site and enable ways to collect waste from households and transfer to the waste disposal site and develop an Island Waste and Resource Management Center (IWRMC) on the island.

The plan was prepared after carrying out numerous consultations with relevant stakeholders of the island such as the Women's Development Committee and various other organisations.

The 6 targets of the IWMP and activities to be undertaken to achieve the targets are as below:

Target 1: Formulate and implement Island waste management regulations and policies –

- Formulation of a Waste Management Committee
- Formulation and publication of (in gazette and Island noticeboards) waste management regulations, policies and guidelines
- Increase awareness of and familiarize the community with the measures, guidelines, policies and regulations to be used for waste management
- Implement the Island waste management regulations

Target 2: Increase awareness amongst the island community of the economic, social and health benefits due to a cleaner island

- Conduct awareness programmes, which also highlight the importance of individual responsibility in maintaining a clean island
- Conduct island cleaning programmes

Target 3: Promote the concept of Reduce, Reuse and Recycle

- Create and distribute awareness materials on the benefits of recycling
- Enable ways to earn an income through recycling
- Launch a campaign to reduce use of plastic bags

Target 4: Establish an Island Waste and Resource Management Centre

- Identify a location for the Island Waste and Resource Management Centre and get land approval for the site
- Source funds
- Construction of the IWRMC

Target 5: Establish a robust mechanism for waste collection and transport

- Hire staff to work at the IWRMC and train them for operations
- Purchase a means of transport for the waste
- Service and maintenance of waste management equipment

Target 6: Establish a mechanism to enable segregation at household level and transfer of segregated waste to the IWRMC

- Outsource waste collection and management work
- Use different dustbins for waste storage of segregated waste while on the transfer vessels
- Designate specific areas for different types of waste at the IWRMC
- Waste collection and transfer to IWRMC at designated hours

Target 7: Establish a mechanism to ensure cleanliness of public spaces

- Formulate a committee
- Ban littering and waste disposal at these locations
- Install dustbins at the sites

Target 8: Formulate and implement a policy on disposal of hazardous / special waste

- Include a clause in a contract made with land owners of various industrial areas, making them responsible for the disposal of such waste generated at their facility
- Establish storage facilities/means to enable storage of such waste until it can be transported to another facility for disposal

The measures to manage waste in the plan were formulated with the above targets in mind. The IWRMC would be managed by staff of the Island Council who would collect waste from the households and transfer to the centre. Households are requested to segregate waste into the following categories: plastic, metal, glass, aluminum, construction waste, green waste, paper, cloth, diapers, food waste and chemical waste.

Waste collection fees as identified in the plan are:

- Households – MRF 100 / month
- Businesses / industrial plots / agricultural plots - MRF 150 / month

As per information provided by the council, this plan was in place up until the COVID 19 pandemic and consequential financial difficulties experienced both by the Council (due to budget cuts) and island community.

2.2 Purpose of the report and need for the ESMP

The Environmental Impact Assessment (EIA) Regulation of Maldives (2012/R-27) and amendments gives a list of development projects for which an EIA is required (Schedule Raa of the Regulation). With respect to waste management, EIA is required for three types of projects; installation of incinerators with a capacity of 10 or more tonnes/day, development of landfill using waste and development of large-scale waste management centres (capacity of treating 10 tonnes/day).

As per due process for projects not listed in this Schedule, a screening form for the project was submitted to the Environmental Protection Agency, to assess the level of impact due to the project. Based on this project description and areas of impact, EPA has stated that the project can commence after submission and approval of an Environmental Management Plan (EMP). At the same time, World Bank (WB), as the funding agency has also carried out screening of the project and stated that an Environmental and Social Management Plan should be prepared, based on the TOR issued by WB. As EPA does not issue a TOR for formulation of EMPs, the TOR issued by WB will be followed (see Appendix 2).

2.3 Terms of Reference (TOR)

As stated above, the Terms of Reference issued by World Bank for the project titled “ESMP for the establishment or upgrading of IWRMCs with Aerobic Technology using Composting Machine”, will be followed for the formulation of this ESMP. The chapters of this report are as per the structure given in the TOR and are as follows:

1. Executive summary
2. Introduction
3. Legislative and Regulatory considerations
4. Project Description and study area
5. Existing environment
6. Environmental impacts
7. Alternatives
8. Mitigation Plan
9. Environmental management and monitoring plan inclusive of Grievance redress mechanism
10. Training recommendations
11. Contingency plans

12. Stakeholder consultations
13. Gender empowerment / Preparation of Gender Action plan
14. Conclusion

2.4 Literature review

The following documents have been reviewed to get a better understanding of the project and formulation of ESMPs for similar projects.

- Environmental and Social Assessment and Management Framework (ESAMF) & Resettlement Policy Framework (RPF) - Maldives Clean Environment Project (Ministry of Environment and Energy, 2016)
- Environmental Management plan for the proposed development of Island Waste Management Centre in Th. Vandhoo. Prepared for Ministry of Environment and Energy (Ahmed Hassaan Zuhair, September 2017)
- Environmental Management plan for the upgrading of Island Waste Management Centre in N. Holhudhoo. Prepared for Ministry of Environment (Ahmed Hassaan Zuhair, October 2019)
- Environmental and Social Management plan for the establishment of Island Waste Management Centre - Th. Kin'bidhoo. Prepared for Ministry of Environment and Energy (MEECO, July 2018)
- Environmental and Social Management plan for the proposed establishment of Island Waste and Resource Management Centre in Th. Madifushi. Prepared for Ministry of Environment and Energy (Ahmed Hassaan Zuhair, January 2021)
- Feasibility Study for a Regional Solid Waste Management System in Zone IV and V, Maldives - Report Phase 2 – Draft 1 Final Version. Prepared for Maldives Clean Environment Project - Ministry of Environment (CITRES and MEECO, November 2019)
- Waste Management Regulation (R-58/2013) and amendments
- Island Waste Management Regulation – Th. Vandhoo (2013/R-1809)
- Regulation on protection of the environment – Th. Vandhoo (2013/R-1813)
- Island Waste Management Plan (01 December 2016 – 01 January 2020) –Th. Vandhoo Council (30th November 2016)

3 Legislative and Regulatory considerations

This chapter describes national relevant laws and regulations, as well as international agreements that are pertinent to the construction and operation of the project. The Environmental Protection and Preservation Act of the Maldives (Law No. 4/93) is the governing legislation for the protection of the environment. Several regulations have been implemented pertaining to this legislation and those of relevance to the project are given in Table 1. The Government agencies that are specifically related to the project are;

- Ministry of Environment (ME)
- Environmental Protection Agency (EPA)
- Th. Vandhoo Island Council

The national laws and regulations and the international conventions relevant to the proposed project are outlined in the following table (Table 1) with specific relevance and level of compliance.

Table 1. Legislation relevant to the project

Legislation	Description	Relevance to the project
National Laws and Regulations		
Environmental Protection and Preservation Act (Law 4/93)	<p>This is a framework law related to overall aspects of environmental protection in the Maldives.</p> <p>The Environmental Protection and Preservation Act (EPPA) states that any developmental project which has a potential impact on the environment should have an EIA carried out prior to commencement of the project. List of such projects are given in the EIA Regulations 2012. Those developmental projects which do not require an EIA undergo screening to assess level of impact based on which EPA issues a decision.</p> <p>Article 2: Government Authorities shall provide necessary guidelines on environmental protection and all concerned parties shall take due consideration to these guidelines,</p> <p>Article 7: Any type of waste, oil, gas or any substance that may be harmful (e.g. toxic/hazardous or nuclear) to the environment shall not be disposed within the territory of Maldives.</p>	<p>The proponent (developer) shall be aware of these requirements and inform the contractor. It is advised to the proponent that the contractor is appropriately informed.</p>
Environmental Impact Assessment Regulation (2012/R27) and amendments (5)	<p>The regulation details out the screening process for environmental assessments, and the contents that need to be covered in the different types of assessments. It includes Initial Environmental Examination, Environmental Impact Assessment and Environmental Management Plans.</p> <p>The regulation also provides a list of the types of development projects that have a socioeconomic environmental relevance in Appendix Raa (D) of the regulation that would require to carry out a detailed Environmental Impact Assessment.</p> <p>The amendments included</p> <ul style="list-style-type: none"> • Revision of EIA review period and associated costs, qualification required for monitoring the Environmental Management Plan, • Revision to the list of projects that requires EIAs, projects that can be undertaken by simply applying mitigation measures for projects such as for maintenance 	<p>The project has been screened by EPA for environmental compliance level categorization and screening decision by EPA was that the proponent should attain environmental clearance through submission of an EMP for the project.</p>

	<p>dredging of harbors, clearance of vegetation within allocated plots for households and for roads,</p> <ul style="list-style-type: none"> • Transferring of Tourism related EIA decision making to Minister of Tourism for tourism related activities and subsequent reversal of decision making to EPA • Categorization of EIA consultants, point system for consultants to assess performance and license suspension, a code of conduct for consultants, and increment to the fine for non-compliance of regulation and violations. 	
Regulation on Environmental Liabilities (2011/R-9)	<p>The main objective if this regulation is to ensure prevention of actions violating the EPPA 4/93. The regulation also aims to ensure compensations for all the damages that are caused by environmentally detrimental activities.</p> <p>The regulation sets measures and standards for different types of environmental liabilities and equal standards that shall be followed by the implementing agencies while implementing the regulation.</p> <p>According to this regulation the Government of Maldives reserves the right to claim compensation for all the activities which have breached the EPPA 4/93.</p>	<p>The proponent, developer and operators of the proposed project will be liable to any environmental damage caused during both construction and operation phase of the project. All parties should be well informed of such requirements.</p> <p>The project should ensure proper mitigation measures are in place to avoid any such damage.</p>
Utility Regulation Authority Act (2020):	<p>The Utility Regulatory Act establishes the powers and responsibilities of the Authority formed to plan and implement the activities with respect to utility service provision. The Act also identifies the policies and guidelines to be followed in planning such service provision.</p> <p>In this act Utility services are referred to provision of freshwater, sewerage, power and waste management services for a fee or as a business.</p> <p>The Act has 7 key objectives, which are as follows:</p> <ul style="list-style-type: none"> • Ensure that utility services are available to the whole population at a reasonable price, and in a trustworthy, robust and sustainable manner; • Ensure that utility services are planned in an efficient and environmentally friendly manner • Ensure that the utility service provision is successful, of good quality and are able to meet the needs of the population 	Operator of the IWRMC shall abide by all requirements under the Act

	<ul style="list-style-type: none"> • Ensure that utility service provision is done in a just manner, and that there is continued development of the services through a competitive market • Formulate and implement policies and guidelines to be followed in utility service provision • Ensure utility service providers abide by this Act and all other relevant acts and regulations and establish a penalization system for those who break the law • Increase awareness about the rights provided to those who receive the services and the service providers <p>The regulatory works for waste management has been transferred to newly established Utility Regulation Authority (URA).</p>	
<p>Waste Management Regulation (R-58/2013)</p>	<p>The Waste Management Regulation of the Maldives was gazetted on the 5th of August 2013 and came into effect 6 months from the date, on 5th of February 2014. The Regulation was enacted through the powers given to the Ministry through Law 4/93. The main objective of this regulation is to implement the national policy on waste management and through its implementation, facilitate the following so as to preserve the environment:</p> <ul style="list-style-type: none"> • Minimise both direct and indirect impacts due to waste on environment and human health. • Establish standards for waste management • Formulate an integrated framework for waste management, and establish environmentally sound and sustainable means for waste management • Encourage waste minimisation, reuse, recycling and recovery • Implement “Polluter Pay” principle • Introduce “Extended Producer Responsibility” <p>The regulation has five focus areas:</p> <ul style="list-style-type: none"> • Waste Management Standards; defines standards for waste collection, transfer, treatment, storage, site management, landfills and managing of hazardous waste • Procedure for approval of Waste management permits (for waste management sites) • Standards and permits required for transport of waste (land and sea) 	<p>The development of the Waste management centre on the island will follow all guidelines and protocols set under this regulation. The operations will commence after obtaining all the required licenses and permits.</p>

	<ul style="list-style-type: none"> • Monitoring and reporting requirements • Enforcement and implementation procedures and penalties 	
Environmental Guidelines for site selection of waste management centers	This set of guidelines formulated by EPA provides guidance in selecting an environmentally suitable site for the waste management centers in inhabited islands. It also aims to provide guidance in ways to minimize and mitigate potential environmental and social impacts from the activities that shall be carried out in the waste management center	Site allocation for IWRMC at Vandhoo was done prior to initial EMP formulation for the project, in 2017 and meets all requirements of EPA.
Island Waste Management Regulation (2013/R-1809)	<p>This regulation states that waste management and disposal areas have to be demarcated, based on the Land use plan of the island and within 3 months of the implementation of the Regulation. Furthermore, all plans and guidelines to ensure proper implementation of the Regulation should be formulated and publicized within 3 months of the implementation of the Regulation.</p> <p>The regulation also outlines the measures the Council should consider when allocating a waste disposal site, guidelines to follow when carrying waste from one place to another, during disposal of waste and burning, both at the disposal site and within own plot.</p>	The land area allocated is in conformance to the regulation
Regulation on protection of the environment – Th. Vandhoo (2013/R-1813)	<p>This regulation was formulated to enable the Island Council to protect the environment of the island and identify the measures to be taken against those who harm the environment of the islands under the Council jurisdiction.</p> <p>With respect to waste, the regulation states:</p> <ol style="list-style-type: none"> a) Disposal of hazardous/ dangerous waste, fuel or oils should not be carried out in a manner which is harmful to the environment, at any area under the Council jurisdiction b) The council should designate a specific area for disposal of material if required c) Disposal of such waste through burning can only be carried out by the Council or through Council authorization d) If the Council does undertake disposal of such waste through burning it should be done so in a manner which is not harmful to the health and wellbeing of the personnel involved as well as the community e) The regulation does not impede the Council from taking a fee for such service provision 	Disposal of hazardous waste through this project will follow this regulation as well as the Waste Management Regulation

Maldives Land Act	<p>The act governs allocation of Maldivian land for different purposes and uses and other issues regarding the issuing of land, issuing of state dwellings or private dwellings constructed for residential purposes and the sale, transfer and lease of Maldivian Land.</p> <p>Under article 2, all transactions concerning issuing, receiving, owning, selling, lease, utilizing and using Maldivian land shall be conducted in compliance with this Act.</p>	Land allocation for development of IWRMC has been approved by the Maldives Land and Survey Authority (Letter from MLSA in Appendix 3)
Land Use Planning regulation (2002)	<p>Land Use Planning (LUP) regulations were first issued in 2002 by the former Maldives Housing and Urban Development Board (MHUD) to provide the necessary policy framework and guidelines to improve land use and development activities nationally, with an emphasis on optimizing the use of the limited land available. It sets out a broad framework for land use activities in planning policies and processes including planning procedures and categories, plan preparation, consultation and approval processes and implementing strategies</p> <p>Clauses specific to waste management in the LUP regulation states that:</p> <p>a) Consideration shall be given to allocation of a waste management site. The waste management site shall be located away from the population and consideration given to wind direction, smell, smoke, flies and other nuisances that impact on local amenities.</p> <p>b) There shall be a buffer zone between the waste management site and the population. The buffer zone can be used to accommodate industrial activities or may consist of vegetation.</p> <p>c) The exact details and stages of how the waste is managed need not be given on the land use plan. However, the land use plan should be prepared in such a way, that it would accommodate a sustainable waste management practice.</p> <p>d) The rules and regulations of the Government agencies on waste management should be followed in terms waste management.</p>	The site proposed for development of the IWRMC has been allocated with due consideration to the guidance given in this regulation.
By-law on cutting down, uprooting, digging out and export of trees and palms from one island to another	The bylaw states that the cutting down, uprooting, digging out and export of trees and palms from one island to another can only be done if it is absolutely necessary and there is no other alternative. It further states that for every tree or palm removed in the Maldives two more should be planted and grown in the island.	The proposed work does not require any vegetation clearance, as work will be carried out at site which was allocated for IWRMC in 2017 and

	<p>The bylaw prohibits the removal of the following tree types;</p> <ul style="list-style-type: none"> • The coastal vegetation growing around the islands extending to about 15 meters into the island are protected by this bylaw; • All the trees and palms growing in mangrove and wetlands spreading to 15 meters of land area are protected under this bylaw; • All the trees that are in a designated protected area; • Trees that are being protected by the Government in order to protect species of animal/organisms that live in such trees • Trees/palms that are unusual in structure 	where development work had already commenced
<p>Protected Areas</p> <p>Regulation on Protected Areas Regulation (2018/R-78)</p>	<p>This regulation was published in 2018 under the EPPA 4/93 pursuant to Article 4. The objectives of this Regulation are;</p> <p>(a) to establish effective guidelines for declaration and management of protected areas; (b) to ensure that the process of protected area declaration is consultative transparent; (c) to enlist environmentally significant areas in the Maldives; (d) to establish and sustainably a mechanism to maintain a framework for protected areas; (e) to enhance awareness and participation of community in protected area designation and management; (f) to ensure future generations benefit from natural resources, ecosystem services and biodiversity richness of the country.</p> <p>61 sites as of July 2019 has been declared as protected areas in the Maldives. These include dive sites, mangroves and some ecologically significant islands.</p>	There are no protected sites within vicinity of project site or even within the Atoll
<p>Environmentally Sensitive Areas (ESAs)</p>	<p>ESAs include possible fish breeding areas, bird sanctuaries, micro atolls, islands, mangroves and marine areas. A total of 274 ESAs has been designated as of 2017.</p> <p>Ministry of Environment has designated these areas as Environmentally Sensitive Areas (ESAs) with regards to the richness of its biodiversity and significance to the ecosystem.</p> <p>These areas are given careful consideration before approval of any type of development to ensure sustainable development which mitigates any negative impact to the environment.</p>	There is one ESA on the western side of the island, approximately 400m from project site (outside impact boundary). Other sensitive areas although not listed on the EPA list also include additional smaller mangrove areas on the NW side of the island and SW side of the island, both outside of the 30m impact boundary area
<p>Regulation of Health and Safety measures specific for</p>	<p>The Regulation on Health and Safety measures specific for the Construction industry was published in the government gazette on 30th January 2019 and came into effect on</p>	The proposed project will have to adhere to this regulation taking all

the Construction industry
(2019/R-156)

the same day. The implementing agency for the regulation is the Ministry which is mandated with enforcing the legislations relevant to the Construction industry at any given time (at present MNPHI).

The main purpose of the Regulation is twofold:

1. Identify and specify the minimum measures which need to be in place to ensure safety of the workers and the general public
2. Identify the penalties which will be given and personnel responsible for this action, in instances where construction projects do not abide by the Regulation

Second chapter of the Regulation identifies the roles and responsibilities of the Contractors and Construction companies/workers. Key points include:

- Formulation of a Health and Safety operations manual for projects exceeding MVR 1.5million in cost. These manuals will be used to train the workforce in this aspect
- Formulation of an Emergency response plan
- Appointment of a Site Safety Supervisor and details of their roles and responsibilities
- Insurance scheme (to ensure compensation of workforce and/or neighboring houses should the need arise during construction work)
- Measures to ensure public safety during construction work
- Proper use or Personal Protective equipment (Contractor's responsibility to provide these to their workforce)
- Regulation further specifies measures to be in place when working on different phases of the project and while using different equipment for work (working at levels 3m high from ground level, on rooftops, in enclosed areas, using scaffoldings, ladders, working with electricity, use of chemicals and welding, use of electric power tools and mechanical tools, heavy machinery)
- Measures to be in place when storing materials for construction
- Use of safety boards issued by relevant authorities
- Use of safety measures (such as demarcation tape) to clearly demarcate construction site, so as to ensure safety of public
- Operation procedures in instance of accidents at the site

precautionary measures identified in the regulation during the construction phase of the project.

	<p>Chapter 3 of the Regulation identifies measures to be taken by enforcement authority in instances of an accident at the construction site. The chapter also details penalties to be issued in instances where the Regulation is not adhered to during construction projects.</p>	
<p>Public Health Protection Act (07/12)</p>	<p>The Public Health Protection Act aims to establish policies to protect public health and identify the institutional arrangement for implementing the polices, regulations and guidelines.</p> <p>The act has a chapter on health hazards which should be adhered in any development project as well.</p> <p>It also includes a section on establishing policies to respond to public health emergencies.</p>	<p>The proposed project should adhere to this act in relation to identifying the potential health hazards during construction and operation stage of the IWRMC.</p> <p>Furthermore, as per this act the policies and guidelines formulated under this act and the ones formulated for the ongoing COVID pandemic should be strictly followed during the development phase of the project.</p> <p>During the preparation of the ESMP, HPA guidelines are followed in carrying out the field surveys and also the stakeholder discussions.</p>
<p>Guideline on travel related quarantine among people travelling in 10 or more groups (HPA Guidelines of relevance to present COVID 19 situation)</p>	<p>This guideline highlights the measure to observe if group of 10 people or more stays in a shared accommodation (room or barracks or dormitory) during travel related quarantine. This guideline also applies to those who are travelling to an island where there is no community spread, from any island where there is community spread of COVID19. Clauses of this guideline of relevance to this project include:</p> <ul style="list-style-type: none"> • If Maldivians and expatriates living in an island where there is community spread of COVID-19 travels to an island where there is no community spread of COVID-19, PCR test must be done not more than 72 hours prior to the scheduled time of departure to the island and should have a negative PCR result prior to travel. 	<p>Construction workforce will abide by these guidelines prior to departure to the island and during their stay on the island.</p> <p>During the preparation of the ESMP, HPA guidelines are followed in carrying out the field surveys and also the stakeholder discussions</p>

	<ul style="list-style-type: none"> • People who have COVID-19 like symptoms such as fever, cough, respiratory symptoms etc., must not travel until 48 hours after resolution of symptoms even if their PCR test results are negative. <p>The Guidelines also details procedures for travel applications, procedures to be followed during quarantine period inclusive of accommodation (such as accommodation in small groups, without meeting people from outside, distance between beds of 3ft etc.) during this period. It also gives details on procedures to be followed if someone who is in quarantine shows symptoms of COVID 19.</p>	
Labour and Working Conditions National Laws	<p>The national laws and regulations relevant to labour and working conditions include:</p> <ul style="list-style-type: none"> • Employment Act (2/2008) • Immigration Act (1/2007) • Anti-Human Trafficking Act (12/2013) • Pensions Act (8/2009) • Human Rights Act (6/2006) • Regulation on Employment of foreign workers in the Maldives (2011/R-22) • Work Visa Regulation (2010/R-7) 	<p>Contractors should ensure that all workers are treated according to the Employment Act.</p> <p>Contractor should ensure that all foreign workers have relevant documentations including the work visa as per Immigration Act and Work Visa Regulation.</p>
National Policies and Action Plans		
National Biodiversity Strategy and Action Plan 2016 – 2025 (NBSAP) prepared under the Convention of Biological Diversity (CBD)	<p>NBSAP is a 10 year plan with the vision of Maldives is to be “<i>a nation of people that co-exist with nature and has taken the right steps to fully appreciate, conserve, sustainably use, and equitably access and share benefits of biodiversity and ecosystem services.</i>” by integration of biodiversity conservation into all areas of national planning, policy development and administration (MEE, 2015).</p> <p>The 6 strategies developed to achieve this includes;</p> <p>S1: Strengthen governance, policies and strategies for biodiversity, S2: Enhancing communication and outreach through awareness programs and capacity building, S3: Work together globally for biodiversity conservation, S4: Ensure sustainable use of biological resources, S5: Address threats to conserve biodiversity, S6: Strengthen information management and resource mobilization.</p> <p>Among these strategies, includes identifying ways to address threats to conserve biodiversity conservation (Strategy 5) under which targets includes:</p>	<p>The current project conforms to these policies, by carrying out the ESMP work prior to commencement of the project, so as to minimize impact on the environment and to incorporate ways of environmental monitoring and management during the project works.</p>

	<p>Target 17: By 2025 pressures on coral reefs and other vulnerable ecosystems due to anthropogenic activities and climate change are minimized</p> <p>Target 19: By 2025, impacted ecosystems that provide essential services related to water, human health, wellbeing and livelihood are restored significantly</p> <p>Target 23: By 2020 pollution from waste and sewage has been brought to levels that are not detrimental to ecosystem functions and biodiversity.</p>	
National Waste management policy (2015)	<p>The key objective of the National Waste Management Policy is to ensure that all the policies, regulations, standards plans and masterplans are prepared with a common basis.</p> <p>The policy includes roles and responsibilities of waste management at individual level, household level, atoll level, regional level and national level.</p> <p>The policy outlines 10 strategies to address the issue of waste management in Maldives. These include the individual responsibilities of managing waste and island councils' responsibilities to prepare waste management plans and manage the waste at island levels; Collecting fees from households to manage waste; Encourage the utilities companies to carry out the task of managing waste at the islands; Establishment of regional waste management centers; Encourage and provide means to generate income using waste products; carry out trainings on waste management at national level.</p>	<p>Operations of the waste management centre will be as per this policy and other waste management guidelines. Island Waste management plan will be implemented to ensure proper operations.</p>
International legal frameworks		
<p>IFC guidelines</p> <p>Environmental, Health and Safety guidelines for Waste management facilities</p>	<p>This set of Guidelines are applicable to all projects involving the management of municipal solid waste and industrial waste, including waste collection and transport; waste receipt, unloading, processing, and storage; landfill disposal; physico-chemical and biological treatment; and incineration projects</p> <p>The Guideline has two main parts:</p>	

	<ol style="list-style-type: none"> 1. Industry specific impacts on the environment, occupational health and safety and community health and safety. Recommendations on ways to mitigate and manage these impacts are also given in the guideline. 2. Performance indicators and industry benchmarks for environmental performance and occupational health and safety performance. 	
Labour and Working Conditions	<p>Maldives has signed 10 convention of the International Labour Organization with regards to labour and working conditions</p> <p>These includes:</p> <p>Fundamental 8 conventions</p> <ul style="list-style-type: none"> • C029 - Forced Labour Convention, 1930 (No. 29) <i>ratified on 04 Jan 2013</i> • C087 - Freedom of Association and Protection of the Right to Organize Convention, 1948 (No. 87) <i>ratified on 04 Jan 2013</i> • C098 - Right to Organize and Collective Bargaining Convention, 1949 (No. 98) <i>ratified on 04 Jan 2013</i> • C100 - Equal Remuneration Convention, 1951 (No. 100) <i>ratified on 04 Jan 2013</i> • C105 - Abolition of Forced Labour Convention, 1957 (No. 105) <i>ratified on 04 Jan 2013</i> • C111 -Discrimination (Employment and Occupation) Convention, 1958 (No. 111) <i>ratified on 04 Jan 2013</i> • C138 - Minimum Age Convention, 1973 (No. 138) Minimum age specified: 16 years <i>ratified on 04 Jan 2013</i> • C182 - Worst Forms of Child Labour Convention, 1999 (No. 182) <i>ratified on 04 Jan 2013</i> <p>Technical 2 conventions</p> <ul style="list-style-type: none"> • C185 - Seafarers' Identity Documents Convention (Revised), 2003, as amended (No. 185) <i>ratified on 05 Jan 2015</i> • Amendments of 2016 to the Annexes of the Convention No. 185 <i>ratified on 08-Jun-2017</i> • MLC, 2006 - Maritime Labour Convention, 2006 (MLC, 2006) <i>ratified on 07 Oct 2014</i> <p>All these conventions are considered in-force in the Maldives. Hence these should be strictly adhered in relation to all labour and working affairs.</p>	<p>The contractor (s) should adhere to the measures mentioned in these conventions where relevant.</p> <p>Among the many things, abiding to these laws would ensure no exploitation of foreign migrant. The contractors should make timely payment to the workers (in full) and they should not hold documents of the workers against their will.</p> <p>It is important to know that foreign migrant workers are not required to pay recruitment fees and there should not be any forced labour.</p> <p>Contractors should ensure that all workers local or foreign should be treated with equality, dignity and respect.</p>

4 Project Description

4.1 Study Area

The proposed project will be undertaken in Vandhoo, Thaa Atoll located in south central region of Maldives. The island is located slightly inside the western peripheral reef of the atoll, at the geographic coordinates of N 02°17'25"; E 72°56'30". The island is 2.55km NE of Hirilandhoo and 4.2km SE of Kandoodhoo. With a total area of 26.1ha, about 15ha of the island (northern side) is developed and inhabited (Figure 1). The proposed work will be undertaken on the southeastern corner of the island, where the current IWRMC is located. The land area required for project development was allocated for the purpose and approved by Maldives Land and Survey Authority in 2017, at the time of initial construction of the IWRMC (evidence of land area approval is given in Appendix 3). The area is not being used as present, as construction is not complete. Waste disposal is currently undertaken at a site to the north of project site (Figure 1).

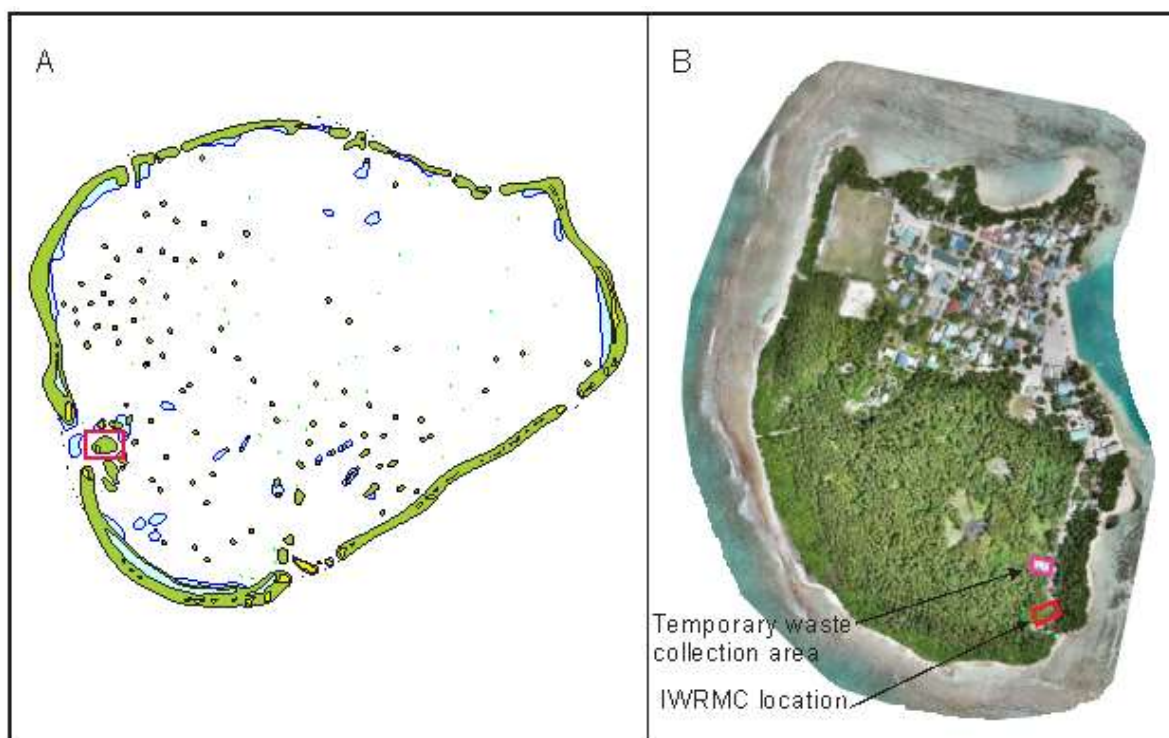


Figure 1. Location of Vandhoo in Thaa Atoll (left, red outline) and location of IWRMC at Vandhoo (right, Existing IWRMC and Temporary collection site) (Large scaled map given in Appendix 4)

4.2 Project components

Project for the establishment of a 500m² IWRMC in Vandhoo was initiated in October 2017. However, only 19 percent of the civil works of the project was completed at the time due to certain issues with the build contractor. The work completed at the time includes establishment of the boundary fence and the excavation of footings in 3 cells of the collection bays (Figure 2). The existing boundary fence will be retained and development of the IWRMC will be undertaken inside the demarcated boundary.



Figure 2. Images of the site at present

The proposed project plans to bring several major changes to the layout of the initial project. However, the size of the IWRMC will remain the same, and all the civil works will be confined to the previously demarcated boundary. New Infrastructure will be developed to cater to the requirements of setting up of a proper IWRMC with mechanical composting setup. Figure 3 gives a schematic of the layout for proposed IWRMC. A larger scale drawing is given in Appendix 5 of this report.

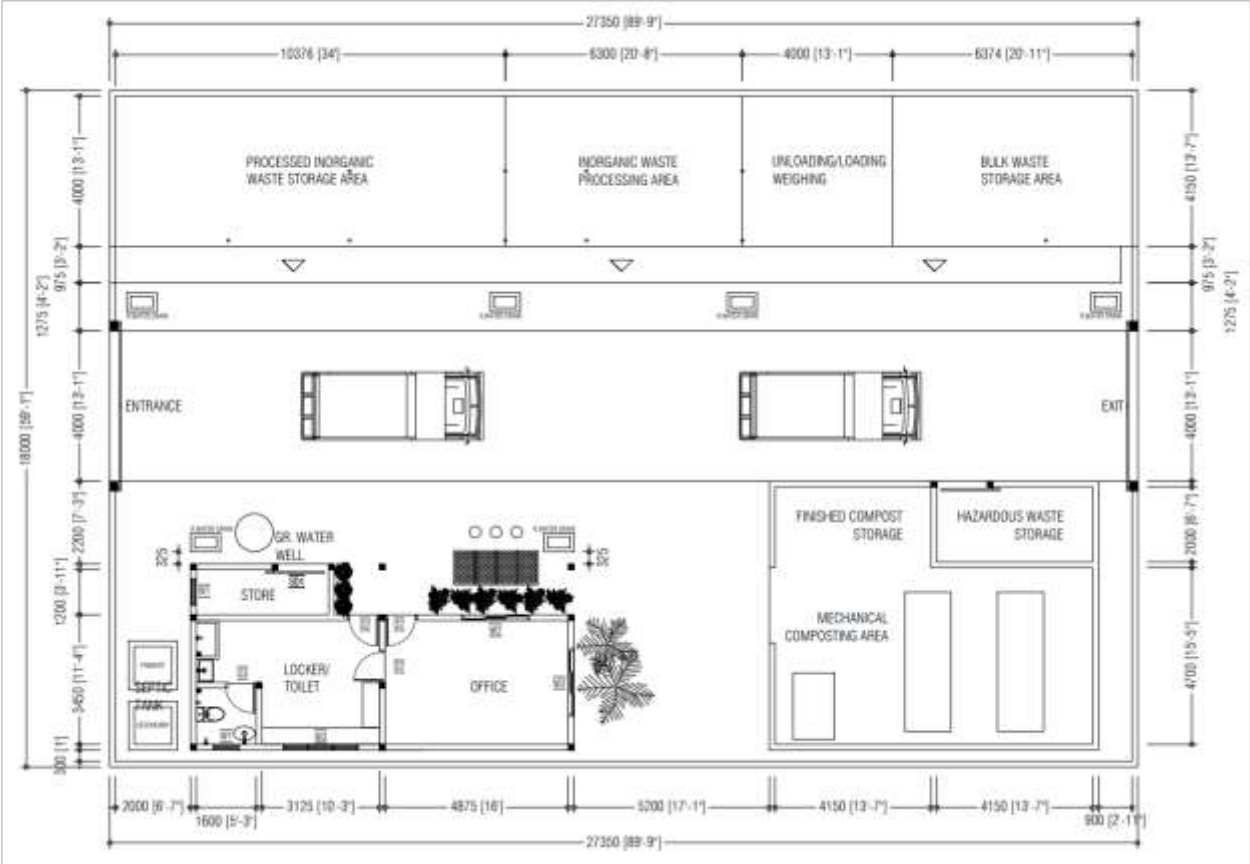


Figure 3. Schematic layout of IWRMC proposed (scaled site plan given in Appendix 5)

4.2.1 Construction phase

The construction contractor for the project has not been identified yet. The contractor will be identified upon approval of ESMP. The contractor shall provide details of materials and methodology for construction subject to approval from the client. Hence, construction work will be carried out as per contract for various components of the project. Machinery and materials to be used (including sand required for construction) will be bought locally or imported if not available.

New infrastructure to be developed at the IWRMC as part of the proposed project includes:

1. Waste unloading, loading and weighing area

A roofed area of 8m² with concrete slab designated for sorting and weighing of incoming waste to organic and inorganic fractions.

2. Inorganic waste processing area

A roofed area with concrete slab where waste will be further segregated into plastic, metal, glass etc. and processed via baling, compaction and crushing. This processing area has an approximate area of 25.2m².

3. Processed inorganic waste storage area

A roofed area with concrete slab where the processed inorganic waste will be stored. The storage area has an area of 41.5m². The design considers storage of such waste for 4 – 6 months, which will then have to be transferred to the Regional Waste Management Facility (RWMF).

4. Bulk waste storage area

A roofed area of approximately 25.5m², with concrete slab, designate for the storage of bulk waste such as old furniture, roofing sheets etc.

5. Hazardous waste storage area

A fully enclosed room of 8.3m² area, with a roof, concrete slab, 4 walls and a gate, where the received hazardous waste will be stored prior to its final disposal at a RWMF. Appropriate hazard, flammable liquid and warning signage will be installed.

6. Mechanical composting area

A fully enclosed roofed area with concrete slab and brick walls to be developed adjacent to the hazardous waste storage area, where in-vessel composting will be carried out. The mechanical composting area has an area of 47.3m² and is also where the finished compost

will be stored. Provisions will be made for the storage of finished compost and chipped wood at this area.

7. Office / Store / Toilet

This is the space and essential utilities operational and administrative staff.

8. Septic Tank

A septic tank will be constructed at the open area adjacent to the proposed toilet to dispose the wastewater generated during operations.

9. Groundwater Well

A groundwater well will be constructed at the open area in front of the proposed store. Water for operations will be drawn from this well.

10. Water connection

Internal water piping and taps 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.

11. Installing drains

Drains will be installed at the waste unloading and loading areas, the waste processing areas, waste storage areas, and the mechanical composting area, which will be subsequently connected to the septic tank. This will also allow collection and drainage of any leachate which might be produced, although this will be of comparably minor quantity (to windrow- based composting) with the proposed method of composting.

12. Rainwater pits

Rainwater pits will be installed throughout the open area of the IWRMC to deal with potential storm water produced during rainy seasons.

13. 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 225m from the proposed site.

14. Resting Area

An open resting area is proposed at the area in front of the proposed office, landscaped with plants and chairs (joali).

15. Fire safety equipment

Fire safety equipment will be supplied and installed as part of the contract, which essentially includes:

- 50KG DCP Trolley 2 nos.
- 50LTR Foam Trolley 1 no.
- Wet Chemical 6Ltr with Cabinet for hazardous waste area 1 no.
- Water 9Ltr with Cabinet for Office Area – Outside 1 no.
- CO₂ 2KG with Cabinet for Office Area – Outside 1 no.

4.2.1.1 Construction methods

Details of construction methods given below are as provided by the proponent (in the absence of a contractor). As per the proponent, normal civil works will be undertaken for the construction of the building.

Foundation

The proposed method of foundation construction for the IWRMC is using concrete footing and concrete foundation beams. As detailed designs are not available at present, depth of excavation is unavailable. However, since this is a single storey structure, it is assumed that depth of excavation will not exceed 600mm. Excavation will be done manually and given the shallow excavation necessary, dewatering will not be required. Ordinary Portland cement will be used for all concrete works.

Construction of concrete slab

The Concrete foundation beams will be covered with a concrete slab with varying thickness at different areas of the IWRMC. Thickness of slab at the office area is proposed to be 75mm, while that at hazardous waste storage area, bulk waste storage area and mechanical composting area will be 100mm. The concrete slab at the rest of the waste processing areas will have a thickness of 150mm.

Construction of groundwater well

Although water and sewerage network for the island is being developed at present, no connections have been laid to the area of the island where the IWRMC is located, as it is at distance from the residential area. Hence a groundwater well is proposed to be constructed to source water for the construction and operations (non-potable uses) of the centre. Excavation depth will depend on the depth of water table. Once excavation is completed, well base and body is fitted into the pit and covered. A pump will be installed with connections to the toilet and wash area, as well as the

waste sorting, mechanical composting and inorganic waste processing areas. Groundwater will be used at these areas for all non-potable uses such as washing the floors.

Construction of septic tank

The sewerage generated during the operational phase of the project will be managed through construction of a septic tank within the IWRMC plot. The septic tank consists of a primary and secondary tank. The primary tank has dimensions of 1.3m by 1.3m and is made with 150mm brick wall. The structure will be covered with 75mm thick concrete with 6mm reinforcing steel. The depth of the primary tank will be 2m. The secondary tank also had the same dimensions, but is proposed to be filled with coral stone and white sand to a depth of 1m. The bottom 1m will be perforated with 25mm equally distributed holes to allow discharge of treated effluent. The two tanks are connected by a PVC pipe of diameter 100mm.

The drains at the different areas of the IWRMC will also be connected to the septic tank.

4.2.2 Operational phase

Since this project involves upgrade of an existing facility (although not functional at present), many components of the operational phase are same as what has been discussed in the EMP earlier prepared for setup of the facility (Zuhair, 2017). Hence all components described below, except composting method have been sourced directly from the previous EMP.

1. Waste Collection Services

After construction works are completed the IWRMC will be officially handed over to the Island Council. The Island Council will manage the operation of the IWRMC according to the approved IWMP. Daily collection services will be provided at a cost of MVR 100 per household. Each house will be supplied with bins to facilitate segregation of waste at household level. Two battery operated vehicles are proposed to be used for household waste collection (Zuhair, 2017).

2. Sorting

Collected waste will be sorted into organic and inorganic waste at site. After sorting, the inorganic waste will be further segregated into plastic, metal, glass etc., and processed via baling, compaction and crushing. The processed waste will be stored at the area designated for storage of processed inorganic waste for offsite disposal (at Thilafushi, which is the designated RWMF for Zones 4 & 5 based on feasibility study and is currently being developed into a contemporary facility under ADB financing). The organic waste will be composted through mechanical composting. The facility also has separate storage areas for bulk waste and hazardous waste.

3. Composting

The proposed method of composting is through use of mechanical composting (using an aerobic system). 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 to it being highly labor intensive. Unlike a normal windrow-based system, the technology involves initial 'in-vessel' processing of the waste in the "Organic Waste Converter (OWC)" machine (detailed process is given in Section 4.2.2.1 below).

4. Leachate Management

The given method of composting is envisaged to greatly reduce leachate generation, especially in comparison to earlier proposed windrow-based composting method. Even so, installation of drains in all areas of the waste management centre provides provision for leachate drainage and management (mostly to counter for that generated during cleaning of floors at the composting area). The drains will be connected to the septic tanks constructed in the open area within the centre.

5. Waste Transport to a Regional Facility

The stored inorganic waste needs to be transported to a RWMF every 4 to 6 months. The RWMF is at Thilafushi, which is currently being developed under financing from the Asian Development Bank.

4.2.2.1 Design of Aerobic system (composting machine)

The proposed technology for composting is through use of an aerobic system, which involves in-vessel composting in the Organic Waste Converter (OWC) machine. The OWC can compost all types of organic waste including kitchen and food waste (both raw and cooked), green waste.

The bio-degradable waste is sorted and segregated and chopped to the desired size. The chopped waste is added to the OWC machine, together with the Bioculum (a bacteria powder formulated with 5 different *Bacillus* species). The Bioculum improves the natural aerobic process. The Bioculum is added at the rate of 1-2g/kg of raw waste. If needed, an absorbent such as saw dust or shredded leaves can also be added at this stage to bring the mix to the desired moisture (40-45%).

The OWC unit is then operated for a period of 15 to 30 minutes, depending on size of unit and batch size. During this time the waste, Bioculum and absorbent are mixed to achieve a homogenous consistency.

At the end of the cycle, the raw compost is discharged into crates of 25kg capacity and these crates are then placed in curing racks for a period of 10 to 12 days. The curing racks are equipped with an automatic fogging device that maintains moisture content at the correct level thereby ensuring curing is completed. Figure 4 shows a flow diagram of the process.

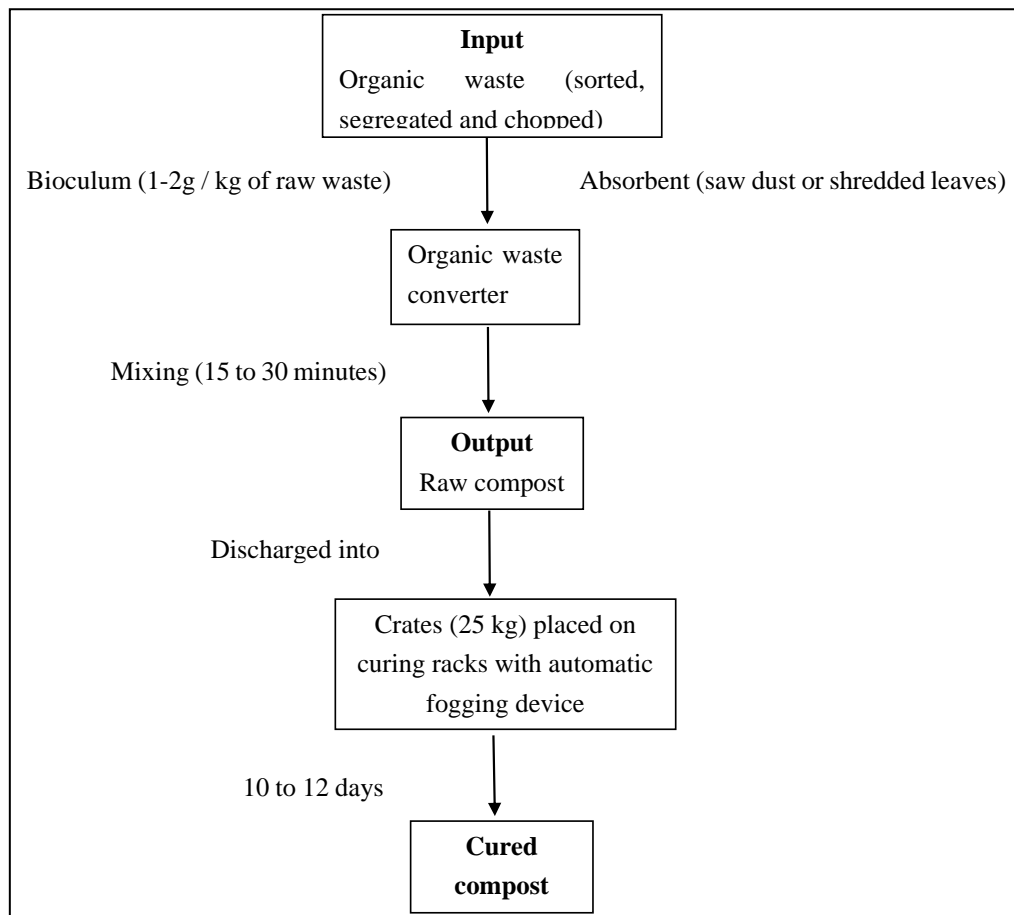


Figure 4. Flow diagram of the OWC machine / composting process

At the end of the curing period, the crates are 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 approximately 25 – 35%, by weight, of the raw waste input.

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 components of the system which require critical sizing is the curing system; however, additional racks and/or crates require only small areas of land and modest capital expenditure. Some of the advantages reported with the use of this system are:

- 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;
- Overcomes the problems of odour, leachate generation and ground water contamination associated with traditional methods of waste disposal.

4.2.3 Schedule for implementation

As per information provided by the Client, all civil works of the project is anticipated to be completed within 6 calendar months. An estimated schedule for construction (as given by Client) is provided in Table 2.

Table 2. Tentative Project Schedule

Activity	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
Mobilization & Supply of Construction Materials	■					
Site Preparation: levelling and earthworks		■				
Civil Works		■	■	■	■	
Demobilization						■

The Client informs that 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.

4.2.4 Major inputs and outputs

4.2.4.1 Inputs

Access to site, mobilization and material unloading

Access to site and material unloading will be via existing harbour on the eastern side of the island. Materials will be transported to the project site and stored at the site.

Workforce requirements, availability and logistics

Work will be carried out by a Contractor, though contractor for the project has not been assigned as yet. Based on information provided by client, workforce will comprise of approximately 10 personnel inclusive of Site supervisor (1), engineer (1) and laborers (8). Workforce will be accommodated through rental of property from the island. If workforce is to be mobilized during the current COVID-19 health emergency, they will follow all required guidelines by HPA prior to and during their time on the island (inclusive of required tests, quarantine etc.).

Provision for water, electricity and Sewerage services during construction

Electricity, Water and Sewerage services required for the workers will be arranged via the existing facilities available on the island as the workforce will be accommodated in existing houses and/or guesthouses.

Neither electricity nor non-potable water are available at the proposed site, where water required for construction has to be attained from a nearby groundwater well. A temporary connection from the powerhouse (225m from the site) may have to be established if electrical equipment are required for the intended civil works.

Mineral water bottles or rainwater will be used for drinking purposes.

Vegetation clearance

The proposed work will be carried out at an existing IWRMC facility, which has been already cleared for initial construction work. The access road to the site has also been cleared previously. Hence no vegetation clearance is necessary for the proposed work.

Fire hazard, health and safety

The IWRMC will be developed with required fire safety equipment as listed below:

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

The IWRMC will be operated by the Council. During consultations it was identified that training would be required for those involved in the operations, both in operations of the centre and firefighting skills. This is hence involved in the training programme identified in Chapter 10 of this report.

Construction waste and waste oil

Demolition work and vegetation removal are not included within the scope of works of this project and hence, minimal construction and demolition waste are expected to be generated. Construction waste may include materials slightly hazardous in nature such as used thinners and paint cartons which will be properly sealed and temporarily stored at an impermeable surface and transferred to Thilafushi at the end of the project, prior to contractor demobilizing from the site.

Temporary storage of construction waste will be at the waste disposal site currently being used by the community, which is about 50m from project site as shown in Figure 1 of this report.

4.2.4.2 Outputs

The key output of the project is an IWRMC setup with mechanical composting using an aerobic system. For the major part, details in the inputs/outputs matrix have been sourced from the previous EMP formulated for the setup of IWRMC at Vandhoo, as majority of the components are similar, with difference being the method of composting. Hence, details of composting machine have been updated as per new proposed technology. Table 3 gives details of inputs of the project while Table 4 gives details of outputs of the project.

Table 3. Inputs of the project

	Input resource	Type and amount	Means of obtaining the resource
Construction phase	Workforce	10	Contractor hired for the project
	Water for Construction	Ground water	Groundwater well dug at the site
	Construction Materials	Concrete, cement, sand, 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
	Construction Machinery	Compactor (for ground leveling), pickups or trucks (for land transport of construction material), Concrete mixing machine and concrete supply pump and pipe	Responsibility of the contractor
	Fuel	Diesel	Local suppliers
Operational phase	Equipment	Glass crusher Metal Can Baler Plastic Shredder Wood Chipper Organic Waste converter machine Crates Curing racks Waste Collection Vessel	Purchased locally or imported.
	Water	Groundwater	Groundwater well within the IWRMC
	Power	3-phase power for operation of waste management equipment.	From local powerhouse. A 25mm, 4 core power supply cable will be laid from nearest distribution box to waste yard distribution board (approximately 225)). Total estimated power requirement for operations of the centre is 42KW.
	Labour	About 5 workers to manage waste in the IWRMC and provide collection services to the community.	To be sourced ideally from within the community, or if not available, other locals or expatriate workers.

	Fuel	Diesel	Local suppliers
	Waste	Waste generated within the island. Approximately 322.4 kilograms per day.	Waste will be collected from households and businesses within the island

Table 4. Project outputs

	Input resource	Type and amount	Means of obtaining the resource
Construction phase	General Construction Waste	Moderate amount of Solid Waste	General construction waste will be reused as much as possible. Any remaining waste will be transferred to the nearest regional facility by the contractor/operator.
	Municipal Waste	Small quantity	Removed to the disposal site designated by the council.
	Soil	Excavation for substructure	Product at site, will be used as backfilling during construction.
	Dust	Moderate amount during cement mixing and excavation	Product at site
	Waste oil and diesel	Small quantity	By-product at site
	Greenhouse Gas Emissions	Small quantity. Emissions from construction material transporting vehicles and construction machinery.	By-product at site
Operational phase	Compost	In-vessel composting and curing in racks	Produced at site, used locally for agricultural purposes or sold to nearby resorts.
	Inorganic Waste	Crushed glass, compacted metal, shredded plastic	Produced at site and reused within community as much as possible. Remaining waste to be stored in their respective area within the IWRMC and transferred to a regional facility every 4 to 6 months.
	Greenhouse Gas Emissions	Electricity usage (Minute quantity)	N/A

5 Existing environment

5.1 Current waste management practices

An Island Waste Management Plan was formulated by the Island Council in 2016 and quite effectively enforced till the recent COVID 19 pandemic, at which time, due to financial difficulties, waste management methods have had to be changed.

During the implementation of the plan, waste collection from the households were undertaken by employees of the Council, for a monthly charge of MRF 100 per household. Waste was segregated at household level. Waste collected from households was taken to a temporary waste management area, about 50m to the north of proposed IWRMC site, as shown in Figure 1. Disposal was through open burning of the waste. However, the waste collection services by the council were discontinued recently due to financial difficulties. The households now have to take their waste to the allocated site at the allocated time (between 6 to 8am and 4 to 6pm), where the biodegradable waste is disposed off through open burning, and non-biodegradable waste is stocked in piles. The food waste is disposed at the shoreline near the project site.

The Feasibility Study for the development of a RWMF for Zones 4 & 5 reports that 322.4 kg of waste is generated per day in Vandhoo, corresponding to 225.7 kg of organic waste and 96.7 kg of inorganic waste. Of the organic waste fraction, it is estimated that 180.5 kg is contributed by food waste (CITRES and MEECO, 2019).

5.2 Existing IWRMC and access road

Figure 5 shows a closeup of the study area with nearest residential areas, utility connections and nearby protected areas and sensitive areas. A large-scale drawing of the study area and project location is given in Appendix 4. The project site, located on the southeastern corner of the island is far away from the inhabited area of the island, with a distance of approximately 325m between the site and nearest residential area. Given the proximity to the residential areas, the project site is also far from other important areas such as the closest mosque (240m), school (460m), council offices (410m), health centre (500m) and commercial / industrial areas (175m).

The nearest 3phase electricity distribution box is at a distance of 225m from project site (power house), water and sewerage connection points are also located at this area (near power house).

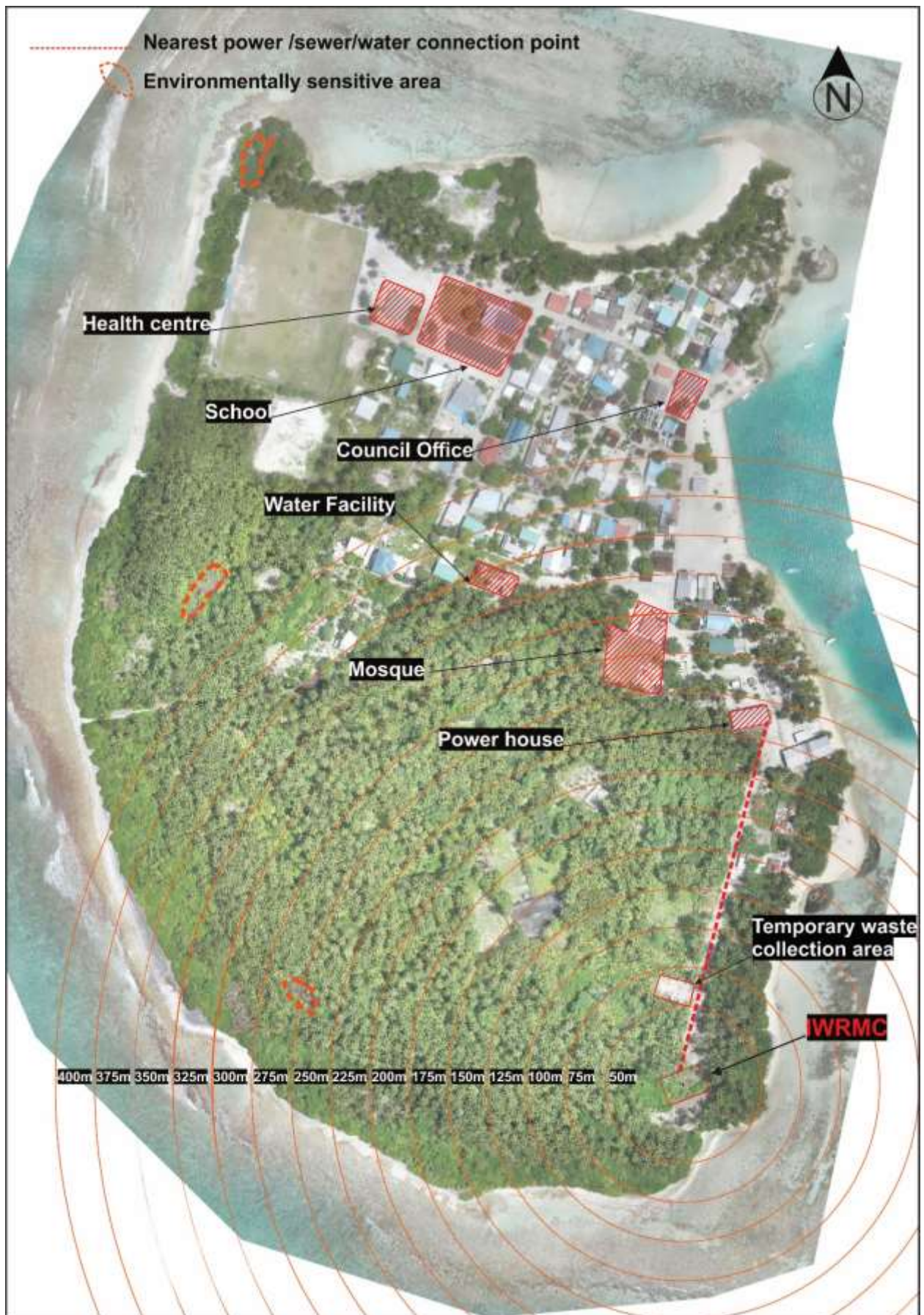


Figure 5. Image showing study area with project site and nearest utility facilities and environmentally sensitive areas as well as other critical infrastructures (Concentric circles give scale: 25m offset circles)

The initial project was stopped due to a conflict between proponent and the contractor: only part of the structure is completed (as seen in Figure 6 below). Vegetation clearance was done at the plot, but since project was stopped, cleared area is covered in shrubs (Sea lettuce trees (*Scaevola taccada*), Japanese cherry tree (*Muntingia calabura*) and Indian Mulberry (*Morinda citrifolia*)).



Figure 6. Drone image of IWRMC at Vandhoo. The boundary wall and some of the civil works are completed at the time of field visit

The IWRMC is located at the south eastern side of the island, located approximately 25m offset from vegetation line. Access to the facility is via a dirt road northward connecting to harbour front road (Figure 7).



Figure 7. Road connecting IWRMC to harbour front road

5.3 Open dumping areas

Open dumping area is located approximately 50m north of IWRMC (see Figure 1) and has dimensions of approximately 24m x 15m. Since IWRMC is not complete, waste generated on the island is at present dumped to this site (apart from food waste). Volume of waste disposed is approximately 1,000-1,500m³, with mostly non-biodegradable waste, including plastic bottles, tin cans, scrap metal, glass bottles, empty barrels and general household waste. Waste was not segregated and the waste dumped at the area was kept on bare ground, increasing the potential for groundwater and soil pollution. According to Island Council, household food waste is not dumped at this site. Food waste is disposed at lagoon near shoreline at project site. All non-burnable waste is transported to Thilafushi for disposal.



Figure 8. Waste disposed at Open dumping site



Figure 9. Open dumping area approximately 50m north of project site

5.4 Unassigned Waste Dumping:

The island is kept remarkably clean with cooperation of community and Island Council. Unassigned waste dumping was not observed on the island during the field visit.

5.5 Temporary waste relocation area

The existing open dumping area is used as temporary location and waste is not dumped at the existing IWRMC. Hence there is no need for identification of a temporary waste relocation area for the project duration.

5.6 Ground condition and soil

The IWRMC plot is already cleared (2017), but at present vegetation such as shrubs and grass has regrown. The soil condition was assessed visually. Thick layer of humus (dark soil) is observed. The soil is composed of coarse coral sand.



Figure 10. Soil condition at IWRMC site

5.7 Coastal Modification / Erosion

Vandhoo experiences seasonal erosion and storm surge related flooding at the northern quadrant of the island. The northern side of the island is low elevated compared to the southern side, hence tidal and surge related flooding is experienced at the bay shape area in the north and harbour area. Erosion is most significant on the north eastern side of island (Figure 11 and 12).

Most notable coastal modification at the island is the harbour facility located at the eastern central area of the island. The harbour facility is developed at the natural deep lagoon area hence harbour protection walls are not observed. The harbour facility is 142m long (quay wall length).

Additional coastal modification works are projected for the island in 2021, under the Project Vandhoo and Buruni Coastal protection works undertaken by Ministry of National Planning, Housing and Infrastructure. The project involves construction of breakwaters at the northern western side of the island, beach fill at northern side and revetments at south and north side of harbour facility to mitigate against erosion and tidal flooding.



Figure 11. North eastern side of the island observed with erosion (north side of the harbor)



Figure 12. North western side of the island

The shoreline area near the project area is relatively stable and composed of shingles and beach rock formations. The nearshore area is comparatively elevated compared to the northern end of the island. No erosion is observed at the area.



Figure 13. Shoreline on southern side near project site

5.8 Vegetation cover

The proposed work will be carried out at the site already allocated for construction of the IWRMC and where construction was commenced in 2017 through an earlier project. Hence the site has already been cleared and no significant vegetation is present at the site. Only shrubs such as Sea lettuce trees (*Scaevola taccada*), Japanese cherry tree (*Muntingia calabura*) and Indian Mulberry (*Morinda citrifolia*) were observed.



Figure 14. Vegetation at the plot are shrubs like Sea lettuce, Indian Mulberry and Japanese cherry tree.

5.9 Groundwater Quality

In accordance with TOR groundwater sampling was done at proposed project site. additionally, as a measure of best practice, Consultant also sampled groundwater from a control site (well inside Old Ziyaarayi). Geographic coordinates of groundwater sample sites are N 02°17'21.71"; E 072°56'35.97" (Project site) and N 02°17'29.99"N; E 072°56'34.75" (Control site, mosque).

Results of groundwater quality tests are given in Tables 5 and 6.

Table 5. Results of tests to assess groundwater quality at project site and control site

Reading	Temp.[°C]	pH	EC[μS/cm]	TDS [ppm]	Sal.[psu]	D.O.[ppm]
1	28.78	7.82	764	382	0.37	3.38
2	28.78	7.82	764	382	0.37	3.29
3	28.78	7.81	764	382	0.37	3.22
4	28.78	7.81	764	382	0.37	3.16
5	28.78	7.80	765	382	0.37	3.11
6	28.78	7.80	764	382	0.37	3.07
7	28.78	7.80	764	382	0.37	3.03
8	28.78	7.80	765	382	0.37	2.99
9	28.78	7.80	764	382	0.37	2.95
10	28.78	7.79	765	382	0.37	2.95
Average	28.78	7.81	764.30	382.00	0.37	3.12

Table 6. Results of tests to assess groundwater quality at project site and control site

Reading	Temp.[°C]	pH	EC[μS/cm]	TDS [ppm]	Sal.[psu]	D.O.[ppm]
1	28.93	8.19	343	172	0.16	5.10
2	28.93	8.19	343	171	0.16	5.07
3	28.93	8.19	343	171	0.16	5.07
4	28.93	8.19	343	172	0.16	5.05
5	28.93	8.19	343	171	0.16	5.02
6	28.93	8.19	343	171	0.16	4.99
7	28.93	8.19	343	171	0.16	4.97
8	28.93	8.19	343	172	0.16	4.95
9	28.93	8.19	343	172	0.16	4.93
10	28.93	8.19	343	171	0.16	4.91
Average	28.93	8.19	343.00	171.40	0.16	5.01

The results of the groundwater analysis shows that project side is slightly saline (0.37ppt) while control site was very low (0.16ppt). This increase in salinity is perhaps due to proximity to shoreline.

5.10 Protected Areas and Environmentally Sensitive Sites

There are no protected areas in or around Vandhoo. A mangrove area which has been listed on the EPA list of Environmentally Sensitive Sites is found on the western side of the island about 450m from project site, at geographic coordinates of N02°17'29.41" E72°56'31.05". A second mangrove area (not listed on EPA list) is found on the south western corner of the island approximately 250m from the project site (Figure 5), while a third mangrove area is observed in the NW corner of the island at coordinates of N02°17'40.49"; E072°56'27.46". The water body located at south western side is 23m long and approximately 10m wide, while the water body at western (central) side is 40m long and 12m at the widest area.

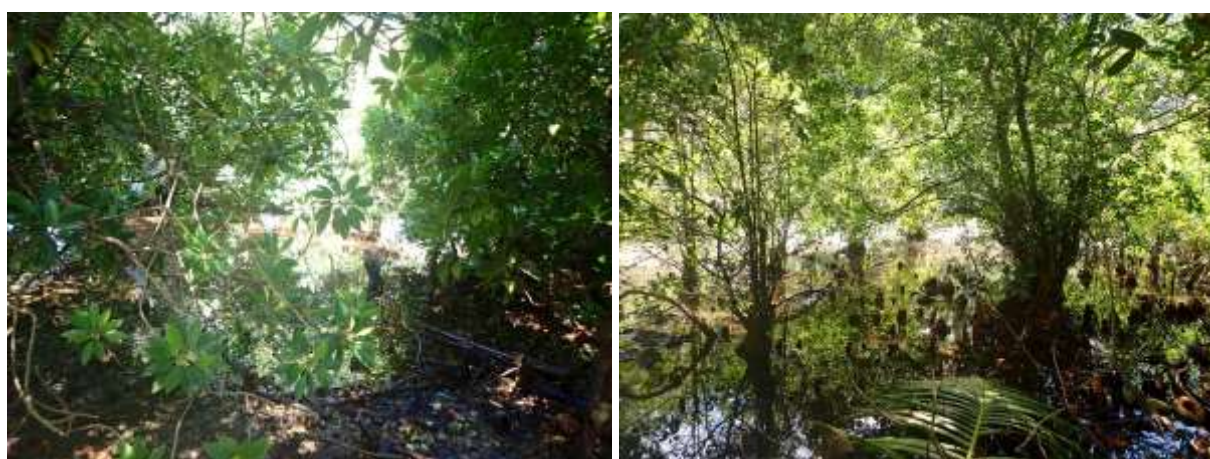


Figure 15. Two inland water bodies at western side of the island

5.11 Areas of Historic and Cultural Significance

Vandhoo has a few places of historic and cultural significance such as:

1. *Bodu valhu* (Old well)
2. Old *Champaapool* (Tail grape, *Artabotrys uninatus*) tree
3. Old Friday Mosque
4. *Ziyaaraiy*
5. *Ufsagandu*



Figure 16. Old well and Old Friday mosque



Figure 17. Ziyaarai Mosque located 240m north of project site separated by thick vegetated area

All these areas are located within the residential area of the island and hence separated from the project site by thick vegetation and considerable distance.

5.12 Socio-Economic Environment

Information on the current socio-economic environment was sourced from the Island Council office and statistics reported below are from the data obtained.

5.12.1 Demography

Total registered population of the island at present was reported to be 404 persons, while the current resident population is 310. The segregation of the total population by major age categories is depicted in Figure 18.

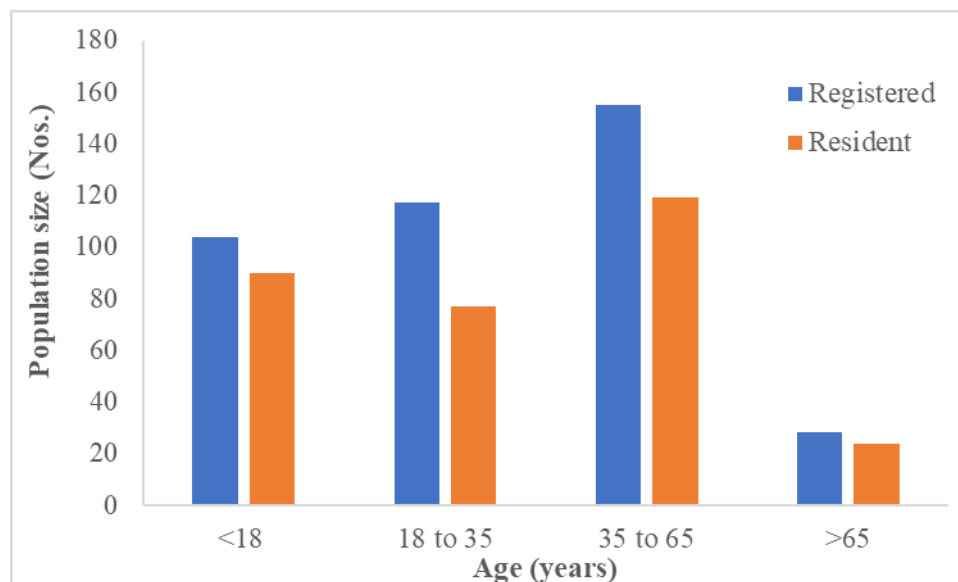


Figure 18. Current registered and resident population of Th. Vandhoo as reported by the Island Council

The total number of registered housing plots on the island are 128, of which 28 are at present empty plots and 3 are uninhabited houses. There are total 74 inhabited houses, of which 14 are households headed by females. At present a total of 6 persons in the island requires special needs and is categorised as such.

5.12.2 Economic activities and livelihood patterns

The main economic activity of the island is fisheries (mainly tuna, with few reef fishermen). Other areas through which income is earned includes construction and carpentry industry, employment in service provision sectors such as teaching and health sector, business operations and agriculture. While majority of people involved in all sectors are Maldivians, there are a few foreigners involved in each sector. Table 7 gives details of personnel involved in the different sectors.

Table 7. Areas of employment and number of persons involved

Area of income generation	Maldivians employed	Foreigners employed
Construction/ carpentry	8	6
Agriculture	2	
Fisheries	63	3
Health Sector	12	3

Teaching	17	8
Businesses	5	3
Housework (maid)		1

The island council reports a total of 8 sea vessels; 2 tuna fishing vessels, 1 reef fishing vessel, 3 Dinghies and 2 speed launces. With respect to the different businesses on the island, there are 3 general shops, 1 café/restaurant and 1 pharmacy.

5.12.3 Status of access to market, health facilities, banking, communication, etc.

As stated above, the island community operates 3 general shops where things required for daily needs can be purchased. The community also has access to health facilities through the Health Centre on the island, while the Island school provides education from Grade 1 to 10. There is also 1 pre-school on the island. Additional facilities available to the community include postal facilities and Cable TV. Waste management services are provided by the Council and have been described in Section 5.1.

5.12.4 Electricity

The island community has access to power 24 hours a day. The powerhouse on the island has a total capacity of 480kW (through 3 generator sets of 160kW each). The average load at present is 120kW.

5.12.5 Water Resources and Sewerage

Sewage disposal at present is through a septic tank system from where the effluent is disposed to sea. Harvested rainwater and bottled water are used for potable uses, while groundwater is used for non-potable uses.

6 Environmental Impacts

Various methods are available to categorize impacts and identify the magnitude and significance of the impact, such as checklists, matrices, expert opinion, modeling etc. Impacts on the environment from various activities of the project construction work (constructional impacts) and post construction (operational impacts) have been identified through interviews with the project management team and field data collection surveys. Data collected during field surveys have been used to predict outcomes of various operational and construction activities on the various related environmental components. This data can also be used as a baseline for future monitoring of the environment. The basis for environmental impact evaluation for this report is based on Rapid Impact Assessment Matrix (RIAM) which allows judgements (both subjective and quantitative assessments) to be made and provide good understanding of these decisions (Pastakia and Jensen, 1998).

6.1 Impact analysis methodology

The environmental impacts as a result of this project was analysed using the Rapid Impact Assessment Method (RIAM). The RIAM approach allows us to analyse and present the results of an all-inclusive EIA, which analyses impacts on all environmental components (physical, biological, social, cultural, economic etc.); the approach allows for data from these different components to be analysed against common important criteria within a common matrix, thus providing a rapid, clear assessment of the major impacts (Pastakia and Jensen, 1998).

Methodology description has been sourced from Pastakia and Jensen (1998). The approach is based on standard definition of important assessment criteria and collation of partially quantitative values for each of these criteria so as to achieve an accurate and independent score for each of the environmental conditions being assessed. The assessment criteria fall into two groups A and B as described in Table 8 below.

Table 8. Assessment criteria used in RIAM approach

Criteria		Scale	Description
A - Criteria that are of importance to the condition, and which can individually change the score obtained	A1 – importance of condition	4	Important to national/international interests
		3	Important to regional/national interests
		2	Important to areas immediately outside the local condition
		1	Important only to the local condition
		0	No importance
	A2 – Magnitude of change / effect	+3	Major positive benefit
		+2	Significant improvement in status quo
		+1	Improvement in status quo
		0	No change / status quo
		-1	Negative change to status quo

		-2	Significant negative disbenefit or change
		-3	Major disbenefit or change
B - Criteria that are of value to the situation, but individually should not be capable of changing the score obtained.	B1 – Permanence	1	No change / not applicable
		2	Temporary
		3	Permanent
	B2 – Reversibility	1	No change / not applicable
		2	Reversible
		3	Irreversible
	B3 – Cumulative	1	No change / not applicable
		2	Non – cumulative / single
		3	Cumulative / synergistic

The value for each of these criteria is obtained through a series of simple formulae as below:

- $(A1) \times (A2) = AT$
- $(B1) + (B2) + (B3) = BT$
- Environmental score (for any given condition) = $(AT) \times (BT)$

Multiplication of the values of group A ensures that the weight of each score is expressed, while summation of values of group B ensures that the individual value scores cannot influence the overall score, but that the collective importance of all values group (B) are fully considered.

Environmental components to be assessed are identified through the EIA process and in the RIAM approach, these are divided into four categories as below:

- Physical/Chemical (PC): covers all physical and chemical aspects of the environment
- Biological/Ecological (BE): covers all biological aspects of the environment
- Sociological/Cultural (SC): covers all human aspects of the environment, including cultural aspects.
- Economic/Operational (EO): qualitatively to identify the economic consequences of environmental change, both temporary and permanent.

A matrix is then produced for the different components identified for the project set against the different assessment criteria. Criteria scores are then given to each component and the environmental score for each component calculated using the formulas given above.

The scores obtained are then interpreted based on range bands, as given in Table 9. Each range band describes the level of an expected change (positive or negative) and they also represent the final assessment from the RIAM analysis. Once the ES score is set into a range band, these can be shown individually or grouped according to component type and presented in a graphical or numerical form as preferred.

Table 9. Range bands used for RIAM approach, with Environmental scores, criteria number and code

Scoring values (ES)	Range band	Criteria Number	Criteria Colour Band Description
72 to 108	E	5	Major positive change/impact
36 to 71	D	4	Significant positive change/impact
19 to 35	C	3	Moderate positive change/impact
9 to 18	B	2	Positive change/impact
1 to 9	A	1	Minimal positive change/impact
0	N	0	No change/status quo / not applicable
-1 to -9	-A	-1	Slight negative change/impact
-10 to 18	-B	-2	Negative change/impact
-19 to -35	-C	-3	Moderate negative change/impact
-36 to -71	-D	-4	Significant negative change/impact
-72 to -108	-E	-5	Major negative change/impact

Possible impacts arising from the construction and operation works are categorized into physical, biological, socio cultural and economic including operational aspects of the project. Environmental impacts of the project are evaluated against these environmental components. The impacts identified are also described according to their location, extent (magnitude) and characteristics. Positive and negative impacts are categorized by intensity of impacts for identifying best possible remedial (mitigation measures) action to be taken. Below are the impact scale and categories.

6.2 Impact Analysis

The significance of environmental impacts associated with the project (positive and negative) is ranked and colour coded to show the intensity of the impact for each environmental component as listed in Table 9. Impacts are assessed according to probability, significance, magnitude and duration. Tables 10 gives the assessment for the impacts, and these are further discussed in the following sections.

Figure 19 provides a graphic summary of the overall impacts for all the environmental components considered. Negative impacts of the project and their negativity scale was in the low to moderate range (-A to -C) while positive impacts were in the moderate range (B to C). The most significant negative impact was that due to sorting and handling of hazardous waste, while the benefits on the environment and community due to proper waste management was the most significant positive impacts.

Table 10. Outcome of the environmental impacts with reference to environmental components considered. (PC = Physical/Chemical, BE = Biological/Ecological, SC = Social/Cultural and EO = Economic/Operational. Colour codes refers to intensities of impact each component subjected to assess)

Code	Description	RIAM Criteria Scores					Environmental Value Score (ES)	Range Value Band (RB)	Graph Value
		A1	A2	B1	B2	B3			
PC 1	Changes to the ambient air quality (smell) due to waste sorting and processing	1	-1	3	2	2	-7	-A	-1
PC 2	Changes to the ambient noise due to waste sorting and processing	1	-1	3	2	2	-7	-A	-1
PC 3	Air pollution at the project site due to emissions associated with construction machinery and vehicles and dust	2	-1	2	2	2	-12	-B	-2
BE 1	Impact on island environment/soil due to waste handling and processing	1	-1	3	2	2	-7	-A	-1
BE 2	Impact to the groundwater due to use for construction	1	-1	2	2	3	-7	-A	-1
BE 3	Impact to the groundwater due to waste handling and processing	1	-1	3	2	2	-7	-A	-1
BE 4	Impact to the flora (vegetation) due to the land clearing required for the project	1	0	3	2	2	0	N	0
BE 5	Impact to the flora and fauna (animals) due to material transfer	1	-1	3	2	2	-7	-A	-1
SC 1	Health and safety risks to the workers due to construction works	2	-1	2	2	2	-12	-B	-2
SC 2	Health and safety risks to the workers due to operation of waste facility	2	-1	2	2	2	-12	-B	-2
SC 3	Impacts of hazardous waste sorting and storage and disposal to the workers	2	-2	3	2	3	-32	-C	-3
SC 4	Benefits to the community due to improved waste management practice and operation of the facility	2	2	3	2	3	32	+C	3
EO1	Changes to the environment due to improved waste processing	2	1	3	2	2	14	+B	2
EO2	Benefits to the community due to improved waste management practice and operation of the facility	2	2	3	2	3	32	+C	3
EO3	Changes to the ambient air quality (smell) due to waste sorting and processing	1	-1	3	2	2	-7	-A	-1
EO4	Changes to the ambient noise due to waste sorting and processing	1	-1	3	2	2	-7	-A	-1
EO5	Risk to IWRMC workers	1	-1	3	3	3	-9	-A	-1
EO6	Impact on island environment/soil due to waste handling and processing	1	-1	3	2	2	-7	-A	-1
EO7	Impact to the groundwater due to waste handling and processing	1	-1	3	2	2	-7	-A	-1

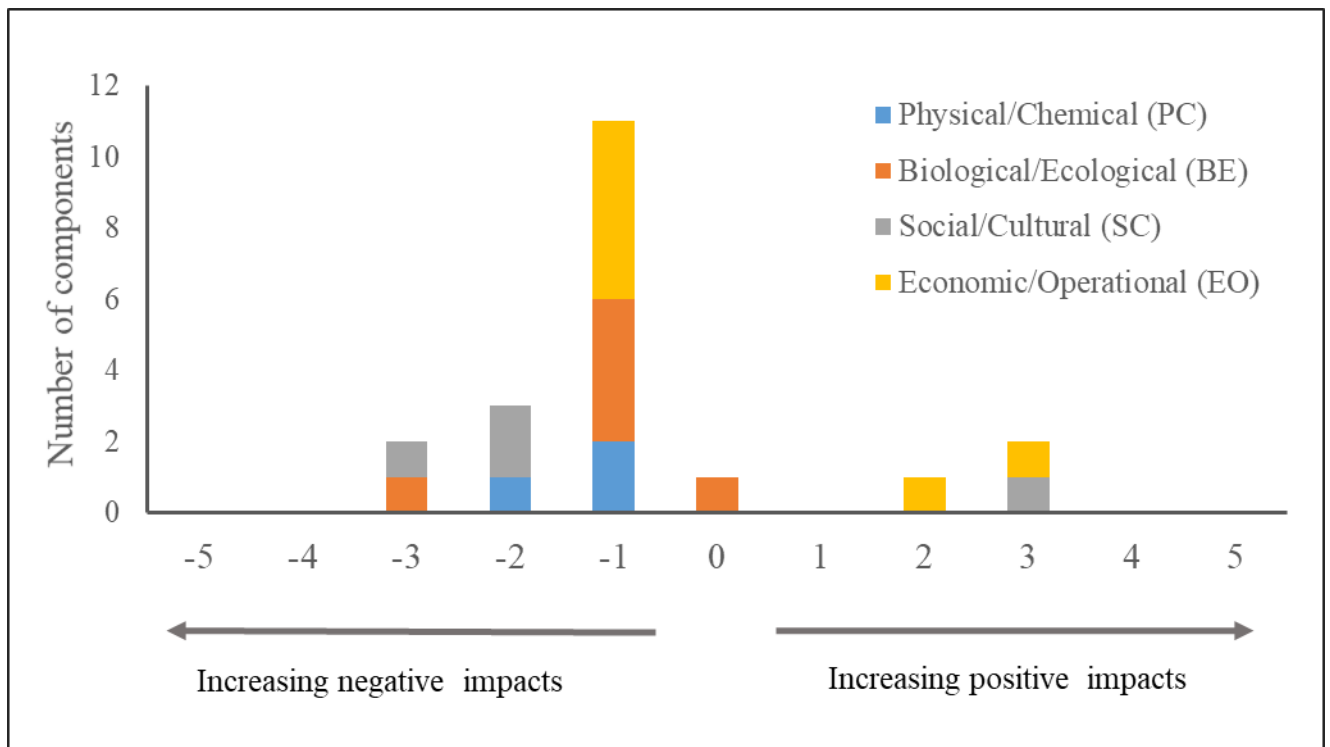


Figure 19. Graphic summary of RIAM analysis for the upgrading of IWRMC at Th. Vandhoo. Y-axis shows the number of components

6.2.1 Construction phase

Impacts on noise pollution and disturbances (PC and SC)

The project site is at a distance of approximately 350m from the nearest residential. While noise impacts during construction work is an unavoidable impact, the work entailed does not require use of much heavy machinery. This coupled with the distance between project site and residential area is hence envisaged to result in negligible impact due to noise during construction phase.

Impacts on groundwater table and quality due to construction work (PC)

Groundwater quality of the island is good (based on test sites). Furthermore, construction phase will utilise groundwater resource for civil works. This would have a localised negative impact on the groundwater resource of the island. This impact is envisaged to be localised, and for the short term.

Impacts on ground vibrations to nearby houses and buildings (PC)

The nearest residential area is approximately 325m from project site. Furthermore, the scope of work and construction required is not envisaged to have any disturbances in terms of ground vibrations as no heavy machinery or vehicles will be used.

Impacts on air quality (PC)

The construction work requires civil works, with main machinery used being a cement mixing machine. The construction work is envisaged to have a negative impact on the air quality at the site, due to generation of dust. This will be a short-term impact, which would clear up after construction work is completed.

Impacts due to material spillage during transfer of construction materials to the project island (PC and BE)

Construction material will be carried to site on barges and bigger vessels. There is always the chance of pollution of the marine environment during mobilization and material unloading. However, given that the materials will be packaged with no loose items, this impact is envisaged to be minor to negligible. However, any oil spills during such trips has the potential to have a significant negative impact both on the physical (seawater quality, reef health) and biological aspects (marine fauna and flora) of the marine environment.

Impact due to vegetation removal (PC and BE)

The proposed work does not require any vegetation clearance and hence this is not applicable to current project.

Impacts to vegetation and fauna due to improper handling and driving during material transportation (PC and BE)

Material transportation during construction phase will be from the harbour to the project site, though the access road to this has also already been cleared. Hence, while impacts due to transport of material is envisaged to be negligible, that due to handling of materials and potential accidents, if it happens, is envisaged to be minor to moderate, depending on the material being handled. Pollution due to accidental spill of construction materials to be used (due to improper handling), especially oil will have a significant negative impact on the environment at the site (on groundwater resource and fauna).

Impacts due to arrival of workforce (SC)

The proposed work will be carried out by an assigned contractor who have their own workforce. Majority of development projects are carried out in the same manner and arrival of workforce on the island to carry out construction work would not be a new aspect for the island community. The Contractor has the responsibility to ensure that the workforce is comprised of all legal personnel and that their actions while on the island are within accepted social norms. The Contractor also has the responsibility to ensure that the workforce also have the required needs met, such as proper

accommodation and daily meals as well as other logistics. This component of the project is not envisaged to have a significant impact on the social environment of the island.

Health and safety of workforce (SC)

The Contractor has the responsibility to ensure the health and safety of the workforce which will be taken to the island. As such the Contractor must ensure that their accommodation and meals while on the island are taken care of regularly. Accommodation in cramped quarters, especially during the COVID 19 pandemic has the potential to have a significant negative impact on the health and safety of the workforce and even the community. First aid kits available on site will ensure that any minor injuries are easily taken care of without delay.

Impacts due to road closure (SC)

Proposed work will be carried out a site located 325m from residential area and on the uninhabited side of the island. Hence any road closure (if required) is not envisaged to have an impact on the day-to-day life of the island community.

Impact due to loss of land (SC)

The site proposed for the work has been allocated for the construction of the waste management centre and approved by MLSA for this purpose in 2017. Construction work has already commenced at the site through a previous contract. The proposed work does not require new land area and hence no additional impact is envisaged in this aspect. Additionally, the island of Vandhoo has available land area, even with this land allocation.

6.2.2 Operational phase

Impacts on noise pollution and disturbances (PC and EO)

The operations of the IWRMC and the technology to be used for composting is not envisaged to have a significant impact in terms of noise pollution. Furthermore, operation of the facility would alleviate existing other disturbances such as that due to open burning currently practiced on the island.

Impacts due to litter, odour and vectors (PC, SC and EO)

The collected waste which is transferred to the IWRMC should be unloaded and stored in the appropriate areas. Improper handling of waste at this stage has the potential to increase the severity of impact due to litter, odour and vectors.

Impacts on groundwater table and quality due to operations (leachate/ stormwater runoff) (PC and EO)

The IWRMC has been designed with provisions in place for drainage of wastewater and any leachate which maybe generated. One of the advantages of the proposed composting technology is that it overcome leachate generation. Hence, even if leachate is generated this would be in minor quantities, mostly due to cleaning of the floors, where the product would be mixed with any leachate generated during composting. The centre also has rainwater pits installed throughout the open area of the IWRMC to deal with potential storm water produced during rainy seasons. Hence no impacts are envisaged on the groundwater quality due to operations at the centre.

Impacts due to material spillage during transfer (PC, BE and EO)

Waste materials will be collected from households and transferred to the centre by staff hired to the centre. They will undergo all necessary training to ensure that the operations are carried out as per all operation guidelines. However, accidental spills during material transfer to site is a potential impact, with significance of impact dependent on the type of material spilled.

Health and safety of the IWRMC operators (SC and EO)

The workforce hired for IWRMC operations will be given all necessary trainings and provided with all required safety equipment and attire. First aid kits will also be available on site to handle any minor injuries. Impact on health and safety during general operations is envisaged to be minor to moderate (if proper care is not taken), especially since the technology to be used at the site is quite environmentally friendly.

However, in the event whereby hazardous waste is brought to the facility to be stored for transfer to the RWMF, handling of this waste has the potential to be a great risk to the IWRMC workers.

Economic impacts due to the IWRMC (SC and EO)

Development of the IWRMC opens employment opportunities for the island community, to be involved in different stages of implementation of the work Island Waste Management Plan. Hence this is a major social benefit due to the centre, which would be for the long term. Additionally, the compost generated through the project is a potential source of income through sale of the product. At present, waste disposal on the island is by the community themselves, hence at no cost. Once the facility becomes operational, waste collection and disposal will be carried out through the staff of IWRMC at a cost.

Island community health (SC and EO)

The setup of the IWRMC would enable proper and safe disposal of the waste generated by the island community. This has a multitude of benefits key of which are improved health of the community and improved aesthetics. The operation of the facility would bring a cessation to the practice of open dumping and burning. Hence the project is envisaged to have a major socioeconomic benefit.

Impacts associated with proposed technology

The proposed composting technology is quite simple and requires very little manpower. The composting of the materials happens inside the machine, thus addressing the issue of odours generated during composting periods. The raw compost is kept in crates on curing racks, which are also setup within the area constructed for the composting work. The dry compost at the end of the curing period can be sold to the agricultural market or even to nearby resorts for their gardening/landscaping purposes, thus being a beneficial impact.

The in-vessel composting method also overcomes the issue of leachate generation, hence minimising the need for construction of additional leachate collection tanks. The design of the structure incorporates drains which will provide the necessary means for removal of any leachate generated.

The IWRMC will be connected to the existing power grid of the island which can cater to the additional load. Hence there is no need for setup of a separate power generator at the site. While one impact due to the sourcing of power is the generation of greenhouse gases through burning of fuel, this is an existing impact due to operation of the powerhouse. The additional load due to connection of IWRMC to the power grid is not envisaged to be of significance.

Overall, the proposed technology is not envisaged to have significant negative impacts on the environment. Moreover, it is envisaged to have major positive impacts due to proper waste disposal.

7 Alternatives

Alternatives for a project are considered for various components of the project, in terms of location, methodology to be implemented etc. Alternatives considered will identify the best practical environmental option for the different components.

Location for the proposed work have already been approved by respective government authorities and construction work had already been commenced at the site after environmental clearance was given for the initial EMP. Furthermore, there are no negative impacts on environment with regards to the choice of location, hence an alternative location will not be considered in this plan.

7.1 Considered alternatives

Waste treatment method / technology

The feasibility report for the project considers different types of waste treatment methods and their advantages and disadvantages (CITRES and MEECO, 2019). The recommended method for organic waste treatment, based on rationales given in the feasibility report is in-vessel composting based on the current waste quantity produced on the island and its projections for 2050. Alternatives considered in this report are:

- Proposed method: In-vessel composting
- Alternative 1: Windrow-based open composting
- Alternative 2: Anaerobic digestion

The environmental, social and economic aspects of In-vessel composting (proposed option) are;

- Small land area required for setup (environmental)
- Overcomes the problem of leachate containment (environmental)
- Burning of waste is not required (environmental)
- Moderate energy is required for operation (environmental)
- Low labour requirement (social)
- Compost can be prepared in a short time frame (15 to 30 minute cycles in OWC machine and 10 to 12 days for curing) (social/environmental)
- Minimal odour associated with processing of waste (social/environmental)
- Highly dependent on mechanical equipment (economic)
- High capital cost (economic)
- Moderate operations and maintenance cost (economic)
- Economic turnover is very high due to fast process (economic)

Appendix 6 gives a matrix of the environmental, economic and social aspects of these three different methods of waste treatment (Table 1 in Appendix 6). The Appendix also gives mitigation measures for each of the alternatives (Table 2 in Appendix 6).

Although the capital cost of using the in-vessel composting method is slightly higher than that for windrow-based composting, all other aspects are positive for the in-vessel composting method (see Appendix 6). Land area requirement being small is a big benefit for small islands of Maldives such as in Vandhoo. In addition to this, controlled leachate and odour generation as well as the absence of burning greatly reduces the negative impacts due to the method, both on the natural environment and community. Low labour requirement is another advantage.

Anaerobic digestion means a higher capital cost, greater land requirement and higher operation and maintenance costs, while use of windrows-based composting also means greater land area and higher labour requirement. The piles have to be turned manually every 5 days and usually takes longer to process (2 to 4 months for final product). Additionally, given that this is undertaken in an open area, this will inevitably attract vectors such as flies and rats and other pests.

Given these benefits of the in-vessel composting method, with the higher capital cost than that for windrows-based composting, and lesser capital costs than Anaerobic digestion option considered, the proposed method of in-vessel composting as proposed in the feasibility study (CITRES and MEECO, 2019) is considered as the most feasible option for organic waste management in this project for upgrading waste management at Vandhoo.

Power supply and energy source

A second component for which an alternative can be considered is the energy source to be used for power generation and operation of the IWRMC.

- Proposed method: power to be sourced from existing grid at the island
- Alternative 1: installation of solar panels
- Alternative 2: installing a generator in the IWRMC specific for each operation.

The proposed method of sourcing power for the IWRMC is through connection to the existing power grid of the island. Total power requirement for the project is 42kW and the existing capacity of the island power facility is 480kW, with average load of 120kW. While use of fuel as energy source at the power facility is a negative impact on the environment, the additional load is not expected to increase the significance of this impact by a great extent. The capital cost is low though, and an operations and maintenance cost will be incurred due to monthly bills. The absence of fuel handling however greatly lowers the risk of environmental pollution due to accidental spills and fire hazards at the centre.

An alternative and more environmentally friendly method is to install solar panels on the roofed areas of the IWRMC so as to generate the required electricity for operation of the centre. However, this would increase the financial cost of the proposed project, as this would incur a high capital cost, although in the long term has the potential to be financially more feasible, due to minimal operations and maintenance cost. Furthermore, the roof areas of the centre can be used, as there is no open burning or incineration at the centre. Other benefits include the avoidance of pollution of groundwater and other environmental components due to accidental spills, nullification of emissions of greenhouse gases due to fuel burning for IWRMC operations and reduced risk on workforce due to use of flammable liquids.

A second alternative option is to install a generator at the IWRMC, specifically for use of the centre and its operations. This option would greatly increase the negative impact due to the project, through contribution of burning of fuel for the operations. Furthermore, additional land area would be required for the installation of the generator and set up of a small power facility within the IWRMC. This space, could however be put to better use. Set up of a power facility would also increase the scope and cost of the project.

While the installation of a solar panel to source power is seen to be most environmentally feasible option of the three options considered, this is an unaccounted high capital cost at present, which is not financially feasible. Hence the proposed option for sourcing electricity to the waste management facility is considered to be feasible as it simply requires establishing a connection to an existing power facility. The Consultant however, strongly urges the installation of renewable energy sources at IWRMC, through a separate project.

Mitigation measures for the alternative energy sources are also given in Appendix 6 (Table 3).

8 Mitigation Plan

Environmental impacts that are associated with the project, both during construction and operational phase and which have been identified as significant impacts are discussed in this chapter. These are discussed in the context of various components of the project; evaluation of baseline environmental conditions at the project impact area and vicinity; concerns raised by the stakeholders through consultations and review of the literature of similar projects and experience of the EIA Consultant.

There are a number of actions that can be taken to minimize or avoid impacts altogether. Mitigation measures are selected to reduce or minimise the severity of any predicted adverse environmental effect and improve the overall environmental performance and acceptability (lower environmental damage) of the project from the perspective of construction and operation.

Mitigation measures are discussed for the construction and operational phase of the project with respect to various components and their likely impacts on physical, biological (within the project area), and social and economic environment (health, culture and economy). Impacts due to the project based on the assessment principles followed are foreseen as low to moderately negative to moderately positive. In order to further minimise potential negative impacts, mitigation measures have been discussed below (Table 11). Translation of the proposed ESMP in Dhivehi is given in Appendix 7 of this report.

Table 11. Mitigation measures proposed for the project (ESMP matrix)

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
Detailed design and Planning Phase	Improper functioning of the waste management facility and associated environmental impacts due to improper design	<ul style="list-style-type: none"> Ensure detailed design takes into account details of the proposed layouts and all designs are as per specifications required, taking into account the environmental components that may be affected. 	Proponent	NA	NA	
	Noise pollution	<ul style="list-style-type: none"> Ensure that the site selection sets a minimum distance of 60m from residential and public areas 	Island council MLSA Proponent	NA	NA	Already approved site
	Coastal erosion due to the proximity of the facility to the shoreline	<ul style="list-style-type: none"> Vegetation buffer of 20m maintained between IWRMC boundary extent and high tideline. 	Island council MLSA Proponent	NA	NA	
Pre-construction Phase	Impact on marine and terrestrial environment during handling and transport of construction materials	<ul style="list-style-type: none"> Ensure all materials being transferred are packed properly with no loose materials Monitor oil spills and maintain machinery 	Contractor (implementation) Proponent (supervision)	N/A	N/A	

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
	Impact on environment due to improper storage	<ul style="list-style-type: none"> Storage areas for construction materials should have an impermeable surface and should be covered Materials should be stored in appropriate containers Area should be regularly monitored for any leaks Storage facility should be setup within project site to minimize vehicle movements 	Contractor (implementation) Proponent (supervision)	N/A	N/A	
	Impact on flora, fauna and groundwater due to handling of construction related materials and equipment	<ul style="list-style-type: none"> Ensure workforce are trained and supervised to handle materials during transfer, and unloading so as to minimize accidental spills, littering etc. Ensure materials are properly packed and any oil/fuel is properly stored in containers used for that purpose 	Contractor (implementation) Proponent (supervision)	N/A	N/A	Pre-construction – site preparation phase
	Sociocultural impact due to arrival of workforce	<ul style="list-style-type: none"> Workforce should be sensitized to the social norms and acceptable behaviour of the Maldivian culture. Workforce should be fully aware of the Do's and Don'ts of the Maldivian culture. 	Contractor (implementation) Proponent (supervision)	Grievance Redress Mechanism given Section 9.4 to be enforced.		Council / MCEP PMU staff to be assigned as focal points hence no additional cost

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		<ul style="list-style-type: none"> Establish Grievance Redress mechanism given in the report. Information displaying contact details of the focal points (Tier 1 and Tier 2) should be displayed on the project board, council notice board and via posters displayed in public areas. QR code for downloading the forms and information on GRM should be given in each of the media used. 				for implementation of GRM
Construction Phase	Noise pollution	<ul style="list-style-type: none"> Operate machinery during day time hours (6am to 6pm) 	Contractor (implementation) Proponent (supervision)	N/A	N/A	
	Air pollution / Dust	<ul style="list-style-type: none"> Regularly maintain machinery so as to reduce emissions. Provide workers with masks and other required gear Regular watering of site to minimize dust (after work every day) 	Contractor (implementation) Proponent (supervision)	As per operational manual of machinery	N/A	Should be included in the construction contract
	Impact on groundwater table and groundwater quality	<ul style="list-style-type: none"> Extract only quantity of water required for the civil works. 	Contractor (implementation) Proponent (supervision)	N/A	N/A	

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
	Impact on health and safety of workforce	<p>Operational Health and Safety measures</p> <ul style="list-style-type: none"> • Ensure workers are well briefed on the health and safety measures to be followed during the project • Ensure work force are given all the appropriate safety equipment and gear required for the work (safety hats, boots, glasses, masks and gloves) • Display PPE requirement board at site which should the PPE required by the workers when carrying out different tasks of the construction work • Ensure set up of easy access toilets, wash basins at the site. either through rental from nearby area or installation of a portable toilet. • Provision of regular meal breaks and an onsite resting area for the workers, where they can rest during the breaks 	Contractor / Island Council (implementation) Proponent (supervision)	Contractor to provide Health and Safety Plan	N/A	Should be included in the construction contract

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		<ul style="list-style-type: none"> • Ensure provision of first aid kit on site ensure readily available transfer in instances of emergency use • Ensure workforce are accommodated in appropriate quarters where they are not cramped. • All staff handling hazardous waste should be given the proper protective gear (protective eye gear, protective gloves) <p>COVID 19 related preventative measures</p> <ul style="list-style-type: none"> • Ensure that there is set number of workers in each room so as to allow social distancing • Ensure that workforce follows all HPA guidelines at all times, with respect to COVID 19 pandemic. • Measures should be in place to undertake daily temperature checks of workforce and enable social 				

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		distancing at the accommodation facilities and work site.				
	Impact on public health and safety	<ul style="list-style-type: none"> Clearly demarcate project area Ensure public does not have access to the project site and appropriate signs are put up at the required areas <p>Establish Grievance Redress mechanism given in the report. Information displaying contact details of the focal points (Tier 1 and Tier 2) should be displayed on the project board, council notice board and via posters displayed in public areas. QR code for downloading the forms and information on GRM should be given in each of the media used.</p>	Contractor (implementation) Island Council	N/A	N/A	Should be included in the project cost
	Fire safety	<ul style="list-style-type: none"> Ensure connections to power facility are established by trained and competent personnel 	Contractor (implementation) Island Council	Firefighting equipment should be included as part of equipment inventory of IWRMC	Should be included in the project cost	

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		<ul style="list-style-type: none"> • Ensure construction workforce are trained in firefighting so as to address any fire hazards promptly • A portable fire extinguisher should be used at the site. • Installation of a fire hydrant / water point at site 				
	Waste Management During Construction Phase	<ul style="list-style-type: none"> • 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. • Green waste to be sundried and left at the forest area for natural decomposition. • Any remaining construction waste shall be temporarily stored and taken out of the island to a RWMF at the time of demobilizing. 	Contractor / Island Council (implementation) Proponent (supervision)	N/A	N/A	Should be included in the project cost

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		<ul style="list-style-type: none"> • Hazardous waste generated should be collected and stored in sealed containers • Area where hazardous waste is stored should have an impermeable surface (such as concrete layer, metal sheet) and should be clearly marked with warning signs 				
Operation and maintenance phase	Impacts due to waste spillage during transfer of waste from households to the centre	<ul style="list-style-type: none"> • Identify correct way in which waste should be left for collection (properly closed bags with no leakage) • Ensure transport vessel carrying the waste carries only a set load • Vessels should be enclosed on all sides to prevent spills • Setup of appropriate bins at identified locations • Provision of proper and complete training to IWRMC operators (in all aspects of operations) • Provision of all required PPE to the staff of IWRMC 	Waste Facility Operator Island Council	Operational plan should be prepared and IWRMC should be registered and licensed by EPA as per Waste Management Regulation.	N/A	Should be included in the project cost

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		<ul style="list-style-type: none"> • 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. • Noise protection gear such as ear muffs should be provided to all workers operating or working within vicinity of loud equipment • Provision of hard hats for workers operating or working within vicinity of heavy mobile equipment, and at the discharge location for collection trucks, include provision of hard hats 				
	Impacts due to machine malfunction	<ul style="list-style-type: none"> • Provision of proper and complete training to IWRMC operators (in all aspects of operations and machine maintenance) 	Waste Facility Operator Island Council	N/A	N/A	Should be included in project cost

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		<ul style="list-style-type: none"> Undertake routine maintenance of machinery as per the manual 1 year stock of bioculum and other spare parts that might be required for the routine functioning of the OWC machine should always be maintained. 				
	Impact on groundwater resource due to leachate and wastewater processing	<ul style="list-style-type: none"> Ensure drains are cleaned regularly to prevent clogs Organic waste brought to the IWRMC must be prepared for composting / composted on a regular schedule 	Waste Facility Operator Island Council	Associated with operation	Associated with operation	
	Litter, odour and vectors	<ul style="list-style-type: none"> Sort waste brought to IWRMC and compost organic waste regularly. Store inorganic waste and other bulk waste in their allocated storage areas Undertake volume reduction via glass crushing, metal can baling, plastic shredding, wood chipping etc. 	Waste Facility Operator Island Council		N/A	Should be included in project cost

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		<ul style="list-style-type: none"> Arrange regular disposal of inorganic waste through transportation to the RWMF 				
	Socio-cultural conflicts	<ul style="list-style-type: none"> Hiring of locals (especially from within the island community) to operate and manage the IWRMC and implement the Island Waste Management Plan Establish the Grievance Redress Mechanism given in this report. Information displaying contact details of the focal points (Tier 1 and Tier 2) should be displayed on the project board, council notice board and via posters displayed in public areas. QR code for downloading the forms and information on GRM should be given in each of the media used. 	Waste Facility Operator Island Council	Costs associated with the contract	Not known	Should be included in project cost
	Workplace safety	<ul style="list-style-type: none"> Set up of all required sign boards as per the Waste Management regulation Ensure all firefighting equipment required for the 	Waste Facility Operator Island Council	Fire safety equipment to be supplied and installed as part of the contract: <ul style="list-style-type: none"> 50KG DCP Trolley (2) 	N/A	Should be include in project cost

Project activity	Potential Environmental impacts	Proposed mitigation measures	Institutional responsibility (implementation and supervision)	Estimated quantities required and material specifications recommended	Cost estimates	Comments
		<p>facility are in place and in good condition</p>		<ul style="list-style-type: none"> • 50LTR Foam Trolley (1) • Wet Chemical 6Ltr with Cabinet for hazardous waste area (1) • Water 9Ltr with Cabinet for Office Area – Outside (1) • CO2 2KG with Cabinet for Office Area – Outside (1) 		
	Impact on resources	<ul style="list-style-type: none"> • Prepare a plan to switch on the compactors and shredders depending on the incoming waste stream to conserve electricity. • Ensure that all equipment is serviced and kept clean daily, to reduce the amount of water required for cleaning. • Work shall be planned to be carried out during day times. • Use solar lights in the premises. 	Waste Facility Operator Island Council	N/A	N/A	Should be included in project cost

9 Environmental Management and Monitoring Plan

Monitoring is the systematic collection of information over a long period of time. It involves the measuring and recording of environmental variables associated with the development impacts. Monitoring is needed to:-

- Compare predicted and actual impacts;
- Test the efficiency of mitigation measures;
- Obtain information about responses of receptors to impacts;
- Enforce conditions and standards associated with approvals;
- Prevent environmental problems resulting from inaccurate predictions;
- Minimize errors in future assessments and impact predictions;
- Make future assessments more efficient;
- Provide ongoing management information; and
- Improve EIA and monitoring process.

Impact and mitigation monitoring are carried out to compare predicted and actual impacts occurring from project activities to determine the efficiency of mitigation measures. This type of monitoring is targeted at assessing human impacts on the natural environment. Impact monitoring is supported by an expectation that at some level anthropogenic impacts become unacceptable and action will be taken to either prevent further impacts or re-mediate affected systems.

Table 12 shows the monitoring work to be carried out for the construction and operational phase of the project. Commitment to carrying out and financing the mitigation and monitoring work is given in the proponent's declaration at the beginning of the report.

Table 12. Monitoring programme for the project

Proposed mitigation measure	Parameters to be monitored	Location	Measurements	Frequency of monitoring	Responsibility	Cost (MRF)
Pre-construction phase						
Monitor oil spills	Spill events	Sea/land	Logs of spill events	After every event	Contractor	N/A
Construction phase						
Groundwater quality	Temperature, Conductivity, pH, Total Dissolved Solids and Nitrate	Project site and control site	Water samples tested in-situ using probe or sent to competent laboratory if necessary	Twice during construction phase	Contractor	4,000.00

Workforce health and safety	Daily temperature checks General health and wellbeing of workforce	Project site	Logs of any illness amongst workforce	Daily	Contractor	Part of the contract
Operational phase						
Monitor spills during the waste collection and disposal process	Spill assessments during collection, transfer, with IWRMC and transfer to RWMF Littering around the island	IWRMC site and transport route Around the island	Logs of spills and type Logs of littering incidents (date, location and type of waste)	Spill logs after every incident Littering monitoring every 3 months	IWRMC operator / Island Council	Part of operational cost
Monitor IWRMC operations	Waste generated and disposed quantities	IWRMC	Daily logs of waste generated Composting logs with details of input/output quantities Logs of disposal of inorganic waste	Daily / for every incidence of disposal of inorganic waste	IWRMC operator / Island Council	Part of operational cost
Groundwater quality	Temperature, Conductivity, pH, Total Dissolved Solids and Nitrate	Project site and control site	Water samples tested in-situ using probe or sent to competent laboratory if necessary	Once every 6 months	IWRMC operator / Island Council	4,000.00 (per year)
Grievance redress mechanism	Monitor grievances by the community or other personnel	Whole island	Log of grievances filed and how these were handled	Continuous process	Island Council / MCEP	Included in operational cost

9.1 Reporting Procedures and Implementation Schedule

The reporting procedures and schedule for the various monitoring components are given in Table 13 below.

Table 13. Reporting schedule for the monitoring programme

Phase	Deliverables	Responsibility	Accountability
Construction phase	Monitoring report (as per format provide by MCEP Safeguards Specialist) submitted every 3 months or earlier based on date of invoice submission by the Contractor which should include the following: <ul style="list-style-type: none"> • Log of spill events during material transfer • Groundwater quality monitoring reports 	Contractor	MCEP
Operational phase	Monitoring report submitted once a year (as per format provide by MCEP Safeguards Specialist) which should include the following: <ul style="list-style-type: none"> • Logs of spill / littering assessments • Waste quantification logs • Compost quantification logs • Groundwater quality monitoring reports • Outcomes of grievances filed 	IWMRC Operator / Island Council	MCEP

9.2 Cost Estimates and Sources of Funds

The cost estimates for the different mitigation measures and monitoring work are given in Tables 11 and 12 respectively. The Tables also identify the personnel responsible for the implementation of these measures, who will also be responsible for funding these components.

9.3 Contract Clauses

Contractual clauses have been identified to ensure that the full implementation of the ESMP which is a requirement of both the World Bank and EPA is carried out during the construction phase of the project. Operation of the facility will be handed over to the Island Council. The Consultant recommends incorporation of the following clauses into the agreement signed with the construction contractor for the project:

1. Contractor should submit a report inclusive of photographic evidence of implementation of mitigation measures such as set up of sign boards, provision of safety gear to workforce at the start of construction
2. Payment invoices must be accompanied with progress reports, which give the following details:
 - Work completed to date of invoice

- Delays faced and reasons for delay
 - Mitigation measures implemented during the time period
 - Environmental impacts observed during the work period and measures taken to correct these impacts
3. Monitoring reports should be submitted in the format required by MCEP, as per the schedule identified in this ESMP. Employer has the right to withhold payment if reports are not submitted as per schedule and in required format
 4. The Employer or the Contractor have the right to terminate the contract, if either party is in violation of any part of the contract. Termination in such instances will be effective immediately from the date of termination.

9.4 Grievance redress mechanism

The Maldives Clean Environment Project has formulated a Grievance Redress Mechanism (GRM) for these projects, which would facilitate the receiving and addressing of any grievances which may arise during both the construction and operational phase of the project. The mechanism has two tiers, whereby Tier 1 will be facilitated by the Island Council and Tier 2 by the MCEP.

The Island Council were briefed about the mechanism during the stakeholder consultation meeting held with them regarding the project and operations of the IWRMC. The Council have also been requested to identify a focal point for managing the GRM at Tier 1. Details of focal point identified by the Council are:

- Name: Ibrahim Nahidh
 - Designation: Assistant Project Officer
 - Contact number: 7455757

Tier 2 will be managed by the MCEP, with the Environmental and Social Safeguards Specialist as the focal point.

Table 14 below gives the details of the GRM formulated by MCEP.

Table 14. Grievance Redress Mechanism for the project, formulated by the PMU

Tiers 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	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, ME (and/or the project), including contact details of the nodal person in each tier.	15 working days

	<p>council will manage grievances on behalf of the council.</p>	<p>Grievances can be addressed informally by contacting the council through email / telephone / in person.</p> <p>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.</p> <p>Electronic version of the complaint form should be available from the websites and/or social media pages of ME and the council. Physical copies of the form should be available from the council front office.</p> <p>Council will provide assistance to fill the form for those who cannot write.</p> <p>The council should keep separate registries for informal and formal complaints and maintain records of all complaints received.</p> <p>The council will discuss the matter with all relevant stakeholders (Farmers, Fishermen, School, Health Center, Women’s group 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.</p> <p>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</p>	
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		<p>within this period, then the decision will be considered as accepted.</p> <p>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.</p> <p>The staff designated as the waste management focal point by the island council will manage and provide feedback for grievances submitted to the council.</p>	
Second Tier: Ministry of Environment (ME)	Environmental and Social Safeguards officer at the Project Management Unit (PMU)	<p>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.</p> <p>A copy of the form (with ME 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 ME and the council. Physical copies of the form should be available from the council and ME front office.</p> <p>A copy of the Tier 1 Complaint Form should be submitted with the Tier 2 Complaint Form.</p> <p>ME will forward the grievance to PMU.</p> <p>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.</p> <p>Environment and Social Safeguards Officer at the PMU will be the</p>	15 working days

		<p>contact person in processing a grievance through the Second Tier.</p> <p>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.</p> <p>The PMU will be responsible to ensure that there is no cost imposed on the aggrieved person, due to the grievance mechanism at the second tier.</p> <p>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.</p> <p>If a complaint requires more time to address, this requirement must be communicated to the aggrieved party in writing and the aggrieved party must consent and sign-off the request for the extension to take effect. An extension can be made to an additional 15 working days. If the grievance is not resolved to the satisfaction of the aggrieved party within 15 working days of submission of the grievance to tier 2 then the aggrieved party may notify the ME, in writing, of the intention to move to tier 3.</p>	
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<p>Third Tier: Judiciary Power / Assistance to Vulnerable Persons beyond the Project's Grievance Redress Mechanism</p>	<p>Judiciary system is an option for an aggrieved person and/or community in case that the other tiers have not been effective</p>	<p>The legal system is accessible to all aggrieved persons.</p> <p>Assistance from the PMU of MCEP is available only for vulnerable person(s)* as per this grievance mechanism.</p> <p>In cases where vulnerable person(s) are unable to access the legal system, the Attorney General's office will provide legal support to the vulnerable person(s). The PMU must assist the vulnerable person(s) in getting this support from Attorney General's Office. PMU must also ensure that there is no cost imposed on the aggrieved person if the person belongs to the vulnerable groups. The list of vulnerable groups is as defined in the footnote but may be further defined by MEE.</p> <p>The verdict of the Courts will be final.</p>	<p>As per established Judicial Procedure</p>
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*Vulnerable person(s): A vulnerable person(s) for the purpose of this project is a person who is poor, physically or mentally disabled/handicapped, destitute, disadvantaged for ethnic or social reasons, an orphan, a widow, a person above sixty years of age, or a woman heading a household.

10 Training recommendations

During consultations meetings with the Island Council, it was identified that operations of the IWRMC can only be effectively and fully implemented with training of the staff involved in the operations. As a result of this, the ESMP identifies areas where training is required and who the training is targeted for and this is given in Table 15. Consultant would like to note that given that training needs for most of these IWRMC projects would be very similar, some details of the training programme have been sourced from ESMP carried out for upgrading of IWMC in N. Holhudhoo (Zuhair, 2019).

Table 15. Training requirements for the implementation of the ESMP

Training activity	Participants	Type of training and content	Responsibility	Scheduling	Cost estimates
Strengthening the capacity of the contractor on ESMP implementation and reporting.	PMU personnel and Contractor	Brief of the ESMP and monitoring requirements Data to be collected and how to be presented (Format of monitoring report)	PMU / Environmental and Social Safeguards Specialist	Kick off meeting	N/A
Strengthening PMU's capacity on compliance monitoring	All PMU staff involved in the work	Familiarisation with monitoring requirements and monitoring report template	Environmental and Social Safeguards Specialist	Construction phase	N/A
General awareness on health, safety and environment	Construction workforce	Introduction to the health and safety precautionary measures to be implemented (site safety rules / PPE / emergency response) Training in environmentally friendly ways of carrying out construction work with minimal littering	Site Supervisor / Contractor	Pre-construction phase Construction phase	N/A

		Training in following COVID 19 guidelines at workplace and accommodation.			
Community Mobilization	Waste Management Committee	<p>Introduction (Refresher) to the Waste Management Regulation, Policy and Guidelines</p> <p>Introduction (Refresher) to the Island Waste Management Plan and Waste Management Committee</p> <p>Training in ways to segregate waste at household level</p> <p>Training in marketing of compost product</p>	Communication Specialist of MCEP	Pre-construction phase	<p>Travel cost of facilitators</p> <p>Designing and printing of training materials and workshop costs</p>
Operation and Maintenance training of the OWC machine and curing system	IWMRC staff	<p>Introduction to compost preparation using organic waste</p> <p>Step by step guidance on mechanical composting using aerobic systems</p> <p>Step by step guidance to use of the organic waste converter machine</p>	<p>Zone-5 Project Coordinator of MCEP</p> <p>WMPCD</p> <p>Island Council</p> <p>Communications Specialist of MCEP</p>	Prior to commencement of operations	<p>Travel cost of trainer</p> <p>Developing and printing of Training Manual</p>

Fire safety training and fire drills.	IWRMC staff	Introduction to potential hazard scenarios and fire safety Training in use of fire safety equipment on the site Emergency response and evacuation plan and drill	PMU/ MCEP MNDF	Prior to commencement of operations	Travel cost of trainer Developing and printing of Training Manual
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11 Contingency plans

The following contingency plan is proposed in case that the project planning, construction and operation as scheduled have not been met due to unforeseen circumstances such as failure to meet specific performance criteria established by law or necessary for the project to meet its commitments in the ESMP and including responses to natural and other risks identified and mitigated in the ESMP. The project related risks and mitigation measures addressed in the report are mainly environmental and socio economic. The significance of environmental and other impacts identified through RIAM are low negative and failure to or deviation from the proposed mitigation measure will not significantly affect the outcome of the project from impact on natural environment and in the worst-case scenario the island waste management system defaults to current status quo. Nevertheless, the following sections highlights proposed measures in the event the upgraded facility and its operations are interrupted.

11.1 Natural Disasters

Natural disaster such as earthquakes are rare in the Maldives. However, the risk of flooding associated with extreme weather such as storm surges and heavy rain is notable. Climate change risks such as sea level rise is projected as long term and such future risks are high with respect to the low elevation of islands in the Maldives.

This ESMP has not addressed potential risks to the project with respect to project design. It appears, from the limited information made available with regard to architectural design of the layout of the facility from the proponent, that the design has not included project sea level risk mitigation factor into the design, somewhat considered for critical infrastructures as general policy (legally not required by law or regulation as yet). That been said, it is challenging to identify what becomes a critical infrastructure or not as any infrastructure (public or private) are equally vulnerable to flooding.

Locally applicable regulation such as EIA regulation requires for all development project to ensure that a minimum 20m vegetation buffer be maintained. The location of this project conforms to that requirement. Additionally, it may be important to review the design of the facility to assess whether the design has considered climate proofing (e.g. flooding risks) as part of the design. If not, identify potential costs involved for such design so that future projects of similar nature consider such cost if they are feasible or important as part of national sustainable development strategy.

11.2 Disruptions to operation of the facility

Few aspects may be associated with potential destruction to the operation of the facility. These include;

- Breakdown of the machinery
- Components required for optimal processing of organic waste not available
- Staff not appropriately trained to operate the machinery

Breakdown of the machinery is often associated with lack of routine maintenance services that are required for any machinery. Hence the facility operator should ensure that adequate supply of materials are stocked at site so that any minor breakdown or disruption to the operation of the machinery is immediately or quickly addressed. Required routine services to the machinery or other equipment or vehicle should be followed according to the operation manuals and guidelines. The facility or operation supervisor shall ensure such protocols are maintained through proper logs and documentations.

Interruption to the operations of vehicles and machinery is also associated with lack of or inadequate training provided to the machinery operators. Adequate training provided to the operators of the machinery or equipment is thus essential. Hired staff shall be based on optimal technical qualifications. If technical qualification are not available due to local human resources capacity that project shall include training to the staff hired prior to the facility become operational.

In case of interruption to the operation of the facility, place for storage of the unprocessed waste at the site should be established by an agreed SOPs established as part of the operation of the facility, between stakeholders of the project. Such shall be agreed by;

- Formulation of agreements with the facility operator, island council and ME to agree on a procedure to handle waste in case of emergency
- Transport the waste to nearby island where such facility is operational until operational issues are rectified
- Ensure appropriate and secured finance is made available in the operational budget.

12 Stakeholder consultation

Stakeholder consultations with relevant personnel, as identified in the TOR for the ESMP, was carried out as online meetings, telephone conversations and through a short survey of households.

Key stakeholders identified in the TOR are:

- Island Council of Th. Vandhoo
- Environmental Protection Agency
- FENAKA Corporation Limited
- Health Protection Agency
- Ministry of National Planning, Housing and Infrastructure and Maldives Land and Survey Authority (MLSA)
- Maldives National Defense Force
- Women’s Development Committee of the island
- Community Consultation or Household Survey on their perception of the project
- Ministry of Environment / MCEP

Table 16 gives details of the discussion points of the different stakeholder consultation meetings. Details of personnel consulted with are given in Appendix 8.

Table 16. Outcomes of the consultation meetings

Meeting details	Discussion points and feedback (in italics)
<p>Consultation with the Island Council</p> <p>Date: 14th January 2021</p> <p>Meeting held via Zoom meetings</p>	<p>EIA Consultant enquired about the waste management plan of the island and current waste management practices</p> <ul style="list-style-type: none"> • <i>A waste management plan was formulated and implemented, where waste collection services were carried out by the Council at a monthly charge of MRF 100 per household. However, due to difficulties with reduced budget as a result of COVID 19 pandemic, this is on hold for now. Currently households take the waste to the temporary collection site (about 50ft north of proposed project site) at allocated times (6 to 8am and 4 to 6pm). Open burning is carried out at these sites by staff of the Island Council.</i> <p>EIA Consultant explained the Grievance Redress Mechanism and explained the responsibility of the Council in implementing this mechanism</p> <ul style="list-style-type: none"> • <i>Council stated that they have not been informed about this mechanism earlier. They will do the needful to ensure proper implementation of the mechanism and will also enquire about this with the Ministry so as to be better informed.</i> <p>EIA Consultant enquired about waste management committee (and who implements the work in their absence)</p>

	<ul style="list-style-type: none"> • Council informed that they do not have a waste management committee. Council staff are involved in the collection and disposal work. With the new IWRMC, they will first try to operate the centre themselves and if not possible, will look into hiring personnel to carry out the work. • Council staff can be given the necessary training to operate and maintain the machinery and ensure efficient functioning of the centre. There are capable staff within the Council. These staff can also be given the necessary training in firefighting, which would be required. <p>EIA consultant enquired about existing utilities on the island.</p> <ul style="list-style-type: none"> • Sewerage and water network construction work is ongoing and most probably will be completed by end of the year. However, there are no connections to the IWRMC. • Nearest power connection is about 200m from project site and can be used for connecting power to the centre <p>EIA consultant enquired whether the southeastern side of the island where project site is located experiences erosion or storm surge.</p> <ul style="list-style-type: none"> • The southeastern side and project site does not experience erosion or storm surge. These are experienced on the northern side of the island. <p>The Council informed that they were in full support of the project and look forward to commencement of work soon, as it would be of great benefit to have an operational waste management centre in place. At present they have a lot of difficulties in this aspect, especially with disposal of waste. Waste is burnt at the dumping site.</p>
<p>Consultation with the Environmental Protection Agency</p> <p>Date: 12^h January 2021</p> <p>Meeting held via Googlemeet</p>	<p>EIA Consultant enquired about the licensing requirements for operating island waste management centers:</p> <ul style="list-style-type: none"> • Operation License needs to be acquired for the vehicles and vessels used for transport of waste from one place to another. • Operation Permits are given to operate the waste management center upon submission of waste management plans. • All waste management practices should be in accordance with the guidelines provided in the waste management regulation <p>EIA Consultant enquired about the duration of the operation permits issued:</p> <ul style="list-style-type: none"> • The duration depends on the method of waste management planned for that island. It may be 5 years, 2 years or even 1 year. The duration is determined after reviewing the waste management plan. • The permits can also be renewed with completion of terms. <p>EIA consultant enquired if there would be any inspection carried out by the EPA before renewing operating permits of the centers.</p> <ul style="list-style-type: none"> • EPA will carry out an inspection and decide on renewal of permit.

	<p>EIA Consultant enquired if EPA has any comments on the design of the waste management centers</p> <ul style="list-style-type: none"> • <i>There are no specific design requirements yet from EPA. The participant noted that the drawings shared were not very clear and to send clear drawings for them to review.</i> <p>Meeting was ended with no further comments. It was agreed to share the drawings for their review.</p>
<p>Consultation with the FENAKA</p> <p>Date: 19^h January 2021</p> <p>Meeting held telephone conversation</p>	<p>EIA Consultant briefed about the project and explained that the estimated power requirement for the IWRMC operations was 42kW. Consultant enquired about existing power capacity and whether it would be sufficient to cater to the needs of the IWRMC.</p> <ul style="list-style-type: none"> • <i>Existing power capacity of the power facility is 480kW (3 gensets of 160kW capacity each) and the average load is 120kW. Hence existing system will be able to cater to the needs of the IWRMC. Head office has also informed that new gensets can be provided if needed with the new projects being implemented, so even if there is an upgrade required, this could be facilitated.</i> <p>EIA Consultant enquired about proximity of nearest power distribution box to the site.</p> <ul style="list-style-type: none"> • <i>Nearest power distribution box is approximately 90ft from project site. If required, they can also install a new distribution box closer to the site.</i> <p>FENAKA personnel enquired as to when the process of transferring the waste to the RWMF will be commenced and where the facility is located for the Atoll.</p> <ul style="list-style-type: none"> • <i>EIA consultant explained that this will be commenced as soon as the RWMF is operational and waste will be transferred on a regular basis. RWMF for Thaa Atoll will be at Thilafushi</i>
<p>Consultation with the MNPHI / MLSA</p> <p>Date: 11^h January 2021</p> <p>Meeting held via Googlemeet</p>	<p>Meeting was held with participant from Land use planning department. EIA Consultant briefed the participant about the project and enquired whether they had any issues with respect to the area allocated for the project site. EIA Consultant also informed that the Client had already received letters from MLSA, approving the locations (for at least majority of the islands) and agreed to send a list of islands for which letters had been received.</p> <ul style="list-style-type: none"> • <i>Participant of the meeting stated that if approval had already been given, then they had not further comments or issues. They further stated that once the list is shared with them, they will also discuss with MLSA and communicate their comments to the consultant in writing.</i>
<p>Consultation with a focal group of women (in the absence of a Women's Development Committee)</p>	<p>Th. Vandhoo does not have a Women's Development Committee. So consultation sessions were held through individual phone calls to the women identified by the Council as those who were involved in various community development activities. Although consultations were held</p>

18th January 2021 via telephone calls

as individual sessions, the outcomes presented here are collective, as they all had similar views.

EIA consultant enquired about their views on the current system of waste management

- *All respondents felt that the system which had been put in place by the Council was very effective. There is not much littering around the island though, and almost everyone disposes of the waste at the allocated site. All respondents were also happy with the fee which had been in place and did not feel it was too much.*
- *At present, since waste collection has been ceased by the Council due to difficulties faced as a result of COVID, all households take their waste to the disposal site by themselves. The site itself is quite polluted and overflowing with waste, especially metal cans and plastic bottles which cannot be disposed through burning. Burning is not being undertaken on a regular basis due to difficulties faced. As they are unable to carry out burning regularly, waste such as diapers are being buried. Additionally, some households are not disposing the waste without segregating.*

EIA Consultant enquired about their views on the proposed system

- *All respondents were in favour of the proposed system, especially since it does not involve open burning which is quite harmful. At present during certain times of the year, even though the disposal site is at a distance from the residential area, effect of smoke is felt at the residential area, depending on wind direction.*
- *Compost generated by the system would be of great use for the community to carry out agricultural work*
- *All respondents stressed that this system should be sustainable so as to effectively manage the waste on the island continuously. If the system breaks down and there are difficulties in managing the waste, this would be very detrimental to the community and bring about many difficulties.*

EIA Consultant enquired whether women were currently involved in any of the work related to waste management and whether they would be involved with the new project to come

- *At present women are not involved, though in the past if they had been needed to go clean the waste disposal area, everyone had taken part in the activity. Respondents felt that if there were job opportunities with the proposed project, women would apply for it.*

EIA Consultant enquired whether they had any additional comments or questions?

- *Respondent 1: enquired how the ash from burning would be disposed and how diapers would be disposed.*
 - *EIA consultant: no open burning would be carried out at this new centre and diapers will be collected and stored in*

	<p><i>tightly sealed black bags and transported to the RWMF for incineration</i></p> <ul style="list-style-type: none"> • <i>Respondent 1: would private parties be able to go and dispose of their waste at the centre, without registering for the service. This was a major issue when the waste management plan by the council was first started, as the centre did not accept waste taken in by private parties and everyone had to register for the system.</i> <ul style="list-style-type: none"> ○ <i>EIA Consultant: the operations will be handed over to the Island Council who will manage the system.</i> • <i>Respondent 2: although the fee of MRF 100 was reasonable, one reason why households wanted to dispose of waste themselves could simply be that Vandhoo was a small island and carrying out the work themselves was not a big thing for most. It would also allow them to save the money they would spend on waste management.</i> • <i>Respondent 2 enquired as to why the construction work of the IWRMC previously commenced had been stopped and stated that such problems would affect the trust the community has towards those implementing such projects.</i> <ul style="list-style-type: none"> ○ <i>EIA Consultant informed that as far as they were aware the work had been ceased due to some issues between the proponent of that project and the contractor.</i>
<p>Consultation with MNDF</p> <p>Date: 28th January 2021</p> <p>Meeting held via Googlemeet</p>	<p>Meeting was held with personnel from the fire safety and training departments of MNDF. EIA Consultant briefed the participant about the project and stated that main points of discussion for the meeting was with respect to fire safety and willingness of MNDF to assist in training the IWRMC operators on firefighting.</p> <p>EIA Consultant enquired whether they had any concerns about the project from a fire safety / hazards aspect.</p> <ul style="list-style-type: none"> • <i>Since there is no fuel storage on site or use of fuel for any purpose on the site, they had no major concerns</i> • <i>Some drawings for these centres have been shared with MNDF. Request to send all drawings, inclusive of fire safety measures to them for their approval.</i> • <i>Recommend to formulate a firefighting and fire safety plan prior to project commencement, so that in the instance of a fire incidence, personnel are well aware of how to handle the situation.</i> • <i>The plan should include details of firefighting team, leading staff, equipment details, assembly points and emergency contact numbers. The plan should be approved by MNDF fire department.</i> • <i>Fire hydrant or water point to be established on site and a water pump should be added to the list of firefighting equipment to be sourced for the site. This will be used for handling of any major fire events.</i>

	<p>EIA Consultant enquired about the willingness of MNDF personnel to give the required training for the workforce of the IWRMC</p> <ul style="list-style-type: none"> • <i>The MNDF regional branch at L. Kahdhoo, F. Nilandhoo and Dh. Kudahuvadho can undertake the trainings for the IWRMC staff of Faafu, Dhaalu, Thaa and Laamu atoll as required by the proponent. Ministry should send a formal request to MNDF to this effect and the public affairs department of MNDF will arrange the trainings.</i> <p>Meeting adjourned with no further questions or queries on either sides.</p>
Ministry of Environment / MCEP	<p>A formal consultation/meeting with the project PMU was held at the Inception stage.</p> <p>Regular communications have also been carried out via phone or email throughout the report formulation process, which also includes communications regarding project progress, delays, request for information.</p>

Note: Meeting request has been made to Health Protection Agency with numerous followups, though a meeting has not been scheduled to date (copies of email communications given in Appendix 9).

12.1 Results of the Household survey

A household survey was undertaken to assess the perception of the community with regards to the current waste management practice and their willingness to pay for a proper waste management system. Survey forms were sent to the Island Council so as to enable the household survey data collection (copy of survey form is given in Appendix 10). Questions were asked about their waste segregation methods, waste disposal methods for both biodegradable and non-biodegradable waste and their perception on the location and size of proposed IWRMC. A total of 15 households took part in the survey, which is approximately 20% of households on the islands. Key findings of the survey include:

- On average, all households produce more non-biodegradable waste than biodegradable waste. Average volume of waste produced on a daily basis (estimated) by the respondents are:
 - Biodegradable waste – 1 small to medium sized dustbin bag
 - Non-biodegradable waste – 1 full container of volume 20m³
- All respondents reported to disposing of biodegradable waste to the shoreline, which is the allowed practice on the island at present
- All non-biodegradable waste is disposed at the site allocated for this purpose by the Island Council
- Waste segregation at household level was being undertaken by approximately 50% of the respondents

- Since the Council has at present discontinued waste collection from houses, no fee is being taken from the households. Hence all answers to the question pertaining to views about the fee being collected was a reflection of this and all respondents reported that a fee was not taken.
- All respondents were unequivocal in their view about the location of the proposed IWRMC and stated that the location was suitable as it was at a distance from the residential area. However, views regarding the size of the centre was divided, with 50% reporting it as a being of suitable size, while the remaining felt that the centre was too small.
- Given the proximity of the IWRMC to the residential area, none of the respondents felt that there would be any impacts on the residential area due to the project work (construction and operational)
- Regular burning and disposal of waste was reported as the best mitigation measure to minimise impacts.

13 Gender Empowerment / Preparation of Gender Action Plan

Traditionally cleaning the roads, houses and waste collection and disposal are carried out mostly by women. With establishment of waste management centres with machinery and facilities in some islands, the activities related to waste management are not only a responsibility of women but men are also actively involved in the process. In most islands with waste management systems in place, women are mostly involved at household level; in cleaning and waste segregation, whereas men are involved in collecting waste from the households and managing the waste at the waste management centres.

As per Census 2014 resident population, in Th. Vandhoo 48% of the population are women and 52% are men (NBS, 2014). Currently 18% of the households are owned by women whereas 81% is headed by men (as per island council). There is no women's development committee in the island though there used to be one in past years.

From the consultations carried out to discuss the proposed upgrading of the waste management centre project in Th. Vandhoo, it was evident that women are not formally involved in the waste management of the island at present. Currently the waste collection process is on-hold due to difficulties caused by Covid-19 pandemic. During when it was carried out, men were involved in collection and management of waste at the centre though cleaning of households, waste segregation at household level, cleaning of island roads and public areas, were still carried out mostly by women. It was noted that although women were not formally involved at the waste disposal site, they took part in cleaning the site when needed and they would like to participate in the future if they get the opportunity to do so.

The Environmental and Social Assessment and Management Framework and Resettlement Policy Framework for the MCEP consists of a Gender Development Plan which identifies Gender Issues, Strategies and Proposed activities relevant to the project (MEE, 2016). As this is the basis for the formulation of a Gender Action Plan for the components under the MCEP and hence is of significant relevance to the proposed project, the Gender Development Plan has been directly sourced from Zuhair (2021) and is given in Table 17 below.

As highlighted in the Gender Development Plan, currently women feel they are excluded from the opportunities of being part of the waste management system, and they have suggestions that would help in management of waste at the island. This was also reflected in the consultations carried out with women of Th. Vandhoo. Based on the findings listed in the Gender Development Plan and the findings from the consultations, a Gender Action Plan is proposed as given in Table 18.

Table 17. Gender Development Plan as in the ESMF for the MCEP (sourced from Zuhair, 2021)

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 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 work.	Inform women groups regarding proposed construction works. Identify women interested to 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

Table 18. Gender Action Plan for the project

Gender Activity/Action Plan	Performance Indicators / Targets	Responsibility	Timeline
Outcome: Th. Vandhoo IWRMC is upgraded with the required environmental and social safeguards as per the existing laws and regulations of the Maldives and the World Bank’s Safeguard Policies			
Output 1: Promote gender equality in employment and income			
<p>1.1 Ensure both genders gain employment and economic benefit during the construction and implementation phase of the project.</p> <p>This may include, but not be limited to architects, quantity surveyors, human resource managers, procurement experts, waste management experts and engineer, fire and safety personnel, heavy duty vehicle drivers, operators and machines.</p>	<p>1.1.1 Include a minimum of 30% female staff in the construction of the project (2021 baseline: 0)</p> <p>1.1.2 Include a minimum of 50% female staff in the implementation of the project (2021 baseline: 0)</p>	<p>Island council</p> <p>Island council</p>	<p>2021</p> <p>2021</p>
Output 2: Promote gender equality in capacity building and training			
<p>2.1 Ensure trainings conducted for the staff of the waste management center including training for operation of various vehicles and machines, will be conducted for both male and female staff.</p>	<p>2.1.1 Include participation from both genders with a minimum of 30% females in all trainings conducted as part of the project (2021 baseline: 0)</p>	<p>Ministry of Environment</p>	<p>2021 – 2022</p>

Output 3: Ensure safety and protection from sexual harassment for all staff			
3.1 Ensure safety of both male and female workers as per the health and safety measures and policies in place	3.1.1. Ensure strict policies are in place in order to prevent acts of sexual harassment among the workers and/or by any member of the workers towards someone in the community (2021 baseline: 0)	Ministry of Environment	2021 – 2022
	3.1.2 Ensure strict actions are taken against those who violate such health and safety regulations and policies	Ministry of Environment Island council	2021 - continuous
Output 4: Gender equal participation in decision making			
4.1 Ensure gender equality in decision making level including but may not be limited to architects, quantity surveyors, human resource management experts, waste management experts and engineers, fire and safety personnel, heavy duty vehicle drivers operators and machinery. 4.2 Ensure equal representation of men and women in public consultations with regards to the project. This will ensure key decisions regarding the project are made in consultation with both genders.	4.1.1 Include a minimum of 30% females at decision making level (2021 baseline: 0).	Ministry of environment Island council	2021 – continuous
	4.1.2 Include 50% of women in any public consultations held with regards to waste management in the island (2021 baseline: 0).	Ministry of environment Island council	2021 - continuous

14 Conclusion

The findings of this assessment for the formulation of an Environmental and Social Management Plan for the proposed project by the Ministry of Environment through the Maldives Clean Environment Project to establish a full-fledged IWRMC and facilitate piloting of in-vessel composting in Vandhoo show that the project has low to moderate negative impacts on the environment. The process followed to identify environmental impacts associated with project was Rapid Impact Assessment Matrix (RIAM) which is based on standard definition of importance assessment criteria, with semi quantitative values for each of these criteria, to provide an accurate and independent score (environmental value) for each condition.

The environmental score for the project is of positive and negative. Positive changes that are of importance (highest positive environmental score) are;

1. Benefits to the island community (both social and economic) due to improved waste management practices and operation of the facility
2. Changes to the environment due to improved waste processing methods

Negative changes or impacts that are of significance (highest negative environmental score) are;

1. Impacts due to sorting and storage of hazardous waste
2. Health and safety risks to the workers during construction and operational work
3. Air pollution due to emissions associated with construction machinery

Lesser negative impacts from the project includes impacts on the environment due to accidental spills during transfers and material handling. The proximity of the project site from the residential area aids to minimize a lot of impacts due to the project, such as that due to noise and air pollution and other disturbances. The land area allocated for the project had been allocated and cleared prior to initial construction of the IWRMC. Hence vegetation clearance and loss of land is also not an impact of this project.

The proposed method of composting, which will be done in the machine itself is predicted to have minimal negative impacts as it greatly overcomes the issues faced by other methods of composting such as windrow-composting. On the other hand, it has several benefits, some of which that have been reported are:

- 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;
- Overcomes the problems of odour, leachate generation and ground water contamination associated with traditional methods of waste disposal

Stakeholder consultations carried out as part of the project showed support for the project overall, with great emphasis on expedited project commencement, especially by the Island Council and community. Concerns were also raised by the community as to the continuity of the project, due to the past experience, and those who were consulted stressed the importance of the project being executed in a sustainable way, which would enable the IWRMC operations to continue without any disruptions. Disruptions to the process after commencement would be very detrimental for the community.

A household survey was undertaken to assess the perception of the community with regards to the current waste management practice and their willingness to pay for a proper waste management system. Results of the survey showed that on average, all households produce more non-biodegradable waste than biodegradable waste. Waste segregation at household level was currently being implemented at some households, while others disposed of their waste without segregation. Up until recently, the Council had been collecting waste from the households for a fee and this system was quite effective, although some residents did request to dispose of their waste by themselves. This is however, an indication that majority of the community were willing to pay the fee for proper waste disposal. The location of the IWRMC was seen to be suitable due to the distance from the residential area, while some felt that the IWRMC was smaller than required for the island.

Mitigation measures considered for the various impacts predicted for the project include:

- Provision of adequate training in proper method of handling of machinery and materials during both construction and operational phase
- Provision of adequate training in proper method of handling of waste during collection and disposal during operational phase
- Provision of all protective gear to workers during both construction and operations
- Implementation of the Grievance Redress Mechanism which has been formulated by the proponent, both during construction and operations

Mitigation measures have also been discussed for the alternative methods discussed in the report. However, should the proponent decide at a later stage to choose one of the alternative methods, rather than the selection option in this report, the Consultant stresses the importance of getting environmental clearance for the change in design and scope through a separate document, as the process would require consultations with the Council amongst other additional information.

Monitoring programme identified in the report will enable the proponent to assess whether the mitigation measures which have been identified in the report are effective. Early identification of negative impacts will enable the proponent to rectify the course of activities.

In order to further minimise and manage environmental and social impact associated with the project the following are recommended:

1. Adherence to all relevant legislations, regulations, guidelines and standards during construction and operation of the IWRMC;
2. Establish environmental and occupational health and safety procedures for all relevant components;
3. Installation of renewable energy sources at IWRMC, such as solar panels to source power for operations;
4. Carryout awareness raising campaigns to increase awareness of the general public regarding proposed work
5. Ensure all trainings identified under the Training programme of this report are properly implemented so as to ensure proper implementation of the project at all phases.
6. Encourage greater participation of women, especially during operational stage
7. Ensure proper supervision and inspection of the IWRMC at regular intervals

In the context of the above conclusions and recommendations, with due consideration to the environmental components identified above and the extent of the project activities and their likely and predicted impacts identified, with proposed mitigation measures and monitoring followed, it is concluded that the project is feasible and justified. Furthermore, the positive benefits due to the project, both to the environment and island community outweigh the negative effects on the environment during the project.

Acknowledgements

The consultant acknowledges the contribution provided by the team members in this report for the valuable contribution to the report and especially at the field. The consultant also acknowledges the assistance provided by the PMU of MCEP. Appreciation also to the Island Council of Vandhoo, especially the focal point for the project, Ibrahim Nahidh for their continuous assistance during the project report formulation and survey work.

CVs of team members are given below.

Curriculum Vitae

Position Environmental Consultant

Name Shahaama Abdul Sattar

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Date of Birth 30 September 1980

Nationality Maldivian

Education **Master of Science (MSc)** in Fisheries Biology and Fisheries Management, University of Bergen. Bergen, Norway, 2004 - 2006
Bachelor of Science (BSc.), The Flinders University of South Australia, Adelaide, South Australia, 1999 - 2001

Membership of Professional Associations Small Island Research Group (SIRG) Maldives, Vice President

Countries of Work Experience Maldives

Languages **Dhivehi** Mother tongue
English Fluent

Employment Record

From: 2008 - 2011

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

From: 2006 to 2008

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

From: 2002 – 2004

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

Line of work at MRC included:

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

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

Secretariat and key organizer – Indian Ocean Cetacean Symposium 2009

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

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

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

From: May 2011 – Dec 2012

Employer: Darwin Reef Fish Project / Marine Research Centre (Maldives) and Marine Conservation Society (UK)

Position: Consultant, Darwin Reef Fish Project (4 year joint collaboration between MRC and MCS, UK)

Assess the various reef fisheries (grouper, aquarium and food fisheries) of the Maldives and aims to establish management plans for these fisheries. Provision of technical support and assistance to the project staff and MRC in implementing the project and formulation of the management plans.

From: July 2011 – Dec 2011

Employer: Bay of Bengal Large Marine Ecosystem Project

Position: BOBLME Sharks Working Group Coordinator

Coordinator for the Sharks WG of BOBLME project, and work with the focal points in the member countries, to assist in the formulation and implementation of their National Plans of Action for Sharks.

From: June 2011 to Present

Employer: Land and Marine Environmental Resource Group Pvt Ltd

Position: Environmental Consultant

Workshops/Seminars Participated

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

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

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

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

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

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

South and Southeast Asia. Bangkok, Thailand

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

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

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

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

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

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

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

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

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

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

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

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

Publications

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

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

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

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

BOBLME (2011) Report of the BOBLME Sharks Working Group, 5-7 July 2011, Male' Maldives,

Prepared for the Bay of Bengal Large Marine Ecosystem Project by Sattar, S. A. and Anderson, R. C. Saleem, M., Sattar, S. A. (2009) Study on post-tsunami restoration and conservation projects in Maldives, Prepared for the International Union for Conservation of Nature.

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

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

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

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

Environmental Impact Assessments Reports and other studies

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

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

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

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

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

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

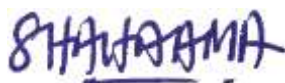
Referees

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Certification

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



Shahaama A. Sattar

Date: October 2018

9. Specific Experience/ Employment Record (as per TOR requirements)

Preparation of B. Hithaadhoo Land Use Plan

Year: August 2019 to October 2019

Client: Hithaadhoo Island Council

Position Held: Planner

Duties Rendered: Community Consultations, land use planning and reporting

Preparation of Ga. Kondey Land Use Plan

Year: March 2019 to July 2019

Client: Kondey Island Council

Position Held: Planner

Duties Rendered: Community Consultations, land use planning and reporting

Maldives Building Regulatory Capacity Assessment (BRCA), Building Regulation for Resilience Program

Year: January 2018- October 2019

Location: Male', Maldives

Client: Ministry of National Planning and Infrastructure, Maldives

Positions Held: Urban Planner,

Duties Rendered: Technical contribution to BRCA Component 1 and 3 assessment for Maldives, and associated recommendation development. Material and technical support to 2. Participation and facilitation of kick-off workshop in Maldives. Facilitation and logistical support for the Action-Planning Workshop in Maldives

Environmental and Social Impact Assessment for the proposed North Upgrading of Infrastructure at North Regional Waste Management Facility Zone 2, Raa Vandhoo

Year: December 2018 – January 2019

Location: Raa atoll Vandhoo, Maldives

Client: Ministry of Environment, Maldives

Positions Held: Urban Planner, Social Impact Assessment Consultant

Duties Rendered: Assessment of possible environmental and social impacts of the proposed upgrade at the WMC. Community consultations, social impact analysis and report writing

Assessment of Climate Sensitive Natural Resources in Laamu Atoll and Preparation of Resources Maps

Year: July 2016- July 2018

Client: UNDP

Position Held: Project Coordinator

Duties Rendered: Overall coordination of the project which includes project planning, keeping PMU updated on the progress of the project, facilitate the project team in addressing the issues, delays etc during the project.

Preparation of R. Inguraidhoo Land Use Plan

Year: March 2018 to May 2018

Client: Inguraidhoo Island Council

Position Held: Planner

Duties Rendered: Community Consultations, land use planning and reporting

Development of Training Modules, Materials and

Field Training; Organic Farming and Handicraft, Climate Change Adaptation Project (CCAP), Livelihood support program for wetland management

Year: June 2017 to February 2018

Client: Ministry of Environment and Energy

Position Held: Project Leader

Duties Rendered: Development of training materials, project Coordination and Reporting

Formulation of Coastal Protection Regulation, ICCRRIP Project

Year: September 2014 to January 2015

Client: Ministry of Environment & Energy

Position Held: Project Coordinator

Duties Rendered: Consultations, Input in formulation of Regulation and reporting

Developing a Handbook to Enhance the Capacity of Trainers to Increase the Resilience of People with Disabilities to DRR and CCA

Year: 2016

Client: National Disaster Management Center

Position Held: Consultant

Duties Rendered: Review and analyze existing; provide input in relevant stakeholder consultations;

Preparation of the handbook Preparation of AA. Feridhoo Land use plan

Year: 2016

Client: Feridhoo Island Council

Position Held: Planner

Duties Rendered: Community Consultations, land use planning and reporting

Preparation of K. Himmafushi Land use plan

Year : February 2016 to March 2016

Client: Himmafushi Island Council

Position Held: Planner

Duties Rendered: Community Consultations, land use planning and reporting

Tool Kit and Training Materials for Increasing Awareness on Climate Change Adaptation & Mitigation Measures in Tourism Sector (Kaaf, Alif Alif, Alif Dhaal, Baa & Lhaviyani Atoll)

Year : May 2015 to August 2015

Client: Ministry of Tourism

Position Held: Project manager

Duties Rendered: Preparation of Materials, Conducting workshops

Tool Kit and Training Materials for Increasing Awareness on Climate Change Adaptation & Mitigation Measures in Tourism Sector (For Tourism Staff)

Year : December 2015 to February 2015

Client: Ministry of Tourism

Position Held: Project manager

Duties Rendered: Preparation of Materials, Conducting workshops

Situation Analysis for the formulation of Master Plan for Sustainable fisheries (MASPLAN)

Year : February 2015 to March 2015

Client: JICA

Position Held: Consultant

Duties Rendered: Community Consultations, Analysis and reporting

Preparation of AA. Bodufolhudhoo Land use plan

Year : May 2015 to June 2015

Client: Bodufolhudhoo Island Council

Position Held: Planner

Duties Rendered: Community Consultations, land use planning and reporting

Preparation of AA. Mathiveri Land Use Plan

Year : June 2014 to July 2014

Client: Mathiveri Island Council

Position Held: Planner

Duties Rendered: Community Consultations, land use planning and reporting

Development of a National Framework/Plan on managing IDP's (internally displaced) persons/population caused by crises, emergencies and climate change

Year : May 2014 –Dec 2014

Client: UNDP/NDMC

Position Held: Team Leader

Duties Rendered: Overall project coordination and delivery

Preparation of Disaster Management Plan for a Guest House

Year : 2014

Client: Sea Side Lodge Guesthouse Manager, Hulhumale'

Position Held: Planner

Duties Rendered: Preparation of the disaster management plan according to the guidelines set by

Perceptions and understandings of climate change and migration survey (K.Guraidhoo and R.Dhuvaafaru) carried out by a Norwegian Research Institute

Year : August 2013 September 2013

Client: CICERO - Center for Climate and Environmental Research – Oslo ; Norwegian Academic Institution

Position Held: Local Consultant

Duties Rendered: Assisted (CICERO to carry out the household survey, focus group discussions and the key informant interviews

Review and Update the Detailed Island Risk Assessment in the Maldives prepared for HDh. Kulhudhuffushi and GDh. Thinadhoo

Year: March 2013 to September 2013

Client: Ministry of Environment and Energy

Position Held: Social Planner/Project Coordinator

Duties Rendered: Review all relevant documents related to DIRAM study, study the social aspects impacting the risks of the islands and overall management of the project.

Integration of Climate Change Risk Resilience into Land Use Planning

Year: February 2011 to April 2011

Client: Ministry of Housing and Environment

Position Held: Planner/Project Coordinator

Duties Rendered: Provide input in planning perspective and also over all coordination of the project inclusive of conducting a workshop to present the findings

Preparation of Heritage Action Plan and Preliminary Inventory

Year: September 2011 to November 2011

Client: Department of National Heritage

Position Held: Team Leader

Duties Rendered: Proposed action plan for the protection and safeguarding of national heritage.

Prepared a preliminary inventory of the existing tangible and intangible heritage of Maldives

Preparation of Atoll and Island Development Plans for AA. Atoll

Year: September 2011 to December 2011

Client: Secretariat of AA Atoll council

Position Held: Planner/ Project Manager

Duties: Manage and prepare the development plans

Reviewing the Third Tourism Master Plan 2005-2011

Year: December 2010 to October 2011

Client: Ministry of Tourism Arts and Culture

Position Held: Planner/Project Coordinator

Duties Rendered: Provide input in planning perspective and also over all coordination of the project inclusive of conducting a workshop to present the findings

Preparation of a detailed Layout Plan for Tourism Zone (Asseyri Project)

Year: December 2010 to February 2011

Client: Ministry of Tourism Arts and Culture

Position Held: Planner/Project Coordinator

Duties Rendered: Provide input in planning perspective through preparing the layout plan and also over all coordination of the project inclusive of conducting a workshop to present the findings

Appraisal of Hithadhoo Regional Hospital Development

Location: S. Hithadhoo, Maldives

Year : November 2010

Client: OPEC Fund for International Development (OFID)

Position Held: Socio Assessment Specialist/Project Coordinator

Duties Rendered: Overall Coordination of the project and carry out social Impact assessment study.

Mapping study of infrastructure and resources for Youth

Location:

Year : January 2010 to April 2010

Client: UNDP

Position Held: Assistant project coordinator

Duties Rendered: Assisting in overall coordination of the project

Professional Referees

Name: Najfa Shaheem Raazee

Position: Project Manager of ICCRRIP Project, Ministry of Environment and Energy

Email Address: najfa.raazee@environment.gov.mv

Name: Hamdhaan Zuhair

Position: Environmental and Social Safeguards Officer (CCAP), Ministry of Environment and Energy

Email Address: hamdhaan.zuhair@environment.gov.mv

Name: Ismail Abid

Position: Managing Director, Land and Marine Environmental Resource Group Pvt Ltd.

Email Address: ismail.abid@lamer.com.mv

CURRICULUM VITAE

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

DELF (Diplôme d'études en langue française) Level A1 and
Level A2
8. **MEMBERSHIP OF PROFESSIONAL SOCIETIES:** Master Instructor with the Scuba Schools
International (SSI).
9. **OTHER TRAINING:**
Fish Watch Training Workshop conducted by Darwin Reef Fish
Project initiated by the Marine Research Centre of Maldives in
collaboration with Marine Conservation Society (UK) in 2009.

IUCN Manta Ray Workshop in 2013.

National Coral Reef Monitoring Framework monitoring protocols
training in 2014 conducted by IUCN Maldives.
10. **COUNTRIES OF WORK EXPERIENCE:** Maldives and Australia
11. **LANGUAGE AND DEGREE OF PROFICIENCY:**
English - Native or bilingual proficiency
Dhivehi - Native or bilingual proficiency
French - Limited working proficiency
12. **EMPLOYMENT RECORD:**
2005 - 2011 Dive Instructor,
Maldivers Diving Centre, Malé.

2012 – 2014 Dive Instructor,
Diveoceanus Dive Centre at Paradise Island Resort

2017 - 2017 Research Assistant
Griffith University, Gold Coast, Australia.

2018 (Present) Environmental Analyst
Lamer Pvt Ltd
13. **DETAILED TASKS ASSIGNED:** **WORK UNDERTAKEN THAT BEST ILLUSTRATES
CAPABILITY TO HANDLE TASKS:**

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

Location: Maldives

Client: IUCN Maldives

Main project features: Surveying of 5 reefs and 3 islands.

Position: Consultant.

Activities performed:

Conducted ecological (marine and terrestrial) surveys at the proposed sites

Data compilation and analysis

Assisted in the final report development.

Project: Environmental Monitoring Report for resort development

Year: 2018

Location: Maldives

Client: Pearl Atoll Pvt Ltd

Main project features: Survey for the Environmental Monitoring Report

Position: Environmental Analyst

Activities performed:

Conducted the marine component of the survey. The seawater quality analysis, sedimentation analysis, reef benthic surveys, and fish surveys.

Project: Environmental Impact Assessment Report for resort development

Year: 2018

Location: Bodufushi, Raa Atoll.

Client: Alibey Maldives Pvt Ltd

Main project features: EIA Survey for an addendum

Position: Environmental Analyst

Activities performed:

Conducted the marine component of the survey. The seawater quality analysis, reef benthic surveys, and fish surveys.

Project: Environmental Impact Assessment for Coastal Protection and Entrance Clearance.

Year: 2018

Location: Bandos Island Resort, Kaafu Atoll.

Client: Bandos Island Resort.

Main project features: EIA Survey

Position: Environmental Analyst

Activities performed:

Conducted the marine component of the survey. The seawater quality analysis, reef benthic surveys, and fish surveys.

Project: Third Addendum to the Environmental Impact Assessment Report

Year: 2018

Location: Enboodhoo Finolhu Lagoon

Client: Dream Islands Development Pvt Ltd

Main project features: Reclamation of Islands for Resort Development at Enboodhoo Finolhu Falhu, South Malé Atoll

Position: Environmental Analyst

Activities performed:

Conducted the marine component of the survey. The seawater quality analysis, reef benthic surveys, and fish surveys.

14. Certification:

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



[Signature of staff member or authorized representative of the staff]

Date: 05th August 2018
Day/Month/Year

Full name of staff member: Azim Musthag

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- Zuhair, A. H., 2019. *Environmental Management plan for the upgrading of Island Waste Management Centre in N. Holhudhoo*. Prepared for Ministry of Environment
- Zuhair, A. H., 2021. *Environmental and Social Management plan for the proposed establishment of Island Waste and Resource Management Centre in Th. Madifushi*. Prepared for Ministry of Environment

Appendices

Appendix 1 List of abbreviations

EIA	-	Environmental Impact Assessment
EPA	-	Environmental Protection Agency
ESMP	-	Environmental and Social Management Plan
GoM	-	Government of Maldives
IWRMC	-	Island Waste Resource Management Centre
IWMP	-	Island Waste Management Plan
MCEP	-	Maldives Clean Environment Project
ME	-	Ministry of Environment
MSL	-	Mean Sea Level
OWC	-	Organic Waste Converter
PSIP	-	Public Sector Investment Programme
RIAM	-	Rapid Impact Assessment Matrix
RWMF	-	Regional Waste Management Facility
SOP	-	Standard Operating Procedures
TOR	-	Terms of Reference
WMPCD	-	Waste Management and Pollution Control Department

Appendix 2 Terms of Reference issued by World Bank

ANNEX 2: TECHNICAL TOR B

ESMP for the establishment or upgrading of IWRMCs with Aerobic
Technology using Composting Machine

Technical Terms of Reference B: ESMP for the establishment or upgrading of IWRMCs with Aerobic Technology using Composting Machine

Objective and Scope of Preparation of ESMP

In order to ensure short and long term environmental and social impacts that would arise due to the proposed development are adequately mitigated and monitored, following the screening decision from EPA and the World Bank, an ESMP will need to be developed as per the scope presented below and in accordance with the ESAMF of the Project and the Environmental Impact Assessment Regulations (2012). The project IWMPs should be reviewed and used as the basis for baseline information. Field level verification should be conducted prior to the preparation of the ESMP.

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

Following should be the key components/assessment outline of the ESMP:

19. Executive Summary: An executive summary of the significant findings of the report shall be prepared both in Dhivehi and English language. The executive summary shall include summaries of project description and how significant environmental and social issues will be resolved. The conclusion of the study must be stated.

20. Introduction: Briefly describe the major components of the proposed project. Provide a brief history and justification of the project and describe how the proposed development will improve on the current arrangements for waste management in the project area. Provide details of the proponent, and institutional arrangements for implementation and operations of the proposed development, and environmental and social issues of similar projects. Include desktop studies and review of similar ESMPs and ESIAAs.

Major components of the Island Waste Management Regulation and the Island Waste Management Plan (IWMP) should be described (fee structure, consultations undertaken for plan preparation etc.), indicating the status of approval (prepared, under review or approved by EPA) and highlighting any

challenges faced by the council in plan preparation and approval (if any). The report also should indicate whether a study or public consultation has been (or should be) undertaken to assess willingness / ability to pay.

21. Legislative and Regulatory Considerations: This chapter should cover the legal aspects related to the project. Outline the project's consistency with the existing national, state, regional and local planning that apply to the project include reference to relevant statutory and non-statutory plans, planning policies, guidelines, strategies and agreements as appropriate. Outline the pertinent policies, regulations and standards governing project location, land use, environmental quality, and public health and safety. This should cover information on legal requirements specific to the project, such as permits to be taken under the Environmental Impact Regulations (2012) and the land allocation process followed with MLSA and other relevant institutions. There should be a brief description on the process (and law) pertaining to the allocation of land to development projects, in general, and to the IWRMC, in particular. Issues related to land acquisition and resettlement should be addressed, stating no impact or minimal impact.

22. Study Area: Submit an A3 scaled plan with indications of all the proposed land infrastructures. Specify the boundaries of the study area for the ESMP highlighting the location and size of the proposed construction. The study area should include nearby environmentally and socially sensitive areas (EPAs / ESAs, houses, mosques, schools, playgrounds etc.), nearest 3 phase distribution box, water connection point (if water network system is present at the island), sewer connection point (if sewer network system is present at the island). Justification for site selection shall be provided. Relevant developments in the area must also be addressed including residential areas and all economic ventures and cultural sites.

23. Project Description: Provide a full description and justification of relevant parts of the project, using maps at appropriate scale where necessary. The following should be provided including all inputs and outputs related to the proposed activities shall be justified.

General Construction and Operations

- Provide a clearly labelled concept design and scaled site plan of the project boundary. If the project involves upgrading of an existing IWRMC, the infrastructure already present and those that will be introduced as part of the upgrading works should be clearly distinguished in the concept design presented.
- Submit a detailed description of the components of the project and how the project activities will be undertaken.

- Describe the construction phase components of the project including but not limited to site clearance, collection bay area, composting machine room, equipment room, groundwater well, toilet, septic tank, leachate collection tank, resting area and perimeter walls and fences. If the project involves upgrading of an existing IWRMC, provide information on the existing structures of the IWRMC and how these structures will be incorporated into the design for upgrading.
- If the project involves upgrading of an existing IWRMC, suggest ideal locations for temporarily relocating the waste currently present at the existing IWRMC (if any). Propose adequate mitigation measures to prepare the temporary storage site with particular emphasis given to leachate prevention.
- Describe the operational phase components of the project including but not limited to waste collection services, method of storing, composting method, leachate management, arrangements for the removal of inorganic waste from the IWRMC and clean-up of existing small open dump sites.
- Details, types and numbers of labor/workers required during construction/establishment and during operation.
- Include a project schedule.
- A matrix of inputs and outputs related to the project activities shall be included and described separately for construction and operational phase.

Design of the Aerobic System (Composting Machine)

- Concept design and process flow diagram of the proposed technology for aerobic digestion using composting machine.
- Type and amount of waste that it can treat (food waste, green waste, paper etc. in mixed form or separated) and details of any products required for activation (such as bioculum) including its corresponding quantities to operate for a period of 1 year.
- Solid and liquid bi-products and output of the process (wet / dry compost) including the method for their potential use and/or disposal.

Fire hazard, health and safety

- Vulnerability analysis of the operational processes proposed for the IWRMC to fire, electrical and explosion hazard.
- Provision to fire safety, including details of firefighting equipment that will be established, signage, alarm system etc.
- Firefighting capacity of IWRMC operators. If not found to be adequate, recommend a fire safety training program to the IWRMC operators which should be completed prior to

operationalization of the center. Indicate the availability of fire wardens in the island and their capability to assist in such a program.

Construction waste and waste oil

- Waste fuel and oil management details.
- Construction waste management and disposal.

24. **Existing Environment:** The existing environment study will not require complex data collection and survey analysis techniques since this is an ESMP and not a full ESIA study. However, a vegetation survey of the site must be presented since a large number of vegetation are subject for clearance. The vegetation analysis should be supplemented by drone imagery and / or photographs. The following information should also be provided based on field observations and consultations with the island council and the community. Photographic evidence should be provided where appropriate.

- m) Current Waste Management Practices: Describe how waste is managed at present. This should include information about waste collection method and times, means of disposal (both organic and inorganic), staffs managing waste etc. Information about existing open dump sites (if any) and method of disposal should also be provided. Provide a map indicating the locations and dimensions of the open dump sites. Describe the waste composition and estimated volumes of each open dump site with photographic references.
- n) Unassigned Waste Dumping: Describe the overall cleanliness of the island and whether unassigned waste dumping is observed. This should include an assessment of the status of contamination of the site as well via visual observation.
- o) Project Site and Access Road: Describe the condition of the ground and soil of the project site (visual analysis). Provide an estimate of the amount and composition of waste present at the existing IWRMC and existing environments of temporary relocation sites (only applicable if an upgrading project). Provide information related to distances between residential areas, commonly used public places (mosques, schools, parks etc.), nearest 3 phase electricity distribution box, water connection point (if water network system is present at the island), groundwater wells and sewer connection point (if sewer network system is present at the island). Additionally, information related to the access road and route to waste unloading area shall be provided.

- p) Land ownership and usage: Describe the legal boundaries of the site, and identified current usage of the land in terms of squatters, land encroachments, fixed and movable structures, trees and wells, etc. Describe land allocation/ownership details of the project area and any need for land taking causing resettlement impacts.
- q) Coastal Modification / Erosion: Provide information related to any coastal modifications undertaken in the island in recent history and the side of the island subjected to coastal erosion. Indicate whether any coastal erosion is noticed from the shoreline closest to the proposed development.
- r) Vegetation present at the site: Describe the number and type of vegetation present at the project site and access road including scientific and local names. The amount of vegetation that require compensation and estimated cost must be indicated (separate for project site and access road, as the proponent of the access road is the island council). An explanation on how the rate of compensation is set by the Council and the process undertaken for the payment of compensation for loss of coconut palms and other trees should be given. Vegetation cover maps shall be included where appropriate (identifying the areas subjected for vegetation removal and translocation). Emphasis must be given to translocate trees (within the source islands or out of the island in instances where space scarcity is an issue) as much as possible. Methods of vegetation removal and translocation must be described, which should yield the preferred method for the project site and access road. Locations for compensatory 2:1 replantation must be identified and indicated on a map. *(Note: If development of an access road is found to be an associated project to which the island council will be the proponent, commitment letter from the island council stating their full responsibility to implement mitigation measures and assume monitoring responsibilities for the associated project must be included in the ESMP).*
- s) Protected Areas and Environmentally Sensitive Sites: Provide information on the environmentally protected and sensitive areas that exists close to the proposed development. Indicate distances from the project sites and if the protected area is in the project impact zone and if there are any observed potential impacts. Proximity of the site to surface water bodies or sensitive habitats (e.g. coasts, mangroves, wetlands) should also be identified.
- t) Areas of Historic and Cultural Significance: Provide information on areas of historic and cultural significance that exist close to the proposed development. Indicate distance from the selected project site.

- u) Socio-Economic Environment: Describe the socio-economic environment of the island.
- Demography: total population segregated by gender, density, growth and pressure on land and marine resources.
 - Details of vulnerable/marginalized groups (households headed by females, households' special needs, households below poverty line etc.) and community-based organizations (i.e. women's/youth groups etc.) & their activities.
 - Economic activities and livelihood patterns: Major economic activities of the community including but not limited to local tourism (no. of operational guesthouses), businesses (no. of wholesale and retail shops), cafés / restaurants, fishing vessels etc.
 - Status of access to market, health facilities, banking, communication, etc.
 - Electricity: Describe how electricity is provided at the islands and the capacity of the generators installed.
 - Water Resources and Sewerage: Source of portable and non-portable water supply. If through RO indicate the type and capacity of the plant and water storage tanks. Describe how sewerage is treated at the island (i.e. through septic tanks or sewer network system).

25. **Impact Identification:** The ESMP should identify all the impacts, direct and indirect, during and after construction, as well as for the operations of the IWRMC and evaluate the magnitude and significance of each. Particular attention shall be given to impacts associated with the following:

- g) Physical / Chemical: describe impacts on groundwater, soil, noise, air and waste.
- Impacts on noise pollution and disturbances (both in construction and operations)
 - Impacts on groundwater table and quality due to construction, operations (leachate / stormwater runoff).
 - Impacts on ground vibrations to nearby houses and buildings.
 - Impacts on air quality.
 - Marine water pollution due to spillage during material transfer.
- h) Biological: describe impacts on vegetation and fauna.
- Impact due to vegetation removal.
 - Impacts to vegetation and fauna due to improper handling and driving during material transportation.
 - Impacts due to material spillage during transfer of construction materials to the project island.

- i) Any resettlement impact - such as loss of land, livelihoods, assets etc. due to land taking/acquisition and/or other project interventions.
- Verify the legal status of the land required; document existing structures, land plots, and other physical assets at the project site to establish a cut-off date for entitlements in accordance with the policies given in ESMF.
 - Identify the persons and their families likely to be affected by the project including those who are vulnerable. This should cover information pertaining to members of families who are residing, practicing any trade, occupation or vocation in the project affected area, including those who may potentially lose income due to loss of coconut palms having a moderate economic value.
 - Project Affected Families are those who are likely to lose their house, homestead, commercial establishment, agricultural land, employment or are alienated wholly or substantially from the main source of their trade, occupation or vocation, or who will lose any other immovable property or their source of livelihood. Including people losing access to private property or common property resources.
- j) Sociological / Cultural: describe impacts of road closure, nearby sensitive areas (mosques, schools etc.), health and safety of surrounding community / contracted labor and sociocultural conflict.
- Sociocultural conflict due to arrival of expatriate workers and recruitment of expatriate IWRMC operators.
 - Impacts due to illegal immigrants being potentially recruited by the contractor.
 - Contractors code of conduct and communication.
 - 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 (which is prohibited under law).
 - Health and safety of the construction workers and the IWRMC operators.
 - COVID19 restrictions and special considerations for the contractor (potential mitigation measures may include daily temperature checks, cleaning procedures, shift roaster, arrangement for social distancing in labor camps, establishment of handwashing facilities at work site and labor camp etc.).
 - Fire hazard due to improper handling of waste.
- k) Economic / Enhancement Plans: describe any potential benefits or losses to the economy.
- Employment opportunities.
 - Impacts to the local economy due to purchasing of locally available construction materials.

- Impacts to the public due to high user fees.
- Cost saving in IWRMC operations due to electricity being generated from waste.
- Some of these opportunities can be further developed to draw environmental and social benefits to the local area. The ESMP should identify such opportunities and develop a plan to systematically harness any such benefit.

1) Specific Impacts Associated with the Proposed Technology: The Consultant should assess the following aspects in line with the proposed technology.

- **Odor Management:** Assess if the technology has an inbuilt odor management system and managed odors automatically.
- **Fluid and Discharges:** Will there be any fluid discharges from the proposed technology, will the machines require any extra piping space or water discharge systems or expansion of the existing leachate management system provided via the design, the consultants should propose suitable design requirements if so in the ESMP.
- **Waste Inputs:** Assess if the technology requires additional segregation of pre management of the incoming organic waste. Indicate specifically under the section on operational aspects of the ESMP what steps need to be taken specifically by the IWRMC operators in handling incoming waste to ensure it can be efficiently used in line with the proposed technology.
- **Energy Requirements and Efficiency:** The energy requirement to run the machinery and the status of energy efficiency of the machinery proposed should be assessed, i.e. the consultants should assess the energy requirements for operating the technology and propose the most efficient means of managing. Can a connection be made to the existing Island Grid, if so, will the capacity suffice, can a solar and battery generator be used as an energy source and if diesel generators are to be used which is the least alternative, the amount of fuel required etc. should be assessed as part of the project alternatives analysis. For all energy sources impacts in terms of emissions, noise, safety risks etc. should be assessed and mitigatory measures suggested in the ESMP accordingly.
- **Sludge and Residuals:** The nature and amount of all residual material produced, solid and liquid should be assessed and recommend means by which it can be re-used and/or managed in the ESMP. If reuse is recommended the consultant should also recommend the requirements for routine monitoring of quality of the digestate and liquid residue for instance if it is recommended to be used in agricultural processes.

- **Safety features on the machinery:** such as presence of emergency stop buttons, emergency lights and/or alarms for emergency use are equipped to ensure the best level of safety should be present and the consultants should assess if the proposed technology, especially machinery include these in addition to proposing other safety features in the ESMP.

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

26. Project Alternatives: Describe alternatives including the “no project option” should be presented. Alternative examined for the project should include alternative locations, design and technology options, and alternative energy sources which shall be evaluated in environmental, social and economic terms. Alternative technology options for the treatment of organic waste may include manual composting and anaerobic digestion systems. Depending on the source of energy proposed to operate the IWRMC, alternative energy sources evaluated shall include connection from existing power grid, solar, battery and diesel generators. For all energy sources impacts in terms of emissions, noise, safety risks etc. should be assessed and mitigatory measures suggested accordingly. All alternatives must be compared according to commonly accepted standards and norms and international standards as much as possible. The comparison should yield the preferred alternative for implementation. Mitigation options shall be specified for each component of the proposed project.

27. Mitigation and management of negative impacts: Identify possible measures to prevent or reduce significant negative impacts to acceptable levels. These will include both environmental and socio-economic mitigation measures. Mitigation measures to avoid or compensate habitat destruction caused by land clearance will have to be considered. Mitigation measures should be provided for COVID19 related aspects such as daily temperature checks, cleaning procedures, shift roaster, arrangement for social distancing in labor camps, establishment of handwashing facilities at work site and labor camp etc. Measures for both construction and operation phase shall be identified. Cost the mitigation measures, equipment and resources required to implement those measures. The confirmation of commitment of the developer to implement the proposed mitigation measures shall also be included. An Environmental and Social Management Plan for the proposed project, identifying responsible persons, their duties and commitments shall also be given. The

environmental and social management plan should be presented in matrix format, clearly indicating the responsible person, cost, equipment and resources required for each proposed action. In cases where impacts are unavoidable arrangements to compensate for the environmental and / or social effect shall be given.

Depending on the source of energy proposed to operate the IWRMC, alternative energy sources evaluated shall include connection from existing power grid, solar, battery and diesel generators. For all energy sources impacts in terms of emissions, noise, safety risks etc. should be assessed and mitigatory measures suggested accordingly.

Mitigation measures should be presented as a matrix consistent to the format provided below.

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g. secondary impacts)
Detailed design and planning Phase						
Pre-Construction Phase -Site Preparation						
Construction Phase						
Operation and Maintenance Phase						

The proposed ESMP matrix shall be translated to Dhivehi language and provided as an Annex to the report.

28. Development of monitoring and reporting plan:

10.5. Monitoring Program: Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan for vegetation clearance, soil, groundwater, noise and air quality, spillage assessment and grievance redress mechanism. Detail of the monitoring program including the physical and biological parameters for monitoring, cost commitment from responsible person to conduct monitoring in the form of a commitment letter, detailed reporting scheduling, costs and methods of undertaking the monitoring program must be provided.

The monitoring program should give details of the following;

- Monitoring indicators to be measured for evaluating the performance of each mitigatory measure (for example national standards, engineering structures, extent of area replanted, etc.).
- Monitoring mechanisms and methodologies
- Monitoring frequency
- Monitoring locations
- Cost of monitoring
- Responsible party

The recommended format for presenting the monitoring program is given below.

Proposed Mitigation Measure	Parameters to be monitored	Location	Measurements (Incl. methods & equipment)	Frequency of Measurement	Responsibilities (Incl. review and reporting)	Cost (equipment & Individuals)
Detailed design and planning Phase						
Pre-Construction Phase						
Construction Phase						
Operation and Maintenance Phase						

10.6. Reporting Procedures and Implementation Schedule: The consultant should propose adequate reporting mechanisms with frequencies for the implementation of the ESMP and the proposed monitoring program.

10.7. Cost Estimates and Sources of Funds: Implementation of mitigatory measures mentioned in the ESMP will involve an initial investment cost as well as recurrent costs. The ESMP should include costs estimates for each measure and also identify sources of funding, which is to be covered under section 9. In addition to this, estimated costs shall be provided (separate for construction and operational phase activities) for specific items and materials that the contractor and the operators would require to implement the ESMP effectively. Such items may include the cost of purchasing PPEs, fire extinguisher, signages, trainings etc. This would essentially enable the contractor to reflect accurate costs in the bid documents. Potential sources of funding for the operational phase should be reflected.

10.8. Contract Clauses: This is an important section of the ESMP that would ensure recommendations carried in the ESMP will be translated into action on the ground. Contract

documents will need to be incorporated with clauses directly linked to the implementation of mitigatory measures. Mechanisms such as linking the payment schedules to implementation of the said clauses could be explored and implemented, as appropriate.

29. Management of Other On- or Off-Site Environmental Pollution Control and Infrastructure

This section should address management of critical elements of pollution control and infrastructure that are not otherwise included in the mitigation plan because they were considered an essential part of the proposed project.

30. Summary of all Training Recommendations

This section should include programs targeted to increase the capacity of the contractor and the operator in the implementation of the ESMP. A capacity needs assessment for the operations of the IWRMC should be undertaken, highlighting gaps and training recommendations for a fully functional system. Special consideration must be given to cover operational training requirements of the proposed AD plant and associated bio-generator (if included with the project scope).

The training recommendations are likely to include the following:

- Strengthening the capacity of the contractor on ESMP implementation and reporting.
- Strengthening PMU’s capacity on compliance monitoring.
- General awareness on health and safety.
- Contractor’s code of conduct.
- Community Mobilization: Based on the assessment, the consultant should describe key messages for communication/awareness and recommend methods/tools. Also, recommend approaches to mobilize communities, enhance community participation (including that of women’s groups) and create ownership/interest around waste management.
- Operation and Maintenance training of the AD plant and bio-generator.
- Fuel handling (if applicable).
- Fire safety training and fire drills.

Institutional Strengthening Activity	Position(s)	Scheduling	Responsibility(is)	Cost Estimates	

Training Activity	Participants	Types of Training	Content (modules, Etc.)	Scheduling	Cost Estimates

31. Contingency Plans

Contingency plans shall be prepared and described to address: a) failure to meet specific performance criteria established by law or necessary for the project to meet its commitments in the ESMP and b) respond to natural and other risks previously identified and mitigated in the ESMP in the event reasonable and feasible mitigation measures to address the risks are inadequate.

- Performance-related Contingency Plans, indicating the steps that will be taken should monitoring indicate that:
 - Environmental standards are not being met
 - Impacts are greater than predicted
 - Mitigation measures and/or rehabilitation are not performing as predicted
- Natural Disaster Risk Response Plan (assumes that risk identification and risk reduction have been addressed in other parts of the EA)
- Other Risks Response Plans (assumes that risk identification and risk reduction have been addressed in other parts of the EA)
- Contingency plans for maintaining service or reducing downtime in the event of accidents or natural catastrophes that disrupt project operation

32. **Grievance Redress Mechanism (GRM):** Describe the proposed grievance redress mechanism of the project developed by the PMU and offer suggested improvements including naming the responsible person in each tier.

33. **Stakeholder consultation:** Identify appropriate mechanisms for providing information on the development project and the GRM to relevant stakeholders. Consultations must be undertaken with all key stakeholders – including communities, government officials etc. During consultations the project activities should be introduced, and stakeholders given opportunity to ask questions/clarifications, raise their objections/concerns and the consultant should provide relevant feedback – this discussion should be documented in the form of a table noting the points discussed/issues raised and feedback provided. The report shall include a brief description of the Council’s plan for GRM execution at tier 1. The report should include a list of people/groups consulted, their contact details and summary of the major outcomes. The following people or institutions should be consulted.

- Island Council (on GRM, Island Waste Management Plan, fee collection system, plan for 2:1 replantation, and the overall project in general)
- EPA (on the overall design of the IWRMC and operation licensing requirements).
- FENAKA (on the capacity of the existing power plant to cater for the energy requirements of the IWRMC).
- Health Protection Agency (on COVID19 health and safety requirements).
- Ministry of Planning and Infrastructure and Maldives Land and Survey Authority (regarding land use plan).
- Maldives National Defense Force (on fire safety and willingness to assist in training the IWRMC operators on firefighting).
- Waste Management Committee (on their role of waste management at the island).
- Women's Development Committee (on their involvement and perspectives on how waste management can be improved in the Island)
- Community Consultation or Household Survey (randomly selected with emphasis given to those residing at a close proximity to the project site: on the adequacy of the proposed site, feasibility of overall design of the IWRMC and the proposed technology, health and safety considerations, proposed fee collection structure, willingness to pay and waste management plan of the council).
- Ministry of Environment / MCEP (on the overall project as the proponent and GRM at tier 2)

The consultant should take into consideration COVID19 safety measure during consultations, follow WHO/WB & GoM guidelines when conducting consultations and explore remote/online options when conducting consultation.

34. Gender Empowerment / Preparation of Gender Action Plan

The consultants will carry out Gender analysis as an integral part of the social assessment. The project designs should be gender responsive based on the gender analysis. The findings and recommendations from the gender analysis during project planning and feedback from beneficiaries during implementation must be discussed thoroughly to determine the need for further action. Listed below are the key action points:

- Identify key gender and women's participation issues.
- Conduct gender analysis as part of overall Social Assessment.
- Examine gender differences in knowledge, attitudes, practices, roles, status, wellbeing, constraints, needs, and priorities, and the factors that affect those differences.
- Assess men's and women's capacity to participate and the factors affecting that capacity.

- Assess the potential gender-differentiated impact of the project and options to maximize benefits and minimize adverse effects.
- Identify government agencies and nongovernmental organizations (NGOs), community-based organizations (CBOs), and women's groups that can be used during project implementation and assess their capacity. The possibility of utilizing such ground to execute 2:1 replantation and if so the requirement to provided financial assistance with estimates must be provided.
- List out major gender actions.
- Develop gender-disaggregated indicators and monitoring plan.

35. **Validation and Disclosure**

The draft executive summary and the ESMP (matrix table in mitigation chapter) in local language should be disclosed in all major affected settlements and at island level in printed format and disseminated as appropriate or made available via online means for public commenting. This should be completed prior to or at the time of submitting the report to the EPA and the World Bank for clearance, so the period for public commenting can be sequenced in parallel to the review process. The consultant will assist the project in disclosure documents in all major affected settlements and at island and national level. The final cleared version of the report will be disclosed in major project websites and social media platforms with a summary of major findings through the disclosure process reflected as an annex.

36. **Conclusion**

This section shall specify the environmental acceptability of the project, taking into account the impacts and measures identified during the assessment process. It shall also identify any other conditions or external requirements for ensuring the success of the project.

Presentation- The ESMP or ESIA report, to be presented in digital format, will be concise and focus on significant environmental issues. It will contain the findings, conclusions and recommended actions supported by summaries of the data collected and citations for any references used in interpreting those data. The ESMP or EISA report will be organized according to the final TOR, in accordance to, but not necessarily limited by, the outline the Environmental Impact Assessment Regulations (2012) and the ESAMF. The report shall include Dhivehi translations of the executive summary and the ESMP matrix. All raw data collected, including maps and surveys should be submitted in Raw form to the client in digital format.

Appendix 3 Approval letter from MLSA



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

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 ބަޔާންކޮށްފައިވާ ގޮތުގައި

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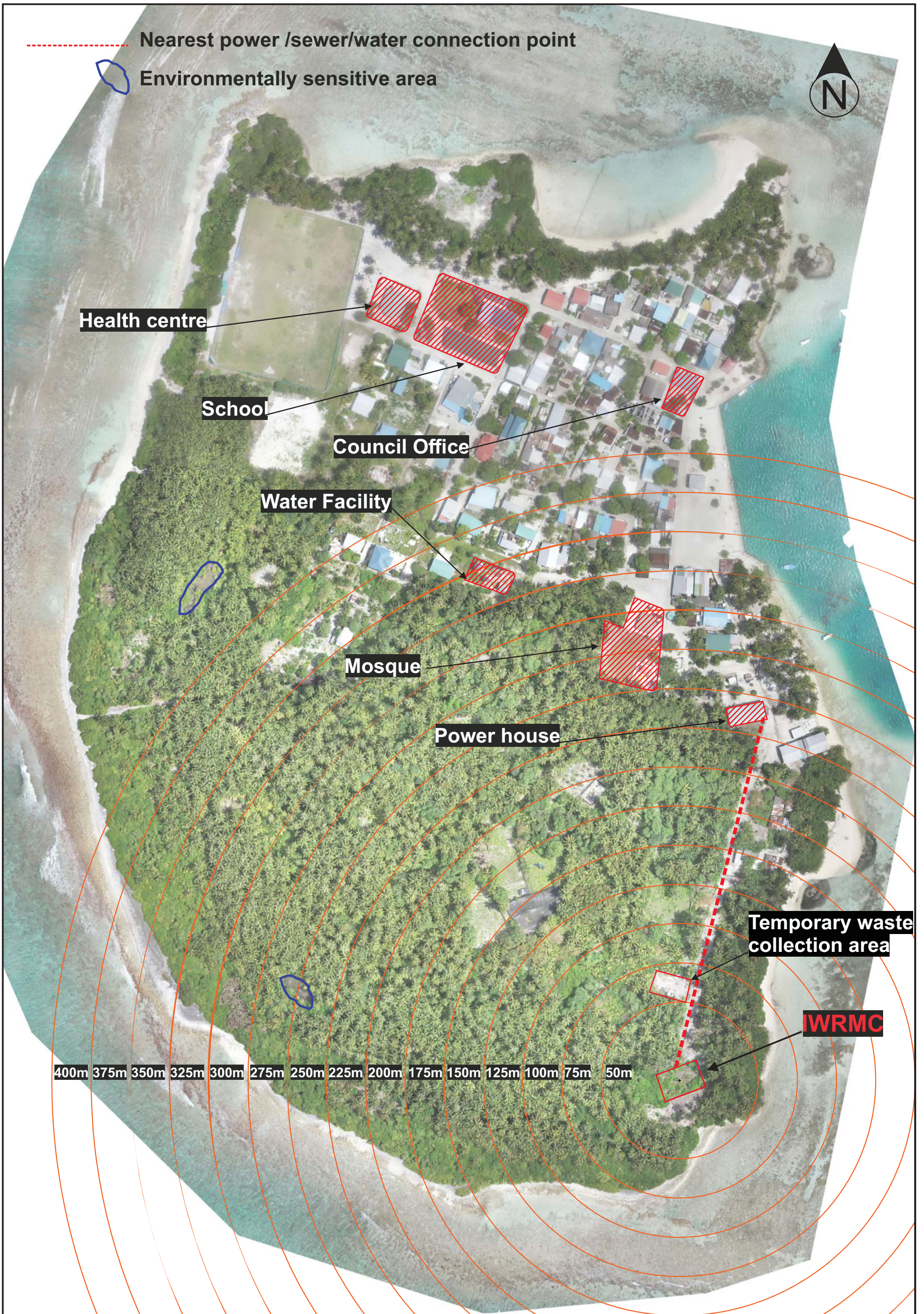
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Appendix 4 Map of study area



Nearest power /sewer/water connection point

Environmentally sensitive area



Health centre

School

Council Office

Water Facility

Mosque

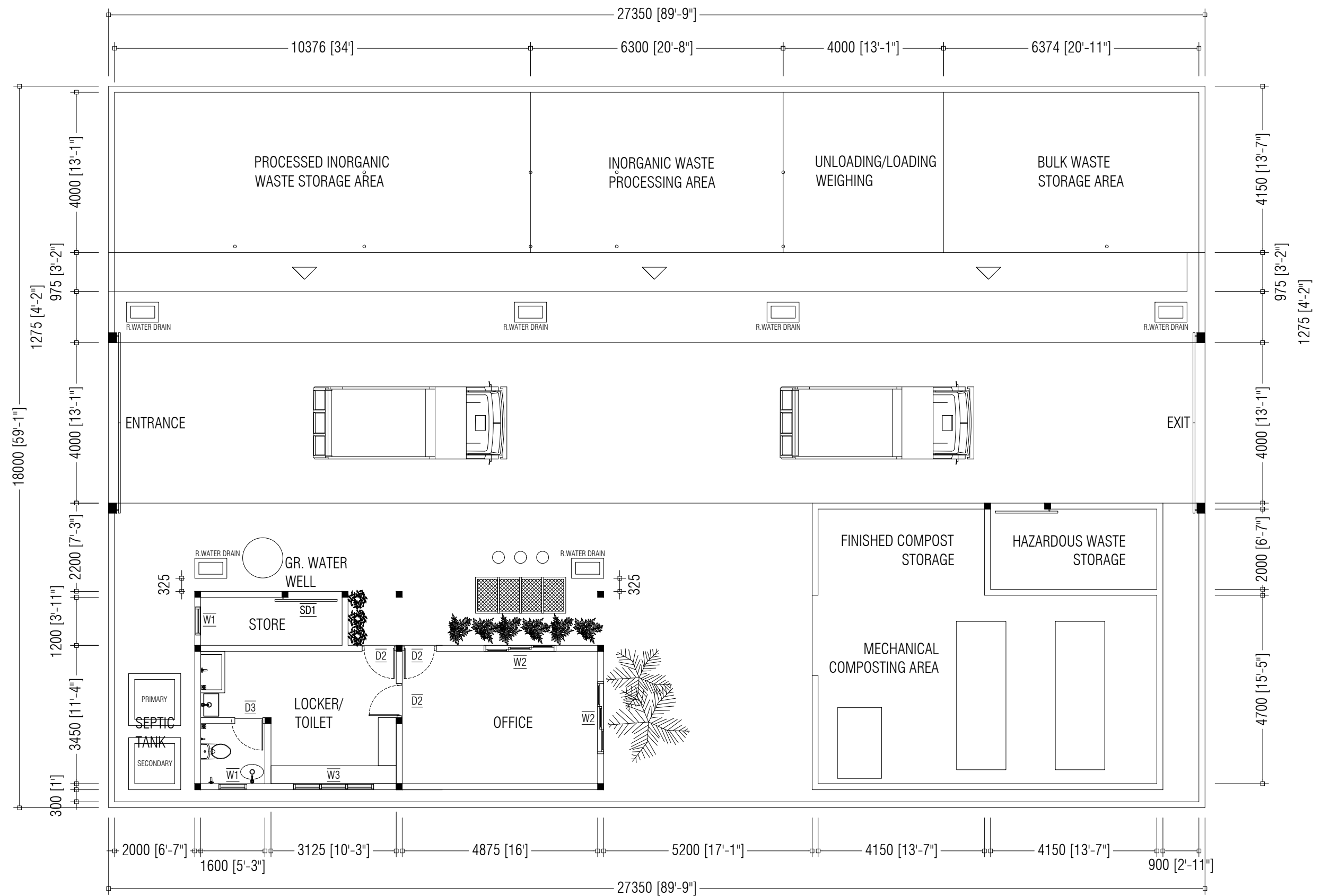
Power house

Temporary waste collection area

IWRMC

400m 375m 350m 325m 300m 275m 250m 225m 200m 175m 150m 125m 100m 75m 50m

Appendix 5 Site plan



PREPARED BY

PROJECT
CONSTRUCTION OF ISLAND WASTE MANAGEMENT CENTRE
TH.VANDHOO

DESIGN BY
AFRAZ

AMENDMENTS



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

TITLE
FLOOR PLAN
CLIENT DEPARTMENT
WMPC DEPARTMENT

STRUCTURE BY
AFRAZ
DRAWN BY
AFRAZ

PAPER SIZE A3
PAGE NO. 02

SCALE 1:100
DWG NO. THVND-A1-02
DATE 30.12.2020

Appendix 6 Alternatives proposed and respective mitigation measures

This section provides comparative description of organic waste composting technologies considered in the ESMP prepared for managing organic waste at Vandhoo. In-vessel composting is the preferred technology where windrow-based open composting and anaerobic digestion has been compared with preferred option. The following matrix provides a comparative assessment of the three options considered for the project from environmental, social and economic perspective (Table 1).

Table 1. Comparison of organic waste treatment option selected with alternatives considered

	Environmental aspects	Social aspects	Economic aspects
In-vessel composting (preferred option)	<ul style="list-style-type: none"> • Small land area required for setup • Overcomes the problem of leachate generation • Burning of waste is not required • The system is only slightly affected by environmental conditions, as work will be carried out indoors (sheltered area) • Moderate energy is required for operation 	<ul style="list-style-type: none"> • Labour requirement is low (2 to 3 persons can carry out operations) • Compost can be prepared in a short time frame (15 to 30 minute cycles in OWC machine and 10 to 12 days for curing) • Minimal odour associated with processing of waste 	<ul style="list-style-type: none"> • Highly dependent on mechanical equipment High capital cost • Moderate operations and maintenance cost • Economic turnover is very high due to fast process
Windrow-based open composting	<ul style="list-style-type: none"> • Large land area required for setup • High leachate generation with potential for groundwater contamination • The system is only highly affected by environmental conditions, as it is carried out in the open • Attracts flies, rodents and other pests • Low energy requirement 	<ul style="list-style-type: none"> • Labour requirement is high as it involves strenuous work. The pile needs to be turned every 5 days or so to ensure even composting • The whole process is time consuming and may require months to complete the process • Strong odour associated with the processing, especially when the pile is being turned • Attracts flies, rodents and other pests 	<ul style="list-style-type: none"> • Minimally dependent on mechanical equipment • Low capital cost • Low operations and maintenance cost • Economic turnover low due to the long time taken for composting

Anaerobic Digestion	<ul style="list-style-type: none"> • Relatively large land area required for set up • Biogas generated can be reused as a potential source of energy (for cooking or converted to electricity). • Organic nutrient content (liquid residue and undigested biproduct) can be used as a liquid fertilizer and compost • High energy requirement 	<ul style="list-style-type: none"> • Labour requirement for operation of Anaerobic digestion composting machine is low • Processing time approximately 1 month • Low to moderate odour due to waste processing 	<ul style="list-style-type: none"> • Highly dependent on mechanical equipment • Very high capital cost • High operation and maintenance cost • Economic turnover is high (shorter time than windrow-composting and high value product) • Potential to use bi products for economic use
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The following table provides environmental and social impact mitigation measures proposed for the alternative technologies compared (Table 2).

Table 2. Mitigation measures proposed for the alternative waste treatment methods

Method	Mitigation measures proposed
In-vessel composting	Mitigation measures for the process as reported in ESMP matrix given in this report (Chapter 8, Table 11)
Windrow-based open composting	<ul style="list-style-type: none"> • Design and construct an appropriately sized compost slab with an impermeable layer, drainage mechanism with leachate collection tank established • Design of composting area should be at least partially shaded to enable composting during rainy season • Ensure compost material are appropriately segregated to avoid potential vermin infestation. Open compost is most suitable for garden waste (branches, twigs, and leaves), vegetable waste and fruit waste • Maintain adequate aeration, temperature and retention time in biological treatment systems to achieve pathogen destruction (World Bank Group, 2007) • Maintain Carbon: Nitrogen (C:N) ratio between 30:1, moisture content between 40-60%, temperature between 30-50°C and pH between 6 and 8 (CITRES and MEECO 2019)

	<ul style="list-style-type: none"> • Ensure that the windrow is high enough to retain the heat and maintain the temperature, but still small enough to let air diffuse to the centre. • Ensure that the compost pile is regularly turned to allow for air diffusion into the material and mixing of the material in order to move larger particles into the core to undergo composting. • As per IFC EHS Guidelines “avoid conditions that can lead to spontaneous combustion (e.g., moisture between 25 – 45 percent and temperatures above about 93°C. This can be achieved for example by keeping windrows less than about 3m high and turning them when the temperature exceeds 60°C)” (World Bank Group, 2007) • Water the compost pile depending on the moisture content in the waste • Isolate workers from spore dispersing components of the composting process such as turning, by opting to mechanical turning (e.g., by using tractors). • Provide protective gears to the workers (gloves, water proof footwear, protective eye wear, masks) • Provide appropriate training to workforce with regard to waste handling, processing and management • Ensure provision and use of dust masks or respirators under dry and dusty conditions (e.g., when compost is being turned) • Ensure provision of a first aid kit on site so as to attend to any medical emergencies immediately. Cover open wounds to prevent contact with the incoming loads
Anaerobic Digestion (AD)	<ul style="list-style-type: none"> • Design and construct an appropriately sized area for machine installation, with an impermeable layer, drainage mechanism and leachate collection tank for leachate management • Ensure Carbon: Nitrogen (C:N) ratio is between 20:30.1 optimum methane production. If ratios is higher than this, nitrogen availability will limit the process and consequentially decrease gas production and digestate produced will be less in nutrient quality (Environment Agency, 2013) • Ensure that the AD plant is operated at the correct operational temperature for the specific plant being used (Environment Agency, 2013) • Operate an anaerobic digester under thermophilic digestion conditions, in order to increase the pathogen destruction, biogas production rate (hence higher energy recovery) and the retention time (World Bank Group, 2007) • Ensure pH inside the AD plant is maintained between 6.5 to 8 which is the wider range for optimum growth rate of methane producing organisms (Environment Agency, 2013). • Recycle wastewater to the reactor to the greatest extent possible

	<ul style="list-style-type: none"> • Explore the potential use of biogas (Methane) such as use for cooking or generating electricity • Explore the potential use of liquid and solid residues for liquid fertilizers and compost • Provide protective gears to the workers (gloves, water proof footwear, protective eye wear, masks) • Provide appropriate training to workforce with regard to waste handling, processing and management • Ensure provision of a first aid kit on site so as to attend to any medical emergencies immediately. Cover open wounds to prevent contact with the incoming loads
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Alternative sources of electricity for the operation of preferred waste management technology also have been considered. The following table provides options considered for using electricity and their potential impact mitigation measures (Table 3).

Table 3. Mitigation measures proposed for the alternative energy sources

Method	Mitigation measures proposed
Electricity to be sourced from existing power grid at the island	Mitigation measures for the process as reported in ESMP matrix given in this report (Chapter 8, Table 11)
Installation of solar panels	<ul style="list-style-type: none"> • Roof structure is appropriately designed and constructed to ensure that the solar panels and substructure load can be sustained • Enough roof area made available to ensure that the energy requirement can be tapped from Photo Voltic structures (PV) installed • Establish a way to provide the excess energy produced to the island electric grid
Installation of a generator in the IWRMC specific for its operations	<ul style="list-style-type: none"> • Ensure required approvals and permits are obtained prior to construction of facility (design should meet all required criteria by relevant authorities) • Ensure that the generator set installed is sufficient to cater to the needs of the IWRMC • Ensure that the floor of the power facility is leak-proof to prevent groundwater contamination due to spills • Ensure fuel is stored in appropriate leak proof containers and area where fuel is enclosed by a bund wall to prevent leakage • Ensure there are no accidental spills during transfer of fuel • Ensure that the power facility is soundproof.

- | | |
|--|--|
| | <ul style="list-style-type: none">• Restrict operations to daytime hours• Ensure all the required sign boards are in place• Ensure power facility operators are provided with all the required protective gear• Ensure that there is sufficient and relevant fire prevention and firefighting equipment at the facility• Ensure that all waste oils, oily rags, lubricants etc. are stored in appropriate, tightly sealed containers and are disposed to the RWMF at regular intervals (4 to 6 months)• Ensure that power facility operators are properly trained in all aspects of the operations and maintenance of the facility• Ensure that the generator set is regularly maintained and that the whole facility is kept in clean conditions• Ensure there are sufficient stock parts for a period of 1 year at any given time |
|--|--|

Appendix 7 Translation of ESMP

Appendix 8 List of stakeholders consulted

Institution	Name	Designation	Contact
EPA	Inaya Abdul Raheem	Civil & Structural Engineer	inaya.abdulraheem@epa.gov.mv
MNPHI/ Landuse planning dept)	Nihaaza Anees		nihaaza.anees@planning.gov.mv
MLSA	Fathimath Shanna	Director / Land department	fathimath.shanna@mlsa.gov.mv
Th. Vandhoo Island Council	Hassan Shiyaz	Vice President of the Council	
Womens' Focus group	Fathimath Faruzana	Community	7712954
	Aminath Shahida		7224196
	Latheefa Abdul Raheem		7514238
	Aminath Athifa		7500705
FENAKA Corporation Ltd	Hassan Shaheel	Manager, Vandhoo FENAKA branch	7590424
MNDF	Warrant Offier Grade 1	Ahmed Hassan	7795838
	Warrant Offier Grade 1	Farooq Ismail	9884399
	Staff Sergeant	Mohamed Ashraf	7776098

**Appendix 9 Copies of emails sent to HPA regarding
consultation meeting**



Shahaama Abdul Sattar <shahaama.abdulsattar@lamer.com.mv>

Formulation of ESMP for establishment or upgrading of IWRMC in Zone 4 and 5

Shahaama Abdul Sattar <shahaama.abdulsattar@lamer.com.mv>

Wed, Jan 20, 2021 at 10:17 AM

To: shiyana@health.gov.mv

Dear Shiyana,

Please find below, mail sent on 9th Jan, requesting for a consultation meeting regarding the formulation of the Environmental and Social Management Plan for the establishment or upgrading of Island Waste Management and Resource Management centres in Zone IV (Meemu, Faafu Dhaalu) and Zone V (Thaa, Laamu). Would appreciate it if a consultation could be arranged at the earliest.

Thank you

Best Wishes,

Shahaama Abdul Sattar

Environmental Consultant



LAMER Group Pvt. Ltd.

Azum(4th Floor), Ameenee Magu, Henveiru, Male' 20054, Maldives

T +960 331 5049, +960 333 5605 | F +960 331 0776 | M +960 790 4985 | E shahaama.abdulsattar@lamer.com.mv |

W www.lamer.com.mv

----- Forwarded message -----

From: **Shahaama Abdul Sattar** <shahaama.abdulsattar@lamer.com.mv>

Date: Sat, Jan 9, 2021 at 5:38 PM

Subject: Formulation of ESMP for establishment or upgrading of IWRMC in Zone 4 and 5

To: <hpa@health.gov.mv>

Cc: Ismail Abid <ismail.abid@lamer.com.mv>, Hussein Zahir <hussain.zahir@lamer.com.mv>, Aisha Abdulla <aishath.abdulla@lamer.com.mv>

Dear Sir / Madam

LaMer has been awarded the work to carry out environmental and social assessments for the establishment or upgrading of Island Waste Management and Resource Management centres in Zone IV (Meemu, Faafu Dhaalu) and Zone V (Thaa, Laamu) by the Ministry of Environment (Letter from ME attached for your information).

As a part of the formulation of the Environmental and Social Management Plans for these projects, we would like to consult with you regarding the three components as below (with specific emphasis on on COVID19 health and safety requirements):

1. Piloting Anaerobic Digestion (AD) and Upgrading of the Existing IWRMC of L. Fonadhoo, Dh. Kudahuvadho, M. Muli and F. Nilandhoo
2. Upgrading of IWRMC at Th. Vandhoo with Aerobic Technology using Composting Machine
3. Construction of an Island Waste Management Centre with Aerobic Technology using Composting Machine at six islands (Dh. Maenboodhoo, L. Dhanbidhoo, L. Gan, M. Kolhufushi, Th. Hirilandhoo, Th. Guraidhoo).

I have attached the project briefs and site plans for the three components. for your information. Would appreciate it if you could inform us of a time for an online consultation regarding this project.

Looking forward to an early reply.

Best Wishes,

Shahaama Abdul Sattar

Environmental Consultant



L A M E R

LAMER Group Pvt. Ltd.

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W www.lamer.com.mv

4 attachments



Project brief - Piloting Anaerobic digestion and upgrade of 4 existing IWRMC.pdf
1551K



Project brief - Aerobic digestion and mechanical composting in Th. Vandhoo IWRMC.pdf
1357K



Project brief - Aerobic digestion and mechanical composting new IWRMC.pdf
2394K



Letter of Award from ME.pdf
54K

Appendix 10 Copy of Household survey form

**Additional Information requested for ESMP for the proposed
upgrade of IWRMC at Vandhoo, Thaa Atoll**

EPA request Reference: 203-ECA/438/2021/52 on 28th February 2021

Proponent: Ministry of Environment

Consultant: LAMER Group Pvt Ltd

1st March 2021

Below are the details for the additional information requested.

- 1. In table 3, (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)**

Project inputs have been provided as per information provided by the proponent.

Article 18 (Haa) of the Water and Sewerage Act (8/2020) states that groundwater (and water other natural water bodies such as mangroves) cannot be used for industrial purposes, or on islands leased for agricultural purposes or tourism. The act does not state that groundwater cannot be used for construction work on inhabited islands.

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

Mitigation measures proposed are those which are already included as part of the scope of work both during construction and operations and hence cost for these should have been included as part of the project cost .