

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Upgrading of Island Waste Resource Management Centre
with Anaerobic technology at Muli, Meemu Atoll



Report Prepared by LAMER Group Pvt Ltd

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February 2021

Environmental and Social Management Plan for the upgrading of Island Waste and Resource Management Centre with Aerobic Digestion (AD) Plant

REVISION 2

Location: Muli, Meemu Atoll, Maldives

March 2021

Prepared for Ministry of Environment

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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 Anaerobic Digestion (AD) Technology at Muli, Meemu Atoll, are true, complete, and correct.

Name: Hussein Zahir

Consultant Registration Number: EIA P04-07



Signature:

Date: 18th March 2021

Proponent's Declaration



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Ministry of Environment
Male', Republic of Maldives.

Date: 8 February 2021

No: 438-MCEP/INDIV/2021/18

To Whom It May Concern

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 M. Muli has been prepared in accordance with the Environmental and Social Assessment and Management Framework (ESAMF) of the Maldives Clean Environment Project (MCEP) and the safeguards requirements of the World Bank.

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, Waste Management and Pollution Control Department

1 Executive Summary

Background

Muli is one of the 9 inhabited islands in Meemu atoll in the central Maldives. Like almost all island of Maldives, the Muli island is also vulnerable to environmental and economic development variables such as waste management, rising sea level, coastal erosion, pollution/depletion of groundwater. Traditionally, food waste is generally disposed to the shoreline while other organic waste was burnt in open fire and were seen as manageable in the context of a small community. However, with increased population and economic development activities associated with the island, the traditional waste management practices have become environmentally unsustainable. The current waste management area in Muli was established in 2015, with an area of 0.24ha as Island Waste and Resource Management Centre (IWRMC), to manage island specific waste. Initially, the council did collect kitchen waste from the households with a charge of MVR 100 per month. However, due to financial constraints the council ceased its services to collect waste from household in 2018. The services were again resumed in 2019 with additional resources and a new fee structure. Kitchen waste was also collected and was outsourced to a private company for it to be disposed into deep sea.

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 Anaerobic digestion (AD) as a means of treating organic waste generated in the island. The project involves construction of a 1.5-ton AD plant within the boundary of the existing IWRMC and undertaking additional civil work to upgrade the IWRMC. This decision was 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 (CITRES & MEECO, 2019).

The project will include construction of new infrastructure inclusive of an organic waste processing area. Once the infrastructure is in place, an anaerobic digester plant will be set up at the facility to facilitate treatment of the organic waste. 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
- Impacts due to vegetation clearance if the temporary waste relocation site is allocated at the north side of the IWRMC
- Health and safety risks to the workers during construction and operational work
- Air pollution due to emissions associated with construction machinery
- Potential impacts due to discharge or excess digester liquid to the ground

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:

- Benefits to the island community (both social and economic) due to improved waste management practices and operation of the facility,
- 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.
- Care should be taken to maintain the flaring vent and the flame so as to have controlled burning (to prevent CH₄ emissions).

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 organic waste treatment 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. Utilise the biogas produced to generate electricity which can be used to power the IWRMC operations
5. Ensure that measures are in place to address the issue of excessive digester liquid (liquid fertilizer), so as to enable its utilization or disposal in an environmentally friendly manner
6. Carryout awareness raising campaigns to increase awareness of the public regarding proposed work;
7. Ensure all trainings identified under the Training programme of this report are properly implemented to ensure proper implementation of the project at all phases;
8. Encourage greater participation of women, especially during operational stage;
9. Ensure proper supervision and inspection of the IWRMC at regular intervals.

2 Introduction

2.1 Background and justification

Similar to almost all island of Maldives, the Muli island is also vulnerable to environmental and economic development variables such as waste management, rising sea level, coastal erosion, pollution/depletion of groundwater. Traditionally, food waste is generally disposed to the shoreline while other organic waste was burnt in open fire and were seen as manageable in the context of a small community. However, with increased population and economic development activities associated with the island, the traditional waste management practices have become environmentally unsustainable. Often the open burning areas are close to the residential areas and public service areas such as school and health center, hence get exposed to the smoke from opening burning. Similarly, a substantial amount of organic and inorganic waste ends up on the beach and nearshore lagoon, leading to pollution of these areas and beyond. Hence, improper waste management practices on islands have become a major concern that needed remedial measures to prevent further degradation of the natural environment and safeguard the wellbeing of the island community. The Island Council, with a vision to properly manage the waste generated on the island, has designated an area on the island and waste collection and disposal are been managed through the Council.

The current waste management area in Muli was established in 2015, with an area of 0.24ha as Island Waste and Resource Management Centre (IWRMC), to manage island specific waste. Initially, the council did collect kitchen waste from the households with a charge of MVR 100 per month. However, due to financial constrains the council ceased its services to collect waste from household in 2018. The services were again resumed in 2019 with additional resources and a new fee structure. Kitchen waste was also collected and was outsourced to a private company for it to be disposed into deep sea.

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 Anaerobic digestion (AD) as a means of treating organic waste generated in the island. The project involves construction of a 1.5-ton AD plant within the boundary of the existing IWRMC and undertaking additional civil work to upgrade the IWRMC. This decision was 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 (CITRES & MEECO, 2019).

In addition to introducing AD technology with its setup, the project also proposed to bring some additions and changes to the layout of the existing setup, though 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:

- Organic waste processing area
- Waste unloading, loading and weighing area
- Inorganic waste processing area
- Processed inorganic waste storage area
- Unprocessed inorganic waste storage area
- Bulk waste storage area
- Hazardous waste storage area
- Office / Store / Toilet
- Septic Tank
- Groundwater Well
- Water and electricity connections
- Drains installation
- Rainwater pits
- Parameter Fence / Wall / Gates
- Fire safety equipment

Additional details of these structures are given in Chapter 4. Once the infrastructure is in place, 1.5-ton capacity Plug Flow Reactor or PFR anaerobic digestion (AD) plant will be set up at the facility to allow the digestion of the waste using anaerobic 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 AD plant, the operations of the plant will be handed over to the Island Council. Training needs for the proper operation of the plant will be identified through the assessment and will also be incorporated into the report.

The Island Council has formulated a Regulation on waste management and disposal for the island. 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 an Island Waste Management Guidelines and an Island Waste Management Plan (IWMP) have also been formulated by the Council. Major components of these two documents are given below.

2.1.1 Island Waste Management Plan (IWMP) of Muli

The Island Waste Management plan (given in Appendix 2) was formulated in 2015 for a 20-year period (2015 – 2035). The main objective of the IWMP is to establish measures to manage the waste produced on the island. This includes designation of areas for waste disposal, collecting fees from households for waste collection, proper segregation of waste etc. The plan was

formulated through consultation with EPA and the whole island community. The main components of the IWMP includes

1. Waste management

- Estimate of different types of waste
- Ways to dispose the different types of waste
- Implementation Authority

2. Fees for waste management

- Although the plans list out the set of fees for different categories, the fees have been updated in the guideline document and this has also changed over the years. As per the guideline document the fees are as below:
 - Households – MRF 150 per month
 - Offices / Businesses – MRF 115per month
 - Restaurants/Cafés/Businesses/Shops-Ranges from MRF 200 to MRF 350 per month
 - Offices/Government Institutions- Ranges from MRF 500 to MRF 600per month
- Currently, it was reported by the households that now they charge a fee of MRF250 from households.

3. Implementation

The plan identifies the responsible authorities for implementation of different aspects of waste management. The authorities and their roles are as are as follows:

- Island council-Implementation of waste management regulation and monitoring
- Police-Enforcement
- Waste management Committee: Planning and Implementation of plan
- NGOs: Actively participate on the ground
- Institutions: Create awareness among community
- Households: Segregate waste and transport waste to the collection centers

Although it stays here that households should carry the waste to the center, it is important to note that currently the waste is collected from the council and taken to the center by a third party.

4. Community Awareness

- Setting up of sign boards and information boards in different parts of the islands

- Meeting with people with grievances and help address the matters regarding waste management through providing information on the regulation
- Distribute awareness materials like leaflets

5. Waste Disposal and Management at the Center

- Sorting and Managing waste at the center twice a day by employees assigned by the council

6. Sustainable Future Plans

- The plan briefly lists the short term and long terms goals with regards to waste management. These include
- Short term goals:
 - Establish an appropriate system to management waste dispose from the island community
 - Reduce the impact on the environment due to waste disposal
- Long Term goals
 - The island community is a well informed and environmentally friendly community
 - Able to address the problems that arise due to waste disposal and help improve the condition of the environment

In addition to the IWMP, the IWM Guideline identifies the following:

- The waste categories
- Waste collection times from the different places
- How to keep the waste segregated before collection
- Opening hours of the IWRMC
- Guidelines for waste disposal by anyone other than the Council or council appointed waste management staff
- Fees for waste collection and disposal
- Fee collection
- Fines and Enforcement

The waste management plan and the guideline document are attached in the Appendix 2 of this report.

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 3).

2.3 Terms of Reference (TOR)

As stated above, the Terms of Reference issued by World Bank for the project titled “ESMP or ESIA for the establishment or upgrading of IWRMC with Anaerobic Digestion (AD) Technology”, 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. Study Area and Project Description
5. Existing environment
6. Impact Identifications
7. Project Alternatives
8. Mitigation and management of negative impacts
9. Monitoring and reporting 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 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)
- Island Waste Management Plan (01 July 2015 – 01 July 2035) –M. Muli Council
- AgStar Project Development Handbook – A Handbook for developing Anaerobic Digestion / Biogas Systems on Farms in the United States. 3rd ed. (USEPA, n.d.)

2.5 Revisions made to the ESMP based on comments from World Bank

The first version of the ESMP was submitted to World Bank for review and based on comments received, following revisions have been made to the ESMP, which will also serve as the final ESMP. Table 1 below gives a response matrix showing comments made by World Bank and feedback from Consultant. The matrix also identifies relevant chapters and sections of the report where revisions have been made to address the comments made by World Bank.

Table 1. Response matrix with comments from World Bank and feedback from Consultant.

Comment from World Bank	Feedback from Consultant
In consultations, again it is noted that there are 20-40 large coconut trees to be cut. But no details provided in the main text of the report. So pls request the consultant to follow guidelines given in ToR points 6 (F)	As noted by WB, the stakeholder consultation notes states that about 20-40 palms will need to be removed. However, as also stated in the consultation notes, this is only IF the IWRMC is being expanded beyond the currently demarcated area (Page 12-127). However, since the project

<p>and 7 (C) to provide details on numbers of HHs affected, estimate any compensation to be made and processes /timelines to be followed to ensure compensation is paid before any tree is cut & construction commenced.</p>	<p>will be carried out inside the earlier demarcated boundary of the IWRMC site, there is no requirement for clearance of these coconut palms or need for compensation.</p> <p>Furthermore, after discussion in the Alternatives Chapter (Chapter 7, Section 7.4) the alternative location proposed as temporary waste relocation site has been selected. This location is on reclaimed land and does not have significant vegetation. Hence no vegetation clearance is required at this site as well.</p> <p><i>Thus, no changes have been made to the main report with respect to these comments.</i></p>
<p>Then the actually concerning issue is regards the impact on nearby houses (situated within 50m) due to the smoke generated (points raised during consultations)</p> <ul style="list-style-type: none"> • So, suggest the consultant to elaborate a bit on these impacts in the main report, clearly stating how many HHs are affected, and how and what measures will be in place during the operation phase to mitigate these impacts – because the ESMP does not include this as an impact, hence no measures are noted in the operation phase. • Also suggest the consultant to briefly provide details on the site selection process followed as per EPA criteria, because ESMF/RPF, p53 notes the EPA site selection criteria which states that a minimal separation 	<ul style="list-style-type: none"> • These impacts are those associated with current practice of waste management, whereby open burning is the main means of disposal of waste on almost all islands of Maldives. This will not be an issue once the IWRMC is upgraded and operations commence, as open burning will be completely ceased at that stage. Hence they have not been discussed under Chapter 6 (Environmental Impacts) of this ESMP, as that addresses impacts due to proposed work (Upgrade of IWRMC with AD technology for composting). • However, disposal of waste at the temporary waste site which is to the east of the IWRMC and open burning at this site during construction period, will have some impact on the residential area, to a lesser extent (due to greater distance between site and residential area). • <i>Thus Chapter 6 (page 6-81) has been revised to include this impact and Chapter 8 (Table 15, page 8-91) has been revised to include mitigation measures to address these impacts. Recommendations have also been made in the report as additional mitigation measures (Chapter 14, page 14-140).</i> • Site selection is not within our scope of work. The proposed work is being undertaken at an existing IWRMC. As per information we have received, the allocated land for IWRMC is designated by the council and marked in the proposed land use plan which was approved by the planning department under Ministry of National Planning, Housing and

<p>distances >300 meters should be maintained between residential dwellings.....</p>	<p>Infrastructure. MNPHI (planning department) approves land use plans developed by Island Councils.</p> <ul style="list-style-type: none"> • The Environmental Guidelines for Site Selection of Waste Management Centers issued by EPA in 2017 states as follows “Any establishment shall not be present within the 30 meter radius from the boundary of waste management center”. Hence the minimal separation distance of >300m given in the ESMF/RPF is a mistake.
<p>Incorporate following mitigation measures to address impacts during transfer of waste from site to temporary site (if required)</p> <ul style="list-style-type: none"> • There should be close monitoring of the waste movements as per the procedures stipulated to the temporary site with photo documentation. • Transfer should be done step wise with careful attention to remove any potential recyclables from the waste being moved and not done in a adhoc manner- it is good to indicate how the transfer will be done, will be via manual labor and trucks etc. • The temporary lining / bund should be carefully removed from the temporary site once the waste is cleaned up. • Make a public announcement prior to shifting waste management activities to the site. This announcement should reflect the date of commencement of the temporary site usage and the duration to which the site will be used. • Designate specific areas to store different types of waste within the temporary site and put the sign boards to indicate the type of waste stored at each respective area. 	<ul style="list-style-type: none"> • <i>Mitigation matrix revised to reflect this measure (page 8-91 to 8-93)</i> • <i>Method of transfer discussed in Section 4.3.2 (page 4-44)</i>

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 2. The Government agencies that are specifically related to the project are;

- Ministry of Environment (ME)
- Environmental Protection Agency (EPA)
- M. Muli Island Council

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

Table 2 Summary of legally relevant requirement associated with 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>	<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>

	<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 dredging of harbors, clearance of vegetation within allocated plots for households and for roads, • 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>	Operator of the IWRMC shall abide by all requirements under the Act

	<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 • 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 gazette 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 	<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"> • 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) • 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 Muli was done prior to initial EMP formulation for the project, in 2015 and meets the requirements of EPA.
Regulation on protection of the environment – M. Muli (2019/R-720)	<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 	Disposal of hazardous waste through this project will follow this regulation as well as the Waste Management Regulation

	<ul style="list-style-type: none"> 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 	
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 provided in the LUP approved by MNPHI (Approved LUP in Appendix 4)
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> <ul style="list-style-type: none"> 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. 	The site proposed for development of the IWRMC has been allocated with due consideration to the guidance given in this regulation.

	<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>	
By-law on cutting down, uprooting, digging out and export of trees and palms from one island to another	<p>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.</p> <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 	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 where development work had already commenced
Protected Areas Regulation on Protected Areas Regulation (2018/R-78)	<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)</p>	There are no protected sites within vicinity of project site or even within the Atoll

	<p>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>	
Environmentally Sensitive Areas (ESAs)	<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>	<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 the Construction industry (2019/R-156)	<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 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).</p> <p>The main purpose of the Regulation is twofold:</p> <ol style="list-style-type: none"> 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 	<p>The proposed project will have to adhere to this regulation taking all precautionary measures identified in the regulation during the construction phase of the project.</p>

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

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>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>	
<p>Labour and Working Conditions</p> <p>National Laws</p>	<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		
<p>National Biodiversity Strategy and Action Plan 2016 – 2025 (NBSAP) prepared under the Convention of Biological Diversity (CBD)</p>	<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</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>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>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>	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.

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. 	
<p>Labour and Working Conditions</p>	<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> 	<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</p>

	<ul style="list-style-type: none"> • 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>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>
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4 Project Description

4.1 Project Location

The proposed project will be undertaken in Muli, Meemu Atoll within the existing area of 0.24ha identified as Island Waste Management Center (Figure 1) located at the north eastern side of the island. Muli (administrative capital of Meemu atoll) is located at the geographic coordinates of N02° 55' 22"; E73° 34' 53", on the eastern periphery of the atoll, with an area of approximately 56ha (natural island). Approximately same sized area has been reclaimed mainly from the shallow reef flat on the east and south. The nearest island, Mulah, roughly 2 km north, followed by Veyvah at approximately 4km further north. The distance between Male (capital of Maldives) and Muli is approximately 138 km. The nearest regional waste management facility at Thilafushi is close to Male, some 140 km from Muli.

All the civil works required for AD plant installation and IWRMC upgradation works are planned to be carried out within the boundary of the existing area. The land area required for project development was allocated for the purpose in the island land use plan which was approved by Ministry of Planning and Infrastructure in 2019 (Appendix 4). A vegetation buffer surrounding the boundary of the IWRMC will be maintained.



Figure 1 Muli island with general location of IWRMC

The existing facility has a partial boundary fence with a roofed comparted building with concrete floor where inorganic waste is currently been stored. Open burning of waste to some extent is currently been carried out at the site to minimize waste stored (Figure 2).



Figure 2 Aerial image of the current waste management facility in Muli

4.2 Project components

Current waste disposal area was established in 2015 and has an area of 0.24ha. This is the allocated area for collecting, depositing, and storing waste produced in the island. The waste collected is stored within the facility and where possible combustible waste is burned at site to minimize waste.

Existing infrastructures at the IWRMC are;

- Boundary wall/fence: Severely damaged boundary fence
- Inorganic waste storage area: Roofed area (75m²) with concrete screed. This structure will not be retained as a concrete slab is not present, instead it would be completely.
- Burner: An enclosed burner with a chimney which was previously used for burning waste, but is currently damaged and dysfunctional. The burner will be decommissioned subject to approval by Island Council.
- Electricity: 3-phase electricity available, supplied by Island Powerhouse.

As part of improving waste collection and processing at the current facility, new infrastructure will be constructed at the IWRMC. The civil works required for upgrading the center would be almost equivalent to the development of a new center. The components and services provided from this project are;

1. Organic waste processing area
2. Waste unloading, loading and weighing area
3. Inorganic waste processing area
4. Processed inorganic waste storage area
5. Unprocessed inorganic waste storage area
6. Bulk waste storage area
7. Hazardous waste storage area
8. Administrative building
9. Sewage disposal (septic tank)
10. Water supply
11. Drainage
12. Electricity
13. Boundary Wall / Fence
14. Fire safety

The proposed project aims to bring improvement to the current waste management facility of Muli through installation of anaerobic digestion plant to biologically convert organic waste to biogas, liquid waste and waste residue that can both be used as nutrient rich fertilizers.

The proposed administrative building includes an office space, locker for staff, store, toilet. The area of administrative building is approximately 70m². Through vehicle access to the facility is also enabled with the design upgrades. All the civil works associated with this project will be confined to the demarcated boundary (Figure 3 and in Appendix 5).

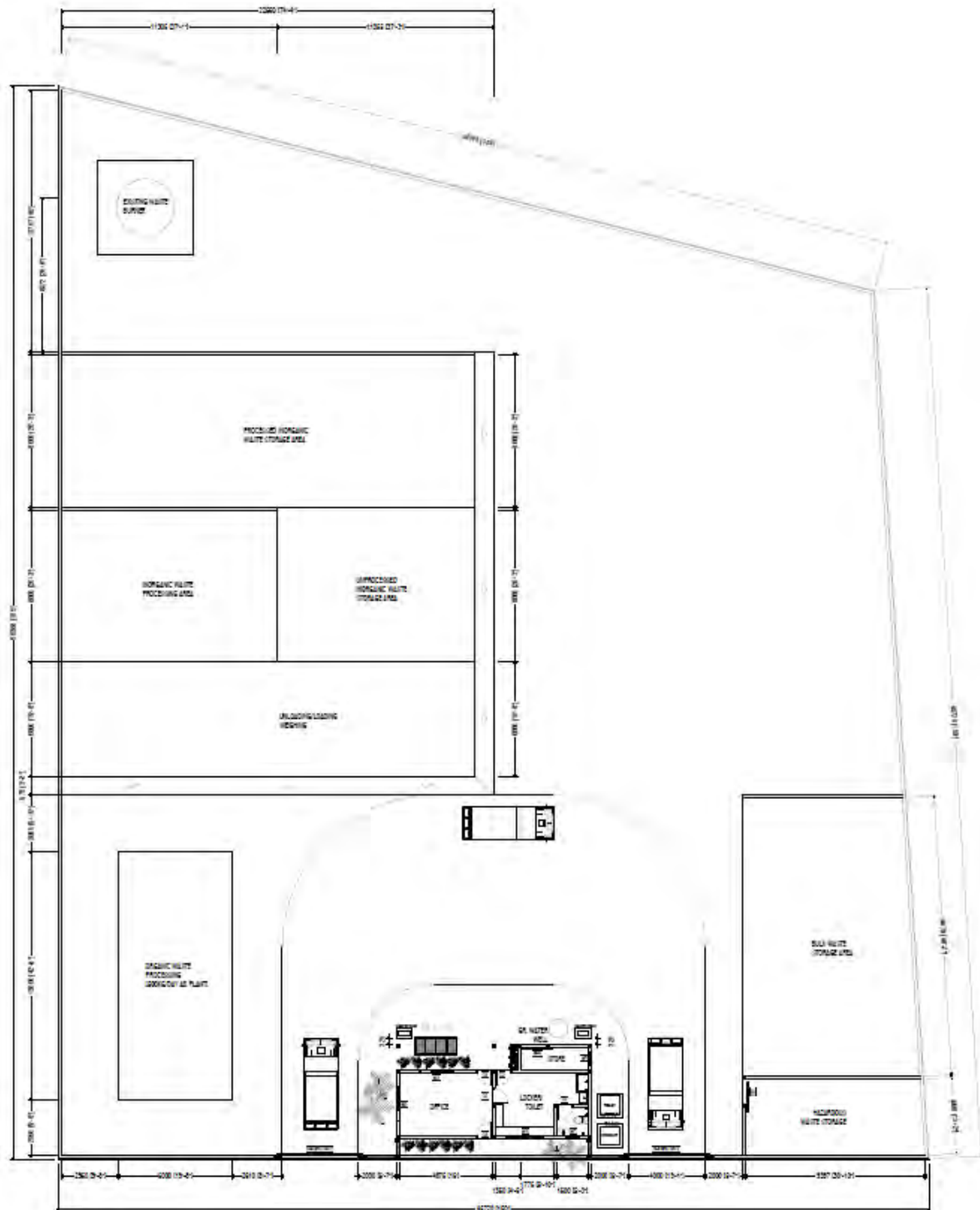


Figure 3. Schematic layout of IWRMC proposed (site plan also given in Appendix 5)

4.2.1 Anaerobic Digestion (AD) plant

4.2.1.1 Technology

The proposed technology for treating organic waste in Muli is a 1500kg capacity Plug Flow Reactor or PFR anaerobic digestion (AD) plant. Its main function is converting organic waste into biogas, while compost and liquid digestate are produced as byproducts. The liquid digestate can be directly used as a fertilizer, while the wet compost can be dried to obtain compost of high nutrient value.

Although the biogas produced can be utilized for cooking or converted to electricity with the addition of a bio-generator or IR biogas stoves with a biogas compressor (2-5Kg/cm²) to the system, provisions for such arrangements are not being made via the proposed project due to budgetary limitations. Instead, the biogas generated will be flared.

Around 5-10% of the biodegradable waste fed into the bio-methanation plant comes out as compost in case of food waste/MSW/cow dung and 30-40% of the material comes out undigested organic residue. The residues and leafy material containing lignin does not get digested completely comes out of the digester at the end of 30d SRT. This material can be pulled out of the digester and dried to obtain compost of high nutrient value. Anaerobic compost is found to have higher nutrient content when compared to aerobic compost. From 1tpd of biodegradable waste fed into a biogas plant around 30-40kg of wet compost (6-10kg dry) compost can be achieved. The digester liquid (600- 700L/pd) is also high in nutrients can be used as fertilizer

4.2.1.2 Cost

The cost of the plant excluding civil works is approximately \$25,000 to \$30,000. The cost of the project including civil works is estimated as Rf 2.5 million (USD 162,127).

4.3 Construction

4.3.1 Construction methods

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.

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. Details of the new infrastructure to be developed at the IWRMC as part of the proposed project are explained below:

1. Installation of Anaerobic Digestion (AD) Plant

A 500kg anaerobic digestion (AD) plant will be installed at an area of 78m². Details of the technology are provided in section 12.

2. Waste unloading, loading and weighing area

A roofed area (120m²) with a concrete slab will be constructed adjoining the existing collection bays, designated for sorting and weighing of incoming waste to organic and inorganic fractions.

3. Inorganic waste processing area

A roofed area (80m²) with concrete slab will be constructed behind the waste unloading, loading and weighing area. This area will be designated for carrying out glass crushing, metal can bale, plastic shredding, etc.

4. Inorganic waste storage area

A roofed area (160m²) with concreted slab will be developed behind 3 cells of the existing collection bays and will adjoin the inorganic waste processing area. This area along with the existing collection bays would enable storage of processed inorganic waste for a period of 4 – 6 months.

5. Bulk waste storage area

A roof area (126m²) with concrete slab enclosed by 3 brick walls, where bulk waste such as old furniture, roofing sheets etc. will be stored and sold or given free to the community.

6. Hazardous waste storage area

A fully enclosed room (36m²), with a roof, concrete slab, and a gate, where the received hazardous waste will be stored prior to its final disposal at a RWMF. Appropriate hazard, flammable liquid, corrosives, etc., warning signage will be made available.

7. Administrative building

This building houses an office space, locker for staff, store, toilet. The area of administrative building is approximately 70m².

8. Sewage disposal

A septic tank will be developed directly behind the proposed toilet to deal with the waste water produced. Connection to the sewerage network of the island is currently not possible as no connection point is available close to the IWRMC.

9. Water connection and drainage

Water for operations will be drawn from the existing well. Water taps will be installed at waste processing areas, waste storage areas and close to the AD plant. Drains will be installed at the newly constructed waste unloading and loading area, waste processing areas and waste storage areas, and beneath the water tap close to the AD plant, which will be subsequently connected to the septic tank. Rainwater pits will also be installed throughout the open area of the IWRMC to deal with potential storm water produced during rainy seasons.

10. Parameter wall/fence

Parameter walls will be constructed at the back of the designated area for IWRMC, while the rest of the boundary will be fenced. The existing fence will be repaired at parts where possible. Two sliding gates will be installed west of the IWRMC which opens to the main road.

11. Fire safety equipment

Currently there are no fire safety equipment present in the IWRMC. Thus the following fire safety equipment will be supplied and installed as part of the contract:

- 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.

Construction of Foundation and concrete slab

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 the structures are single storey structures, 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.

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 and bulk waste storage area will be 100mm. The concrete slab at the rest of the waste processing areas will have a thickness of 150mm

4.3.2 Temporary location for relocating existing waste

At first during the screening stage, it was proposed to allocate the area east to the IWRMC to be used as the temporary waste relocation/disposal area during construction of the IWRMC. However, it was proposed by the island council to allocate the northern side adjacent to the IWRMC (Figure 4) as the temporary waste relocation/disposal site. This area is heavily vegetated. Waste relocation to this area will require removal of a large number of trees and this is envisaged to cause a significant impact to the natural environment. This issue was raised with the council during the preparation of this report and after a discussion with the island council including the PMU and environment consultant, it was decided that the alternative location proposed will be used as the temporary waste relocation/disposal land. The proposed alternative location is further discussed in section 7 of this report.

Waste at the existing IWRMC will be transported to the temporary site (if required) prior to construction work. Waste transfer will be through use of covered trucks and manual labour.

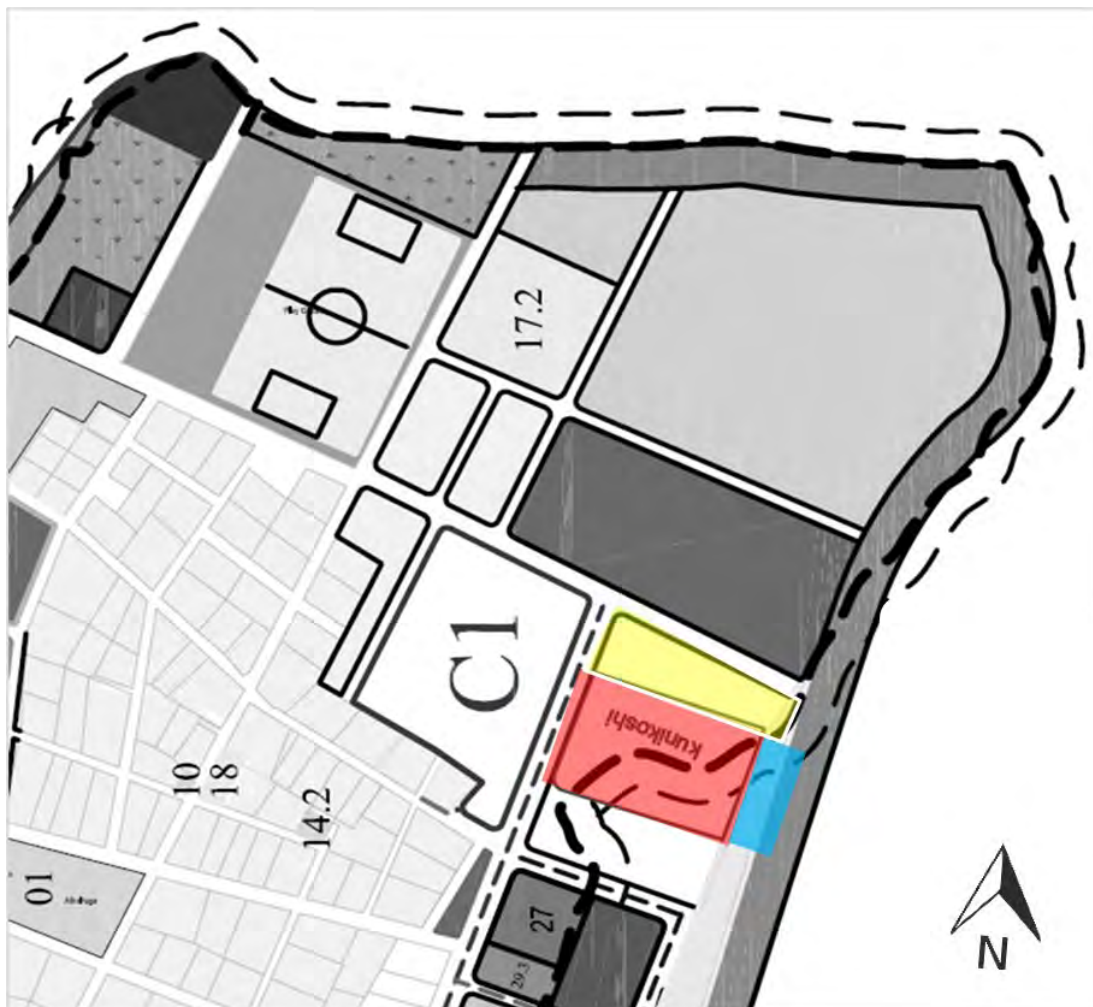


Figure 4. Proposed location for temporary waste relocation area during screening (blue), location proposed by island council (in yellow); location of IWRMC (in red)

4.3.3 Access to site, mobilization and material unloading

Access to site and material unloading will be via existing harbour on the north eastern side of the island. Materials will be transported and stored at the project site or another material storage site secured by a successful contractor.

4.3.4 Workforce requirements, availability and logistics

Work will be carried out by a Contractor, though contractor for the project has not been assigned 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.).

Workforce will be accommodated in existing accommodation facilities on the island that may be available for rent.

4.3.5 Water, electricity and Sewerage services

Electricity and non-portable water are already available at the existing IWRMC, which the workers can use during working hours for construction related purpose. Sewerage required for the workers will be arranged via the existing facilities available at the islands as the workforce will be accommodated in existing houses and/or guesthouses.

Rainwater, bottled drinking water will be made available to the construction worker for drinking purposes, by the assigned contractor.

Electricity will be connected to the new developments from the existing electricity distribution board of the IWRMC.

4.3.6 Vegetation clearance

Vegetation clearance is not required constructing proposed new infrastructures as all are proposed within the existing waste management area boundary, where vegetation has been already cleared. The proposed temporary location is also on reclaimed land with no vegetation hence no vegetation clearance is required.

4.3.7 Construction waste

Some demolition works are expected while carrying out the upgradation of the center. The amount is considered not significant. Such types of waste include parts of demolished walls and roofing sheets. These materials will be utilized for the construction of the proposed new infrastructures of the IWRMC as much as possible, with any remaining waste transferred to the disposal area designated at the island.

Other construction waste may include materials slightly hazardous in nature such as used thinners and paint cartons which will be properly sealed and stored at the existing IWRMC or a temporary waste disposal site and transferred to the nearest RWMF during demobilization of construction machinery and waste.

The existing waste present at the IWRMC will have to be temporarily relocated within the IWRMC or to another part of the island to accommodate space for construction. A temporary site for such waste disposal has been identified and approved by the council. Proper waste storage practices shall be followed to mitigate leachate and storm water runoff and prevent subsequent pollution of groundwater and soil. Such leachate prevention measures may include laying out a thin screed, or a non-permeable material laid on the ground and a cover on top of waste to prevent soaking of waste and thus preventing potential leachate that may be harmful to the surrounding environment.

4.3.8 Fire hazard, health and safety

The IWRMC with the upgrading will be equipped with the following fire safety equipment:

- 50kg Dry Chemical Powder (DCP) Trolley (2 nos.);
- 50liter Foam Trolley (1 nos.);
- Wet Chemical 6liter 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.).

4.4 Operational phase

In Muli, it is estimated that, 792 kg of domestic waste per day is generated (CITRES and MEECO, 2019). This corresponds to approximately 555kg of organic and 237kg of inorganic waste. The fraction of food is estimated as 443kg. To process this daily food waste an Anaerobic Digester (AD Plant (Plug flow reactor) of 500kg ton capacity will be installed at the current waste management facility.

The organic proportion of waste would be processed through AD plant, via systematic collection of households at source and transported (motorized vehicles) to the waste

management facility. Waste will be sorted at site and the organic (food and easily degradable organic materials) will be processed through Anaerobic digestion. The following figure shows a general schematic flow diagram of the process (Figure 5).

Bi product of the digestion process after approximately 30days are biogas (predominantly methane, 50% of gaseous composition), liquid bi-product of after organic digestion and solid residues. Currently due to financial restriction biogas will not be further processed which can be used as generating electricity or cooking. Gas produced from the anaerobic processing of organic will be flared (wasted). Liquid residue and solid residues have the potential use as organic fertilizers such as liquid fertilizer or compost. The fate of the residues has not been clear yet.

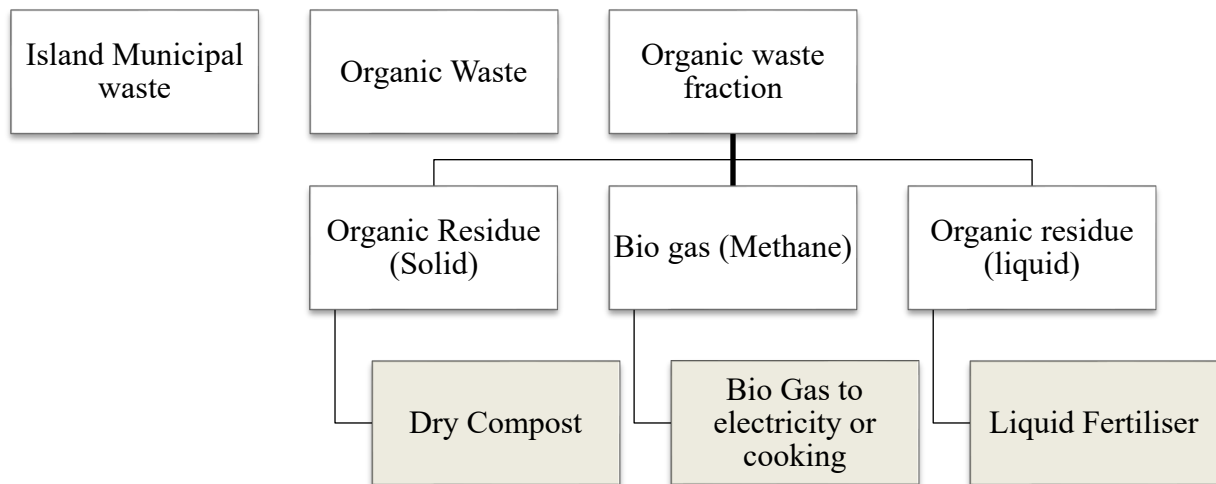


Figure 5 Schematic of the flow diagram of the organic waste treatment process

1. Waste Collection

Each household will be supplied with bins to facilitate segregation of waste at household level. Three motorized vehicles are proposed to be used for household waste collection. Daily collection services will be provided at a cost of MVR 150 per household.

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 within the management facility. The organic waste will

be treated through anaerobic digestion. The facility also has separate storage areas for hazardous waste.

3. Leachate Management

The proposed method of organic waste disposal through anaerobic digestion will greatly reduce leachate from waste handling and disposal. Appropriate design with leachate proof flooring associated with the proposed construction aspects, with surface drainage mechanisms at site ensures unmanaged leachate seepage leaked to the ground. The drainage system will be connected to the septic tanks constructed to dispose sewage and other wastewater generated at site.

4. Waste Transport to a Regional Facility

The inorganic waste processed and hazardous waste stored at storage areas within the management facility. This waste will be shipped periodically (once enough bulk material for a ship load is processed) to the nearest regional waste management facility. The organic waste will be composted through Anaerobic Digestion technology. Thilafushi has been proposed as the regional waste management facility for zone 4 and 5 of strategic waste management policy of Maldives. Thilafushi is currently being developed under financing from the Asian Development Bank

4.4.1 Anaerobic Digestion Plant Process

The Anaerobic technology is adopted for the facility is Plug Flow Reactor or PFR technology. The PFRs function like a three-zone fermenter where rapid fermentation occurs within the inlet zone with over production of VFA making it acidic. During this phase gas bubbles (CO₂) generally nucleate around and adhere to the biomass making them float in the digester liquid. In the second zone after the simple compounds present in the leaf biomass are converted to acids, a balance between the acidogenic and methanogenic bacteria is achieved when the biomass is still in a floating state. The third zone is a region where VFA produced in earlier zones diffuse into it and are converted to biogas. Under normal circumstances when the digesting biomass from the inlet starts to float it tends to gradually dry and form fermentation arrested 'scum'. The PFR system overcomes this issue by retaining the biomass under digester liquid for a sufficiently long period for the acidogenic bacteria to initiate fermentation and digests the easily fermentable fractions of the biomass. As the decomposition rates fall and several slow-growing methanogenic bacteria colonize this biomass in sufficient numbers, the rates of acidogenesis and methanogenesis very quickly become balanced enough to carry out a stable and continuous fermentation of the biomass even when the biomass feedstock is afloat.

The technology allows domestic waste to be fed in a partially segregated manner, wherein inorganic waste like glass and plastic bags can be fed to the reactor without segregation and can be collected from a passage of the reactor later. Thereby, labor charges spent for

segregation can be largely minimized. The machinery and other moving parts involved in the reactor is less, by means, reduces the consumption of energy used to produce biogas. Also, this technology produces the high volume of biogas up to 60m³/ton/day.

The PFR reduces one ton of bio-waste to less than 100kg in a 30-day retention time. While in bio-methanation plant even though segregation is suggested some number of plastics/metals less than 2% is not an issue and does not hinder the process.

In this advanced technology any type of waste even agro-residues and long banana stems can be fed as it is without pulverization which not only reduces moving parts but also requires very little input energy. Also, addition of water is not required for pre-treatment or for any process in this technology. The technology and gives the highest amount of biogas which is 80-85% of the theoretical methane yields.

A schematic of the anaerobic digestion process by the proposed technology is shown in Figure 6.

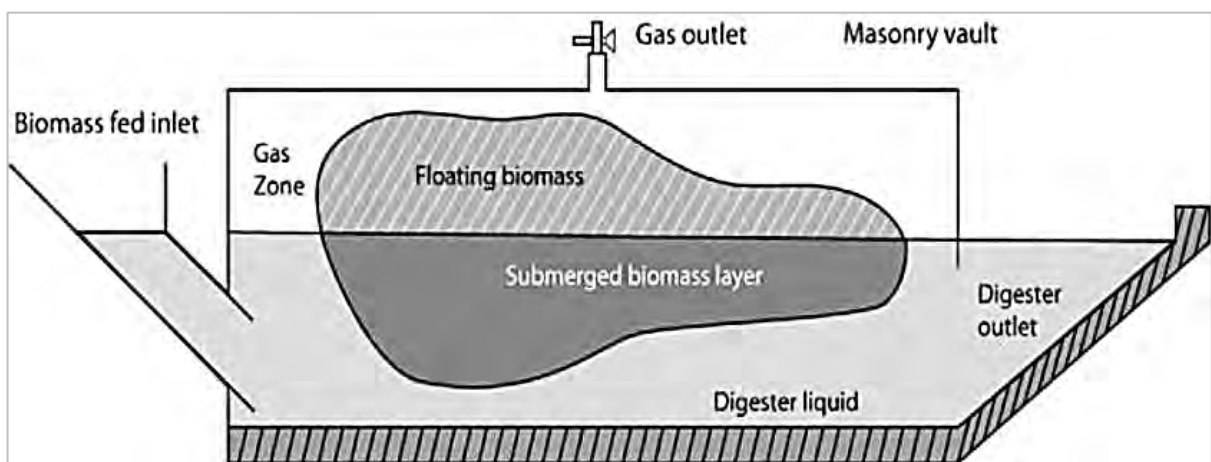


Figure 6 schematic of the anaerobic digestion process

4.4.1.1 Input (Feed material)

The proposed feedstock in these bio-methanation plant is food waste, agriculture residues etc. This technology enables material fed to the plant without pre-processing to form slurry like material with water. The material is fed as it is without size reduction or pulverization and hence the

4.4.1.2 Outputs

The main output of the processing is biogas (60m³/day, mainly methane) of from for food waste & agricultural-residues. In addition, the digester will generate solid residues and organic liquids.

Around 5-10% of the biodegradable waste fed into the bio-methanation plant comes out as compost in case of food waste. The leafy material containing lignin does not get digested completely comes out of the digester at the end of 30d period. This material can be pulled out of the digester and dried to obtain compost of high nutrient value. Anaerobic compost is found to have higher nutrient content when compared to aerobic compost. From 1ton/day of biodegradable waste fed into a biogas plant around 30-40kg of wet compost (~10kg dry) compost can be achieved. The digester liquid (500/liters/day) is also high in nutrients can be used as fertilizer.

It is proposed that the gas will be flared at site. The liquid which can be considered as a fertilizer and solid residue (compost) will be used locally for agricultural purposes or can be processed and sold to nearby resorts.

The Client informs that the AD plant will be supplied at a later stage after the completion of the civil works required for its installation. As per the current project implementation schedule, the plant is expected to be supplied, installed, and commissioned within the final quarter of 2021. An example of such a plant is shown is figure 7.



Figure 7 Example of AD plant installed in a resort hotel, Reethifaru, Baa atoll (source: BIOGEN, India)

4.5 Major inputs and outputs

4.5.1 Project Inputs

The project inputs are mainly construction materials. Labour for the construction will be sought through a local contractor. AD plant for waste processing as the main component of upgrading will be purchased and installed through contracted supplier. Table 3 shows major inputs of the project.

Table 3 Project inputs for upgrading of IWRMC in M. Muli

	Input resource	Type and amount	Means of obtaining the resource
Construction phase	Workforce	Site supervisor – 1 Site engineer - 1 Workers - 8	Contractor hired for the project
	Water for Construction	Ground water (150 litres per day), for civil works purposes	Groundwater well at the site
	Construction Materials	Concrete, cement, sand, masonry blocks, flood lights, G.I. pipes, metal sliding doors, aluminium doors and windows, emulsion paint, Lysaght Roofing Sheet, 3 phase power sockets, ceiling fan and Timber	Imported or purchased where available locally. Contractor will make arrangements to import or purchase these materials and transport to the island
	Construction Machinery	Compactor (for ground levelling), pickups or trucks (for land transport of construction material), Concrete mixing machine and concrete supply pump and pipe	Responsibility of the contractor. Local resources such as pickups for hire will be utilized as much as possible. If not available locally the contractor will import these machineries.
	Fuel	Diesel	Local suppliers
	Firefighting	Portable fire extinguisher	Responsibility of the contractor. Imported or purchased locally and to be brought to the site during mobilization.
Operational phase	Equipment	1.5-ton capacity Plug Flow Reactor or PFR anaerobic digestion (AD) plant	Purchased locally or imported. Responsibility of the Proponent (Capital Investment) and Island Council (O&M). Purchased locally or imported.
	Water	Groundwater (non-potable use)	Groundwater well within the IWRMC
	Power	3-phase power for operation of waste management equipment.	Power connection already made to the IWRMC site. Total estimated power requirement for operations of the AD plant is approximately 3kW.
	Labour	About 3 workers to manage waste in the IWRMC and 3	To be sourced ideally from within the community, or if not available, other locals or expatriate workers.

	workers to provide collection services to the community.	Responsibility of the Island Council. The Council of the outsourced third party will make accommodation arrangements within local houses or guest houses if expatriate workers are hired.
Fuel	Diesel	Local suppliers
Firefighting equipment	<p>CO₂ and water-based fire extinguishers</p> <ul style="list-style-type: none"> • 50kg Dry Chemical Powder (DCP) Trolley (2 nos.); • 50liter Foam Trolley (1 nos.); • Wet Chemical 6liter 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.). 	Responsibility of the Proponent (Capital Investment) and Island Council (O&M). Purchased locally or imported.
Waste	Waste generated within the island - approximately 2286 kilograms per day.	Waste will be collected from households and businesses within the island

4.5.2 Outputs

The IWRMC will be managed by the Island Council. During consultations it was identified that training would be required for those involved in the operations, both in operations of the machinery and fire and safety skills. Hence a training programme identified in Chapter 10 of this report

The key output of the project is AD Plant (organic waste processing) system installed within existing IWRMC facility. Table 4 gives details of outputs of the project.

Table 4 Project outputs

	Resources	Type and amount	Means of obtaining and disposing outputs
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 for 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	Facility staffing, plant operator, admin, and drivers	10	Employed
	Waste	Daily waste: <ul style="list-style-type: none"> 55% of daily organic waste (weight) anaerobically processed 	<ul style="list-style-type: none"> Biogas (30% of daily waste processed by volume) by-product of anaerobic digestion of waste flared

		<ul style="list-style-type: none"> • 15% of daily organic waste (weight) managed at site • 30% of inorganic waste collected, sorted and stored at site 	<ul style="list-style-type: none"> • Liquid waste and Solid residue (potential compost) used locally for agricultural purposes or sold to nearby resorts.
	Wastewater	Small amount	Disposed to the ground through a septic tank system established at site
	Waste oil and diesel	Small quantity	By-product of the equipment and machinery (collected and stored for later disposal at RWMF at Thilafushi
	Greenhouse Gas Emissions	Electricity usage (Minute quantity) Methane flared and vehicle emissions	Vehicle emissions and biproduct of anaerobic digestion of waste
	Noise	From the operation of machinery and vehicles	Minimal

4.6 Schedule for implementation

As per information provided by the Client, all civil works of the project is anticipated to be completed within 6-9 calendar months. An estimated schedule for construction (as given by Client) is provided in Table 5.

Table 5 Tentative Project Schedule

Activity	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
Mobilization & Supply of Construction Materials						
Site Preparation: levelling. Earthworks and relocation of existing waste						
Civil Works						
Demobilization						

5 Existing environment

5.1 Current Waste Management Practice

The waste management issue is one of the significant environmental concern for the island and communities. The island council have undertaken all the necessary preparatory work in order to facilitate the implementation of the Island Waste Resource Management Center (IWRMC) at the island. These include clearance of the access road facilities and preparation of lighting poles for the access road and most importantly designating land area for waste management. The land for the waste management is distanced from the residential area which would not cause any significant impact to the communities during waste management at the site.

The council have invested approximately 2 million Maldivian Rufiyaa (MVR) from its own resources to build an effective mechanism of waste management in the island. The existing waste management system was established by the council in 2015. Initially, the council did not collect kitchen waste from the households, and the household was later charged Rf100 per month. However, due to financial constrains the council ceased its services to collect waste from household in 2018. To overcome these financial constraints and to provide a better service, it was decided to increase the monthly fee to Rf155 and invested in four foreign labours dustbins and one vehicle (pickup lorry). The services were again resumed in 2019 with the new fee structure. Kitchen waste was also collected and was outsourced to a private company for it to be disposed into deep sea.

Waste is segregated at household level broadly into kitchen, green, metal, bulk and plastic waste. Waste is collected from the houses daily by pickup lorry. IWRMC have different zones allocated to separate waste stream at the site shall be there any mix. There were separation bays at the site although they are not used currently as the volume is too much for these bays to handle. The site also has a waste incinerator which is currently not in use due to a mechanical failure (see Figure 8). Waste is currently managed by open burning of green waste and sea (nearshore) disposal of kitchen waste. The other inorganic waste is transferred to Thilafushi on periodic (few months) basis.



Figure 8 Waste separation bays, collection trucks and incinerator (burner).

5.1.1 Island Waste Stream

Different zones are identified to store and manage the waste. Visual assessment was undertaken at the site to estimate current waste stream of the island (see Figure 9).



Figure 9 Different waste streams at the site.

An attempt was made to estimate the current stockpile at the site during the field visit. Table 6 shows the waste estimation for the island.

Table 6 Waste stream estimation for Muli

Type of Waste	Method of Management	Approx. amount / tons
Scrap metal	Transfer to Thilafushi (RWMC, zone 4&5)	6 – 7
Cans	Transfer to Thilafushi (RWMC, zone 4&5)	2 – 7
Green waste (coconut husks)	Use by communities and others burned	2
Glass and Porcelain	Transfer to Thilafushi (RWMC, zone 4&5)	2 – 3
Baby diapers	Open burning	2 – 3
Plastics	Transfer to Thilafushi and small amount are burned	1 – 2
Mix and ash	Open burning	50
Kitchen/food waste	Disposed to the sea	3 litre per household

5.2 Unassigned Waste Dumping

Since the island waste is adequately managed despite the challenges, there is no other unassigned waste dumping on the island. The roads and public places are generally clean as seen during the site visit. The practice of waste separation at the household, levels, the management practices, increase in the awareness and the public support deserves credit for this.

5.3 Project Site

The IWRMC is located in northeast of the island (Figure 10). The IWRMC shares part of the new reclaimed land together with the actual island land area. It has an area of 0.24 ha, although recently land has been reclaimed. The entire site is fenced with mesh wire and 2 m foundations. Furthermore, the collection bay is also constructed west to the entry. This collection bay is currently used to store equipment's required waste management activities for the island including bins, jumbo bags, spades.



Figure 10 Location of the waste site in M. Muli

5.3.1 Soil Condition

The soil condition at the site is generally similar to that of the island. There is no observation of contamination of the ground (see Figure 8 and Figure 9) The soil however, is contained with the ashes from the open burning that is taking place at the site.

5.3.2 Proximity to residential areas

The site in Muli is in very close proximity to houses. As seen in Figure 11 the closest residential place is in within a radius of 50m. During the northeast monsoon with the wind from NE will influence these houses nearby. This was confirmed by the random household interviews within this proximity. Approximately houses within a radius of 150 m experience the negative impact when waste is burned during the NE monsoon.

Power distribution boxes are close by and the site is provided with three phase electricity for 24 hours provided by FENAKA Muli branch. The island does not have water network established and the waste site does not have water connection point at site. A gravity type sewerage network is established on the island.



Figure 11 Proximity to residential and other areas.

5.3.3 Environmentally sensitive areas

Adjacent to the waste of the site, a muddy land area is found where freshwater turtle (Kanzu Kahanbu, *Melancholy's trijuga thermali*) dwells. These are listed as near threatened species by IUCN and listed in Appendix II of Endangered species. This area has been identified by EPA as an environmentally sensitive area in a protected areas list published in their website. The list includes habitats throughout Maldives (land and marine) that is seen as ecologically and environmentally significant areas identified through mainly stakeholder consultations. These are not protected areas by law. The area marked as “C1” in the land use plan (Figure 12), shows the location of this place (see Appendix 4 for the LUP).



Figure 12 Cut-out of the land use plan showing the environmentally sensitive area (C1) north west to the IWRMC (shaded in grey)

With declining numbers, many species of animals including tortoise is declared as an endangered and a protected species in Maldives by the EPA. During this field trip and general observation of the site, no tortoise was encountered. Consultation with the community confirmed presence of turtles in the said area, however they are only visible with heavy rain. There are also no published reports on the abundance of this species and associated fauna in this environmentally sensitive area. According to the council future expansion of the waste site is planned to the north of the existing site and since this project is planned to be implemented within the existing boundary of the site, no damage to this habitat is envisaged due to this project. As per EPA (See Appendix 10 for the meeting minutes of the discussion), there are no restrictions to carry out waste

management activities at the designated IWRMC site / existing IWRMC. However, other development projects that may compromise the importance of this area should be reviewed as part of such development approval process.

5.4 Accessibility to the waste site

Waste site is accessible by existing roads. Main roads connect to location where the waste site is located. The roads connecting to the site is depicted in Figure 11.

5.5 Land ownership

The allocated land for IWRMC is designated by the council and marked in the proposed land use plan which was approved by MNPHI. The planning department under Ministry of National Planning, Housing and Infrastructure approves land use plans developed by Island Councils. The approved land use plan showing the location of proposed waste management area is shown in (Appendix 4). Allocated land area is approximately 1,870m². The land is owned by the council.

5.6 Coastal Modification

Approximately 42 ha land was reclaimed around the south eastern part of the island in 2015. This has resulted doubling the size of the island. Since there are no revetments constructed after the reclamation activity, several parts of the reclaimed land have undergone erosion which is shown in Figure 10 above. Figure 13 shows the erosion scraps observed since no protection was placed after land reclamation. As the IWRMC is located inland, no impacts are envisaged due to the observed coastal erosion. In addition to land reclamation and construction of a harbour, there are no other coastal modifications in Muli.



Figure 13 Sediment being eroded as there was no protection put in place.

5.7 Vegetation

The current waste management area does not have any large trees or coconut palms. However, as initially the council proposed to assign the adjacent area north to the existing IWRMC plot as the temporary location, where vegetation exists, vegetation assessment was undertaken. Three transects of each 30 m was taken at the site. The main features of the vegetation transect are discussed below. Figure 14 shows vegetation transects and abundance of types of vegetation at the transect.



Figure 14 Types of major vegetation near M. Muli WRMC

5.7.1 Salient Features of transect 1

Five types of plants are found in this transect 1. The total number of plants that were observed in the transect were 12. Table 7 shows the type of plants that were observed at the transect. It is estimated that 40% of the transect 1 comprises of Boa Kashikeyo, 30% of the plants were Hinrundu while other 30% of the types of vegetation (Dhivehi Ruh, Keyogas and Uni) is equally abundant (See Figure 15 (top left)).

5.7.2 Salient Features of transect 2

Four types of plants are found in this transect 2. The total length of this transect is 15 m, as beyond there was a swamp area. The total number of plants that were observed in the 15 m transect

were 10. Table 7 shows the type of plants that were observed at the transect. It is estimated that 30% of the transect 2 comprises of Boa Kashikeyo and Bambukeyo and Dhivehi Ruh, while the rest 10% is representative of the Nika gas (See Figure 15 (top right)).

5.7.3 Salient Features of transect 3

Four types of plants are found in this transect 3. The total number of plants that were observed in the transect were 20. The average height of the plants along the transects and the type of plants that were observed at the transects are shown in Table 7. It is estimated that transect 3 represents Dhivehi Ruh (45%), Boa Kashikeyo (35%), Dhigga and Dhubuni each 10% (See Figure 15 (bottom)). Figure 16 shows the general types of vegetation in the proposed expansion area.

Table 7 Types and quantity of plants recorded at the proposed expansion site

Transect	Local Name	Common Name	Scientific Name	Quantity	Observed average height (m)
1	Boa Kashikeyo	Pandanus, screw pine	<i>Pandanus odoratissimus</i>	4	8 – 10
	Hirun'du	Tulip tree, portia tree	<i>Thespesia populnea</i>	3	6 - 10
	Keyogas	Banana	<i>Musaceae</i>	1	7
	Uni	Nit pitcha	<i>Guettarda speciosa</i>	1	10
	Dhivehi Ruh	Coconut Palm	<i>Cocos nucifera</i>	1	7
2	Boa Kashikeyo	Pandanus, screw pine	<i>Pandanus odoratissimus</i>	3	2 - 10
	Dhivehi Ruh	Coconut Palm	<i>Cocos nucifera</i>	3	3 - 10
	Bambukeyo	Breadfruit	<i>Artocarpus altilis</i>	3	10 - 15
	Nika gas	Banyan tree	<i>Ficus benghalensis</i>	1	30
3	Boa Kashikeyo	Pandanus, screw pine	<i>Pandanus odoratissimus</i>	7	2 - 5
	Dhivehi Ruh	Coconut Palm	<i>Cocos nucifera</i>	9	6 - 30
	Dhigga	Sea Hibiscus	<i>Hibiscus tiliaceus.</i>	2	3 - 6
	Dhunbuni	Cork wood tree	<i>Ochrosia oppositifolia</i>	2	3

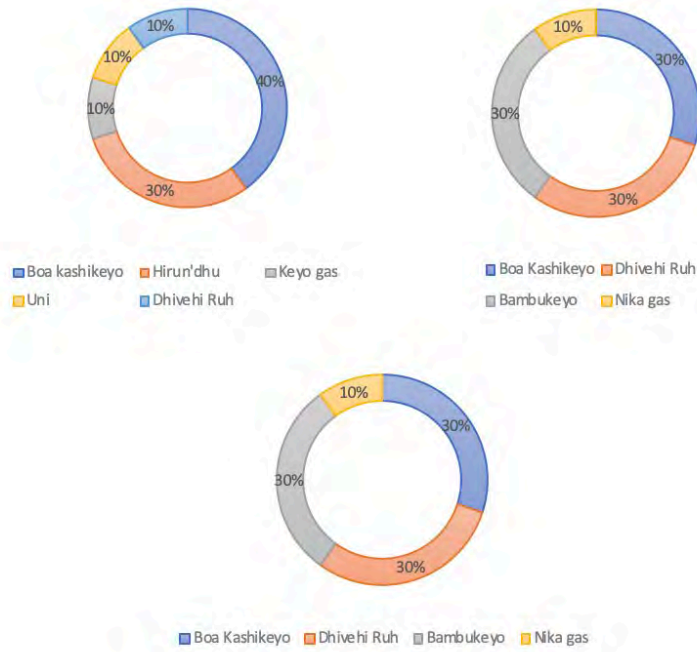


Figure 15 Abundance of plants found in vegetation transects. Transect 1 (top left), Transect 2 (top right), and Transect 3 (bottom)



Figure 16 Vegetation around the IWRMC

5.8 Groundwater Quality

The groundwater samples are taken from two locations (IWRMC and Control Site). Table 8 below shows the results of the sampling. MWSC laboratory analysis is attached in Appendix 6. All the parameters are within the normal range.

Table 8 Water quality results

Parameter	Source or Site	Control	EPA Optimum Range
Physical Appearance	Clear with particles	Clear with particles	NA
Temperature (°C)	24.5	24.6	25-30
pH	7.0	7.93	6.5-8.5
Conductivity (μscm^{-1})	973	481	<1500
Total Dissolved Solids (mg l^{-1})	487	241	<1000
Nitrate (mg l^{-1})	0.8	0.8	
Total Petroleum Hydrocarbon (mg l^{-1})	<0.038	<0.036	

5.9 Air Quality

Air quality was measured at the current waste disposal location (source) and from a playground (control location) approximately 200 meters due north west of source. Locations of the air quality is shown in (Figure 11). Air quality measuring equipment was installed at the site. Graywolf air quality measuring instruments were used to measure the ambient air quality. Particulate Matter (PM10 and PM2.5) were measure using 6 channel particle counter (Graywolf PC-3016A) and toxic gases; carbon monoxide (CO), nitrogen dioxide (NO₂) and Sulphur dioxide (SO₂) using Graywolf Direct Sense II.

On average, PM10 levels of 14.47 $\mu\text{g/m}^3$ and 12.68 $\mu\text{g/m}^3$ were observed at the source control during the day and night, respectively (Table 9). At the control site, on average, PM10 levels of 6.96 $\mu\text{g/m}^3$ and 3.54 $\mu\text{g/m}^3$ were observed during the day and night, respectively. cPM2.5 levels of 281 $\mu\text{g/m}^3$ and 257 $\mu\text{g/m}^3$ were observed at the source control during the day and night, respectively. At the control site, on average, PM2.5 levels of 32 $\mu\text{g/m}^3$ and 28 $\mu\text{g/m}^3$ were observed during the day and night, respectively.

Toxic gases (CO, NO₂ and SO₂) concentrations were also measured at source and control site. Carbon monoxide (CO) concentration measured at source and control ranged between 2.43-2.99 $\mu\text{g/m}^3$ and 2.08-3.5 $\mu\text{g/m}^3$ respectively (Table 10). Sulphur dioxide (SO₂) concentration levels at

both sites were not detected. Due to time limitations and of COVID restrictions, monitoring time was limited during the site visit.

Little comparable air quality data are available in the Maldives. Air quality baseline data has been reported in the EIA report prepared by Water Solutions in 2019 (EIA, SW, 2019) for waste management project proposed for Thilafushi waste disposal site (central waste disposal area of the Maldives). Currently open burning of waste is practiced in Thilafushi. Air quality measurement around Thilafushi and at Villingili (a residential island) 5 km from Thilafushi is shown in Table 10 for comparison. The average concentration of PM_{2.5}, PM₁₀, NO₂ and SO₂ measure at AQ3 (nearest to Thilafushi) were significantly higher than the values measure at the 2 locations in Muli. These values are significantly higher than the threshold values by WHO for the parameters referenced (Table 10). The concentration values of PM_{2.5}, PM₁₀, NO₂ and SO₂ were significantly lower than the WHO threshold values for the reference parameter. However, the averaging period for this survey is limited to 1 hour and Thilafushi area sampling was based on 24-hour average. Due to different sampling methods, comparative inference should be made cautiously. Nevertheless, open burning of waste at the project site as a potential source of air pollution is far less than that of Thilafushi in terms of volume and duration.



Figure 17: Air quality measuring instrument.

Table 9 Summary of air quality at both the sites.

	Source (site)				Control			
	PM10 (µg/m ³)		PM2.5 (µg/m ³)		PM10 (µg/m ³)		PM2.5 (µg/m ³)	
	Day	Night	Day	Night	Day	Night	Day	Night
Max	188.51	221.78	3727.85	4295.07	138.61	27.72	79.53	39.76
Min	0.00	0.00	6.14	28.95	0.00	0.00	13.16	16.08
Average	<u>14.47</u>	<u>12.68</u>	<u>281.45</u>	<u>257.74</u>	<u>6.96</u>	<u>3.54</u>	<u>32.54</u>	<u>28.40</u>

	Source (site)						Control					
	NO ₂ (ppm)		CO (ppm)		SO ₂ (ppm)		NO ₂ (ppm)		CO (ppm)		SO ₂ (ppm)	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Max	0.25	0.24	5.40	3.60	0.00	0.00	0.24	0.25	7.40	2.40	0.00	0.00
Min	0.19	0.22	1.30	2.10	0.00	0.00	0.14	0.23	0.40	1.90	0.00	0.00
Average	<u>0.22</u>	<u>0.23</u>	<u>2.99</u>	<u>2.43</u>	<u>0.00</u>	<u>0.00</u>	<u>0.19</u>	<u>0.24</u>	<u>3.50</u>	<u>2.08</u>	<u>0.00</u>	<u>0.00</u>

Table 10 Pollution levels observed at Thilafushi and Villingili (source: EIA report, Water Solutions, 2019)

	Parameters / Results (based on 24 hr average)			
	PM10	PM2.5	SO ₂	NO ₂
	µg/m ³	µg/m ³	µg/m ³	µg/m ³
Thilafushi Downwind (AQ-1)				
Minimum	7.0	8.0	5.0	0
Maximum	427.0	384.0	72.0	87.0
Mean	26.5	26.9	25.3	59.5
99th Percentile	147.0	122.0	76.0	78.0
Thilafushi Crosswind (AQ-2)				
Minimum	8.0	5.0	0.0	49.0
Maximum	134	112	18.5	65.0
Mean	19.3	12.1	9.8	56.0
99th Percentile	37.6	24.6	16.5	60.0
Thilafushi Downwind (AQ-3)				
Minimum	4.0	1.0	2.0	53.0
Maximum	690.0	362.0	112.2	81.0
Mean	88.4	42.8	32.4	64.9
99th Percentile	281.0	85.4	40.3	72.1
Vilingili Island (AQ-4)				
Minimum	13.0	22.7	2.0	2.0
Maximum	41.0	41.0	19.0	87.0
Mean	22.7	22.1	7.6	60.6
99th Percentile	32.0	32.0	2.0	70.8
WHO Standard	50.0 (24 hr avg)	25.0 (24 hr avg)	20.0 (24 hr avg)	200.0 (1 hr avg) 40.0 (1 yr avg)

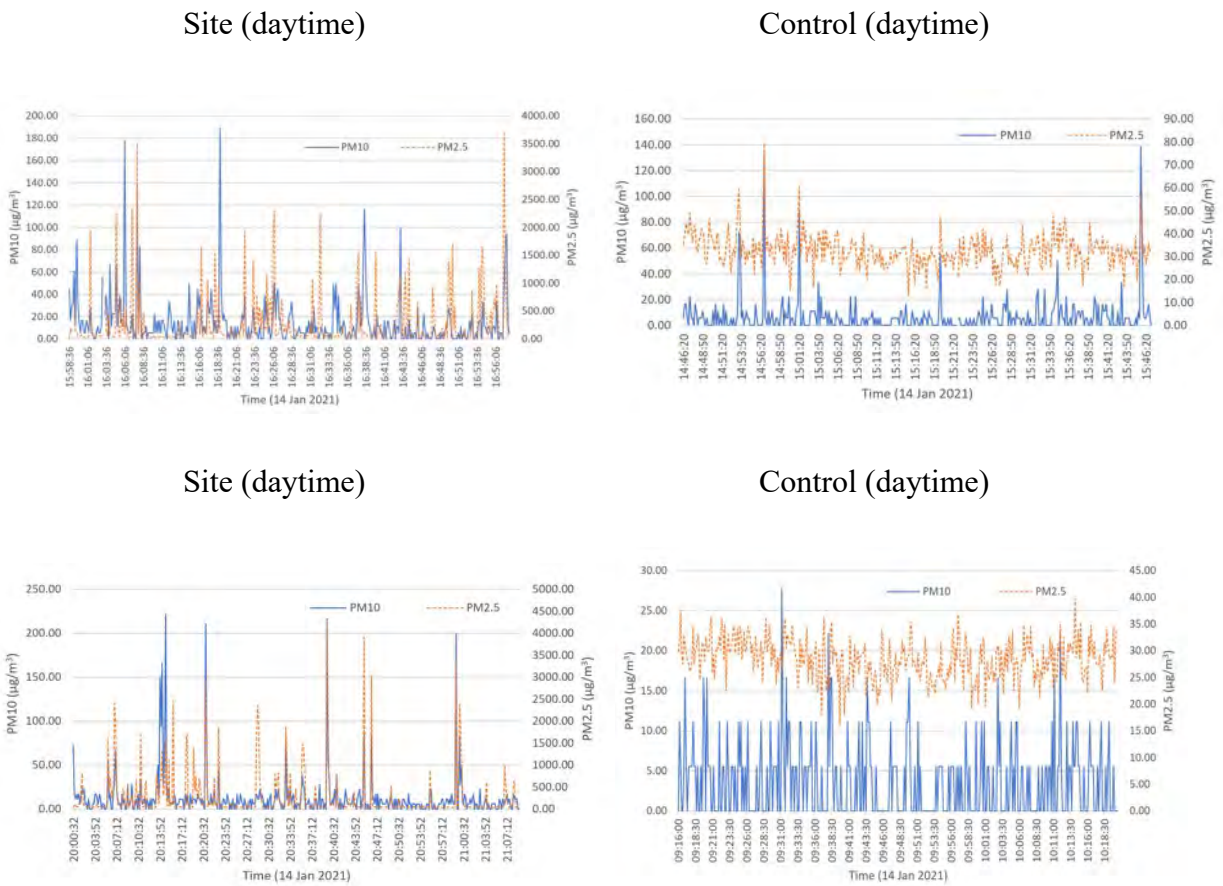


Figure 18: Profiles of particulate matter at the site and the control.

5.10 Noise

Noise level around project site was measured using noise meter (Extech 40776, sound level data logger). Sound was measured for 1 minute at the desired location both at the source and control area during day and night. The maximum and minimum noise and an average was recorded. Table 11 shows the noise recordings at the Muli. Noise measurements indicate that level of noise does not change significantly during day and night times at source. However, at the control location there is significant decrease of noise level. This may be due to the reduced activity during night time at the control location. The values recorded based on the sound assessment are within the limit of 70dB(A) for 24 base hours for industrial areas by WHO (<https://www.who.int/docstore/peh/noise/Comnoise-1.pdf>).

Table 11 Noise levels at source and control locations

	Noise level at Source		Noise level at Control		USEPA Noise level standards	
Date	14 January, 2021				Day	Night
Time	1520 hrs	2015 hrs	1415 hrs	2110 hrs	50	45
Minimum / dBs	40.1	40.2	43.4	36.7		
Average / dBs	46.0	46.0	45.7	38.1		
Maximum / dBs	53.6	58.5	49.0	40.8		

5.11 Protected Areas and Environmentally Sensitive Sites

The island is known for one of the few islands in the Maldives where freshwater tortoise are found. Hence, habitat of these tortoise is marked as an environmentally sensitive area list issued by EPA. This area is approximately 18 m west of the IWRMC. Figure 11 shows the area and its proximity to the site.

5.12 Areas of Historic and Cultural Significance

There are no nationally significant historical places in Muli. However, Muli has an old mosque (Hukuru Miskiy) which is approximately 270 m southwest of the is IWRMC.

5.13 Socio-Economic Environment

5.13.1 Demography

The island has reported that in 2017, Muli has a total population of 982 (512 Male and 470 Female) (See Figure 19). The island has generally maintained number of female and male population in a balanced manner (see Figure 20). The island has an annual population growth rate of 0.90. The growth of population is slow in contrast to the national population growth which is estimated at 2.9.

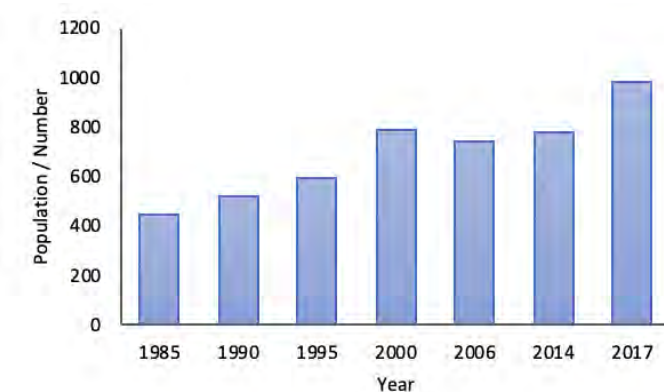


Figure 19 Demographic Characteristics of M. Muli from 1985 – 2017 (Source: Isles)

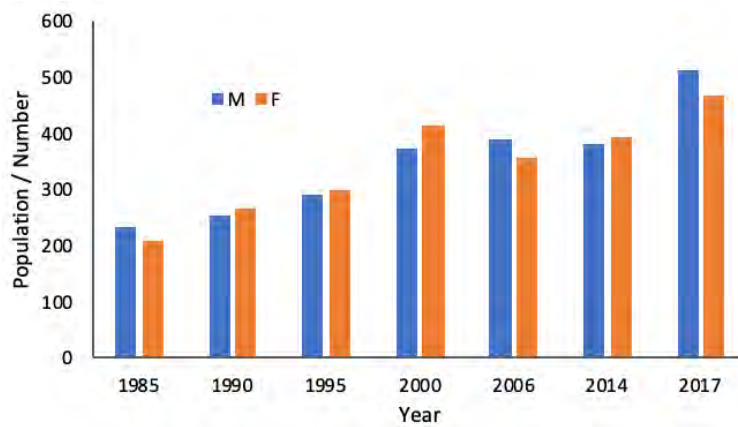


Figure 20 Gender disaggregated population of M. Muli 1985 – 2019

5.13.2 Economic activities and livelihood patterns

The island is one of the developing economies within the atoll. Previously the island was considered as a fishing dependent community. However, with improved facilities and strong employment among public and private sector the community’s dependence over fisheries has been reduced.

5.13.3 Essential Infrastructures

The island has a large harbour which have improved access to the island. The island also hosts the Atoll Education Center which offers classes up to higher secondary level. Moreover, the island also hosts Meemu Atoll Hospital with one private pharmacy and one operated by STO. The island has an atoll branch of Bank of Maldives. Thereby providing basic banking services to the community and the visitors.

5.13.4 Utility Services

The island has three phase electricity for 24 hours provided by FENAKA Muli branch. The island has installed capacity of approximately 1MW, that is generated by 3 sets of generators (500kv, 400kv, 250kv).

5.13.5 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.

5.13.6 Community based organisations/NGOs

The island has a Women's' Development Committee comprising of 5 members. They are involved in the different community-based activities carried out in the island including cultural activities and waste management activities. As for waste management, they are actively involved in carrying out awareness programs on waste management practices, planning and executing cleaning programs. Also, they are in charge of cleaning of the industrial zone and public spaces in the island. They also are in-charge of running the island's pre-school. The consultation outcomes with WDC of Muli are given in section 12 of this report.

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 because of this project were 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 12 below.

Table 12 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
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 13. 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 13 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 13. Impacts are assessed according to probability, significance, magnitude and duration. Tables 14 gives the assessment for the impacts, and these are further discussed in the following sections.

Figure 21 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 14 Output of the impact evaluation

Code	Description	RIAM Criteria Scores					Environmental Value Score (ES)	Range Value Band (RB)	Criteria number
		A1	A2	B1	B2	B3			
PC 1	Changes to the ambient air quality (smell) due to waste sorting and processing	2	1	3	2	2	14	+B	2
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
PC4	Air pollution due to emissions associated with operation of bio-digester and flaring of Methane	2	-1	3	3	2	-16	-B	-2
BE 1	Impact on island environment/soil due to waste handling and processing	1	0	1	1	1	0	N	0
BE 2	Impact to the groundwater due to use for construction	1	0	1	1	1	0	N	0
BE 3	Impact to the groundwater due to waste handling and processing	1	0	1	1	1	0	N	0
BE 4	Impact to the flora (vegetation) due to the land clearing required for the allocation of temporary waste relocation area	1	-3	3	2	2	-21	-C	-3
BE 5	Impact to the flora and fauna (animals) due to material transfer	1	0	1	1	1	0	N	0
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	3	3	3	18	+B	2
SC 3	Impacts of hazardous waste sorting and storage and disposal to the workers	2	-1	2	2	3	-14	-B	-2
SC 4	Benefits associated with improved waste processing and disposal to the community	2	3	3	1	3	42	+D	4
EO1	Changes to the environment due to improved waste processing	2	2	3	3	3	36	+D	4
EO2	Benefits to the community due to improved waste management practice and operation of the facility	2	2	3	3	3	36	+D	4
EO3	Changes to the ambient air quality (smell) due to waste sorting and processing	1	2	3	2	3	16	+B	2
EO4	Changes to the ambient noise due to waste sorting and processing	1	1	3	2	3	8	+A	1
EO5	Risk to IWRMC workers	1	3	3	1	3	21	+C	3
EO6	Impact on island environment/soil due to waste handling and processing	1	2	3	2	3	16	+B	2
EO7	Impact to the groundwater due to waste handling and processing	1	1	3	2	3	8	+A	1

Note: Environmental components the project inputs and outputs subjected to evaluation are; PC = physical and chemical, BE = Biological and ecological, SC = Social and cultural, EO = Economic and operational. Environmental scores are referenced as impact range bands (alphabetical letters) and number (roman numeric). Increasing numbers (values) and ascending alphabetical letter indicate severity of impacts. (+) indicate positive and (-) indicate negative impacts.

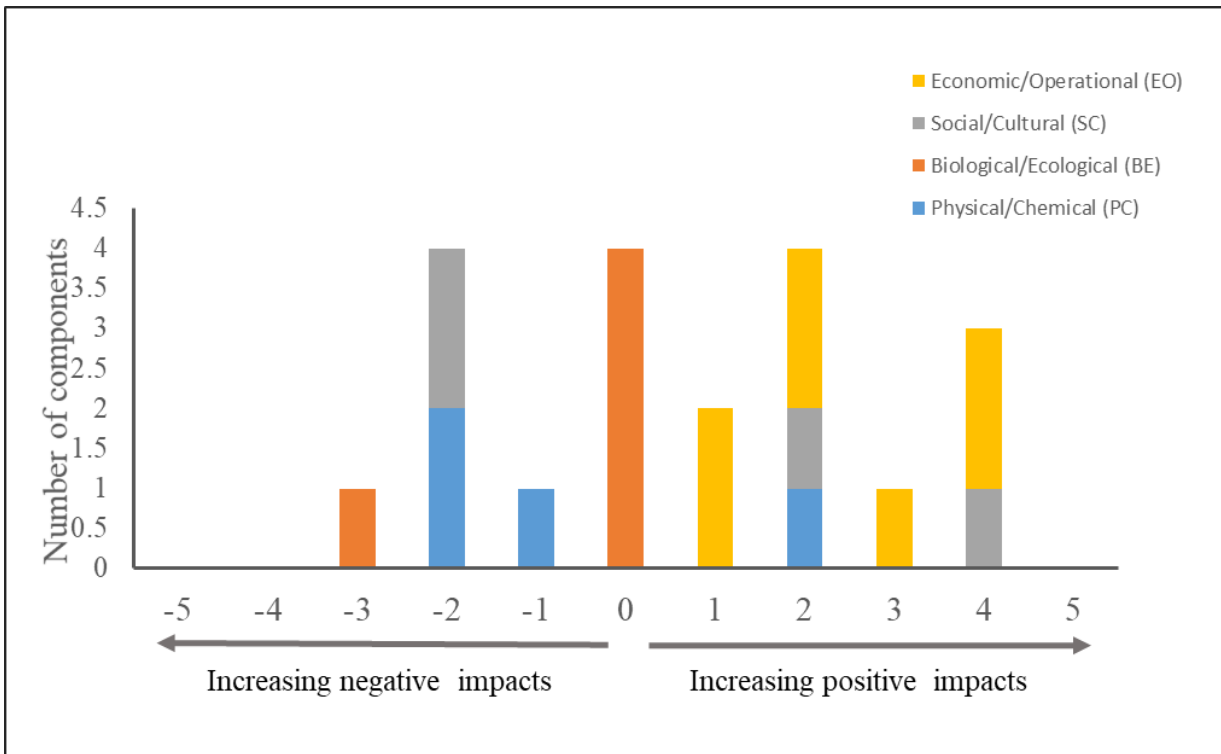


Figure 21: Graphic summary of RIAM analysis for the upgrading of IWRMC at M. Muli. Y-axis shows the number of components

6.3 Construction phase

Impacts on noise pollution and disturbances (PC and SC)

The project site is at a distance of approximately 35m 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. Concrete machine would be the main source of sound at project site and work will be limited to day hours. Therefore, sound emission associated with the project is limited to the duration of foundation construction period and masonry works that would be limited and short term. This coupled with the distance between project site and residential area is hence envisaged as minor.

Impacts on groundwater 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 only. This may have a localised (location of water extraction well) negative impact on the groundwater. This impact is envisaged to be minimal, and short term.

Impacts of potential vibrations due to construction activities (PC)

The nearest residential area is approximately 35m from project site. Based on project inputs outlined for the required construction no significant vibration is anticipated during building foundation works or masonry works. 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 have 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 on vegetation (PC and BE)

The proposed work does not require any vegetation clearance however, impact from the vegetation clearance at the proposed temporary waste disposal site (by the island council) is highly significant. Hence an alternative location is being proposed and approved by the council.

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).

Impact due to relocating of waste and disposal of HH waste to the temporary waste disposal site

Waste at the IWRMC will be relocated to the temporary waste disposal site for the duration of construction period. Furthermore, waste disposal by the island community will also be to this temporary waste disposal site. As discussed above, the area is thickly vegetated, hence need for vegetation clearance would have a significant negative impact on the environment. Furthermore, given that the site is adjacent to existing site, it is also in close proximity to some households. Hence these households would still feel the impacts due to open burning of waste (as have been discussed during consultations), although to a slightly less extent.

Additionally, disposal of waste at this area, especially if done so on bare ground would have a negative impact on the groundwater resource due to leachate and associated pollution of the resource. Furthermore, the area being an open area, pollution due to windblown waste and spill over is also a potential impact.

Impacts due to construction 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.

Furthermore, it is proposed to manage temporary waste at a site adjacent to project site, during construction phase. In doing so, daily waste disposal will be carried out by the island community and open burning at the site to dispose of biodegradable waste will have a negative impact on the health of the construction workforce working within very close proximity to this site.

Impacts due to road closure (SC)

Proposed work will be carried out a site located 35m from residential area and on the uninhabited side of the island. The proposed works associated with the project will be carried out within the existing demarcated boundary of the project. Based on the location of the project site it is not anticipated that the works will require any road/street closure for the construction works.

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. Construction work has already been carried out within the waste management area boundary. The proposed work does not require new land area.

6.4 Operational phase

Impacts on noise pollution and disturbances (PC and EO)

The operations of the IWRMC and the technology to be used for managing is not envisaged to have a significant impact in terms of noise pollution. Furthermore, operation of the facility with existing technology would eliminate environmental disturbances with t open burning of organic waste 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. However, on the other hand improved handling, and disposal of waste will aid to improve the overall environmental aspects associated with the project.

Impacts on groundwater (leachate/ stormwater runoff) (PC and EO)

The IWRMC has been designed with provisions in place for drainage of wastewater and leachate which maybe generated. One of the advantages of the proposed technology is that it enables to contain and eventually dispose leachate environmentally safer method. Leachate generated from waste processing and sorting and would be mostly due to cleaning of the floors. The floor surface with the proposed construction method will prevent leachate seepage to the ground and contaminate groundwater lens. Contaminated water from waste sorting area cleaning will channelled through a runoff drainage system established. The volume of such contaminated water produced is anticipated as low. The centre also has rainwater pits constructed in nonpaved areas of IWRMC to allow drainage potential storm water produced during rainy seasons. Impacts envisaged from potential leachate on the groundwater quality due to operations at the centre thus is anticipated as low.

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, and significance of such impact depend on the type of material spilled. With proposer handling and transport of materials from households to the waste processing site unnecessary littering due to waste transfer will be minimal.

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 organic waste treatment technology is quite simple and requires very little manpower. The technology allows domestic waste to be fed in a partially segregated manner, wherein inorganic waste like glass and plastic bags (less than 2%) can be fed to the reactor without segregation and can be collected from a passage of the reactor later. Additionally, any type of waste even agro-residues and long banana stems can be fed as it is without pulverization. The process generates some level of odour, although not of significance. The key outputs of the process, biogas (Methane and CO₂), liquid fertilizer and compost can be utilized for various purposes. The compost and liquid fertilizer are of high nutrient quality. They can be used for agricultural purposes on the islands or can be packaged and sold to nearby resorts/islands. The, improper handling of the excess liquid fertilizer including the method of disposal however may cause significant negative impacts on the environment, if seeped into the ground, due to high BOD of the product. The Biogas is proposed to be flared, which would produce CO₂ and water vapour. CO₂ is a GHG and will cause an increase in emissions from waste composting thereby degrading the quality of air. However, this impact will be significantly lower than emission of Methane which is found in the biogas.

The AD plant and waste treatment method also addresses the issue of leachate generation, hence minimising the need for construction of additional leachate collection tanks. The design of the area where the AD plant will be housed incorporates drains which will provide the necessary means for removal of any leachate generated.

The existing IWRMC is already 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. Alternative options aim to consider and identify the best practical environmental option for the proposed project.

7.1 Alternative location for proposed upgrades

The proposed work under this project will be carried out within the existing land allocated for island specific waste disposal and management site. This area as waste management site has been already approved by respective government authorities. The proposed works under this project will add to and improve the waste processing management capacity of the existing facility. The works will be carried out within the existing boundary of the facility. Furthermore, there are no negative impacts on environment with regards to the choice of location, hence an alternative location will not be considered in for the proposed upgrades through this project.

7.2 Alternative methods/technologies

The feasibility report for the project describes various types of waste treatment methods and their advantages and disadvantages and has proposed practical option for processing organic waste in Muli (CITRES and MEECO, 2019). The recommended method for organic waste treatment, based on rationales given in the feasibility report is anaerobic digestion of food and suitable organic waste using a 500kg Anaerobic Digestion (AP) plant based on the current waste quantity produced on the island and its projections for 2050.

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

The environmental, social, and economic aspects of AD technology (proposed option) are;

- Relatively large land area required for AD plant installation (environmental)
- Overcomes the problem of leachate containment (environmental)
- Open burning of waste is not required (environmental)
- Significant reduction in waste volume
- Moderate energy is required for operation (environmental)
- Few labour requirements for waste processing (social)
- 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)

The following alternatives methods and technologies are considered to improve waste disposal at current waste management area:

- Alternative 1: Windrow-based open composting
- Alternative 2: In-vessel composting

Capital cost of using the AD (biogas) is slightly higher than that of windrow-based or in vessel composting options. All other aspects of the proposed technology are positive compared with the other two options (see Appendix 7). Land area requirement for the plant can be accommodated within the existing area allocated for waste management in the island, therefore not requiring additional land for this project. In addition to this, controlled leachate and odour generation as well as the absence of burning greatly reduces the negative environmental and social impacts due to the method, both on the natural environment and community. Low labour requirement is another advantage.

Comparing the benefits of AD plant-based waste processing with that of in-vessel composting and windrow-based composting, the proposed method appears as best practical solution for the island waste management in the context of daily waste generated on the island. This option has also been proposed in the feasibility study made waste management in zone 4 and 5 (CITRES and MEECO, 2019). Hence AD plant with 1,500kg capacity (daily) is considered the most feasible option for organic waste management in this project for upgrading waste management at Muli.

A comparison matrix of the environmental, economic and social aspects of the three different methods considered are waste processing options are described in Appendix 7. The Appendix also gives mitigation measures for each of the alternatives (Table 2 in Appendix 7).

7.3 Alternative sources of power supply and energy source

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 approximately 5kw per day, including operation of the waste processing plant. With the existing capacity of the island power facility installed with 1MW electricity generating capacity (Diesel fuel based), the required electricity for the operation of the waste management facility is low. 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. Opting this option as means for power supply cost is low.

The following alternatives for power supply options as sources of energy are considered;

- Alternative 1: installation of solar panels
- Alternative 2: installing a generator in the IWRMC specific for each operation.

First alternative and more environmentally friendly method is to install solar panels on the roofed areas of the IWRMC to generate and supply the required electricity for operation of the centre. However, this would increase the financial cost of the proposed project, although in the long term this option has the potential to be financially attractive, despite initial capital cost with solar based power setup. In his regard the roof area can be used for installing the solar panels. Renewable energy-based option as a source of power will reduce project footprint on the environment such instead to opting to diesel-based energy source.

Second alternative option is to install a generator at the IWRMC. This option would 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. Set up of a power facility would also increase the scope and cost of the project.

Installation of a solar panel to source power is seen to be most environmentally feasible option from the three options considered. This is, however an unaccounted capital cost of the project at present, which is may not be feasible to implement due to budget limitation associated with e current project. Hence the proposed option for sourcing electricity to the waste management facility is considered most 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, as part of future upgrades associated with the facility. Option of converting the biogas (methane) emitted from the plant to electricity should explored.

Mitigation measures for the alternative energy sources are also given in Appendix 7.

7.4 Alternative location for temporarily relocating waste

Initially, the island council proposed the area adjacent to the northern boundary of the waste management facility as the waste relocation site. As per the vegetation survey carried out as part of this assessment and presented in section 5.7, this area is heavily vegetated with significant number of trees of various types. Thus, land clearance will be required to temporarily move the existing waste within the current waste disposal site to enable construction of the proposed infrastructure. This would incur removal of many mature trees and this is not included in the scope of the proposed project and would also cause a significant impact to the surrounding environment.

Therefore, in order to avoid this, an alternative location for temporary relocating waste has been identified through consultation with Island Council (see appendix 10 for minute of meeting), which is located adjacent to the eastern boundary of the waste management facility (see Figure 22). This is mainly reclaimed area without significant vegetation. Hence, in terms of impacts, negative impact due to vegetation clearance is removed, while that due to leachate / spillover and potential pollution of environment and groundwater resource, as well as social impact due to open burning are similar to that envisaged for initially proposed temporary location.

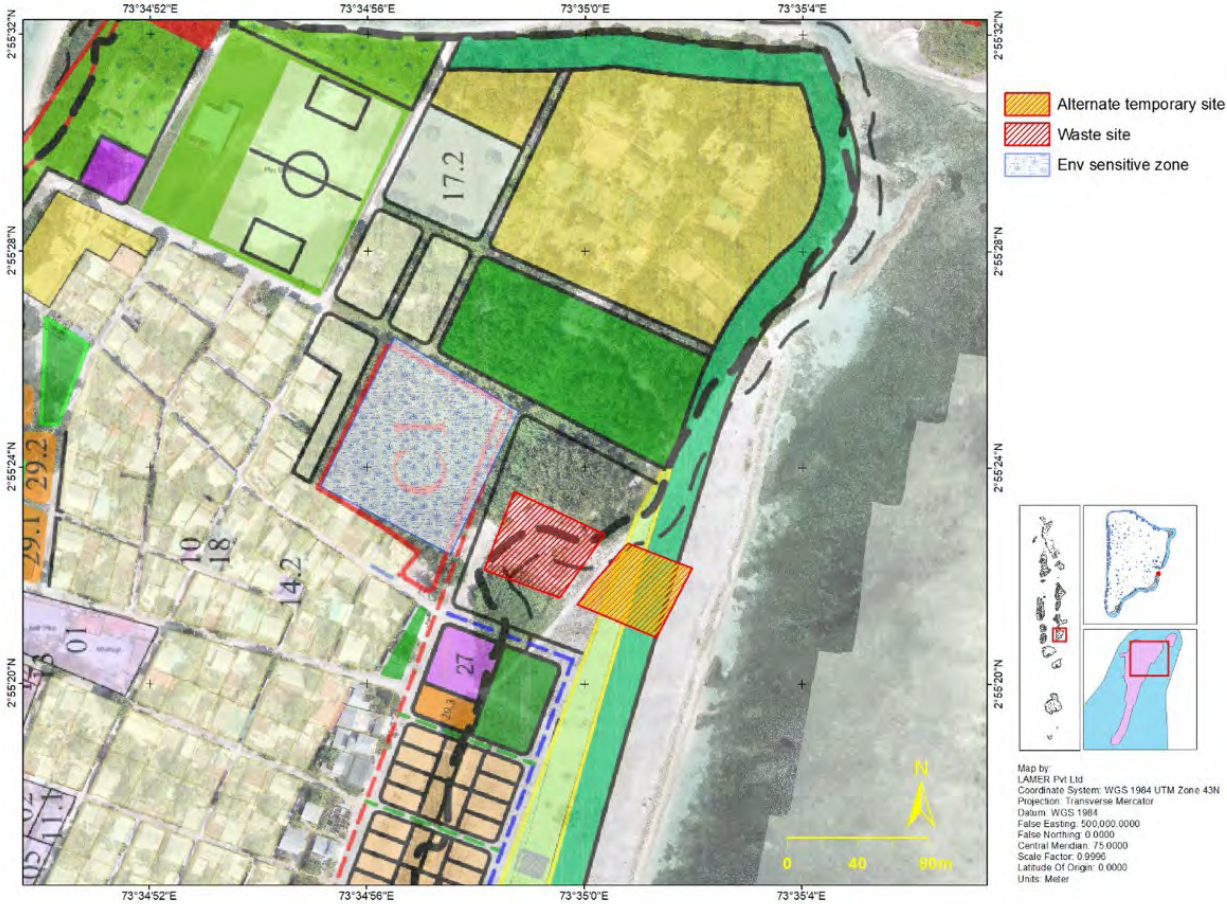


Figure 22: Alternate temporary location with the current land use plan.

The consultant strongly recommends to follow the mitigation measures proposed in section 8 to prepare the temporary setup to ensure prevention of leachate and waste disbursement during unfavorable weather conditions such as heavy winds and rainfall. This includes proper waste storage practices to mitigate leachate and storm water runoff and prevent subsequent pollution of groundwater and soil. Such leachate prevention measures may include laying out a thin screed, or a non-permeable material laid on the ground and a cover on top of waste to prevent soaking of waste and thus preventing potential leachate that may be harmful to the surrounding environment.

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 15). Translation of the proposed ESMP in Dhivehi is given in Appendix 8 of this report.

Table 15 Mitigation measures proposed for the project (ESMP matrix)

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
Design and Planning phase						
Detailed design and Planning in relation to the location of the project with respect to coastal erosion, noise, and social impacts	Improper functioning of the waste management facility and associated environmental impacts due to inadequate design and planning	<ul style="list-style-type: none"> • Ensure detailed design considers details of the proposed layouts and all designs are as per specifications required, considering the environmental components that may be affected • Ensure that the site selection sets a minimum distance of 60m from residential and public areas considered in the design • Vegetation buffer of minimum 20m maintained between IWRMC boundary extent and/or high tideline in the design 	Proponent (agency responsible for architectural and engineering design), Maldives Land and Survey Authority, EPA, Island Council	Currently not available	NA	None

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
Construction Phase						
Relocating of waste and disposal of HH waste to the temporary waste disposal site	Impact on groundwater due to waste relocation/disposal to the temporary site	<ul style="list-style-type: none"> • Close monitoring of the waste movement as per the procedures stipulated to the temporary site with photo documentation (if waste at the centre is required to be transferred to the temporary site). • Transfer should be done step wise with careful attention to remove any potential recyclables from the waste being moved (if waste at the centre is required to be transferred to the temporary site). • The temporary area should be clearly demarcated with a fenced boundary to mitigate leachate and storm water runoff • Provide clear signboards • Cover the ground of the site with an impermeable 	Contractor / Island Council (implementation) Proponent (supervision)	None	NA	Should be included in the project cost

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
		<p>surface (such as concrete layer, metal sheet) to prevent soaking of waste and thus preventing potential leachate that may be harmful to the surrounding environment.</p> <ul style="list-style-type: none"> • Make a public announcement prior to shifting waste management activities to the site. This announcement should reflect the date of commencement of the temporary site usage and the duration to which the site will be used. • Ensure that appropriate signs are put up at the temporary site to indicate the purpose of the site to the public • Designate specific areas to store different types of waste within the temporary site and put the sign boards 				

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
	Impact on nearby households / construction workforce due to disposal at temporary location	<p>to indicate the type of waste stored at each respective area</p> <ul style="list-style-type: none"> • Facilitate the cleanup of stored waste at the temporary site and transfer it to Thilafushi after completion of the civil works of the proposed project through negotiations with the president's office via the ongoing legacy waste cleanup program • Daily waste collected and disposed, to be stock piled within the IWRMC • Open burning of waste should not be carried out during this period 	Proponent (supervision)			
Noise pollution associated with construction machinery and vehicles	Noise and vibrations associated during the construction period.	Area of construction works is in proximity, of residential area. Noise impact would be reduced through;	Contractor, Island Council focal point	NA	NA	None

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
		<ul style="list-style-type: none"> Limiting work schedule to daylight hours Equipment vehicles property serviced 				
Air pollution at the project site due to emissions associated with construction machinery and vehicles and dust	Excessive use of vehicles and vessels would emit GHG deteriorating the quality of air. However, this would be short term and temporary.	The equipment and vehicles/vessels used should be maintained and serviced and care must be used to reduce the idling time while using the vehicle/vessels.	Contractor and vehicle/vessel operators.	NA	NA	
Impact on groundwater	Over extraction of groundwater Contamination of groundwater through potentially harmful chemicals	Quantity of water required for the civil works not wasted	Contractor	NA	NA	
Arrival of workforce from other islands/countries	Sociocultural impact due to arrival of workforce	<ul style="list-style-type: none"> Recruit local companies and Maldivians for the work (priority given to locals) 				

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
		<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. • Develop Contractor's Code of Conduct (sample Code of Conduct provided by World Bank given in Appendix 9, which the contractor can adopt by customizing it to the local context). • 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. 				

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
		QR code for downloading the forms and information on GRM should be given in each of the media used.				
Fire safety	Potential fire incidents at the construction site leading to damage to property and injury to workers	Provide appropriate fire prevention and management means at the construction site	Contractor	Part of the construction contract	Part of the construction contract	
Health and safety of workforce	Workers becoming sick, exhausted due to exposure to improper work environment and extended working hours	Occupational Health and Safety measures <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 	Contractor	Part of the construction contract	Part of the construction contract	

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
		<p>workers when carrying out different tasks of the construction work</p> <ul style="list-style-type: none"> • Minimal use of manual lifting must be practiced. • 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 • 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. 				

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
		<ul style="list-style-type: none"> • 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 distancing at the accommodation facilities and work site. 				
	Waste Management During Construction Phase	<ul style="list-style-type: none"> • Clear the area from all the existing waste, relocate it to Thilafushi as much as 	Contractor / Island Council (implementation)	N/A	N/A	Should be included in

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
		<p>possible and relocate the remaining to the temporary relocation site</p> <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. • Hazardous waste generated should be collected and stored in sealed containers 	Proponent (supervision)			the project cost

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
		<ul style="list-style-type: none"> 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						
Waste collection from households and transport to the waste management facility	Waste spillage (litter) on to the streets during transport	<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 Provide appropriate bins at identified locations Provision of all required PPE to the staff of IWRMC Protective clothing, gloves, respiratory face masks and slip-resistant shoes are recommended for waste 	Operator	Part of the Operational such as staff, equipment, vehicles, and waste storage bins/bags	Proponent to determine	

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
		<p>transport workers and hard-soled safety shoes for all workers to avoid puncture wounds to the feet.</p> <ul style="list-style-type: none"> • 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 				
Waste sorting and storage	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 	Operator	Part of the Operational such as staff, equipment for waste sorting, compacting and storage	Proponent to determine	

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
		<p>bale, plastic shredding, wood chipping etc.</p> <ul style="list-style-type: none"> • Arrange regular disposal of inorganic waste through transportation to the RWMF • Establish pest control measure at the storage areas 				
Operation of AD Plant	Impacts due to installation and operation of AD plant	<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 				

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
		<p>less in nutrient quality (Environment Agency, 2013)</p> <ul style="list-style-type: none"> • 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). 				

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
		<ul style="list-style-type: none"> Recycle wastewater to the reactor to the greatest extent possible Explore the potential use of biogas (Methane) such as use for cooking or generating electricity 				
Flaring of methane produced from AD plant	Methane (CH ₄) is expected to be produced from the waste composting. It is proposed to flare the CH ₄ before it goes into the atmosphere. Flaring process will produce CO ₂ and water vapour. CO ₂ is a GHG and will cause an increase in emissions from waste composting thereby degrading the quality of air.	<ul style="list-style-type: none"> Warming potential of CH₄ is higher than CO₂. Therefore, flaring of CH₄ will reduce the warming potential by conversion to water vapour and CO₂. Care should be taken to maintain the flaring vent and the flame to have controlled burning and not to allow CH₄ to escape. Explore the possibility of investing to capture and store Methane (biogas) for potential power generation and/or cooking gas 	Operator of waste management facility Project implementing agency	0.5 of waste produces 200 kg of CH ₄	No cost involved except daily operational cost of the AD plant	-

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
Liquid nutrient (byproduct of AD plant)	Unmanaged and inappropriate disposal of liquid waste at site and to the island environment	Use as liquid fertilizer for soil enrichment or farming	Operator	600-700 liters/day	Not yet determined	
Wet compost (byproduct of AD plant)	Unmanaged and inappropriate disposal of wet compost at site and to the island environment	Wet compost converted to dry compost potential farming	Operator	30-40kg/day	Not yet determined	
AD plant breakdown	Unmanaged and accumulation of waste at the waste management facility	<ul style="list-style-type: none"> Provision of proper and complete training to AD plant operators (in all aspects of operations and plant maintenance) Undertake routine maintenance of plant as per the manual Essential spare parts that might be required for the routine repair and maintenance of the AD plant 	AD plant installation contractor	NA	Part of the contract	

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
		should be made available at site				
Hazardous waste sorting and storage and disposal	Handling of hazardous waste (e.g., waste oil, solvents, batteries, hospital, and non-municipal waste etc.) would be harmful to the workers' health	<ul style="list-style-type: none"> • Waste storage area designated for hazardous waste appropriately designed • Storage of different types of hazardous waste separated and labeled • Relevant labels/signs made visible at site 	Operator	Not very significant amount	N/A	
Health and Safety to workers during operation	The health and wellbeing of the staff working to collect and manage waste at the center would be exposed to health risk including exposure to bad air quality, high noise and odour. These impacts are	<ul style="list-style-type: none"> • Provide health and safety equipment to the workers including, safety gloves, helmets, suits and boots. • Furthermore, the workers should be brief about the potential hazard exposure and emergency plans should be explained. • All safety measures need to be enacted within the sites; 	Operator	Gloves, adequate working attire, boots, and masks.	Included in the operation cost o	

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
	considered cumulative as they would be existing until the operation of the facility.	hence adequate signage should be posted.				
Socio-cultural aspects	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. 	Island Council	To be determined	NA	

Project Activity	Potential Impacts	Proposed Mitigation Measures	Institutional Responsibilities (Implementation and Supervision)	Estimated Quantities Required and Material Specifications Recommended	Cost Estimates	Comments (e.g., secondary impacts)
Groundwater/water required for AD plant operation	Impact on groundwater resource due to potential leachates from waste processing and water required for AD plant operation	<ul style="list-style-type: none"> • Ensure drains are cleaned regularly to prevent clogs • Organic waste must be processed daily • Water required (75m³) for priming AD plant shall be pre planned and stored in storage tank/s to minimise the impact on ground water lens and avoid strong and short period hydraulic extraction from the well or any other source. • Rainwater collection and preplanned storage options shall be explored to use the required water for plant operation 	Operator	75m ³ of water for plant operation (one off) and limited quantity of leachate from wet waste	Included in the operation cost o	

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 16 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 16 Monitoring programme for the project

Proposed mitigation measure	Parameters to be monitored	Location	Measurements	Frequency of monitoring	Responsibility	Cost (Rf)
Pre-construction phase						
Not applicable						
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
Monitor quality of outlet flows of the anaerobic digester.	Total Organic Carbon (TOC), Chemical Oxygen Demand (COD), Nitrogen (N), Phosphorus (P) and Chlorine (Cl)	AD plant at IWRMC	Sample collected from outlet flow of AD plant sent to competent laboratory	Once after installation of AD plant and priming of unit (test run)	AD plant installation contractor/ Proponent	2,500.00
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
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	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. In addition the following parameter shall be monitored; <ul style="list-style-type: none"> Total organic carbon 	Project site and control site (baseline data collected sites)	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	Whole island	Log of grievances filed and how these were handled	Continuous process	Island Council / MCEP	Included in operational cost

	or other personnel					
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9.1 Reporting Procedures and Implementation Schedule

The reporting procedures and schedule for the various monitoring components are given in Table 17 below.

Table 17 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 15 and 16, 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: Ahmed Siraj
 - Designation: Municipal Officer
 - Contact number: 9999626

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

Table 18 below gives the details of the GRM formulated by MCEP

Table 18. 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
<p>First Tier: Island Council</p>	<p>Island Council will be the first point of contact for any grievances.</p> <p>The staff designated as the waste management focal point by the island council will manage grievances on behalf of the council.</p>	<p>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.</p> <p>Grievances can be addressed informally by contacting the council through email / telephone / in person. If the grievance cannot be resolved informally, an aggrieved party must submit a complaint on the Tier I Complaint Form. A copy of the form (with the council seal) should be provided to the aggrieved party as evidence of receipt.</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</p>	<p>15 working days</p>

Tiers of Grievance Mechanism	Nodal Person for Contact	Contact Communication and other facilitation by the project	Timeframe to address grievance
		<p>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 within this period, then the decision will be considered as accepted. If a complaint requires more time to address, this requirement must be communicated to the aggrieved party in writing and the aggrieved party must consent and sign-off the request for the extension to take effect. An extension can be made to an additional 15 working days. The staff designated as the waste management focal point by the island council will manage and provide feedback for grievances submitted to the council.</p>	
Second Tier: Ministry of Environment (ME)	Environmental and Social Safeguards officer at the Project Management Unit (PMU)	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.	15 working days

Tiers of Grievance Mechanism	Nodal Person for Contact	Contact Communication and other facilitation by the project	Timeframe to address grievance
		<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 it's 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 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>	

Tiers of Grievance Mechanism	Nodal Person for Contact	Contact Communication and other facilitation by the project	Timeframe to address grievance
		<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.</p> <p>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>	

Tiers of Grievance Mechanism	Nodal Person for Contact	Contact Communication and other facilitation by the project	Timeframe to address grievance
<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) is 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>

*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 19. 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 19. 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 Training in following COVID 19 guidelines at workplace and accommodation.	Site Supervisor / Contractor	Pre-construction phase Construction phase	N/A
Community Mobilization	Waste Management Committee	Introduction (Refresher) to the Waste Management Regulation, Policy and Guidelines Introduction (Refresher) to the Island Waste Management Plan and Waste Management Committee	Communication Specialist of MCEP	Pre-construction phase	Travel cost of facilitators Designing and printing of training materials and workshop costs

Training activity	Participants	Type of training and content	Responsibility	Scheduling	Cost estimates
		<p>Training in ways to segregate waste at household level</p> <p>Training in marketing of compost product</p>			
Operation and Maintenance training of the anaerobic digestion plant	IWMRC staff	<p>Introduction to compost preparation using organic waste</p> <p>Step by step guidance on anaerobic digestion and preparation of compost</p> <p>Step by step guidance to use and maintenance of the AD plant installed on the island</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	<p>Introduction to potential hazard scenarios and fire safety</p> <p>Training in use of fire safety equipment on the site</p> <p>Emergency response and evacuation plan and drill</p>	<p>PMU/ MCEP</p> <p>MNDF</p>	Prior to commencement of operations	<p>Travel cost of trainer</p> <p>Developing and printing of Training Manual</p>

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 is 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 is 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 M. Muli
- 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

12.1 Consultation Meetings

Table 20 gives details of the discussion points of the different stakeholder consultation meetings. Details of personnel consulted with are given in Appendix 10.

Table 20. 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>Secretariat of Muli Council</p> <p>Participants from the council</p>	<p>EIA Consultant enquired about the waste management plan of the island and current waste management practices, including presence of waste management committee, Grievance redress mechanism and essential services available on the island. The meeting was also to inform the proposed project and identify their concerns and expectations from the project. The following are the main outcome of the meeting.</p> <p>General Waste Management Issues in the island:</p> <ul style="list-style-type: none"> • Council outlined that waste management issue is one of the problems that island is facing. The Council stressed on the importance of the waste issues and this has been a concerning and growing issue of the public. • The island council have undertaken all the necessary preparatory work in order to facilitate the implementation of the Integrated Waste Resource Management Center (IWRMC)

	<p>at the island. These include clearance of the access road facilities and preparation of lighting poles for the access road. Furthermore, the council have designated a land area within the island to dispose waste.</p> <ul style="list-style-type: none"> • The land for the waste management is distanced from the residential area which would not cause any significant impact to the communities during waste management at the site. • M. Muli waste is managed by the council. The council have invested approximately MVR 2 million from their own resources to build an effective mechanism of waste management in the island. The existing waste management system was established by the council. The first waste collection system started in 2015. Since this was a public service, the Council decided that a fee needs to be taken from the public to provide this service. During that time, the council did not collect kitchen waste from the households, and the household was charged MVR 100 per month. • When the waste collected gets too much for the facility to handle, the waste management area has to be cleaned. A complete clean was done in 2018. The Council was told by the central government that once its cleaned, the money will be reimbursed to the Council. However, a bill of MVR 255,000 is still pending to be paid to WAMCO as none of the government offices either Ministry of Environment or President Office took the responsibility to reimburse the bill as they initially indicated. This became a huge loss to the Council as they are still trying to settle this payment to WAMCO. Therefore, due to financial constrains the council ceased its services to collect waste from household in 2018. • They also highlighted that with all these efforts, there was no support from the government to supplement for the continuity of this service. Government institutions such as the LGA, Ministry of Environment and Presidents Office was approached various occasions with no avail. Therefore, the services eventually came to a halt. • With the growing concern from the public and due to nuisance caused by the waste generated, the services were again resumed in Jan 2020, with some changes. The council employed four foreign labours as well as on collection bins and one collection vehicle (pickup). However, the household themselves has to fund for their own house level segregation bins. The council increased the waste collection fee to 155 MVR per month from each household and start collecting
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kitchen waste. In addition, there is a higher tariff charged for the businesses. In this new scheme, every single household has to register in this scheme and if they don't, the Council does not collect waste for them.

- Waste is segregated at household level mainly into kitchen waste, green waste, metal waste, bulk waste, and plastic waste. The waste site has different zones allocated to separate waste stream at the site shall be there any mix.
- They do have difficulty of disposing the waste metal as they have no means to dispose them of.
- Waste is currently managed by open burning of green waste and sea disposal of kitchen waste. Kitchen waste disposal to sea is carried by another company on a contract basis. The other inorganic waste is transferred to Thilafushi after few months. The site also has a waste incinerator which is currently inoperable due to a mechanical failure.
- Council indicated that during the NW monsoon if waste has to be burnt, a significant impact is felt on the households nearby and they make every effort to minimize the time of burning and change the hours to minimize the impact.

Environmentally Sensitive or Protected Area

- To the west of IWRMC there is a tortoise habitat which is marked as an environmentally sensitive area.

GRM at Council Level

- The island does not have a waste management plan; however, the council have designated municipal council unit established at the Council office with a focal person who handles all municipal services including waste management issues. Furthermore, Vice President of the Council is the designated councilor to oversees the waste management issues for the island. A dedicated hotline is established for the public complaints.

Removal of vegetation from the site

- The council estimates that there are approximately 20-40 large coconut palms that needs to be removed or relocated if any expansion is needed (expansion or removal of trees from this area is not under the scopet of this project).

	<ul style="list-style-type: none"> • A small marsh is located at west of the facility. • The access roads are cleared. There is no large vegetation such as trees or coconut palms. However, if the expansion of IWRMC is required, the large trees and coconut palms cannot be replanted. But the council stressed that they would be undertaking replanting 2 tree for every tree removed. <p>Proposed composting technology.</p> <ul style="list-style-type: none"> • The council welcome the proposed technology by the Project Proponent as it would enable production of a usable material (compost) from the otherwise not usable waste material and disposed to the sea. <p>Council also remarked the importance of capacity building and training needed for new technologies. They informed that staff would be identified for training once the installation of the system beings.</p>
<p>Consultation with Island Council to discuss an alternative location for temporary waste relocation/disposal</p> <p>Date: 25th January 2021</p> <p>Mode of Meeting: Online</p>	<p>The objective of this meeting was to discuss a better alternative for the temporary waste relocation/disposal site until the IWRMC is fully developed</p> <p>Minutes of meeting with details of the discussions and participants is attached separately in Appendix 10</p>
<p>Consultation with Women’s development committee</p> <p>Date: 14th January 2021</p> <p>Venue: Secretariat of Muni Council</p>	<p>The objective of this meeting was to inform and undertake consultation on the current waste management practices on the islands and identify concerns of the Women’s Development Committee (WDC) with regards to installation of Anaerobic Digester. The outcomes of the discussions are below;</p> <p>Institutional capacity and role of WDC</p> <ul style="list-style-type: none"> • WDC comprises of 5 members. • WDC undertake a supervisory role regarding the waste management issues. The Committee undertake voluntary work in providing information to general public and especially to the female population of the island on waste management matters. WDC organise cleaning activity regularly and dispose the waste on their own to the sites. • WDC notes that they have lobbied to the council to include collection of kitchen waste daily by council when the council started waste collection system in 2015.

	<ul style="list-style-type: none"> • WDC is involved in the cleaning of the industrial zone and public place. WDC is paid by the Council for doing so. • The islands pre-school is operated by the WDC and awareness about waste is created at the school.
<p>Consultation with FENAKA</p> <p>Date: 14th January 2021</p> <p>Venue: Secretariat of Muni Council</p>	<p>The objective of this meeting was to inform and undertake consultations on the current electricity demand and understand FENKA capacity to provide electricity for operation of the IWRMC including the Anaerobic Digester.</p> <p>Current Electricity demand</p> <ul style="list-style-type: none"> • The island has installed capacity of approximately 1MW, that is generated by 3 sets of generators (500kv, 400kv, 250kv). All the generators are synchronized and the island is provided with 3 phase electricity for 24 hours. • For electricity production approximately 1400 – 1900 liters of oil is used per day. <p>Future plans</p> <ul style="list-style-type: none"> • With the new possible upcoming airport facility at M. Muli, FENAKA is aiming to install additional 800 KV or 1 MW by end of year 2021. • Provision of electricity for operation of IWRMC <p>FENAKA has the capacity to provide electricity requirements to the IWRMC including the power requirements of the proposed digester. Furthermore, FENAKA would be able to provide electricity requirements to contractors who will undertake civil works.</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 • The duration of permit depends on the method of waste management planned for that island. The duration is determined after reviewing the waste management plan which are generally on 1,2,and 5 year renewable basis. • EPA will carry out an inspection and decide on renewal of permit.

	<ul style="list-style-type: none"> • 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.
<p>Consultation with the MNPFI / MLSA</p> <p>Date: 11th January 2021</p> <p>Meeting held via Google Meet (teleconferencing)</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 location the proposed location.</p> <ul style="list-style-type: none"> • Participant of the meeting stated that if approval had already been given, then they had not further comments or issues.
<p>Consultation with household residents</p> <p>14th January 2021</p>	<p>Random household resident's perception was performed to get a sense of the magnitude of impact and their concerns. Discussions were held with households within 4-5 blocks of radius from the waste center. The main concerns were;</p> <ul style="list-style-type: none"> • experience a significant impact from smoke when the waste is burnt during the NE monsoon or when the wind is towards their residents. • Unable to stay outdoors and once they start to feel the impact of smoke, shut the doors, and stays inside. • During severe waste burning they have to move the kids to other places of the island either to their grandparents' home or to some other relative's place until the impact of smoke subsides. • The smell might stay for a day or two and have to manage with air fresheners on some occasions. Most of the time, they have to rewash the clothes either due to bad smell or due to ash on the clothes. • None of the households indicated that they have identified any health issues related to smoke. However, if there are asthma patients, they take extra care as those patients sometimes experienced difficulty in breathing due to smoke. • Council office or operator of the waste management facility do not communicate with any waste burning schedule. to burn the waste for the day. In severe smoke cases they report to the Council or police, and fire has to be put out. In recent times,

	<p>the condition has improved, and more consideration is given by the facility on time of burning.</p> <ul style="list-style-type: none"> • The households further away indicated that they do not experience much impact due to burning. Sometimes the smell could be felt. They are aware of the impact felt on those within the proximity and they do not have such an impact.
<p>Consultation with MNDF Date: 28th January 2021 Meeting held via Google Meet</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 fire safety measure.</p> <p>EIA Consultant enquired whether they had any concerns about the project from a fire safety / hazards aspect. The following are the general responses from MNDF fire department;</p> <ul style="list-style-type: none"> • No concern as there is no fuel storage or use on site or use of fuel on the site • fire safety measures to them for their approval. • 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. • 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. • 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. <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> <ul style="list-style-type: none"> ○ Meeting adjourned with no further questions or queries on either sides.
<p>Ministry of Environment / MCEP</p>	<p>A formal consultation/meeting with the project PMU was held at the Inception stage.</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.
Health Protection Agency (HPA)	Meeting request has been made to Health Protection Agency with numerous follow ups, though a meeting has not been scheduled to date (copies of email communications given in Appendix 11).

12.2 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 12). 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. Only 5 households took part in the survey. Key findings from the survey include:

- On average, all households produce more non-biodegradable waste than biodegradable waste.
- All respondents reported having their waste collected by the Council appointed waste management staff and taken to the IWRMC for disposal.
- Waste segregation at household level was carried out by all respondents
- When enquired about the fee being taken by the Council for waste management (MRF 250 per household), 3 out of the 2 felt that the fee was acceptable while the rest just mentioned the fee.
- 2 out of 5 respondents felt that the location of the IWRMC felt that it was too close to the residential area and hence residents living in nearest areas feel the impacts due to waste management (such as impacts due to smoke because of open burning and odour impacts). In terms of views regarding the size of the centre, all the respondents felt that the size of the existing area for the IWRMC is small.
- When enquired about impacts faced by the island community, due to the current location of the IWRMC, impacts due to smoke and odour from the centre, nuisance of cats and mosquitoes were noted by the different respondents while 1 noted there is minimal impact.
- When enquired about the best mitigation measures to minimize impacts due to the IWRMC and associated work, the following was reported:
 - Regular disposal of waste from the centre (4 out of 5)
 - Creation of a vegetation buffer between the site and residential area (3 out of 5)
 - Complete cessation of burning of waste at the centre (2 out of 5)
 - Increase height of perimeter wall (1 out of 5)
 - Installation of firefighting equipment at the IWRMC (3 out of 5)

- Proper storage of waste which cannot be regularly disposed (5%)
- An additional measure that was proposed include to manage waste in a manner where mosquito is controlled.

In addition to the survey, as in Muli there are many houses within the proximity of the waste center, random household interviews were performed to get a sense of the magnitude of impact to them and how they have been managing.

Interviews were held with households within 4-5 blocks of radius from the waste center. Most of the households within the 3 blocks indicated that they experience a significant impact when the waste is burnt during the NE monsoon or when the wind is towards the land. Most of them indicated that they are unable to stay outdoors and once they start to feel the impact of smoke, they shut the doors and stays inside. On occasions when it is very severe, they have to move the kids to other places of the island either to their grandparents' home or to some other relative's place until the impact of smoke subsides. It was reported that the smell of burning of waste may stay for a day or two and they usually manage with air fresheners on some occasions. Most of the time, they have to rewash the clothes either due to bad smell or due to ash on the clothes.

None of the households indicated that they have identified any health issues related to smoke. However, if there are asthma patients, they take extra care as those patients sometimes experienced difficulty in breathing due to smoke.

The households are not usually informed by the Council office or by the facility when they start to burn the waste for the day. In cases of very severe days, the households report to the Council or either the police, and fire must be put out. In recent times, the condition has improved, and more consideration is given by the facility on time of burning.

The households more to the south (about 4 to 5 blocks) indicated that they do not experience much impact due to burning. Sometimes the smell could be felt. They are aware of the impact felt on those within the proximity and they do not have such an impact.

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 Island Council reports resident population, in Muli, 48% are women and 52% are men (NBS, 2017). The total estimated population in 2017 is 982. The island has a 5-member, Women's Development committee. WDC undertake a supervisory role regarding the waste management issues in the island. The Committee undertake voluntary work in providing information to general public and especially to the female population of the island on waste management matters. WDC organises cleaning activity regularly and dispose the waste on their own to the sites. WDC notes that they have lobbied to the council to include collection of kitchen waste daily by council when the council started waste collection system in 2015. WDC is involved in the cleaning of the industrial zone and public place. WDC is paid by the Council for doing so.

The islands pre-school is also operated by the WDC and awareness about waste is created at the school.

The Environmental and Social Assessment and Management Framework (ESMAF) 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 ESAMF and is given in Table 21 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. However, this was not the case in M. Muli. The WDC of the island is actively involved in waste management. But it was noted that they lack awareness. Hence, 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 22.

Table 21. Gender Development Plan as in the ESMF for the MCEP (MEE, 2016)

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 22. Gender Action Plan for the project

Gender Activity/Action Plan	Performance Indicators / Targets	Responsibility	Timeline
Outcome: M. Muli 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 upgrade existing IWRMC with proposed civil works and installation and operation of anaerobic digestion of organic waste as a piloting component in Muli 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. Impacts due improper waste management at the temporary waste relocation/disposal site
3. Health and safety risks to the workers during construction and operational work
4. Air pollution due to emissions associated with construction machinery
5. Groundwater pollution due to potential disposal of excess digester liquid and leachate drain

Lesser significant negative impacts from the project includes impacts on the environment due to accidental spills during transfers and waste handling and processing. The proximity of the project site with respect to residential area is approximately 35 meters where the location of the waste management center has been already determined and approved by Maldives Land and Survey Authority upon request by the island Council in 2016. The project civil works and AD plant installation will be carried out within the existing boundary of the waste management center, Vegetation clearance and for the purpose of the project and no additional land is required. A location for temporary storage of waste already exist within the waste management centre has been proposed adjacent to eastern boundary of the centre, which is a requirement to implement the proposed construction works associated with upgrades.

The proposed method of composting, which will be done in a relatively compact anaerobic digestion plant where the primary output from the processing will be biogas (predominantly methane). Additional bi product waste processing includes organic liquid and wet compost as undigested residue. This technology enables organic waste processing more efficiently and environmentally safer compared to what has been currently practiced such as composting and open burning of waste generated in the island. several benefits of the technology chosen are;

- Input material (organic waste) can be directly fed into the plant with partial segregation and without the need for pulverization
- Low labour requirement
- Plant composed of minimal parts, hence energy requirement is low
- High nutrient quality end products (compost and digester liquid)
- Biogas generated can be utilized for cooking or converted to electricity
- Comparatively shorter processing times ensures high economic return
- Beneficial to the environment;
- Minimises the problems of odour, leachate generation and ground water contamination associated with traditional methods of waste disposal

Stakeholder consultations showed support of the community for the project overall, especially due to the project enabling the conversion of waste into potential usable biproducts. Although few agricultural works is carried out in Muli, nearby Mulah community are quite involved in the agriculture sector and hence processed waste (liquid fertiliser and dry compost) will be of economic benefit (fertiliser and compost used for gardening and agriculture). The opted technology is also environmental beneficial with lesser footprint on the island compared to the current organic waste management methods adhered.

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. Only few households participated in the survey and from the findings it can be concluded that they felt the existing IWRMC is small in size and they are not happy with the impacts it causes due to open burning and other nuisances such as cats and mosquitoes. Majority felt that the current location was not suitable, quoting proximity to residential areas as the reason for this. They further stated that this proximity results in residents (especially the residents within 3 blocks distance from IWRMC) feeling the impacts due to open burning and odour, which would be more significant depending on wind direction. In terms of size of the IWRMC, majority felt that the current size was also small to properly cater to the waste management needs of the island.

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

- Proper set up of the temporary waste relocation/disposal site to prevent all associated negative impacts
- 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
- Care should be taken to maintain the flaring vent and the flame to have controlled burning and not to allow CH₄ to escape.

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. Establish a buffer around the IWRMC as recommended in the Landuse Planning regulation of Maldives (*Raajjeyge Binvaaveshi plan kurumaai hingumuge gavaidhu*)
4. Installation of renewable energy sources at IWRMC, such as solar panels to source power for operations;
5. Utilise the biogas produced to generate electricity which can be used to power the IWRMC operations
6. Ensure that measures are in place to address the issue of excessive digester liquid, to enable its utilization or disposal in an environmentally friendly manner
7. Carryout awareness raising campaigns to increase awareness of the general public regarding proposed work

8. 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.
9. Encourage greater participation of women, especially during operational stage
10. 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 especially Ali Shareef and Mareer Mohamed Husny 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 Muli, especially the focal point, Ahmed Sirraj for the project, 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. Kudavillingili, 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

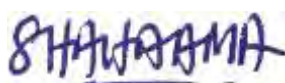
Referees

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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

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



CURRICULUM VITAE (CV)

1. **Full Name/ Address:** Aishath Abdulla
2. **Date of Birth:** 10/09/1986 **Nationality:** Maldivian
3. **Education:** 2012 Masters in Environment & Development, University of Melbourne, Australia
2010 BA (Hons) in Urban and Regional Planning, International Islamic University
Malaysia, Malaysia
4. **Membership of Professional Associations/Non-Governmental Organisations:** - Secretary of
Small Island Research Group NGO
5. **Other Training:** Attended the Expert Group Meeting (EGM) on: Urbanization in Small Island
Developing States as an Urban Planner from the Maldives; at the United Nations in New York (June
2016)
6. **Countries of Work Experience:** Maldives, Malaysia
7. **Languages:** Dhivehi-Good, English-Good
8. **Experience/ Employment Record (General)**

February 2013- Present	Senior Planner: Work in environmental and planning consultancies, including preparation of plans, studies and EIA reports etc LAMER Group Pte Ltd Male' Maldives
November 2010 – January 2011	Urban Planner/ Acting- Business Development Manager: Work in handling and managing bidding processes, HR, project proposals, Marketing. Planning related projects Riyan Pte.Ltd Male' Maldives
May 2009 - July 2009	Urban Planner-Trainee ANZ PLANNERS SDN. BHD Selangor Malaysia

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

Maldives Housing Market Needs and Assessment Study; Maldives Urban Development and Resilience Project (MUDRP)

Year: September 2020-Ongoing

Client: Ministry of National Planning, Housing and Infrastructure

Position Held: Qualitative Analyst

Duties Rendered: Design, conduct and reporting of Consumer Research; mapping of existing regulatory and institutional frameworks related to housing and land in Maldives; provide input to the recommendations to develop national housing policy and housing strategy.

Developing International Port Facilities in the North or South of Maldives; Stage 2 Reports – Transshipment Hub in Ihavandhippolhu Atoll

Year: July 2020

Location: Upper North Atoll, Maldives

Client: Ministry of Economic Development

Positions Held: Social Impact Assessment Consultant

Duties Rendered: Assessment of socio-economic setting and impacts, stakeholder consultations, public perception survey, social impact analysis and report writing.

Preparation of an Integrated Urban Development Master Plan for Addu City

Year: October 2019-Onhold

Client: Addu City Council

Position Held: **Urban** Planner and Project Manager

Duties Rendered: Carry out consultations and assessments, preparation of plans, overall management of the project

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 2016
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

References

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- 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
ESMAF	-	Environmental and Social Assessment and Management Framework
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 Island Waste Management Plan M. Muli

דָּוִד אֶרְסֹבֶנְוִי

לְסֵרֵד סְרִיחַ לְמֵרֵד

דָּוִד אֶרְסֹבֶנְוִי

01-04-2016

דָּוִד אֶרְסֹבֶנְוִי לְסֵרֵד סְרִיחַ לְמֵרֵד דָּוִד אֶרְסֹבֶנְוִי

4/24/2016

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މުލީ ސަރުކާރުގެ ސަރުކާރުގެ ގެޒެޓް ގަވާއިދު 10: 20 ގަވާއިދު 10

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❖ ގަވާއިދު 10:

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Կարգից և քաղաքակրթական կարգի պահպանման համար կարևոր է հարգել և պահպանել
 պատմության հուշարձանները, որոնք պարունակում են մեր հայրենիքի հուշերը և անհրաժեշտ է
 դրանց համար համապատասխան միջոցներ օգտագործել:

❖ Ներդրվող փողերը

Հիմնականում փողերը հավաքվում են հայրենասեր և հայրենասեր ընտանիքներից և կազմակերպություններից:

❖ Հիմնականում փողերը հավաքվում են հայրենասեր և հայրենասեր ընտանիքներից և կազմակերպություններից:

Ներդրվող փողերը հավաքվում են հայրենասեր և հայրենասեր ընտանիքներից և կազմակերպություններից:

1. Կարևոր է հարգել և պահպանել պատմության հուշարձանները, որոնք պարունակում են մեր հայրենիքի
 հուշերը և անհրաժեշտ է դրանց համար համապատասխան միջոցներ օգտագործել:

Ներդրվող փողերը հավաքվում են հայրենասեր և հայրենասեր ընտանիքներից և կազմակերպություններից:

2. Կարևոր է հարգել և պահպանել պատմության հուշարձանները, որոնք պարունակում են մեր հայրենիքի
 հուշերը և անհրաժեշտ է դրանց համար համապատասխան միջոցներ օգտագործել:

Appendix 3 Terms of Reference issued by World Bank

ANNEX 1: TECHNICAL TOR A

ESMP or ESIA for the establishment or upgrading of IWRMC with
Anaerobic Digestion (AD) Technology

Technical Terms of Reference A: ESMP for the establishment or upgrading of IWRMC with Anaerobic Digestion (AD) Technology

Objective and Scope of Preparation of ESMP or EISA

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 or an ESIA 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 or the ESIA.

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 or ESIA report.

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

1. **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.
2. **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 ESIA.

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.

3. 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.

If the gas generated from the AD plant is intended to be used to produce electricity using a bio-generator, approval from Maldives Energy Authority (MEA) should be acquired and included in the report.

4. 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 or the ESIA 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.

5. 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, AD plant 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, AD plant operations, bio-generator operations (if applicable), 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 AD plant and associated components

- Concept design of the AD plant and process flow diagram with all its components including the proposed method for gas storage and its subsequent use (conversion to electricity).
- Description of the AD plant and associated bio-generator (if the intended use is for generating electricity for the energy requirements of the IWRMC). Details of the materials that will be used for the construction of the plant should be given (fiber reinforced plastic, stainless steel etc.)
- Corresponding sizes and daily processing capacities of the AD plant and the associated bio-generator (if applicable) should be given.
- 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 water and bacterial inoculum) including its corresponding quantities to operate for a period of 1 year.

- Type and quantity of gas generated (methane, CO2 etc.), method of gas collection and storage, process for conversion to electricity (or any other use) and how to deal with any excessive gas must be clearly mentioned.
- Solid and liquid bi-products and output of the process (wet / dry compost) including the method of their potential use and/or disposal.
- If a bio-generator is to be installed, the following should be addressed:
 - Noise ammunition measures
 - Cooling water system including cooling pipe location (if any) and justification.
 - Emergency power supply plan.
 - Lower energy consumption ventures and awareness.
 - Chimney height and justification on how the height was determined based on relevant local and international standards.

Fuel Management (if applicable – in case additional fuel is required to operate the bio-generator)

- Volume required for plant operation
- Rate of waste lube oil generation, its collection, storage and disposal.
- Fuel storage tank details (size, location, method of transportation from harbor to storage plant).
- Fuel transportation, pipeline drawing and specification especially leakage proofing.
- Measures of fuel containment
- Method of fuel transport from harbor to storage
- Fuel handling and management plan during operations
- Mitigation in case of fuel spillage

Fire hazard, health and safety

- Vulnerability analysis of the system 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.

6. **Existing Environment:** The existing environment study will require data collection and survey analysis techniques given the nature of the project and the proposed technology. 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.

- a) 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.
- b) 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.
- c) 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.
- d) 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.
- e) 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.

- f) 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 or ESIA).*
- g) Groundwater Quality: Temperature, pH, conductivity, total dissolved solid (TDS), Nitrate and total petroleum hydrocarbon (from the proposed location of AD plant).
- h) Air Quality: Particulate matter (PM10 and PM2.5), carbon monoxide (CO), nitrogen oxide (NO) and Sulphur dioxide (SO₂).
- i) Noise: outside within 1m radius and within the nearest residential area.
- j) 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.

- k) 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.
- l) 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 tourisms (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).

7. **Impact Identification**: The ESMP or EISA 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:

- a) 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) and accidental fuel spillage (if fuel tanks are included within project scope).
 - Impacts on ground vibrations to nearby houses and buildings.
 - Impacts on air quality.
 - Marine water pollution due to spillage during material transfer.
- b) 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.
- c) 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.
- d) 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 fuel (if fuel storage is included with the project scope) and waste.

- e) 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
- f) 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 in coming 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 asses 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.

8. **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 the use of compost machines. 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.

9. **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 (ESMP) 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.

On islands where large volumes of residual legacy waste are identified at the IWRMC site, the consultant will present a recommended course of action for island clean up, need for waste segregation and management options, including onsite and offsite, resource recovery, recycling and/or final disposal in the form of mitigatory actions defined for the context of each Island.

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.

10. Development of monitoring and reporting plan:

10.1. 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						

10.2. 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.

10.3. 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.

10.4. 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.

11. 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.

12. 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

13. 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

14. 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.

15. 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, AD component and operation licensing requirements).
- Maldives Energy Authority (on the operations and the bio generator to produce electricity for the IWRMC operations).
- FENAKA (on the capacity of the island 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 handling of fuel, 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.

16. 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.

17. Validation and Disclosure

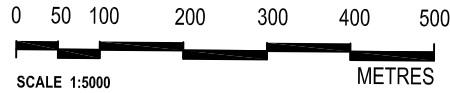
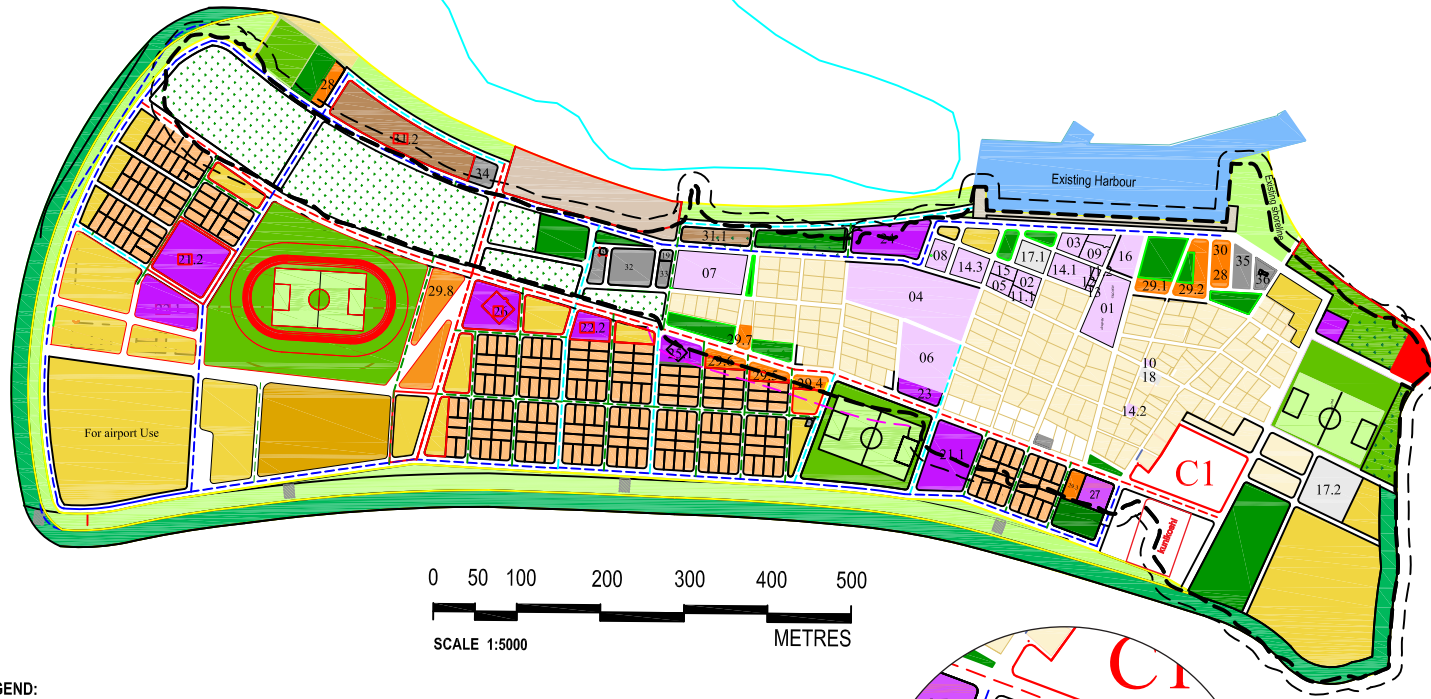
The draft executive summary and the ESMP (matrix table in mitigation chapter) in local language should be disclosed in all major affected settlements and at island level in printed format and disseminated as appropriate or made available via online means for public commenting. This should be completed 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.

18. 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 4 Approved Land Use Plan



LEGEND:

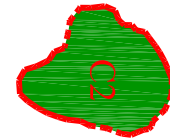
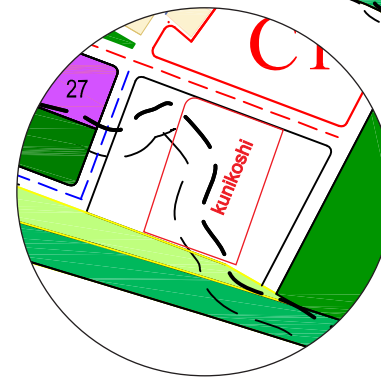
EXISTING:

- VEGETATION
- RESIDENTIAL AREA
- INSTITUTIONAL & COMMUNITY FACILITIES
 - 01- ATOLL OFFICE & ATHOLHUGE
 - 02- ISLAND OFFICE
 - 03- ISLAND COURT
 - 04- SCHOOL
 - 05- PRE SCHOOL
 - 06- REGIONAL HOSPITAL
 - 07- RESIDENCES FOR HOSPITAL STAFF (Mini)
 - 08- TEACHERS' BLOCK
 - 09- POLICE
 - 10- YOUTH CENTRE
 - 11.1-11.2 GUEST HOUSE
 - 12- CYBER STATION
 - 13- ATOLL STORE
 - 14.1 MOSQUE (MASJIDUL JAAMIRU)
 - 14.2 NEIGHBOURHOOD MOSQUE
 - 14.3 FRIDAY MOSQUE (MASJIDUL MUSA'AVA)
 - 15- BANK OF MALDIVES
 - 16- STAGE
- UTILITY & MUNICIPAL SERVICES
 - 17.1-17.2 CEMETRY
 - 18- POWER HOUSE
 - 19- DHRIRAGU ANTENNA SITE
- HARBOUR BASIN

PROPOSED:

- PUBLIC HOUSING UNITS (4.32 Ha)
- RESIDENTIAL PLOTS (12.51 Ha)
- INSTITUTIONAL & COMMUNITY FACILITIES (3.20 Ha)
 - 20- COMMUNITY CENTRE AND INDOOR SPORTS COURT
 - 21.1-21.2 PRIMARY SCHOOLS
 - 22.1-22.2 PRE SCHOOL
 - 23- PROPOSED EXTENSION OF THE REGIONAL HOSPITAL
 - 24- NSS / FIRE
 - 25.1-25.2 NEIGHBOURHOOD MOSQUE
 - 26- GRAND FRIDAY MOSQUE
 - 27- GUEST HOUSE
- COMMERCIAL ZONE (0.85 Ha)
 - 28- LOCAL PRODUCE MARKET
 - 29- SHOPS AND CAFES
 - 30- FISH MARKET
- LIGHT INDUSTRIAL ZONE (0.84 Ha)
 - 31.1-31.3 LIGHT INDUSTRIAL USE
- UTILITY & MUNICIPAL SERVICES (0.76 Ha)
 - 32- POWER HOUSE
 - 33- DESALINATION AND WATER SUPPLY PLANT
 - 34- ICE PLANT
 - 35- WARE HOUSES
 - 36- FUEL STORAGE AND RETAIL
 - 37- CEMETRY
 - 38- WASTE MANAGEMENT
 - 39- Ooredoo Antena
- HARBOUR AREA (LOADING / UNLOADING)
- BOAT REPAIR
- RESERVED FOR UTILITIES
- POSSIBLE LOCATIONS OF SEWERAGE TREATMENT AND SEA OUTFALL LOCATIONS
- RESERVED FOR FUTURE USE (2.90 Ha)
- RECREATIONAL AREA (5.49 Ha)
- PARKS / GREEN AREA / BUFFER ZONE (1.79 Ha)
 - 2.4M HIGH GREEN BELT
- LOWER DRAINAGE AREA (WITH RECREATIONAL FACILITIES)
- ENVIRONMENTAL PROTECTION ZONE (EPZ) (8.15 Ha)
- BEACH AND RECREATIONAL
- PEDESTRIAN ROUTE
- CONSERVATION SITE
 - C1 TURTLE SANCTUARY
 - C2 UNINHABITED ISLAND (BOAHURAA)

- 13M WIDE ROAD
- 11M WIDE ROAD
- 9M WIDE ROAD
- 6M WIDE ROAD



MINISTRY OF NATIONAL PLANNING AND INFRASTRUCTURE

AMEENEE MAGU, MAAFANNU 20392, MALE', REPUBLIC OF MALDIVES
 TEL: 4004700 FAX: 4004701 email: urban@planning.gov.mv

TITLE:
 M. MULI LAND USE PLAN

PROJECT:
 M. MULI LAND USE PLAN

DRAWN BY:

CHECKED BY: NA

SURVEYED BY:

SCALE:

DATE: 14 OCTOBER 2019

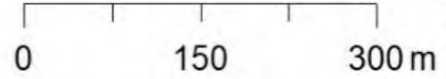
Appendix 5 Map of Muli and Site plan

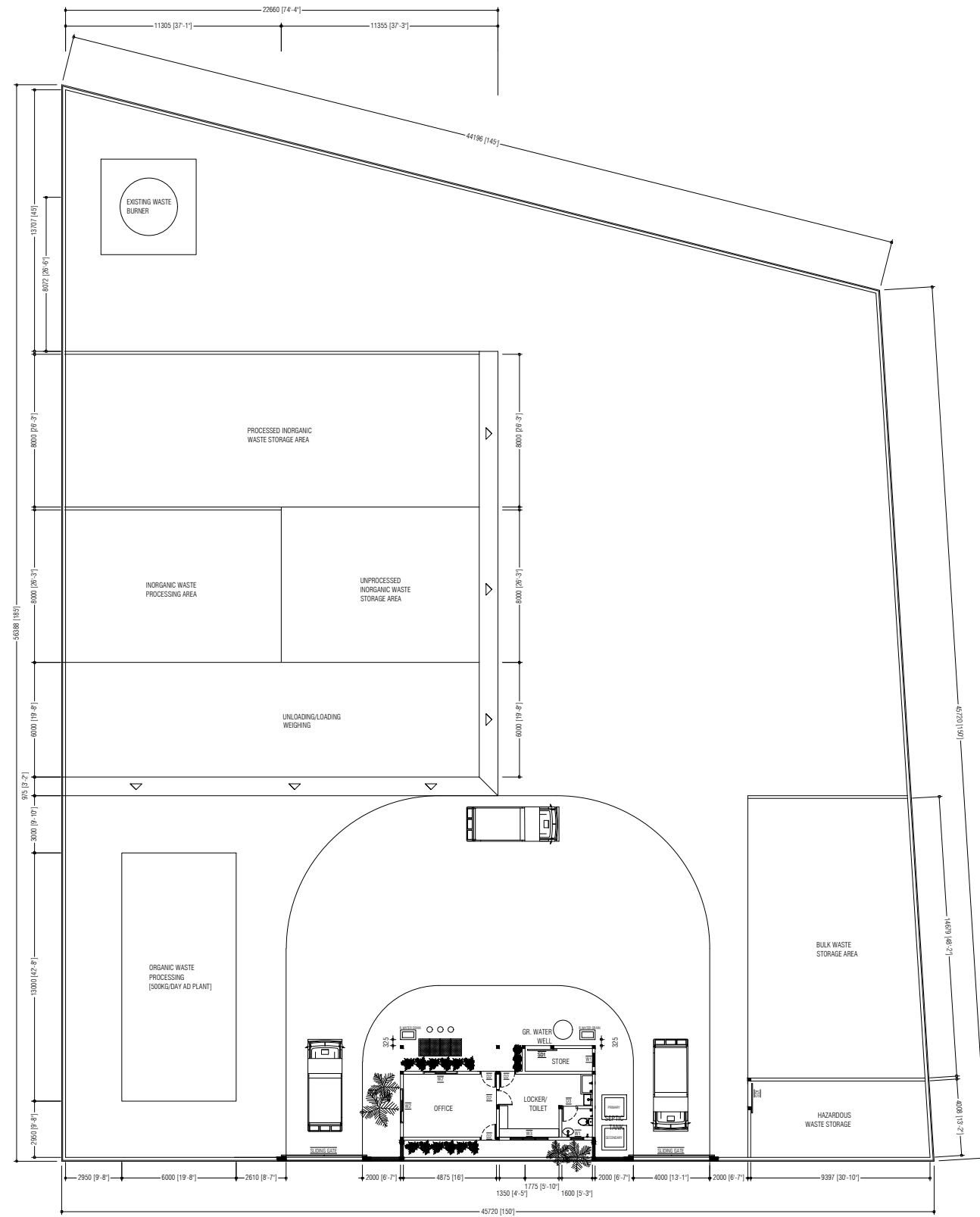


- Closest electric DB
- Air_water_control
- Air_water_source
- Erosion zones
- Access_road



Map by:
 LAMER Pvt Ltd
 Coordinate System: WGS 1984 UTM Zone 43N
 Projection: Transverse Mercator
 Datum: WGS 1984
 False Easting: 500,000.0000
 False Northing: 0.0000
 Central Meridian: 75.0000
 Scale Factor: 0.9996
 Latitude Of Origin: 0.0000
 Units: Meter





PREPARED BY

PROJECT

DESIGN BY

AMENDMENTS

UPGRADING OF ISLAND WASTE MANAGEMENT CENTRE
M. MULI

AFRAZ

TITLE

STRUCTURE BY

FLOOR PLAN

AFRAZ

CLIENT DEPARTMENT

DRAWN BY

WMPC DEPARTMENT

AFRAZ

PAPER SIZE A3

SCALE

1:150

PAGE NO. 02

DWG NO.

MULI-A1-02

DATE

24.12.2020



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

Appendix 6 Water test results reports from MWSC

Male' Water & Sewerage Company Pvt Ltd

Water Quality Assurance Laboratory

Quality Assurance Building, 1st Floor, Male' Hingun, Vilimale', Male' City, Maldives
Tel: +9603323209, Fax: +9603324306, Email: wqa@mwsc.com.mv



LB-TEST-090



WATER QUALITY TEST REPORT Report No: 500185946

Customer Information:

Land & Marine Environment Resources
H.Azum
Ameeneemagu
Male' MALE

Report date: 24/01/2021
Test Requisition Form No: 900191048
Sample(s) Received Date: 19/01/2021
Date of Analysis: 19/01/2021 - 19/01/2021

Sample Description ~	Nilandhoo Control	Nilandhoo Site	Fonadhoo Site	TEST METHOD	UNIT
Sample Type ~	Ground Water	Ground Water	Ground Water		
Sample No	83216050	83216051	83216052		
Sampled Date ~	11/01/2021 09:00	11/01/2021 09:00	16/01/2021 09:00		
PARAMETER	ANALYSIS RESULT				
Physical Appearance	Clear with particles	Clear with particles	Clear with particles		
Conductivity *	653	780	850	Method 2510 B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	µS/cm
pH *	7.42	7.23	7.43	Method 4500-H+ B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	-
Temperature	24.3	24.4	24.5	Electrometry	°C
Total Dissolved Solids	326	390	425	Electrometry	mg/L
Nitrate *	1.4	0.5	2.7	HACH Method 8171	mg/L
Total Petroleum Hydrocarbon (TPH)	<0.036 (LoQ 0.036 mg/L)	0.042	<0.036 (LoQ 0.036 mg/L)	UV Fluorescence	mg/L

Keys: µS/cm : Micro Seimen per Centimeter, °C : Degree Celcius, mg/L : Milligram Per Liter

Checked by

Aminath Sofa
Laboratory Executive

Approved by

Mohamed Eyman
Manager, Quality

Notes: Sampling Authority: Sampling was not done by MWSC Laboratory
This report shall not be reproduced except in full, without written approval of MWSC
This test report is ONLY FOR THE SAMPLES TESTED.
~ Information provided by the customer
*Parameters accredited by EIAC under ISO/IEC 17025:2017

Male' Water & Sewerage Company Pvt Ltd

Water Quality Assurance Laboratory

Quality Assurance Building, 1st Floor, Male' Hingun, Vilimale', Male' City, Maldives
Tel: +9603323209, Fax: +9603324306, Email: wqa@mwsc.com.mv



WATER QUALITY TEST REPORT
Report No: 500185946

Customer Information:

Land & Marine Environment Resources
H.Azum
Ameeneemagu
Male' MALE

Report date: **24/01/2021**
Test Requisition Form No: **900191048**
Sample(s) Received Date: **19/01/2021**
Date of Analysis: **19/01/2021 - 19/01/2021**

Sample Description ~	Fonadhoo Control	Muli Site	Muli Control	TEST METHOD	UNIT		
Sample Type ~	Ground Water	Ground Water	Ground Water				
Sample No	83216053	83216054	83216055				
Sampled Date ~	16/01/2021 03:00	14/01/2021 09:00	14/01/2021 03:00				
PARAMETER	ANALYSIS RESULT						
Physical Appearance	Clear with particles	Cloudy with particles	Clear with particles				
Conductivity *	901	973	481	Method 2510 B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	µS/cm		
pH *	7.59	7.00	7.93	Method 4500-H+ B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	-		
Temperature	24.5	24.5	24.6	Electrometry	°C		
Total Dissolved Solids	451	487	241	Electrometry	mg/L		
Nitrate *	0.6	0.8	0.8	HACH Method 8171	mg/L		
Total Petroleum Hydrocarbon (TPH)	<0.036 (LoQ 0.036 mg/L)	0.038	<0.036 (LoQ 0.036 mg/L)	UV Fluorescence	mg/L		

Keys: µS/cm : Micro Seimen per Centimeter, °C : Degree Celcius, mg/L : Milligram Per Liter

Checked by

Aminath Sofa
Laboratory Executive

Approved by

Mohamed Eyman
Manager, Quality

Notes: Sampling Authority: Sampling was not done by MWSC Laboratory

This report shall not be reproduced except in full, without written approval of MWSC

This test report is ONLY FOR THE SAMPLES TESTED.

~ Information provided by the customer

*Parameters accredited by EIAC under ISO/IEC 17025:2017

***** END OF REPORT *****

Appendix 7 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 Muli. 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 	<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 	<ul style="list-style-type: none"> • Minimally dependent on mechanical equipment • Low capital cost • Low operations and maintenance cost

	<ul style="list-style-type: none"> • Low energy requirement 	<ul style="list-style-type: none"> • 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"> • 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

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) • 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)

	<ul style="list-style-type: none"> • 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 are 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 • 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

Table 3. Mitigation measures proposed for the alternative temporary waste relocation/disposal area

Method	Mitigation measures proposed
Assigning the north side adjacent to IWRMC with dense vegetation	<ul style="list-style-type: none"> • Mitigation measures for the location as reported in ESMP matrix given in this report (Chapter 8, Table 15)
Assigning the reclaimed land east to the IWRMC	<ul style="list-style-type: none"> • The temporary area should be clearly demarcated with a fenced boundary and ensure it is aesthetically acceptable as the location is near the public beach area. • Cover the ground of the site with an impermeable surface (such as concrete layer, metal sheet) to prevent leachate • Cover the area with a polyurethane bounded tent to avoid any displacement of waste • Clear the area after the completion of IWRMC

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

<p>Installation of a generator in the IWRMC specific for its operations</p>	<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. • 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
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Appendix 8 Translation of ESMP

<p>דבר הנדרש</p>	<p>אמצעי הגנה</p>	<p>אמצעים הנדרשים למניעת הפרת החוק</p>	<p>הפרת החוק (אמצעים למניעת הפרת החוק)</p>	<p>הפרת החוק הנדרשת למניעת הפרת החוק</p>	<p>הפרת החוק הנדרשת למניעת הפרת החוק</p>	<p>הפרת החוק הנדרשת למניעת הפרת החוק</p>
-	-	-	<p>- הפרת החוק הנדרשת למניעת הפרת החוק</p>	<p>הפרת החוק הנדרשת למניעת הפרת החוק</p>	<p>הפרת החוק הנדרשת למניעת הפרת החוק</p>	<p>הפרת החוק הנדרשת למניעת הפרת החוק</p>
-	-	-	<p>- הפרת החוק הנדרשת למניעת הפרת החוק</p>	<p>הפרת החוק הנדרשת למניעת הפרת החוק</p>	<p>הפרת החוק הנדרשת למניעת הפרת החוק</p>	<p>הפרת החוק הנדרשת למניעת הפרת החוק</p>
-	-	-	<p>- הפרת החוק הנדרשת למניעת הפרת החוק</p>	<p>הפרת החוק הנדרשת למניעת הפרת החוק</p>	<p>הפרת החוק הנדרשת למניעת הפרת החוק</p>	<p>הפרת החוק הנדרשת למניעת הפרת החוק</p>
-	-	-	<p>- הפרת החוק הנדרשת למניעת הפרת החוק</p>	<p>הפרת החוק הנדרשת למניעת הפרת החוק</p>	<p>הפרת החוק הנדרשת למניעת הפרת החוק</p>	<p>הפרת החוק הנדרשת למניעת הפרת החוק</p>

<p>רשומות דאטומיות</p>	<p>אסעקציע דאטומ</p>	<p>אסעקציעס און ארעאס</p>	<p>עסעקציעס (אסעקציעס און ארעאס)</p>	<p>עסעקציעס און ארעאס</p>	<p>עסעקציעס און ארעאס</p>	<p>עסעקציעס און ארעאס</p>
			<p>- אסעקציעס און ארעאס</p>	<p>- אסעקציעס און ארעאס</p>	<p>- אסעקציעס און ארעאס</p>	<p>- אסעקציעס און ארעאס</p>

<p>תחום אחריות</p>	<p>אמצעי הגנה</p>	<p>מצב הגנה</p>	<p>תחום אחריות</p>	<p>מצב הגנה</p>	<p>מצב הגנה</p>	<p>מצב הגנה</p>
			<p>- תחום אחריות (תחום אחריות)</p>		<p>מצב הגנה</p>	
<p>תחום אחריות</p>	<p>-</p>	<p>מצב הגנה</p>	<p>- תחום אחריות (תחום אחריות)</p>	<p>מצב הגנה</p>	<p>מצב הגנה</p>	<p>מצב הגנה</p>

<p>د پرمختګ ساحې د ترمیمونو</p>	<p>د پرمختګ ساحې د ترمیمونو</p>	<p>د پرمختګ ساحې د ترمیمونو</p>	<p>د پرمختګ ساحې د ترمیمونو</p>	<p>د پرمختګ ساحې د ترمیمونو</p>	<p>د پرمختګ ساحې د ترمیمونو</p>	<p>د پرمختګ ساحې د ترمیمونو</p>
		<p>د پرمختګ ساحې د ترمیمونو</p>		<p>د پرمختګ ساحې د ترمیمونو</p>		
-	-	-	-	<p>د پرمختګ ساحې د ترمیمونو</p>	<p>د پرمختګ ساحې د ترمیمونو</p>	

<p>דבר הנדרש</p>	<p>אמצעי הגנה</p>	<p>אמצעים הנדרשים למניעת הפרת החוק</p>	<p>הפרת החוק (אמצעים הנדרשים למניעת הפרת החוק)</p>	<p>הפרת החוק הנדרשת למניעת הפרת החוק</p>	<p>הפרת החוק הנדרשת למניעת הפרת החוק</p>	<p>אמצעים הנדרשים למניעת הפרת החוק</p>
				<p>- יסודות הנדרשים למניעת הפרת החוק</p> <p>- אמצעים הנדרשים למניעת הפרת החוק</p> <p>- אמצעים הנדרשים למניעת הפרת החוק</p> <p>- אמצעים הנדרשים למניעת הפרת החוק</p>		
-	<p>אמצעים הנדרשים למניעת הפרת החוק</p>	<p>אמצעים הנדרשים למניעת הפרת החוק</p>	<p>אמצעים הנדרשים למניעת הפרת החוק</p>	<p>- אמצעים הנדרשים למניעת הפרת החוק</p> <p>- אמצעים הנדרשים למניעת הפרת החוק</p> <p>- אמצעים הנדרשים למניעת הפרת החוק</p>	<p>אמצעים הנדרשים למניעת הפרת החוק</p>	<p>אמצעים הנדרשים למניעת הפרת החוק</p>

<p>דבר הנדרש</p>	<p>אמצעי הנדרש</p>	<p>מטרות הנדרשות</p>	<p>השקעה הנדרשת</p>	<p>הזמן הנדרש</p>	<p>הסכום הנדרש</p>	<p>המקור הנדרש</p>
		<p>הגדרת המטרות הנדרשות</p>	<p>השקעה הנדרשת</p>	<p>הזמן הנדרש</p>	<p>הסכום הנדרש</p>	<p>המקור הנדרש</p>

<p>דבר אשר נאמר</p>	<p>אשר נאמר בנו</p>	<p>אשר נאמר בנו</p>	<p>אשר נאמר בנו</p>	<p>אשר נאמר בנו</p>	<p>אשר נאמר בנו</p>	<p>אשר נאמר בנו</p>
				<p>- אלה הם הדברים אשר נאמרו בנו</p>		
-	-	-	-	<p>- אלה הם הדברים אשר נאמרו בנו</p>	<p>אלה הם הדברים אשר נאמרו בנו</p>	
-	-	-	-	<p>- אלה הם הדברים אשר נאמרו בנו</p>	<p>אלה הם הדברים אשר נאמרו בנו</p>	
-	-	-	-	<p>- אלה הם הדברים אשר נאמרו בנו</p>	<p>אלה הם הדברים אשר נאמרו בנו</p>	

<p>רעיונות והצעות</p>	<p>אמצעי הגנה</p>	<p>השקפת המדינה</p>	<p>השקפת הממשלה (השקפת הממשלה)</p>	<p>השקפת הממשלה הממשלה</p>	<p>השקפת הממשלה הממשלה</p>	<p>השקפת הממשלה</p>
				<p>השקפת הממשלה</p>		
-	רעיונות והצעות	רעיונות והשקפת המדינה	<p>השקפת הממשלה</p>	<p>השקפת הממשלה</p>	<p>השקפת הממשלה</p>	
-	-	-	<p>השקפת הממשלה</p>	<p>השקפת הממשלה</p>	<p>השקפת הממשלה</p>	
-	-	-	<p>השקפת הממשלה</p>	<p>השקפת הממשלה</p>	<p>השקפת הממשלה</p>	

<p>دې ډول د ډول</p>	<p>د ډول د ډول</p>	<p>د ډول د ډول</p>	<p>د ډول د ډول (د ډول د ډول)</p>	<p>د ډول د ډول د ډول</p>	<p>د ډول د ډول د ډول</p>	<p>د ډول د ډول</p>
				<p>- د ډول د ډول</p>		

Appendix 9 Sample Contractor’s Code of Conduct by the World Bank

CODES OF CONDUCT

Codes of Conduct	1
<i>Company Code of Conduct.....</i>	<i>2</i>
<i>Manager's Code of Conduct.....</i>	<i>5</i>
<i>Individual Code of Conduct.....</i>	<i>8</i>

Codes of Conduct

Three Codes of Conduct are presented below:

- i. **Company Code of Conduct:** Commits the company to addressing ESHS, OHS and GBV issues;
- ii. **Manager's Code of Conduct:** Commits managers to implementing the Company Code of Conduct, as well as those signed by individuals; and,
- iii. **Individual Code of Conduct:** Code of Conduct for everyone working on the project, including managers.

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

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

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

General

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

Health and Safety

8. The company will ensure that the project’s OHS Management Plan is effectively implemented by company’s staff, as well as sub-contractors and suppliers.
9. The company will ensure that all persons on-site wear prescribed and appropriate personal protective equipment, preventing avoidable accidents, and reporting conditions or practices that pose a safety hazard or threaten the environment.
10. The company will:
 - i. prohibit the use of alcohol during work activities.
 - ii. prohibit the use of narcotics or other substances which can impair faculties at all times.
11. The company will ensure that adequate sanitation facilities are available on site and at any worker accommodations provided to those working on the project.

12. The company will not hire children under the age of 18 for construction work, or allow them on the work site, due to the hazardous nature of construction sites.

Gender Based Violence

13. Acts of GBV constitute gross misconduct and are therefore grounds for sanctions, which may include penalties and/or termination of employment and, if appropriate, referral to the Police for further action.
14. All forms of GBV, are unacceptable, regardless of whether they take place on the work site, the work site surroundings, at worker's camps or within the local community.
15. Sexual harassment of work personnel and staff (e.g. making unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature) are acts of GBV and are prohibited.
16. Sexual favors (e.g. making promises of favorable treatment such as promotions, threats of unfavorable treatment such as losing a job, payments in kind or in cash dependent on sexual acts) and any form of humiliating, degrading or exploitative behavior are prohibited.
17. The use of prostitution in any form at any time is strictly prohibited.
18. Sexual contact or activity with children under 18—including through digital media—is prohibited. Mistaken belief regarding the age of a child is not a defense. Consent from the child is also not a defense or excuse.
19. Unless there is full consent¹ by all parties involved in the sexual act, sexual interactions between the company's employees (at any level) and members of the communities surrounding the work place are prohibited. This includes relationships involving the withholding/promise of actual provision of benefit (monetary or non-monetary) to community members in exchange for sex (including prostitution). Such sexual activity is considered "non-consensual" within the scope of this Code.
20. In addition to company sanctions, legal prosecution of those who commit acts of GBV will be pursued if appropriate.
21. All employees, including volunteers and sub-contractors are highly encouraged to report suspected or actual acts of GBV by a fellow worker, whether in the same company or not. Reports must be made in accordance with project's GBV Allegation Procedures.
22. Managers are required to report and act to address suspected or actual acts of GBV as they have a responsibility to uphold company commitments and hold their direct reports responsible.

Implementation

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

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

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

24. Ensuring that all employees sign the project's 'Individual Code of Conduct' confirming their agreement to comply with ESHS and OHS standards, and not to engage in activities resulting in GBV, child endangerment or abuse, or sexual harassment.
25. Displaying the Company and Individual Codes of Conduct prominently and in clear view at workers' camps, offices, and in in public areas of the work space. Examples of areas include waiting, rest and lobby areas of sites, canteen areas and health clinics.
26. Ensuring that posted and distributed copies of the Company and Individual Codes of Conduct are translated into the appropriate language of use in the work site areas as well as for any international staff in their native language.
27. Ensuring that an appropriate person is nominated as the company's 'Focal Point' for addressing GBV issues, including representing the company on the GBV Complaints Team (GCT) which is comprised of representatives from the client, contractor(s), the supervision consultant, and local GBV Service Provider.
28. Ensuring that an effective GBV Action Plan is developed in consultation with the GCT which includes as a minimum:
 - i. **GBV Allegation Procedure** to report GBV issues through the project Grievance Redress Mechanism (Section 4.3 Action Plan);
 - ii. **Accountability Measures** to protect confidentiality of all involved (Section 4.4 Action Plan); and,
 - iii. **Response Protocol** applicable to GBV survivors and perpetrators (Section 4.7 Action Plan).
29. Ensuring that the company effectively implements the agreed final GBV Action Plan, providing feedback to the GCT for improvements and updates as appropriate.
30. Ensuring that all employees attend an induction training course prior to commencing work on site to ensure they are familiar with the company's commitments to ESHS and OHS standards, and the project's GBV Codes of Conduct.
31. Ensuring that all employees attend a mandatory training course once a month for the duration of the contract starting from the first induction training prior to commencement of work to reinforce the understanding of the project's ESHS and OHS standards and the GBV Code of Conduct.

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

Company name: _____

Signature: _____

Printed Name: _____

Title: _____

Date: _____

Manager's Code of Conduct Implementing ESHS and OHS Standards Preventing Gender Based Violence

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

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

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

Implementation

1. To ensure maximum effectiveness of the Company and Individual Codes of Conduct:
 - i. Prominently displaying the Company and Individual Codes of Conduct in clear view at workers' camps, offices, and in public areas of the work space. Examples of areas include waiting, rest and lobby areas of sites, canteen areas and health clinics.
 - ii. Ensuring all posted and distributed copies of the Company and Individual Codes of Conduct are translated into the appropriate language of use in the work site areas as well as for any international staff in their native language.
2. Verbally and in writing explain the Company and Individual Codes of Conduct to all staff.
3. Ensure that:
 - i. All direct reports sign the 'Individual Code of Conduct', including acknowledgment that they have read and agree with the Code of Conduct.
 - ii. Staff lists and signed copies of the Individual Code of Conduct are provided to the OHS Manager, the GBV Complaints Team (GCT), and the client.
 - iii. Participate in training and ensure that staff also participate as outlined below.
 - iv. Put in place a mechanism for staff to:
 - (a) report concerns on ESHS or OHS compliance; and,
 - (b) confidentially report GBV incidents through the Grievance Redress Mechanism (GRM)
 - v. Staff are encouraged to report suspected or actual ESHS, OHS, GBV issues, emphasizing the staff's responsibility to the Company and the country hosting their employment, and emphasizing the respect for confidentiality.
4. In compliance with applicable laws and to the best of your abilities, prevent perpetrators of sexual

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

Training

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

Response

16. Managers will be required to take appropriate actions to address any ESHS or OHS incidents.
17. Regarding GBV:
 - i. Provide input to the GBV Allegation Procedures and Response Protocol developed by the GCT as part of the final cleared GBV Action Plan.

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

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

Signature: _____

Printed Name: _____

Title: _____

Date: _____

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

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

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

I agree that while working on the project I will:

1. Consent to Police background check.
2. Attend and actively partake in training courses related to ESHS, OHS, and GBV as requested by my employer.
3. Will wear my personal protective equipment (PPE) at all times when at the work site or engaged in project related activities.
4. Take all practical steps to implement the contractor's environmental and social management plan (C-ESMP).
5. Implement the OHS Management Plan.
6. Adhere to a zero-alcohol policy during work activities, and refrain from the use of narcotics or other substances which can impair faculties at all times.
7. Treat women, children (persons under the age of 18), and men with respect regardless of race, color, language, religion, political or other opinion, national, ethnic or social origin, property, disability, birth or other status.
8. Not use language or behavior towards women, children or men that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate.
9. Not sexually exploit or abuse project beneficiaries and members of the surrounding communities.
10. Not engage in sexual harassment of work personnel and staff—for instance, making unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature is prohibited. E.g. looking somebody up and down; kissing, howling or smacking sounds; hanging around somebody; whistling and catcalls; in some instances, giving personal gifts.
11. Not engage in sexual favors—for instance, making promises of favorable treatment (e.g. promotion), threats of unfavorable treatment (e.g. loss of job) or payments in kind or in cash, dependent on sexual acts—or other forms of humiliating, degrading or exploitative behavior.
12. Not use prostitution in any form at any time.
13. Not participate in sexual contact or activity with children under the age of 18—including grooming, or contact through digital media. Mistaken belief regarding the age of a child is not a defense. Consent from the child is also not a defense or excuse.
14. Unless there is the full consent¹ by all parties involved, I will not have sexual interactions with members of the surrounding communities. This includes relationships involving the withholding or

¹ **Consent** is defined as the informed choice underlying an individual's free and voluntary intention, acceptance or agreement to do something. No consent can be found when such acceptance or agreement is obtained using threats, force or other forms of coercion, abduction, fraud, deception, or misrepresentation. In accordance with the United Nations Convention on the Rights of the Child, the World Bank considers that

promise of actual provision of benefit (monetary or non-monetary) to community members in exchange for sex (including prostitution). Such sexual activity is considered “non-consensual” within the scope of this Code.

15. Consider reporting through the GRM or to my manager any suspected or actual GBV by a fellow worker, whether employed by my company or not, or any breaches of this Code of Conduct.

With regard to children under the age of 18:

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

Use of children's images for work related purposes

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

24. Before photographing or filming a child, assess and endeavor to comply with local traditions or restrictions for reproducing personal images.
25. Before photographing or filming a child, obtain informed consent from the child and a parent or guardian of the child. As part of this I must explain how the photograph or film will be used.
26. Ensure photographs, films, videos and DVDs present children in a dignified and respectful manner and not in a vulnerable or submissive manner. Children should be adequately clothed and not in poses that could be seen as sexually suggestive.
27. Ensure images are honest representations of the context and the facts.
28. Ensure file labels do not reveal identifying information about a child when sending images electronically.

Sanctions

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

1. Informal warning.
2. Formal warning.
3. Additional Training.
4. Loss of up to one week’s salary.

consent cannot be given by children under the age of 18, even if national legislation of the country into which the Code of Conduct is introduced has a lower age. Mistaken belief regarding the age of the child and consent from the child is not a defense.

5. Suspension of employment (without payment of salary), for a minimum period of 1 month up to a maximum of 6 months.
6. Termination of employment.
7. Report to the Police if warranted.

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

Signature: _____

Printed Name: _____

Title: _____

Date: _____

Appendix 10 List of stakeholders consulted

Institution	Name	Designation	Contact
Muli Council	Mohamed Latheef	Council President	7785003
	Ahmed Shathir	Vice President	-
	Ahmed Siraaj	Municipal service officer	9999626
	Ibrahim Zaki,	Council Member	-
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
Womens' Development Committee	Massoodha Moosa Fulhu	Chairwomen	-
	Sheereena Abdul Latheef	Member	-
FENAKA Corporation Ltd	Hussain Sobah	Manager, Muli FENAKA branch	-
	Hussain Tholal	Supervisor	-
	Naziya Ibrahim	Admin Officer	-
MNDF	Warrant Officer Grade 1	Ahmed Hassan	7795838
	Warrant Officer Grade 1	Farooq Ismail	9884399
	Staff Sergeant	Mohamed Ashraf	7776098

Meeting with M.Muli Council

25/01/2021

Meeting Minutes

MEETING	Meeting with Muli Council_ Regarding the upgradation of IWRMC
DATE	January 25 2021
TIME	13:00
LOCATION	Virtual Meeting via google meet
ATTENDEES:	<p>Maldives Clean Environment Project (MCEP)</p> <ol style="list-style-type: none">1. Ahmed Nizam, Project Manager2. Ahmed Hassaan Zuhair, Environmental and Social Safeguards Specialist3. Ibrahim Rlshad, Project Coordinator4. Aishath Ajfaan Jawaadh, Assistant Project Coordinator <p>Muli Council</p> <ol style="list-style-type: none">5. Ahmed Shathir, Council President6. Mohamed Latheed, Vice President <p>LAMER</p> <ol style="list-style-type: none">7. Ismail Abid, Consultant8. Aishath Abdulla, Consultant <p>EPA</p> <ol style="list-style-type: none">9. Hussein, EPA

Purpose:

The meeting with M.Muli Council was organized on the request of Environmental Consultants (LAMER) in order to discuss land allocation for temporary waste storage during the civil works of upgrading Island Waste Resource Management Centre (IWRMC).

SUBJECT	DISCUSSION	AGREED ACTIONS
<p>Discussion on the temporary waste storage area proposed by the Council</p>	<p>Mr. Shathir highlighted that Council intends to expand the IWRMC towards the North of the island closer to a sensitive area and thus Council prefers this as the temporary location for the waste storage as specified in the stakeholder consultation with LAMER.</p> <p>In regard to this, Mr. Hassan specified that extension of the current center is not in the scope of this project thus clearing vegetation to make space for a temporary storage contradicts with EPA screening decision and world bank safeguards.</p>	
<p>Clean up of the accumulated waste in the island</p>	<p>Council informed that 80% of the waste accumulated in the center was transferred out of the island on August 2019.</p> <p>Mr. Nizam highlighted that temporary stored waste will be removed from the island rather than transferring it back to the centre. And noted that waste transfer in Muli is planned under the clean up program initiated by the government. However, precise date for Muli clean up is not known as prioritization will be given for the islands according to amount of waste accumulated.</p>	
<p>Managing incoming waste during the construction phase of IWRMC</p>	<p>Mr. Shathir noted that if the waste accumulated in the centre is removed it will be possible to accommodate the incoming waste in adjacent to the centre, however due to the financial challenges, council will not be able to finance it.</p> <p>The centre is fully loaded and there is huge amounts of waste to be transferred from the centre to the temporary storage. However, if the waste is transferred out of the island, it will be convenient to store the incoming waste for the duration of civil works.</p> <p>The council emphasized on the need to transfer the existing waste out of the island.</p>	

SUBJECT	DISCUSSION	AGREED ACTIONS
<p>Proposed location by the Consultants</p>	<p>Consultants identified the area adjacent to the existing waste management center towards the reclaimed area in the east to temporary store the waste.</p> <p>Mr. Nizam recommended the council to consider the area proposed by the consultants as there are no ongoing projects or near future plans for the area.</p> <p>Since there is a road used by the community, Council is not in favour of allocating this area. After discussion it was decided to allocate temporary storage in the reclaimed area.</p> <p>In response to the Council's concern on transferring the existing waste to the temporary location, Mr. Nizam clarified that the civil contractor will be tasked to transfer the waste as it required heavy machinery and man power.</p> <p>Mr. Nizam notified that the temporary storage area will be cleaned upon the completion of civil works (estimated duration is 5-6 months). In addition to this, he advised to demarcate the boundary of the temporary storage area to prevent waste dumping to other areas.</p> <p>Since this is a temporary storage, Mr. Shathir noted that Council requires assurance that waste will be cleared from the temporary storage as soon as the construction works are completed.</p> <p>Mr. Nizam assured that temporary stored waste will be cleared within this year and highlighted that the clean up program initiated by the government includes Muli clean up and if this program is not executed accordingly, MCEP will ensure temporary stored waste is cleared under project/other finances.</p> <p>The ideal size for the temporary location recommended by the consultant:</p> <ul style="list-style-type: none"> - a width of the existing center and length to be demarcated after leaving a buffer zone of 20 meter from the coastline. 	<p>Council to demarcate the area for temporary storage as discussed and agreed in the meeting.</p> <p>Council to send a map indicating the temporary storage location with dimensions.</p>

SUBJECT	DISCUSSION	AGREED ACTIONS
Land approval of the IWRMC	<p>On the query of the consultants, Mr. Shathir informed that land was not approved due to unresolved issues in the boundary of the protected area.</p> <p>Reviewing the land use plan with Atoll Council which was planned for last year is halted due to the current pandemic.</p> <p>Mr. Rishad recommended to acquire approval for the land allocated for IWRMC from Maldives Land Survey Authority (MLSA), which will be integrated into the land use plan once it is finalized.</p> <p>Representative from EPA, Mr. Hussein notified that the existing waste management center does not fall into the boundary of the sensitive area, thus will not hinder acquiring approval from MLSA.</p>	Submit to MLSA land allocation of waste management center
<p>Agreed Actions:</p> <ul style="list-style-type: none"> - Submission of land approval of the existing waste management centre to Maldives Land Survey Authority, Ministry of National Planning, Housing and Infrastructure - Island Council to send a map to Environment Ministry which indicates the temporary storage location with dimensions. 		

Minutes approved by:

Ahmed Hassan Zuhair
Environment and Social Safeguards Specialist
MCEP PMU

Appendix 11 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

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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



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 12 Copy of Household survey form

