ENVIRONMENTAL IMPACT ASSESSMENT

FOR THE CONSTRUCTION OF ISLAND WASTE MANAGEMENT CENTERS AT

HA.ULIGAMU

AUGUST 2017

Prepared for: Ministry of Environment and Energy

MEECO
MALDIVES ENERGY AND ENVIRONMENTAL COMPANY

PROJECT SYNOPSIS

Name of the Project: Construction of IWMC's at Ha.Uligam
Project Proponent: Ministry of Environment and Energy
Project Value: -
Expected Duration: 10 weeks
EIA Consultant: Ahmed Saleem (MEECO)
EIA Date: August 2017

WEIGHTS AND MEASURES CONVERSIONS

1 metric tonne = 2,204 pounds (lbs.)
1 kilogramme (kg) = 2.2 pounds (lbs.)
1 metre (m) = 3.28 feet (ft.)
1 millimetre (mm) = 0.03937 inches (")
1 kilometre (km) = 0.62 mile
1 hectare (ha) = 2.471 acres

LIST OF ABBREVIATIONS

CBD	Convention on Biological Diversity
CO_2-e	Carbon dioxide equivalent
DA	Decentralisation Act
DDRPM	Development of Disaster Risk Management Profile Maldives
DIRAM	Detailed Island Risk Assessment in Maldives
DNP	Department of National Planning
DO	Dissolved Oxygen
EIA	Environment Impact Assessment
EMP	Environmental Monitoring Plan
EPA	Environmental Protection Agency
EPPA	Environmental Protection and Preservation Act
ES	Environmental Score
EPZ	Environmental Protection Zone
GHG	Green House Gas
GPP	Gross Primary Production
GoM	Government of Maldives
HIES	Household income and expenditure survey
HIA	Hanimaadhoo International Airport
Hs	Peak Height
IWM	Island Waste Management
IWMC	Island Waste Management Center
IWMF	Island Waste Management Facility
LUP	Land Use Plan
MCA	Multi Criteria Analysis
MEE	Ministry of Environment and Energy
MHI	Ministry of Housing and Infrastructure
MMS	Maldives Meteorological Service
MOFA	Ministry of Fisheries and Agriculture
MPA	Marine Protected Area
MSL	Mean Sea Level
MoT	Ministry of Tourism
NBSAP	National Biodiversity Strategy and Action Plan
NBSAP	National Biodiversity Strategy and Action Plan
MNSSD	Maldives National Strategy for Sustainable Development
NAPA	National Adaptation Programme of Action

RWM	Regional Waste Management
RWMC	Regional Waste Management Center
RWMS	Regional Waste Management System
WMP	Waste Management Plan
RWMP	Regional Waste Management Plan
IWMP	Island Waste Management Plan

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DECLARATION OF THE CONSULTANT AND PROPONENT

Consultant
I certify that the statements made in this Environmental Impact Assessment are true, complete and correct to the best of my knowledge and available information at the time of writing this report.

Ahmed Saleem (EIA 03/13)
Signature:

Proponent
The Proponent's declaration and commitment to undertake the mitigation and monitoring is given in **Annex 1**.

ސާރާ ޚުލާސާ:

މިއީ ހއ.އުލިގަމުގައި ކުނިކޮށި އެޅުމަށް ބިންސާފުކުރުމާއި ކުނި ކޮށި އާއި ސަރަހައްދަށް ވަދެވޭނެ މަގު ކަނޑުވަރާއި މިރަށުގައި ކުނިކޮށި ގާއިމްކޮށް ހިންގުމުގެ މަޝްރޫއުއަށް ތައްޔާރު ކުރެވިފައިވާ ތިމާވެއްޓަށް އަސަރު ފޯރާ މިންވަރު ބަޔާންކުރާ ރިޕޯޓެވެ.

މިއީ ދިވެހިރާއްޖޭގެ ތިމާވެއްޓަށް އަސަރުފޯރާ މިންވަރު ބަޔާން ކުރާ ރިޕޯޓު ހެދުމާބެހޭ ގަވާއިދުގެ ޖަދުވަލު 4 ނަންބަރު 8 ގެ ދަށުން ދިވެހިރާއްޖޭގައި ހިންގާ ބޮޑެތި ބިންސާފުކުރުމުގެ މަޝްރޫޢުތަކާއި ކުނި މެނޭޖްކުރުމުގެ އަދި މަސައްކަތްތަކުގެ ސަބަބުން ތިމާވެއްޓަށް ކުރަމުންދާ ނޭދެވޭ އަސަރުތަކުން ކުޑަކުރުމަށް ގަވާއިދު ސަރުކާރުގެ ސިޔާސަތު ތިމާވެށި ރައްކާތެރި ކުރުމުގެ ގޮތުން ހަރަކާތް ތިމާވެއްޓަށް އަސަރުފޯރާ މިންވަރު ބަޔާން ކުރާ ރިޕޯޓެކެވެ.

މަޝްރޫއުގެ ވެރި ފަރާތަކީ މިނިސްޓްރީ އޮފް އެންވަޔަރަމަންޓް އެންޑް އެނަރޖީއެވެ. މަޝްރޫއު ފުރިހަމަ ކުރެވޭނީ ކަމަށް ބެލެވޭ މަސައްކަތް ފަށާތާ 10 ހަފްތާގެ ތެރޭގައެވެ. މަޝްރޫއުގެ ތިމާވެއްޓާބެހޭ ކޮންސަލްޓެންޓުގެ ގޮތުގައި އައްޔަންކޮށްފައިވަނީ މީކޯ ޕްރައިވެޓް ލިމިޓެޑްގެ ކޮންސަލްޓަންސީގެ ޓީމެވެ. މިމަޝްރޫއަކީ ސަރުކާރުގެ ސިޔާސަތުތަކާއި، ރާއްޖޭގެ ކަމާބެހޭ ގާނޫނުތަކާއި ގަވާއިދުތަކާއި ފުރިހަމައަށް ފެތޭގޮތަށް ކުރިއަށް ގެންދާ މަޝްރޫއެކެވެ.

ދިރާސާތައް ދައްކާގޮތުން ދިވެހިރާއްޖެއަކީ ޖަޒީރާތަކުން އެކުވެގެންވާ ގައުމަކަށްވާތީ ދިވެހިރާއްޖޭގައި ބޮޑުކަމަކީ ކުނި އުފެދުމާއި މިންވަރު އިތުރުވުމުގެ ސަބަބުން ދިވެހިރާއްޖޭގައި ކުނި މެނޭޖްކުރުން ވަނީ އުދަގޫކަމަކަށް ވެފައެވެ. މިގޮތުން ރާއްޖޭގައި އެއްރަށުން އަނެއްރަށަށް ކުނި އުފުލުމަކީ އަގުބޮޑު ކަމެކެވެ. ބިމުގެ ޖާގަ ނުވުމުގެ ސަބަބުން ރަށުގައި ކުނި ބެހެއްޓުމަކީވެސް އުނދަގޫކަމެއް ކަމަށްވެއެވެ.

މިކަންތައްތައް ހައްލުކުރުމަށްޓަކައި ދިވެހިސަރުކާރުން ވަނީ ގައުމީ ފެންވަރުގައި ކުނި މެނޭޖްކުރާނެ ޕޮލިސީއެއް ހެދި، މިޕޮލިސީން ތަންފީޒު ކުރާނެ ސިޔާސަތު އެކުލަވާލާފައެވެ. ކުނިމެނޭޖްކުރުމުގެ ގޮތުން މިޕޮލިސީގައި ހިމެނޭ ރަށުގެ ފެންވަރުގައި ކުނި މެނޭޖުކުރުމާއި، ސަރަހައްދީ ފެންވަރުގައި ކުނި މެނޭޖްކުރުމެވެ. ރަށު ފެންވަރުގައި ކުނި މެނޭޖްކުރުމުގެ ގޮތުން ކޮންމެ ރަށެއްގައި ކުނިމެނޭޖްކުރާނެ ސެންޓަރެއް ގާއިމްކުރުމަށް ވަނީ ނިންމާފައެވެ. މިސެންޓަރުގައި ކުނީގެ ބާވަތްތައް ވަކިކުރުމާއި ދަނޑުވެރިކަމަށް، ކޮމްޕޯސްޓް އަދި ބައޮގޭސް ފަދަ ކުނިކުރުވާނެއެވެ. މިގޮތުން އިތުރުން ރަށުގައި އުފެދޭ ހަމަވާފަދަ ގޮތުގެ ކުނީގެ ތެރެއިން 30-20% ކާޑުފުއްދަން ބޭނުން ކުރެވޭނެއެވެ. ބާކީ ހުންނަ ކުނިތަކުގެ، ކޮމްޕޯސްޓް އަދި ބައޮގޭސް ސަރަހައްދީ މަރުކަޒަށް ގެންދެވޭނެއެވެ. ރިސައިކަލް ސެންޓަރުގައި ކުނިއެއްޗެހި ޖައްސާލުމާއި ކުނީގެ އަންދާލުމުން ނައްތާލެވޭނެއެވެ.

މިމަޝްރޫއުގައި ހިމެނޭ ހއ.އުލިގަމުގައި ކުނިކޮށި ގާއިމުކުރުމާއި ކުނިކޮށި އާއި ބިމާ ކުނިކޮށަށް ވަންނަ މަގު ސާފު ކުރުމެވެ. މަޝްރޫއުގައި ހިމެނޭ މައިގަނޑު ބައިތަކަކީ:

ބިންސާފުކުރުން؛

ކުނިކޮށި ހެދުން؛

ކުނިކޮށި ހިންގުމަށް ބޭނުންވާ ސާމާނު ފޯރުކޮށްދިނުން؛

ކައުންސިލުން ތަޢާރަފު ކުރާ ކުނިމެނޭޖުކުރާ ޕްރޮގްރާމާއި އެއްގޮތަށް ކުނި ކޮށި ހިންގުން؛ އަދި ކުނި ކޮށި މޮނިޓަރ ކުރުމެވެ.

މިހާރު ކުނީގެ ހާލަތާއި ކުނިކޮށި އަޅަން ހުށަހަޅާ ސަރަހައްދު

ހއ. އުލިގަމުގައި ކުނިމެނޭޖް ނުކުރެވުމުގެ ސަބަބުން ވަނީ ރަށުގެ ހަޑިވެ ތަނަށްއަރާފައެވެ. ކުނިކޮށި އެޅުމަށް ހުށަހަޅާފައިވަނީ ރަށުގެ އުތުރު ފަރާތުން 625 އަކަމީޓަރު ހިރާސް ބިމެކެވެ. އެސަރަހައްދަކީ ދުއްވާ އުޅަނދުފަހަރުގައި ވަދެ ނިކުމެވޭނެ ބޮޑު މަގެއް އެބައޮތެވެ. ނަމަވެސް ކުނިކޮށިބަރަށް ވަދެވޭނެ މަގެއް ސާފުކުރަން ޖެހޭނެއެވެ. އެސަރަހައްދުގައި ކަނޑަން ޖެހޭނީ ރުކެއް ނުވަތަ ބޮޑު ގަހެއް ނެތެވެ. ބިންސާފުކުރުމުގެ ގޮތުން ބޮޑު ގަހެއް ކަނޑަން ނުޖެހުނަސް ކޮންމެވެސް ވަރަކަށް ބިންމަތީ ފޮތިގަސް ފަދަ ކުދި ގަސް ކަރާ ގިނަ އަދަދަކަށް ހުދު ގަސް ކަނޑަންޖެހޭނެކަމަށް ދިރާސާތަކުން ދައްކައެވެ. ކުނިކޮށި އެޅުމަށް ހަމަޖެހިފައިވާ ސަރަހައްދާއި އެންމެ ކައިރީގައި ހުރި ގެއަށް ދުރުމިނީ ހުރީ ގެއިގެ ނިޔަލާއި ކުނިކޮށިބާއި 94 މީޓަރު ދުރުގައެވެ. ކުނިކޮށި އެޅުމަށްހުށަހަޅާފައި ރަށުގެ ދެކުނު ފަރާތުން ދިރާސާކުރެވުނު ސަރަހައްދު މާ އެކަށީގެންވާކަމަށް ދިރާސާތަކުން ދައްކައެވެ.

ތިމާވެށްޓަށް މަޝްރޫޢުގެ ސަބަބުން ކުރާނެ އަސަރު

މިފަދަ އެހެން މަޝްރޫޢު ތަކާތާ އެއްފަދައިން ހުރަހެދިފައިވާ މި މަޝްރޫޢަކީ، އޭގެ ގާތުގައި ތިމާވެށްޓަށް ނޭދެވޭ އަސަރުތަކެއް ކުރާނެ މަޝްރޫޢެކެވެ. މިގޮތުން ފާހަގަ ކުރެވޭ އަސަރުތަކުގެ ޚުލާސާ ތިރީގައި އެވަނީއެވެ.

އިމާރާތް ކުރުމުގެ މަރުހަލާ

ކުނިކޮށި އެޅުމުގެ ސަރަހައްދު ރަށުގެ ބިމުން ބައެއް އިމާރާތް ނުކުރެވިފައިވާ ބޭނުމަކަށް ކަނޑައެޅިގެން ދާނެއެވެ. ރަށުން ވަކި ކުޑަ މިންވަރަކަށް ގަސް މަދުވެގެންދާނެއެވެ. ގަސް ކަނޑާލެވޭ ސަރަހައްދު، އިކޯ ސިސްޓަމްތަކުގައި ގަސްތަކުގެ އަދާކުރާ ދައުރަށް ކޮންމެވެސް އުނިކަމެއް އަންނާނެއެވެ. ދުނިޔަ ސާފު ސާފު ބަސްއަޑާ،ދިރި އުޅޭ ތަނތަނަށް ނުބައި ގޮތަކަށް އަސަރު ކުރާނެއެވެ. ކަސްތަކުނުޖެހުމުގެ ސަރަހައްދު އެޅޭ ކުނީގެ ސަރަހައްދު ބަރުކަށިވެ ކުނި އިސްތިޢުމާލު ނަގާ ކުރިމަތީ ވާނެ ކަމަށް ބެލެވިއްޖެއެވެ. ބިންސާފުކުރުމާއި އަދި ކުނިކޮށީގެ ރަޙަތުގައި މަސައްކަތް ކުރާ ސަރަހައްދުގައި ކުރަހައިގަނޑު ކުރުމުގެ އާދަޔާ ޚިލާފު އަސަރުތަކެއް ވެސް ފާހަގަ ކުރެވިފައެވެ.

ދިރާސާތަކުން ހާމަވާގޮތުގައި، މަޝްރޫޢުގެ ހިނގާ ހަރަކާތްތަކަށް ކުރިމަތިވާ މަޝްރޫއަށް ބޭނުންވާ މަސައްކަތް މީހުން ރަށުގައި ގެއިން ފުރާ، ބިންފަހަރު ކުރުމާއި، ބިން ތަޢާރަފު ކުރުމާއި، ސާމާނާއި ތަކެތި ގެންނަ ދުރުކުރުމުގެ ސަރަހައްދު ތިމާވެށްޓަށް ކުރާނެ އަސަރުތަކެއް ވަރަށް ކުޑަވާނެ ކަން ފާހަގަކުރެވެއެވެ. އިމާރާތް ފައުންޑޭޝަން އެޅުމަށް ކޮނުމާއި، ފެން ބޭރުކުރުމާއި، ސާމާނާއި ތަކެތި ސައިޓަށް ގެނައުމަށް ދަތުރުކުރުމާއި، ހަކަތަ ބޭނުން ކުރުމާއި، މަސައްކަތު މީހުންގެ ޖަރާއިމް އިތުރުވާ ނަތީޖާއި މަސައްކަތުގެ ސަރަހައްދު އެހެނިހެން ގޮތްގޮތުގެ މައްސަލަތަކާ ގުޅިގެންގައި ތިމާވެށްޓަށް އަސަރު ފޯރާނެ ގޮތް ކަންކަމެވެ.

މިކަންތައްތައް ހައްލުކުރުމަށް ނޭދެވޭ އަސަރުތައް ކުޑަކުރުމުގެ ގޮތުން، ކަނޑައެޅިގެންވާ ތެރެއިން ވިޔަސްކިޔަ ގަޑެއް ނުވަތަ ރަގަޅު ތަރުތީބާއި ބޭނުމާއި ޖެހުމަށް މި ރިޕޯޓު ބާރު އަޅައެވެ. ގަސް އޮއްސަރުން އުފެދޭ ގެނދަގޮސް އެހެން ސަރަހައްދުތަކުގައި ޖެހުމަށް އަމިއްލަ ކަނޑައެޅުން ވަރަށް މުހިއްމު ކަމެއް، މި ގަސްތަކުން އެދެވޭ ކަމުގެ ރިޕޯޓުގައި ބަޔާން ކޮށްފައިވާ ގޮތަށް އުފުރާލައިގެން ގެންދިޔުމަށް ވިސްނާލުމަށް މި ރިޕޯޓުގައި ބާރުއަޅައިގަނެ ވާސިލުކުރުމުގެ ގޮތުން އުފުލުން ކުރި ރަނގަޅުކޮށް ނަހަމަޖެހިގެން ފަހުން ކުރިއަށް ގެންދާ ނަގާ ރާއްޖޭގެ އިމާރާތްކުރުމުގެ ގޮތުން އުފުލުން ކުރި ނިންމާލުން ރަނގަޅު ތަރުތީބެއް ގޮތަށް ރިޕޯޓުގައި ބާރުއަޅާ ބޭނުމުގައި ބައްލަވަނީ ގޮތް މާނައަކަށް ބާރު ކުރެވޭނެއެވެ.

<u>ހިންގުމުގެ މަރުހަލާ</u>

ޖުމްލަ ގޮތެއްގައި މިމަރުހަލާގައި ތިމާވެށީގެ ގޮތުންނާއި އިޖުތިމާޢީ ގޮތުން ރަނގަޅު ފައިދާތަކެއް ކުރާނެ ކަމަށް ބެލެވެއެވެ. އެހެން ނަމަވެސް ރަނގަޅު ގޮތެއްގައި ނުހިންގައިފިނަމަ ކުނި މަސައްކަތުގެ ދާއިރާގެ ހިނގާމުން ދާ މަސައްކަތާއި ގުޅޭ ގޮތުން ހުރި ނުރައްކާތައް ކުރިމަތިވެދާނެއެވެ. އަދި ކުނި މެނޭޖްކުރާ ސައިޓުން ނަގާ ކުނީގެ މިންވަރު ހޯދުމަށް ފެންނަ ތިމާވެށީގެ ސަލާމަތަކަށް ކުރާ ބާރުތަކުގެ ގޮތުން ކުރިމަތިވާނެ ކަމަށް ބެލެވެއެވެ. ކުނި މެނޭޖްކުރާ ތަނުން ޖަހާފައިވާ ކުނީގެ ތެރެއިން ސައިޓަށް ގެންދާ ކުނި ހިންގުމަށް ހުރި ގޮތްތައް ކަމަށް ސަލާމަތް ހިންގުމަށް ހުރަސްތަކެއް ކުރިމަތިވެދާނެ ކަމަށް ބެލެވެއެވެ.

މީގެ އިތުރުން ސައިޓުގައި އަލަށް ފިނި އަރައިތަކުގެ ކުނި ބަހައްޓާލެވޭނެ ބިމެއްގެ ހޭލުންތެރިކަން ދަށްކަމުން، ބަރުން ކުނި ބޭނުން ކުރުމަށް ކުނި މެނޭޖްކުރާ ސައިޓަށް ފޮނުވުމަށް ހަމަޖެހިފައިވާ ނަމަވެސް ކުނި އަންދާ ވަޒީފާ ހިންގާފައެވެ. މިފަދަ ހާލަތެއް ގުޅުވައިދޭ ނިޒާމަކީ ކުނި މެނޭޖްކުރާ ބޭނުމުން ކުނި ނެގުމަށް ޖާގަ ހޯދުމެވެ. ދިރާސާކުރެވުނު ދާއިރާގެ ބަހައްޓާ ގޮތަށް ކުނި ކުރެވުނު ނަމަވެސް ކުރެވިފައި 1-2 ހަފްތާއަކުވެ. މިއީ ރިޕޯޓުގައި ހުށަހަޅާފައިވާ ގޮތުގެމަތިން ކުނިބަރުގައި 16 660 ޓަނުގެ ކުނި ވެރިވެސް ބަހައްޓައިގެންނުވެ.

ހިންގުމުގެ މަރުހަލާގައި އެންމެ ބޮޑު އަސަރުތަކަށް ކުރާނެ ކަމަށް ބެލެވިފައި ކުނި ބަހައްޓާގައި މަސައްކަތް ކުރާ މީހުންނަށެވެ. މިގޮތުން ވަރަށް އެއްގޮތް ނަޖިހުގެ އަސަރުކުރުން އެކަހެރިކުރެވެއެވެ. ކަމަކީ ސަރަހައްދުތަކަށް މިއަސަރު ކުރާނެ ކަމަށް ބަލާ ކަމަށް ބެލެވެއެވެ. ނަމަވެސް ކުނީ ރަނގަޅަށް ނުބެލެހެއްޓިނަމަ ކަމަކީ ސަރަހައްދުތަކަށް ވަސް ދުވުން އެކަހެރިކުރެވެއެވެ. އަދި ކުނިބަރު ނުބެލެހެއްޓިނަމަ މިއަސަރުތައް އިތުރުވާނެކަން ފާހަގަކުރެވެއެވެ.

މި އަސަރުތައް ކުޑަކުރުމަށް ހައްލުކުރުމުގެ ގޮތުން ކުނީ ހިންގާ އުސޫލުތަކާއި، ރިޕޯޓް ކުރަހާ ގޮތާއި ޖެނެރޭޓަރ ޖެހޭ ފަރާތްތަކުގެ މަސްއޫލިއްޔަތު ބަޔާންކުރެ، ތިމާވެށި ރައްކާތެރި ކުރާނެ ގޮތުގެ ފޮރުން އެކުލަވާލެވިފައިވާނެއެވެ. އަދި މި ރިޕޯޓުގައިވާ ގޮތުގެ މަތިން މަސްއޫލިއްޔަތު ހިނގައިދާނަމަ ނޫނީ އަސަރުތައް ކުރޭ ކުރިވި ހައްލުކުރުވާނެއެވެ. މިރިޕޯޓުގައިވާ ގޮތުގެ މަތިން ކަން ކުރުމަށް މަސްއޫލުގެ ފެދިގަތުން އެއްބަސްވެއެވެ. އެކަމުގެ ކޮމިޝަންގެ ލިޔުން ރިޕޯޓުގައި ހިމަނާފައިވާނެއެވެ.

ކަނޑައެޅިފައިވާ އުސޫލުތަކާއި އެއްގޮތަށް މަސްއޫލު ހިންގުމަށް، މަސްއޫލު ސަލާމަތް ޖެހޭ އަދި އިތުރު ތަފާސީލު ފައިދާ ރޭވުން ހިމަނާ ކަމުގެ ރޭވުމަކީ ނޯވޮޓުގައި، ގަނޑު ކުރާ ރޭވުމުގައި ލިބޭނެ ކަންތައް މިދިޔާ ގޮތުގެ ކުރިއަށް ފާހަގަކުރެވެއެވެ.

މަޝްރޫއުގެ ސަބަބުން އާދަޔާ ހިލާފު މާހައުލެއް ނުވި ހިނގައިދާނެ ކަމަށް ނުފެންނާތީއާއި، އަދި ސަގާފީ ގޮތުންނާއި ތާރީޚީ ގޮތުންވެސް މުހިންމު ތަރިކައެއް ނެތިގެންދާނެ ފުރުސަތެއް ނެތުމާއި، ކުނިކޮށި އިމާރާތްކޮށް ހިންގުމުގެ ސަބަބުން ނުކުންނަ ތިމާވެށީގެ މައްސަލަތަކީ ގަބޫލުކުރުވާ މިންގަނޑެއްގެ ތެރޭގައި ހިފެހެއްޓުމަށް އެކަށީގެންވާ ފިޔަވަޅު އެޅުމުން ބޮޑަށް މައްސަލަތަކެއް ކަމަށް ނުފެންނާތީ، ރިޕޯޓުގައި ފާހަގަ ކުރެވިފައިވާ ތިމާވެށި ރައްކާތެރި ކުރުމުގެ ފިޔަވަޅުތައް އަޅައިގެން މަޝްރޫއު ކުރިއަށް ގެންދެވިދާނެ ކަމަށް މިރިޕޯޓުން ނިންމާފައިވެއެވެ.

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NON-TECHNICAL SUMMARY

This Report highlights the results of the Environmental Impact Assessment (EIA) carried out for the Development of Island Waste Management Centre (IWMC) and associated access road in Ha. Uligam proposed by the Ministry of Environment and Energy (MEE).

Development of IWMC is a component of a nationwide two tier waste management concept formulated by MEE to address the challenging waste management issue of the Maldives. The proposed two tier waste management system involves Island Level Waste Management (ILWM) and Regional Level Waste Management (RLWM). ILWM involves:

1. Sorting waste;
2. reducing volume of waste;
3. temporarily storing waste; and
4. composting 20-30% of organic waste at the IWMC.

RLWM Involves, routine transport of waste from the IWMC's of specified zones and managing the waste at the Regional Centre by

1. Sorting waste;
2. Incinerating waste;
3. landfilling rejects; and
4. composting up to 70-80% of the organic waste incoming from allocated zones.

The nationwide waste management plan will be implemented according to the *Saafu Raajje* Waste Management Policy, which forms the basis of waste management framework and lays out the implementation strategy of the waste management plan. The goals of the nationwide waste management plan and policy are to:

- Protect the environment and ensure health and wellbeing;
- prevent pollution of natural environment and safeguard natural resources; and
- promote best practices of waste management and utilise waste as a value addition.

The project has been developed in line with these goals. The major components of the project include:

1. Land clearance (IWMC plot area and access road);
2. construction of IWMC;
3. equipping IWMC with relevant waste management machines;
4. operation of IWMC according to approved waste management plan and waste management framework; and
5. monitoring and adaptation of waste management plan/policy.

Components one and four of the project will be undertaken by the respective island council. The councils shall prepare island level waste management plans in line with the waste management policy and waste management regulation implemented by EPA. Components two, three and five will be undertaken by MEE.

Since the proposed project in the above mentioned island involve significant land clearance preparation of an EIA was commissioned by the EPA after screening the proposed project. The EIA Regulation 2012/R-27 of the Maldives states that projects carried out in the Maldives which require significant land clearance and removal of coconut palm trees (under *Annex 4* bullets 8 of EIA 2012/R-27) will have to undertake an Environmental Impact Assessment prior to its construction and operation. Hence the EIA report is primarily aimed at capturing and presenting information needed to meet the legal requirements of both Environmental Protection and Preservation Act (4/93) and the Environmental Impact Assessment Regulations of the Maldives.

Major findings of this report are based on as much information as possible that could be gathered within the study time constraints, including field inspection of both the existing environment assessments and the features and possible effects of the planned activities. The assessment also included reviewing of virtually the same types of works and methods that will be used at project island and review of actual effects arising from their construction and operation in very similar island environments. Stakeholder consultations undertaken with the island councils and public was used when assessing the existing waste management situation of the island and alternatives of the project.

The following observations and findings were made for the project island based on field surveys and data analysis:

Ha.Uligam – The island did not have a proper waste management system. Existing waste management practices have led to the pollution of island. The proposed IWMC plot is located on the northern side of the island and consists weeds shrubs and small bush type trees. The area did not have coconut palms or significantly large tress. There is an access road to the proposed area, however a minor road shall be cleared to access the IWMC. There are nor large trees which will have to be removed at the proposed site. Nearest public areas to the site are the football field and public school. There were no environmentally sensitive or protected sites close to the proposed area. All residential, public and environmental sites are located at the distance recommended by EPA. Alternative site analysis showed that the alternative location at the southern side of the island was more preferred compared to the proposed area based on evaluation of impacts arising from site location.

The study has identified a number of potential adverse effects arising out of the project. The study also notes that the developmental phase and operational phase of the project will have equally significant impacts. There are factors which could cumulate into major negative impacts during the operational phase unless proper mitigation and management is not implemented. The assessment has not identified any negative effects of national or regional importance and will not result in the loss of nationally endangered or globally endangered species as a result of the project. The assessment identified the following activities of the project to have impacts on the environmental receptors.

Construction phase:

1. Settlement of workers: evaluated to be a minor impact activity;
2. Site demarcation and fencing: evaluated to be a minor impact activity;
3. Material storage: evaluated to be a minor impact activity;
4. Land clearance: evaluated to be a major impact activity;

5. IWMC construction: evaluated to be a moderate impact activity;
6. Transportation of trees, waste etc: evaluated to be a moderate impact activity;
7. Waste generation: evaluated to be a moderate impact activity; and
8. Resource consumption (Waster, Electricity and Sewerage): evaluated to be a minor impact activity.

Operational phase:

1. Waste collection and transportation: A major activity of IWM. Ha.Uligam has a draft waste management plan prepared which has yet to be approved
2. Waste sorting, separating and compost making: The biggest component of IWM. If carried out as per the waste management concept plan, this activity would result in the most positive impacts. However, based on fair assessment of the existing condition, this activity was observed to have the highest potential for failure which would result in major negative impacts;
3. Waste generation: considered a minor impact activity;
4. Resource consumption (water/electricity): considered a minor impact activity;

The direct footprint area in Uligam is localized only on land Within this area, the biodiversity richness was observed low since much of the area has been utilized for the wind turbine project. Flora and fauna enclosed within the direct impact boundary will be effected by construction activities. Nesting areas for birds and other fauna will be effected. Habitat fragmentation and permanent change to the existing island ecosystem will occur as a result. Removal of vegetation will also affect the net carbon balance as vegetation act as a carbon sink. Noise generated from these activities are also envisaged to have a direct impact on the biodiversity. Significant volumes of yard waste will be produced during the site clearance works. The island has no waste management system and therefore additional waste created if left on the island will have multiple direct and indirect impacts on the island. During the, operational phase of the project management of waste at the IWMC is considered to have numerous impacts which include emission of GHG, smell/odor impacts and health impacts. These arise from compost pile, sorting activities and volume reduction activities. There is a high risk of accidents and injuries during the operational phase of the IWMC. Due to the volume of incoming organic waste the risk of running out of storage capacity is imminent during the operational phase of the IWMC if not managed properly. This would lead to significant cumulative negative impacts, as a result of burning waste at the IWMC. Continued burning of waste could potentially convert the IWMC into a dumpsite resulting in loss of investment. It would also impede the progress of the waste management framework of the country. However, if the waste management plan is implemented accordingly the overall impact of IWMC during the operational phase will be positive. It would create job opportunities and new markets which would develop the local economies.

As a practical and a reasonable mitigation measure to minimize the impacts arising from removal of vegetation, translocating and replanting trees have been proposed (see **Section 8.5** for details). Trees at project site, shall be encouraged to be translocated within the island or to other islands. Due to numerous challenges faced by the island council to undertake land clearance and translocation of trees, the report also proposes to procure parties interested in buying and relocating trees (See **Section 8.5.2 A** for details). Procurement announcement shall be advertised as widely as possible. Evaluation shall be undertaken as described in the report. Except when all options to relocate trees

have been exhausted only the decision to cutting down of a tree for timber or any other use shall be considered. Hence it is strongly recommended to give the highest priority to transplanting trees as an impact mitigation measure.

The volume of waste that is expected from land clearance is closely linked to the number of trees that can be salvaged from those that get uprooted. Without a robust tree translocation plan it is believed that up to 5-10 tons of waste will be generated from the island. This would require costly long distance transportation from project island to Thilafushi. With the proposed mitigation measures combined with burning of dried yard waste, waste requiring transportation could be significantly reduced.

During the operational phase best practices in compost management, together with strict health/ safety guidelines, emergency planning and implementation of monitoring/management program have been recommended to mitigate noise/odour impacts, avoid injuries and reduce carbon footprint. In order to address the issue of organic waste accumulation at the site, the assessment proposes to install 660 L waste bins at the IWMC. Based on size and population of the IWMC at the project island, a maximum of 1-2 week of organic waste can be stored at the project island using such bins (See **Section 2.3.2** for details). Hence it is recommended to schedule waste collection trips more frequently for islands based on population size.

Due to the project being located in an inhabited island, negative social impacts arising as a direct consequence of the Project during construction phase have been found to be minor. The project does not involve removal of privately owned palm trees from coconut groves. Cumulative negative impacts have been envisaged during operational phase due to poor management of the IWMC which can result in smell/odour impacts to nearby public areas.

Hence the monitoring plan of the project is designed to address the constructional and operational phase impacts by identifying assessable indicators and assigning relevant stakeholders to prepare and assess the outcome of these indicators. The management plan of the IWMC is designed based on adaptability from feedback provided by different levels of management. This is to ensure that cumulative negative impacts do not exceed to a level that could disrupt the proposed waste management system.

On the basis that mitigation measures proposed in this EIA report will be implemented by proponent and the robust environmental monitoring plan suggested in the report will be fully taken into consideration and the recommendations set forth in the report will be duly considered, it is concluded that the benefits of the planned Island Level Waste Management when implemented will substantially outweigh its imposition on the environment.

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1. INTRODUCTION

1.1 PROJECT BACKGROUND

Under the "Provision of Water Supply, Sanitation and Solid Waste Management Project" financed by the OPEC Fund for International Development (OFID) and facilitated by the Ministry of Environment and Energy, Maldives (MEE), establishment of Island Level Waste Management Centres (IWMC) have been proposed for nineteen (19) islands in Zone 1 which consists of Haa Alif, Haa Dhaal and Shaviyani atolls.

The completion of the proposed project will result in the construction of an IWMC in these nineteen islands (19), and the operation of the IWMC will be facilitated under the Waste Management Plan devised by the Island Council and approved by EPA.

The project will be implemented under the *Saafu Rajje Policy* formulated by MEE to:

1. Reduce the amount of waste produced and discarded;
2. reuse, items discarded as waste;
3. recycle waste to create value added products;
4. use waste to generate energy; and
5. depose waste in an environmental responsible manner.

The main objectives of the policy are to:

- Ensure that all Maldivians understand the importance of waste management and create awareness with regard to the waste management policy;
- evolve and develop the society through awareness so that it strives to protect and manage the natural environment sustainably;
- make sure all aspects of civil life are hygienic;
- ensure that air pollution is controlled and prevented and
- make sure that Maldives retains its natural coastal and marine environment without pollution.

In order to achieve the objectives of *Saafu Raajje Policy* MEE has plans to implement a regional waste management system together with Island Level Waste Management systems based on previous studies that has been done on waste management in the Maldives. In this regard, the Ministry had procured consultants to conduct the feasibility study of the regional waste management system which would work congruently with the Island Waste Management System. The scope of the proposed IWMC is to facilitate island level management of the waste generated within the island, which includes sorting of waste types, management of hazardous wastes, volume reduction, stockpiling and composting of the waste. The waste that is not manageable in the island level is planned to be transported to the proposed Regional Solid Waste Management Facility (RSWMF) of Zone 1. At the time of the report, design of the Regional Waste Management System (RWMS) had been commissioned by MEE and was ongoing.

The proposed IWMC will be financed by OFID and constructed by contractors procured by MEE locally. Prior to construction of IWMC, preliminary studies such as site selection/approval,

environmental impact assessments and environmental management plans are to be completed. Therefore, proposed locations for IWMC was screened by EPA and Ministry of Housing and Infrastructure (MHI). The initial screening of the locations resulted in the following islands being classified as those which require preparation of an EIA.

- Ha.Maarandhoo;
- Ha.Uligam;
- Sh.Kanditheem;
- Sh.Feydhoo and
- Sh.Lhaimagu.

This was mainly due to the fact that the proposed sites did not have access roads and were close to sensitive sites or require removal of significant vegetation from the island. The remaining islands which are listed below was classified as requiring an Environmental Management Plan (EMP).

- Ha. Muraidhoo
- Ha. Molhadhoo
- Ha. Thakandhoo
- H. Dh Nolhivaram
- H. Dh Neykurendhoo
- H. Dh Makunudhoo
- H. Dh Kurinbi
- H. Dh Hirimaradhoo
- H. Dh Kumundhoo
- H. Dh Vaikaradhoo
- H. Dh Finey
- Sh. Noomara
- Sh. Feevah

Field surveys conducted revealed that the initial screening outcome of the following islands will have to be re-screened in light of the field survey findings. Hence the following three islands were Environmentally re-screened in light of new information.

- Sh.Bilehfahi
- Sh.Feevah
- Ha. Uligam

Based on this development MEE sanctioned two EIA packages as follows:
Package 1

- Ha.Maarandhoo
- Sh.Kanditheem
- Sh.Feydhoo
- Sh.Lhaimagu

Package 2

- Sh.Bilehfahi

- Sh.Feevah
- Ha.Uligamu

Environmental re-screening of the aforementioned islands resulted in the following outcome:

- Sh.Bilehfahi and Sh.Feevah was declared to require an EMP while Ha.Uligam was declared to require an EIA.

The scope of this EIA report includes construction of IWMC and its associated access roads for Ha. Uligam (Package 2).

Hence, Maldives Energy and Environmental Company (MEECO) who was contracted for the task after being the successful bidder, prepared this document in accordance with the EIA Regulation 2012 to obtain the required environmental clearance for the proposed construction of IWMC and access road clearance in accordance with the Regulation enforced by Environmental Protection Agency (EPA). This EIA provides a focused assessment of the proposed IWMC and access road in terms of existing environmental conditions and potential environmental impacts on the island. It follows and addresses Terms of Reference (TOR) for the project which is attached in **Annex 2** of the report. The findings of this report are based on information collected from literature, qualitative/quantitative assessments of the project consultations with stakeholders, professional expertise and judgements. For detailed site investigation, a field visit was conducted from 3 May 2017 to 24 May 2017.

1.2 INTERPRETATION OF SPECIFIC TERMINOLOGY USED IN THE REPORT

Certain terms used in this report shall be interpreted in the context of the current project taking into account legal and administrative requirements for preparing the EIA report in the Maldives. The term Environment has been used in a broad context to include, natural environment, human environment, heritage, recreation and amenity assets and livelihood, lifestyle and well-being of those affected by the Project. Hence the term Environmental Impact Assessment (EIA) shall be taken synonymous to Environmental and Social Impact Assessment (ESIA).

Proponent in the document implies to the project owner MEE and Project Island shall be interpreted as the project island of Ha.Uligam. The term Project means 'Development of IWMC and access roads to the IWMC in Ha.Uligam and the developer shall be interpreted as the company undertaking development works of the Project. Unless specified in the report, road development/ access roads shall be interpreted as development of sand surfaced roads (dirt roads). Minor road shall be interpreted as dirt road with length 57 m and width 7 m which shall be used to access the IWMC.

1.3 THE PURPOSE OF THE EIA

Among modern environmental statutes Environmental Impact Assessment (EIA) laws crystallize a preventive approach to environmental protection, because they integrate environmental considerations in decision making processes. Generally, EIA laws require the preparation of an environmental impact assessment for any proposed development activity, to review and assess its environmental impacts. The requirement can be applicable to a broad array of actions, and may

include issuance of a permit or prior authorization, the funding of a project, and the adoption of a new statute or policy. The environmental assessment may be required to identify appropriate mitigation measures, or alternatives to the proposed action, that minimize environmental impacts. The Government has thus given due diligence to the formulation of these statutes to regulate environment policies, laws and institutions to deal with all the environmental issues that the country is faced with.
This EIA report is primarily aimed at capturing and presenting information needed to meet the legal requirements of both Environmental Protection and Preservation Act (4/93) and the Environmental Impact Assessment Regulations of the Maldives.

The EIA Regulation 2012/R-27 of the Maldives states that projects carried out in the Maldives which require significant land clearance and removal of coconut palm trees will have to undertake an Environmental Impact Assessment prior to its construction and operation. The details of the EIA procedure is stipulated in the EIA regulation 2012/R-27.

Ha.Uligam was determined to require an EIA after evaluating Waste Management Centre (WMC) site selection form submitted in accordance with the Waste Management Regulation 2014/R-29, which stated that there were no access roads to the proposed WMC site and a significant number of vegetation had to be cleared to construct the Island Level Waste Management Centre (IWMC) and access roads (See **Annex 12**).

The proposed waste management project falls under the category of projects which require major vegetation and palm tree removal under *Annex 4* bullets 8 of the EIA Regulation 2012/R-27. Hence this EIA is prepared to fulfil this legal requirement.
The scope of this EIA includes:

1. Vegetation clearance for the IWMC plot;
2. vegetation clearance for the access road;
3. construction of IWMC; and
4. operation of IWMC.

More specifically, this EIA focuses on the management of potential environmental and social impacts and risks of the proposed waste management project.
Four major objectives of the EIA are to:

- Identify and assess potential impacts or consequences of the project on the natural and human environment in the project area;
- propose measures to avoid or mitigate or control potential adverse impacts and risks and to enhance beneficial impacts;
- develop an environmental monitoring plan (EMP), where the proponent should adhere to during construction and operations of the said project; and
- enhancing sustainability of the project and to promote environmentally sound decision making.

1.4 THE EIA IMPLEMENTATION PROCESS

The EIA implementation process is explained in detail in the EIA Regulations. The process is summarised below in **Figure 1**.

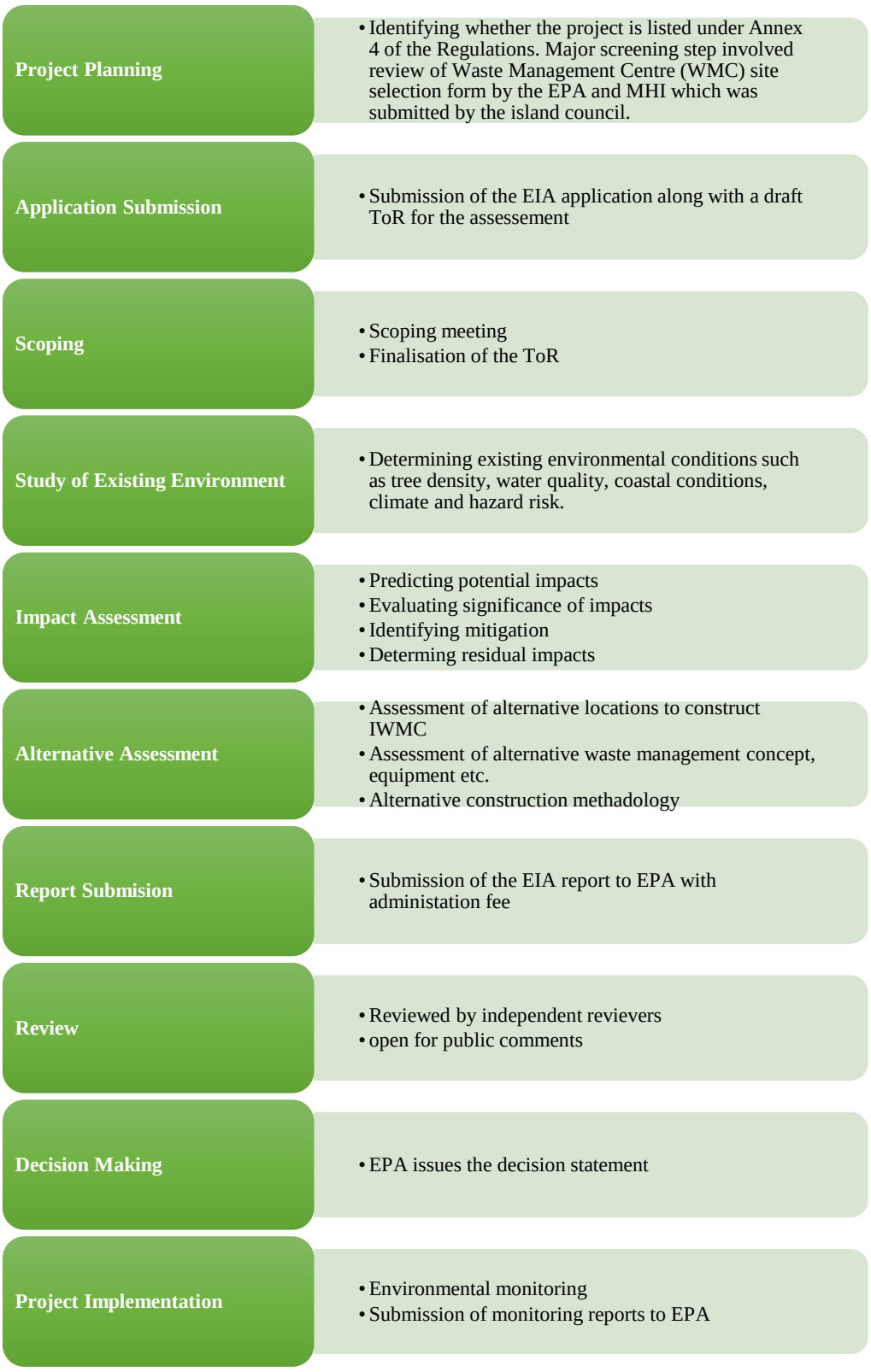


Figure 1: EIA implementation process

1.5 EIA APPROACH & METHADOLOGY

1.5.1 EIA Approach

The approach adapted for this EIA report is primarily aimed at capturing and presenting information needed to meeting the legal requirements of both Environmental Protection and Preservation Act (4/93) and the Environmental Impact Assessment Regulations of the Maldives. The approach used in this EIA study involved systematically understanding and evaluating the project components and identifying their impacts (both positive and negative) on the bio-physical and socio-environment followed by determination of practical and sound mitigation measures. The EIA also identified and proposed appropriate monitoring mechanism to evaluate the effectiveness of the proposed mitigation measures and evaluates alternative approaches ranging from alternative project options to alternative work methods and designs.

Two most important aspects in impact prediction involved understanding in detail all aspects related to the proposed project, which include, project setting, design, development, operation, decommissioning and the characteristics of the natural and social environment of the project location. Once these have been achieved, it was followed by predicting potential impacts and evaluation of the impact characteristics to determine their significance using generally accepted methodologies. For the identified negative impacts, regardless of the significance level, practical cost effective mitigation measures have been proposed to avoid, or further minimise the negative effects.

1.5.2 Scoping and Terms of Reference

Scoping and finalising the Terms of Reference (ToR) was one of the very first steps in the initiation of the EIA process. The ToR initially drafted by the EIA team based on the experience gained from development projects of similar nature undertaken in the Maldives was submitted to EPA. Following submission of draft ToR and project summary the scoping meeting was held on 30th April 2017 at EPA and attended by project environmental consultant, proponent and MHI. Stakeholders present at the meeting discussed the ToR and suggestions were made to the ToR. These suggestions were then incorporated into the revised ToR which was submitted to EPA for final approval.

All issues identified in the ToR have been carefully considered in the relevant chapters of this report. The final ToR was shared on 23rd July 2017 and is attached in **Annex 2.**

1.5.3 EIA Methodology

To effectively determine and evaluate the impacts the right mix of expertise in relevant disciplines were chosen. This was followed by a number of critical steps such as, defining the spatial boundary of the study area, identifying specific areas for detailed study to understand the sensitivities of the baseline environment. It also included, a number of specific stages in the preparation of the EIA characterisation of baseline environment, determining project sequence, activities and methodology, alternatives evaluation and review of relevant laws policies. The details of the various aspects involved in identifying impacts are explained in the following sub-sections.

A. Identifying Impacts and Analysis

Impact definition used in the report has been adapted from the United Nations Environment Program (UNEP). Accordingly, an impact or effect used in the current assessment implies the

change in an environmental parameter, which results from a particular activity or intervention relating to the proposed Project. Thus, the change or the impact is the difference between the environmental parameter with the Project compared without the Project (baseline) measured over a specified period and within the Project location (UNEP, 2002). In identifying and predicting impacts 'best estimates', past experiences, professional judgements, references, and information collected from stakeholder discussions were the main methods used.

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

A modified Leopold Matrix (Leopold, et al., 1971) was applied to evaluate the impacts identified. The steps involved are briefly summarised below:

- Identification of all project related activities;
- identification of impacts associated with significant actions;
- the magnitude of the impact was then determined by assigning a number from 1 to 10 (1 is the minimum and 10 the maximum). this number is placed in the upper left hand corner in the corresponding box of the matrix, representing the scale of the action and its theoretical extent. a plus (+) was used for positive impacts and a minus (-) was used for negative impacts; in the lower right hand corner of each cell a number from 1 (least) to 10 (most) to indicate the importance of the impact was placed. it then gives an evaluation of the extent of the environmental impact according to the judgement of the EIA team; and
- the significance was then determined by the joint consideration of its magnitude and the importance (or value).

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

Importance

Relative importance of environmental impacts, have been characterised by considering the following;

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

Magnitude

Magnitude of the impact was expressed in terms of relative severity, such as major, moderate or minor/negligible. In determining severity other aspects of impact magnitude, notably whether or not an impact is reversible and the likely rate of recovery were considered.

Hence, the following equation was used to determine the impact significance (UNEP, 2002).

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

The scores obtained for the magnitude of each of the impacts (both positive and negative) were categorised as given in **Table 1**. The method used in assessing significant impacts thoroughly addressed cases where magnitude and importance were not directly related. For instance, in cases where a regulatory clause specifically states a number or condition, the impact significance is greatly increased even though the magnitude of the activity is relatively small.

For example, removal of ten coconut palm trees has a relatively minor impact on overall loss of vegetation from the island hence is classified as an activity having a relatively small magnitude, however since the regulation on uprooting palm trees states that removal of ten coconut palm trees required approval from the regulatory, the activity is considered to be very important. In such cases the impact has been classified as a significant major impact. Hence the impact analysis approach used in the EIA report takes into account two important properties of an impact activity. Its magnitude and its relative importance based on local and national laws and regulations.

Table 1: Categorization of the significance

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

Significance categories of negative impacts given in **Table 1** is defined as explained in **Table 2.**

Table 2: Impact characterization matrix

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

B. Social Assessment

The aim of the social assessment (SA) is to study the potential social and community benefits of proposed project. In recognition of this, the report includes aspects related to social inclusion and labour impacts. The specific objectives of the social assessment are to:

1. Identify major and minor stakeholders of the project;
2. identify appropriate mechanisms for providing information about the project to all stakeholders;
3. investigate the impacts to the stakeholders from the implementation of the project;
4. understand the impacts of the project on the social and socio-economic profile of the island and region as a whole;
5. formulate mitigation and enhancing measures to optimise the benefits for the communities and limit the adverse effects; and
6. monitor socio-economic impacts during implementation of the project.

C. Cumulative Impacts

Cumulative impacts which may be defined as impacts that result from incremental changes caused by other past, present or reasonably foreseeable activities as a result of the project are generally considered in EIA studies. The proposed approach for assessing cumulative impacts was to consider activities and receptors within the current scope of project that could have a potential negative cumulative impact during the construction and operational phase, in order to prevent it.

1.5.4 Impact Mitigation

Impact mitigation in the report refers to measures that are necessary to avoid, eliminate or reduce the negative effects of the project on the environment and enhance positive effects. The ToR for the EIA requires practical and appropriate mitigation measures for significant impacts identified to be proposed. For each identified significant negative impact in proposing mitigation measures the priority was given to avoidance of a predicted impact by taking measures such as bringing

changes to the design and/or work methodology. In cases where avoidance of an impact was not possible practical and cost effective measures have been proposed to reduce the impacts and enhancing positive impacts. Practical experience and lessons learnt by the EIA team from projects of similar nature played a key role in proposing mitigation measures. Hence in interpreting the impacts and mitigation the document as a whole shall be taken into account rather than a particular section of the report. The proponent as part of this report has submitted a letter of commitment stating that all the mitigation measures proposed in the report will be implemented during all phases of the project. Hence the project will be implemented with full commitment of the proponent to undertake the mitigation measures to ensure environmental sustainability of the project.

It should also be noted that in addition to predicting impact of the project on the environment, the EIA regulations also require determining impacts of the environment on the project components for ensuring sustainability of the project. This aspect was well taken into account in the project formulation.

1.5.5 Gaps in Baseline Information

Availability of quality baseline data is an important element for any EIA study. Most of the baseline information of the existing environment for the project were collected on site and are based on actual topographical and vegetation surveys. As a whole the study consisted of minor limitations in baseline information.

However certain baseline information is limited in the evaluation partly due to capacity constraints. For most of the sites, actual survey data was available however when the plot or access road is moved or altered projections using actual survey data were used. However, this is not a significant gap in baseline information due to the uniform nature of existing vegetation and small size of the roads and plot. Soil chemical composition, grain size distribution and hydro conductivity were referenced from lab analysis done on soil samples collected from similar islands in the Maldives. Due to the similar nature of geology and formation of islands in the Maldives, it was assumed that these results were representative of soil at project site. This represents a sufficiently conservative and cautious approach which takes account of the study limitations.

1.5.6 Gaps in Understanding Impacts

Impact identification, characterization as well as significance analysis also involved uncertainties as ideally such an exercise should take place against a framework of criteria and measures established for the purpose in the relevant legislation which is not the case in the Maldives at present. Specified criteria necessary for impact evaluation such as environmental standards and thresholds are yet to develop in order to strengthen the EIA process in the country. In order to address these gaps, where impact magnitude cannot be predicted with certainty, professional experience and scientific literature was used and adapting criteria and measures from elsewhere that are relevant to local circumstances was used.

For instance, extent of impacts on the physical and biological environment as a result of de-vegetation have not been studied in detail in the Maldives. In addition, there has been no scientific work done on natural and plantation forest ecosystem in the Maldives. Identification and documentation of terrestrial fauna in particular invertebrates in the Maldives is also lacking. Soil ecosystem has not been properly documented. Moreover, composting and management of waste

as per the project concept has never been tried and tested in any of the islands previously, which means there is a greater degree of uncertainty with regard to the operational phase of the project. In cases where a greater degree of uncertainty is believed to exist a precautionary approach had been adopted in which likely maximum impact was considered.

1.5.7 Review of Similar Reports

EIA reports previously prepared for waste related projects and projects involving significant waste clearance was reviewed to address gaps of the study and to determine findings of similar assessments. Major findings of the review include a step wise approach to mitigating impacts of site clearance and waste management. These include:

- Changing design or position of structures to reduce amount of vegetation to be cleared;
- trimming/ removing branches of larger trees to avoid removal of large trees if possible;
- replanting trees to maintain overall plant budget of the island;
- containing leachate and smell from releasing into the environment;
- implementation of the management and monitoring plan;
- separating yard waste and using it as compost and
- prohibiting disposal of yard waste into the marine environment.

A summary of reports reviewed for the study are detailed below describing the scope and mitigation measures proposed to reduce impacts of site clearance, construction and operation of waste management centres.

Environmental Impact Assessment: Proposed Road Development Project, L.Baresdhoo (L.Baresdhoo Integrated Resort Development Project) by *Saleem,A & Hammadh, A(2017)*

Baresdhoo Integrated Resort Project is an initiative by the government of Maldives aimed at developing mid-market resort and hotel properties. The main objective of the project is to develop Baresdhoo as a self-sustaining, eco-friendly tourist city.

The major activities proposed under the road development project involve site clearance with removal of mature trees and undergrowth that fall on the footprint of the planned roads, levelling and removal of waste generated from the works. The total road network covers a distance of 11.2 km with a total road footprint area of approximately 85,582 m^2 accounting for 12% of the island's total area.
During the road development phase, most significant negative impacts on the environment are associated with removal of vegetation, and pollution from wastes generated. It is estimated that in the worst case scenario 9.04 ha of area will have to be cleared for the footprint of the road network reaching 11.2 km of length impacting approximately 10% of the island's vegetation.

Translocating coconut palm trees within the island was proposed as the main mitigation to prevent and reduce negative impacts arising from the project. The remaining palms and trees that cannot be relocated within project island was encouraged to be translocated to another island by interested parties. Transportation of yard waste generated during the construction phase of the project was identified to increase the overall cost and viability of the project. The report stressed on managing yard waste at the source and reduce the amount of waste transportation.

Environmental Impact Assessment: Access Road Development Project, K.Thilafushi by *Saleem, A (2015)*

The scope of the project involves developing an asphalt surfaced road which was approximately 1 km. The road will connect Thilafushi 1 and Thilafushi Industrial Zone. The road was to be built on a coral sand causeway. The project proponent was Thilafushi Corporation Limited. The project involved marine works which included dredging to obtain the required fill material for the road. Hence the EIA explored the impacts of road construction and marine works.
Key environmental impacts both during development at operational were identified as follows

Developmental

- Impacts of asphalt on workers during construction phase;
- impacts due to sedimentation and dredging;
- elevation of environmental pollution from waste generated during the construction; and
- road traffic during the construction stage since the cause was readily used.

Operational

- Traffic accidents and pollution caused by increased use of vehicles.

Environmental and Social Impact Assessment: For North Regional Waste Management Facility Construction and Operation Vandhoo, Raa Atoll, Maldives by *NIRAS (2013)*

The scope of the project involves developing Regional Solid Waste Management Centre (RSWMC) in R.Vandhoo. Fifteen scoping components were identified for the construction phase, and forty-two scoping components were identified for the operational phase. Each component was derived from the Consultancy Team's field studies, as well as studies carried out by other consultancies.
Key environmental impacts and findings for development and operational phase were identified as follows:

- Incorporating suitable mitigation measures into project design;
- highlighted that small patches of wetlands provide a regulatory function in which they serve as rainwater collection point for recharging groundwater. Noted that *Bruguiera cylindrica*) native to Maldivess was classified as least concern with a population trend decreasing globally as per the IUCN Red List.
- highlighted possibility of waste being lost during loading and unloading;
- identified waste transportation as the main reason for the worsening situation with solid waste build up on the islands;
- usage of heavy vehicles and vegetation clearing identified as significant impacts of waste project;
- pollution related diseases, handling of hazardous materials, accidents and noise from operating waste handling machineries were identified as the most significant impacts during operational phase;
- using scrubbers and protective gear and general best practices including enforcing safety guidelines were recommended to managing the most significant impacts.

These observations and findings were referred and adapted during the impact analysis of the EIA.

1.6 THE EIA TEAM

This EIA report was prepared by a multi-speciality team of local experts. The team consisted Mr. Ahmed Saleem and Mr. Ali Hammadh registered EIA consultants with the Maldives Environment Protection Agency (EPA). The team members, their respective field of expertise and areas of contribution to the assessment is given in **Table 3**.

Table 3: The EIA Team

Name	Qualification	Designation/Field of Expertise	Contributing Area
Mr. Ahmed Saleem	MSc. Ecology & Environment	Lead EIA Consultant	• Overall administration of the EIA • Contributed to the various chapters • Report review
Mr. Ali Hammadh	BSc. Environmental Management	EIA Consultant	• Deputy Team Leader • Report writing and compile • Data analysis • Data collection • Water sampling • Stakeholder consultations • Contributed to the various chapters of the report.
Mr. Maumoon Saleem		Civil Engineer	• Data analysis • Data collection • Concept review • Contributed to the various chapters of the report.
Mr. Dinal Shalika		Surveyor	• Terrestrial survey • Preparation of maps and charts
Mr. Muslih Mujtaba		A.Surveyor	• Terrestrial survey • GIS analysis

1.7 PROJECT JUSTIFICATION

Solid waste remains the most visible environmental threat to the Maldives. The management of solid waste is especially challenging in the Maldives, where waste generation is significantly greater than many other small island states mainly due to highly active tourism sector which had established a moderate economy in the island state.

With a highly dispersed population spread across numerous islands, there is little scope for harnessing scale economies, as the costs of delivering services in Maldives are high (NIRAS, 2013). A high population growth rate, a large influx of foreign workers and the execution of extensive infrastructure projects have meant that land space available for the disposal of waste is now extremely limited, and that accordingly there is an urgent need for the waste stream to be minimized through incentives for resource recovery such as recycling and composting. Finally, the fragile marine atoll ecosystem requires special attention in terms of the choice of waste management technology and system design to mitigate adverse impacts, which adds to cost implications.

Moreover, the state of island level waste management in the Maldives is inadequate. Recent waste audits show that per capita waste production in the islands of zone 1, which include Haa Alif, Haa Dhaal and Shaviyani atolls were 1.30 kg/capita/day. This meant that a small island with a population of 500 people will produce significant amounts of waste which mainly comprises of organic material. Since there are no waste management facilities established in these islands waste is disposed all across the island. Most commonly waste is discarded into the coastal areas, forested areas and any empty area within the island. Uncontrolled disposal of waste has the following implications:

- Coastal area, that have significant aesthetic, economical and social values are damaged and its value is lost as residents cannot use coastal area for fishing or recreational activities due to pollution;
- waste, including hazardous waste can easily come in contact with children which can lead to health implications. Disposed waste becomes a suitable breeding ground for mosquitoes, pests and other harmful bacteria;
- it changes the island landscape unfavourably. Waste is usually burned to reduce volume and piled or buried in the island. These piles limit land development and causes flooding by impeding natural drainage of islands creating environments suitable for parasites.
- burying waste causes significant negative impacts to the groundwater resources as a result of leachate drainage. Groundwater resources are sensitive and since island life depends on groundwater resources, pollution of this vital resource may threaten sustainability of island life. The state of pollution by waste threatens Sustainable Development Goals (SDG) especially access to clean water and sanitation;
- lack of proper waste management facilities, in the islands means that polluters are not and cannot be held accountable as there is no better way. This makes implementation of existing waste regulations difficult in the islands;
- uncontrolled disposal of waste has created conflicts between polluters and victims who are affected by waste pollution; and
- burning waste releases harmful gases and particles into the environment that has environmental and health implications.

Many options have been explored to manage waste at the island level. Transportation of waste from the islands to the nearest operational waste management centre K.Thilafushi was found to be too expensive. Thilafushi is the largest waste disposal site in Maldives serving the capital city, Malé and surrounding islands; Villingili, Hulhumalé and Huluhullé. In addition, Thilafushi receives waste from resorts and construction and demolition sites. Thilafushi is not an engineered waste disposal facility but an uncontrolled open dump. It is situated approximately 6.5 km west of Malé. Thilafushi was originally a lagoon which has been reclaimed using both sand and waste as reclamation material. The length of the lagoon is 7 km across with a capacity to continue as a landfill site for another five decades or so. Preliminary level of waste segregation is practiced at Thilafushi to remove high value recyclables such as PET bottles, scrap, crushed cans, etc. These recyclables are stored at Thilafushi and sold intermittently. The remaining waste is then burnt by spraying waste oil and the burnt waste is mixed with construction and demolition waste which are subsequently used to reclaim the reef/ lagoon. Potentially hazardous materials such as used batteries, lead, asbestos and mercury are mixed with municipal wastes, creating health and

environmental problems. In addition, since Thilafushi is only one meter above sea level, leaching of toxic pollutants into the sea is a distinct possibility. Therefore, the adverse environmental impacts from Thilafushi are significant, including the potential for legacy pollution.

The rationale for excluding Thilafushi Island as a potential option for disposal of solid waste from the islands of the North Region was due to the existing methods of waste management and the adverse environmental situation in Thilafushi Island, including the potential for legacy pollution and the problems that would be encountered during sea transport during the south west monsoon period. In addition, the cost of transportation of waste from Northern Province to Thilafushi would not be economical. Therefore, it has been recommended the way forward for the Maldives would be to set up regional waste management facilities in the key regions.

Hence the closest regional waste management centre to the project island is at R.Vandhoo which is located at a fair distance from the islands at Zone 1. Transportation of waste from the islands to the regional centre still had many challenges which include:

- Cost of transportation and lack of a feasible regional waste transportation system;
- absence of an appropriate waste collection and storage system and space. A large area cannot be allocated to store waste in islands which already lack land area;
- lack of incentives to collect, store and transport waste at the island level; and
- proper waste management concept and a framework applicable to all the islands.

In order to address the shortcomings explained above the steps illustrated in **Figure 2** was undertaken by the project proponent.

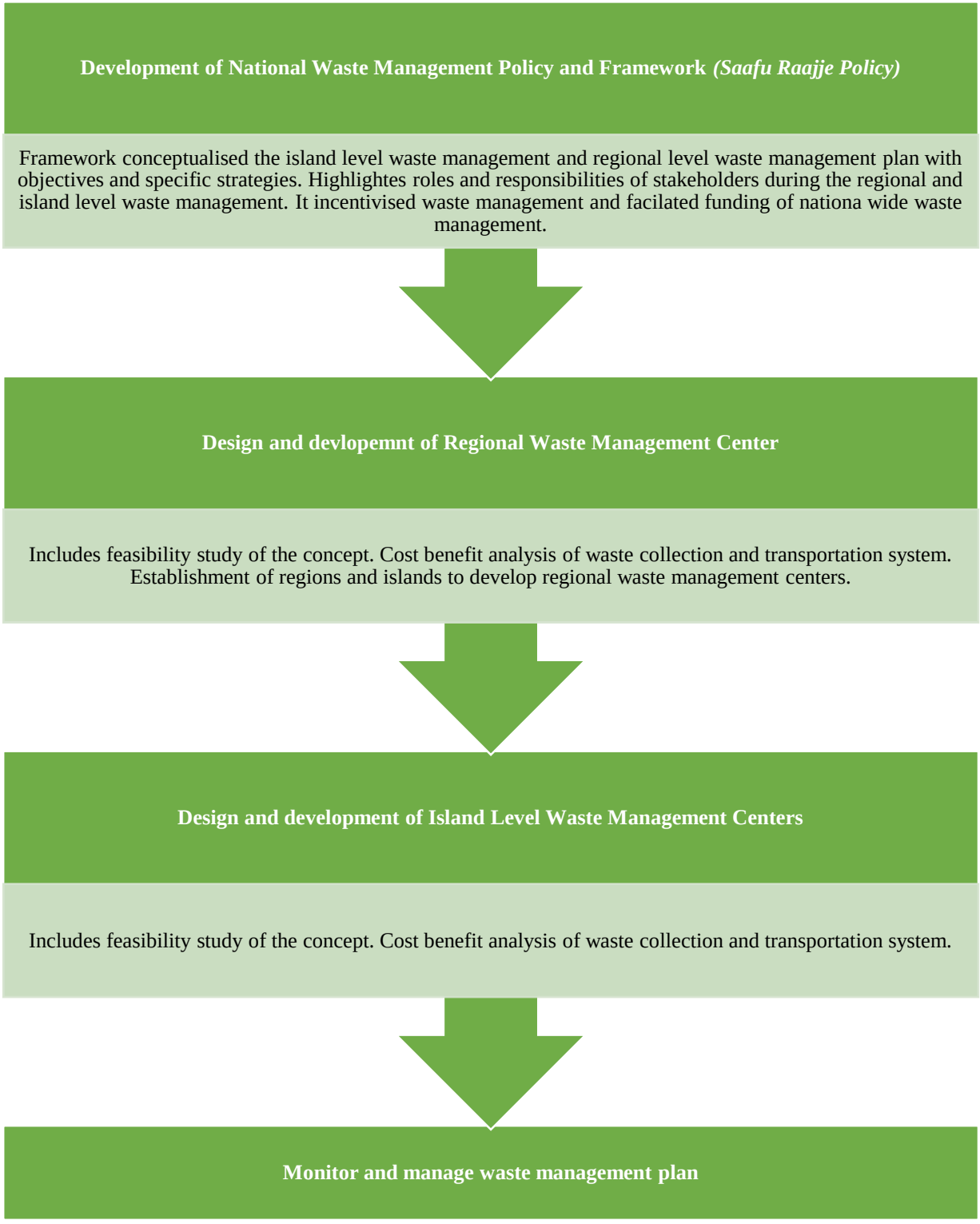


Figure 2: Waste Management Plan

Saafu Raajje waste management policy was drafted to act as the backbone of the two tier national waste management concept. As part of the nationwide waste management plan MEE has commissioned the design and feasibility studies for regional center at Zone 1. Concept and design of island waste management centres have been approved. Currently the required permits and approvals from respective regulators are being obtained before commencement of construction.
Hence, the proposed project is a crucial part of the nationwide waste management policies and plans and it is an important aspect of the solution proposed for the challenging waste management issue facing the country.

2. DESCRIPTION OF THE PROJECT

2.1 PROJECT PROPONENT

The project is proposed by Ministry of Environment and Energy (MEE) of the Government of Maldives (hereinafter referred to as the Proponent). The Project was formulated with the broad objective of solving the waste management challenges that is currently facing the country and to implement the *Saafu Raaje* Waste Management Policy.

MEE as the competent authority of the Project will be responsible for the implementation as well as post-project monitoring of the Project outcomes.

The contact details of the Proponent are given below;
Ministry of Environment and Energy
Green Building
Handhuvaree Hingun, Maafannu, Male', 20392
Republic of Maldives
Tel: + (960) 301 8300, Fax: + (960) 301 8301
Email: secretariat@environment.gov.mv

2.2 PROJECT LOCATION & SITE

The proposed Project is located in the island of Ha.Uligam as illustrated in map shown in **Figure 3**. The following subsections describe the geographical context of Ha.Uligam and the proposed site to establish the IWMC and access road in the island.

The EPA has provided recommendations for the optimum zoning of the IWMC site. The distances include, the site being at least 15 m from the coastal vegetation belt, at least 30 m from the nearest freshwater well, at least 40 m from the nearest recreational area and at least 30m from the mangrove area as well as the residential area. The field surveys done on the island recorded the locations of the aforementioned categories and the comparison table for the actual distances and EPA recommendations are provided below under project site.

Figure 3: Location map of project island

2.2.1. Project Setting

Ha.Uligam is an inhabited island belonging to the administrative atoll of North Thiladhunmathi. Situated in the northern region of the atoll at 7° 4'58.46"N 72°55'39.54"E, the island is situated southeast of the nearest inhabited island of Ha. Thuraakunu separated by 2.1 km. Uligam is approximately is 335 km from the capital Male'. Nearest airport is in HDh. Hanimaadhoo, approximately 45 km from the island. The nearest uninhabited island is Madulu which is located 3 km to the southeast. Uligam is located between *Uligam Kandu* and *Thuraakunu Kandu'olhi* at edge of the atoll. The population of Uligam is 513 according to census data provided by the island council. Uligam is large in size having a surface area of 112 ha. The main economic activities of Uligam is reef fishing and agriculture.

2.2.2. Project Site

The proposed area to establish the IWMC is located on the north northwestern side of the island at (6°51'10.24"N 72°59'9.06"E) and measures 625 m^2. The site currently consists of mixed shrub type vegetation. The site does not have privately owned coconut trees or other large trees. The site is moderately close to the harbour. The harbour is located 412 m to the south west of the plot. There is a major access road from the harbour to the site which can be used by vehicles. There are no minor access roads present to the site from inland. Hence an access road is proposed as illustrated in

Figure 4. The closest infrastructure to the site is the football ground located 94 m south of the IWMC plot. Based on survey data, no large trees will have to be removed in order to establish the IWMC and access road at the proposed area. However, shrub type vegetation will have to be

removed. The plot was adjacent to a discontinued wind farm. Hence the area had been previously cleared for the wind farm project, which is a reason why large/mature trees were absent from the IWMC footprint area. On average, the plot was 75 m away from coastal areas. Photo profile of the site and features are provided in **Figure 5**. As seen on **Table 4**, the site fulfils the EPA recommended distances. Site selection forms are attached in **Annex 12**.

Table 4: Comparison between the proposed site location and EPA recommended distances

Location	Distance from site (m)	EPA Recommended Distance (m)
Coastal vegetation	70-80	15
Freshwater well	188	30
Recreational area	94	40
Residential area	181	30
Harbour	412	N/A

Figure 4: Project site (Ha.Uligam)

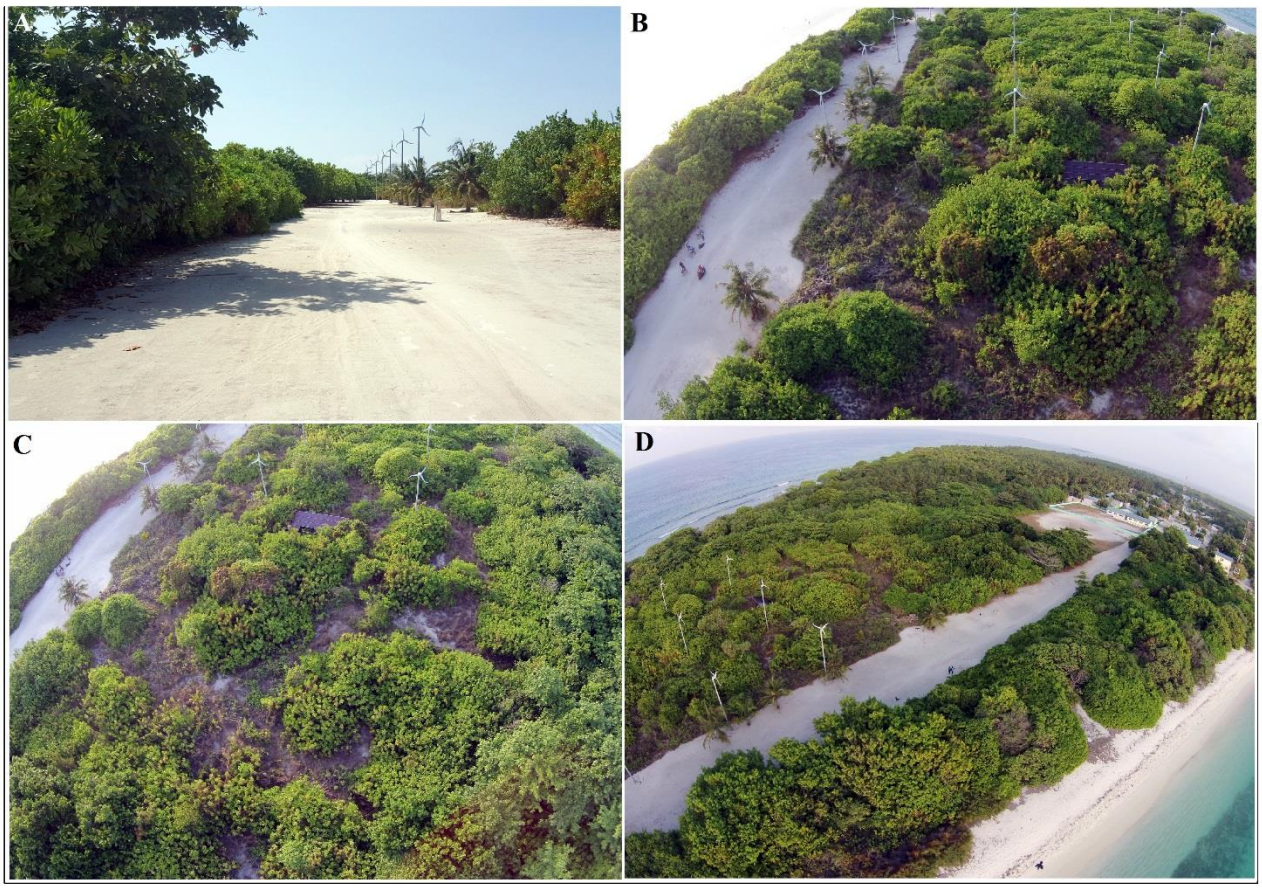


Figure 5: Photo profile of proposed location for IWMC Ha Uligam(A) Main access road (B)(C) Vegetation at the site and adjacent wind farm (D) Aerial photo of proposed location for access road and IWMC relative to the populated area

2.3 CURRENT STATE OF WASTE GENERATION

Waste generated from Ha.Uligam was estimated using waste audit data obtained from four islands in Zone 1 which encompasses Haa Alif, Haa Dhaal and Shaviyani Atolls. The waste audits were conducted for the islands of Ha.Ihavandhoo, H Dh. Nolhivaram and Sh.Foakaidhoo. The study involved collecting waste generated from 20 households over a 24 hr period for a duration of one week. Waste from each household were collected in uniform bags and sorted into constituent classes and weighed. The results of the waste audit conducted to determine waste generated from zone 1 was used to estimate waste generated in the project island and is considered to be very reliable, as the islands where waste audits were conducted had a similar socio-economic background to the project island. Moreover, since no waste audits have been done for the project island, the data used in the report to estimate waste generated is the most up to date.

2.3.1 Waste Generation in Zone 1

The waste audit conducted by MEECO in 2016 showed that the average waste generation of the islands in Zone 1 was 1.30 kg/capita/day. The analysis shows that the majority of the waste generated includes organic wastes at 72%, which include kitchen and green/yard wastes. This waste can be used for composting in addition to paper and cardboard wastes which are at 5% of the total waste generated. Recyclable materials such as plastic, metals, and glass make up 9% of the composition. Approximately 6% of the total waste generated is chemicals and hazardous waste. 8% of waste produced were classified as other. These were mainly materials with a combination of plastic, glass and metal that could be separated into its constituent parts (See **Figure 6**).

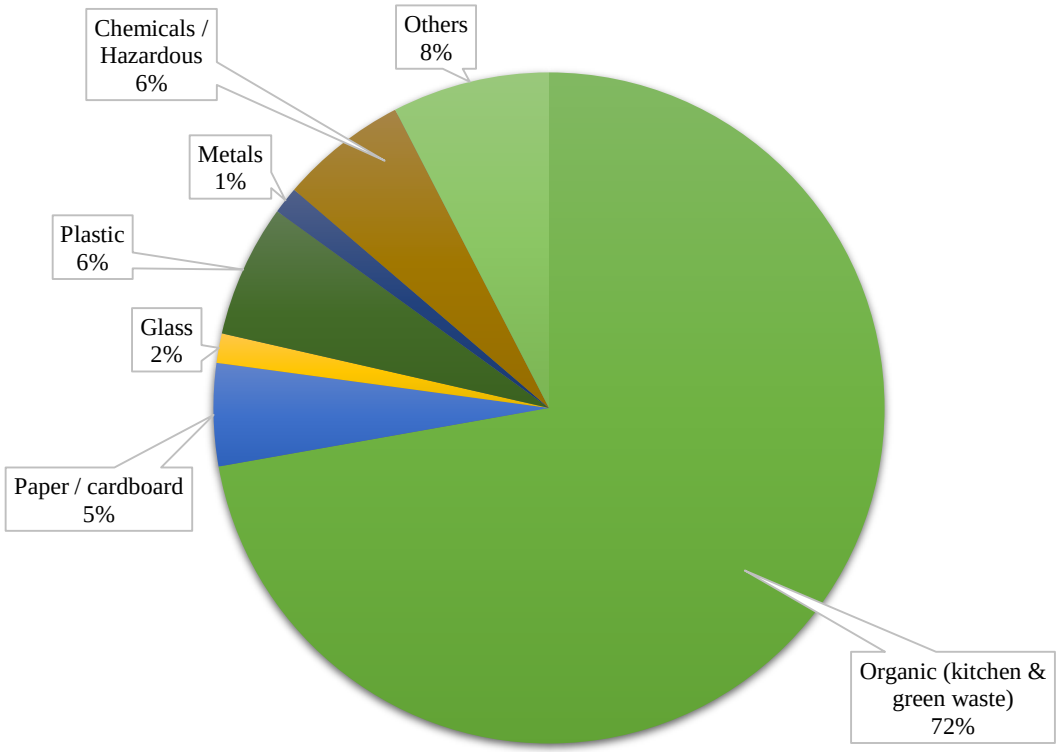


Figure 6: Waste Composition of Zone 1 (Source: MEECO, 2016)

2.3.2 Waste Generation Estimates for Ha.Uligam

Daily waste generated in Ha.Uligam was estimated using the census data provided by the council and waste audit results which is described in **Section 2.3**. **Table 5** below shows estimated daily and monthly waste generated for Ha.Uligam.

Table 5: Estimated monthly and daily waste generated at Ha.Uligam

Population (2017)	**513**	
Number of Dwelling Households	174	
Per Capita Waste Generation	**1.3 Kg/Day/Person**	
Waste Type	Zone One Average (%)	Uligam Waste Generation (Kg/Day)
Organic (kitchen & green waste)	72.2	480
Paper / cardboard	4.94	33
Glass	1.42	9.5
Plastic	6.4	42
Metals	1.3	8.6
Chemicals / Hazardous	6.15	41
Others	7.58	46
Total	100.0	**660**
Monthly Waste Generation/ (tons)	**18**	

2.4 CURRENT STATE OF WASTE MANAGEMENT AT HA.ULIGAM

This section describes the existing waste management practices the island. In order to capture the waste management condition of the island, key parameters related to waste management were identified. The condition of these parameters were assessed based on field visits and stakeholder consultation.

According to the Island Council, waste is not properly managed in Ha.Uligam. Pollution of the island including health impacts due to dust and rapid land use and land alteration have been identified as the main risks facing the island due to the existing waste management system.
Table 6 summarises the existing waste management setup and **Table 7** shows types of waste that are sorted, burnt, buried and dumped into the coastal areas of the island.**Figure 7** illustrates existing dumpsites at the island and **Figure 8** provides photos of current waste management practices at the island.

Table 6: Current waste management system of Ha.Uligam

Parameter	Yes	No	Number	Description
Harbour (accessibility)				• Determined to be accessible. • Prone to shoaling
Waste transportation				• No waste collection systems or services provided in the island
Vehicles for waste transportation				• No vehicles. People carry waste in wheel burrows to designated dump area inside the forest (See figure xx)
Waste management equipment				• No waste management equipment
Presence of dumpsites			1	• One dumpsite is present as illustrated in **Figure 7**
Dumpsites demarcated				• Dumpsite is not demarcated. Waste is dumped into the forest area in general.
Separation of waste at dumpsite				• Waste is not separated.
Burning waste				• Waste is burned inside the dump area and on the household level as well.
Burying waste				• Waste is buried in pits that have been dug inside the dump area and at numerous other locations in the forest area
Dumping waste into the beach/sea				• Mainly to the areas illustrated in **Figure 7**
Presence of large waste piles				• Dumpsites contain piles of waste which has spread throughout the forest area due to runoff as the area had not been demarcated or fenced.
Risk of waste piles failing due to weather				• Waste spread across the forest area
Pollution of inland/other areas				• Waste is discarded into designated area or inside the forest area and coastal areas.
Clinical waste management				• Clinical waste is managed at the Health Centre
Public area waste collection				• Council contracts a local party to clean and collect waste from public areas
Presence of waste bins				• No
Presence of workers				• No
Electric connection at the dumpsite				• No

Table 7: Type of waste separated, burnt, buried and dumped at Ha.Uligam

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

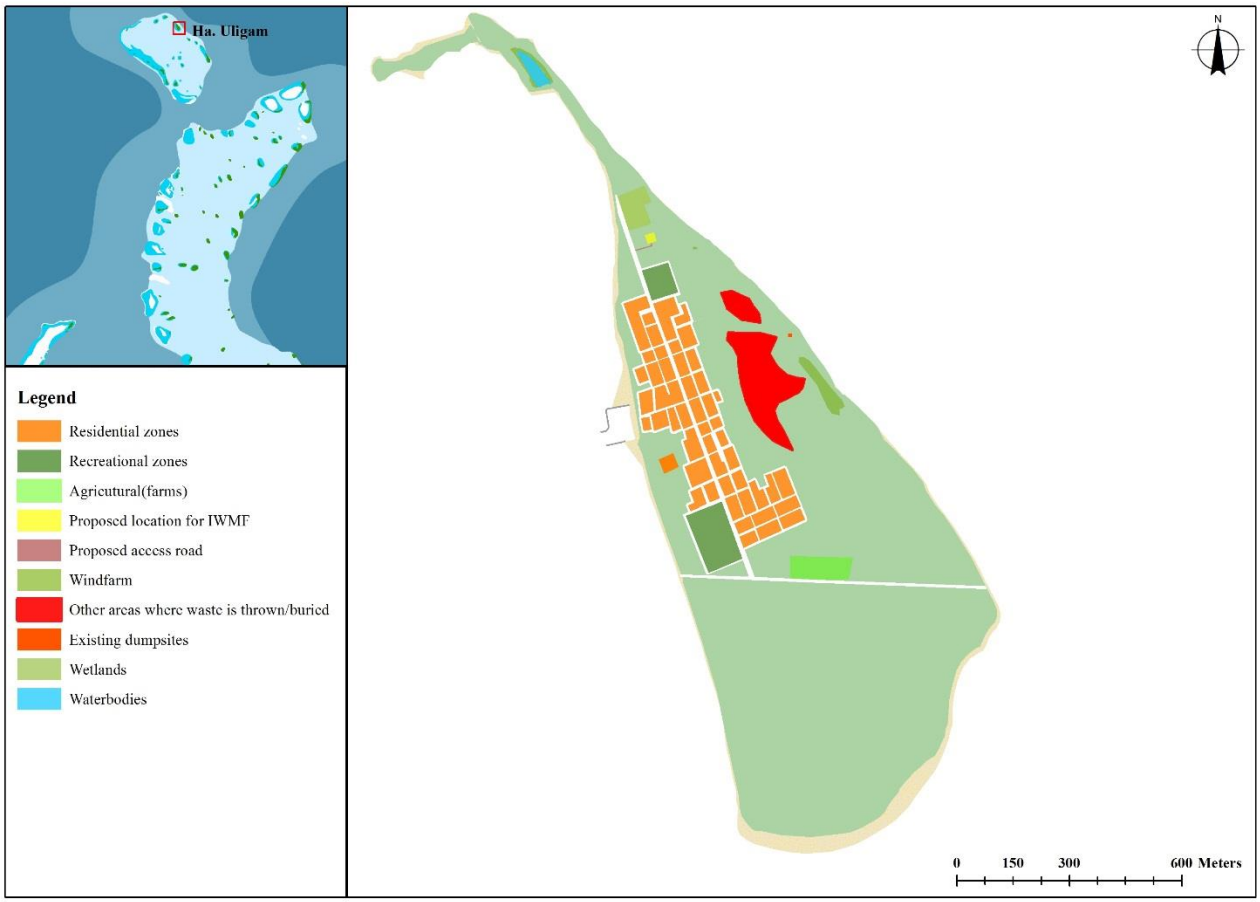


Figure 7: Existing waste dumpsites (Ha.Uligam)

Figure 8: Current state of waste management Ha. Uligam (A) Waste being burned at existing dumpsite on north eastern side of the island (B) Mixed waste piles (C) Mixed waste discarded into forest area(D) Mixed waste in holes.

2.5 WASTE MANAGEMENT PLAN

A waste management plan has been prepared by the island council which will be submitted for approval. The *Saafu Raajje* Policy booklet and conference/workshop on national waste management conducted during last half of 2016 is mainly referenced by the council to draft the waste management plan. In general, the council has revealed that numerous challenges exist to formulate and implement the waste management plan. These challenges and risks are listed in **Table 8** with its immediate risk categorised.

Table 8: Risks and challenges to draft and implement Island WMP

	Risk Categorisation	Description	Adaptive Measures
Formulation of Waste Management Plan			
Lack of technical staff	High	Technical experts with knowledge of waste management and waste management planning	• MEE to train pool of people from the island with regard to waste management. • MEE to conduct capacity building workshops and island specific training programmes.
Lack of reliable information	Moderate	Information with regard to amount of waste generated from the island, including type of waste generated etc.	• Review of previous waste management studies. (See **Section 2.3.2** for waste generation estimates)
Understating regional and local waste management concept	High	Lack of knowledge regarding the *Saaffu Raajje* waste management framework and strategy.	• MEE to conduct workshops briefing and lecturing councils and relevant stakeholder with regard to nation-wide waste management framework. • MEE to utilise public media to conduct waste management awareness programs. • Share information with regard to past experience. • MEE should train selected members from the council and community on how to operate and trouble shoot machineries. It is recommended to train a diverse group (Teachers, members from NGO's, Hospital etc.) of people (at least 5 from the island) so that students may be able to teach in the future. This will be important to address risk of losing
Lack of knowledge with regard to IWMC operation	High	Poor understating of the activities undertaken at the IWMC. Poor understanding of the roles and responsibilities of IWMC workers and stakeholders.	
Poor knowledge of waste management progress/failure indicators.	High	Describes indicators such as volume/weight of incoming waste, compost output, equipment operation frequency, complain logs etc which can be tracked to better understand and strengthen waste management plan	
Unfamiliarity with the proposed waste management equipment	High	Inability to trouble shoot and operate proposed waste management equipment .Poor knowledge of when/how to operate the equipment.	

			technical staff during operational phase of the IWMC.
Lack of knowledge with regard to local businesses and household expendable income.	Minor	Poor understanding of the type and size of waste generated from businesses/industries. Poor understanding of the willingness to pay by the public. Poor understand of incentives to enable source separation.	• Council shall take initiative and conduct island wide surveys to determine the willingness to pay and type of waste generated from local business and industries if any. • Previous studies shall be referenced when drafting the waste management plan.
Implementation of Waste Management Plan			
Lack of vehicles	High	Dump trucks, lorries and pickups required for waste collection and transportation within the island.	• Councils to raise funds to procure vehicles through better planning and budget control. • MEE to provide aid in procuring vehicles for waste collection. • Councils to make contracts with vehicle leasing companies or individuals who own vehicles, for waste management. • Granting agencies or charities may be approached.
Lack of budget and financial capacity for start-up.	Moderate	In order to operate the IWMC, employees shall be hired. Initial start-up cost of operation will be significant.	• Councils to make better financial plans and to raise funds to start up waste management. • MEE to provide aid to start-up the waste management operations. • Obtain assistance/grants from charities and international authorities. • Councils to make contracts with private/state companies to operate the IWMC.
Operational cost and income from waste services not feasible	Moderate	In islands where dwelling households and enterprises are low, operating a waste collection service and managing the IWMC may not be feasible to sustain.	• Councils/MEE to identify feasibility of waste collection services. • Councils to conduct intensive willingness to pay surveys. • MEE to review individual WMP's and

			categorise islands based on feasibility of implementing a waste collection and IWMC management plan with regards socio-economic condition of the island. • Councils to increase fees in case income do not meet operational cost. • Lowering operational cost through effective management. • Devise a cost sharing scheme in the form of subsidies for islands. • Create a market to sell compost to increase income. • Plan regional waste management plans to encompass limitation at island levels waste management.
Lack of knowledge with regard to composting	High	Composting is the most significant aspect of island level waste management, hence knowledge regarding compost management will be vital to sustain island level waste management. Many of the councils do not have experience with regard to composting.	• Awareness and capacity building as described above. • MEE to invite experts from related fields to share knowledge and past experience.
Unfamiliarity with the proposed waste management equipment	High	Same as above	
Poor knowledge of waste management progress/failure indicators and roles/responsibility of stakeholders	High	Same as above	Same as above

The analysis showed that, significant risks exist to draft/design the island level waste management plan and implement the waste management plan once the IWMC's are constructed. This entails a higher risk for the overall failure of the IWMC during the operational phase which would result in accumulation of negative impacts detailed in **Section 9.3**. Hence, design and implementation of a thorough island specific waste management plan is identified to be crucial for the successful operation of the IWMC.

At present a standard operation procedure of the IWMC's is not available for implementation in cases where adequate IWMP's have not been prepared and approved by the time IWMC

construction is completed. Hence the risk of IWMC's failing during the operational phase are very high.

Section 2.5.1 below summarises the approved IWMP of Ha.Uligam which demonstrates the challenges described in **Table 8**.

In order to prevent conversion IWMC's into waste dumpsites as commonly observed in the Maldives, the report recommends to follow an intermediary management plan as described in **Section 2.5.2**, until a workable and effective IWMP is prepared and approved.

2.5.1 Ha.Uligam WMP

Under the Waste Management Plan (WMP), the Island Council of Uligam has highlighted that waste management is one of the most pressing issues for the island. The waste management plan of Ha.Uligam is attached in **Annex 11**. The Council estimates that the majority of the waste is produced from households. Household generated waste mainly include garden waste, kitchen waste and other categories such as nappies. WMP is formulated such that the council undertakes the responsibility of operating the IWMC. However, the council mentioned that it had plans to assign Fenaka to undertake operational activities of the IWMC.
The Council proposes the following targets to achieve in order to manage the aforementioned waste:

- Waste Management rules to be formulated and passed by the council. Public awareness programs to be held to provide information regarding the newly formed rules;
- implementation of a waste collection system;
- implementation of a waste recycling system; and
- provision of dustbins to collect waste at various recreational areas.

In order to provide the waste collection service, the Council proposes the use of a vehicle which will operate every day from 9:00am to 12:00pm. The Council will monitor the aforementioned works.

The council proposes the following fee system for waste management works:

- Residential households: 100 MVR
- Small –medium enterprise: 150-200 MVR
- Government Institutions: 200 MVR
- Large enterprise: 200 MVR

2.5.2 Intermediary Waste Management Plan

Based on the analysis of prepared Waste Management Plan (WMP) and challenges faced by the council to draft and implement WMP's, it is recommended to follow the intermediary waste management plan proposed as a guideline to:

1. Prevent the IWMC from becoming a dump site. Uncontrolled waste disposal into the IWMC will quickly overfill the IWMC causing damage to the structure and resulting in burying and burning waste at the IWMC and
2. act as a contingency in case WMP is not prepared by the time IWMC's are constructed.

The intermediary WMP shall be used as guideline to achieve the objectives described above.**Table 9** notes important aspects which shall be considered during the intermediary phase of IWMC implementation by significant stakeholders. It highlights the relative potential risk of IWMC failure as a result of not fulfilling the activity.

Table 9: Intermediary waste management plan

Activity	Responsible stakeholder	Recommendation	Activities potential risk contributing to IWMC failure
1. Establish IWMC management team	Island council	Waste coordinator and 2-3 laborers	Major
2. Awareness and training	MEE	At least 5 selected people including assigned waste coordinator, council employees, teachers etc shall be trained to manage the IWMC, operate and troubleshoot waste management equipment. The aim of the sessions shall be to equip participants with enough knowledge so that they can train other people. In order to accomplish this, a training course shall be designed where industry experts shall share knowledge and past experience.	Major
3. Assign IWMC operating times	Island council/ IWMC Management team/MEE	During the intermediary phase it is recommended to operate the IWMC for at least 6 hours.	Moderate
4. Establish waste collection criteria	Island council/ IWMC Management team/MEE	Since, a waste collection system is unlikely to be designed during this stage, waste shall be taken to the IWMC by individuals during the IWMC operating hours. Waste shall be accepted when it has been separated into three constituent categories as follows: 1. Kitchen waste 2. Yard waste 3. Plastics metals, glass and others. Category 3 shall be sorted by the laborers and stored at the respective compartments while organic waste shall be used for composting or stored in bins.	Moderate
5. Install organic waste collection bins	MEE	Each IWMC has enough space to store approximately 20-25 660L bins which will hold organic waste for approximately 1.5-2 weeks. These bins shall be provided	Major

		prior to starting waste management operations	
6. Waste management activities			
a) Sorting	IWMC management team	Daily	Major
b) Metal compacting	IWMC management team	Rarely. Waste audits show that percentage of metals are very small hence it is likely that this activity will have to be performed rarely. An exact schedule for these activities, shall be drafted after assessing incoming waste streams for the island.	Minor
c) Plastic shredding	IWMC management team	Occasionally	Moderate
d) Bottle crushers	IWMC management team	Occasionally	Minor
e) Compost management	IWMC management team	Daily	Major
f) Determine amount of waste generated	IWMC management team	Weekly. This could be done using scales or by estimating volumes. This information will be useful to take preventive measures before the IWMC runs out of storage space. The reporting plan described in **Section 10.3** shall be followed during this stage as well.	Major
g) Maintenance of IWMC	IWMC management team	The IWMC shall be cleaned and maintained daily	Moderate
h) Regular transportation of waste from IWMC to Regional Center	MEE/Island Councils	MEE shall make the necessary arrangements to transport waste from the IWMC to the regional center. In case, the regional WMC is not operational by the time IWMC's are constructed, MEE shall make alternative arrangements to transport waste from IWMC's to the nearest waste management center at Thilafushi. MEE shall regularly monitor reports from respective IWMC's and plan ahead before the IWMC's run out of storage space. Inability to transport waste from the IWMC's during this phase of the operation could result in failure of the nationwide waste management concept. See **Section 2.3.2** which estimates monthly waste	Major

		generated at the island. Assessments have shown that the IWMC's can store organic waste for a maximum period of 1.5-2 weeks in 660L bins.	
7. Enforce rules to stop disposal of waste into areas other than IWMC	Island council	The island council shall enforce rules and penalties to prevent pollution of the environment. Public announcements shall be made to inform IWMC operating hours etc.	Moderate

2.6 PROJECT DURATION AND SCHEDULE

The proposed Project is planned to be carried out in 10 weeks. This project is expected to be opened to bidders in June 2017 and the select party notified before the end of the validity period of 90 days. A tentative schedule of the work plan is found in **Table 10**.

Table 10: Work plan for IWMC

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

2.7 PROJECT COMPONENTS & DETAILS

The proposed typical IWMC site plan is presented in **Figure 9**. Engineering details are provided in **Annex 3**.

The construction of the IWMC consists initially of mobilization and site clearing. The main works include shallow excavation, substructure and superstructure works as well as masonry works. The proposed design of the IWMC requires a shallow foundation due to the structure being a single storey structure. After the structural works are done, masonry, plastering, roofing works are completed prior to the addition of the services components such as electricity and plumbing.

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

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

The IWMC is made up of an equipment room, and separate areas to store metal waste, paper and cardboard, plastic waste, glass waste as well as hazardous waste.

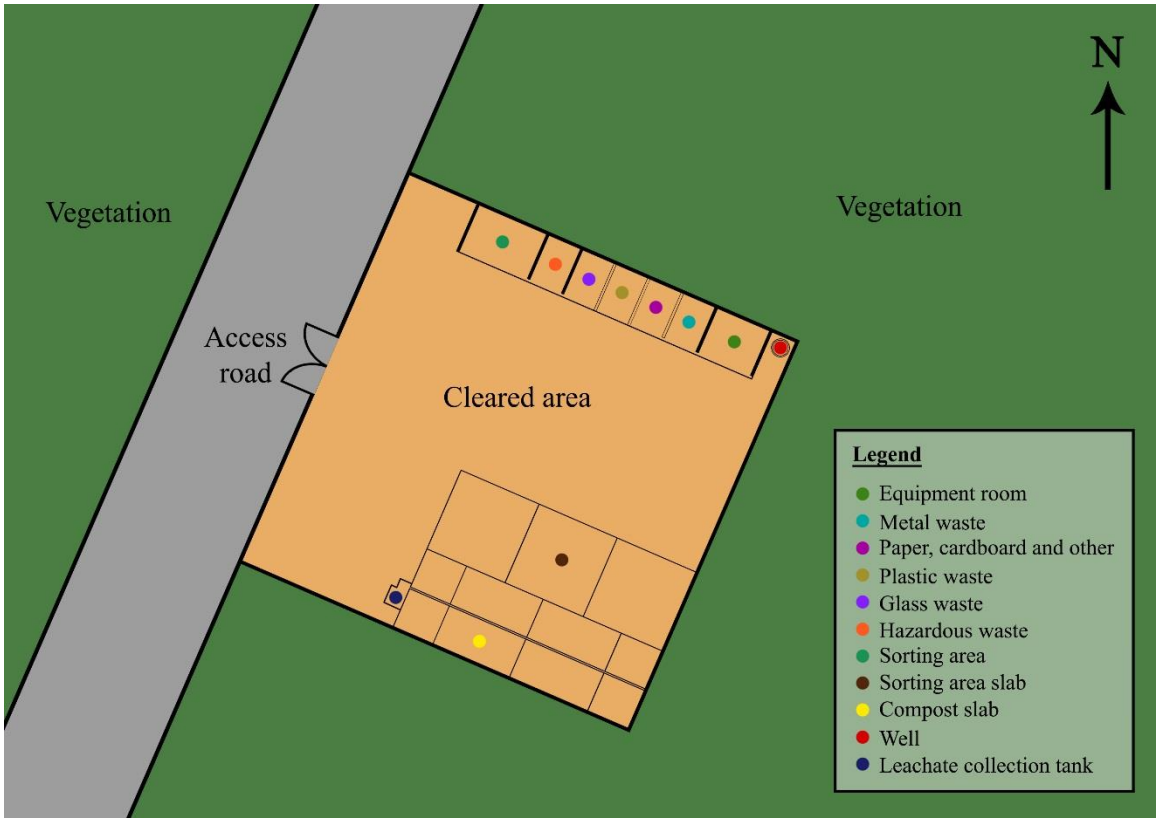


Figure 9: Typical plan of the IWMC center

2.8 CONSTRUCTION PHASE

2.8.1 Machinery

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

a) Lorry crane for placing of well;
b) Truck for transportation of materials;
c) Vibratory plate compactor;
d) Concrete mixer;
e) Concrete supply pump and piping; and
f) Daily 4" pump.

2.8.2 Mobilisation

Involves sourcing and transport of material and equipment to the island. Material and equipment will be transported by sea if it is not available from the island. Labourers/workers will be transported by air and sea.

2.8.3 Demarcation & Site Clearance

Prior to beginning construction works, a survey shall be done by the contractor to demarcate the limits of the site, determine exact number of trees intersecting with the plot and access road. The site shall be fenced off and work shall be conducted within these limits. The respective island councils are responsible for this component of the project, which include site demarcation and land clearance and its associated waste management.

Since the EIA was conducted based on actual vegetation data, it shall be used as a reference to determine the exact number of trees falling into the proposed plot and access road to be removed.

The proposed site has not been cleared and consists of shrub type vegetation. Survey data showed that the proposed plot measuring 625 m^2 can be oriented in the area such that no significantly large trees will have to be removed. **Figure 10** shows the distribution of trees at the plot. All trees within the vicinity of plot area have been surveyed.

The proposed access road measuring 7 m in width and 57 m in length has not been cleared. No large trees intersected with the proposed access road. **Figure 27** illustrates the number and type of trees in the vicinity plot area. There are no sensitive sites or protected trees within or close to the Project location.

Figure 10: Surveyed site condition and features Ha. Uligam

Before site clearance activities begin a professional surveyor will mark the boundaries of IWMC and access road using pegs. These control points will guide the construction crew during the entire process. The survey will include a tree survey which will list all tree species within the footprint of the project, including the type, height, diameter and the estimated age. Following the set out survey all trees will be marked as per its final use using a letter code; ***RI (number) – relocation within the project island***, ***RO (number) – relocation outside the project island, T(number)*** – ***timber*** **and** ***W(number) – waste***. Hence trees needing removal can fall into any of these four categories. Abbreviation shall be used to code for the location and batch, as well which would make tracking and distribution easier. The final outcome of the set out

survey will be a detailed inventory of all trees (not including shrubs, herbs and vines) requiring removal appropriately labelled.

2.8.4 Uprooting Trees

Although removal of significantly large trees will not be required from the proposed area by orienting the IWMC plot and access road as illustrated above, this section provides detailed description of method to be used when removing large trees and coconut palm trees.

All large trees within the plot and access road will require removal using hydraulic excavators (20 tonnes or higher) by direct pulling. The excavator will have a lock-out mechanism fitted to the hydraulics so that the boom does not drop if a hose bursts. During the felling process the excavator will be directly behind the tree. This is the position from which it can apply the most leverage. The excavator should contact the tree with either the bucket or live heel. Holding the tree with the grapple is not considered the best practice. The grapple can knock bark down on to the faller and even the smallest boom movement will alter the forces on the tree. Stump pullers may also be attached for removing dead stumps. In areas where undergrowth is found, the process of removing larger trees will begin by clearing undergrowth using machete or chainsaw which will be necessary for making tree access and creating work space also for enhancing visibility of the tree crown and removing obstructions in the landing zone. All the private trees that have been marked shall be compensated prior to removal of trees.

Site clearance will be conducted responsibly aimed at removing only targeted trees that are pre-labelled and identified. Work will be done under strict supervision and clear record keeping by the site supervisor. Work can progress in multiple sections simultaneously depending on availability of workers, supervisors and equipment. Within a given section, trees removed for timber will be uprooted using excavator arm, the trees will be pushed from the mid-section until the root bulb detaches from the ground and falls down. The uprooted trees will be set aside until all the trees in the surveyed section has been removed.

i) <u>Trees for relocation</u>

Trees identified for re-location shall be removed with extreme care as palms are not very tolerant of extreme root disturbances.

The following section highlights removal method for palm trees. Since the proposed area project area at Ha.Uligam do not have palm trees which may require removal, the method described below can be adapted to relocate and remove other types of medium to large trees.

According to literature, for palms less than fifteen feet in height, a root ball of shovel-width radius from the trunk is a common industry average for size of root ball that needs to be carefully extracted. This would provide for adequate root survival chance once the tree is replanted elsewhere (Broschat & Meerow, 1997).

Soils that cling to the root ball are the most amenable to mechanized harvest. Prior to digging, the soil around the root system will be thoroughly wetted to help keep the root ball together. Palms grown on sandy soils will usually need to have their root balls burlapped after digging, while palms grown on soils with greater structural integrity may not require burlapping. Excess sand shall be removed prior to burlapping. However, since trees will be stacked for some time before being transported to replanting site, it is recommended to burlap all palm trees removed

for relocation. A supporting splint will be required to tie each trunk and this will extend up to the foliage to protect the bud.

The greatest loss of water in newly dug palms occurs from transpiration through the leaves. To minimize this, one half or more of the older leaves will be removed at the time of digging. The remaining leaves will be tied together in a bundle around the bud with a twine.

Once the palm tree is carefully extracted it will be transported and stacked at the harbour area, where it will be transported out of the island by concerned parties. The root ball cavity will be filled and levelled. Sand shall be used as a fill material for the root cavities before levelling. (See **Figure 11** for an illustration of uprooting method)

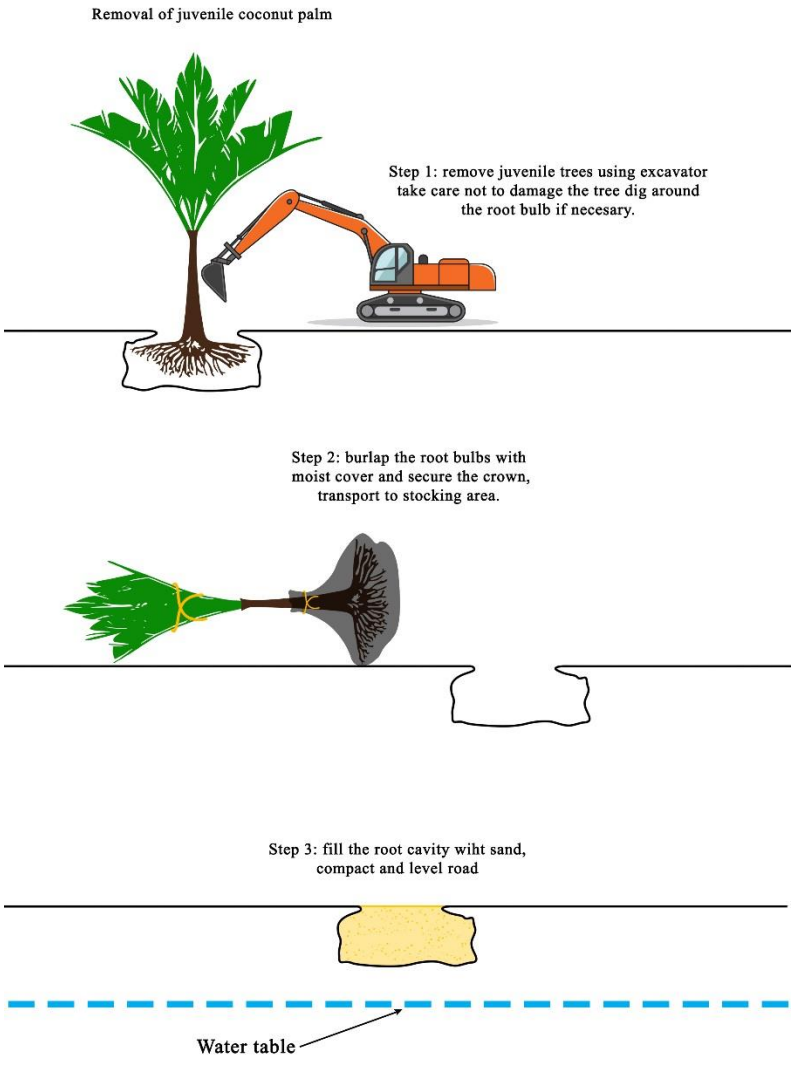


Figure 11: Illustration of uprooting palm trees for re-plantation

If the water table is reached during removal of trees, sand shall be used to cover up before adding organic material. Trees removed for relocation out of the island shall be stored at the designated areas illustrated in **Section 2.8.12**.

ii) <u>Trees for timber</u>

All fronds and root bulb and base of the trunk of the tree that is felled for timber or firewood shall be cut using a chainsaw and only trunk will be transported to the stockpiling area to be sold. Parts of the root bulb will be used for backfilling of the depression created (See **Figure 12** for illustration of removal method). The use of root bulbs for backfilling or grinding the stump of the root bulb will minimise waste generated during site clearance, maintain original soil conditions as well as minimise additional sand needed for filling. All fronds and nuts will be removed from the terminal bulb and piled up separately. Nuts will be sold and fronds will be left to dry and eventually burned. All residual waste shall be disposed of as described in **Section 2.8.12**.

Similarly, all the undergrowth and other trees will be removed and depending on the size of the tree, excavator or chainsaw shall be used. Branches of shrubs and other types of trees will be cut to manageable pieces to be stockpiled for firewood and smaller branches and leaves will be left for sun drying after which they will be burnt.

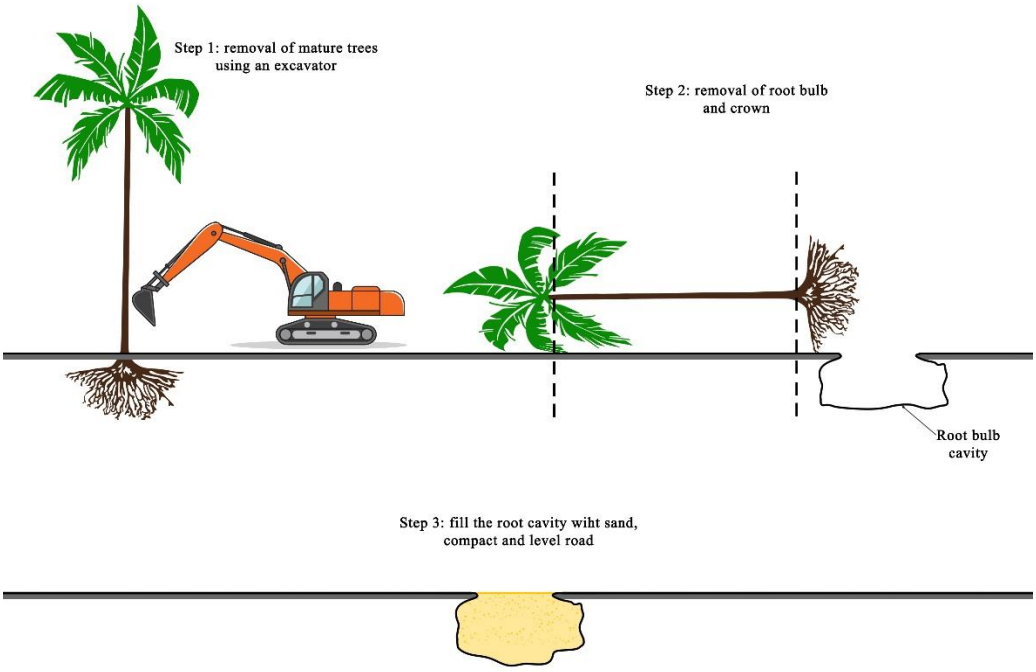


Figure 12: Illustration of removal of trees for timber

2.8.5 Construction of Sorting Area Foundation

The storage areas consist of a 3.15 m by 18.85 m area in the IWMC. The proposed foundation below the masonry walls of the structure is a line (strip) foundation.

2.8.6 Construction of Compost Slab and Sorting Area Slab

The compost slab and sorting area slabs has an area of 15 m by 10 m. The 100 mm thick reinforced concrete slabs are cast over ground beams B1, B2 and B3. The ground beams B1 and B2 have a depth of 0.3m while B3 has a depth of 0.4m from the top of the slab. B3 has a void on top of the beam centrally to receive a 100mm PVC pile cut in half sloping at 1% from the upper end to the lower end, connecting to the leachate tank at the end. Excavations will be

done manually to receive the ground beams as per the drawings indicate. The maximum depth of excavation for the beams is 0.4m. The construction of the slab and ground beams include initially laying of HDPE membrane on the slab and beam footprint. Formwork will be added to the sides of the beams, and following that, the arrangement of the required reinforcing steel. Concrete will be poured for the ground beams, followed by the slabs. Concrete mixing will be done on site.

2.8.7 Construction of Leachate Tank

The leachate collection tank is located at the end of the compost slab. The leachate tank has an area of 1.1 m by 1.5 m and a depth of 1.09 m extending below ground. The valve junction of the leachate tank has a size of 0.8 m by 0.55m, and has a depth of 0.63 m. Excavation of the leachate tank area will be done to the required depth. Formwork is placed to the sides prior to placement of 10 mm reinforcing bars at 100 mm centre to centre distance, horizontally and vertically. The mixed concrete will be poured into the formwork and curing commences until the concrete reaches desired strength. The excavation can be done manually and the excavated material is stored on the side of plot.

2.8.8 Construction of Perimeter Fence

The perimeter of the site covers a total length of 100 m, of which the whole length will be fenced except the gate area. The fencing includes a 150 mm thick masonry wall of 0.6 m height from ground level, followed by the PVC coated mesh fence of elevation 2.8m from ground level. The mesh is held together by 50 mm diameter GI pipes vertically 2 m centre to centre which are welded to three evenly spaced 38 mm GI pipes horizontally. The strip foundation below the masonry wall has a depth of 0.3 m with a 50 mm thick lean concrete placed below. Each vertical GI pipe is fixed to a 300 × 300 mm concrete footing with a depth of 0.6 m. The GI pipe is welded into a 200 × 200 mm plate. Therefore, the excavations done for the masonry wall strip foundation and GI pipe footing will be at 0.35 m and 0.6 m respectively. The trenches required to receive the strip foundation and footings will be excavated manually.

2.8.9 Construction of Well

A well is proposed to be constructed at the eastern corner of the IWMC. This well is 900 mm in diameter and the walls will be precast concrete while the base and top cover will be precast reinforced concrete. The pre-casting of the well will be done on site. Excavations will be done to a depth depending on the depth of the water table. It is approximated from previous excavations and wells nearby that the depth of the water table will be at 0.6 m from ground level. After the excavation, the well base and body is fitted into the pit, and the top cover is laid on top of it. A lorry crane will be used to lower the body into position.

2.8.10 Construction of Superstructure

The superstructure of the IWMC consists of the sorting area, storage area and the equipment room. The structure consists of a 3 m high wall separating the compartments. The roofing is supported by GI Pipes of diameter 38 mm and 75 mm. The roofing is made of LYSAGHT roofing sheets.

2.8.11 Labour Requirements and Availability

A 10-person workforce would be involved in the construction. It is encouraged to choose workers from within the island, to reduce the impacts of influx of non-local workers. If no such arrangements are made, labour accommodation will be arranged for the 10-person workforce in vacant houses. The EIA strongly recommends not to create temporary shelters for the

workers to minimise environmental impacts and to enhance socio-economic benefits of the Project to the community.

2.8.12 Waste Management

Construction waste, which would mainly consist of excavated earth, nylon cement bags and general construction debris shall be collected and temporarily stockpiled in the cleared area next to the project site.

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

A. Biodegradable waste

Wastes such as leaves, paper, and materials collected from cleaning of the public areas will be stored as describe in **Figure 13.** Only organic waste generated during site clearance shall be burnt to reduce its volume. Large wood stumps shall be cut into smaller pieces and sold to locals to be used for firewood or carpentry. If not sold they shall be stored in bins or sacks and transported to nearest waste management facility.

B. Non-biodegradable waste

Materials such as plastics and glass will have to be collected separately and transported to nearest operational waste management centre during waste transfer. These will most likely be nylon cement bags, wrappings, steel/glass leftovers and other municipal waste generated at the construction site.

C. Kitchen waste

Food wastes and other biodegradable wastes generated in food preparation shall be buried in the ground. The pit dug to bury such wastes shall not reach the water table.

D. Waste from Site Clearance

Most of the waste is expected to be generated during the site clearance process. Since the project involves removal of trees and shrubs, a large volume of yard waste will be generated during construction phase.

For those trees that are not suitable for re-planting but may be useful as timber the crown and root bulb of the trees will have to be removed and those residual parts generated will become waste elsewhere. This is mainly because the root section trees comprises of low quality or unusable wood. This means the Project's negative impact will be extended, beyond project island. Transportation of these waste will not be viable hence, the following waste reduction strategy shall be applied.

1. The highest priority shall be given to reduce the number of trees removed during the site clearance. Careful surveying and strict supervision shall ensure that the trees removed are absolutely essential;
2. trees that are removed because they fall on the footprint of the IWMC and access road shall be attempted to relocate;
3. those trees which require removal but are not suitable for replanting shall be assessed for their suitability for use as timber or firewood;
4. only once these uses have been thoroughly exhausted can a tree be considered as "waste"; and

5. yard waste generated after relocation of trees shall be managed at the island level by burning them as described below. Those that cannot be managed at the island shall be transported to nearest operational waste management centre.

E. Burning of Site Clearance Waste

Yard waste shall be burned only after attempting to reduce site clearance waste as described in the report.

The crown parts of the palms, tree branches, shrubs, stumps produced as residual waste can be cut into smaller pieces using a chainsaw or wood chipper can be left to dry on the island**.** This would significantly reduce transportation cost and associated GHG emissions. Furthermore, the soil will be nourished by the biological activity facilitated by the buried root bulb and the amount of fill material required for levelling will be significantly reduced.

Since transportation of all the yard waste from the island will be prohibitive in terms of costs and other resources required, residual yard waste at the site, shall be left to dry and burnt them at a designated safe area away from residential areas. Burning shall be carried out in an open area that would not impact unintended vegetation. Care should be taken to contain fire within the area of burning to prevent fire becoming uncontrolled. Plastics, metals, fabric and other inorganic wastes shall NOT be mixed with yard wastes while burning. Wood ash contain calcium, potassium, and a variety of trace minerals important for plant health. They also work well as a lime substitute to raise the pH of acid soils. They can also be stored in sacks and used for composting once the IWMC becomes operation. In effect this means, majority of yard waste generated from land clearance can be managed at the island level avoiding the costlier transportation of these waste to the nearest waste management facility.

F. Hazardous waste

Hazardous waste from machineries such as oils, solvents, batteries etc shall be sealed in labelled containers and shall be stored on paved hard surface before being transported to the nearest waste management centre. They shall be stored at the designated areas illustrated in **Figure 13** prior to transportation. It is essential to ensure that hazardous waste is fully contained and transported as quickly as possible. It is recommended to install signs in the designated temporary storage area.

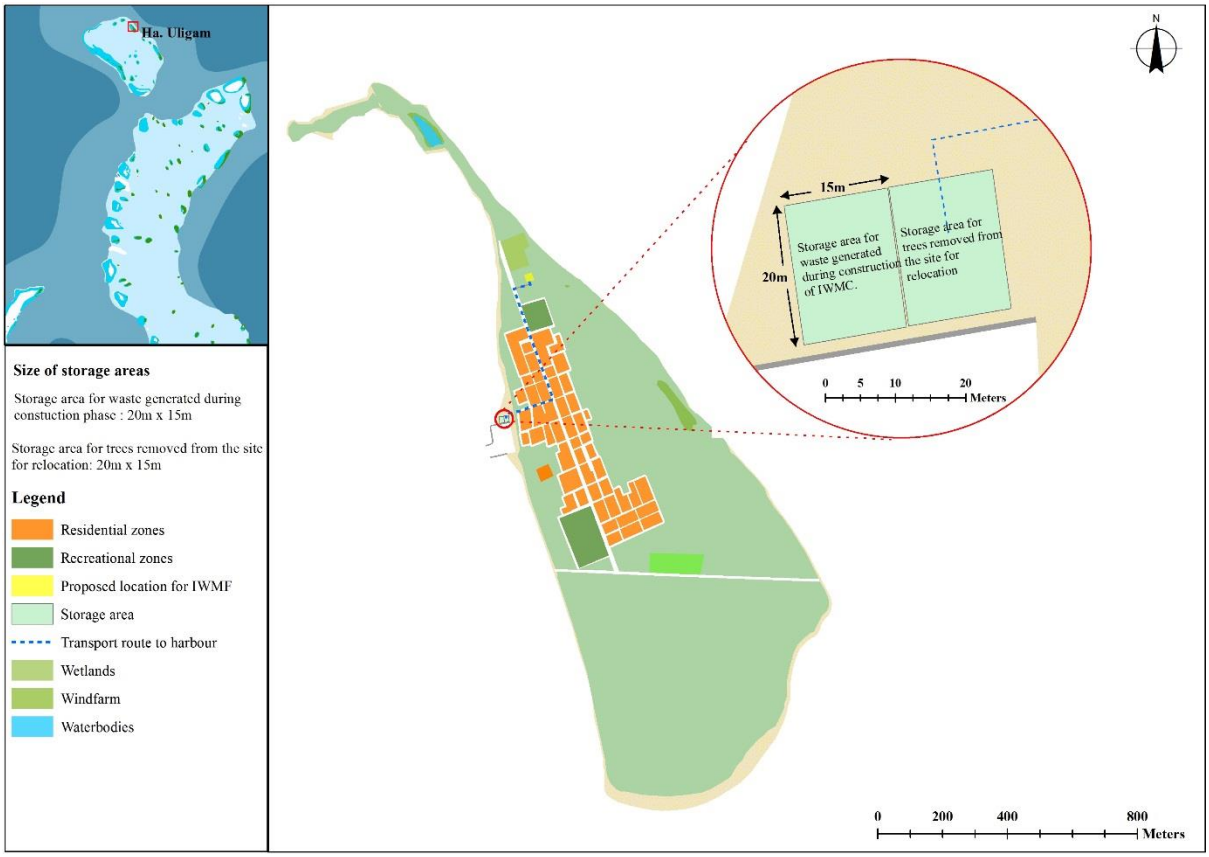


Figure 13: Waste transportation route and storage area Ha. Uligam

2.8.13 Pollution and Control Measures

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

a) Machinery to be properly tuned and maintained to reduce emissions/spills/leaks;
b) fuel storage, paint, lubricants will be stored securely and bonded; and
c) spill kits would be made available on site to control any liquid spills.

2.8.14 Health and Safety Measures

The proposed project involves transportation as well as construction of the IWMC at the site. These works will include use of vehicles, machinery, and heavy materials, and the workers may be put in situations where there is a risk of injury. These risks need to be identified and managed through the implementation of health and safety guidelines for the site. Health and safety measures for the construction phase include and are not limited to:

a) The contractor would be briefed regarding the laws and regulations that need to be followed regarding the proposed works and would ensure that Health and Safety procedures are complied with at all times;
b) there would be a construction supervisor at the site;
c) only experienced and licensed operators will be allowed to operate heavy machines;
d) first aid kit should be made available at the work site;
e) the work force would be equipped with all safety gears and warning signs would be provided;
f) fire extinguishing equipment would be available at the site;
g) PPE should be provided to all workers and the use of PPE enforced;
h) operation of any heavy machinery will need the assistance of a banksman as all times;

i) all heavy lifts must be supervised and slings inspected; and
j) all other similar environment personal safety and quality control measure to be in place and checked by a qualified personal and approved and maintained at all times.

2.8.15 Demobilization

The demobilization plan will commence in the last week of the contract. No waste generated from the construction works shall be left on the island and the Project site shall be handed over to the respective stakeholder.

2.9 OPERATIONAL PHASE

The following sections will highlight the operational aspects of the IWMC. This includes the machinery and equipment proposed to be used in the IWMC, in addition to the main activities to be carried out at the IWMC and within the island. **Figure 14** shows an illustration of the operation of the IWMC and proposed waste management system.

The activities begin from the households and institutions, where the waste is generated. This waste is disposed of in the dustbins in the households as well as the dustbins placed at recreational areas and public spaces. During the operational hours, the designated vehicle will collect the dustbins and bring them to the IWMC. This collected waste is sorted into categories such as compostable waste, recyclable waste and hazardous waste. Compostable waste is used in making compost while glass, plastics and metals undergo volume reduction processes before being stored in their respective compartments. The hazardous waste is stored in the hazardous waste compartment.

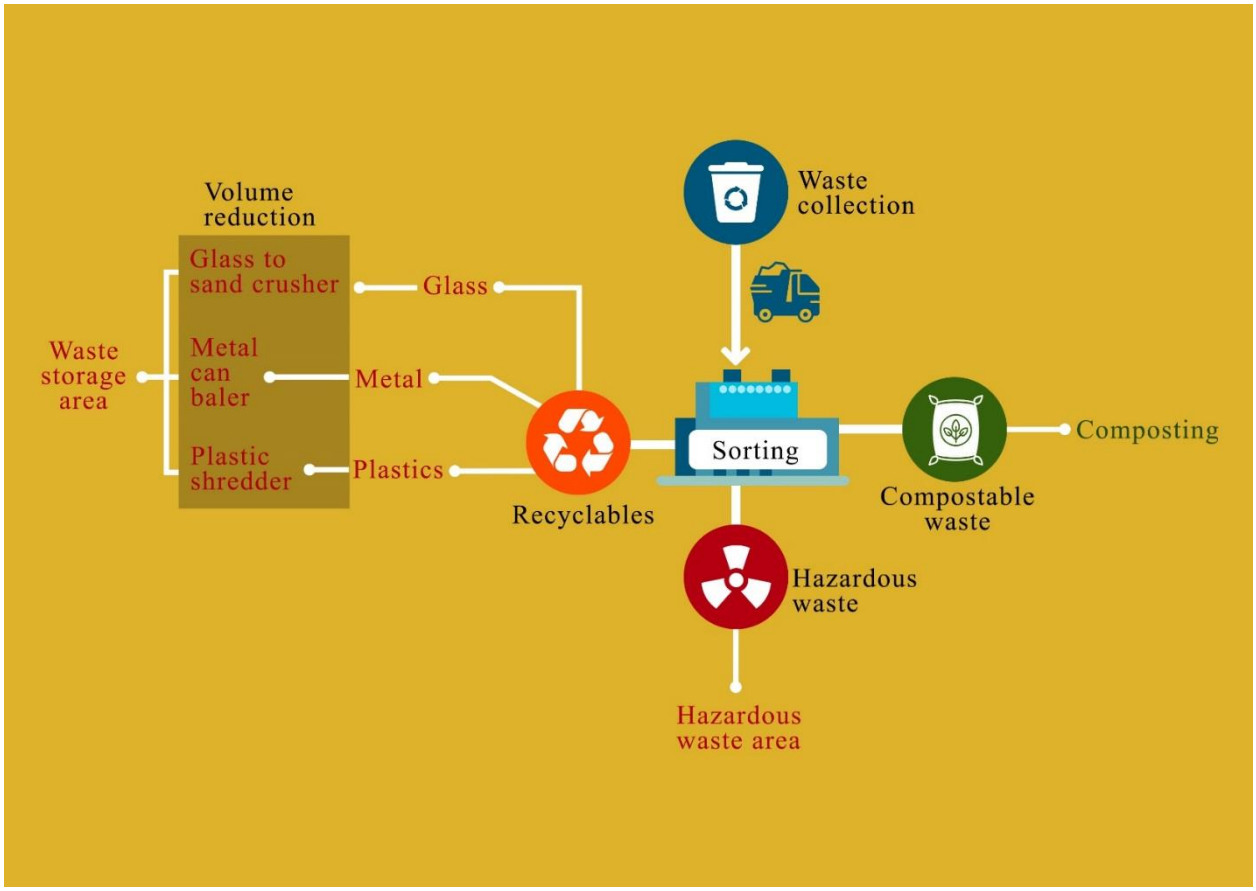


Figure 14: Operational phase flowchart of the IWMC

2.9.1 Machinery and Equipment

During the operational phase of the IWMC, in addition to the collection of the waste and sorting, different activities such as composting, and waste volume reduction will be done. The proposed equipment for the IWMC include general equipment needed to handle the waste such as wheelbarrows, garden hoes, shovels, buckets and cultivators. This equipment will be used during the IWMC operation for handling as well as composting operations. A manual rotary compost screen is also included for the screening stage of the composting process.
Other equipment includes waste volume reduction equipment such as a plastic shredder, metal can baler, vegetation shredder, and glass to sand crusher. The equipment and their specifications are detailed below.

Table 11: Equipment proposed for waste management works

Equipment	Details
Chainsaw	
Wheelbarrow	HDPE 6 cub. Ft.
Heavy Duty Gumboots	PVC or rubber
Heavy Duty Hand Safety Gloves	Rubber or Latex
Long Handled Flathead Steel Rake	Steel, 54 inches length
Long Handled Cultivator	Steel, 54 inches length
Garden Hoe	Steel, 57 inches length
19” Round Point Shovel	Steel
48” Square Point Shovel	Steel
19” D-Handle Square Point Shovel	Steel
20L Bucket	HDPE
40L Bucket	HDPE
Polypropylene Surgical Mask Box (50pcs)	Polypropylene
Weighing Bench Scale	50-75 kg capacity
Wheelie Bins	HDPE
Glass to Sand Crusher	0.5 to 1.0 tonne/ hr, output 0.5mm and less, 2-5HP motor
Plastic Shredder	30-100Kg/hr Output material less than 10mm
Metal Can Baler	3 to 5 HP, 2m2 or more inside volume
Vegetation Shredder	Petrol / diesel driven multi vegetation shredder / chipper
Manual Rotary Compost Screen	1m to 1.5m drum

2.9.2 Waste Collection

The waste management plan of Ha.Uligam has not been approved. Hence a definitive collection method has not been established. However, the council plan to assign waste collection and management works to a third party opposing the drafted WMP attached in **Annex 11**.

2.9.3 Sorting

As per the IWMC site layout plan, a ground slab is dedicated for the sorting area. This sorting area is located next to the compost slab. Here, the collected waste will be kept, and sorted into their respective categories. In addition to this, a dedicated sorting area is also provided

alongside the storage areas. The IWMC is designed to have separate storage areas for metal, paper and cardboard, plastic, glass, and hazardous waste. After sorting, the waste is stored in the respective location.

2.9.4 Composting

The IWMC is designed in order to facilitate the storing, sorting and reusing of the waste generated in the island. One of the main operations that will be conducted in the IWMC is the composting of the organic waste such as kitchen waste and garden waste. Composting uses the process of the slow decomposition of the organic matter by various microorganisms, in an optimised and controlled process. The process is controlled in terms of parameters such as input materials, temperature, moisture and pH. The finished product of composting can be sold as fertilizer, thus enabling the reuse of the waste collected within the island.

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

2.9.5 The Composting Process

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

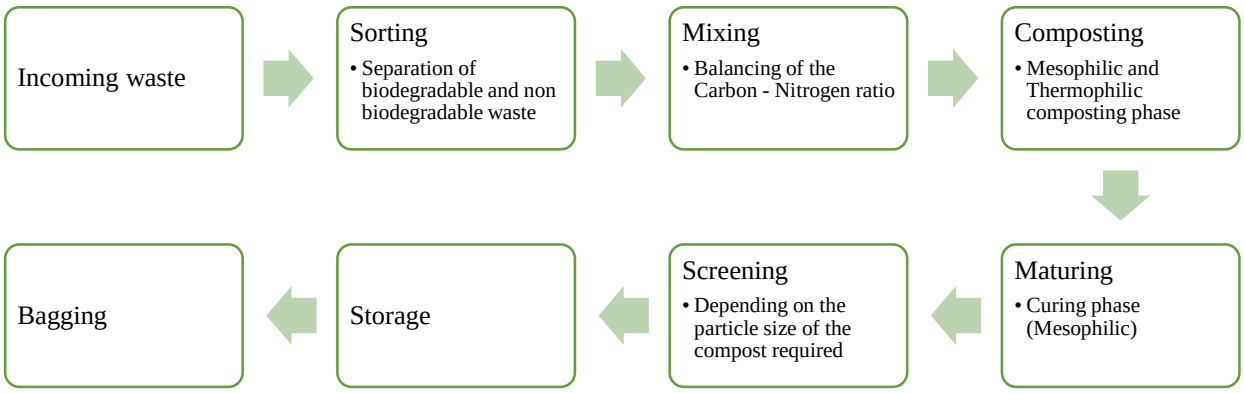


Figure 15: The composting process

2.9.6 Sorting of Incoming Waste

Incoming waste will be sorted to separate biodegradable and non-biodegradable waste. Even though this is the case, further sorting of the biodegradable materials is done in order to separate garden waste, food waste and others such as scrap paper and cardboard. Hazardous waste and residues are kept in their respective compartments, as well as recyclables. A compactor will be used to reduce the volume of the waste as needed.

Table 12: Domestic Waste Categories

Incoming Domestic Waste			
Suitable for composting	**Not suitable for composting**		
Biodegradable materials	**Hazardous materials**	**Others**	**Recyclables**
Organics • Food waste • Garden waste • Animal waste Paper & Cardboard • Printed paper • Cardboard	• Paints & Solvents • Batteries • Cleaners • Expired medicine • Medical waste • Pesticides • Special (Nappies, tampons)	• Textiles • Wood • Inert (Dust/Dirt/Ash/Rock) • Liquid container	• Metal • Plastic • Glass
Composting Process	**Storage**		

2.9.7 Mixing (Carbon – Nitrogen Ratio)

One of the most important factors in the process of composting being successful is the Carbon – Nitrogen ratio. Carbon is used for energy by the microbes in order to continue with the decomposition, while Nitrogen is needed by the microbes to grow and multiply. The optimum Carbon – Nitrogen ratio is 25 - 30:1 (DEC NSW, 2004). If the ratio is less than 30:1, it would result in the loss of Nitrogen as ammonia gas which would result in undesirable odours. If the ratio is greater than 30:1, it results in the cooling of the compost and slow degradation of the pile.

Looking into the composition of compostable wastes from the Zone 1 Waste Audit, it is seen that the majority of compostable wastes constitute of garden (green) wastes. Garden wastes make up 64% of waste generated, while the second largest contributor to compostable wastes is kitchen wastes, at 28%. Printed paper and cardboard make up 5% of compostable waste while 2% of the category includes animal waste. This composition is important in determining the Carbon-Nitrogen ratio of the compost heap in order to provide optimum conditions for composting.

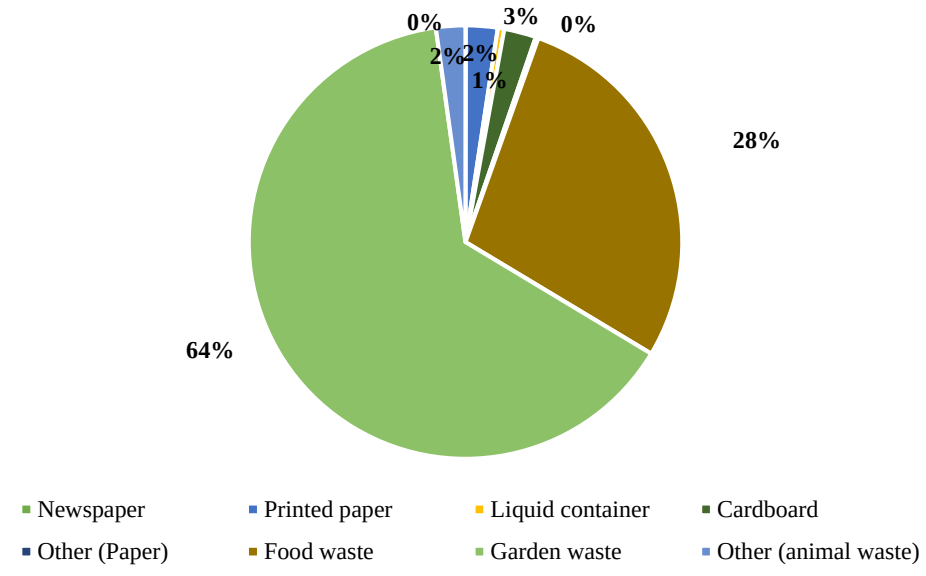


Figure 16: Composition of compostable waste for Zone 1

Table 13: Estimated compostable waste generation quantities of Zone 1

CATEGORY		Average Per Capita (kg/day)	Percentage
Primary	**Secondary**		
Paper & Cardboard	Newspaper	0.00	0.0%
	Printed paper	0.02	2.4%
	Liquid container	0.00	0.5%
	Cardboard	0.02	2.4%
	Other (Paper)	0.002	0.2%
Organics	Food waste	0.29	28.2%
	Garden waste	0.67	64.2%
	Other (animal waste)	0.02	2.2%
Total		1.04	100

Green wastes such as vegetable wastes (kitchen waste), and poultry manure have high Nitrogen values while brown wastes such as foliage, wood chips, bark and paper have high carbon values. From the waste audit, it is seen that 64.2% of the compostable waste produced is garden waste while 28.2% of the waste generated is food waste. Therefore, it can be said that the composition of compostable waste in the Ha.Uligam is in favour of providing a high Carbon content compared to Nitrogen.

2.9.8 Composting and Maturing

Thermophilic composting is the process of composting using thermophilic (heat-loving) bacteria. Thermophilic composting consists of three phases which have been detailed in table. As seen from the table, the composting process can prolong to several months.

Table 14: The phases of composting

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

2.9.9 Leachate Management

As the process of composting occurs, leachate will be produced from the organic waste within the compost pile. The composting will be done on the specially constructed compost slab. This slab is 15m long by 5m wide. The bottom of the slab and ground beams in this area have an HDPE membrane between the reinforced concrete and the ground.

In addition to this, the expansion joints of the compost slabs are filled with silicone and polythene joint filler foam. This ensures that the leachate does not leak into the ground. The compost slab is also designed with a 1° slope from both sides, towards the centre, where the ground beam is fitted with a 100mm PVC pipe cut in half with 1% slope towards the leachate collection tank. The leachate is then collected in the dedicated leachate collection tank at the end of the compost slab.

2.9.10 Volume Reduction

The incoming waste is sorted, and either used for composting, or stored in their respective compartments. Prior to storage, volume reduction of the waste is conducted. This includes metal can baling using the metal can baler, plastic shredding using the plastic shredder, and glass bottle crushing using the glass to sand crusher. The resulting reduced volumes of the waste is then easily stored in their respective compartments.

2.9.11 IWMC Design Capacity

The IWMC is designed to manage 20-30% of organic waste generated in the island. Approximately 70 – 75% of waste generated within the island is to be transported to the nearest RSWMF. The projected capacity for 1 month's waste for Ha.Uligam is shown in **Table 15**.

Table 15: Projected waste management capacity for Ha Uligam in 1 month

Waste Type	Details	Amount	Unit
Organics	Composting capacity in IWMC. Assuming 1m height windrow with a width of 2m	39	m^3
	Organic waste generated per month	22.2	m^3
Paper waste	Storage capacity (2.5m by 3.15m compartment assuming height of pile 1.5m	7.875	m^3
	Waste generated bulk density after volume reduction 0.65 tons/m^3	1.521	m^3
Glass	Storage capacity (2.5m by 3.15m compartment assuming height of pile 1.5m	7.875	m^3
	Waste generated bulk density after volume reduction 0.65 tons/m^3	0.437	m^3
Plastics	Storage capacity (2.5m by 3.15m compartment assuming height of pile 1.5m	7.875	m^3
	Waste generated bulk density after volume reduction 0.65 tons/m^3	1.970	m^3
Metals	Storage capacity (2.5m by 3.15m compartment assuming height of pile 1.5m	7.875	m^3
	Waste generated bulk density after volume reduction 0.65 tons/m^3	0.40	m^3

The calculations showed that the IWMC will have the capacity to manage 39 m^3 of organic material through composting, which means that the facility will be able to manage one month's organic waste from the island. Since composting may take 3-4 months, it is calculated that 60-80 m^3 of incoming organic waste will have to be stored and transported to the regional center before initial compost batch is matured. Our calculations show that 16 660L bins will have to be used to store the excess organic waste at the IWMC for two weeks. Since, the IWMC has space to accommodate approximately 20-25 660L bins this will be a viable option to store excess organic waste. This means waste from the IWMC will have to be transported by two weeks to prevent over loading the IWMC.

2.10 PROJECT INPUTS AND OUTPUTS

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

Table 16: Project inputs

Stage	Input	Source / Type	Estimated Amount	Means of obtaining the resources	Comments
Construction	Workers	Local and foreign	10	Encourage the use of local / regional workers	-
	Fuel	Diesel	-	Local Suppliers	-
	Water	Groundwater for non-potable use	Average 150 l/p/d	Groundwater wells present in the island	-
	Materials	Concrete	29.66 m^3	Local Suppliers	-
		Reinforcement			
		Reinforcement T10	1.231 tons	Local Suppliers	-
		Reinforcement R6	0.19 tons	Local Suppliers	
		Reinforcement T12	0.09 tons	Local Suppliers	
		Formwork	135.66 m^2	Local Suppliers	-
		Masonry Works (200mm bricks)	205.8 m	Local Suppliers	-
		Structural Steel			
		50mm and 38mm GI Pipe for perimeter fence	77.4 m	Imported / purchased where available locally	-
		75mm GI pipe (flood light fixing poles and roof fixing)	18 Nos.		
		38mm GI bearer pipes	46.2 m		
		38mm GI purlin pipes	95 m		
		38mm GI pipes between columns	35.2 m		
		75mm GI pipe to support machine room door	3.5 m		
		Paint			
		Primer and 2 paint coats (Grey Color)	345.96 m2	Local suppliers	-
		Electrical Components			

		3 Phase power sockets	4 Nos.	Local suppliers	-
		Single phase power sockets	3 Nos.		
		100 mm ceiling mount lights	1 Nos.		
		Wall mount exhaust fan	2 Nos.		
		500W flood light	2 Nos.		
		25 mm2 4 core power supply cable	290 m		
		Well water pump	1 Nos.		
		Metal doors for			
		Equipment room	1 Nos.	Local suppliers	-
		Hazardous waste area	1 Nos.		
		Waste yard entrance	1 Nos.		
		Plumbing			
		25mm PVC intake pipe		Local suppliers	-
		1/2 inch PVC pipe from pump to all distribution points	40.9m		
		Roofing			
		Storage area roof sheets	85.5 m2	Local suppliers	-
		Flashing sheets	28 m		
		Lysaght gutter	19 m		
		50x50 PVC coated mesh fence	77.4 m2	Local suppliers	-
		HDPE membrane	209.54 m2	Imported / purchased where available locally	
		Timber top cover	1 nos.	Local suppliers	
		PVC pipe for leachate tank drain	15 m	Local suppliers	
		600 x 900 5mm plastic sheet signboard	1 Nos.	Local suppliers	
Operation	Equipment and Materials	Chainsaw	1	Imported / purchased where available locally	-
		Wheelbarrow	4		
		Heavy Duty Gumboots	5		
		Heavy Duty Hand Safety Gloves	5		
		Long Handled Flathead Steel Rake	3		
		Long Handled Cultivator	3		
		Garden Hoe	3		
		19” Round Point Shovel	3		
		48” Square Point Shovel	3		
		19” D-Handle Square Point Shovel	2		
		20L Bucket	3		
		40L Bucket	2		
		Polypropylene Surgical Mask Box (50pcs)	5		
		Weighing Bench Scale	1		
		Wheelie Bins	40		
		Glass to Sand Crusher	1		
		Plastic Shredder	1		
		Metal Can Baler	1		

		Vegetation Shredder	1		
		Manual Rotary Compost Screen	1		
	Waste	Waste generated within the island	18 tons/month	Waste generated from households, restaurants, industrial areas etc. Waste will be collected as per the approved waste management plan.	-
	Fuel	Diesel	5,000-15,000 L/month	Local suppliers	20-50kW
	Food supplies	Food waste	1500 [1]calorie/day/person	Local suppliers	-
	Water	Fresh water	200-1000 l/day	groundwater	-

[1] Based on recommendations provided in (NHMRC, 2013)

Table 17: Project outputs

Stage	Output	Source / Type	Amount	Means of managing	Comments
Construction	Soil	Excavation for substructure	11.78 m^3	To be used back in the levelling and backfilling of site.	-
	IWMC and access road	-	Ha.Uligam IWMC - 625 m^2 Access road – 7m ×57 m	IWMC will be managed as per the approved waste management plan according to the proposed waste management concept. Access road clearance and management will be undertaken by the island council.	-
	Waste	Construction waste	209.54 m^2	Collected in the temporary waste area and transported to Thilafushi after completion of the project	-
		Yard waste Mostly coconut wood, which is known as a medium wood. These will be sourced from mature coconut trees and other trees that intersects with the project footprint area. While a great emphasis is placed on relocating, trees some trees and branches may have to be removed and preferably used as timber or discarded as yard waste.	Approximately 5-10 tons	Management includes relocating trees to other islands etc, to reduce amount of yard waste produced. In general relocation reduces yard waste produced by 95%. (See **Section 2.8.4** for details). Yard waste produced shall be discarded at the nearest waste management center. (See **section 2.8.12 and 2.8.12** for details of waste management)	Based on measured height and girth of trees.
	Hazardous waste	Empty fuel/lubricant drums, used oil/air filters, scrap batteries, vehicle	Approx. 30 -50 l/month	Collected as per hazardous waste management guidelines and transported to	-

		parts and waste oils/grease, spent solvents/detergents and possibly spent acid/alkali from batteries maintenance		Thilafushi after completion of the project	
	Municipal waste	Workers	346.5 kg	Shall be discarded in designated containers and transported to Thilafushi during demobilization.	
	Dust	Excavation	Moderate amount of dust		
		Cement mixing	Moderate amount of dust		
	Green House Gases	Machinery			
		Concreting works	100.1kg of CO_2 indirect emissions (DEFRA/DECC, 2012)		
		Reinforcement	5311.1kg of CO_2 indirect emissions (Ma et.al, 2016)		
		PVC Pipes	164.81kg of CO_2 indirect emissions (DEFRA/DECC, 2012)		
	Noise	Construction work. Earthmoving equipment such as excavators produce noise in the range of 73-96 dBA Partially mobile equipment such as concrete mixers/cranes range from 75 to 90 dBA stationary equipment such as pumps/generators range from 70 to 80 dBA	60-80 dbA eq within 5 m of construction site	See **Section 9.3.5**.	

Operation	Compost	Open windrow composting	Approximately: 30-40 m^3	Sold as fertilizer	
	Crushed Glass	Glass crusher	See **Section 2.3.2**	Stockpiled in the IWMC compartment before transferring to RWMF	
	Compacted Metal	Metal baler	See **Section 2.3.2**	Stockpiled in the IWMC compartment before transferring to RWMF	
	Shredded plastic	Plastic shredder	See **Section 2.3.2**	Stored in the waste compartment before transferring to RWMF	
	GHG	Electricity usage	-	N/A	

2.11 PROJECT RISKS

This section addresses foreseeable risks that may be associated with the project. Even though some of these risks may carry a low probability of occurring, it is necessary to consider whether both the risk and the outcome can be managed if at all they occur. Risks can cause unnecessary delays with resulting cost implications to both the proponent and contractor. Hence identification of potential risks and implementation of management plans will be a very important exercise. Project risks have been compiled based on similar projects, published literature and experience of consultants.

Table 18 below summarises the project risks that could potentially slowdown of temporarily stop progress.

Table 18: Project risks and management

Type of risk	Risk	Risk significance	Cost driver	Description	Risk Management
Administrative risks	Design approval and environmental clearance	Moderate	Overall project cost	These include EIA and concept approval from EPA.	Ensuring that the proponent, consultants and designers fully comply with regulations and ToR set forth by the EPA. EPA and MEE to fast track the approval process.
	Delays in final design drawings and environmental impact assessments and other design documentation required for the project	Moderate	Overall project cost	Delays in final design could incur additional costs and create additional social issues within the respective island.	Ensuring that time schedule are followed, and provide the facilitation required to complete by proponent and relevant stakeholders. Simple yet efficient design, which would save cost and time.

	Changes in design and construction standards during the construction period	Low	Overall project cost	-	If the original design was deficient risks shall be borne by proponent. If required by the authority without default by proponent then risk shall be mitigated, distributed or alternative options explored.
Site related risks	Land acquisition	Moderate	Overall project cost	If proposed land is defaulted due to lack of proper procedures in acquisition of land or any other reason such as inappropriate site selection etc., the proposed project is at risk of being delayed or stopped.	Land acquisition shall be followed in accordance with state regulations. Waste management site selection form approved by the EPA, LUP and EIA are all tools to ensure that the most feasible land is selected in line with the existing regulation.
	Access risks	High	Overall project cost and duration	Difficulty in accessing project site. Most of the sites are moderately accessible. However, they will have to cleared to enable access and facilitate construction of IWMC. The risk is considered high due to the numerous challenges faced by the island council who will be responsible for land clearance. Land clearance is a crucial step of construction and delays in this component could delay the project significantly.	Following the management and mitigation proposed in the EIA. (See **Section 9**)
	Social	High	Overall Project	The proposed project involves removal of privately owned coconut palm trees to establish the IWMC and access road. Removal of private coconut palm trees shall be commissioned only after identifying its respective owners and after coming to an agreement with the owners with regard to compensation. This activity encompasses	To manage this risk, it is important to secure and safely store all equipment on site. Proper information sharing with the local authorities. Establishing a good coordination mechanism with the authorities and Approval of the EIA. Compensation arrangements shall be made according to mitigation measure proposed in **Section 3**.

				a high risk as failure to identify and compensate for the tree may result in protests or legal implications. Equipment and construction site may be a health hazard to the public in the form of accidents and injuries. Easy access to the construction site may enable criminals to steal valuable equipment and machineries.	
	Cultural/archaeological/ heritage	Low	-		-
	Environmental	Moderate	Construction cost	Prolonged unfavourable weather conditions, incidents of swells flooding the island, high winds and site having unfavourable soil properties.	Weather related impacts are difficult to completely avoid. However, given the nature of the works, weather factor shall be seriously taken into account to minimise the risk. Work could be planned to avoid months of strong wind and wave conditions May-July. (See **Section 5.2**). The IWMC is located in favourable grounds hence will not require extensive levelling or reclamation.
Construction Risk	Quality of work	Low	Construction cost	Careless workmanship and poor quality, could have economic and environmental implications.	Proponent should monitor work progress Qualified site supervisors shall be on site at all times when the work is in progress Quality control measures should be implement during construction Environmental monitoring and site monitoring shall be undertaken routinely Construction standard and specifications shall be met by the contractor.

Construction /Operational Risk	Delays due to contractor	Moderate	Construction/ Operation cost	These may range from, equipment malfunction, lack of finance, issues with registration etc.	Contractor shall ensure adequate financing is set aside for the smooth operations of the project activities Timely settlement of payments both from the contractor side and proponent side Contractor should ensure time schedule is followed All vehicles, equipment's shall be serviced regularly. Spare parts and backup plants and machineries shall be arranged before work commences.
Construction/Operation Risk	Delays due to proponent or government	Low	Overall Project Cost	These may include change in rights of the project or changes to the ownership of the project	All work done shall be compensated and time shall be given to complete work under the changes. Contingency plan shall be in place not to cause disruptions to work even if the project ownership changes.
	Labour and material availability	Moderate	Overall Project Cost	These risks may arise due to unavailability of spare parts, replacements, labour etc.	All major resources shall be made available on site before the work commences Backup arrangements
	Damage/insolvency due to third party	Moderate	Overall Project Cost	If a third party is involved in the project as subcontractor for subcomponents such as removing waste, cutting down of trees, site clearance, implementation of waste management plan etc, and delays from their side would affect the progress of the project.	Proper due diligence will have to take place prior to the engagement of third parties to ensure their capacity to do the work. If third parties are involved in the project, guidelines, rules and standards shall be created and implemented by the proponent.
	Water/air/soil pollution pre-existing or arising from work	Low	Construction and Operation cost	Spills ,accidental or intentional if caused could be costly in terms of time and resources and will cause project delays.	All related mitigation measures prescribed in the EIA report shall be strictly implemented to avoid such incidents from happening.
	Workplace health and safety	Moderate	Construction costs	Injury, damage or loss of life due to site clearance can be extremely costly. Diseases such as diarrhoea, flue that are contagious can affect the workforce severely. If a key	Contractor shall be liable to ensure all safety measure are put in place at the work site. These include providing safety gear to workers and installing firefighting and safety equipment on site. Arrangements shall be in place to replace key personnel

				member of the work force is lost due to sickness or injury, it can affect the work progress.	should a situation of a replacement arises. If signs of a contagious disease is observed, the sick shall be isolated and be not allowed to report to work. First aid services shall be available on site. If a major injury to a worker occurs arrangement shall be in place to transport the injured to the nearest hospital. Contractor shall also implement all mitigation measures stated in the EIA. Proponent shall commit to monitoring and ensure health and safety measures are implemented.
	Loss/lack of technical staff	High	Overall project cost	Describes resignation of technical staff in key roles tasked with the successful implementation of the project during construction and operational phase. Loss of such staff, results in delays and impedes progress of the project. Similarly lack of technical staff to undertake specific trades or manage IWMC can completely disrupt the project development.	In order to address delays and cost acquired by loss/lack of key technical staff the method proposed in **Section 2.50** shall be followed. Proper handover procedures shall be made part of the employment contract to enable smooth transfer of responsibilities. Vigorous knowledge sharing plans shall be prepared and implemented by MEE.
Operational Risks	Inadequate waste management plan	High	Operational cost and overall project cost	See **Section 2.5**	See **Section 2.5**
	Lack of resources to implement IWMP	High		See **Section 2.5**	See **Section 2.5**
	Regional waste management services	High	Operational cost	IWM is based on regular transfer of waste to a regional waste management facility. If this is not implemented during the operational phase of the IWMC, the risk of its failure is imminent.	Ensure that the RWMF is operational as soon as possible. Arrange/ plan for alternative and intermediate transport methods in case, regional waste management centre is not operational by the time IWMC's are constructed.

	Actual operating and maintenance costs higher than anticipated	High	Operation and maintenance costs	Increasing costs, poor management, lack of resources, ineffective waste management plans and prolonged inactiveness of regional waste management system could leave the IWMC in poor shape which can have environmental and social impacts. Such risks can be magnified by currency devaluation, inflation etc.	Recovery through fees from clients. Committing to undertake the mitigation and management plans recommended in the EIA. See **Section 2.5** for details.
Force majeure Risk	Natural disasters, terrorism	Low	Construction cost	-	Although difficult to completely avoid, better planning and proper security and safety measures could greatly reduce the risk.

In general, as can be seen in the risk evaluation matrix, the perceived risks of the project have been evaluated to be moderate to low. However, none of these risks can be completely overlooked since even though how small they may appear if risks are to occur, they can cause delays with environmental and financial consequences. Therefore, it is recommended to consider these risks among others in managing the project and due attention be paid by the proponent and the contractor as appropriate.

3. ADMINISTRATIVE AND REGULATORY FRAMEWORK

3.1 INTRODUCTION

This Chapter highlights relevant national policies and legislative framework applicable to the proposed Project. The relevant national polices and legislative framework provides guidance on several aspects related to planning, and implementation of coastal projects. The legal framework pertaining to the proposed Project is also aimed at sustainable development, impact mitigation and conservation of the country's natural resources.

An institutional mapping and analysis was conducted in the context of the proposed Project on environmental policies and legal frameworks and roles and responsibilities of key institutions driving development and environmental management at the national and local levels as required in the ToR **(Task 3)**. The chapter describes pertinent legislation, regulations, standards, and environmental policies that are relevant and applicable to the Project. In addition, appropriate authority jurisdictions that will specifically apply to the project are also discussed. In keeping to the ToR, the review also identified different articles and clauses in laws and regulations that applies to the Project and explanation provided on how the project meets these requirements.

3.2 ENVIRONMENTAL GOVERNANCE

Environmental governance in the Maldives takes places at two distinct levels; national and local. Central administration in the Maldives is conducted through national ministries headed by Cabinet Ministers based in the capital of Male'. Ministries are responsible for formulating relevant policies, planning development, coordination with donors and to a large extent formulating and implementation of projects in the country. Below the central government are 19 administrative units (roughly one per atoll) and each administrative atoll having an Atoll Council elected under the DA (2010). Each atoll in turn is divided into smaller administrative units comprising usually of inhabited islands and uninhabited islands. The governance system in the Maldives consists of 19 atoll councils, three city councils (Malé, Fuvahmulah and Addu) and 188 island councils. The specific roles and responsibilities of the councils in relation to the project are discussed in detail in the following sub-sections. The island councils are supported by advice from Women's Development Committee comprising of elected members from the community. In addition, Island Councils can seek opinion of youth groups, community elders and individuals on matters related to them. Public information on projects and other important matters is shared through formal and informal meetings organised by the council. All land is the property of the state, however uninhabited islands and land parcels from inhabited islands may be rented out by the government to private individuals or businesses.

The Maldivian institutional structure to protect the environment is relatively young, having been developed in the 20 years or so. Presently, the Environment Department within the Ministry of Environment and Energy (MEE) and Environment Protection Agency (EPA) are the main focal point for all environmental issues in the Maldives.

3.2.1 Ministry of Environment and Energy

The Environment Department of the MEE has a policy making and developmental role in relation to waste management. MEE has a general mandate to formulate policies, regulations and standards needed for waste management and prevention of environmental degradation pursuant to Environmental Protection and Preservation Act (EPPA). As such MEE is tasked

with the overall designing and implementation of Waste Management Framework in the Maldives. Hence the most comprehensive waste management framework and guideline was published by MEE in November 2015 titled "*Saafu Raajje Initiative*".

The Environment Department has the function of developing and implementing projects targeted for the building of waste management infrastructure to prevent environmental, economic health and social impacts associated with waste, and pursuant to this, the department seeks funds from the national budget and donor sources. The beneficiaries of such projects are determined on the basis of national development priorities. The department though it has a regulatory function has limited its role to promulgation of regulations, and has delegated monitoring and enforcement function to the Environmental Protection Agency.

Hence, the current project is a donor funded project implemented by MEE to meet the goals set in in "*Saafu Raajje Initiative*". The scope of the works involves,

1. construction of an IWMC in Ha. Uligam;
2. supply of waste management equipment to these island and facilitate implementation of the island waste management plan prepared by the island council and approved by EPA and
3. ensure that the overall waste management framework is implemented on a national level.

3.2.2 Environmental Protection Agency

The EPA is a semi-autonomous regulatory body affiliated to the MEE and operates under the guidance of the Minister in-charge of the MEE.
The EPA has been assigned the following functions pertaining to waste management:

- Approval of land required for waste management
- approval of waste management centres;
- issuing licence for all waste management activities;
- approval of waste management plans and
- approval of EIA related to waste management projects.

EPA is responsible for the discharge of functions in relation to waste management and enforcement of regulations and standards promulgated by the MEE for waste management including the following;

- Implementation of the EIA regulations;
- implementation of waste management regulations; and
- implementation of environmental damage and liability regulations.

3.2.3 Ministry of Housing and Infrastructure

The Ministry of Housing and Infrastructure (MHI) has the following functions that have a bearing on public infrastructure and waste management:

- Approval of land proposed for waste management. In islands where a Land Use Plan (LUP) has not been prepared, MHI and EPA are tasked to review and approve the proposed land as per the waste management regulation of the Maldives (See **Annex 12** for approved land area in the absence of a LUP).

- approval of LUP of islands;
- maintain information (database) on use and condition of government and public infrastructure;
- maintenance of an infrastructure register;
- formulate policies for the development of public infrastructure and give technical advice for implementation of such projects;
- plan and manage public infrastructure projects that does not fall under the purview of a specific institution;
- co-ordinate and manage reconstruction of public infrastructure damaged by natural disaster or any other event; and
- co-ordinate activities for reconstruction and repair of public infrastructure damaged by natural calamities.

Specific functions pursuant to the above activities are undertaken and supervised by the Infrastructure Department and the Planning Department of the MHI.

The Infrastructure Department is involved in the planning and budgeting processes within government to ensure harmonisation of implementation of infrastructure development projects, through coordination and collaboration of the work through relevant Ministries and government departments.

3.2.4 Island Council & Atoll Council

Every inhabited island in the Maldives, except islands where city councils are established, is governed by an elected island council which prepares island development plans in consultation with the community, and submits them to the atoll council. On a broader sense atoll councils oversee major development projects within the atolls and is the main trading hub within the atoll. The island councils are also mandated to take all necessary measures to establish a safe and peaceful environment on the island in collaboration with the police. This includes ensuring the overall cleanliness of the island and management of pollution and degradation of the environment.

Each island council has a women's development committee advising on key women's issues, including: income generation and development of women, women's rights, religious awareness amongst women, political participation by women, higher education for women, women's health, and collection of information and statistics on women's issues.

Island Councils have associated rights to enter into ventures with the private sector under Public Private Partnership models to build harbours and other such infrastructure (Clause 86, Decentralisation Act) and to formulate regulations governing the maintenance public infrastructure of the island in consultation with the Local Government Authority (Clause 151, Decentralisation Act). In practice, however, the Island Councils have a limited role in development of island level infrastructure, and the Councils depend on the sectorial ministries to take the necessary actions for building public infrastructure such as IWMC's.

The scope of island council in this particular project includes:

1. IWMC site selection through consultation with the relevant stakeholders and submission of waste management site selection form as per the waste management regulation;
2. provide an alternative site in case the proposed site was deemed to be inappropriate by EPA and MHI;
3. if the proposed site has not been cleared and is inaccessible, the council is responsible for the land clearance aspect of the project in order to facilitate the construction of IWMC;
4. development of island waste management plan as per the waste management regulation;
5. monitoring and support during construction phase of the IWMC;
6. implementation of approved island waste management plan; and
7. regular reporting to MEE during operational phase of the project according to the Environmental Management Plan (EMP).

3.2.5 Ministry of Health

The Public Health Preparedness and Response and Epidemiology Division under the HPA has been tasked with the mandate to take the initiative to respond to medical emergency situations brought on due to natural disasters and other crisis situations and to maintain emergency stock of medicines and medical equipment's in accordance with the manner stipulated in disaster preparedness plans prepared and implemented by the Division. The Division has the responsibility to provide the necessary guidance to local level health sector institutions to prepare rapid assessment of medical emergencies or natural disasters and crisis situations and work in accordance with Health Sector Emergency Risk Framework (2014). The Division has also been assigned the function of conducting training programmes and drills to prepare health care personnel on emergency preparedness and response.

3.2.6 Local Government Authority

The LGA is working in close collaboration with the NDMC to incorporate disaster management and disaster risk mitigation into island level development planning. For this purpose, the LGA is revising Island Development Plan templates to include and integrate disaster risk mitigation measures where coastal development is also considered.

3.3 REGULATORY CONSIDERATIONS

The key national legislation, policy, regulation and guidelines governing waste management are located in the following policy and legislative instruments:

- Environment Protection and Preservation Act (Law No. 4/93)
- Waste Management Regulation (2014/R-29)
- Environment Impact Assessment (EIA) Regulations (2012)
- Regulation on uprooting, cutting and relocating trees and plants from one island to another
- Law on Coral, Sand and Aggregate Mining from Inhabited Islands (Law No. 20/98)
- Coastal Dredging and Reclamation Regulation (2013)
- Regulation on Sand and Aggregate Mining
- National Adaptation Program of Action (2006)
- *Saafu Raajje* National Waste Management Policy (2015)

The key national legislative frameworks and other secondary legislative frameworks relevant for the proposed Project and proposed compliance arrangements are summarised in **Table 19.**

Table 19: Relevant laws and regulations pertaining to the Project and measures to ensure compliance.

Law/Regulations & Policies	Measures to comply with the laws/regulation
The Environmental Protection and Preservation Act of the Maldives, EPPA (Law No. 4/93)	
Clause 2: Concerned government authorities shall provide necessary guidelines and advice	EIA prepared as per the EIA 2012/R-27
Clause 3: Environment Ministry responsible for formulating policies as well as rules and regulation;	EIA prepared as per the EIA 2012/R-27
Clause 4: Environment Ministry shall identify and designate protected areas and nature reserves;	The project does not have any impact on a protected area
Clause 5: Environment impact assessment mandatory for any new projects;	EIA prepared as per the EIA 2012/R-27
Clause 6: Power to terminate developments causing significantly detrimental impacts;	Comprehensive impact mitigation and management measures have been proposed.
Clause 7: Refers to the disposal of oil, wastes and poisonous substances in to the Maldivian territory. According to this clause, any type of waste, oil, toxic gas or any substance that may have harmful effects on the environment should not be disposed within the Maldivian territory. If, however, the disposal of such substances becomes absolutely necessary, the clause states that they should be disposed only within the areas designated for that purpose and if incinerated, appropriate precautions should be taken to avoid harm to the health of the population.	Fully complied to – Waste management during the construction and operational phase are in line with the clause (See **Section 2.8.12 and 9**).
Clause 8: Disposal and transboundary movements of hazardous wastes banned;	N/A
Clause 9: Fines for damage to the environment;	Commitment letter provided by proponent to implement mitigation measures as proposed in EIA to avoid environmental damage. See **Annex 7**
Clause 10: Compensation for environmental damage that may take place;	Commitment letter provided by proponent to implement mitigation measures as proposed in EIA to avoid environmental damage.

Environment Impact Assessment (EIA) Regulations (2012/R-27) • Annex 4 bullet 8 of the regulation states that projects that require major vegetation and land clearance will be required to submit an EIA.	The waste management site selection screening form revealed that the project island of Ha.Uligam, required land clearance which requires preparation of an EIA. Hence the EPA issued the Decision Statement (DS) for the proposed site on 5 May 2016. (See **Annex 12** for DS). Hence the EIA is submitted to fulfil this requirement.
By law about the cutting down, uprooting, digging out and export of trees and palms from one island to another, 2006.	
Clause 2 (a) States the purpose of this by law is to educate citizens and developers about the importance of trees including best management practices for maintaining trees and to provide standards for the preservation of trees in Maldives and to set down rules and regulations to be adhered to prior to commencing felling, uprooting, digging out and exporting of trees and palms from one island to another in Maldives	-
(b) Palm trees shall be removed and relocated only after exploring all other options	Design changes and relocation of plot were considered in the assessment prior to recommending removal of trees. See **Section 8 and 9.**
(c) States that regulatory authority have the right to issue and approve removal of trees for national development purposes under the condition that 6 new trees are planted for every tree removed.	Fully complied through the approval of EIA
Clause 3 states trees that are prohibited to be removed	
(a) The coastal vegetation growing around the islands extending to about 15 metres into the island are protected by this by law	Has been fully addressed in the project description and Environmental Impacts and Mitigation chapter (**See Sections 2.2 and 5.6.2**). The project does not involve removal of coastal vegetation from the designated buffer area.
(b) All the trees and palms growing in mangrove and wetlands spreading to 15 metres of land area is protected by this law	Site fully comply with the clause. There are no mangrove areas close to the proposed site.
(c) All trees in Government protected areas	N/A since no protected area on the island is impacted by the project
(d) Trees that are being protected by the Government in order to protect species of animal /organisms that inhabit on such trees.	N/A

(e) Trees / palms those are abnormal in structure.	N/A no such trees were observed in the vicinity of the Project site.
Clause 4 The regulation states that prior permission must be obtained for removal and/or relocation of 10 or more trees or palms. For indiscriminate removal and land clearances and EIA and Decision Note is required. The size of the trees and palms that are allowed to be relocated should have more 15feet from lowest point to the crown spread for palms and 8 feet from the lowest point to the trunk to tip of the highest branch for trees other than palms. The law also states that cutting down and uprooting of the trees shall be made under supervision of the island / atoll offices (in the current context Atoll / Island Councils).	More than 10 trees will not be removed from the proposed plot under the project hence conditions of the clause will not apply. However, in case a tree is to be removed, **Section 2.8.3** describes proposed method for removal and the number of trees to be removed. **Section 8.5.2** describes the management and preferred procurement method to remove the trees. Approval of the EIA will ensure that the regulation is fully complied.
Clause 5 of the bylaw describes Issuance of permits to cut down, uproot, dig out and export trees and palms from one island to another.	
(a) Prior to the commencement of any project(s) that would require the indiscriminate removal and export of trees/palms from one island to another for the purposes of agriculture, development/redevelopment, construction or any other purpose, it is mandatory under this Regulation to prepare an Environment Impact Assessment Report stating clearly the details of the project(s) with all necessary information and submit the same through the relevant Ministry to Ministry of Environment, Energy and Water, and the project(s) can only commence upon the grant of written approval from Ministry of Environment, Energy and Water.	Approval of the EIA will ensure that the regulation is fully complied.
(b) In the event that a need arises to remove 10 or more Trees/palms at a time that are grown in private dwellings for one's own use, then the requirements stated in clause 8 a) and b) must be fulfilled.	N/A
(c) All the persons who are granted a permit to remove trees/palms by the Ministry of Environment, Energy (EPA) must complete the work of removal of the trees/palms before the end of the stipulated time. If the work is not completed in time, then the concerned parties must apply in writing to extend the period to Ministry of Environment, Energy (EPA) and cease work until the issuance of a new permit.	Bidders or any party undertaking the removal of trees shall have valid approvals from the regulator as described in **Section 8.2.5** of the EIA.
(d) If it is necessary to export the trees/palms with soil, then it must be done only in nursery bags that measure up to 8"/10".	These type of trees are not present at the proposed site. In case a large tree is to be removed See **Section 2.8.4** for proposed relocation method which complies with the regulation.
(e) In the event that the trees/palms are larger than the size specified in clause 8 a) of this Regulation and they are to be removed for export to another island; the tree/palm	These type of trees are not present at the proposed site. In case a large tree is to be removed See **Section 2.8.4** for

must be cleaned of all excess black soil from the root balls before it is exported to another island.	proposed relocation method which complies with the regulation.
(f) If excavators/bulldozers are used for the removal of trees/palms and if it might cause injury to another tree, then such machinery should not be used to remove the tree(s)/palm(s).If damage is caused or might be caused to a neighbouring tree/palm while in the process of removing the desired tree/palm, then the desired plant/palm cannot be removed.	Will be complied as when required. There are no palm trees at the proposed area which will require removal
Clause 6 states special permit issued to cut down, uproot dig out and export trees and palms from one island to another	Will be complied as when required **(See Section 8.5.2).** The project does not involve removal of palm trees and other large trees. The report recommends to transplant or relocate even the small trees that may be need to be removed.
Clause 7 states that the maximum number of trees that can be removed from an island will be determined by Ministry of Environment, Energy and Water who shall also permit for the export of trees/palms from one island to another.	N/A
(b) Trees/palms that are in inhabited/uninhabited islands that are used by species of birds as a roosting or breeding spot are protected under this Regulation and if any of these trees/palms are to be removed, a special permit should be obtained from Ministry of Environment, Energy and Water. In addition, if a tree/palm that is a roosting or breeding spot for certain species of birds are to be cut down permission has to be sought from the Ministry of Environment, Energy and Water.	Will be complied as when required
Clause 8 states certain conditions have to be met for the grant of a permit for the removal and export of trees/palms from one island to another. It states that for relocation of 10 or more palm trees that have a height of 15 ft and other trees that have a height of 8 ft permission shall be obtained from regulatory body. Smaller palm trees shall be removed as not to exceed 1/3 of small palm trees in the area. Council shall be responsible to monitor removal of trees from the island	Will be complied as the project does not involve removal of coconut palm trees and other large trees.
Clause 9 The holes created from uprooting trees/palms must be covered with soil and made firm, it is prohibited to cover the holes with waste.	Will be complied
Regulation on Protecting and managing historically culturally significant trees	
Purpose of the regulation is protecting endangered species and other species of historical, cultural and natural significance. The regulation came into being in 5 June 2007 with the aim of fulfilling the agreement of convention on biological diversity.	
Clause 3 states that four types of trees will be protected under the regulation • Trees that are between 50-100 years or more than 100-year-old • Environmentally significant trees	These types of trees did not intersect with the projects direct footprint areas.

• Trees that are protected at the be hence of communities	
The Law on the Palms and Trees in the Inhabited Islands of Maldives (21/98)	
Clause 8 says that cutting down of any palms or trees that belong to the public can only be done after receiving advice from the Ministry of Fisheries and Agriculture and in accordance with the direction given by the Ministry of Atolls Development[2]	Alternatives assessment showed that cutting down or removal of coconut palms can be avoided by opting either seaside coastal revetment or offshore breakwater. Landside coastal revetment has been ruled out to avoid any degree of coastal vegetation clearance.
Regulation on Dredging and Reclamation (2013/R-15)	
The regulation requires having permission of EPA on projects requiring alteration of the island, either by reclamation or dredging. Specifically, the regulation requires producing scaled maps of the island before and after the proposed intervention. Special provisions have been made on protected and sensitive area restricting changes to the environment of the islands.	N/A
Regulation on Sand and Aggregate Mining (2000)	No locally mined sand or aggregate will be used for the construction purposes. Sand used for backfilling will be obtained by the contractors from registered suppliers.
Waste Management Regulation, (No. 2013/R-58)	
The regulation provides set of comprehensive guidelines on collecting, storing, transporting and managing solid waste as well as management of hazardous waste. The waste management regulation identifies the following areas prohibited from dumping of waste; protected areas under the Environmental Protection and Preservation Act, mangroves, lagoons of islands, coral reefs, sand banks, beaches of islands, coastal vegetated areas of islands, harbour, parks and roads. Additionally, waste management regulation states that those involved in waste management must be permitted by the Environmental Protection Agency.	The proposed waste management project is designed to comply with the waste management regulation. Existing waste management practices in the island do not meet the regulation.
Employment Act (2/2008)	
• The Employment Act of the Maldives prohibits the employment of a minor under the age of sixteen except for the purpose of training in relation to such	No minors will be allowed to work in the Project

[2] The ministry doesn't exist anymore and the function is believed to be with the respective island council.

minor's education and requires parental consent be obtained for employing minors. The Act makes an exception for children participating, with their consent, in work undertaken by their families. The Employment Act also prohibits the employment of a child (below 18 years of age) in any work or employment that may have a detrimental effect on a child's health, education, safety or morals due to the work or job undertaken or the conditions of work. Those who employ minors are required to maintain a register of minors employed containing their names, addresses and dates of birth The Act also requires a medical fitness test prior to employing minors on vessels and further such tests for continued employment on vessels	

3.4 NATIONAL POLICIES

3.4.1 *Saafu Raajje* National Waste Management Policy (2015)

The policy is the most comprehensive waste management plan devised thus far with the goals to

- Reduce the amount of waste produced and discarded;
- Reuse, items discarded as waste;
- Recycle waste to create value added products;
- Use waste to generate energy; and
- Deposal of waste in an environmental responsible manner.

The objective of the policy is to:

2. Ensure that all Maldivians understand the importance of waste management and create awareness with regard to the waste management policy;
3. Evolve and develop the society through awareness so that it strives to protect and manage the natural environment sustainably;
4. Make sure all aspects of civil life are hygienic;
5. Ensure that air pollution is controlled and prevented; and
6. Make sure that Maldives retains its natural coastal and marine environment without pollution.

It highlights Nationwide Waste Management Guidelines which is aimed at achieving its goals and objectives. In this regard a nationwide consortium was held in 2016 to brief relevant stakeholders about the policy and developmental arrangement that have been planned under the policy. A summary of the main components of the waste management plan given below.

1. Individual are entitled to manage waste generated by themselves according to the guidelines and regulations set by municipal or local council;
2. Waste generated at the house hold level shall be managed according to the municipal or local waste management guidelines and regulation;
3. All inhabited islands shall have an approved waste management plan designed by the island council with the help of the public, according to the waste management policy and regulation;
4. Fees shall be collected from, households, businesses and industries to operate the waste management center according to proposed and approved design;
5. It is advised to involve state utility companies to operate waste management centers;
6. The government shall construct and provide equipment to facilitate and implement waste management operations according to the approved waste management plan;
7. The government shall construct and install equipment necessary to operate regional waste management centers for predetermined zones. The regional waste management centers will be utilized to manage waste that is not processed at the island level;
8. Waste transportation systems shall be designed and operated to transport rejects from the island waste management centers to the regional waste management centers;
9. Waste shall be reused or recycled for economic gains where viable during the operational stage pf waste management center. Income from such activities shall be used to

management the day to day activities of the waste management center or increase its efficiency, productivity and profitability; and

10. Waste management awareness and training programs shall be organized and implemented at a national level.

The strategies to achieve the waste management plan targets which are listed above include the following action plans that are described in detail:

1. Develop the 3R concept to reduce amount of waste discarded.
    a. Change policies/regulations at the local and national level to facilitate 3R.
    b. Regulate the waste recycling industry so that it is economically viable, which would allow more private entities to participate in the waste recycling, reusing and reducing market.
    c. Study and research ways to reduce waste and modify laws/regulation based on the findings
    d. Provide consultancy and assistance to industries, households and businesses which have been identified as mass waste producers.
    e. Undertake awareness programs to teach the importance of 3R with the aim of incorporating this ideology in the daily life of individuals.
    f. Implement '*Saafu Rajje*' campaign, with the aim of reducing, re-using and recycling waste. Depending on the progress of these campaigns island level waste management policies shall be improved.
2. Public awareness with regard to integrated responsible waste management.
    a. Organize and implement a national level waste management campaign
    b. Carry out waste management campaign under a unified slogan
    c. Under the unified slogan carry out campaigns nationwide campaigns to clean and manage waste. Each campaign shall be adapted to individual islands depending on their needs and extent of development. The waste management campaigns shall aim to incorporate responsible waste management into the daily lives of individuals.
3. Mandate Ministry of Environment and Energy with implementing and monitoring waste management policy of the Maldives.
    a. Ensure that all waste management activities conducted under *Saafu Raaje* initiative in the islands are regulated, monitored and approved by MEE.
    b. Officially invite all local councils to participate in the *Saafu Rajje* Initiative.
    c. Clearly lay out the entitlements and services which will be provided by MEE to participants and obligations of the participants under "*Saafu Raajje"* initiative.
    d. Implement an annual forum titled "*Saafu Rajje*" Forum" where all participants of "*Saafu Raajje*" initiative could network, plan, solve challenges and exchange information with regard to waste management.
    e. Under the first "*Saafu Raajje"* annual forum, a workshop shall be implemented with the aim of planning and drafting the island level waste management concept, which shall be further modified and improved by the

local council of respective islands. Once island waste management plan is designed it shall be submitted for approval.

f. Provide assistance to island level waste management under public sector investment programs. In addition, assistance shall be provided to solve problems encountered by waste management programs designed and implemented by local councils.
g. Design a contingency plan in case of unexpected risks to waste management and provide assistance by MEE in case of such events.

4. Design island level waste management plans specific to individual islands and implement waste management according to the management plan.
    a. Each council shall assign an employee to coordinate waste management.
    b. Instructions to design waste management plan shall be prepared
    c. Consultancy services shall be provided to island councils in preparing waste management plans.
    d. Waste management plans shall be reviewed and adapted annually
    e. A monitoring plan shall be designed to ensure that waste management plan is implemented effectively.
5. Draft and implement the waste management framework.
6. Revision of hazardous and infectious waste management regulation
    a. Conduct baseline study of the existing condition of hazardous and clinical waste in the islands upon which a suitable waste management plan designed.
    b. Inclusion of plans to manage infectious and clinical waste in the revised waste management regulation.
7. Monitor, manage and share national and island level data with regard to waste and its management.
    a. Plan and implement a mechanism to monitor and manage waste related data locally and nationally.
    b. Develop an electronic system to store, share and record waste data.
8. Plan a polluter pay fee structure.
    a. For islands that have a low pollution, a plan shall be devised through witch state sanctioned subsidies are provided to make the waste management plan economically feasible.
    b. Plan a general fee structure that can be applicable to all islands
    c. Find out existing challenges in implementing a fee structure
9. Provide all inhabited islands with appropriate waste management centers, equipment and resources.
    a. Develop waste management center design and concepts based on population, main economic activities.
    b. Categorize islands based on these key parameters
    c. Design waste management centers keeping in mind future population growth and development
    d. Establish IWMC's in all the islands within a time frame of 10 years.
10. Implement waste management awareness programs and courses nationwide.

   a. Identification of an island within the region to conduct all waste management courses
   b. Networking with neighboring international waste management companies or centers to build local capacity
11. Create an inventory data base to account for all equipment and assets that have been provided to IWMC's across the nation
   a. Oversee national waste management inventory and implement plans to change ownership of all existing equipment and assets to MEE
   b. Lease waste management equipment and resources to island councils for a period of 99 years under contract
12. Develop regional waste management centers
13. Design waste management system such that residual waste which cannot be managed at the island is transported to the nearest regional waste management center.
   a. Every island shall keep records of waste that are managed in the island and waste that are to be transported out of the island
   b. Development of a feasible waste transportation system
   c. Development of infrastructure in islands to facilitate waste transportation to the regional waste management center (example construction of harbours)
14. Research on latest and most viable waste management technology
   a. Establish a research unit under waste management and pollution control department
   b. Compile all relevant literature with regard to previous waste management projects and establish a waste related database/library
   c. Undertake research and studies to determine the most feasible technologies that could be adapted to the context of Maldivian islands.
15. Waste management plans of industrial islands shall be prepared and approved.
   a. Update and address challenges of existing regulations and policies with regard to industrial waste management
   b. Monitor waste plan of industrial islands
16. Establish a national trust fund for waste management
   a. Update relevant laws
   b. Draft the trust fund regulation
   c. Assign the trust fund board
   d. Establish the administration to manage the trust fund
   e. Open trust fund account

3.4.2 Maldives National Strategy for Sustainable Development

Maldives National Strategy for Sustainable Development (MNSSD) (2009) sets out the strategy on how the Maldives will fulfil its commitment to meet the challenges of sustainable development. The overall aim of the MNSSD was to identify and develop actions to enable the people of the Maldives to achieve continuing improvement in their quality of life both now and in the future. This guiding policy recognizes seven sustainable development goals for the Maldives (GoM & UNEP, 2009).

The proposed project has been designed with the prime objective of addressing the principles of sustainable development. Sustainable development is the managing and conserving of natural recourse based on technological and industrial changes in such a manner as to ensure the attainment and continued satisfaction of human needs for the present and future generations (Rio Summit, 1992). Such a development will conserve land, water, plants, animals and genetic resources in environmentally non- degrading, technically appropriate, economically viable and socially acceptable manner.

In this regard, proper planning of the access road and IWMC site to ensure minimising of land clearance have been ensured. Importance has been attached to conserve as many trees, relocating trees as much as possible and where relocation is not possible to compensate for the lost trees by replanting six trees for every tree removed has been emphasised. Measures have been set in the report to avoid pollution, responsible waste management and re-use of resources. In addition, it has also been proposed to update operational concept during the operational phase to prevent waste burning in the island and to prolong storage capacity. These measures will ensure that the impacts of the project on climate change is minimised and that the project is implemented according to the generally agreed principles of sustainable development.

3.4.3 Third National Environmental Action Plan (NEAP3 2009 – 2013)

NEAP 3 was formulated to set the environmental agenda for the five-year period with an objective of creating liveable and sustainable places in which protection of the environment while making people and properties resilient. It was aimed at promoting resilient island communities, conserving environment, promoting healthy communities, providing safe water and environmental stewardship among other objectives.

3.4.4 The Strategic National Action Plan

The Strategic National Action Plan for Disaster Risk Reduction and Climate Change Adaptation (SNAP) (2010-2020) recognizes the islands of the Maldives by nature are low lying exposing the communities to the threat of beach erosion, sea level rise and saltwater intrusion into the groundwater lens and other climate change impacts as natural hazards faced to the Maldives. Among the key goals of the SNAP building resilient communities through empowerment and incorporating disaster risk reduction into government's decentralization policy have been stated.
The IWMC site has been selected to ensure that there is adequate setback distance to protect it against potential disasters such as sea swells which are among others. In most places, the average distance of the IWMC the vegetation line was 40-100 m which far exceeds the regulatory requirement of 15 m setback.

3.4.5 Maldives Climate Change Policy Framework

Maldives Climate Change Policy Framework (MCCPF) (2015) highlights the climate vulnerabilities of Small Island Developing States such as the Maldives and further states that these islands are in a special risk of being inundated as sea-level rise, land loss and beach erosion continues to increase and threatens food and water security. MCCPF calls for strengthening adaptation actions and building climate resilient infrastructure and communities as an adaption and opportunity to address current and future climate vulnerabilities with the following specific objectives;

i. To develop effective adaptation and risk reduction responses and capacity in all climate change priority areas for adaptation and opportunities;

ii. To promote and implement adaptation programmes that support and improve communities' livelihoods to reduce the vulnerability and increase the resilience;
iii. To make the inhabited islands and people of Maldives resilient against the threats posed by global climate change; and
iv. To protect critical infrastructure such as international airports, other inhabited islands and tourist resorts from sea related hazards and predicted climate change impacts.

The IWMC has been designed to ensure that there is adequate setback distance to protect it against potential climate related events. In most places, the average distance of the roads from the vegetation line was 40-100 m which far exceeds the regulatory requirement of 15 m setback. In addition, minimising vegetation clearance and reuse of resources have been considered in carrying out the works to promote climate resiliency of the project.

3.4.6 National Adaptation Programme of Action

National Adaptation Programme of Action (NAPA) (2007) presents the framework to climate change adaptation to enhance the resilience of the natural, human and social system to ensuring their sustainability against predicted climate change. NAPA lays out the national policy framework for the Maldives. The document comprehensively describes the climate vulnerabilities faced to the Maldives. It also emphasizes wetland conservation through priority actions such as flood control, recognizes the importance of coral, and also includes enhancing capacity for solid waste management as a priority action to prevent pollution of the marine environment.

As described in various sections of the report the design of the project has emphaised on minimising impacts on the environment, recognizing the importance of sensitive marine and terrestrial environment thereby putting place appropriate mechanisms for solid waste management and pollution control as a priority action to prevent pollution of the environment.

3.4.7 National Biodiversity Strategy and Action Plan

National Biodiversity Strategy and Action Plan (NBSAP (2016 – 2025) is the government's key policy document on conservation of the nation's biological diversity. It sets out the vision as "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". The document is guided by three key principles emphasising that the need for everyone's participation in achieving the goal set forth in the NBSAP. The three principles of NBSPA include:

- The people of this generation and the generations to come reserves the right to access and share benefits of rich biodiversity and ecosystem services;
- responsibility of conserving and sustainably using biodiversity lies on every one's shoulders and shall be taken a s a shared responsibility; and
- biodiversity shall be mainstreamed into all sectors and in a manner whereby monitoring progress and accountability is ensured.

NBSAP identifies destruction of habitats, including reefs, lagoons, beaches and mangroves due to development activities as a major threat to conservation of biodiversity. In addition, NBSAP states, increase in population and economic growth intensified the demand on natural resources and space with resulting over-exploitation of biodiversity, decline in certain species such as turtles and tuna

catch, clearance of vegetation to meet the demands of development as contributing factors threatening the country's biological diversity. Importing of alien species and those listed in CITES have been included among the growing challenges. Improper waste management, disposal of dangerous chemicals, oils and non – biodegradable wastes into the surrounding sea has also been highlighted posing threats to biological diversity.

In order to address the threats faced to the nation's biodiversity NBSAP identifies six strategies of which Strategy 1: Strengthen governance, policies and strategies for biodiversity, Strategy 4: Ensuring sustainable use of biological resources, and Strategy 5: Addressing threats to conserve biological diversity are particularly relevant to the proposed project.

Target 4 under Strategy 1 is about producer/ extractor responsibility which states that private sector remains the main beneficiary of the biological resources of the country and thereby has the responsibility in being a benefactor. Hence a target by 2025 has been set for the government, businesses and stakeholders at all levels to taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.

Target 17 under strategy 5 states by 2025 pressures on coral reefs and other vulnerable ecosystems due to anthropogenic activities and climate change are minimized. While target 23 says by 2020 pollution from waste and sewage has been brought to levels that are not detrimental to ecosystem functions and biodiversity.

The proposed project will be managed responsibly in line with the relevant provisions of the NBSAP as detailed in this report. Hence minimising vegetation clearance has been given a strong emphasis on this report. Further, managing wastes so as to prevent pollution of the marine and terrestrial habitat have been given due consideration in the report. For areas where notable impacts are identified, adequate mitigation measures in line with existing regulation have been proposed.

3.5 CONVENTIONS AND AGREEMENTS

The GOM is a Party to a number of international conventions and agreements some of which are of relevance to this project.

3.5.1 Convention on Biodiversity

The objective of the Convention on Biodiversity (CBD) is "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding". The Maldives signed the convention in June 1992 and ratified it on 28th October 1992. Maldives is one of the first nations to ratify CBD. Maldives has developed the National Biodiversity Strategy and Action Plan (NBSAP) in 2002. The Maldives made its fourth national communication to CBD in 2010 and the fifth in 2015.

The proposed project involves habitat alterations, which will result in habitat fragmentation, loss of vegetation, disturbance to habitats as well as generation of wastes and pollution. The compliance

arrangements under CBD will be achieved through the proposed mitigation measures in the report. At the national level CBD is implemented through the NBSAP as explained in **Section 3.4**

3.5.2 MARPOL Convention

The International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international convention which addresses pollution of the marine environment by ships due to operational and accidental causes. As a party to the MARPOL convention, Maldives is required to oblige and maintain the standards specified by the convention with regard to maritime pollution and their control. These include pollution due to:

- Oil spillage
- Noxious liquid substances in bulk
- Spillage of harmful substances carried by sea in packaged form
- Sewage and garbage from ships
- Air pollution from ships

Marine pollution prevention during all project activities have been given highest importance as explained in the relevant sections of this report.

3.5.3 United Nations Framework Convention on Climate Change

United Nation Framework Convention on Climate Change (UNFCCC) is a global legal instrument on the control and management of greenhouse gases (GHG) to which the Maldives is a Party to. It was adopted in 1992 and entered into force in 1994. The Convention contains two annexes:
Annex 1: countries with obligations to take measures to mitigate the effects of climate change
Annex 2: countries with obligations to provide financing to developing countries for their obligations under UNFCCC.

The overall gall of UNFCCC is to protect the climate system for the benefit of present and future generations of mankind and to achieve stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.
In order to protect the climate system, the following general measures have been proposed;

- Enhancement of energy efficiency in relevant sectors and development of new and renewable energy forms/sources;
- Protection of sinks and reservoirs of GHGs; and
- Limitation and reduction of transport and waste management-related emissions.

These aspects have been seriously taken into consideration in preparing the report and in proposing mitigation measures.
National policy documents described in **Section 3.4** are the main means by which this Convention is implemented at the national level.

3.6 ENVIRONMENTAL PERMITS

3.6.1 EIA Decision Statement

The EIA Decision Statement, as it is referred to, shall govern the manner in which the project activities must be undertaken. The environmental permit to commence the proposed project is the decision statement to be made by the EPA. The decision statement will be given to the proponent after independent review of EIA report. The decision statement will be based on the degree/significance of impacts to environment from the proposed development. This EIA report will assist the EPA in making informed decision relevance to the proposed project.

3.6.2 Permit on Uprooting Coconut Palms and Trees

The permit is invoked only when more than 10 significant trees highlighted in the relevant regulation is to be removed. Analysis have shown that only shrub type vegetation will have to be removed from the area. Hence, this permit will not be required for the project.

3.6.3 IWMC Design Approval

The design of IWMC's shall be approved by the EPA as per Waste Management Regulation 2014/R-29. This is to ensure that the design fits the criteria set in the regulation.

3.6.4 Waste Management Plan Approval

The waste management plans drafted by the island council shall be approved by the EPA as per the Waste Management Regulation 2014/R-29. This approval shall be obtained by the regulatory body to approve the waste collection, transportation and operation of the IWMC according to the waste management plan.

4. EXISTING ENVIRONMENT STUDY METHOD

4.1 INTRODUCTION

This section of the report addresses **Task 2** of the TOR and provides descriptions of the methods used to collect data of the existing natural and socio-economic environment of the project site. The chapter also addresses sensitivity and limitations of methods used in the study. Efforts were made to collect as much primary data as possible within the time limitations. Relevant information was also collected through interviews, discussions and formal meetings with stakeholders. Available information from reliable literature was also used to supplement the existing environmental study.

A team from MEECO conducted site assessments at the Ha. Uligam from 4 – 7 May 2017, to conduct environmental and socioeconomic surveys for this EIA report.

The main environmental component focused on the study was the terrestrial and land environment based on the project scope. Primary surveys were done to study the existing terrestrial environment of project island specifically proposed project sites and surrounding areas.

The different methods used in assessing and reporting the conditions of the existing environment of the island are given in the following subsections.

4.2 CLIMATE

Climate conditions at the project site was assessed after compiling most recent five years (2012-2016) of weather data obtained from Hanimaadhoo International Airport (HIA). The data was provided by Maldives Meteorological Centre (MMS, 2016) HIA chosen as it was the closest hosting, weather station which had sufficient long term data for assessment of weather patterns.

The statistical data were analysed for the following parameters:

- Rainfall;
- temperature; and
- wind.

4.3 WAVES

Long term wave climate at the project area was determined using NOAA long term hind cast data of the region. As a first step, wave data was extracted from 6.5 latitude, 73.5 longitude coordinates as illustrated in **Figure 17**. The study accurately determined the wind wave and swell wave behaviour of the offshore locations on the western and eastern side of the three atolls. The study was conducted within the limitations of a 0.5 grid. Data was extracted at a frequency of three hours for the most up to date full set of data available (2015).

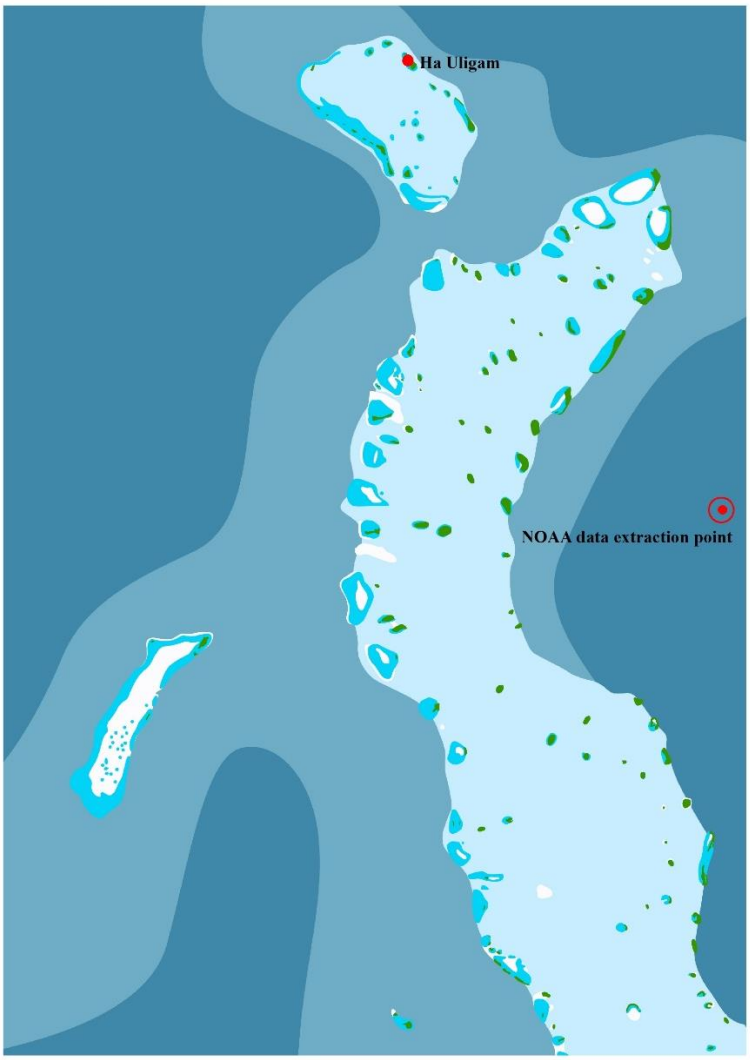


Figure 17: NOAA data extraction point and project island

4.4 GEOLOGY, SEDIMENTS AND COASTLINE

In the absence of soil testing facilities in the country, information obtained for soils studies for islands of similar setting was used. Soil profile and geological properties of project area was inferred after referencing soil analysis done for R. Vandhoo. Vandhoo was a significant in size and elongated in shape. It was a mature island that is comparable to most of the islands. Since geological formation of islands in the Maldives are quite similar, soil analysis of Vandhoo was considered reliable for the EIA purposes. Samples were collected from the two distinct zones (top soil and bottom soil layer). The samples were stored in airtight sample bags, transported to Sweden and tested for the following parameters:

- Grain size distribution and
- Permeability of two layers.

The coastal surveys were carried out using the GNSS RTK system. The survey determined the vegetation line and tidal zone of the coastal areas adjacent or closest to the waste management site.

4.5 WATER QUALITY

Water quality assessments was carried out after testing the following parameters on site using *Horiba* Multi Parameter Water Analyser:

- Temperature;
- pH;
- Turbidity(NTU);
- Dissolved Oxygen (mg/L);
- Electrical conductivity (ms/cm);
- Salinity (ppt); and
- Total dissolved solids (g/L).

The location of data collection sites was marked using the handheld GPS. Survey map in **Figure 18** shows the groundwater data collection and sampling locations. Groundwater was collected and sampled from a well.

The samples were analysed for the following parameters as indicated in the environmental monitoring manual issued by the EPA (See **Table 20**). The groundwater data was also compared with WHO guidelines for drinking water attached in **Table 21**.

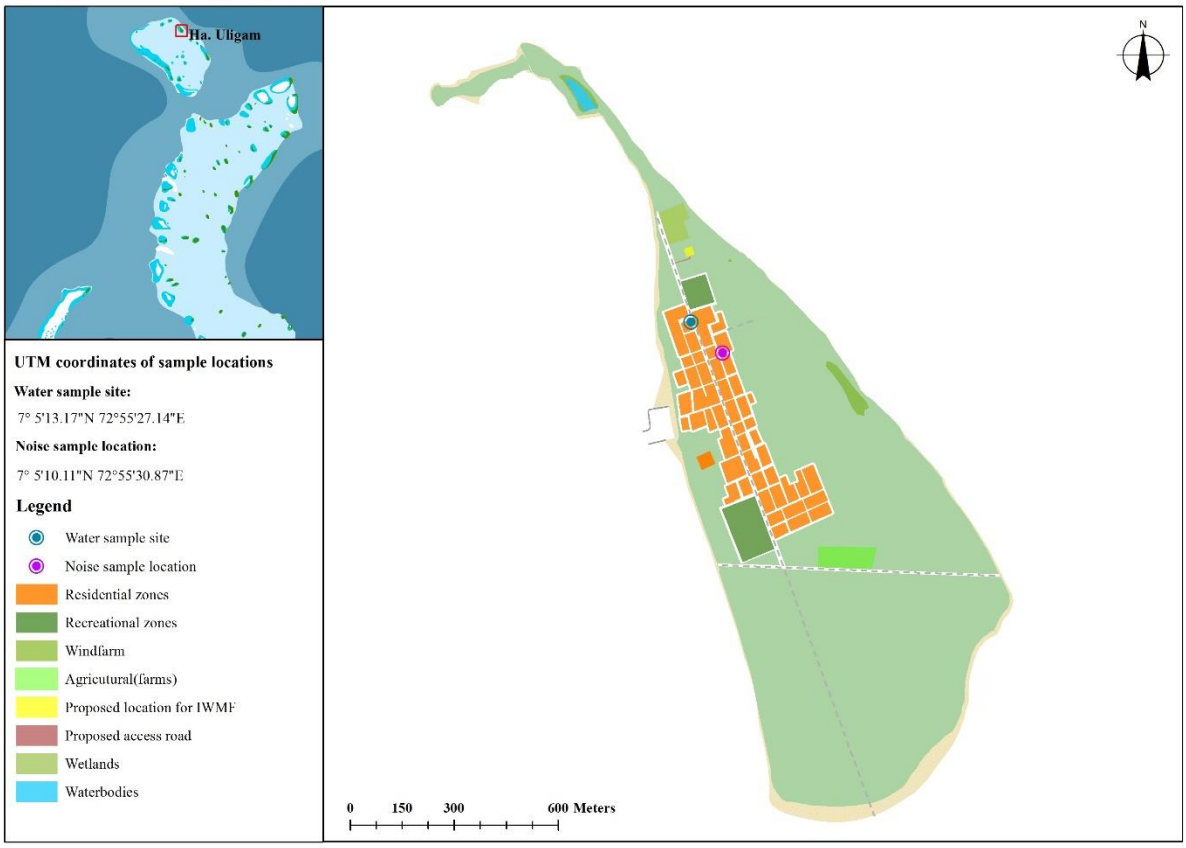


Figure 18: Groundwater and noise data collection locations

Table 20: EPA guideline for water quality

Parameter	Optimal range	Reference
Temperature	18ºC and 32ºC Changes should not surpass 10 ˚C above the average long term maximum	GBRMPA, 2009
Salinity	0.032 - 0.042 ppm	GBRMPA, 2009
pH	8.0-8.3 Levels below 7.4 pH cause stress to corals	
Turbidity	3-5 NTU >5 NTU causes stress to corals	Cooper et al. 2008
Sedimentation	Maximum mean annual rate 3 mg/cm^2/day Daily maximum of 15mg/cm^2/day	GBRMPA, 2009
Nitrates	<5 mg l^{-1} NO_3-N	UNESCO/WHO/UNEP, 1996
Ammonia	Max. 2-3 mg l-1 N	UNESCO/WHO/UNEP, 1996
Phosphate	0.005 - 0.020 mg l-1 PO4-P	UNESCO/WHO/UNEP, 1996
Sulphate	2 mg l-1 and 80 mg l-1	UNESCO/WHO/UNEP, 1996
BOD	< 2 mg l-1 O3	UNESCO/WHO/UNEP, 1996
COD	< 20 mg l-1 O2	UNESCO/WHO/UNEP, 1996

Table 21: WHO guideline for drinking water. Source: (WHO, 2006)

Parameter	Reference Range
pH	6.5-8.5
Physical appearance	Clear & Colourless
Electrical conductivity	<1500 µs/cm
Total coliforms	0/100ml
Faecal coliforms	0/100ml
Turbidity	<5NTU
Total dissolved solids (TDS)	<1000 mg/l
COD	10mg/l
BOD_5	6mg/l

4.6 BASELINE NOISE

The baseline noise measurements were taken using a calibrated Integrated sound level meter, TES 1353S noise measurement device. Background noise measurements were recorded as 1 minute time weighted averages (LEQ) at the nearest public area to the proposed waste management site. The time period for data collection was determined after considering the uniform and constant sound sources which were observed through out the day in these island. Since most noise generating sources remained constant throught the day, a 1-minute measuring period was determined to be sufficient to capture the baseline noise levels at Uligam. The measurement also determined the Sound Exposure Level (SEL) and the noise levels ranging from the 5th percentile to the 95th percentile (L05 – L95). Locations of noise measurments were recorded using hand held GPS and are shown in **Figure 18**.

4.7 VEGETATION SURVEY

Vegetation and tree cover of the project area was determined using two methods.

1. The primary method employed involved surveying all the significant trees within the proposed project site and at the footprint of the proposed access road using the GNSS RTK system. The survey recorded actual count, type, position and features of all trees within the project boundary, following which, breast height girth of the trees was measured using a tape. In order to get a representative average of the girth, 30 trees were sampled. Tree heights were also measured using an Electronic Distance Meter (EDM). A buffer of approximately 30 m on either side of the proposed road and waste management site was surveyed to identify areas with the least tree cover. All surveyed trees were marked as not to repeat readings and identify trees that have not been marked within the specified boundary.
   The primary method was applied to survey the proposed/approved sites.
2. The secondary method employed involved surveying a specific boundary (fixed are plot sampling) and projecting the surveyed data onto unknown areas to estimate and determine tree type and cover. This method was selected to prevent damage to the environment during assessment of sites and to save time when assessing multiple locations. The secondary method was applied to determine vegetation of alternative sites. **Section 2.8.3** distinguishes trees that have been surveyed and projected.

In addition to the methods described above, aerial pictures of proposed sites and alternative sites were taken using a drone, to visually assess the vegetation condition, proximity of coastline, public areas, roads and sensitive sites to the proposed waste management site. The following table was used to classify abundance of trees at the project site.

Table 22: Classification of abundance based on tree count

Abundance	Count
Low	1-10
Medium	10-20
High	20+

Limitations

The limitations of the primary method used to survey vegetation are relatively small since actual tree data were recorded. The main limitation of the method includes sampling errors such as omissions and additions. However, these errors will be significantly reduced as a result of validation checks employed in the survey.

Non-sampling Errors: These are errors associated with humans, rather than chance, mistakes. These include using counting/sampling methods where attributes cannot be accurately counted or measured. Inconsistent field sampling effort, due to difference in effort level also constitutes to non-sampling errors. The method used for the vegetation survey does not incorporate significant sampling errors. Total stations were used to register population and photographs of each numbered data point were recorded for post analysis error mitigation.

4.8 SOCIAL ASSESSMENT

The study was carried out with a participatory approach that aimed at putting the community at the centre and involved a collective process of reflection, discussion and consultation with the public. The social assessment mainly relied on information obtained from questionnaires shared with the council and from the public consultation conducted in the island. The questionnaires were aimed at capturing the existing social condition of the island, such as determining main economic activities, existing education/ health system, existing waste management system and access to basic utilities. The public/community consultation were carried out to discuss the proposed project in order to gather local perspective with regard to the project, its location and to collect local knowledge with regard to existing environment and waste management practices. In order to facilitate participation of all the members of the community, invitations for the meeting were announced publicly in the afternoon. Moreover, published documents and statistics from (DNP, 2016) and (National Bureau of statistics, 2014) were also reviewed for the social assessment.

5. EXISTING ENVIRONMENT

5.1 INTRODUCTION

This Chapter of the report addresses the existing environmental baseline conditions at the project island. The analysis of existing environment is fundamental for the assessment of the projects feasibility and its impacts and determining the effective mitigation measures to avoid or minimise the effects of project activities on the environment.

5.2 CLIMATE

The Maldives, in general, has a warm and humid tropical climate with average temperatures ranging between 25°C to 30°C (MMS, 2016) and relative humidity ranging from 73 per cent to 85 per cent. The country receives an annual average rainfall of 1,948.4 mm (NIRAS, 2013).
Monsoons of Indian Ocean govern the climatology of the Maldives. Monsoon wind reversal plays a significant role in weather patterns. Two monsoon seasons are observed: The Northeast (*Iruvai*) and the Southwest (*Hulhangu*) monsoon. Monsoons can be best characterized by wind and rainfall patterns. These are discussed in more detail in the following subsections. The southwest monsoon is the rainy season which lasts from May to September and the northeast monsoon is the dry season that occurs from December to February. The transition period of southwest monsoon occurs between March and April while that of northeast monsoon occurs from October to November. **Table 23** below shows a summary of four seasons in Maldives.

Table 23: Summary of Seasons in the Maldives

Season	Months
North East-Monsoon (*Iruvai Moosun*)	December
	January
	February
Transition Period - 1 (*Hulhangu Halha*)	March
	April
South West-Monsoon (*Hulhangu Moosun*)	May
	June
	July
	August
	September
Transition Period - 2 (*Iruvai Halha*)	October
	November

General meteorological conditions expected to prevail in the project environment was based on meteorological data collected at Hanimadhoo. These findings are briefly discussed in the sub sections below.

5.2.1 Temperature

The northeast monsoon is classified as the dry season and brings less rainfall and higher, high temperatures and higher low temperatures while the opposite is observed for the Southwest monsoon which is the wet season. Based on temperature collected at various centres across Maldives. Minimum and maximum temperature was observed to remain constant with small variances. The minimum low temperature was cooler in the southern atolls compared to the northern atolls (See **Figure 19**).

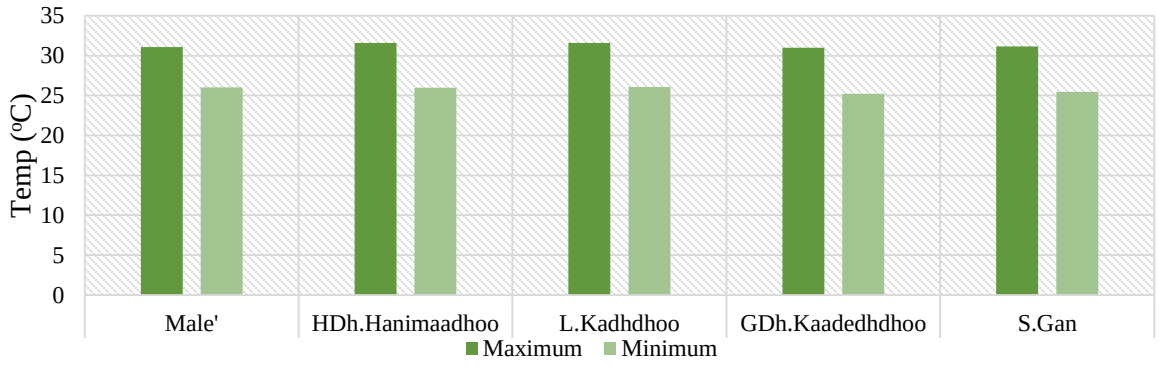


Figure 19: High and low temperature variance between atolls of the Maldives

The mean yearly high temperature for the past 38 years was 30.9 ^{0}C. The mean yearly low temperature for the past thirty-eight years was 24.7 ^{0}C. Yearly temperature variance for the past thirty-eight years was extremely consistent with 0.4 ^{0}C.

5.2.2 Wind

Wind data since 1964 indicate that the Maldives experience southwest to northwest winds (~225 – 315º) from April to November (westerly monsoon) with a mean wind speed of 0.5 ms^{-1}. In contrast, winds from the northeast-east (~ 45 – 90$^{0)}$ prevail from November to March (northeast monsoon) with a mean wind speed of 4.8 ms^{-1}. Wind strength is most variable during the cross-over between northeast and westerly monsoons with mean wind speed falling to 3.5 ms^{-1} in March (DNP, 2016).
Wind pattern influencing project area was assessed after compiling wind data obtained from Hanimadhoo from 2012 - 2016 via Maldives Meteorological Centre. **Figure 20** illustrates the wind pattern at HIA based on data compiled from 2012-2016. **Figure 21** shows monthly wind pattern at HIA for the year 2016.

An analysis of the data for the two seasons indicates that during the NE monsoon the wind direction predominantly varies between N and E with wind speed reaching 5 – 10 knots for 16% of the time. About 4% of the time speed reaches as high as 10 – 15 knots. During the transition from NE to SW monsoon the predominant direction changes to N and NW directions with speeds of 2 – 6 knots for 8% of the time. During the SW monsoon and the transition from SW to NE monsoon the wind is distinctly from W and NW directions. During SW monsoon predominant winds were from the W and NW. A minor component of wind from the SE direction was observed during NE transition period at 2 knots. High wind speeds of 10-15 knots are observed for 10% of the period

and wind speeds of 6 – 8 knots are observed for 10% of the time. Analysis shows the mean winds in the region hardly reach 50 miles per hour throughout the year.

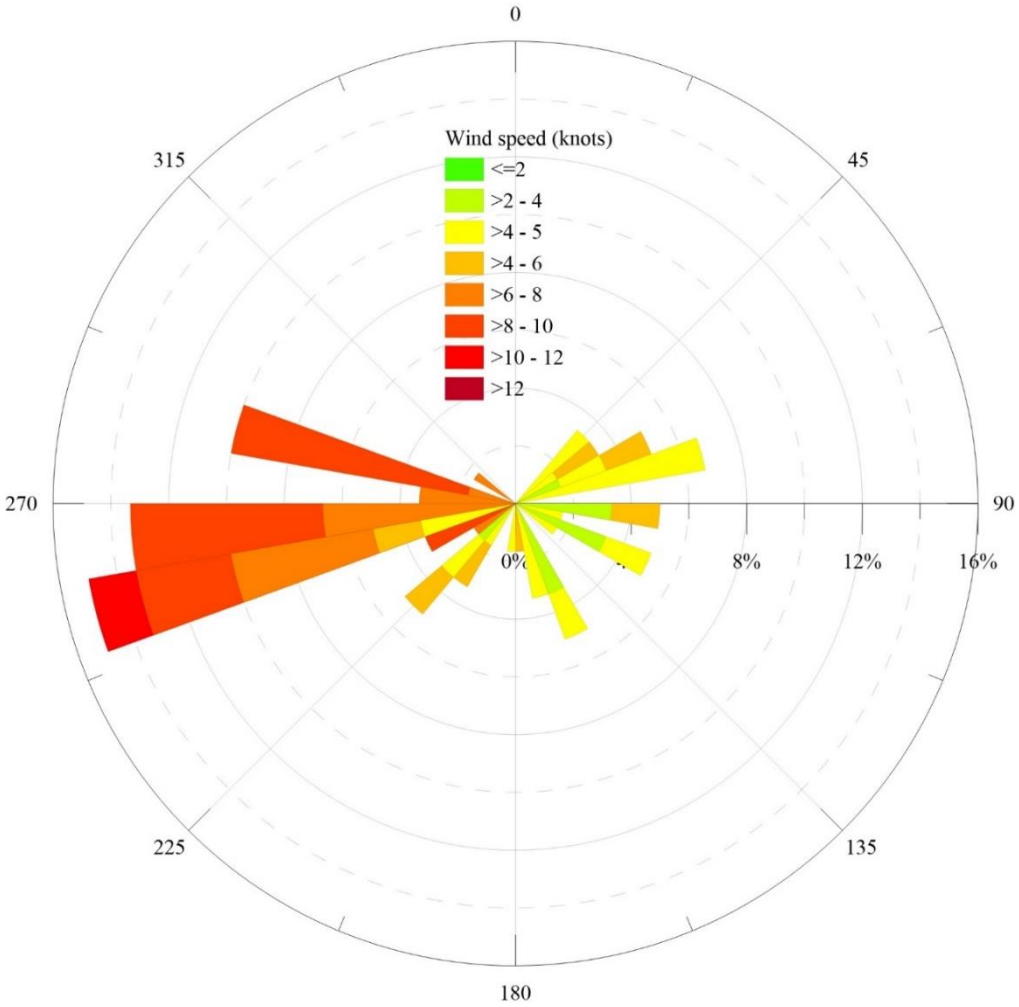


Figure 20: Windrose for Hanimaadhoo station 2012 to 2016

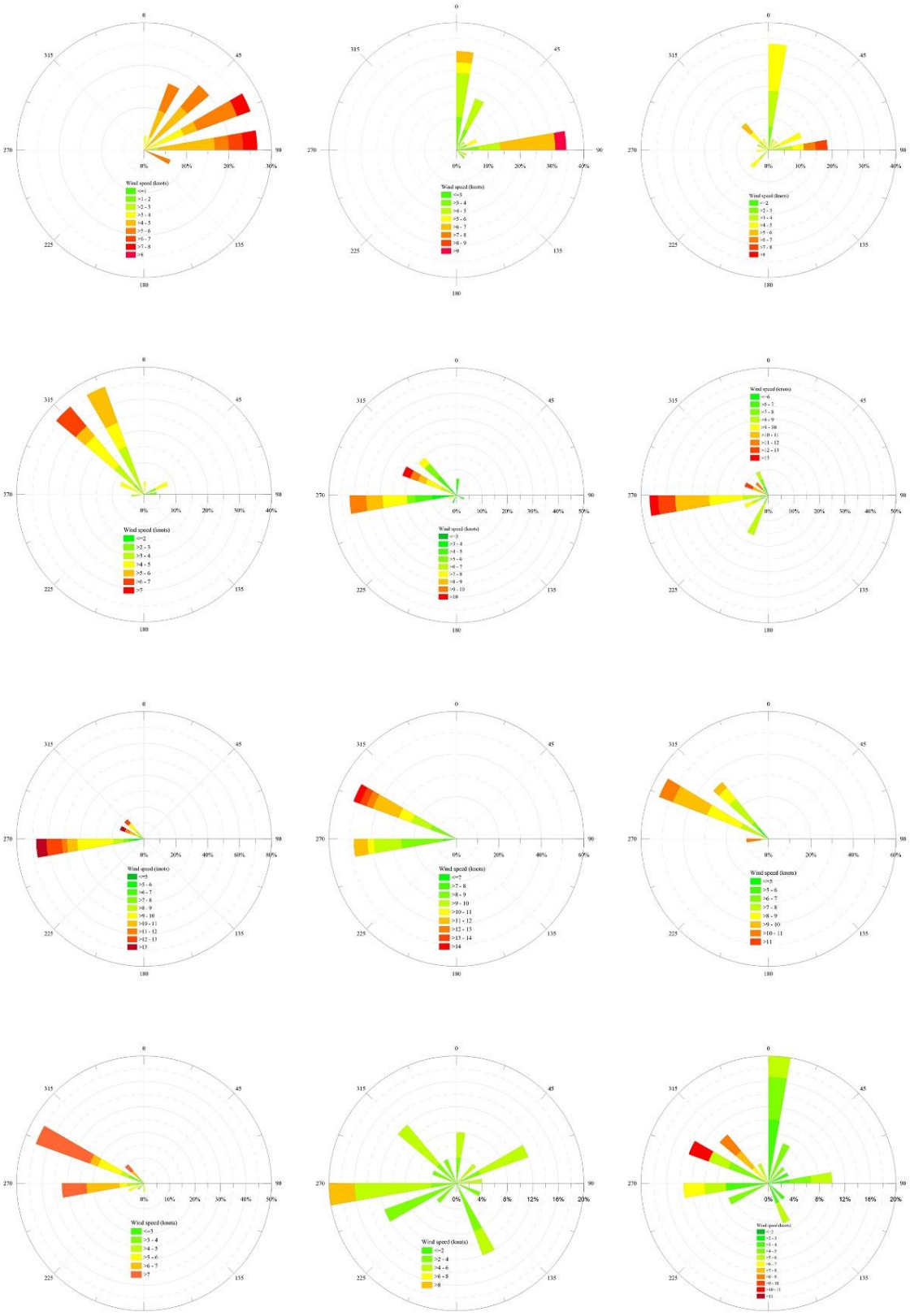


Figure 21: Monthly wind patterns at Hanimaadhoo station (Jan – Dec 2016)

5.2.3 Rainfall

Rainfall data for the year 2016 from Hanimaadhoo metrological station shows that the average rainfall in the northern parts of the Maldives is approximately 1700 mm per year. The rainfall pattern from January to December shows that only 30% of the annual rainfall is received during the NE Transition and NE monsoon compared to SW transition and SW monsoon. The wettest period is in the middle of SW monsoon, i.e. May-July. **Figure 22** illustrates comparison of monthly rainfall from the year 2012 – 2016,

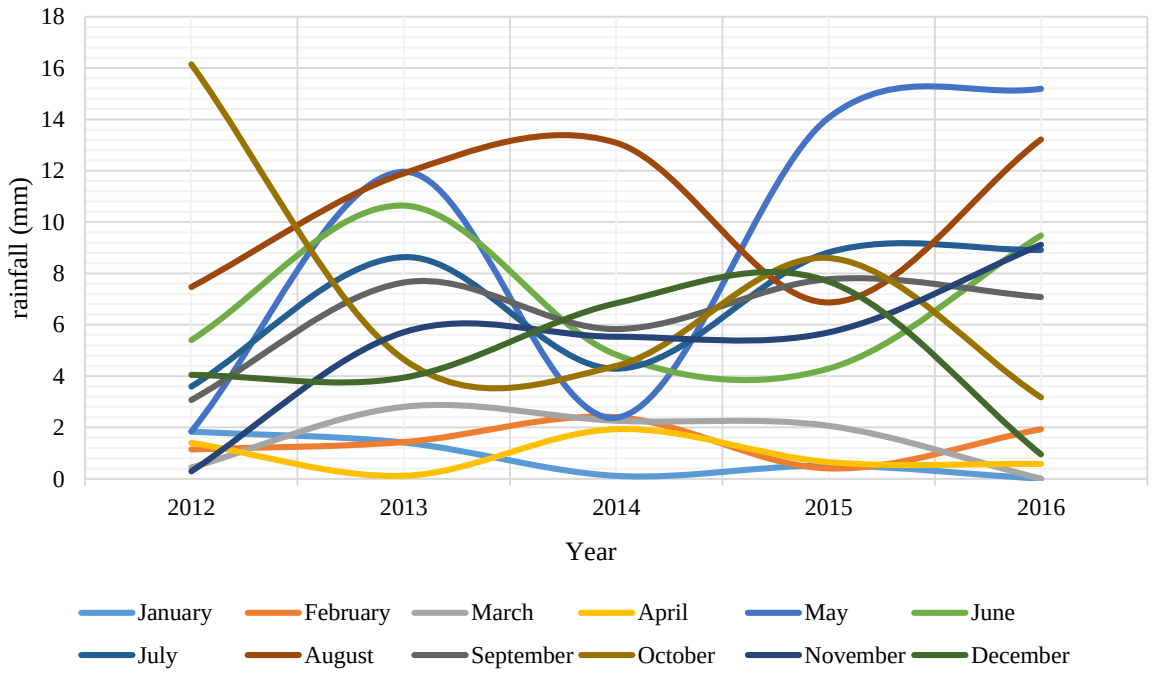


Figure 22: Comparison of monthly rainfall data 2012 - 2016

5.3 WAVES

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

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

Kench et al. (2006 & 2009) also reported from the experiments carried out on reef platform scale around the perimeter of reef islands that:

- Windward shorelines receive greater input of energy through a combination of swell and wind-wave energy.

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

Figure 23 illustrates wave patterns from offshore location 73.5 longitude 6.5 latitude (NOAA-2016)

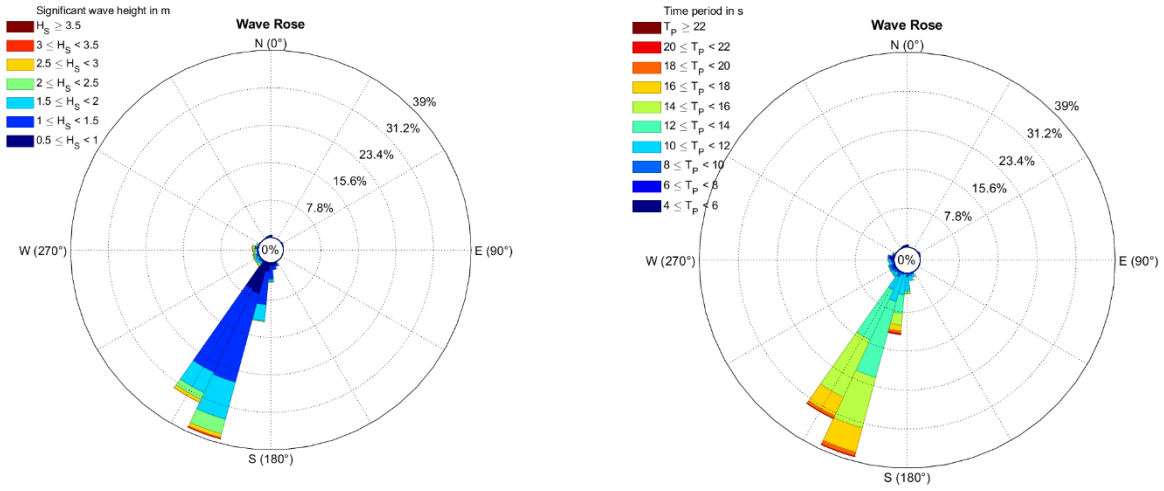


Figure 23: Offshore annual wave pattern (source: NOAA 2016)

Offshore NOAA wave data showed that:

- The average wave height was between 1-1.5 m
- the average wave period was between 12-16 s
- waves dominantly approached from SW

5.4 WATER QUALITY

Baseline water quality assessments was done for ground water. Chemical parameters tested include, temperature, pH, conductivity, turbidity, DO, total dissolved solids and salinity. **Table 24** shows water quality results of groundwater.

Table 24: Water quality results

ID	Date	Type	Temp /°C	pH	Cond/ mS/cm	Turb/ (NTU)	TDS/ (g/L)	Sal/(ppt)	DO/(mg/L)
U1	5/5/17	GW	30.53	7.8	1230	2.2	0.58	0.3	9.20

The groundwater temperature was 30.53°C, which was within the characteristic range for the Maldives. An average pH of 7.80 was calculated. pH of the sample tested was within the acceptable range specified by WHO. The turbidity level was 2.2 NTU. The total dissolved solids (TDS) recorded was 0.62 g/L. TDS of the site was within acceptable limit for drinking. Similarly, the average salinity of samples tested were 0.4 ppt. The groundwater samples tested can be classified as being non saline. The average DO was 9.20 mg/L.

5.5 BASELINE NOISE LEVEL

Noise measurements were taken from the locations shown in **Figure 18** to determine the baseline noise levels of the island. **Table 25** shows the result of noise measurements where main influencers of baseline noise have been identified. Noise from birds (crows) and ambient chatter were the main contributors to the background noise. Diffuse noise sources included the occasional motor vehicle (motorbike) and vessels entering and leaving the harbour. Wave action also played a role in baseline noise for Ha.Uligam.

Based on the measured data the averaged out baseline noise level is considered to be Leq 54.3 dBA. This is considered a normal quiet sound range with no health impacts by (WHO, 2004). A noise exposure of 90 dBA and above is considered as hazardous and dangerous.

Table 25: Baseline noise level of Ha.Uligam

Name	Ha.Uligam
L05	60.7
L10	59.5
L50	46.3
L90	43.2
L95	40.8
SEL	71.8
Leq	54.3
Time	6:30:39 PM
Noise influences	• Light breeze • Few crows in the background
Measurement unit	dB(A)
Measurement rate	Fast (1 minute)
Measurement range	30 – 90 dBA

5.6 TERRESTRIAL ENVIRONMENT

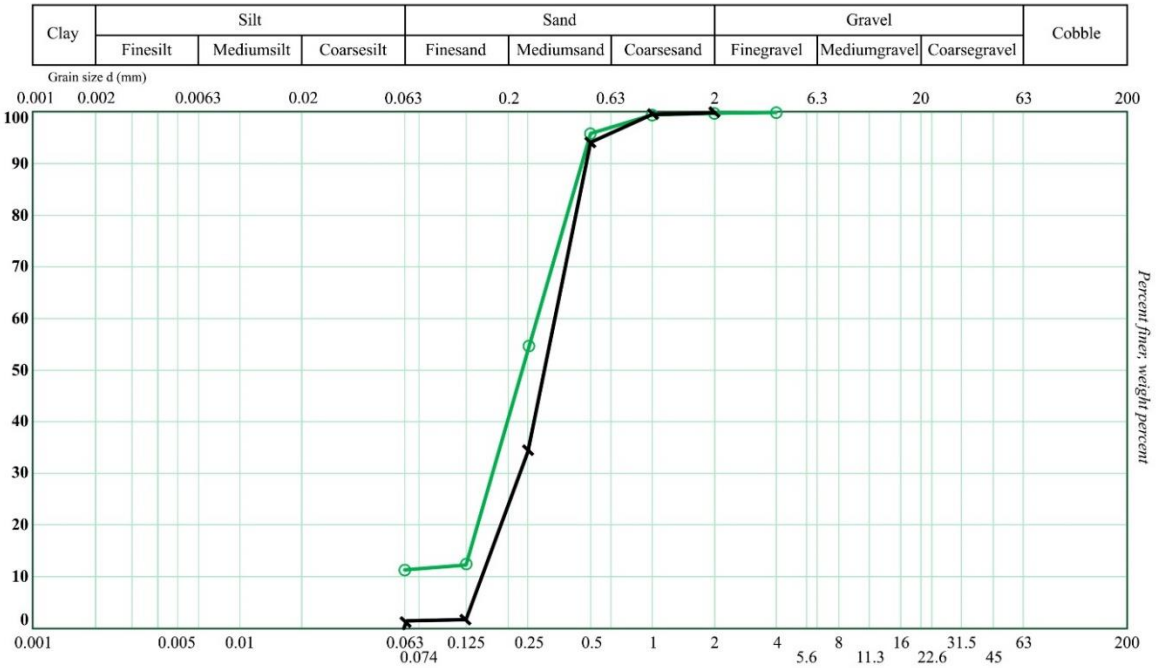
5.6.1 Landform and Soil

The land allocated from the terrestrial environment for the proposed development had a flat terrain and was densely vegetated.

Physical inspection of the soil at IWMC site in Ha.Uligam do not show any dissimilarities compared to soils found in other islands. In general Maldivian soils are mainly made up of mineral soils, the basis for soil is calcareous material derived from coral rock fragments intermixed with various amounts of plant litter forming a top soil layer which is generally darker in colour. This thin topsoil layer is underlain by a layer of sand before reaching the water lens. Several past studies indicate that the water lens is generally overlain by just about a meter of sand (FAO, 1974) (SWECO, 2009) which can be safely applied to be the case for the land of the island.

Grain size distribution analysis of top soil extracted from 0.25 m from the surface and bottom soil extracted from 1.3 m below surface from a similar island showed that the soil did not contain silt or cobble. See **Figure 24** for grain size distribution of the top soil and bottom soil layer.
One of the most important physical features to consider is the hydraulic conductivity of the soil which indicates soil's ability to prevent water transport. The high infiltration capacity of the soils would mean susceptibility of the groundwater lens to ground surface pollution.

According to (Selvam, 2007) Maldivian soils are geologically young and consist of substantial quantities of the unweathered coral parent material, coral rock and sand. In most of the places, soils are coarse in texture and shallow in depth with a top layer of brown soil (0 to 40 cm in depth) followed by a transition zone on top of the underlying parent material of coral reef limestone. The soils are generally poor and deficient in nitrogenous nutrients, potassium and several micronutrients particularly iron, manganese and zinc. Though the phosphorus content of the soils is high it is present mostly in the form of calcium phosphate and, thus, remains unavailable to plants. The soils of the Maldives are generally alkaline with pH values between 8.0 and 8.8. This is mainly due to the presence of excess calcium.



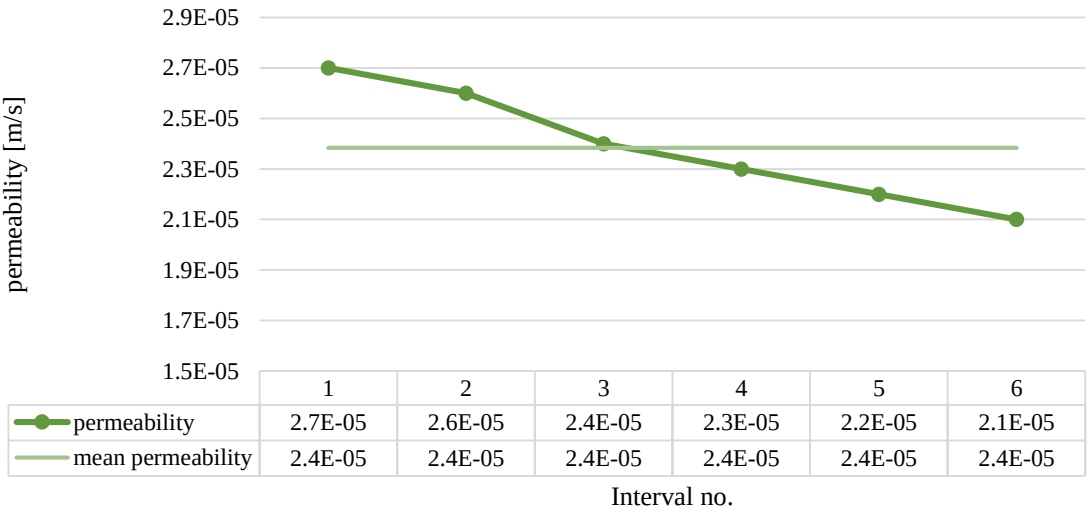
Location	Sieved legend	Soil classification	Quantity Sieved	Frost-heav cap	d10	d60	d90
Bottom Soil Layer Vandhoo		Sand	310	2/1*	0.149	0.336	0.476
Top Soil Layer Vandhoo		Sand	309	2/1*		0.273	0.453

Figure 24: Grain size profile of typical Maldivian Islands (Data from Vandhoo soil samples tested in Jan 2017)

The grain size analysis for a soil sample obtained from a similar location in the Maldives showed that:

- Bottom soil contained less fine sand compared to top soil. Fine sand was the least prominent type of sand in both layers.
- Medium sand with lower grain size (approximately 0.2 mm) comprised of about 40% weight percent of the topsoil while it was 35% weight percent in bottom soil.
- The difference between sand composition between the top soil and bottom soil layers decreased significantly as grain size increased.
- Coarse sand and fine gravel (grain size of approximately 1-3 mm) comprised the majority of the two soil fractions

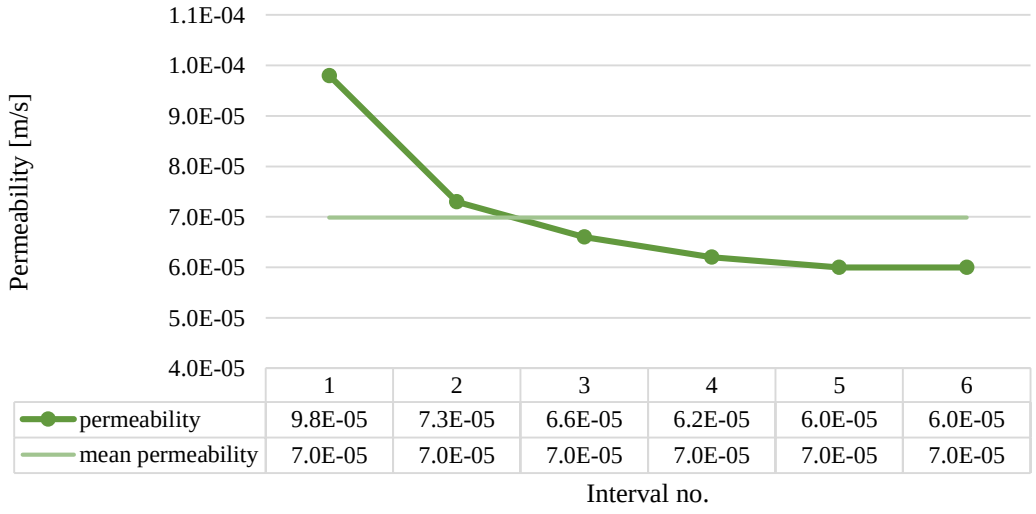
Permeability of water is a crucial factor of soil as it determines infiltration rate or potential to contaminate the ground water should a pollutant is spilled on the soil surface. In other words it indicates soil's ability to transport fluids through it.
Graph illustrated in **Figure 25** shows the permeability test and results of top soil.



	1	2	3	4	5	6
permeability	2.7E-05	2.6E-05	2.4E-05	2.3E-05	2.2E-05	2.1E-05
mean permeability	2.4E-05	2.4E-05	2.4E-05	2.4E-05	2.4E-05	2.4E-05

Figure 25: Permeability of top soil

Top soil had a density of 1.59 g/cm^3 with a water ratio of 8%. The mean permeability of top soil was found to be 2.4×10^{-5} m/s.
Graph illustrated in **Figure 26** shows the permeability test and result of bottom soil layer.



	1	2	3	4	5	6
permeability	9.8E-05	7.3E-05	6.6E-05	6.2E-05	6.0E-05	6.0E-05
mean permeability	7.0E-05	7.0E-05	7.0E-05	7.0E-05	7.0E-05	7.0E-05

Figure 26: Permeability of bottom soil

Bottom soil had a density of 1.59 g/cm^3 with a water ratio of 6%. The mean permeability of bottom soil was found to be 7.0×10^{-5} m/s.

The lower the permeability figure, the better for protecting the groundwater, since it represents a large resistance to water transport, i.e. transport of possible pollutants into the water table which is generally found a meter below the surface. The increased hydraulic conductivity is anticipated

as much of Maldivian soils are composed of course sand to fine gravel that are poor at retaining water.

5.6.2 Vegetation

The vegetation of project site was determined based on actual survey data. Dominant vegetation of the area were shrubs and bush trees mainly comprising of sea lettuce and headache tree. **Figure 27** shows the type of trees and its count at the project area. **Figure** 27: Vegetation at the proposed site Ha. Uligam

Table 26 shows the frequency of different types of trees in the area. There were no plam trees at the proposed area.

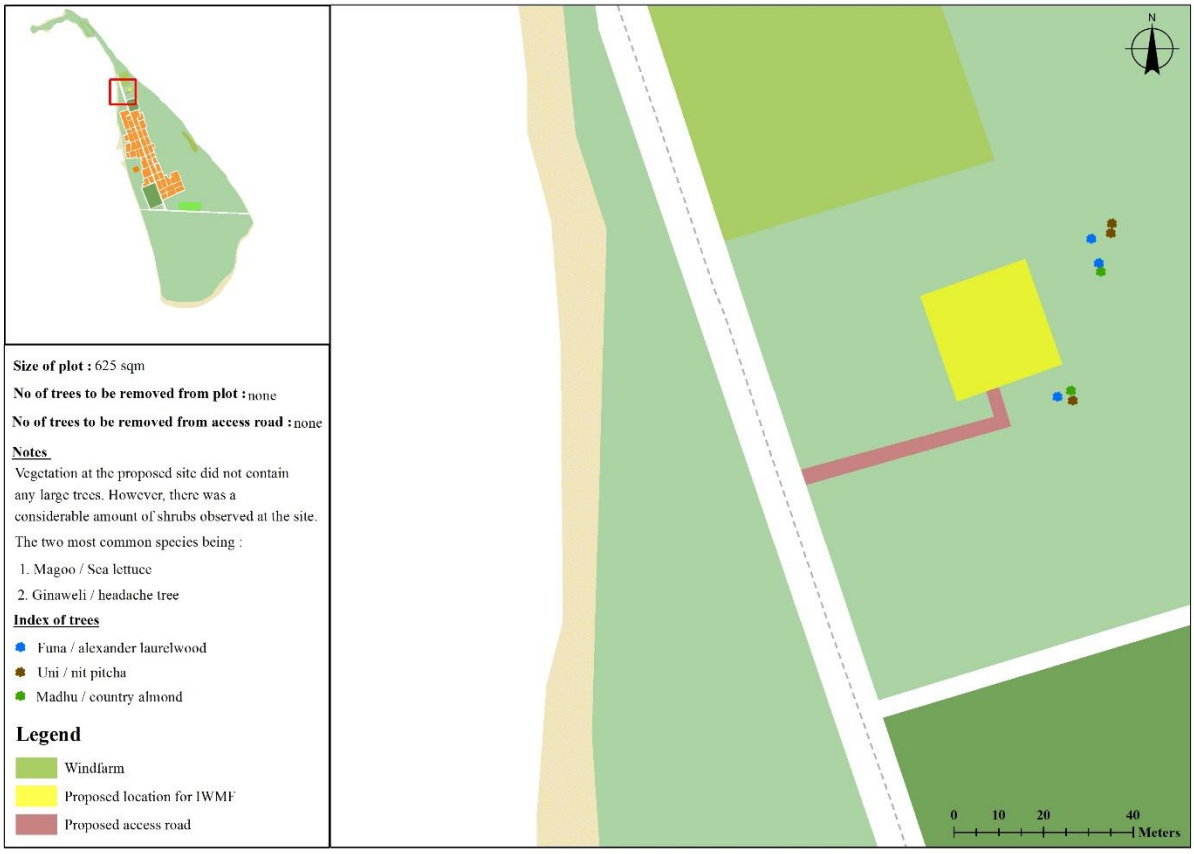


Figure 27: Vegetation at the proposed site Ha. Uligam

Table 26: Types of trees observed at Ha. Uligam project area

Native vegetation						
Common name	Scientific name	Local name	No. of trees/ 50m^2	**Abundance**		
				Low	Moderate	High
Alexander laurelwood	*Calophyllum inophyllum*	Funa	3			
Country almond	*Terminalia cattapa*	Midhili	2			
Nit Pitcha	*Guettarda speciosa*	Uni	3			

5.6.3 Terrestrial Fauna

Most of the common terrestrial invertebrates of the country are observed on the island. In general, several terrestrial and intertidal crabs, butterflies, moths, beetles, spiders and scorpion were observed on the Island. No unusual invertebrate was encountered during the limited survey period. The fruit bat (*Pteropus medius*), the only endemic terrestrial mammal in the Maldives was observed in the island.

Bird calls were common in the island throughout the day. Several species of shore birds including, *Ardea cinerea* (grey heron), *Areneria melanocephala* (black turnstone), *Tringa hypoleucos* (common sandpiper), *Numenius arquata* (eastern curlew) and *Sterna sumatrana* (black-naped tern) were observed. All these birds enjoy protected status in the Maldives. Endemic and protected birds *Eudynamys scolopacea* (Asian koel) were believed to be found in reasonable numbers as they were frequently sighted and calls heard. Mangrove crabs belonging to the family *Sesarmidae* such as *Neosarmatium smithi (*red mangrove crab*)* were observed in the wetland areas of the island. Mangrove crabs helps to remove sulphides and ammonium from wetland areas which affects the productivity and reproductive output of the vegetation which makes them a keystone species.

Two species of reptiles; the mourning gecko (*Lapidodactylus lugubris*) and the garden lizard (*Calotes versicolor*) were also observed. House rats, crows and mosquitoes were found to be widespread throughout in the island.

5.6.4 Pests

Mosquitoes, rats (*Rattus rattus*) and house crows (*Corvus splendens maledivicus*) were prevalent on the island at the time of this assessment. Rampant presence of these species was an indication of the poor management of waste in the island and poor maintenance of general cleanliness in the island. Such widespread nature of mosquitos would necessitate making available suitable clothing and mosquito repellent to workers to prevent nuisance and potential health risks posed by mosquitoes.

5.6.5 Protected Areas and Sensitive Sites

There are no protected areas close to the project sites. The nearest protected area (*Kuredhu Express)* to the project island is in Lhaviyani Atoll. The project is not expected to have any negative impacts on protected sites. However, since the project involves management of waste, pollution of coastal areas and sea will be considerably reduced which means protected areas would have a secondary positive impact as a result of the proposed project.

However, there are closed wetland systems which are considered to be sensitive sites in the island as illustrated in **Figure 28**. The wetland consisted of a thick *Bruguiera cylindrica* forest, *Bruguiera gymnorrhiza* trees and a *Rhizophora macrorrhiza* tree**.**

Figure 28: Wetlands and water bodies in Ha.Uligam

Figure 29: Wetland at Ha.Uligam (A) small leafed orange mangrove forest (B)Wetland area on the far north of the island (C)(D) Red mangrove crab and brackish-water snail.

Wetlands are areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods of time during the year, including during the growing season. Water saturation (hydrology) largely determines how the soil develops and the types of plant and animal communities living in and on the soil. Wetlands may support both aquatic and terrestrial species. The prolonged presence of water creates conditions that favor the growth of specially adapted plants (hydrophytes) and promote the development of characteristic wetland (hydric) soils. Wetlands also act like sponges by holding flood waters. Wetlands filter and purify water as it flows through the wetland system. Plants found in wetlands help control water erosion. Provide habitat for a wide variety and number of wildlife and plants, Filter, clean and store water - in other words, acting like kidneys for other ecosystems.

5.7 HAZARDS AND VULNERABILITY

In general, natural hazards that occur in Maldives can be broadly distinguished into geological and meteorological hazards. Based on the DIRAM UNDP 2006 the following hazards are relevant to the project location.

- Wind storms;

- Swell waves and wind waves;
- Flooding due to heavy rainfall/storms;
- Gravity waves (sea swells and *udha*); and
- Tsunami.

DIRAM report stated that major natural hazards in the Maldives are strictly controlled by the geophysical and climatic settings and shows quite different patterns in their distribution, as shown in **Figure 30.**

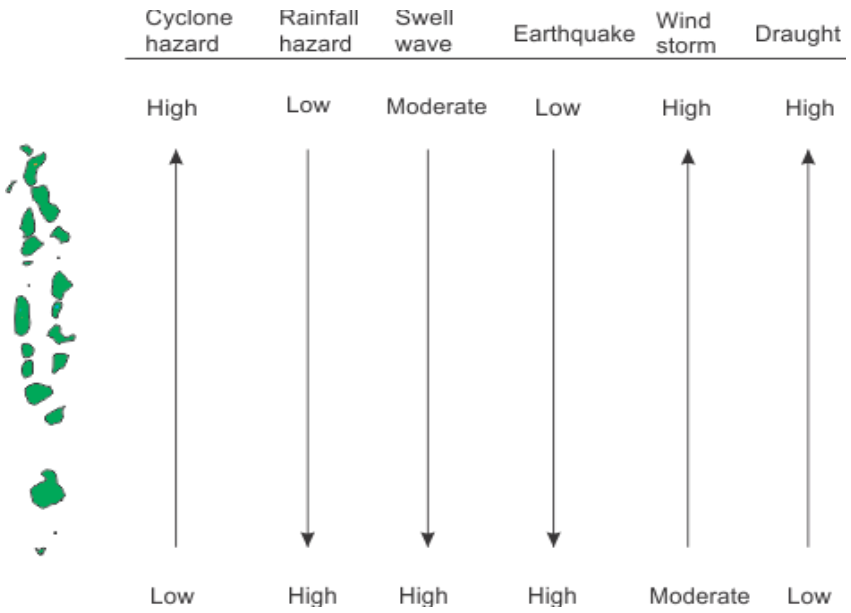


Figure 30: Exposure to hazards based on geographic location of atolls (source: UNDP, (2006)

The damage potential based on frequency of natural hazard to the Maldives is summarized in **Table 27**.

Table 27: Damage potential based on frequency of hazard (UNDP, 2006)

Hazard	Tsunami	Swell waves or storm surges	Rainfall flooding	Strong winds
Frequency	Once in 200 years	Occasionally every year	Once every year	Several times a year
Potential damage	Very high	high	moderate	low

Maldives being located within the equatorial region of the Indian Ocean is generally shielded from cyclonic activity (UNDP, 2005). There have only been a few cyclonic strength depressions that have tracked through the Maldives, all which occurred in the northern and north central regions. Only 11 cyclones crossed the islands over the entire span of 128 years. None of them passed the southern islands.

The northern atolls are at a greater risk from being effected by cyclonic winds and storm surges compared to southern atolls as depicted in **Figure 31** (UNDP, 2009)

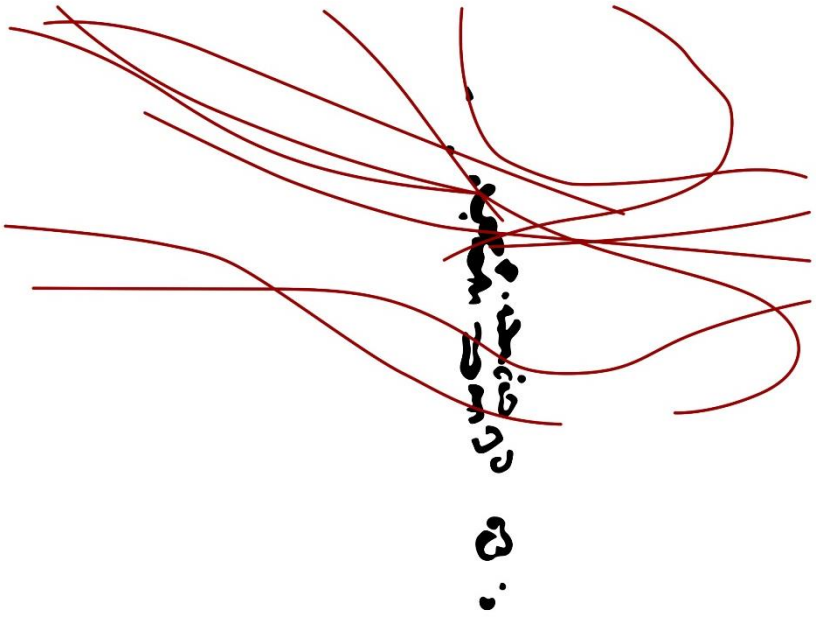


Figure 31: Tracks of cyclones affecting Maldives, 1877 - 2004 (Source: UNDP, 2009)

Natural hazards vulnerability for the project island was also analysed based on the Detailed Island Risk Assessment in Maldives (DIRAM) carried out for H Dh. Kulhudhuffushi (Riyan, 2013). Since Uligam is fairly close to H Dh. Kulhudhuffushi, it was anticipated that in general similar risks factors will be observed for Ha.Uligam as well.

Based on findings of the previous study the most common risks to the project island is flooding caused by heavy rainfall, swell surges and wind storms including cyclones. These were in line with the previous studies conducted by UNDP for the Maldives. **Table 28** describes significant vulnerabilities of the island to natural hazards.

Table 28: Vulnerability of project island to natural hazards

Hazard	Time	Description	Ha Uligam
Flooding caused by heavy rainfall	Commonly during SW monsoon	Flooding occurs in settlements situated at low areas of the island. Minor disruption to daily activities are caused by flooding (UNDP, 2007)	High risk Natural drainage from wetlands help to mitigate flooding. The island has wetlands but do not have storm water drainage systems. Low lying nature of the island makes it more vulnerable.
Flooding caused by swell surges	Commonly during SW monsoon	On top of damaging coastal integrity of island, swell waves damage farming lands and causes flooding and damages to infrastructure.	High Risk Exposed from the eastern side to the open ocean. There have been records of minor to moderate swells causing erosion.
Windstorms	SW monsoon	Strong winds, cyclones have been known to cause physical damages. These include damage to farms and infrastructure.	High Risk Island is located on the northern half which is more readily effected by cyclonic winds and storm surges.
Droughts	-	-	-
Earthquake	-	-	-
Tsunami	26th December 2004	70% of the islands were flooded. The primary reason for Tsunami inundation was due to the low ridge of the island and low areas located at the center of the island. (UNDP, 2005)	Low Risk

6. SOCIO-ECONOMIC ENVIRONMENT

This chapter covers socioeconomic environment of project island as required in the ToR for the EIA study. The demographical, economic situation, land use planning, natural resource use, accessibility, transport services, basic infrastructure services such as water supply, wastewater disposal, solid waste disposal, energy supply and social services (health, education, security and recreation) and community needs of the local population is covered in the chapter.

6.1 BACKGROUND

The project island is located Haa Alif atoll where the capital island of Haa Alif atoll is Dhihdhoo A summary of the socio economic condition of Ha.Uligam is given in **Table 29.**

Table 29: Socio-economic condition of project Island

Island	Crime	Youth employment	Legal services	Health services	Bank	Police	Harbour	Electricity	Safe water	Sewerage service	Waste management	Transport services	School	Tourism	NGOs
Ha. Uligam	low	moderate	no	yes	no	no	yes	yes	no	no	no	no	yes	no	yes

In terms of total land area of the islands in the atoll, Haa Alif Atoll is ranked 3rd (see **Figure 32)**. On the other hand, in terms of atoll size Haa Alif atoll was the 4th smallest and is one of the smallest atolls among the 20 administrative units in the Maldives considering the total area covered as shown in **Figure 33**.

In terms of reef area Haa Alif Atoll have a considerably smaller reef area compared to the rest of the Maldives. However, it has the 3rd largest reef area for an administrative unit in the country (**Figure 34**).

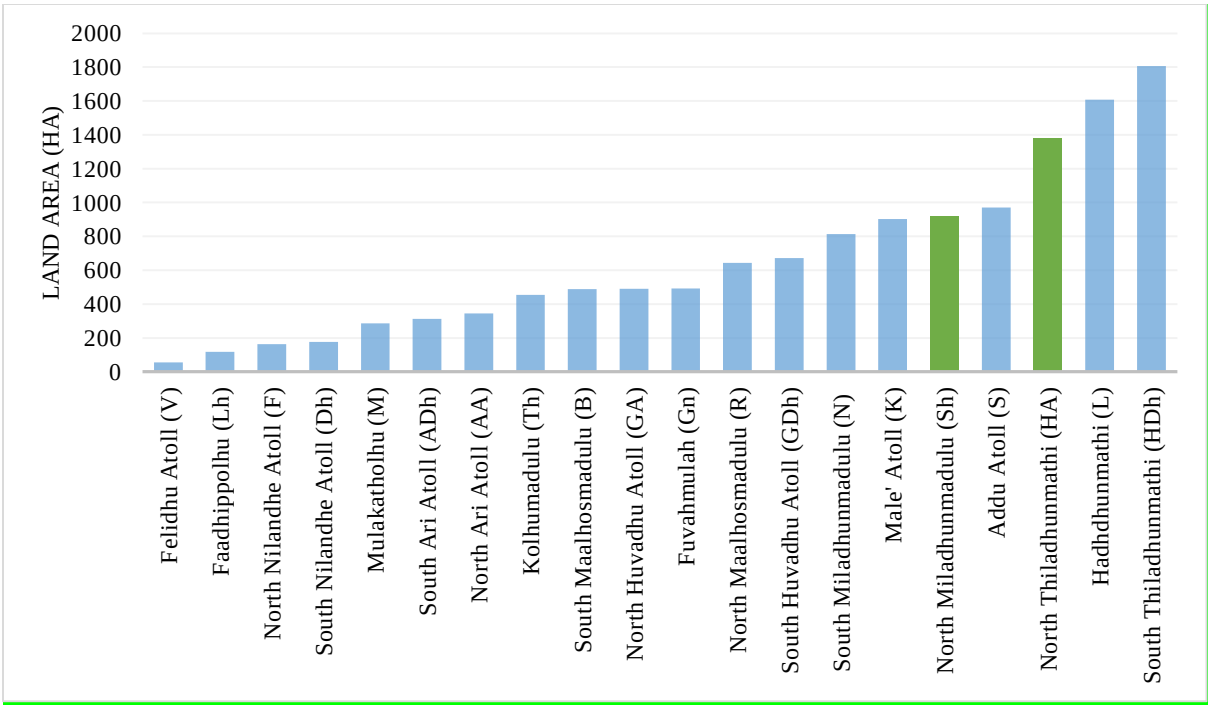


Figure 32: Land area of inhabited islands in the 20 atolls of the Maldives (DNP, 2010)

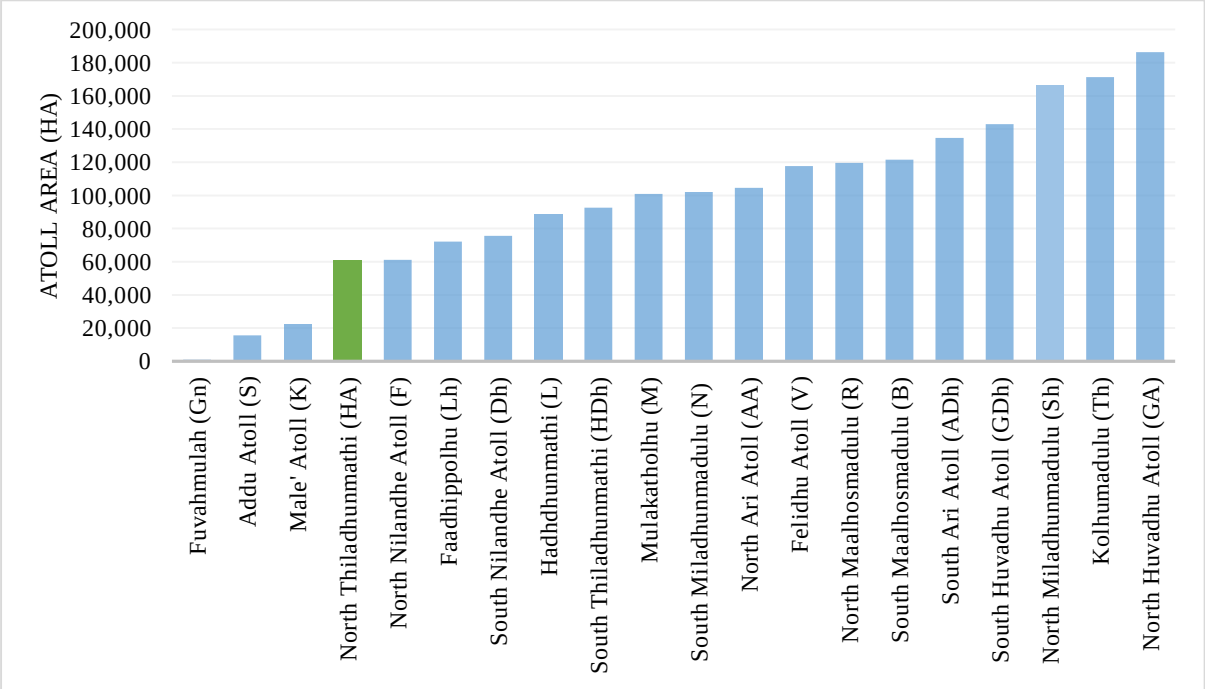


Figure 33: Atoll area of administrative atolls of the Maldives (Source: DNP, 2010)

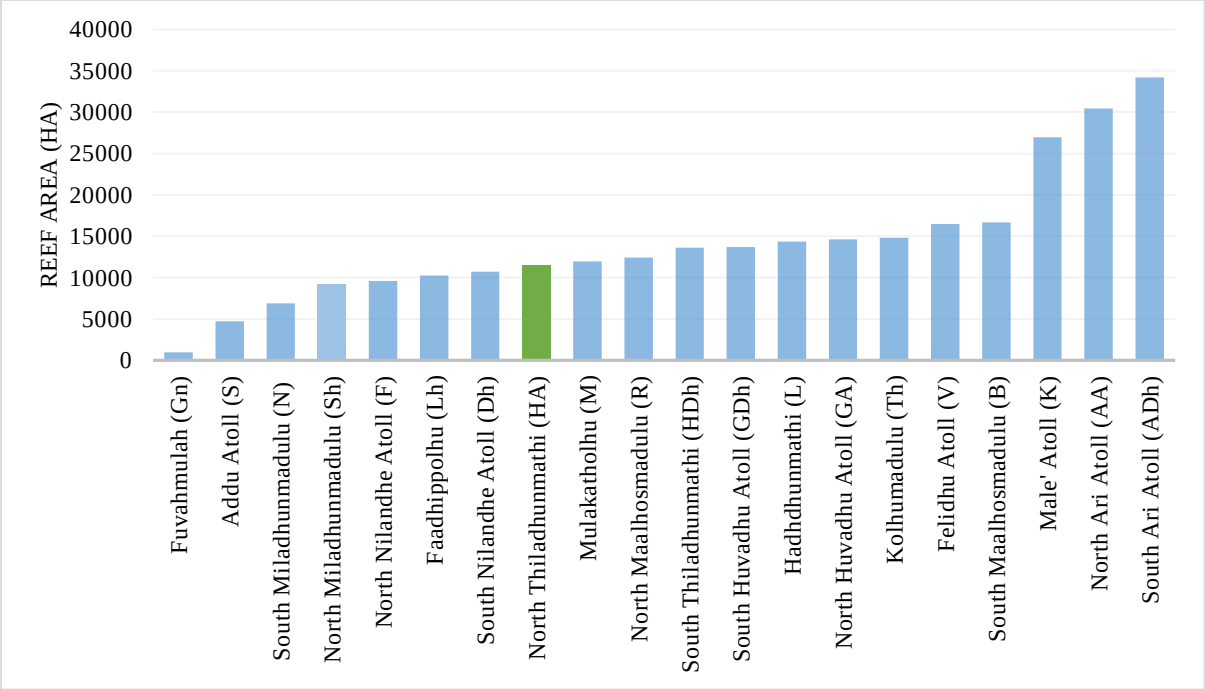


Figure 34: Reef area of administrative atolls of the Maldives (Source: DNP, 2010)

6.2 LAND USE

Ha.Uligam can be considered as a moderately urbanised island with a low population. The settlement footprint covers a minor area of the island. There are no major industrial activities on the island. There is one cafe in the island. Most of the island's natural vegetation belt remains intact. Inland vegetation had been cleared for the larger part and replaced with coconut palms on the northern area. The island does not have an approved LUP. Hence the proposed area to construct the IWMC has been approved by EPA and MHI through the waste management area zoning form which is attached in **Annex 12**. There were significant tourism developments planned on the southern side of the island where land has been allocated as a tourism zone. However, this project has been discontinued. Future population growth is anticipated towards the south. The council has highlighted that local tourism will be developed on the island most preferably at the previously demarcated tourism zone or on the northern side of the island.

6.3 POPULATION

The current population of Ha.Uligam is 513 based on census data provided by the council on 2016. **Figure 35** shows the population distribution of all inhabited islands in Haa Alif, Haa Dhaal and Shaviyani Atoll. Pie chart in **Figure 36** shows relative population distribution categories of zone 1. Ha.Uligam was observed to fall between the 29% of the population distribution category. The average family size of the island is between 4-5 people. (National Bureau of statistics, 2014) data showed that Haa Alif atoll had a negative annual population growth of 0.28.

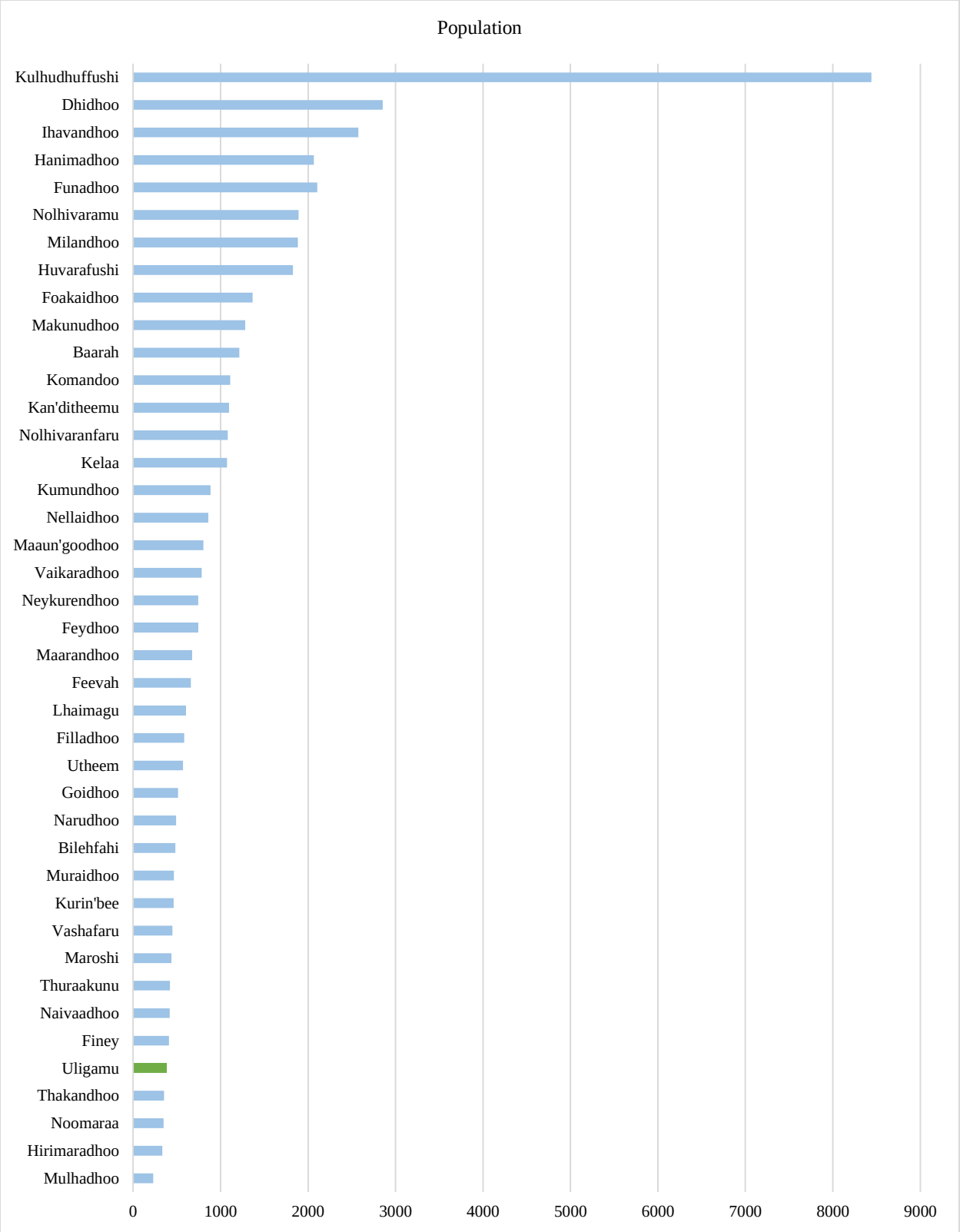


Figure 35: Population of islands in Zone 1. Project Islands in green. (Census 2016 provided by island council)

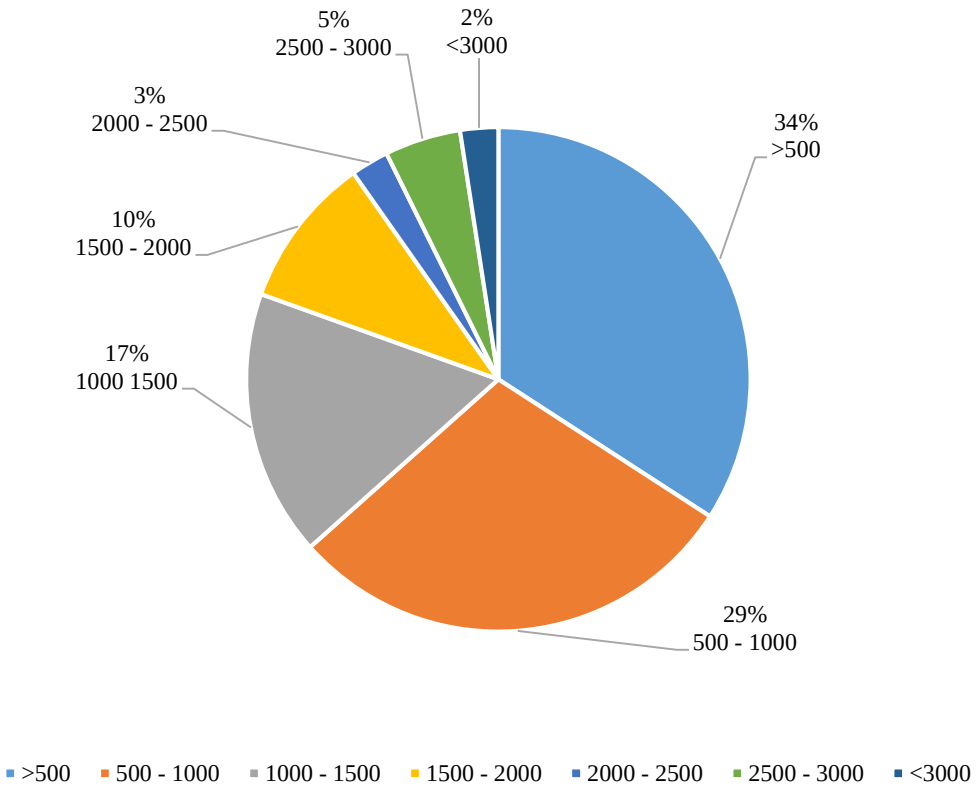


Figure 36: Population categories based on population size in zone 1

6.3.1 Education

Ha.Uligam have a public school that teaches up to the higher secondary level. The school has all the facilities required for teaching.

6.3.2 Health

The health services provided in Ha.Uligam is generally comparable to other islands in the Maldives.

There is one health centre in the island that provides medical services and assistance for 24 hrs. The health centre has a laboratory which is able to do the essential medical tests. There are approximately 7-12 nurses and 1-4 doctors at the health centre. Medicines are easily available from the *Asandha* pharmacy established in the island.

Most commonly reported diseases are acute respiratory infections, viral fever, and diarrhea. Other diseases rarely reported in the island include dengue fever, typhoid and scrub typhus.

6.3.3 Economic Activities

Table 30 shows the main economic activities of Uligam. Zone 1 is not known for tourism activity.

Table 30: Main economic activities of the island.

	Commercial Fisheries	Small scale fisheries	Poultry	Animal husbandry	Commercial scale farming	Small scale farming	Building construction works	Carpentry	Tourism	Hand crafts (*Fangiviyun*, mat weaving)
Ha Uligam										

Small scale farming involves harvesting coconuts from trees. The most common type of trees grown in the islands includes watermelons, papayas and bananas. Most of the small scale fisheries involves reef fishing and selling catch within the island.

6.3.4 Access to Social Services & Civic Amenities

Electricity services is provided by FENAKA. A single power house is present in the island that provide electricity for 24 hrs. the island has a closed harbour which protects from swells and can be used to access the island. The island does not have a sewerage system or a water network. Most people collect rainwater and use groundwater for washing purposes. "Ooredoo" along with Dhiraagu provides mobile communication services. Almost all the people in the working population have a mobile phone. Internet services are provided by the private companies Coax net and Sat link. Other amenities available on the island includes cable and satellite TV service.

The main sports played in the island are football, cricket, volleyball, netball, badminton and a traditional game called *bashi*. The island has a designated football field which can be used for recreational purposes.

7. STAKEHOLDER CONSULTATION

This section of the report aims to address **Task 8** of the TOR. The key stakeholders of the project include:

1. Ministry of Environment and Energy (MEE);
2. EPA;
3. Ministry of Housing and Infrastructure;
4. Island Councils;
5. General Public;
6. Contractor and
7. Consultants.

The stakeholders that participated in the consultations extensively discussed the issues relating to the project and their perception and recommendation to enhance the project. Public consultations and workshops conducted during the field visit revealed that most of the primary stakeholders identified that the proposed waste management project would be beneficial. The consultations highlighted a wide array of concerns and recommendations which included critical assessments of proposed locations and its direct and indirect short term and long term impacts.
Sections below summarises the outcome of all the consultations held with the primary stakeholders with regard to the project.

7.1 CONSULTATION WITH MEE

7.1.1 Meeting with Proponent

The proponent was consulted at the start of the assignment to discuss project scope and after field surveys to discuss findings of the initial field surveys.
Meeting Summary

- Proponent informed that scope of the EIA shall include land clearance and construction of the IWMC.
- Proponent informed that MEE will be responsible for the construction of IWMC, while land clearance shall be undertaken by the respective island councils.
- MEE highlighted that EPA issued DS stating to prepare an EIA for the islands of Ha.Maarandhoo, Sh.Kanditheem, Sh.Feydhoo, Sh.Lhaimagu and Ha.Uligam
- Based on initial field surveys consultant informed MEE that in light of the findings, three islands Ha.Uligam, Sh.Bilehfahi and Sh.Feevah will have to be environmentally re-screened.

7.2 CONSULTATIONS WITH EPA

7.2.1 Scoping Meeting

The scoping meeting was held on 30 April 2017 to set the scope for the project. Representatives from EPA, Ministry of Environment and Energy (Proponent), Lhaimagu Council, Maarandhoo Council and Environmental consultant was present at the scoping meeting. Representatives of Ha.Uligam council was not present at the meeting. Five island councils were invited for the scoping meeting which include Ha. Maarandhoo, Sh.Kanditheem, Sh.Feydhoo, Ha.Uligam and Sh.Lhaimagu council.

Meeting Summary

- Brief overview of the project: It was highlighted that waste management will not involve burning waste at the island level. Waste from islands will be transferred to the regional waste management center. Only organic waste will be managed at the island level to make compost. All necessary equipment required to manage waste at in the IWMC will be provided as part of the project.
- Scope of EIA: The scope of EIA involves land clearance to construct the Island Level Waste Management Centre (IWMC) and to create the access road.
- Summary of existing waste management practices were shared by the members of the council who were present at the meeting. Waste management in Lhaimagu and Maarandhoo mainly involved burning and burying waste at designated areas. Both councils raised concerns with regard to lack of land area and impacts arising due to burning waste.
- Maarandhoo Council member highlighted concerns with regard to the potential damage that can be caused to the harbour by the waste collecting vessel.
- Council members highlighted that most of the vegetation intersecting the proposed road and plot consists of privately owned coconut palm trees. Hence, removal of such trees will have to be compensated.
- EPA highlighted, relocation of trees within the island or outside of the island is preferred and requested the consultant to explore or identify options for which trees can be relocated as opposed to being removed for timber.
- EPA informed that assessment of alternatives shall be carried out in order to select sites with least social and environmental impacts.
- EPA informed that buffer distances recommended by EPA in the zoning form shall be kept in order to mitigate impacts.

The TOR for Ha.Uligam was approved on 23rd July 2017. See **Annex 2** for approved TOR of the project.

7.3 CONSULTATIONS WITH ISLAND COUNCILS

Island councils are one of the main stakeholders of the project. Island Councils are assigned with the mandate of managing waste at the island level. They are responsible for designing managing and implementing the island level waste management plan. The island councils are also responsible for land clearance and mitigating various impacts arising from the project most notably compensation for removal of trees where necessary.

Consultations with Island Councils were was held to discuss

1. The existing waste management situation in the island;
2. The proposed waste management plan by the council;
3. The main impacts which will arise during the construction phase and measures taken or proposed by the council as mitigation; and
4. The alternative locations which can be considered to establish the IWMC.

7.3.1 Meeting with Ha. Uligam Council

Meeting with Ha.Uligam council was held on 4/5/2017. Meeting attendance sheet is attached in **Annex 5** of the report.

Meeting Summary

- The council highlighted that currently waste is dumped into a designated area on the north eastern side of the island's forested area (See **Figure 7**). However, since there is no constructed dump site, people occasionally throw waste into the bushes and else ware around the island. Most of the kitchen waste are thrown into sea or beach., non-perishable waste such as diapers are buried in at the dumpsite. Public areas of the island are kept clean by parties hired by the council on contract basis.
- The council informed that they plan to assign *Fenaka* to manage and operate the IWMC once it is constructed. This is mainly because the council does not have the necessary man power and resources to implement a waste management plan. The council does not have a vehicle to implement waste collection and the amounts of waste produced in the island is not considered to be economical by the council.
- The council highlighted that the proposed waste management site does not have palm trees which require compensation. Since it is closest to the inhabited area installation of electricity will be the easiest. Hence the proposed site option 1 was the most economically feasible site.
- The council informed that the alternative site is situated close to the existing dump site. However, the area consists of privately owned palm trees which makes it economically less favourable.

7.4 CONSULTATION WITH THE PUBLIC AND COMMUNITIES

7.4.1 Community Consultation (Ha.Uligam)

Community consultation at Ha.Uligam was held on 5/5/2017. Meeting attendance sheet is attached in **Annex 5** of the report.

Meeting Summary

- In general majority of the participants did not prefer the proposed site for IWMC (option 1). Mainly because:
    - The site is close to the public school;
    - It is situated in an area which is being used for swimming by the locals;
    - Some participants highlighted that the area can be used for future local tourism development;
    - It was located on the far north of the island which will be a disadvantage for households located on the south.
    - In case waste is burned at the site due to improper management, the participants preferred a site which is located further away from residential and public areas;
    - During the north east monsoon wind direction was likely to carry smell from the IWMC towards the residential areas.

    However, some members highlighted that option 1 was economically most feasible as the plot contained a relatively small number of large trees and electricity can be supplied readily.
- Proposed alternative 1 (option 2) which was located on the north-eastern side of the island next to the existing waste dump site was more favoured compared to option 1. However notable points highlighted with regard to the location are:
    - Site requires extensive land clearance which would have a significant impact on livelihood of those who rely on coconut palm trees;
    - In case waste is burned and not managed properly at the site, impacts of smoke will be significant on nearest households;
    - During the northeast monsoon wind will carry smell from the IWMC towards the residential areas.

    In contrast some members highlighted that accessibility to IWMC from different parts of the island will be much easier compared to option1 and option 2 is not located in an area that is used by the public or planned to be used for future development.

- Participants of the meeting informed an alternative location (option 3) after discussing among themselves which was more preferred. The site was located on the southeast section of the island (See **Figure 39**). The site was proposed mainly because
    - It is far away from residential areas, and impacts of smell and smoke (in case of burning) will be negligible.
    - Since it is close to the agricultural plots compost can be easily transported.
    - The area does not contain significant/protected trees or privately owned trees, hence it will be environmentally and economically more feasible.

    Main disadvantage highlighted with regard to the site are:

  - Its distance from residential areas which would make commuting difficult and
  - Installation of electricity to the site will be costly.
- The participants highlighted that a proper waste management system in the island is crucial.

8. ALTERNATIVES

This section explores alternatives for the proposed project as required by **Task 5** of the TOR for the EIA. The options explored include:

1. No project option;
2. Alternative location to construct the IWMC;
3. Alternative waste management options;
4. Alternative tree removal methodology and
5. Alternative options for removed trees

The proposed options are compared with alternatives in detail. When comparing the alternatives, environmental, economic and social considerations were taken into account. The principle of sustainable development is used as the guiding principle in selecting the preferred alternative. Sustainable development has been broadly defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". (UNWCED, 1987).

Hence, the aim is to ensure that all project activities are undertaken without any adverse long term irreversible environmental damages that cannot be mitigated. This is the principle that is applied when discussing the preferred alternative through the discussions that entails in the sections below.

8.1 NO DEVLOPMENT OPTION

Under the current scenario waste is not managed at the island (See **Section 2.4**). Although a designated waste disposal areas have been allocated in the island, health impacts arising from burning waste and pollution of nearby areas have been identified as significant negative impacts. Moreover, waste piles and waste footprint area have been growing in size which is rapidly taking up land space. In Uligam waste is not separated. In general waste piles mainly consist of burned residue and other mixed waste. Areas that have been used to dispose and burn waste cannot be used for other productive purposes unless it is somehow removed from the island. The council faces numerous challenges to coerce people into discarding waste at the designated sites as they cannot be considered as waste management sites. People start to pollute other areas of the island which could lead to disease outbreaks. Hence the no development option of the project is rejected as the existing situation results in more environmentally and socially negative impacts. **Table 31** below shows comparison of no development option with the development option at Ha.Uligam.

Table 31: Comparison of the no development option with development option

Option	Environmental	Social	Economic
No Project Alternative	Island largely remains in its current form. The island environment may continue to slowly deteriorate due to pollution as a result of waste disposal. It is likely that disposal of waste into sensitive areas will remain largely uncontrolled without being regulated. A lot of land area will be rendered unusable or will be polluted by the residual waste remaining after burning and burying waste. Seepage of leachate into groundwater film as a result of burying waste in excavated pits. Risk of waste piles sliding as a result of heavy rain or flooding events. However, all negative impacts of the project detailed in **section 8** can be avoided with the no project alternative.	Benefit to the society by the project will be missed and chances of polluting the island is high which could lead to health implications as well as visual negative impacts. Risk of waste coming into direct contact with children. Without a proper waste management system there is a risk of the island turning into a slum as a result of rapid urbanisation.	No significant improvement to the local and regional economy. New job opportunities will not be created Income opportunities missed. Increase in illegal waste disposal.
Project Alternative	Ha.Uligam		
	The project does not involve, removal of large trees from the island. It involves minor vegetation clearance. It will generate waste and GHG and bring irreversible change to existing landscape. This would have negative impacts on the soil and biological environment of the island. However almost all the foreseeable impacts of the project can be mitigated and	Increased direct and indirect employment opportunities for the locals as the IWMC and waste management system becomes operational. Knowledge transfer and development of technical capacity with regard to waste management and compost making. More resources and manpower to manage the island hence pollution of the island will be stopped or controlled.	Enhanced opportunity for locals to start and diversify tourism related services, since a safe and clean island would facilitate and benefit any local tourism venture. Direct contribution to government revenue through taxes and duties. Creation of job opportunities and skilled labour in the region. Development and expansion of agriculture

	kept at an acceptable level and the project will not result in a loss of a sensitive or critical habitat or species. The project will control and prevent further pollution of the environment, and facilitate utilisation of land area more effectively.	During the operational phase of the project, smell dust and smoke will be emitted from the IWMC.	and fisheries market in in the island. Price and profit from agricultural produce will become more competitive due to availability of compost. Potential to attract foreign currency by selling compost etc. which would develop the national economy. More settlers will be attracted to the island, which would promote the development of local public services and infrastructure.

Hence based on the evaluation the ***no development option*** is ***rejected*** as the existing situation results in more environmentally and socially negative impacts.

8.2 ALTERNATIVE LOCATION TO CONSTRUCT IWMC

Construction of IWMC and associated access roads will result in various environmental and social impacts. One of the main impacts of the project can be identified as loss of vegetation and waste generation from the island, which has numerous economical repercussion on top of environmental impact. Other notable impacts of the project include land use change and impacts to the health and wellbeing of the public. Perception and effect of these impacts vary based on the proposed location, hence evaluation of the most suitable site with the least impacts is a major component of the EIA.

The current proposed/preferred location defined as option 1, to construct the IWMC is assigned and allocated by the council as per the waste management regulation 2013/R-58 (See **Section 3.3** for details). However, EIA consultations with the public and council revealed that, site selection process varied in transparency which had led to insufficient analysis of alternatives.

Hence, this section aims to apply a consistent alternative analysis method for all the project islands in order to determine the most feasible location in the island to establish the IWMC. Information required for the analysis was gathered from stakeholder consultations and existing environmental studies. Moreover, the following materials and resources were used during the option analysis:

- Literature review
- Past EIA reports
- Expert opinion of EIA consultant and Engineer

Evaluation of alternatives was conducted using a simple matrix based upon a scoring criteria (**Table 32**) which was applied to predetermined key parameters. The key parameters used in the option analysis are highlighted in **Table 33**.

Table 32: Scoring Criteria

Range	Major Negative	-3
	Moderate Negative	-2
	Minor Negative	-1
	No Change	0
	Minor Positive	1
	Moderate Positive	2
	Major Positive	3

Table 33: Parameters used in option analysis

Number	Parameter	Code	Description
1	Health/Wellbeing	S1	Health/wellbeing describes impacts of smell, smoke and noise on closest residential area as a result of the proposed project location.
2	Accessibility from inland	S2	Describes the ease of accessibility from residential areas to the IWMC based on proposed access road and existing environmental condition.
3	Accessibility to harbour	S3	Describes the ability for larger trucks and cranes to access the IWMC from harbour as waste from IWMC will be transported to the regional centre.
4	Environmentally sensitive sites	S4	Describes proximity and impact to sensitive sites, such as wetlands, protected trees etc as a result of proposed IWMC site and access road.
5	Vegetation cost	S5	Describes the cost incurred to clear vegetation for the IWMC and access road. This may include cost as compensation etc. This parameter is assessed based only on financial terms.
6	Power supply cost	S6	Describes cost incurred to provide electricity for the IWMC at the proposed Location, mainly based on information provided by council and Fenaka representatives.
7	Environmental impact	S7	Describes loss of vegetation, hazard/vulnerability and impacts to shoreline as a result of the proposed location
8	Land use plan	S8	Describes current usage of land and future population growth direction, /rate and usability of proposed land for other purposes such tourism etc.

8.2.1 Ha.Uligam

Three sites were identified as potential options to establish the IWMC. These include:

1. ***The proposed site (option 1***)

   The proposed location for IWMC (option 1) was on the northern side of the island as illustrated in **Figure 10.** The number of trees intersecting with the proposed plot including the access road was zero (0) as detailed in the figure. Nearest infrastructure to the site are the public school located 150 m to the south. The site meets all the guidelines recommended by the EPA.

2. ***Alternative site 1 (option 2)***

   The proposed first alternative location for IWMC (option 2) was on the north eastern side of the island as illustrated in **Figure 37**. The number of coconut palm trees and valuable trees intersecting with the proposed plot including the access road was 63 as detailed in the surveyed **Figure 37**. The site currently consists of a privately owned coconut farm. Nearest infrastructure to the site is residential plots located 93m from IWMC. An access road will have to be cleared to enable access to the IWMC if the site is selected which would result in further loss of vegetation. The site meets all the guidelines recommended by the EPA. (See **Annex 6** for surveyed Drawing)

Figure 37: Proposed first alternative location for IWMC (option 2) Ha. Uligam

Figure 38: Photo profile of alternative site 1

3. Alternative site 2 (option 3)

The proposed second alternative location for IWMC (option 3) was on the south eastern side of the island as illustrated in **Figure 39**. Nearest infrastructure to the site are agricultural plots located at a distance of 226m. The site mainly consisted of screw pines and other common littoral zone vegetation found in the Maldives.

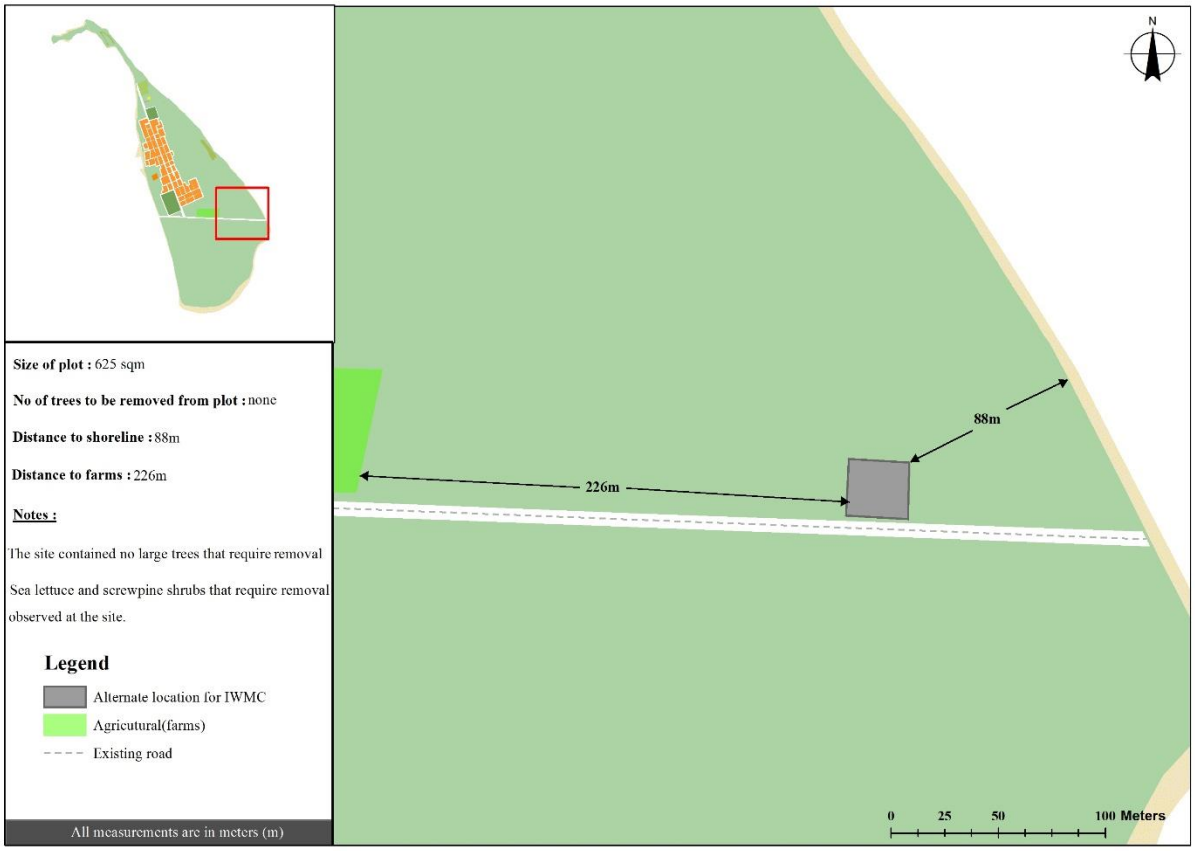


Figure 39: Proposed second alternative location for IWMC (option 3) Ha. Uligam

Figure 40: Photo profile of second alternative site

Table 34 shows the option analysis matrix for Ha.Uligam.

Table 34: Option evaluation matrix for Ha.Uligam

	Option 1	Option 2			Option 3		
Option 1		Code	Option 1	Option 2	Code	Option 1	Option 3
		S1	-3	-3	S1	-3	3
		S2	-2	-3	S2	-2	-3
		S3	-1	-2	S3	-1	-3
		S4	-1	-2	S4	-1	-1
		S5	-1	-3	S5	-1	-1
		S6	1	-3	S6	-1	-1
		S7	-1	-1	S7	-1	-2
		S8	-3	-2	S8	-3	2
		Total	-11	-19	Total	-13	-6
					Code	Option 2	Option 3
					S1	-3	3
					S2	-3	-3
					S3	-2	-3
					S4	-2	-1
					S5	-3	-1
					S6	-3	-1
					S7	-1	-2
					S8	-2	2
					Total	-19	-6
Option 3							

Table 35: Summary of evaluation. Ha.Uligam

Number	Parameter	Code	Description
S1	Health/Wellbeing	Option 1	Located closest to public infrastructure out of the three options (159 m from school). Smell, noise and dust as a result of wind could be a potential impact. Outcome – major negative
		Option 2	Located close to residential areas (94 m from nearest house) Potential impacts to nearby households as a result of smell, noise and dust. Outcome – major negative
		Option 3	Located furthest from residential areas. Unlikely that residential areas will be impacted by smell, noise and dust from IWMC. Outcome – major positive
S2	Accessibility from inland	Option 1	A minor road to the IWMC has to be cleared as shown in **Figure 10**, however existing main road provides access to the plot from inland with ease. Since the site is located on the far side of the island which has been highlighted as a slight disadvantage. Outcome – moderate negative
		Option 2	No roads exist to the proposed IWMC site; hence a main road shall be cleared. Access to the site from inland will be difficult. Outcome – major negative
		Option 3	A main road was present which had been cleared and accessible by vehicles. The main road will require vegetation trimming. However, since the site is located on the far side of the island accessibility is considered to be negative. Outcome – moderate negative
S3	Accessibility to harbour	Option 1	Minor negative
		Option 2	Moderate negative
		Option 3	Major negative
S4	Environmentally sensitive sites	Option 1	Closest environmentally sensitive site was located 96 m to the east. Outcome – Minor negative
		Option 2	Closest environmentally sensitive site was located 167 m to the north. Outcome – Moderate negative
		Option 3	Closest environmentally sensitive site was located 497 m to the north. Outcome – Minor negative
S5	Vegetation cost	Option 1	No significantly large trees were present at the proposed site which are protected or requires compensation. Bush type vegetation was present at the site. Outcome – Minor negative
		Option 2	Significantly large trees coconut palm trees fell within the footprint of proposed plot and access road. Clearance of these vegetation would require compensation and heavy vehicles. Outcome – Major negative
		Option 3	No significantly large trees were present at the proposed site which are protected or requires compensation. Common littoral zone trees were observed. Outcome – Minor negative
S6	Power supply cost	Option 1	Close to existing power supply line. Electricity can be provided easily according to Fenaka representatives. Outcome – Minor positive
		Option 2	No existing power supply line. Outcome – major negative
		Option 3	No existing power supply line. Outcome – major negative
S7	Environmental impact	Option 1	Loss of vegetation Outcome – slight negative

		Option 2	Loss of vegetation which include significantly mature trees and palms Outcome – major negative
		Option 3	Loss of vegetation Outcome – Moderate negative
S8	Land use plan	Option 1	Future local tourism development area. Used for swimming by the public. Outcome – Major negative
		Option 2	Private coconut farms. No significant land use plan for the future. Outcome – Moderate negative
		Option 3	Vacant land. Farmlands exist to the south and west of the site Outcome – Moderate positive
Conclusion			The option analysis showed that **option 3** scored the highest score, making it the most preferred option, with the least impacts on the overall key parameters.

8.3 ALTERNATIVE WASTE MANAGEMENT OPTIONS

Section 2.9 describes the proposed waste management concept. Main activities of the plan include sorting, recovering and composting waste.
This section evaluates alternative methods to sort, recover and compost waste at the island level and compares the advantages and disadvantage of alternative methods.

8.3.1 Waste Sorting

A. Bag Opener

The bag openers allow for easy separation of constituent wastes that are bagged during transportation. It also allows for coarse size reduction of input material. Bags are opened, with the help of a specialised shredder that can be adjusted to retain the integrity of constituent waste or reduce its size. The bag opener usually come with a conveyor belt or feed into a conveyor belt where waste can be separated further for homogenisation of waste. In-feed Conveyor
After bag-opening, waste is loaded homogenously by means of apron from in-feed conveyor into the trammel or mechanically sorted.
Advantages

- Bag openers are fast and automated;
- It can accommodate large waste streams making the sorting process very efficient;
- Bag openers will make separation of constituent waste very easy;
- It can handle a wide range of material and
- It can be easily collated with waste separators and waste recovery machines.

Disadvantages

- Bag openers are expensive
- High operational and maintenance cost
- Can damage recyclable materials and
- Only feasible when incoming waste streams are significant.

Although bag openers are fast and efficient, installation of it becomes unfeasible due to its high cost compared to the average waste generated in most of the islands. However, bag openers of adequate size remains to be a viable option to make IWMC waste management more efficient in the future once significant amounts of mixed waste is transported to the IWMC.

B. Trommel Screen

Trommel screens works via a feeder belt or manual transfer of mixed materials into the trammel screen. The mixed material gets guided onto multiple spiral shafts driven with the same rotary direction. Material that is smaller than the size of the grate falls down between the shafts and is transported via automatically or mechanically to a designated storage area for further treatment (compost area or to the sorting area).
Advantages

- Can easily separate waste constituents based on its size which would ease manual sorting;
- Cost effective;
- It has many different configurations;
- Various types are available with varying capacity and function and
- Organic constituents can be separated from mixed waste easily.

Disadvantages

- Not able to separate organics from inorganics and

- Operational cost.

In a scenario where mixed waste is transported to the IWMC, tommel screen will play a crucial role to make sorting waste more efficient.

8.3.2 Waste Recovery

A. Electro Magnet

Electromagnets are used to separate metals from the mixed waste streaming. Usually the magnets are placed over a conveyor belt, onto which waste streams are fed.

Advantages

- Able to recover all metals from mixed waste streams which can be recycled. This would also prevent metal scraps from mixing with organic waste that will be used for composting and
- Fast and efficient. The electromagnet can recover a lot within a short time frame;

Disadvantage

- Electromagnets are expensive and its operational costs are high;

Unless significant amounts of metal wastes are not produced from the island, installation of electromagnets in the IWMC will not be feasible. Waste audit results (See **section 2.3.2**) showed that metals constituted 1-2 percent of the waste generated. Moreover, the waste audit showed that, metals generated as waste were made up of cans which can be easily separated manually.

8.3.3 Waste Composting

The proposed composting system involves simple wind row composting. The alternative composting methods evaluated are

1. Controlled biological composting using bags. The proposed bag system is a static composting system employing forced aeration through a series of valves and
2. Vermicomposting.

1. Controlled biological composting using bags

The proposed system involves a compost machine equipped with a hydraulic cylinder, which pushes the material through the tunnel and into the bag. It is also equipped with a diesel engine to power the hydraulics. It features a remote control unit for the operator to control the system, permitting a one-man operation. The remote control unit will maintain the optimum environment required for optimum composting. Composting in bags using remote controlled regulators take approximately 10-16 weeks.

Advantages

- Composting completed within a short period of time;
- Impacts associated with smell is reduced or prevented;
- Can be operated using few employees and
- Compost pile will not be susceptible to bad weather conditions etc.

Disadvantage

- The bag composting system is expensive and requires a lot of machineries and equipment;
- Operation of the system will require skilled laborers;
- Operational cost of these system will be high;
- Suitable for large scale composting and

- Trouble shooting such a system at the island level will be challenging.

Based on the advantages and disadvantages it is not viable to install bag composting systems in Ha.Uligam. Since a viable market for compost has not been established at the island level there is an uncertainty with regard to cost and benefit of such a system. The risk of halting operations due to malfunction is also high due to limited number of skilled laborers. Based on these issues, the proposed windrow composting option is determined to be more feasible than bag composting at the island level.

2. Vermicomposting

The production of vermicompost requires a mixture of worm castings, organic material and bedding in various stages of decomposition. First, manure is composted for approximately 30 days aerobically, and then transferred to open vermicompost beds. The beds are approximately 1.5 meters wide and of varying length. The compost is mixed with soil and "seeded" with earthworms. At some sites these beds are located in the shade of large mango trees which benefit from nutrients leached from the piles. Primary source of organic material used in vermicomposting are cow manure, filter press cake from sugarcane, coffee pulp and municipal waste.

Vermicompost beds are sprinkled with water to maintain optimum moisture and temperature requirements. The worms feed on the freshly applied compost at the top of the beds and deposit their castings in the lower levels. Compost is continually applied until the beds reach a height of approximately 0.9 metres after about 90 days. The worms are concentrated in the top 10 cm of the pile and scraped off or separated from the vermicompost in a screening process. The humus is both dried and bagged or used on-site as a soil amendment and fertilizer (Halliburton KBR Pty Ltd, 2002).

Although vermicompost produces a more superior compost that is beneficial to plants and environment compared to artificial fertilisers, the process of vermicomposting has not been thoroughly tested for tropical climates. Some of the disadvantages of vermicomposting in the Maldives are:

- The worms used in vermicomposting *Eisenia foetida* and *Lumbricus rubellus* are non-native to the Maldives and have a tendency of migrating with low productivity rates when the temperature is higher. Vermicomposting has not been tried and tested extensively in tropical climates and
- Its application would require trial runs or concepts whereby animal husbandry is co-joint with vermicomposting to determine its feasibility.

Due to the uncertainties that exist in transfer of vermiculture technology to the Maldives, this alternative is not recommended at this stage of the project.

8.4 ALTERNATIVE TREE REMOVAL METHODOLOGY

There are various types of specialised equipment which are used for removing, trimming and grounding trees.

8.4.1 Traditional Methods

Traditionally trees are removed in one of (or a combination of) 2 different methods. Felling: This is the fastest way to get a tree on the ground. Felling a tree is the method in which a tree is cut from the base and it falls to the ground in one piece. This method is appropriate with enough space available for grounding the tree. The advantage of this method is speed. The disadvantage is that enough space is required and unintended vegetation in the surrounding is impacted. The trees in this cannot be re-planted. Climbing and Rigging. This is the slowest way to get a tree on the ground. Climbing and Rigging is just that, a climber climbs into the tree and uses ropes, pulleys and groundsmen to dismantle a tree part by part. This method is suitable for properties with limited landing space or obstacles in the way of the tree. Although these two methods do not require burning of fossil fuels to power the work, they are however, not recommended since the intention here is to rescue as many trees as possible for re-planting

8.4.2 Alternative Advanced Methods

Trees that need to be removed for relocation, require special attention and care as described in **Section 2.8.4**. Soil that surrounds the root system of these trees will be vital for its survival when relocated, as these will contain symbiotic organisms that help the plant to grow. Taking these into consideration, an alternative, method for removing trees particularly for those trees suitable for relocation is explored in this section.

In removing trees use of automated spade can be considered where the tree removal, machine consist of automated spades mounted onto loaders or trucks. The operation of these spades can be pre-set. Once the tree has been identified, the tree can be removed with the surrounding earth. Once removed they can be transported and transplanted at the prepared alternative location. This method causes the least stress to the trees and ensures the highest survival rate. **Figure 41** shows a typical automated spade used for removing trees.

Figure 41: Automated spade used for removing trees

Advantages of this method are:

- Trees can be relocated without much stress to the tree itself;
- Time and effort required to remove the trees are significantly less;
- Trees can be replanted with its native soil and at the same depth, which greatly enhances its survival and
- The method does not require separate machineries such as cranes/excavators to erect the trees.

Disadvantages of the method:

- Suitable for areas where relocation site is close, but in this case not all trees are expected to be replanted on the island of origin;
- Although automated spades are very efficient at removing trees, it is not considered to be an efficient tool for the overall progress of project. It is designed to remove and relocate individual trees. Since these spades can service one tree at a time, multiple spades will be required to clear all the trees within the road footprint, which will not be feasible; and
- Automated spades are very costly to obtain. There are no contractors that provide specialized tree removal services in the Maldives.

Based on the advantages and disadvantages of the alternative tree removal methodology. The proposed method is considered to be more suited for the current project. The proposed, work method is also commonly applied in the Maldives and elsewhere in removing large number of trees. (See **Section 2.8.4)** for proposed construction method which includes description of tree removal). The contractor is familiar with the method and has considerable experience in applying this methodology. Once these trees are toppled, the root bulbs and crown can be easily separated. Since coconut palms make up most of the trees at project site, specialised trimming equipment can be avoided.

8.5 ALTERNATIVE OPTIONS FOR REMOVED TREES

8.5.1 Baseline Scenario

The baseline scenario involves removal of all trees intersecting with the project area. Since many of these trees comprise of privately owned palm trees, they will have to be compensated before removal. There are not many options available for the councils other than removal of trees using manual labour. This is due to the lack of resources specialized contractors available in the island. Under the baseline scenario, most of the trees intersecting with the project area will be lost, Furthermore, due to the limited resources and financial capacity of the council there is a significant risk of the project being hindered under the baseline scenario.

8.5.2 Alternative Scenario

The alternative options for trees intersecting with the project site is proposed with the aim of conserving bio-diversity loss by saving as many trees as possible while avoiding delays and hindrance to the proposed project. The three main alternative options proposed are:

1. **Option 1:** Removal of shrubs/bush and small trees from the plot and replanting or relocating small trees to other areas;
2. **Option 2:** Procurement of parties that are willing to buy and replant the trees intersecting with the project area which include the IWMC and access road and
3. **Option 3:** Removal of trees to be used as timber/firewood and compensating for trees lost by replanting trees.

A. Option 1: Removal of shrubs/bush and small trees from the plot and replanting or relocating small trees to other areas in the island

Option 1 is aimed at conserving the overall biomass of the proposed plot. Since no significantly large trees that are of notable value intersects (See **Section 5.6.2** for vegetation of plot) with the proposed IWMC and minor access road, the land clearance can be undertaken by the council.
The following points shall be followed during land clearance:

- Shrubs/weed shall be removed and discarded as detailed in **Section 2.8.12**.
- Small trees such as headache trees and any other healthy tree shall be dug from the base and relocated to adjacent spaces outside the plot area. Other potential areas in the island where trees could be relocated include the harbor, and eroding vegetation line. Trees relocated to these areas will provide shade, act as wind barriers and control further erosion of the shoreline.

B. Option 2: Procurement of parties that are willing to buy and replant the trees intersecting with the project area which include the IWMC and access road

Vegetation clearance is a crucial step in the construction phase. It is also the activity which will result in the most significant negative environmental impact during construction phase. Since vegetation clearance is not within the scope of project works by MEE as highlighted in **Section 7.1**, it is identified as a progress limiting activity of the project. This is because, vegetation clearance is expensive and requires specialized equipment. Completion of this activity during construction phase falls within the scope of the island council.

However according to consultations with the council, undertaking this activity during the construction phase of the project would place additional pressure on the council financially since most of the council's budget have been allocated for other purposes. Moreover, Uligam does not have specialized equipment or contractors equipped to undertake significant land clearance.
These constraints are further magnified since private trees will have to be compensated for before its removal and re-plantation of trees by relocating them are environmentally more preferred in order to mitigate negative environmental impacts (See **section 9.3.4**).

In order to solve these limitations and challenges that could hinder project progress, it is highly recommended to procure parties who are willing to buy and relocate trees intersecting with the footprint of the project area. The approach will result in the following advantages.

- Prevention of bio diversity and biomass loss;
- proper management of site during vegetation clearance;
- means of income to the island council and
- clearance of vegetation by specialized equipment will be highly efficient which would result in land clearance within a short period of time.

When procuring potential buyers, the council shall reference the steps highlighted in the flowchart below (see **Figure 42).**

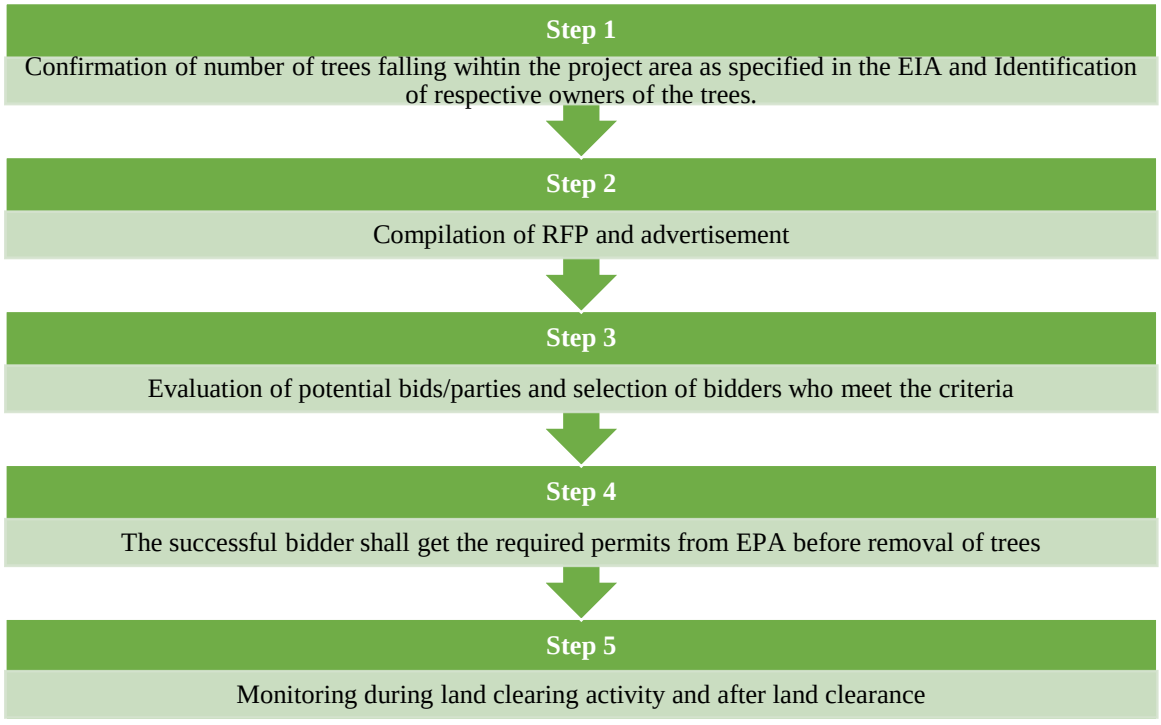


Figure 42: Steps involved in procuring vegetation buyers

Prior to selecting buyers, it is important to define the roles/responsibility of selected parties and the council (state) in terms of contract administration, contract terms /conditions, contract

structure, main contract activities, termination/cancellation, records/inspection, financial provisions and project plan. The Contract must in all respects be governed by, and construed according to, the substantive laws of the country.
In general, as a minimum the bidder shall provide the following details for effective evaluation of the proposals:

1. Proposed work schedule and work method;
2. details of key members including project manager;
3. signed power of attorney letter to respective individual. Representatives of the bidder must have the authority to make binding commitments within the bounds set forth in the contract; and
4. financial provisions, which shall include bidding price for individual trees in accordance to the RFP.

The successful bidder shall follow the guideline given below when removing trees and vegetation.

- All trees designated by the council in the RFP as per vegetation survey shall be removed. Trees designated for removal shall be marked distinctly at Diameter Breast Height (DBH). A list of trees to be removed and their locations shall be supplied by the Island Council. Only those trees so marked and on the list shall be removed. The Island council reserves the right to increase or decrease the quantity of trees at any time based on the vegetation survey and approved EIA;
- prior to removal and relocation of trees, successful bidder shall obtain a permit from EPA (see **Section 3.3**);
- trees shall me removed for relocation, hence removal methodology described in **Section 2.8.4** of the report or any similar methodology evaluated to be acceptable shall be followed;
- all brush less than three (3) inches in diameter within a two-meter boundary of the major tree being removed shall be chipped immediately and removed from the work site within three (3) days of being cut as described in **Section 2.8.12**;
- all wood and brush disposed of during removal of tree must be in accordance to **Section 2.8.12** of the EIA report;
- trees shall not be dropped or placed across road ways;
- for any plant or tree that had been cut during the removal process the successful bidder shall grind stumps and brace roots so that soil can be returned to the hole and levelled;
- for root bulbs cavities created after removal of trees for relocation the successful bidder shall cover it up using soil or mixture of soil and debris as described in **Section 2.8.12**. These cavities shall not be filled with waste or left without levelling;
- tree trimming shall be performed on trees that have been designated by the island council and
- the successful bidder shall remove all chips, grinding and trimming residue from the site and dispose it according to the waste management plant proposed.

Following option 1 could theoretically save all the significant trees that intersect with the project area, which would have been lost otherwise. Loss of trees have been identified as a major negative impact due to its eco system services, economic and cultural value.

C. Option 3: Removal of trees to be used as timber/firewood and compensating for trees lost by replanting trees elsewhere

Removal of trees for timber or firewood is the least preferred option due its numerous negative impacts which has been describe in **Section 9.3.4**. Those trees that cannot be replanted still needs removal, shall be checked for suitability for use as timbre or firewood and sold. Coconuts and dried branches shall be cut into manageable sizes and may be sold. Root bulbs shall be grinded and waste generated during vegetation clearing shall be managed as explained in **Section 2.8.12**. Undergrowth vegetation and other parts of the tree shall be cut into manageable sizes using chainsaw or wood chipper and allowed to dry and burned.

9. ENVIRONEMNTAL IMPACTS AND MITIGATION

9.1 INTRODUCTION

This section aims at addressing **Tasks 4 and 6 of the TOR**. The aim of the section is to identify all the impacts that may arise during the construction and operational phase of the project, and propose mitigation measures to address the negative impacts to make the project environmentally sustainable. The methodology applied is described in detail in **Section 1.5.3.**

In assessing the impacts, a differentiation was made between the construction and operational phase of the project, since impacts during the construction phase of the project and operational phase of the project are vastly different. Environmental receptors were classified under three main subheadings which include *physical environment, biological environment* and *social environment*. Under each component environmental receptors were adapted from the Leopold method based on consultation with the stakeholders and findings of the existing environment. Mitigation measures for all relevant activities that may have an effect on the natural and socio-economic environments have been identified. Elaboration of the assessed effects of impact factors on environmental components have been discussed in the following Sections.

9.2 THE IMPACT BOUNDARY

Impacts from the proposed project has been differentiated into three main categories depending on their nature and spatial extent. The impact categories of the project include:

1. **Primary Impact Zone:** The primary impact zone is defined as the area that will have a direct impact as a result of the project. The direct impact footprint area is defined as the area enclosed within a 10-m buffer of the construction and land clearance activities. Direct impacts are mainly caused by human activities such as site selection, land clearance, excavation etc.

   The projects primary impact area will be completely altered, due to long term irreversible changes brought to it by the proposed development. In general, the primary impact area encompasses the most negative environmental impacts over the smallest area **Figure 43**, illustrates and details the impact areas of project island.

2. **Secondary Impact Zone:** The secondary impact zone is defined as areas that may be effected as a result of the projects direct impacts. Spatial extent of the secondary impact zone depends on factors related to direct impacts.

   Secondary impact zone mostly will encounter short term, reversible, cumulative impacts that may or may not be exacerbated depending on the time and place. This is because secondary impact zone is mostly influenced by a mixture of natural factors such as wind, waves etc and manmade factors such as LUP. In general, the secondary impact zone encompasses minor to moderate negative environmental impacts over moderately large areas.

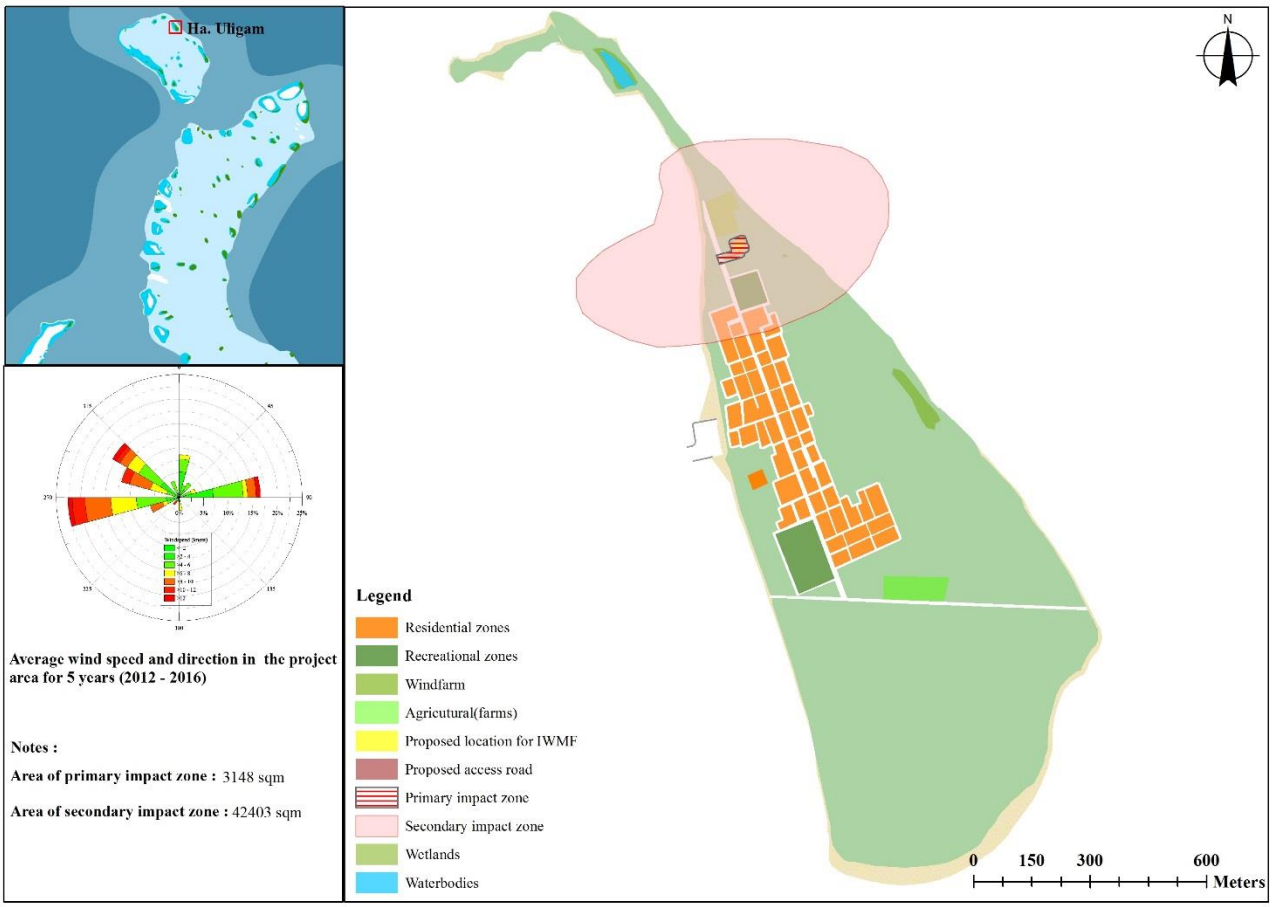


Figure 43: Primary and secondary impact zones Ha. Uligam

3. **Tertiary Impact Zone:** The tertiary impact zone for the project is defined as areas that may or may not be effected by the proposed project activities. Tertiary impact zone will encounter minor to negligible impacts which are mostly temporary and cumulative. These impacts can be easily managed or prevented. The tertiary impact zone for the project is illustrated below and encompass a large area (approximately 118,000 km^2). This is mainly due to the likelihood of tree being relocated to other islands.

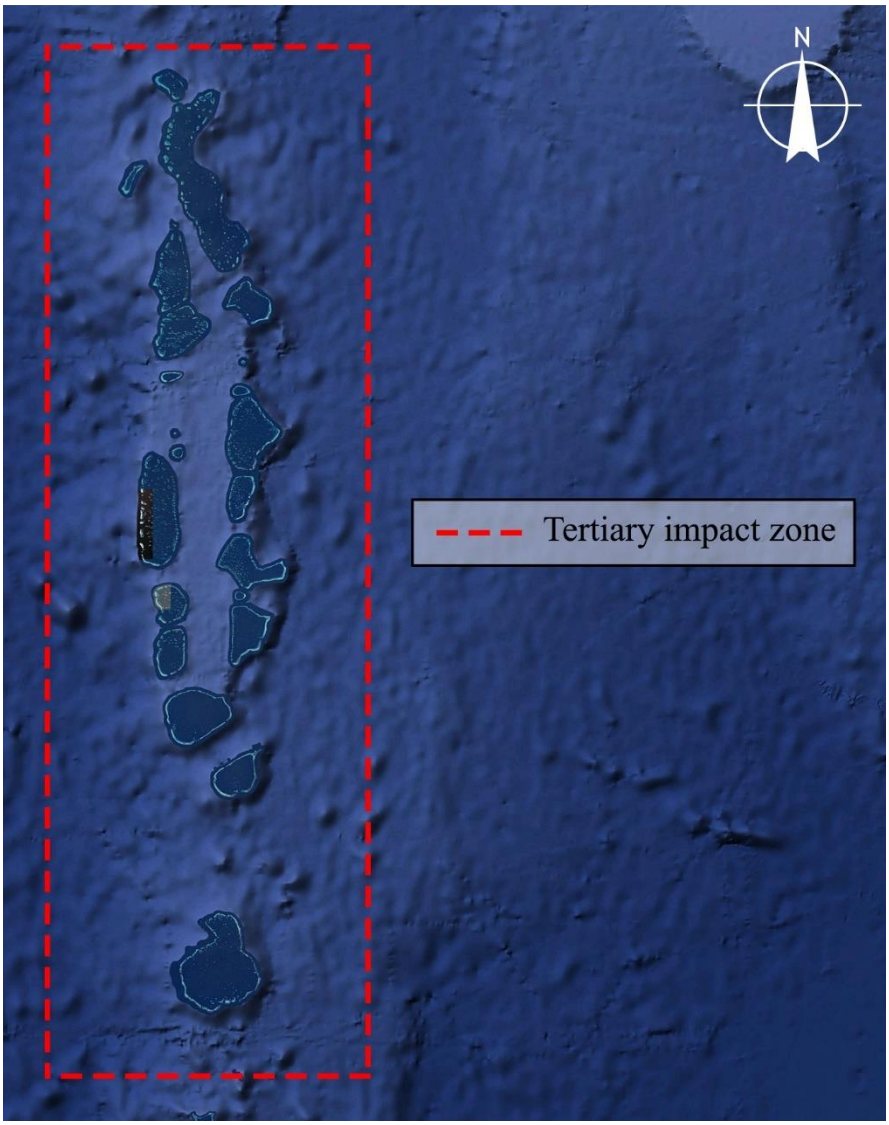


Figure 44: Tertiary impact zone

9.3 CONSTUCTION PHASE IMPACTS AND MITIGATION

In order to measure impacts during the construction phase of the project, major activities of the construction phase have been identified.

The main activities of construction phase are:

1. C1 – Settlement of workers
2. C2 – Site demarcation and fencing
3. C3 - Material storage
4. C4 – Land clearance
5. C5 – IWMC construction
6. C6 – Transportation of trees, waste etc
7. C7 – Waste generation
8. C8 – Resource consumption (Waster, Electricity and Sewerage)

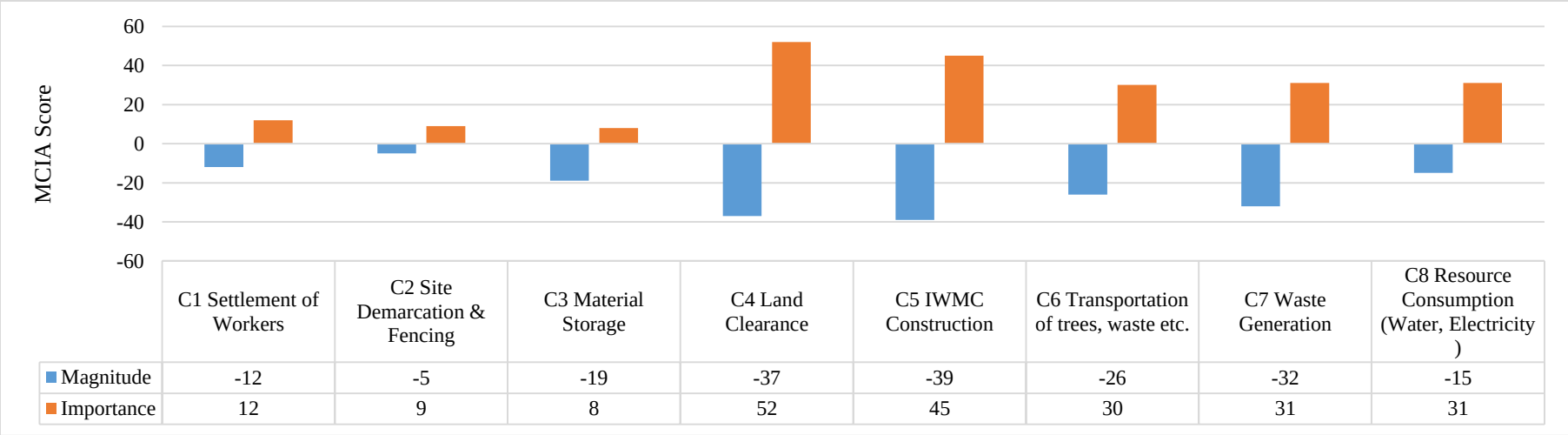
Leopold Matrix for the construction phase of the project is shown in **Table 37. Figure 45** illustrates the impact magnitude of each activity and their relative importance. **Figure 46** illustrates impact on the environmental receptors during the construction phase of the project. A summary of the major activities and their associated overall impact represented by colour codes are given in **Table 36.**

Table 36: Construction phase impact summary, its properties and mitigation cost indicator.

No	Potential Risk/Impact	Receptor	Nature	Reversibility	Significance	Mitigation	Cost indication of measure
	Description	Description	Positive	Reversible	Major Negative	Description	USD
					Moderate Negative		
					Minor Negative		
					Neutral		
			Negative		Minor Positive		
					Moderate Positive		
				Irreversible	Major Positive		
C1	See **Section 9.3.1**	See **Section 9.3.1**	Negative	Reversible		See **Section 9.3.1**	Included in construction costs
C2	See **Section 9.3.2**	See **Section 9.3.2**	Negative	Irreversible		See **Section 9.3.2**	$ 2,000
C3	See **Section 9.3.3**	See **Section 9.3.3**	Negative	Reversible		See **Section 9.3.3**	Included in construction costs
C4	See **Section 9.3.4**	See **Section 9.3.4**	Negative	Irreversible		See **Section 9.3.4**	$5,000 – 10,000
C5	See **Section 9.3.5**	See **Section 9.3.5**	Negative	Reversible		See **Section 9.3.5**	Included in construction costs
C6	See **Section 9.3.6**	See **Section 9.3.6**	Negative	Reversible		See **Section 9.3.6**	Included in construction costs
C7	See **Section 9.3.7**	See **Section 9.3.7**	Negative	Reversible		See **Section 9.3.7**	Included in construction costs
C8	**9.3.8**	**9.3.8**	Negative	Reversible		**9.3.8**	Included in construction costs

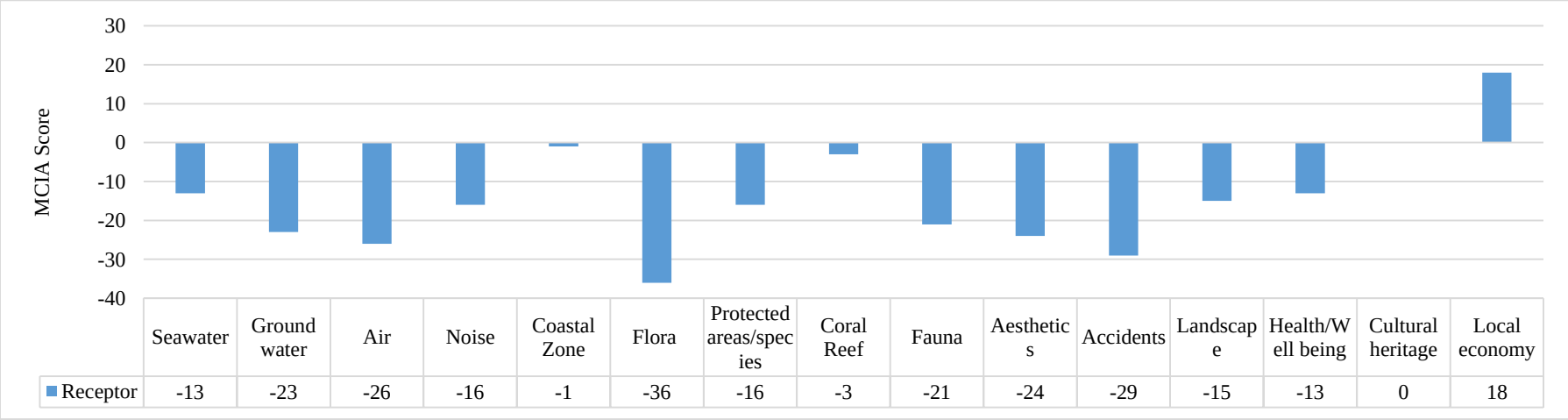
Table 37: Impact matrix for the construction phase

	Envisaged impact factors	C1 Settlement of Workers	C2 Site Demarcation & Fencing	C3 Material Storage	C4 Land Clearance	C5 IWMC Construction	C6 Transportation of trees, waste etc.	C7 Waste Generation	C8 Resource Consumption (Water, Electricity)	Total (Impact Area)
Physical Components	Seawater	-2		-2				-3		-7
		1		2				4		7
	Ground water	-3			-4	-3		-4	-5	-19
		1			3	4		4	5	17
	Air	-3	-2		-5	-3	-7	-5	-3	-28
		2	2		4	3	6	4	3	24
	Noise	-2	-1		-5	-7		-2		-17
		1	2		3	6		2		14
	Coastal Zone								-1	-1
									1	1
Biological Components	Flora	-2		-6	-5	-5	-4	-5	-3	-30
		2		2	8	5	3	5	2	27
	Endangered species/protected areas				-3		-2			-5
					6		2			8
	Coral Reef							-1		-1
								1		1
	Fauna				-3	-4	-2	-4		-13
					6	3	2	3		14
Socio-Cultural Component	Aesthetics	-2		-5	-2	-5	-3			-17
		2		2	3	5	3			15
	Accidents	-1	-2	-2	-5	-7	-7	-2	-1	-27
		1	1	1	5	4	5	2	1	20
	Landscape				-5	-7				-12
					5	7				12
	Health/Well being	-1	-1	-4	-4	-5	-5	-6		-26
		1	2	1	3	3	5	6		21
	Cultural heritage									0
										0
	Local economy	4	1		4	7	4		-2	18
		1	2		6	5	4		2	20
Total (Construction Activity/Risk)		**-12**	**-5**	**-19**	**-37**	**-39**	**-26**	**-32**	**-15**	
		12	**9**	**8**	**52**	**45**	**30**	**31**	**14**	



	C1 Settlement of Workers	C2 Site Demarcation & Fencing	C3 Material Storage	C4 Land Clearance	C5 IWMC Construction	C6 Transportation of trees, waste etc.	C7 Waste Generation	C8 Resource Consumption (Water, Electricity)
Magnitude	-12	-5	-19	-37	-39	-26	-32	-15
Importance	12	9	8	52	45	30	31	31

Figure 45: Impact magnitude and importance of key construction phase activities



	Seawater	Ground water	Air	Noise	Coastal Zone	Flora	Protected areas/species	Coral Reef	Fauna	Aesthetics	Accidents	Landscape	Health/Well being	Cultural heritage	Local economy
Receptor	-13	-23	-26	-16	-1	-36	-16	-3	-21	-24	-29	-15	-13	0	18

Figure 46: Impact magnitude on environmental receptors during construction phase

9.3.1 C1 Settlement of Workers

The project will require a total of 10-15 workers including technical staff and laborers. Workers will be sourced from the contractor and they will be accommodated in the island at guest houses or residential houses. Since, the properties have already been established, impacts that are generally associated with construction of worker's facilities such as site clearance, disturbance to marine environment due to creation of access to the island, waste generation, emissions etc will be completely avoided. In addition, due to small workforce expected for the works, direct impacts as a result of their settlement will not be significant. Workers settlement related impacts include, generation of waste, sewerage, consumption of resources, emission stemming from power generation, pollution and habitat disturbance which are elaborated in their respective sections. When a new group of foreign workers arrive on the island conflicts can arise with the resident population in the instances where local culture is overlooked or not respected.
These impacts can be significantly mitigated through good management practices, provision of necessary facilities, implementation of house rules etc that are prescribed below.
Overall multi criteria impact for this activity was -12, which meant that the activity would have a minor negative impact on the environmental receptors.

Mitigation Measures

a) Workers rules must be in place before the work begins;
b) avoid construction of new buildings/structures, make use of the existing facilities on the island;
c) hire locals for the workforce as much as possible;
d) recruit skilled and experienced workers as much as possible;
e) give proper instruction for environmental safeguards before work is commenced;
f) awareness signs shall be placed on the site to display "do's" and "dont's" with respect to protecting the environment;
g) expatriate workers shall be briefed with regard to local customs and culture if they are new to the island;
h) catching, killing, keeping or disturbing birds and other animals will be prohibited at the project site;
i) waste generated by workers and work shall be managed as per Section on Waste Management;
j) orient foreign workers on how to communicate with locals and personal hygiene and sanitation and prevention of sexually transmitted diseases and other infectious diseases; and
k) ensure proper documentation for foreign labourers to avoid use of illegal expatriates for the Project.

9.3.2 C2 Site Demarcation & Fencing

Site demarcation and preparation involves, surveying all the trees within the footprint of the road and identifying trees that needs to be removed or relocated as described in **Section 2.8.3**. Vegetation surveys of certain plots has already been done in detail during the EIA assessment which will reduce the amount of work required for the activity (**Section 2.8.3)**. This activity is considered to have minor environmental impacts as it is largely noninvasive.

However, improper or inaccurate demarcation and labelling could result in removal of untargeted trees which could result in having to remove more number of trees than that are required. Incorrect labelling of the trees may lead to increased waste generation and reduced number of trees that can be salvaged. Surveyors and helpers during the survey works will be required to spend significant amount of time inside the dense coconut plantation with the risk of accidents caused by falling coconuts. Also there are areas where thick undergrowth was observed. Walking into such areas may also cause bodily harm if proper protective clothing is not used. Trimming undergrowth to access vegetated areas and use of spray paint during demarcation could have a slight negative impact on the biological environment and health of workers. Maldivian islands are heavily infested with mosquitos and therefore can become a nuisance and discomfort for people engaged during the survey works. The mosquito problem is more prevalent during the nighttime than daytime.
With proper planning, engaging qualified people and use of proper equipment, and with proper protective measures these impacts can be avoided. Overall multi criteria impact for this activity was -5 which meant that the activity would have a minor negative impact on the environmental receptors.

Mitigation Measures

a) Ensure that the surveyors and helpers engaged in site demarcation properly understand the scope of works and recommendations of this report;
b) qualified surveyors shall be engaged in site demarcation and labelling of trees;
c) accurate and reliable equipment shall be used to minimize errors;
d) ensuring proper labelling according to how they will be used following uprooting. Example labelling method proposed is described in **Section 2.8.3;**
e) hazardous waste used during site demarcation and fencing such as empty spray paint containers shall not be discarded haphazardly. These will have to be managed as per the **Section 2.8.12**.
f) wearing, clothes/helmets to protect against thorns and freefalling coconuts and wearing protective clothing;
g) carrying out the works during the day time; and
h) ensure mosquito repellants are available for the workers;

9.3.3 C3 Material Storage

This includes, storing all the vehicles, machineries, and tools required for the land clearance and IWMC construction. Due to the nature of the project, a lot of construction materials are not required. Apart from the vehicles and tools, fuel and water will be required for storage. Fuel will be stored on the cleared land in tanks on a paved surface. Vehicles will be stored inside the fenced plot area. Tools and equipment will be stored in the tool shed within the fenced land plot. The project does not require land clearance or construction of extra building for material storage, hence the impacts arising from this activity is considered to be minimal. However, there is a risk of accidents, such as fires, oil spills and trespassing. Improper storage of materials may result in loss of material and its quality due to rusting or theft. Improper storage of fuel may cause spills which may pollute groundwater and surrounding terrestrial environment through leaching.
These could be easily mitigated by implementing appropriate measures. Overall multi criteria impact for this activity was -19 which meant that the activity would have a minor to moderate negative impact on the environmental receptors.

Mitigation Measures

a) Equipment shall be stored in fenced areas and maintained appropriately during the cause of the project and no new such facilities shall be developed for the purpose of the project;
b) national Fire Code (NFC) shall be strictly followed while handling, transporting and storing fuel. Inflammable goods such as fuel drums, portable fuel containers Liquid Petroleum Gas (LPG) bottles and cleaning solvents and chemicals will be closed off from public access. Fire extinguishers and instruction in case of fire will be located in all the public, industrial and staff accommodation areas;
c) portable extinguishers placed to be readily available when someone finds a fire;
d) placing at least one portable firefighting pumps or pressurized fire hydrants at suitable location;
e) closed off non-public storage areas will be provided for inflammable goods (fuel drums, portable fuel containers, LP gas bottles, cleaning solvents etc.) with NO SMOKING, NO NAKED LIGHTS, HIGHLY FLAMMABLE sign boards in both English and Dhivehi languages;
f) fuel should be stored in well contained barrels and place over a concrete. This is to contain oil spills during storage and to prevent infiltration of oil into soil;
g) the work site shall have firefighting equipment readily available;
h) temporary tool shed shall be locked and all the equipment, vehicles and tools must be accounted for and
i) fuel shall be stored as on paved surfaces, roofed and well secured so that it does not easily spill over during bad weather conditions.

9.3.4 C4 Land Clearance

Trees will be removed using an excavator or through manual labour, by gently uprooting the tree from its base (See **Section 2.8.4** for details of tree removal method). Two scenarios have been proposed in the report for the management of trees the baseline scenario where all trees are removed and the preferred scenario where majority of trees are relocated. Since scope of land clearance falls under the island council, preferred method of removing trees is to remove and relocate trees as stated in **Section 8.5.2 A**. This method is proposed to conserve biomass loss.

Land clearance will also involve removal of undergrowth which will be stockpiled and burned. Trees that require removal shall be labeled and identified during the site demarcation.

The environmental impacts resulting from the removal of trees can include, damage and death of trees. Loss of trees can directly affect the nests and nesting birds on such trees and destroy habitats for invertebrates that live on trees. Tree removal can alter the visual landscape of the island. Trees provide numerous eco-system services. They help reduce, storm water runoff, wind penetration and air pollution. Trees, prevent and reduce soil erosion which is one of the major issues currently faced by Maldivian islands. Trees maintain groundwater quality, and keeps the land fertile. Removal of trees, could increase surface salinity of groundwater. They are a habitat for animals and act as a food source. They enrich soil nutrient, facilitating growth of different types of trees. Maldivian soils are generally weak in nutrient. The typical concentration of total nitrogen in soil

samples tested in Maldivian islands hovered at 1140 mg/kg (ALS Scandanavia AB, 2015)[3]. Nitrogen content decreased rapidly, at the bottom soil layer where, concentration hovered at 209 mg/kg. Hence removal of trees would reduce the thickness of organic topsoil. Addition of fill material which usually consists of coralline sand and rubble to cover root bulb cavities and use of fill material to level the road would further deplete the organic top soil and interfere with the natural bioturbation of the soil. Since the root systems of coconut palm trees are embedded deep into the ground, removal of the root system may expose the groundwater below, which will be sensitive to pollution (Meerow & Broschat, 2003).

Forests and tree plantation crops are particularly important as carbon reservoirs because trees hold much more carbon per unit area than other types of vegetation (Lasco et al., 2002; Lamade & Bouillet, 2005). Trees hold cultural and economic value.

The project will however not result in a loss of protected species or have an effect on threatened or rare plant species. There are no significantly large trees intersecting the proposed IWMC and access road area. Moreover, the direct footprint area of the project will be 3148 m^2. Due to the small size and types of trees present at the project area, the net loss of carbon balance as a result of land clearance is considered to be minor. There are no privately owned trees including coconut palms at the project area hence social impacts arising from land clearance will be prevented. Adjacent area to the north of the proposed plot had been previously cleared for the wind turbine project which makes the area suitable for relocation of trees. Hence the activity is considered to have a moderate negative impact. Although removal of trees and associated activities are considered to have negative impacts under the proposed project, most of these can be avoided and reduced to an acceptable level through appropriate mitigation measures proposed in the report. All necessary measures shall be in place to minimise the number of trees that are removed and to salvage as many trees as possible by making arrangements to relocate them.

Mitigation Measures:

Measures to Salvage as Many Trees as Possible

- A thorough tree survey shall be carried out to ensure only those trees that are absolutely required for uprooting is removed from the project area;
- each tree falling on the footprint shall be labelled as per the code given in **Section 2.8.3** and recorded;
- following the final tree survey, the planning team, the contractor, the proponent and the respective council representatives shall meet to explore minor adjustments that could be brought to the road centrelines in cases where trees can be spared from removal;
- once the trees have been identified and marked as requiring removal, all trees suitable for re-location shall be identified. Relocation of trees shall be prioritised as described in **Section 8.5.2.**

[3] Source: Soil chemical analysis for R.Vandhoo, Lab report: T1633252

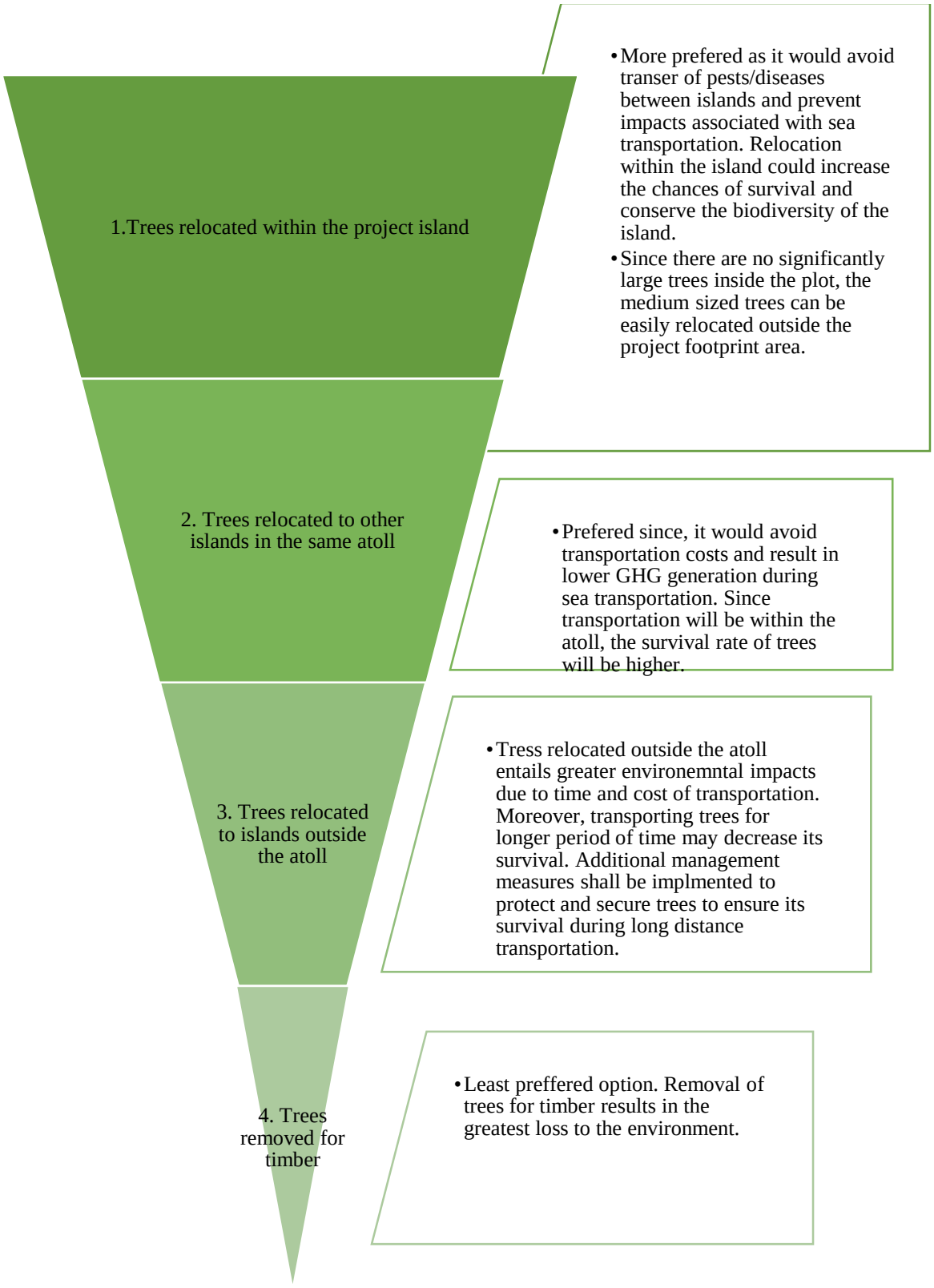


Figure 47: Preferred steps of relocation and removal of trees

- MEE shall provide assistance and support to the island councils as described in the report (See **Section 2.5**). This involves facilitating and assisting the island councils during land clearance;
- establish a good coordination arrangement with the potential buyers of trees identified for relocation, to minimise the transfer time and to enhance tree survival, in case trees inside the plot are to be sold;
- strict supervision shall be in place during the tree removal works to ensure only the intended trees are removed;
- method prescribed for removing the tree in **Section 2.8.4** shall be followed and adapted depending on the type of tree to be removed;
- method prescribed for replanting trees in **Figure 11** shall be followed and adapated depending on the type of tree to be removed; and
- all records of trees removed and their end use shall be kept and monitored.
- All risk management measures proposed in **Table 18** with regard to social risks shall be followed;

Measures to Minimise Impacts to the Soil and Groundwater

- Fill the root bulb cavity as soon as possible to prevent spills and contamination of groundwater (As described in **Section 2.8.4**);
- plastics, non-biodegradable wastes shall not be used in backfilling of the hole created by uprooting of trees;
- when removing trees it is important to follow steps described in **Section 2.8.4** to minimise impacts on soil and groundwater;
- Ensure that root bulb cavities are filled with sand or root bulbs if trees are removed for timber (See **Section 2.8.3** for details). The sand shall be responsibly sourced by respective buyers of the trees. Sand shall not be mined from the lagoon or the island; and
- After removal of trees the ground shall be levelled and compacted.

Minimising Impacts to Untargeted Species

- In cases where bird nests are strongly believed to have existed on a tree that is targeted for removal, efforts shall be made to remove the nests carefully and relocate them to safer tree before the tree is knocked down.

Minimising Impacts of Vehicular Emission during Site Clearance

- Vehicles should be serviced and maintained regularly to avoid delays and emission of harmful gases;
- machines should be switched off when not in use; and
- idle time shall be decreased; fuel minimization should be practiced by reducing use of electricity during day time.

Measures to Minimise Accidents and Injuries to Workers

- Work shall be carried out only during fair weather. Work shall be terminated and employees moved to a place of safety when environmental conditions such as but not limited to high winds, heavy rain, and darkness that may endanger employees in the performance of their jobs;

- hard hats, eye protection, hearing protection, and foot protection shall be used by the workers during work times. Equipment operators should wear seat belts. Wear high visibility clothing as well;
- overhead hazards can cause injuries and therefore all workers should practice "heads up" to avoid possible hazards;
- inspect all machineries and equipment before use. Establish a regular, preventative maintenance program on all equipment; and
- all safety measures given **Section 2.8.14** shall be applied during construction phase.

Measures to Minimise Economic Impacts

- Sale of the trees that could be used as ornamentals, for landscaping, or as timber and edible plants that are consumable shall be advertised as widely as possible to encourage people to buy as many parts as possible to mitigate economic impacts as well as to reduce waste and prevent loss of biomass.

Measures to Minimise Aesthetic Impacts

- Limiting the number of trees removed to bare minimum by carefully surveying the project area and bringing minor adjustments to access road as described above without compromising the functionality access road; and
- re-planting as many trees as possible by relocation as recommended in the report.

9.3.5 C5 IWMC Construction

The major environmental components effected by the activity includes the climate in the form of greenhouse emission and air pollution, noise and vibration from construction activities, health and wellbeing in the form of accidents and injuries and to some extent minor impacts to flora and fauna.

Transportation of construction materials from the source to the project island is identified as an activity with climate impacts, through the transportation of sea vessels, as well the transportation of the materials on land. The use of vessels and vehicles would require burning of fossil fuels which result in the release of greenhouse gases (GHG) into the atmosphere. The fuel usage of a supply barge is estimated at 1.3 kWh / t (Saleeem, et al., 2016). Reduction of the transportation distance from the source to the project island is proposed. As the resource sourcing hierarchy in **Figure 48** shows, the greatest importance shall be placed on sourcing any available materials from within the island, with the next option being from within the north region, from islands such as HDh. Kulhudhuffushi. Site visits to the Zone 1 islands show possible sources for sand in islands (such as HDh. Kumundhoo, where a pile of excavated sand is present which can be procured for use in concreting works). Next in the hierarchy is Male' and the industrial areas in the zone, from where majority of the remaining materials can be sourced. Lastly, in cases where a proposed material cannot be obtained from within the country, only shall the contractor procure the material from a neighbouring country.

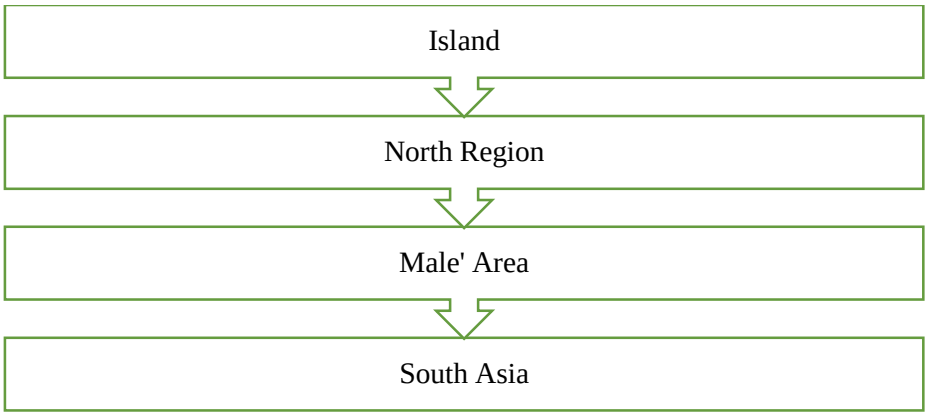


Figure 48: Material sourcing hierarchy proposed for the project

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

The inputs of the project elaborated in the section 2.1 show the amount of resources that will be used for the project. The use of resources for the project can have indirect impacts of GHG emissions from the production process. The main materials used in this project include concrete, reinforcing steel, structural steel, in addition to PVC pipes. (Defra/DECC, 2012) states that for every tonne of concrete casted, 135 kg of indirect CO_2 emissions result. Therefore, for this project, an estimated 100.1 kg of CO_2 emissions are expected for the concrete casted. 3136 kg of indirect CO_2 emissions (Defra / DECC, 2012) occur per tonne of PVC pipe produced. For this project, the amount of indirect CO_2 emissions is estimated at 164.8 kg. The greatest indirect CO_2 emissions are estimated from the usage of reinforcing steel. 1.5 tonnes of reinforcing steel are estimated to be used for this project, which can cause a release of indirect CO_2 emissions of 5311 kg (Ma, et al., 2016). Due to the small scale of the construction, the estimated indirect CO_2 emissions from material usage are minimal for this project.

The use of heavy vehicles on unpaved roads can cause compaction of the soil by the force applied by the tires of the vehicles. This can lead to the destruction of the soil structure, reduction of porosity, and thus reducing the water and air infiltration into the soil. The resulting soil is dense with few large pores and poor internal drainage. Roads impacted with the traffic from heavy vehicles can thus result in undulations and puddling.

Figure 49: Impact on roads from heavy vehicle transport in an island in Maldives

For the purpose of this project, heavy vehicles will be used during land clearance, and earthworks. Although this is the case, a pickup truck will be used to transport the construction materials to the site. The number of trips required are also reduced in the case of the proposed project, due to the small scale of construction.

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

It is important to identify the sources of noise and vibrations and the intensity of such impacts on the project island. Sensitive hours are taken as prayer times and between 10pm and 6am except Fridays and on Fridays between 10am and 2pm in the context of the Maldives. Noise impacts are expected to be minor during construction phase as construction activities will take place away from public areas.

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

Table 38: Typical construction equipment and their noise levels 50ft from the source

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

Assuming the highest noise produced during construction is at 85 dBA, a noise decay calculation was done using initial assumptions without factoring for dampening effects due to obstacles and vegetation. From the initial calculations, the noise levels are projected to decrease at a rate of 0.1 $dBAm^{-1}$ down to 61 dBA. This means that a continuous noise source producing 85 dBA will be at:

- 75 dBA at the football field and 69 dBA at the public school in Ha.Uligam

These levels are further expected to decrease taking into consideration the vegetation surrounding the proposed site, as well as the soil characteristics of the ground. Moreover, it is unlikely that a noise level of 85dBA will be maintained continuously for more than 30 minutes during construction phase of the project. Considering these findings noise impacts on public will be minor to negligible. However, the construction workers will be affected by the noise impacts.

Another area that will be effected during the construction of IWMC is health and wellbeing of worker mainly in the form of accidents and injuries. There could be many risks (hazards) and accidents to consider associated with many possible scenarios that could unfold depending on time, magnitude and the location it occurs

Hazards during construction

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

Overall multi criteria impact for this activity was -39. This meant that the activity would have a moderate negative impact on environmental receptors.

Mitigation Measures:

Measures to minimise climate impacts

- It is recommended to consider sourcing material from the closest point according to the hierarchy presented in **Figure 48** to minimise GHG impacts;
- the materials shall be bought in bulk and transported to the island within a single trip where possible;
- detailed BOQ has been produced by the proponent, which shall be followed by the contractor when purchasing materials in order to reduce wastage of materials as well as the number of trips;
- the materials shall be stored on the project site to eliminate transportation of vehicles within the island throughout the construction phase;
- idle time of the vehicles shall be avoided in order to reduce emissions;
- the contractor shall use serviced vehicles and plant equipment for the project;
- the contractor shall only use the needed amount of vehicles and plant for project; and
- the vehicle used for the purpose should comply with the roadworthiness requirements of the Transport authority and display the compliance stickers.

Measures to minimise road impacts

- The contractor shall only bring in the necessary number of vehicles and plant to the island for the project. Oversized heavy vehicles which are not required for this project, shall not be used in the island for transportation and construction purposes;
- it shall be stated in the contract that any damages to the roads from transportation of construction materials and machinery shall be assessed after the civil works are completed, and the damages shall be repaired by the contractor. Similarly, after land clearance the council shall assess roads and damages shall be repaired by the buyers of trees.
- use the direct route of the main road from the harbour area to the site;
- avoid use of heavy vehicles during rough weather;
- cover the materials being transported to and from the site; and
- spray water on the road surface during dry periods to suppress dust.

Measures to Minimise Noise Impacts

- Provide workers with noise cancelling headphones;
- use quieted equipment where possible, such as mufflers on engines;
- use of well serviced vehicles and plant; and
- switching off equipment and vehicles when not in use.

Measures to Minimise Accidents and Injuries

- The contractor shall be required to develop occupational safety management plan, and safety guidelines shall be displayed in the work site at all times;
- occupational safety training should be given to all workers present on site;

- workers should be provided Personal Protective Equipment and the use of PPE shall be enforced;
- site visitors shall be accompanied at all times and required PPE shall be provided;
- provide first aid services in the site;
- proper signage and fencing should be provided around the site;
- carry out works during good weather;
- well trained personnel to use machinery and vehicles;
- avoid transportation during night; and
- securing any loads on vehicles during transportation.

9.3.6 C6 Transportation of Trees, Waste etc

Significant volumes of yard waste will be produced during the site clearance works. The island has no waste management system and therefore additional waste created if left on the island will have multiple direct and indirect impacts on the island. Based on worst case scenario, where relocation or mitigation measures are not implemented it is estimated that removal of trees would result in generation of approximately 5-10 tons of waste from Ha.Uligam.

Since MVR 400 is charged per ton of waste transferred to Thilafushi waste management center, it will cost approximately MVR 6000, just to dispose these waste without transportation cost.

Since there are no waste management facilities nearby, all the waste generated from the island will have to be transferred to Thilafushi by boat. Long haulage of waste would result in burning of fuel that would emit greenhouse gases in addition to extensive costs. Taking into consideration these challenges, it is proposed to give utmost priority to minimising waste that is required for transportation. Similarly proposed scheme in **Figure 47** shall be followed when transporting trees for relocation.

Hence careful planning and adopting to the proposed waste management strategies will have to be taken into consideration to minimize environmental and economic impacts associated with site preparations.

This activity will generate noise and constitute to air pollution, it has the potential to damage flora and fauna outside the project direct footprint area. Accident such as spills and fires could exacerbate the impacts. However, since the extent of direct impacts are low and propensity for negative impacts are high this activity has been classified as having a moderate negative impact. Overall multi criteria impact for this activity was -26 based on number of trees to be removed. In order to mitigate significant impacts to environmental receptors the following mitigation measures have been recommended.

Mitigation

Strategies to Avoid Polluting the Island

- Waste shall be managed as described in **Section 2.8.12**;
- all wastes that are not managed at the island level during the site preparation activities will have to be collected and transported to Thilafushi or nearest waste management center for final disposal;

- the contractor shall track the amount of waste generated. Waste from origin shall be same as waste discarded at the nearest waste management center;
- avoid idle time for vehicles and plants to reduce emission;
- ensure land vehicles used meets the local road-worthiness requirements;
- implement proper traffic safety measures;
- trucks used for that purpose should be fitted with tailgates that close properly and with tarpaulins to cover the materials;
- clean-up of spilled material should be done in a timely manner;
- waste shall be stockpiled at the work site and shall be enclosed and secure;

Measures to Minimize Waste Needing Transportation

- Waste shall be managed as described in **Section 2.8.12.** By following the waste management plan proposed in the report all yard waste can be managed at the island itself;
- replant as many trees as possible as described in **Section 8.5.2 A** of the report ; and
- advertise as widely as possible to encourage buyers who may relocate trees.

Measures to Avoid Accidents and Injuries

- Avoid land transport of materials during night time;
- materials shall not be transported during bad weather conditions. Ensure to get clearance from Maldives Meteorological Centre; and
- marine vessels used for transport of waste shall have seaworthiness certificates and experienced crew.

9.3.7 C7 Waste Generation (Construction Phase)

Solid waste generated during land clearance and IWMC construction work would negatively impact the site and surrounding environment if not properly managed and disposed of at an approved dumpsite. Yard waste will the major form of waste generated from the project as detailed in **Section 9.3.6**. Waste burned onsite would generate smoke, possibly impacting negatively on ambient air quality and human health. On the other hand, if all site clearance waste is to be transported this would also result in requiring burning fossil fuels and would require significant finance. Solid waste, if allowed to accumulate, could cause localised conditions conducive to the breeding of nuisance and health-threatening pests such as mosquitoes. Poor construction waste management constitutes a short-term, possibly long-term, negative impact.

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

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

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

Municipal wastes are also expected to be generated during the construction phase by the workers comprising of food wastes, packaging wastes and waste paper (See **Table 17** for estimated quantities of municipal waste).

The amount of human waste generated per person is approximately 125 g/day, which means 1.8 kg will be produced daily if approximately 15 workers were active which equates to discharge of approximately 2,540 l/day of waste water per island. Sewage will be managed through existing sewage systems that have been installed in the island.

Since there is no existing waste management system in the atoll or since the existing island level waste management dumpsites are not sufficient to accommodate the construction waste generated, the environmental receptors will have a significant burden from construction waste. Some of the hazardous oils if not disposed properly may cause health implications to the people and vegetation. Overall multi criteria impact for this activity was -31, which meant that the activity would have a moderate negative impact on environmental receptors.

Mitigation Measures

- Ensure to manage waste as described in **Section 2.8.12** of the EIA report;
- ensure to reduce waste by relocating trees as described in **Section 8.5.2**; and
- open defecation whether it's on land or on the beach shall be prohibited;

9.3.8 C8 Resource Consumption (Water and Electricity)

During the construction phase, on site small generators will be used to provide electricity required for the operations of machineries. Notable impacts of this activity include, increased air pollution, risk of spillage, impacts to health/wellbeing and accidents.
The primary pollutants generated due to power production from diesel based generator system include Nitrogen oxides (NO_X), Sulphur dioxide (SO_2), Carbon monoxide (CO), Hydrocarbons/ Polycyclic Aromatic Hydrocarbons (HC/PAH), Particles (PA) and Carbon dioxide (CO_2) in the form of emission although the exact amount is difficult to quantify.

The visible pollution generated by burning diesel contains elemental carbon as soot. The typical odour comes from polycyclic aromatic hydrocarbons, which also are cancer causing components. **Table 39** shows NO_x and particles emission of burning a cubic meter of diesel by a generator.

Table 39: Emission from a typical diesel generator

Pollutant	Diesel generator mg/m^3
NO_x	4000
Particles	100

The emission of nitrogen oxides is a serious problem and is often overseen. Nitrogen oxides are as seen in **Table 39** responsible for a number of negative impacts on the environment. People living close to a generator will be affected by an elevated concentration of nitrogen oxides.

Nitrogen oxides contain different oxides of nitrogen, the most important being nitrogen monoxide (NO) and nitrogen dioxide (NO_2). Nitrogen dioxide is a respiratory irritant and is responsible for a number of respiratory diseases. People with sensitive respiratory systems are especially affected. Due to the scale of these activities, the generators and excavators won't be used for long periods of time. This would significantly reduce the impact of electricity generation. Dump truck usage will be prominent during the site clearance step, whilst IWMC construction stage will not use heavy vehicles and equipment extensively.

Water used during construction will be sourced from the groundwater well-constructed at the IWMC. Water used for drinking and cooking will be purchased from local shops or collected from existing rainwater tanks or from the groundwater well in the island (See **Table 16** for resource requirement during construction phase). Water and electricity consumption for the project is considered to be minor.

Overall multi criteria impact for this activity was -14, which meant that the activity would have a moderate negative impact on environmental receptors.

Mitigation Measures

- As one of the first step of construction, install the proposed well at the IWMC. Water quality analysis have shown that groundwater will be suitable for construction activity use (See **Table 24**).
- use well maintained, energy efficient equipment. Energy efficiency measures are of high importance for generators that operate for 24 hrs of each day both with regard to economy and the release of CO_2 and other pollutants. The emission of carbon dioxide is directly related to the amount of fuel used. High efficiency is therefore important to reduce the amount of released carbon dioxide and consequently to reduce the global greenhouse effect;
- reduce idle time of machineries and vehicles. Switch them off after use;
- utilize day time hours for the construction when plenty of light is available, and
- where possible obtain electricity from island grid during construction to prevent handling of fuel and genset.

9.4 OPERATIONAL PHASE IMPACTS AND MITIGATION

In order to measure impacts during the operational phase of the project, major activities of the operational phase have been identified.

The main activities of operational phase are:

1. O1 – Waste collection and transportation: A major activity of IWM. Ha.Uligam has a draft WMP (See **Annex 11**).
2. O2 – Waste sorting, storing and compost making: The biggest component of IWM. If carried out as per the waste management concept plan, this activity would result in the most positive impacts. However, based on fair assessment of the existing condition, this activity was observed to have the highest potential for failure which would result in major negative impacts. A precautionary approach was used in assessing the impacts of this activity.
3. O3 – Waste generation: Describes waste generated from the operation of IWMC.
4. O4 – Resource consumption (water/electricity): Describes resource consumed to operate the IWMC on a daily basis.

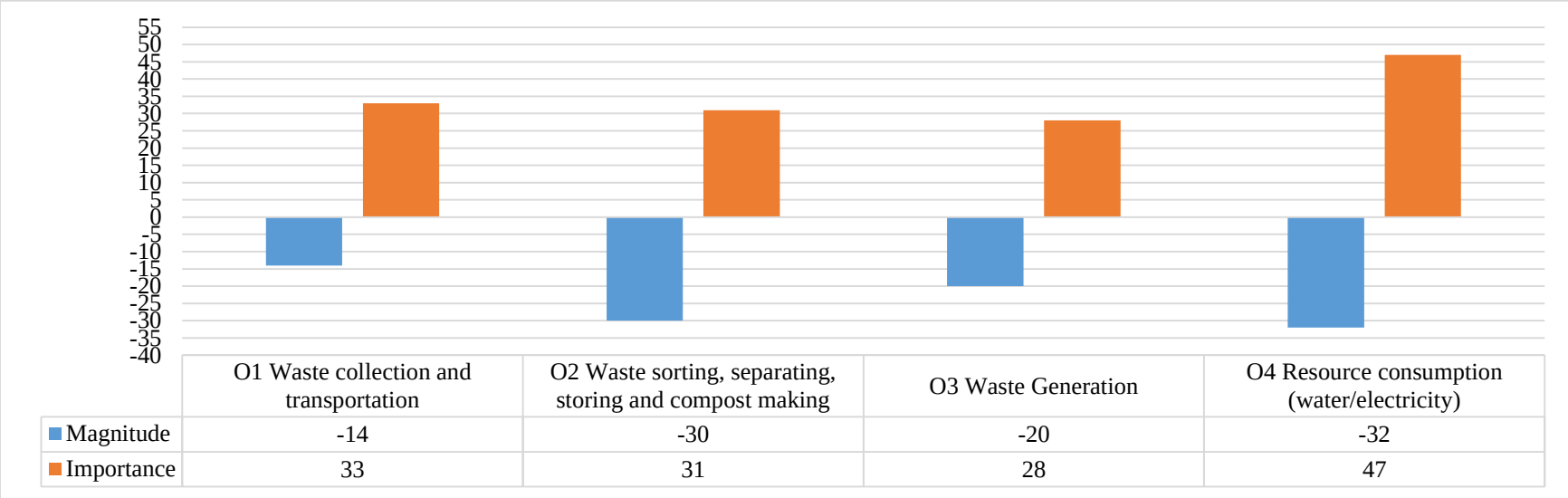
Leopold Matrix for the operational phase of the project is shown in **Table 41. Figure 50** illustrates the impact magnitude of each activity and their relative importance. **Figure 51** illustrates impact on the environmental receptors during the construction phase of the project. A summary of the major activities and their associated overall impact represented by colour codes are given in **Table 40.**

Table 40: Operational phase impact summary, its properties and mitigation cost indicator.

No	Potential Risk/Impact	Receptor	Nature	Reversibility	Significance	Mitigation	Cost indication of measure
	Description	Description	Positive	Reversible	Major Negative Moderate Negative Minor Negative Neutral Minor Positive Moderate Positive Major Positive	Description	USD
			Negative	Irreversible			
O1	See **Section 9.4.1**	See **Section 9.4.1**	Positive	Reversible		See **Section 9.4.1**	Included in construction costs
O2	See **Section 9.4.2**	See **Section 9.4.2.1, 9.4.2.2 and 9.4.2.3**	Positive	Reversible		See **Section 9.4.2.1, 9.4.2.2 And 9.4.2.3**	$ 2,000
O3	See **Section 9.4.3**	See **Section 9.4.3**	Negative	Reversible		See **Section 9.4.3**	Included in construction costs
O4	See **Section 9.4.4**	See **Section 9.4.4**	Negative	Reversible		See **Section 9.4.4**	$130,000 - $200,000

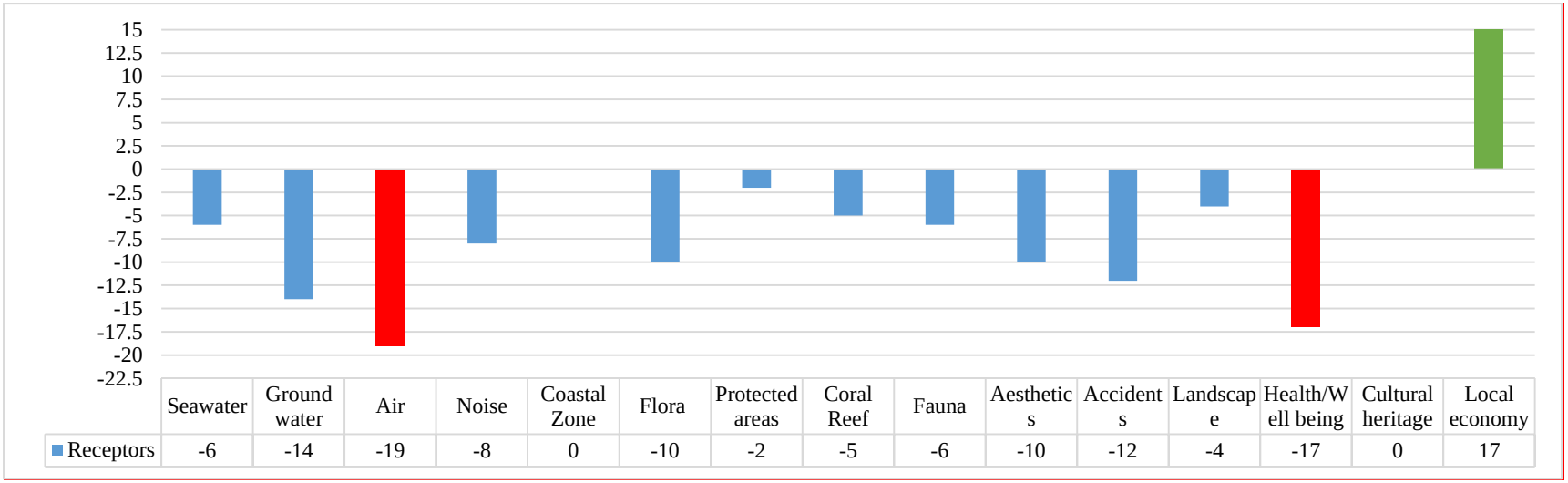
Table 41: General operational phase impact matrix

	Envisaged impact factors	O1 Waste collection and transportation	O2 Waste sorting, separating,	O3 Waste Generation	O4 Resource consumption (water/electricity)	Total (Impact Area)
Physical Components	Seawater	4				4
		4				4
	Ground water	5	-2	-1		0
		3	2	5		12
	Air	-3	-2	-2	-4	-14
		5	3	2	4	16
	Noise	-3	-1			-4
		4	2			6
	Coastal Zone					0
						0
Biological Components	Flora	6	7	-1	-3	4
		2	6	1	4	18
	Endangered species/protected areas					0
						0
	Coral Reef					0
						0
	Fauna	5	5	-1	-3	3
		5	5	1	4	19
Socio-Cultural Component	Aesthetics	6	8			9
		6	6			17
	Accidents	-4	-4		-6	-20
		4	4		5	19
	Landscape	5	6	-1		5
		6	5	2		18
	Health/Well being	5	-5	-2	-6	-10
		6	5	2	8	23
	Cultural heritage					0
						0
	Local economy	-3	8	-2	-1	5
		9	2	4	1	19
Total (operational Phase Activity/Risk)		23	20	-10	-23	
		54	40	17	26	



	O1 Waste collection and transportation	O2 Waste sorting, separating, storing and compost making	O3 Waste Generation	O4 Resource consumption (water/electricity)
Magnitude	-14	-30	-20	-32
Importance	33	31	28	47

Figure 50: Impact magnitude and importance of key operational phase activities.



	Seawater	Ground water	Air	Noise	Coastal Zone	Flora	Protected areas	Coral Reef	Fauna	Aesthetics	Accidents	Landscape	Health/Well being	Cultural heritage	Local economy
Receptors	-6	-14	-19	-8	0	-10	-2	-5	-6	-10	-12	-4	-17	0	17

Figure 51: Impact magnitude on environmental receptors during operational phase

9.4.1 O1 Waste Collection and Transportation

As described in the report, there are no proper waste management systems in the project island. Existing waste management practices in the island is inadequate and have associated health risks. (See **Section 2.4** for detailed description of existing waste management practices) Public disposing of waste in various locations of the island, including the beaches and the periphery of the residential areas, have resulted in the spread of diseases in the island. Current practices also include burning waste at various locations of the island, which leads to respiratory issues from the inhalation of smoke.

With the successful implementation of the IWMP waste littering and burning throughout the island will prevented which would result in positive impacts to the environmental and social receptors of the island. This will lead to the improved health and psychological well-being of the residents and visitors. It has been identified as a long term positive impact. However, since the proposed waste collection system will involve trucks, there will be minor to moderate negative impacts due to air pollution and accidents. Furthermore, if the waste collection plan is not designed properly it could be a burden on the residents economically. These impacts can be prevented and reduced significantly with proper management and planning.

After considering these aspects, the overall multi criteria impact for this activity was 23, which meant that the activity would have a minor positive impact on environmental receptors.

Measures to ensure and enhance the positive impacts

- The intermediary waste management plan described in **Table 9** shall be referenced;
- all measures proposed in **Table 8** shall be followed by the proponent and respective council;
- procure vehicles from a reliable supplier. Ensure vehicles are able to operate in Maldivian climate which is characterised of high temperature and exposure to high salt content in an island setting. Ensure that vehicle spare parts are easy to obtain locally. In general vehicles shall be resistant to corrosion and must be able to withstand high temperatures. Supplier shall provide after sales services and the vehicle shall be familiar to locals;
- the Island Council shall formulate a feasible waste management plan which shall be approved by the EPA and made available to the public;
- the aforementioned plan shall state the penalties on persons that do not act according to the regulation and guidelines (i.e. littering, burning and dumping of wastes elsewhere), and Island Council shall enforce the penalties as prescribed;
- the proponent and Island Council shall follow the management plan provided with the EMP (See **Section 10**) in order to monitor the operations of the IWMC, and bring about any necessary changes to the operations and policies, in addition to providing any needed technical assistance for the island;
- the proponent shall review the waste management operations within the island regularly and update the National Waste Database;
- if implementation of Waste Management Plan (WMP) is outsourced, the operations shall be awarded to a contractor with the capacity to run the IWMC;
- heavy vehicles could damage the dirt roads as described in **Section 9.3.5**, hence mitigations measures described in **Section 9.3.5** shall be followed during operational phase as well;

- fee structure for waste collection shall be designed after consulting with all the relevant stakeholders; and
- mitigation measures regarding reduction of vehicular emission described in **Section 9.3.6** shall be followed.

9.4.2 O2 Waste Sorting, Storing and Compost Making

Waste sorting, separating storing and composting make up the largest portion of the IWM concept. on top of reducing the volume of waste, these activities, convert waste to re-sable and value added products. These activities will be carried out in the IWMC where employees will be trained to undertake these activities.

In general, the operational phase of the project will greatly improve the existing waste management condition of the island preventing pollution and spread of diseases. These activities would prevent pollution of groundwater, coastal areas and forested areas which would prevent impacts to biodiversity, health and wellbeing of the public. Hazardous chemicals that get into the soil (contaminants) can harm plants when they take up the contamination through their roots. If humans eat plants and animals that have been in contact with such polluted soils, there can be negative impact on their health.

All these impacts can be mitigated and prevented by the proposed IWM concept. During the operational phase, on top of preventing environmental pollution and related health impacts, the project would facilitate growth of local economy. Recyclables and compost from IWMC can be sold. This way IWMC operations could become financially viable. It would also create job opportunities for the locals.

Measures to Enhance Positive Impacts:

- Ensure that technical support to the operators of IWMC is provided by MEE. This includes practical tutorials on best compost practices and how to operate waste management equipment. All project risk mitigation measures and all adaptive measures and recommendation proposed in **Section 2.11** shall be followed;
- ensure that IWMS's are monitored by MEE and provide support based on findings of reports provided by the IWMC operators and island council;
- help find a viable market for compost and recyclables produced and generated from the IWMC;
- provide, business planning and financial planning support to the IWMS operators; and
- ensure that island council prepares a detailed island level waste management plan and ensure that management of waste is undertaken as per the waste management plan of the island.

However, if these activities are not properly implemented there is a risk of IWMC being deteriorated into a dump site where mixed waste are disposed, burned and buried. The risk is more prominent for islands where the population size is greater. This means without proper mitigation measures and regular transportation of waste out of the island to the regional centre, there is a greater risk of IWMC being overfilled. More so considering that IWMC is equipped to handle only about 20-30% of organic waste generated in the island. This entails a loss of investment and a greater impact to environmental receptors as some of these sites are moderately close to public areas. Moreover, impacts associated with composting sorting and storing waste has inherent impacts which will have to be properly managed, identified and

mitigated to enhance and ensure the positive impacts of the proposed IWM. Propensity of these impacts are greater for the following environmental receptors:

1. Groundwater;
2. Climate/air; and
3. Health and wellbeing: noise, odour and accidents/injuries

The following sections describes the factors influencing these impacts and proposes measures to mitigate negative impacts and to ensure the overall positive impact of the IWMC during operational phase. Furthermore, during the operational phase of the project, workers health will be significantly affected.

9.4.2.1.Groundwater Impacts

When organic waste is stockpiled for composting, there is potential for leachate production from the waste. This is especially prevalent in cases where the waste includes food, meat, fish and fatty sludge. This leachate can infiltrate into the ground and mix with the freshwater lens of the island, thus polluting the lens with high amounts of nutrients, which can introduce bacteria and other microbes. If the conditions are anaerobic, the resulting leachate can be acidic and cause the corrosion of metals and introduction of metallic compounds in the groundwater. If the conditions are aerobic, alkaline leachates will result with a low carbon – high nitrogen ratio. Leachate production can increase during the rainy season, with the additional water from rain causing leachate from garden materials, wood and fibrous materials. Rain can also cause the stockpile to become anaerobic, thus resulting of undesirable odours.

The operation of the IWMC is identified to have an overall positive impact of the groundwater of the island. While the aforementioned infiltration of leachate would still be an issue (if improperly managed at the IWMC), it should be noted that the same waste has been dumped throughout the island without any measures, enabling the pollution of the groundwater with the leachate. Therefore, the proper operation of the IWMC and the proper management of the collected waste will result in the reduction of the pollution of the groundwater from waste sources, thus improving the status of the groundwater in the island.

The current design of the IWMC consists of a composting slab is an open windrow composting system. The compost windrow is kept on the compost slab which is sloped in such a way that the leachate from the compost will collect at the pipe in the centre, which will propagate the leachate into the leachate collection tank (See **Figure 52**). While this scenario is ideal during fair weather, heavy rainfall and strong winds should also be considered. There is a possibility of heavy rainfall increasing the produced leachate, as well as the water collected over the composting slab propagating to the leachate collection tank. This can cause an overflow of the leachate collection tank, releasing its contents into the ground and subsequently the groundwater aquifer.
The rainfall can also cause the scattering of the compost materials, the increased water content in the compost windrow can cause another issue: the saturation of the windrow can decrease the available oxygen within the compost windrow, leading to anaerobic conditions.

Groundwater Impact Mitigation

- The composting area has a dedicated composting slab made of reinforced concrete, along with an HDPE lining between the soffit of the slab and the ground. Concrete is an inert and highly impermeable material, and with the combination of HPDE lining, the possibility of leachate leaking directly from the compost slab is low;
- the composting slab is designed to have a slope towards the centre from both sides, which will propagate any leachate produced towards the 100 mm PVC pipe, which in turn drains into the leachate collection tank;
- regular turning of the compost pile can help minimise the quantity of leachate produced;
- the leachate collected shall be reused to provide moisture to the compost heaps; and
- leachate tank shall have a monitoring device installed such as a high level alarm or management practices should be implemented to ensure any overfill will not occur.

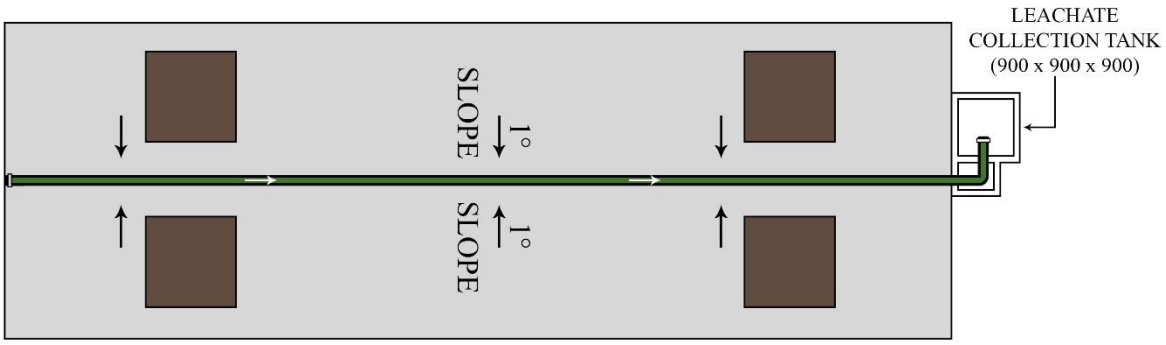


Figure 52: Compost slab design and leachate collection system (Plan view)

- There is a valve placed at the inlet pipe which can be closed in instances where the leachate tank may overflow from heavy rainfall onto the compost slab;
- the compost slab is raised through design, to avoid any ingress of water which may otherwise be possible from puddles and possible inundating due to heavy rain;
- a windrow cover shall be used to mitigate the impacts from rainfall. The cover shall be made of geofabric and allow for the air circulation while protecting the compost. The advantages of the cover include moisture control, which reduces leaching and nutrient loss, as well as reducing water loss from the sun and wind. In order to keep the cover in place during strong winds, weights attached to ropes shall be placed on top of the cover at regular intervals.

Figure 53: Windrow cover being utilised in an open composting system

(source: Midwestbiosystems.com)

9.4.2.2.Health Impacts

A. Odour and smell

Composting can be a source of particulate matter in the atmosphere. The highest concentration of particulate matter in the air occur during the pre-treatment phase where the fresh organics are shredded and mixed. Particles also become airborne during the turning of the biodegrading compost heap to regulate the temperature.

Certain pathogens may be transmitted via air during the composting process. These include *Legionella longbeachae, Aspergillus fumigatus, Mycobacterium tuberculosis* and *Hantavirus* (DEC, 2004). (Harrison, 2007) has done a comprehensive literature review on the health effects of composting operations, which show increased concentrations of bio aerosols within the vicinity of the composting facilities and related health effects to workers as well as affected public. (Bunger , et al., 2006) states that exposure to organic dust at composting workplaces is associated with acute and chronic respiratory health effects. (Wouters, et al., 2006) agree with these findings, stating that changes were found in white blood cell counts, increase in neutrophils, decrease in oesinophils were measured in healthy subjects.

As for the association between the health symptoms and the distance from the site, Herr et. al (2004) showed that total bioaerosols were found at $> 10^5$ CFU / m^3 close to the composting site and dropped to background levels within 550m from the site. Herr et. al (2004) also showed from another study where higher than background concentrations were found within 200 m from an outdoor composting site ($> 10^5$ CFU / m^3), and dropped to background concentrations at 300 m.

Wheeler et al (2001) stated that composting activities do not emit bio aerosols at levels that can be of a hazard to the public. Wheeler et al suggests a buffer zone of 250 m. The conservative values for the concentrations given by Wheeler at al includes:

Table 42: Background concentrations of bio aerosols (Source: Wheeler et al (2001))

Bio aerosol	Concentration
Total Bacteria	1000CFU/m^3
Total Fungi	1000 CFU/m^3
Gram-negative bacteria	300 CFU/m^3
Inhalable dust	250 µg /m^3

Wheeler et al states the concentrations of bio aerosols exceed this limit where 10^5 – 10^6 of bacteria and 10^3 and 10^4 of fungi have been measured, the concentrations drop to background levels at 250m distance from site. Although it should be noted that the expected composting operations in the IWMC are not as large scale as the studies cited above. The composting capacity of the IWMC is expected to be two windrows of approximately 39 m^3, each batch to take around 4 – 6 months to mature. Therefore, the health impacts of the bio aerosols can be minimised by following the mitigation measures provided.

Composting odours can originate from sulphur compounds, nitrogen compounds and volatile organic compounds. Ammonia is also commonly associated with unpleasant odour resulting from composting. If the composting is done under aerobic conditions, the main gaseous product is carbon dioxide. Gas compounds contributing to the odours of composting organics containing bio solids include dimethyl sulphide, dimethyl disulphide, dimethyl trisulphide, carbon disulphide and benzothiazole. These chemicals, while potentially toxic, are not present in high concentrations in open air composts. The gas methane is generated when the microbes do not get enough oxygen, and anaerobic biodegrading occurs. Methane gas has a strong and foul odour. The generation of ammonia, volatile amines, hydrogen sulphide and volatile organic compounds cause these odours.

Table 43: Odours generated from the composting process. Source: Goldstein (2002)

Compound	Description of smell	Detection limit for a particular odour panel (µg/m^3)
Sulphur compounds		
Dimethyl disulphide	Rotten cabbage	0.1
Dimethyl sulphide	Rotten cabbage	2.5
Carbon disulphide	Rotten pumpkin	24
Hydrogen sulphide	Rotten egg	0.7
Methane thiol	Pungent sulphur	0.04
Nitrogen compounds		
Ammonia gas	Medicinal	27
Trimethyl amine	Fishy	0.11
Volatile fatty acids		
Acetic acid	Sour (vinegar)	1019
Propionic acid	Rancid	28
Butyric acid	Putrid	0.3

On the other hand, the issue of unpleasant odour throughout the island can be eliminated through the operation of the IWMC. The current practices of dumping waste all around the island will be replaced with the collection and disposal of the waste at the proposed IWMC site. These sites are at least 80m away from the nearest residential site, and is located in such a way

that the monsoonal winds will not carry the odour towards the residential areas. Therefore, the impact of odour on the residential areas are deemed minimal.

Odour Mitigation Measures

- Increasing buffer distance between IWMC and residential areas or situating the IWMC in a downwind location (See **Section 8.2** for preferred site based on this aspect);
- ponding shall be minimized at the site by grading of the ground;
- all safety gear illustrated in **Figure 54** shall be worn by the IWMC workers;

Figure 54: Safety gear to be worn by IWMC workers

- compost turning shall be done based on temperatures and not on schedules;
- material movements and compost turning shall be done during low winds. Weekends, holidays and times of the day when most people are likely to be outside (and use of football grounds) shall be avoided when handling the materials and turning compost;
- add moisture to the compost to minimize dust;
- add a geofabric cover over the compost windrow to minimize release of bio aerosols;
- workers shall follow the workplace safety mechanisms and guidelines set by the contractor and practice safety and personal hygiene when handling the compost.
- covering of rapidly biodegradable organics. Rapidly biodegradable organics include grass clippings, food and animal organics and organic sludges. The exposure of such organics to the atmosphere should be kept at a minimum. In open air composting such as the proposed technique for the IWMC, piles of compost can be covered by a 15cm thick layer of fresh compost in the curing stage. The microbes present in this layer of compost help reduce the odour of the compost pile underneath;
- keep the moisture levels of the compost pile below 60%, which promotes free airspace and results in aerobic respiration;

- avoid uncontrolled emissions of biogas from the compost pile by keeping the pile well aerated;
- follow all adaptive and mitigation measures proposed in **Table 8, Table 9** and **Table 18**
- keep the carbon – nitrogen ratio at an optimum level to decrease the amount of ammonia produced; and
- keep records of complaints about odours, and correlate with weather conditions and categories of organics used.

B. Influx of pests, littering inside IWMC and running out of storage capacity

Other potential health effects can arise from the introduction of vermin or pests, putrescible wastes attracting flies, puddles allowing the breeding of mosquitoes.
Biodegrading organics as well as compost heaps can attract birds such as crows which can lead to noise problems, and the littering of organic waste scraps within the site as well as away from the site. The unprocessed organic wastes as well as the compost heaps can be an attraction to pests and vermin. These pests can be environmental as well as health hazards. Airborne dust from a poorly managed site can have a visual impact as well as public health impacts including respiratory issues.

As some of the proposed sites are close to the coastal areas or are situated n open area with little protection, wind can blow the materials off the compost heaps as well as the other stockpiled waste types out of the IWMC, which can degrade the local amenity.

Littering inside the IWMC can cause amenity issues such as tracking of litter on the wheels of the waste transport vehicles leaving the IWMC. The litter can be deposited out on the roads of the island, which leads to issues such as visual impacts, odour, and possible contamination of groundwater from leachate.

There is a significant risk of IWMC running out of storage capacity specially since it is equipped to handle only 20-30% of organic waste. Unless the remaining waste is not transported out of the island, the IWMC will run out of storage within the second month, which could lead to burning and exposure to additional health risks.

Mitigation Measures (Control pests/litter and storage capacity)

Keeping stockpiles of raw organics low
Stockpiles of raw organics (waiting to be processed or transported) can cause impacts such as foul odour from the biodegrading organics, leachate reaching and contaminating groundwater, issue of vermin and pests, and visual impacts from the stockpiles.

As per the design of the IWMC, there are compartments for the storage of all major waste types other than organic wastes. A dedicated slab is provided for the composting of the organic waste materials. As per the calculations in **Section 2.9.11** it is seen that the composting slab has the capacity for composting 1 month's organic waste produced in the island. As the composting process may take between 4 – 6 months (Halliburton KBR Pty Ltd, 2002), the remaining months' organic wastes can accumulate unmanaged and without any means of storage.

The consultant proposes the following mitigation measures:

- Arrangement to transport the unmanaged waste to the nearest RSWMF with transportation frequency of at least once a week.
- provision of approximately 16. 660 L wheelie bins to store unmanaged organic wastes. 26 nos. are recommended in order to provide for storage of approximately 1-2 week's organic waste in the case of any unforeseen delays in the schedule transportation to the RSWMF. It is imperative for the waste storage and separation at the IWMC to be in line with the Regional Waste Management System. This ensures that both levels of waste management are coherent and complimentary and prevents delays due to inconsistent waste management. Management plans shall be adapted to incorporate these during the operational phase.
- Although the size of the plot is increased based on the island population, size of storage compartments within the IWMC are not increased accordingly. Hence to prevent storage issues related during the construction phase it is recommended to change the size of storage compartments based on waste generation estimates in **Section 2.3.2.**
- the intermediary waste management plan described in **Table 9** shall be referenced; and
- all measures proposed in **Table 8** shall be followed by the proponent and respective council;

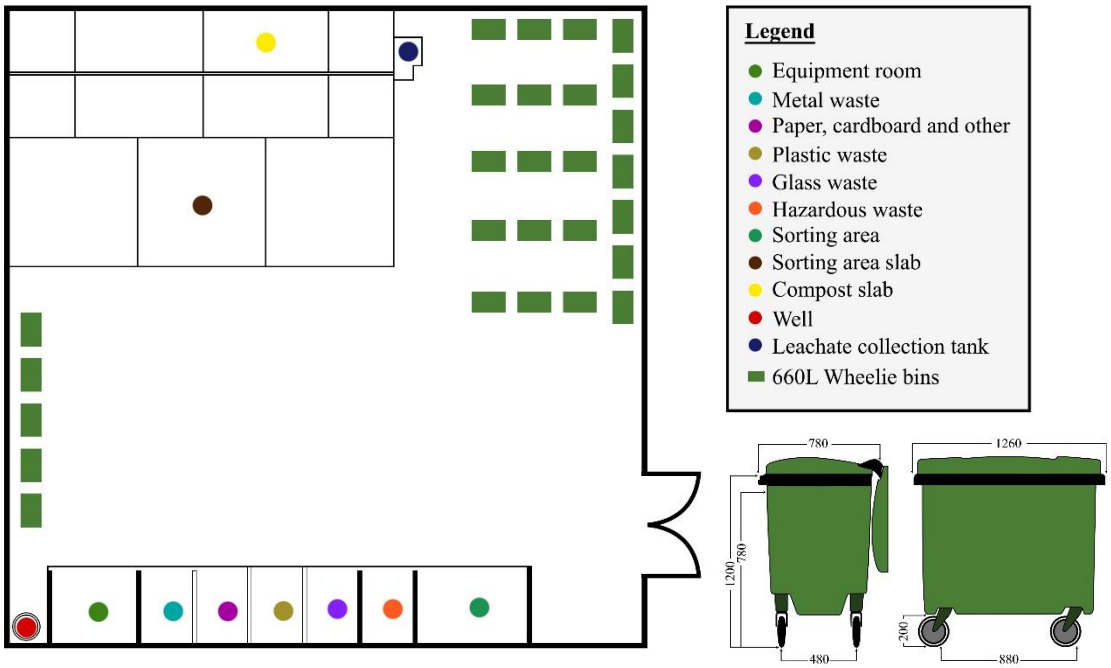


Figure 55: Proposed wheelie bin arrangement to provide for temporary storage of unmanaged organics

Keeping pest and vermin populations low

An area where waste (especially raw organics) is concentrated will naturally be an attraction to pests and vermin. In order to reduce the possible health hazards from such pests, their population shall be kept low with the following mitigation measures.

- Unprocessed waste (including those waiting to be processed and unmanaged waste awaiting transportation) shall not be kept uncovered. Wheelie bins shall be provided to store such organic wastes. The bins are lidded, which controls both the possibility of odours emanating and the means of access to pests. The bins are also watertight in order

to avoid the infiltration of water both into and out of the bin. The bins shall be designed to resist the action of organic acids and facilitate washing.;

- follow all adaptive and mitigation measures proposed in **Table 8, Table 9** and **Table 18** .
- see **Figure 53** for covering the compost heap;
- ensure that the IWMC surfaces are adequately drained to prevent the occurrence of ponds; and
- establish deterrence and eradication measures to control the outbreaks of pests or vermin.

Control of wind-blown litter

- Wind-blown litter control is incorporated in the design of the IWMC, with the provision of a 2.8m high PVC coated mesh fence. Even with this mitigation measure in place, there is a possibility of wind-blown littering occurring. Such litter shall be cleaned by the occupier of the IWMC. It is recommended to implement procedures to clean up the wind-blown litter after strong winds;
- clear all litter within the premises daily and any litter that has been blown out of the IWMC;
- implement rules within the IWMC to impose penalties on the workers such as vehicle drivers causing any littering within the island due to improper handling of the waste and improper transport practices; and
- littering of the roads during transportation of the waste can be mitigated through conformation to the Waste Management Regulations 2013/R-58 and secure the waste being transported in order to avoid littering.

C. Noise and vibration

The main sources of noise from the operation of waste management centres come from the material recovery machineries used and the operation of vehicles. According to the Health and Safety Executive UK, most material recovery facilities have noise levels exceeding 80 dBA and 85 dBA. Assuming a maximum noise level of 85 dBA, the noise decay properties in **9.3.5** can be used for this purpose too. The map shows that the noise reduces to a maximum level of 60 dBA near the closest residential areas. This calculation does not take into account the dampening effects of the surrounding vegetation. Therefore, the long term negative impacts of noise would be borne by the employees of the IWMC, and the effects of noise to the residential areas are minimal.

Mitigation Measures (Noise)

- Obtain noise data from supplier prior to purchase of machinery;
- enclose the noisy machinery with sound insulating enclosure;
- reduce duration of exposure by implementing job rotation; and
- provide employees with hearing protection as illustrated in **Figure 54**.

D. Accidents and fire

The group of people most likely to be impacted by the IWMC operations are the workers at the site. The various operations such as transportation, collection, handling, sorting and storing of the wastes, in addition to the composting and volume reduction operations all pose different risks to the worker onsite. The impacts discussed above and their proposed mitigation measures can provide a level of safety to the workers. Even with these mitigation measures put in place, a proper workplace safety guideline shall be formulated by the contractor for all workers onsite to follow.
In addition to the impacts discussed above, other work related safety issues include falling stock or during lifting activities, moving vehicles and falls from height. The accidents can result in injuries of varying nature.

Moreover, there is a possibility of fire hazards at the IWMC coming from biogas emissions and human activities. Fires can pose a risk to the workers through explosions and suffocation from smoke, in addition to damage to equipment.

Possible fire hazards are caused by the following (DCE NSW, 2004)

- Spontaneous combustion;
- Sparks from welding;
- Lightning strikes;
- Cigarettes; and
- Arson

The most common causes of fire during composting activities are reported to be cigarettes, welding activities and spontaneous combustion (Rynk, 2000) The cause of spontaneous combustion is when the decomposing organics self-heat to ignitable temperatures (DCE NSW, 2004). Although Rynk (2000) states that spontaneous combustion is more prevalent within large undisturbed piles containing raw organics, curing compost or finished compost rather than active composting. Therefore, it is important to limit the storage of organics (meant for transport to a RSWMF) on the IWMC

Mitigation Measures (Accidents/fires)

- A fire management plan shall be developed by the IWMC operator;
- adequate firefighting equipment shall be provided at the IWMC, and placed at locations easy to access;
- the IWMC operator shall be able to show that firefighting capacity of the IWMC is sufficient to suppress and minimize the incidence and impact of fires; and
- workers shall be trained to use the firefighting equipment and able to manage fire outbreaks.
- signs shall be kept on the premises stating that flammable liquids are not permitted on site.
- the contractor shall be required to develop occupational safety management plan, and safety guidelines shall be displayed in the work site at all times;
- provide clear instructions to the workers on:
    - The possible risks;
    - Measures in place to control risks and

  - Follow emergency procedures.
- provide proper training and instructions to all employees on how to operate any machinery;
- instruct employees on safe systems of work;
- conduct proper and regular maintenance of machinery;
- follow all adaptive and mitigation measures proposed in **Table 8, Table 21** and **Table 18**
- prior to maintenance, make sure the equipment is made safe and prevent access to dangerous parts. Make sure others are aware that maintenance is being carried out;
- machinery and vehicles should only be handled by employees with the proper credentials and training; and
- proper PPE should be provided at work. PPE should be used after all possible risks have been eliminated as much as possible and to manage any remaining risks.

Table 44: Operational phase hazards and suitable PPE

Hazard	Suitable PPE
Stock movement and falling items	• Safety shoes • Hard hats
Moving vehicles	• High-visibility jackets
Slips	• Safety shoes with slip resistant soles
Sharp edges	• Gloves • Forearm protection • Aprons • Hand pads • Thumb guards • Head protection
Noise	• Noise cancellation headphones

9.4.2.3.Climate

The main gaseous by product from the composting is CO_2. In anaerobic conditions, methane is released into the atmosphere, which has a higher greenhouse warming potential compared to CO_2. In open systems, methane is not released in large quantities as long as the aerobic environment is maintained. (US EPA, N.a). If the composting is well managed and kept in aerobic conditions, the methane production is reduced, which contributes to the reduction in global warming, as such waste would otherwise produce methane in a normal oxygen poor landfill or dump. It has been debated that, the CO_2 produced from the degradation of the compost pile would have been produced anyway, in the longer term if kept in a landfill or dumped. Moreover, GHG emissions from burning of fossil fuels to run the waste management equipment will also have minor impacts.

Mitigation Measures

- Ensure that compost pile is managed properly as described;
- regular servicing of vehicles used to transport waste;
- ensuring the vehicle has roadworthiness certification from the Transport Authority; and

- restricting the use of the vehicle only for the stated time in the Waste Management Plan.

9.4.3 O3 – Waste generation (Operational)

Waste generated during the operational phase of the IWMC will be relatively low. These will include waste oil/batteries from waste management equipment. Since eating and cooking inside the IWMC will be prohibited, no mixed municipal waste will be generated during the operational phase of the project. Hence overall multi criteria impact for this activity was -10, which meant that the activity would have a minor negative impact on environmental receptors.

Mitigation Measures:

- See mitigation measures described in **section 9.3.7** and
- prohibit eating/cooking in the IWMC.

9.4.4 O4 – Resource Consumption (Water/Electricity)

Water will mainly be required for washing equipment, work ware, hands etc and to water the compost pile. Water required for moistening compost piles will be relatively small. As most of the moisture required for the compost pile will be sourced from the compost tea collected the leachate tank the volume of water required will be significantly less. It is estimated that approximately 200 -300 l/day of ground water will be required during the operational phase of the project. However, during the dry season more water may be required to supress dust from the IWMC compound. Hence during the northeast monsoon water requirement may be as high as approximately 1,000l/day. The water required during operational phase of the IWMC will be sourced from the ground water well. Since the volume of water required is relatively low, it is not expected to have a significant impact on groundwater.

A compactor and shredder/crusher can be used to reduce the volume of waste streams. The waste weight will remain the same so there will be no savings from the total amount of waste produced. However, savings will occur because waste volume will be reduced by approximately 80% which will decrease the number of times the storage area is required to be empties, therefore resulting in lower transportation costs. Compactors and crushers are run very infrequently when enough waste has been separated and stored and are relatively efficient when run, meaning the amount of energy consumed by the compactor will be low. The running wattage mid-range compactors and shredders may range from 700 – 2000 watts, which means approximately 30-60 kW will be required to power all equipment simultaneously. However, this will not be the case since many of these equipment doesn't need to be switched on daily and at the same time. There may be periods where the only electricity required will be for switching on the lights at the IWMC. Therefore. Electricity consumption of the IWMC during the operational phase will be relatively low. The overall multi criteria impact score for this activity was -23, which meant that the activity would have a minor negative impact on environmental receptors.
However, the following mitigation measures shall be implemented to reduce water and electricity consumption.

Mitigation Measures

- Ensure that the compost pile is shaded during dry periods to avoid rapid loss of moisture content;

- use a spray hose so that the surface area of water droplets is increased which would reduce the amount of water consumed;
- ensure that all equipment is serviced and kept clean daily, to reduce the amount of water required for cleaning;
- prepare a plan to switch on the compactors and shredders depending on the incoming waste stream to conserve electricity and
- make sure all equipment are properly serviced and maintained.

10. ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

10.1 AIMS AND OBJECTIVES

In order to demonstrate the effectiveness of the proposed mitigation measures and to ensure unforeseen impacts arising out of project activities are controlled in a timely manner a robust environmental monitoring and management program is essential. Additionally, the monitoring program is also important to bring desired changes to the proposed mitigation measures as and when necessary and to enhance benefits of the Project. This chapter presents in detail the management and monitoring program put in place under the proposed project to evaluate the actual impacts and the effectiveness of the proposed mitigation measures and to ensure that the project is implemented responsibly ensuring that the project activities do not result in unacceptable changes to the environment. This plan primarily focuses on:

a) Monitoring and managing impacts of the project on the terrestrial environment;
    i. This includes ensuring that the least number of trees are disturbed during the construction;
    ii. labelling trees marked for removal and keeping a log of all trees removed, relocated and sawed for timber;
    iii. ensuring that all administrative procedures are in place to smoothly sell and hand over various types of wood, seeds, plants and trees which will be transported out of the island;
    iv. ensuring the survival of all trees relocated and
    v. ensuring proper management and reduction of waste by closely monitoring and recording work plan and method.
b) Ensuring that the IWMC is not converted into a dump site and prevent the status of island waste pollution returning back t status quo;
c) collecting information that can be used for improving project performance and environment;
d) collecting information that can be used for evaluating the effectiveness of implemented mitigation measures so it can provide information for better decision making and future improvement of environmental quality for similar projects;
e) ensuring that the impacts are eliminated in a timely manner; and
f) providing evidence of compliance assurance to laws and regulations and requirements of enforcement agencies.

The detailed impact monitoring plan for the proposed project is given in **Table 47**. Indicative cost of the monitoring and environmental management is also given in the same Table. The Proponent will ensure that the monitoring program is carried out in a timely manner. A commitment letter confirming to undertake the mitigation measures and monitoring is given in **Annex 7** of the report**.**

Activities and parameters proposed to be monitored during the construction and operational phase, of the project include:

- All changes to the terrestrial environment associated with removal and relocation of trees;
- Exact record of species, count and type of tree removed during construction phase;

- Detail log of the fate of uprooted trees
- Health of relocated and replanted trees and
- Quality of the groundwater.

In addition, the project will also record all significant matters such as:

- Outbreak of diseases and invasive organisms;
- Accidents, injuries and occupational illness; and
- Incidents and emergencies such as spills and other potentially dangerous incidents.

The long term management plan for the IWMC is highlighted in **Table 46**. An adaptive management plan is proposed where stakeholders and their responsibilities are clearly defined. The aim of the management plan is to meet the goals of Saafu *Raajje* waste management policy (See **Section 3.4.1** for details).

10.2 ENVIRONMENTAL MANAGEMENT STRUCTURE

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

10.2.1 The Proponent, Ministry of Environment and Energy

MEE will be responsible for the execution of all the project activities within the required timeframe. MEE is also responsible of policy level decisions and provision of support regarding the waste management works undergone in the island as well as the regional level.

10.2.2 The Contractor

Contractors to construct the IWMC and clear land will be procured by MEE and Island Council respectively. The contractor will undertake the project in accordance with the EMP proposed in the EIA and will report to the proponent and environment consultant about any unexpected environmental impact or health and hazard issues. During the construction stages, the contractor will follow all mitigation and management measures proposed in the report, mainly waste management, pollution control, accident prevention and work methodology proposed.

10.2.3 Environmental Consultant

The environmental consultant would prepare the EMP based on field visits and surveys and based on past project experiences in similar settings. If there are any modifications to be made to the EMP during any stages of the project, the consultant would do the modification and would conduct the environmental monitoring according to the monitoring framework. The environmental consultants are also responsible for auditing the management/monitoring plan to identify gaps, limitation in management and propose remedial measures to ensure the project is sustainable.

10.2.4 Environmental Protection Agency

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

10.2.5 Island Council

The Island Council will be responsible for the formulation and implementation of the Waste Management Plan (WMP) for a period of 5 years.

10.2.6 Operations Contractor

The operations contractor will be responsible in running the operations in accordance with the guidelines set by this EMP and the WMP. The responsibilities of the operations contractor include producing the IWMC operations reports and submitting the reports to the Island Council at the proposed regularities.

10.3 MANAGEMENT PLAN OF THE IWMC

A practical plan taking into consideration available resources is proposed to meet the aims and objectives of the EMP stated in **Section 10.1** specifically point b. One of the major risks to the investment and operation of the IWMC and island level waste management is the center itself which can be converted back into a dumpsite due to mismanagement as often seen in island level waste management endeavors all across the Maldives. This is partly due to the fact that a lot of linkages connecting island level waste management with regional level waste management are absent or unknown until it is much too late. As described in **Section 2.9.11** and **9.4.2**, one of the main risks facing the current project is rapid accumulation of organic waste at the IWMC. Hence the proposed IWMC management plan aims to control and mitigate such risks without severe negative impacts.**Table 46** shows the proposed environmental management plan for the IWMC.

Table 45:Details of environmental management plan proposed for the IWMC

Activity	Phase	Measures	Time frame	Responsible person
Training of workers and contractors	Pre-construction	Contractor and project workers are provided with detailed information on the project, impact mitigation measures, compliance with environmental permits and the EMP. Workers are also provided with the information on sensitive areas of the island and other environmental issues. Training of staff involved in the monitoring of the construction phase	Prior to construction works	Proponent Environmental Consultant
Documenting non-conformances and corrective actions	Construction Operation	Non-conformances to the environmental regulations, permits and the EMP is monitored and documented. Corrective measures are taken and follow ups are done. IWMC operations reports and public grievances are compiled by the island council and reported to the proponent within the prescribed frequencies as stated in **Table 46.**	Construction and Operation phase	Construction phase: Proponent & Environmental Consultant Operational phase: Island Council and Proponent
Supervision of activities	Construction Operation	The project activities are to be supervised by the proponent throughout the construction and operational phase to ensure the activities are carried out accordingly and the impacts are minimised. The proponent shall review the IWMC operations reports from the island councils, and provide the required support, bring about any necessary policy updates	Construction and Operation phase	Proponent

Table 46:Details of the reporting mechanism proposed for the IWMC

IWMC (Contractor)

Reporting	Details	Frequency
General report	Logs of the incoming waste	Monthly
	Classified by type and weight	
	Vehicle maintenance details	
	Machinery maintenance details	
	Machinery fuel usage details	
	Workplace injuries	
IWMC capacity	Details of the utilized and remaining capacity of IWMC	Every two months
	Leachate tank maintenance and capacity	
IWMC inventory status report	Details of the status of IWMC equipment	Bi-Annually
	Details of the status of emergency kits and firefighting equipment	
Compost output report	Details of amount and composition of input waste materials	Bi-Annually
	Details of compost output in weight	
Noise and odour complaints	Log of noise and odour complaints	Every two months
	Complaints to be provided along with weather conditions and incoming waste details coinciding with the dates of complaints	

Island Council (Municipal Unit)

Components	Details	Frequency
Public grievances	Log of public grievances regarding	Bi-Annually
	Fee structure	
	Waste Management operations	
	Noise and odor complaints	
IWMC monitoring	Monitoring report of the IWMC operations	Bi-Annually
Compilation of IWMC reports from operations contractor		Bi-Annually
Income report	Summary of IWMC operations income	Bi-Annually

MEE

Components	Frequency
Review of IWMC Reports from Councils	Bi-Annually
Update National Waste Database	
Policy updates from findings	
Provision of support to IWMCs	
Overview of the waste management system on island level and regional level	

10.4 MONITORING PLAN OF THE IWMC

In order to monitor the impacts of the three main activities of the proposed project which include:

1. Land clearance;
2. IWMC construction and
3. Operation of IWMC the monitoring plan proposed in **Table 47** shall be implemented.

The plan is prepared to ensure all mitigation measures proposed in **Section 9** of the report is implemented to ensure that the project meet the monitoring and management goals. The monitoring plan is based on identification of stakeholders and their responsibilities during each major component of the project. To ensure the monitoring plan and management plan is implemented successfully a third-party review and audit has been proposed. This is because in projects where there are numerous components there will be gaps and challenges which may not be addressed during the implementation which may result in exacerbation of impacts and failure of the proposed project.

Table 47: Environmental Monitoring and Management Plan

Objective	Activity	Parameters to be monitored	Location	Method	Frequency	Responsible Agency	Verifiable indicator	Cost (MVR)	Phase[4]
Minimize vegetation removal	Tree survey & set out survey	Vegetation falling within the footprint of road and plot. Set out survey shall be carried out as described in **Section 2.8.3**	At project site (land)	Vegetation and set out survey.	Once	Contractor	Survey report. The report shall contain the exact number of trees identified to be relocated and removed as timber should be identified. The survey report shall provide a justification for removal of a tree as timber.	45,000 per island	C

[4] C = construction phase, O = Operational phase

Ensuring that the project activities does not affect the quality of the groundwater	Establish baseline just before the construction works begin and continue monitoring as stated. Establish a groundwater monitoring stations and geo-reference it. Preferably close to the IWMC.	Groundwater quality for electrical. conductivity, salinity, temperature, DO, BOD_5, Nitrates, phosphates, Turbidity, pH, hydrocarbon, total coliform and faecal coliform	**Project site**	Potable water quality testing equipment and/ or by sending samples to the lab	Baseline data before work begins. During Operational Phase. Bi annually	Proponent and environmental consultant	Water quality report	12,000 per monitoring trip	O
Ensure waste generated at work site is audited and managed responsibly	Management of waste generated as described in **Section 2.8.12** of the report	Estimation of waste generated at project site and recording these data routinely. This includes quantifying and recording the amount of yard waste, hazardous waste and general waste stacked and stored for transportation.	**Work site & IWMC**	Keep records in a log book, or data sheet	Every two months (See **Table 46**)	Operational Contractor Construction al Contractor	Record sheets, photographs and quantity of waste processed at Thilafushi/ (nearest waste management center) and IWMC. If there are no significant discrepancies between the quantity of waste generated on site and processed at regional waste management facility, it can be safely assumed that impacts of waste on the environment was reduced.	Included in the project costs	C&O

Monitoring and managing trees removed for timber and relocation.	Ensure that trees are removed as proposed in **Section 2.8.4** Ensure that waste and pollution is controlled as proposed in the EIA. Ensure that if a land clearance contractor is procured, it is done responsibly. Keep record of trees or other parts of trees sold for re-plantation or as timber.	Exact record of trees and associated parts. Successful bidder's information and records. Method of transaction, end use and mode of transportation. Proposed waste management method. Equipment to be used for removal.	**Approved IWMC plot and access road**	Keep records in a log book, data sheet or application forms	During land clearance.	Proponent and contractor (successful bidder)	Land clearance report provided by the land clearance contractor. Verification against contractors set out survey report or survey data presented in the EIA. Both reports should be complimentary. Bids submitted by interested parties to relocate trees. Monitoring sheet/record kept by island council representative. (See **section 10.3**)	-	C

Ensuring survival of relocated and re-planted trees.	Since majority of trees intersecting with the road network are proposed to be relocated within the island it is important to ensure the survival of these trees after investing heavily in its relocation. Hence major deficiencies of coconut palms and other type	The parameters for monitoring include: 1. Nitrogen Deficiency 2. Phosphorous Deficiency 3. Boron Deficiency 4. Manganese Deficiency 5. Water Deficiency 6. Pests and Diseases	**Re-planted and relocated islands**	**Symptoms:** N deficiency is typically caused by insufficient N in the soil. Nitrogen deficiency begins as a uniform light green discoloration / yellowing (uniform chlorosis) of the oldest leaves. Yellowing starts from tip to base of the lower leaves and will proceed up. As the deficiency progresses, younger leaves will also become discoloured. Older leaves are golden yellow colour. Growth virtually stops when N deficiency is severe and become shedding of leaves. **Diagnostic Techniques**: Nitrogen deficiency is easily diagnosed by symptoms alone	Monitoring shall be undertaken for a period of 4 years, annually.	Environmental consultant Incase trees are bought and relocated the buyer shall monitor survival of trees. If the council relocates the trees within the island the council shall ensure survival of trees	Monitoring reports which shall include diagnosis, remedial measures and observations after remediation.	MVR 280,000.00	O

	of trees shall be monitored. Based on the findings the frequency of watering cycles or nutrient enrichment shall be adapted or enforced.			**Symptoms of Phosphorous Deficiency**: occurs in acid and alkaline soils. • Purple coloration in leaves (In severe cases leaves may turn yellow before drying prematurely) • Sluggish growth • Leaves stay upright • Premature leaf shedding The growth, leaf size and leaf number reduced. The root growth is restricted if phosphorus deficiency is recorded. There are no clear visual symptoms of phosphorus deficiency other than stunting and decrease in yield.					

				Symptoms of Boron (B) Deficiency: Boron deficiency is caused by insufficient B in the soil. It may be caused by soil drying and high soil pH, while temporary B deficiency is caused by heavy leaching. • Symptoms always occur on newly emerging leaves, and remain visible on these leaves as they mature and are replaced by younger leaves. • One of the earliest symptoms of B deficiency on coconut palm is leaf wrinkling and manifested as sharply bent leaflet tips, commonly called “hook leaf”. These sharp leaflet hooks are quire rigid and cannot be straightened out without tearing the leaflets. Leaves have a serrated zigzag appearance. • One of the most common symptoms of B deficiency is the failure of newly emerging spear leaves to open normally. In a chronic stage, multiple unopened spear leaves may be visible at the apex of the canopy. • Boron deficiency also occurs in inflorescence and nuts. The					

				inflorescence and nuts are become necrotic. **Diagnostic Techniques:** Boron deficiency symptoms are quite distinctive and are usually sufficient for diagnosis by themselves. Manganese deficiency produces symptoms similar to those of B deficiency, but no other common deficiency produces symptoms that could be confused with those of B deficiency. Because B deficiency is so transient in nature, the element is immobile within the palm (cannot move from one leaf to another), and deficiencies affect only leaf primordial developing within the bud area, leaf analysis is not particularly useful.					

				Manganese (Mn) **Deficiency**: Manganese deficiency is very common on alkaline soils, but can occur in containers if drainage is poor or soils temperatures are cool. **Symptoms:** The newest leaves of Mn deficient palms emerge chlorotic with longitudinal necrotic streaks. As the deficiency progresses, newly emerging leaflets appear necrotic and withered on all but basal portions of the leaflets. This withering results in a curling of the leaflets about the rachis giving the leaf a frizzled appearance (‘frizzle top’). On new leaves of Mn-deficient palm, necrotic leaflet tips fall off and the leaf has a signed appearance. In severely Mn-deficient palms, growth stops and newly emerging leaves consist solely of necrotic petiole stubs. **Diagnostic Techniques:** Visual symptoms may be sufficient to diagnose this disorder,					
				Water Deficiency: Water stress usually appears on palms as reduced growth and a browning of leaflet tips that spreads as the condition worsens. These symptoms appear on oldest leaves first, though young leaves also eventually wither and die, and the meristem or bud may also die. Some species of palm demonstrate a lack of water with wilting leaflets or leaflets folding along the midrib. In older, established palms, the trunk may shrivel or collapse.					

				Pests: If the mite infestation is observed in few palms in an area for the first time, cut and burn all bunches in the infested palms. Apply palm/vegetable oil and Sulphur mixture **Diagnostic Method:** Observations **Stem Bleeding Disease:** Occurs when a reddish-brown liquid oozes from cracks and holes in the stem. The disease is caused by Chalara paradoxa, a mainly soil borne plant-pathogenic fungus that infects wounds and openings in the coconut stem. **Diagnostic Method:** Observations. Ensure that wounds are avoided during removal and relocation of trees by following the steps described in **Section 2.8.3.**					

Monitoring Health and safety of workers and the public	Accidents during construction of IWMC, land clearance, operation of IWMC and maintenance of IWMC. Fire hazards and natural disaster events. Noise and smell complaints during operation and construction phase. Compost condition, output and quality	Type of accident/complaint Cause of accident/complaint Date and time. Physical inspection of compost. Determination of input feed and output product. Rate of compost production	IWMC	Keep records in a log book, or data sheet	Biannually	Operational phase contractor Construction (phase) land clearance contractor Island council MEE See **Table 46** for responsibility of each stakeholder.	Measures to adapt and prevent accident and risks. Health assessment reports published or available from the local health center. Policy changes and upgrades. Compost quantity and quality. Income from selling compost.	Included in project cost.	C&O

10.5 RESOURCE REQUIREMENT FOR MONITORING

For the monitoring program to be successful, it is important that adequate financial and human resources are available and strong coordination among the key stakeholders is maintained.
The primary function of implementing the mitigation and monitoring plan will lie with the proponent and environmental consultant. Since the project at developmental and operational stage will be engaged by the proponent it will be the responsibility of the proponent to take care of the environmental safeguards at all stages of the project during implementation and at operational phase. The proponent should prepare an Environmental Action Plan, which states all measures for mitigation and enhancement and monitoring as described here in the EIA with their responsible organisation and person, planning, methodology, timing and other relevant aspects.
An independent registered environmental consultant shall be hired and contacted to undertake and audit the monitoring program prescribed in this report. Following each monitoring visit the consultant will prepare a report with clear recommendations and corrective measure if necessary. The report will have to be submitted to EPA for their review and actions.

10.6 MONITORING SCHEDULE

Table 47 highlights the monitoring plan in which responsibilities of main stakeholders has been assigned. In order to track and compile the findings of these measures an independent environmental consultant shall be tasked to audit the projects EMP. This is to

- identify gaps in monitoring and mitigating impacts arising from the project;
- determine the challenges and resource inadequacies to implement the proposed EMP; and
- determine the current environmental condition and propose modification/upgrades to the initial EMP.

Monitoring frequency for various individual components given **Table 47** shall be followed by all responsible parties. **Table 48** gives indicative timeline for the monitoring visits by third party consultant.

Table 48: Monitoring visit schedule

Visit	Indicative timeline	Indicative parameters to monitor	Reporting	Cost (MVR)/per report/island.
Visit 1	During land clearance	Setting out survey, work method, waste management monitoring and monitor health and safety of workers. Review reports by contractors and proponent.	Submit monitoring summary report 1 to Proponent (Island Council) within 2 weeks	10,000.00
Visit 2	During construction of IWMC	Monitor work method, waste management, monitor health and safety of workers. Monitor impacts to nearby vegetation and ensure vegetation removal is as per set out survey. Review reports prepared by contractors.	Submit monitoring summary report 2 to Proponent (MEE) within 2 weeks	10,000.00
Visit 3 (Optional)	One year after relocation/replantation of trees. Annually for four years.	Monitor relocated and replanted trees according to **Table 47.**	Submit summary report 3 (1-4.) within 2 weeks[5].	10,000.00
Visit 4	Two months into operation of the IWMC. Biannually for four years	Monitor water quality and noise. Monitor IWMC. This includes review of reports dated in **Table 46** or determine condition of IWMC. Monitor compost condition as described in **Table 46** and **Table 47.**	Submit summary report 4 (1-4.) Proponent within 2 weeks	25,000.00

As indicated, during the course of the Project implementation summary reports following each trip is expected to be submitted by the Project's environmental consultant. These environmental audits will provide a basis for assessing at least the shorter-term efficacy of the environmental measures and thereby provide lessons to be learned for future monitoring sessions and other projects with

[5] This report is optional as ownership of trees will change once it has been bought and relocated. However, ensuring survival of relocated trees will prevent loss of biomass and provide beneficial eco system services.

similar impacts. The consultant will prepare and submit the reports to Proponent and Proponent in turn will submit it to MoT. Based on the findings of the report, the management approach may be adapted and its efficacy will be determined in the consecutive monitoring trip.
Long-term monitoring has been proposed due to the complex behaviour of trees after relocation and since coconut palm trees shows signs of withering after a long period of time. Therefore, continuous monitoring of these trees would be essential for their long term well-being.

10.7 MONITORING REPORT

Reporting will be carried out by the environmental consultant assigned for the purpose by the proponent.
The report will include among other information;

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

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

10.7.1 Monitoring Report Format

The environmental monitoring report outlined in **Table 49** below will be used in reporting environmental monitoring to be carried out as given in the monitoring plan.

Table 49: Monitoring report format

Project Title:
Name of the Island:
Monitoring Date:
Period Covered:
Prepared by:
Contributions:

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

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

C. Environmental Monitoring

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

b. Management of trees removed
These include monitoring trees removed, its fate and validation of number of trees removed.

c. Survival of relocated plants
These include monitoring for pests and diseases as described.

d. Waste generation and management at IWMC
These include monitoring for pests and diseases as described.

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

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

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

G. Conclusions

Reference

Appendix

11. CONCLUSION AND RECCOMENDATION

The assessment has been based on as much information as possible that could be obtained within the study time constraints on both existing environment and the features and possible effects of the planned development.

The study has identified that the proposed construction of IWMC and access road is a pre-requisite for the development of the integrated waste management plan. It also serves as a basis for the smooth implementation of Island Waste Management Plan (IWMP) and Regional Waste Management Plan (RWMP) during the operational phase. The proposed area to construct the IWMC meets the buffer guidelines set forth by the EPA. There is a major road which can be used to access the project area. However, a minor road will have to be cleared in order to access the IWMC. There are no significantly large trees or coconut palms (privately or state owned) at the site which may be required for removal. However, since the proposed site is situated in a vegetated area, development of the IWMC and access road through land clearance will enviably result in negative environmental impacts.

However, the study found no evidence that the project requires or involves:

- loss of unique habitat or wilderness areas;
- loss of protected area;
- loss of protected flora or fauna;
- removing or destroying cultural properties;
- resettling of local communities;
- contravening with national laws, regulations, policies or multinational environmental agreements to which the Maldives is a Party to or customs or aspirations concerning environment, economy, employment, cultural traditions or life styles.

The study has also identified the following unavoidable terrestrial impacts due to proposed development works:

- Almost an irreversible change to the overall terrestrial environment as a result of the placement of the access road and IWMC footprint;
- unavoidable loss of between 0.09% of the island's vegetation (with no mitigation); and
- generation of approximately 5-10 tonnes of yard waste as a result of site clearing (with no mitigation).

The study also found that during the operational phase of the project, there is a high potential for cumulative negative impacts. The study also identified that lack of proper waste management planning and lack of an efficient mechanism to transport organic waste to the RSWMC could lead to progressive failure of the IWMC during operational phase.

The study also found that through the implementation of the proposed practical and cost effective mitigation measures almost all significant impacts can be brought to an acceptable level.
On the basis that this EIA will be thoroughly followed and all mitigation measures will be implemented by the proponent, it is concluded that the benefits of the planned development works will substantially outweigh its imposition on the environment.

RECCOMENDATIONS

- The EIA report shall be taken as a whole in its entirety and be made part of the legal contract with the contractors;
- Follow procurement procedures described in the report;
- Follow recommendations made in the EIA with regard to project alternatives;
- Implement the work method and mitigation plan as prescribed in the report to the fullest;
- Implement monitoring and environment supervision during all phases of the project;
- Allocate adequate resources for the environmental monitoring of the project;
- Ensure that the necessary clauses regarding the workers safety are fully implemented;
- The enforcement agency to make an effort to make at least one visit to the project site during the construction phase to ensure environmental compliance of the project activities;
- Proponent appoints a focal point to coordinate activities relating to monitoring and reporting;

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13. ANNEX 1: DECLARATION (PROPONENT)

14. ANNEX 2: TERMS OF REFERENCE

15. ANNEX 3: APPROVED CONCEPT PLAN

16. ANNEX 4: LAND USE PLAN

Ha.Uligam does not have an approved LUP.

17. ANNEX 5: STAKEHOLDER ATTENDANCE

18. ANNEX 6: A3 SITE LOCATION

19. ANNEX 7: COMMITMENT LETTER (PROPONENT)

20. ANNEX 8: LETTER BY ATOLL COUNCIL

21. ANNEX 9: DECLARATION OF AUTHORS

22. ANNEX 10: CV'S

23. ANNEX 11: WASTE MANAGEMENT PLAN HA.ULIGAM

24. ANNEX 12: IWMC SITE SELECTION & ENVIRONMENTAL SCREENING DS

Ministry of Environment and Energy
Male', Republic of Maldives.

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މާލެ، ދިވެހިރާއްޖެ.

Date: 02nd August 2017

No: 438-WMPC/203/2017/94

Mr Ibrahim Naeem
Director General
Environmental Protection Agency
Handhuvaree Higun, Green Building,
Male', Maldives

Dear Sir,

<u>Sub: Declaration of the Proponent</u>

As the proponent of the proposed project, we inform you that we have read and reviewed the EIA report, and to the best of our knowledge all non-technical information provided in the report are accurate and complete

Yours Sincerely,

Ahmed Murthaza
Director General

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No: 203-EIARES/438/2017/100

Terms of Reference for Environmental Impact Assessment for the Development of Island Waste Management Centre In Ha. Uligamu.

The following is the Terms of Reference (ToR) for undertaking the EIA for the development of island waste management centre in Haa Alif Uligamu, The proponent of the project is Ministry of Environment and energy.

***scoping meeting for the project (development of waste management centers in Ha. Maarandhoo, Sh. Feydhoo, Sh. Kanditheem, Ha. Uligamu & Sh. Lhaimagu) was held on 30th April 2017. This TOR for development of waste management center in Ha. Uligamu is issued separately due to a request by the proponent.**

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

1. **Introduction and rationale** – Describe the purpose of the project and, if applicable, the background information of the project/activity and the tasks already completed. Objectives of the development activities should be specific and if possible quantified. Define the arrangements required for the environmental assessment including how work carried out under this contract is link other activities that are carried out or that is being carried out within the project boundary. Identify the donors and the institutions arrangements relevant to this project. List down the methodologies to be used for this study.

2. **Study area** – Submit a minimum A3 size scaled plan with indications of all the proposed infrastructures. Specify the agreed boundaries of the study area for the environmental impact assessment highlighting the proposed development location and size. The study area should include adjacent or remote areas, such as relevant developments and nearby environmentally sensitive sites (e.g. coral reef, sea grass, mangroves, marine protected areas, special birds site, sensitive species nursery and feeding grounds). Relevant developments in the areas must also be addressed including residential areas, all economic ventures and cultural sites.

3. **Scope of work** – Identify and number tasks of the project including preparation, construction and decommissioning phases.

Task 1. Description of the proposed project – Provide a full description and justification of the relevant part of the works, using maps at appropriate scales where necessary. Information on the following activities should be provided where appropriate:

- Summary of proposed new development and justification;

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- Design parameters and project inputs and outputs;
- Justification for the selection of the location of waste management centers and any access roads ;
- Area requiring vegetation removal, number and types of trees to be removed,
- A full description of the relevant parts and nature of the works, an indicative construction timetable, including expected commissioning and start-up dates and hours of operation, and a description of major work programs for the construction phase, including an outline of construction methodologies. transport and storage. temporary site location and construction site management.
- Method and equipment to be used and impact control measures while construction;
- Duration of the construction activity and decommissioning;
- Construction method, equipment and technologies;
- Temporary labor arrangements;
- Emergency plan during construction activities;
- Project risks;
- Measures to protect environmental values during construction and decommissioning phase;
- Project management description (including project schedule, labour, housing, machinery management and operation, health and safety measures);

Task 2. Descriptions of the environment – Assemble, evaluate and present the environmental baseline study/data regarding the study area and timing of the study (e.g. monsoon season). Identify baseline data gaps and identify studies and the level of detail to be carried out by consultant. Consideration of likely monitoring requirements should be borne in mind during survey planning, so that data collected is suitable for use as a baseline. As such all baseline data must be presented in such a way that they will be usefully applied to future monitoring. The report should outline detailed methodology of data collection utilized.

The baseline data will be collected before construction and from at least two benchmarks. All sampling/survey locations shall be geo referenced including but not limited to water sampling points. reef transects/photo quadrats, vegetation transects, soil profiles, and manta tows sites for monitoring data comparison. Information may be divided into the categories shown below:

1) Physical environment:

- Describe the general geomorphology, meteorology and oceanographic conditions (rainfall, wind, waves and tides) in the area;
- Map the existing shoreline and vegetation line closest to the project area.
- Baseline groundwater quality at the project area shall be determined. The groundwater shall be tested for the following parameters (Turbidity, DO, Salinity, Conductivity, pH, TDS)

- Describe the physical properties of the soil including conductivity and grain distribution; and
- Describe the baseline noise levels and contributing sources to ambient noise levels at the nearest and adjacent inhabited households. Sensitive noise receptors should be identified.

2) Biological environment:

- Description of the terrestrial environment of the footprint area proposed to be developed. Identification of the type and amount of vegetation that fall into the direct footprint area including waste management area and any required access roads.
- Details of protected trees within the project boundary
- Identify protected and sensitive areas which might be affected by the project.

3) Socio-cultural environment:

- Describe the socio-cultural aspects of the project site as well as the project beneficiary region.
- Describe the visual amenity from the nearest and adjacent inhabited island.
- Describe any structures on the project site which may have cultural or religious significance.
- Socioeconomic environment of the island

4) Hazard vulnerability:

- Vulnerability of area to flooding and storm surge.
- Identify the existing flooding areas of the island

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

Task 3. Legislative and regulatory considerations – Identify the pertinent legislation, regulations and standards, and environmental policies that are relevant and applicable to the proposed project, and identify the appropriate authority jurisdictions that will specifically apply to the project.

- Location approval for the waste management centres and access roads
- Demonstration that the waste management centres adhere to the Waste Management Regulations

Task 4. Potential impacts (environmental and socio-cultural) of proposed project, incl. all stages – The EIA report should identify all the impacts, direct and indirect, during and after construction,

and evaluate the magnitude and significance of each. Particular attention shall be given to impacts associated with the following:

Site preparation, construction and operation:

- Site clearing impacts including the area to be cleared (m^2), how waste from land clearing would be managed, measures that would be taken to comply with the ***Regulation on Cutting Down, Uprooting, Digging Out and Export of Trees and Palms from One Island to Another*** including locations for relocating trees, source of obtaining new plants to comply with planting two or more trees for each mature tree cut down, compensation plan if any trees owned by the local community needs to be cut down;
- Impacts of the project during construction and operation of the waste management centre on nearby inhabited island or sensitive areas;
- Impacts associated with composting;
- Impacts of vegetation removal;
- Impacts of storing waste;
- Impacts on workers' health and safety during operational phase;
- Impacts associated with leachate treatment;
- Impacts of smell and noise on the local populated area;
- Impacts associated with mechanical sorting;
- Impacts associated with waste transportation;
- Impacts associated with chemical and hazardous waste storage and
- Construction impacts including noise, fugitive dust, solid waste disposal, traffic and employment.

Socio-cultural:

- Describe the impacts of the proposed development on the natural features and landscapes of the project site which may have cultural significance and which may impact on nearest and adjacent islands;
- Impact on coastal fishing and tourism related activities and navigation;
- Impacts on employment, income and economy diversification on the impact zone;
- Level of protection against hazards like sea-level rise storm surges etc;
- Impacts of workers on the local population;
- Impacts on cultural sites and heritage;
- Impacts of increased demands on natural resources and services especially water supply, land availability, waste management and energy supply;
- Monitoring of socio-economic impacts.

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.

Task 5. Alternatives to proposed project – Describe alternatives including the *"no action option"* should be presented. Determine the best practical environmental options. Alternatives examined for the proposed project that would achieve the same objective including the "no action alternative".

The report should highlight how the location was determined. Alternatives need to consider design and locations to minimize impacts on the bay area.

All alternatives must be compared according to international standards and commonly accepted standards as much as possible. The comparison should yield the preferred alternative for implementation. Mitigation options should be specified for each component of the proposed project.

Task 6. Mitigation and management of negative impacts – Identify possible measures to prevent or reduce significant negative impacts to acceptable levels. These will include both environmental and socio-economic mitigation measures with particular attention paid to pollution control and future changes to terrestrial and coastal processes. Mitigation measures to avoid or compensate habitat destruction caused by the project activities will have to be considered. Measures for both construction and decommissioning phase shall be identified. Estimated cost of implementing mitigation measure shall be included. The confirmation of commitment of the developer to implement the proposed mitigation measures shall also be included. In cases where impacts are unavoidable arrangements to compensate for the environmental effect shall be given.

Task 7. Development of monitoring plan (see appendix)– Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan for coastal modification, beach morphology, sediment movement around the island, waste management, etc. Ecological monitoring will be submitted to the EPA to evaluate the damages during construction, after project completion and every three months thereafter, up to one year and then on a yearly basis for five years after. The baseline study described in task 2 of section 2 of this document is required for data comparison. Detail of the monitoring program including the physical and biological parameters for monitoring, cost commitment from responsible person to conduct monitoring in the form of a commitment letter, detailed reporting scheduling, costs and methods of undertaking the monitoring program must be provided.

Task 8. Stakeholder consultation, Inter-Agency coordination and public/NGO participation) – The EIA report should include a list of people/groups consulted and summary of the major outcomes and concerns raised. The following parties should be consulted.

- Ministry of Housing and Infrastructure regarding location of access roads and WMCs and regarding the issue of access for landing crafts and potential impacts to harbours
- Island Council
- Atoll Council

Environmental Protection Agency
Green Building, 3rd Floor, HandhuvareeHingun
Male', Rep. of Maldives, 20392
Tel: [+960] 333 5949 [+960] 333 5951
Fax: [+960] 333 5953
Email: secretariat@epa.gov.mv
Website: www.epa.gov.mv

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

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

Date: 23rd July 2017

Environmental Protection Agency
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Male', Rep. of Maldives, 20392
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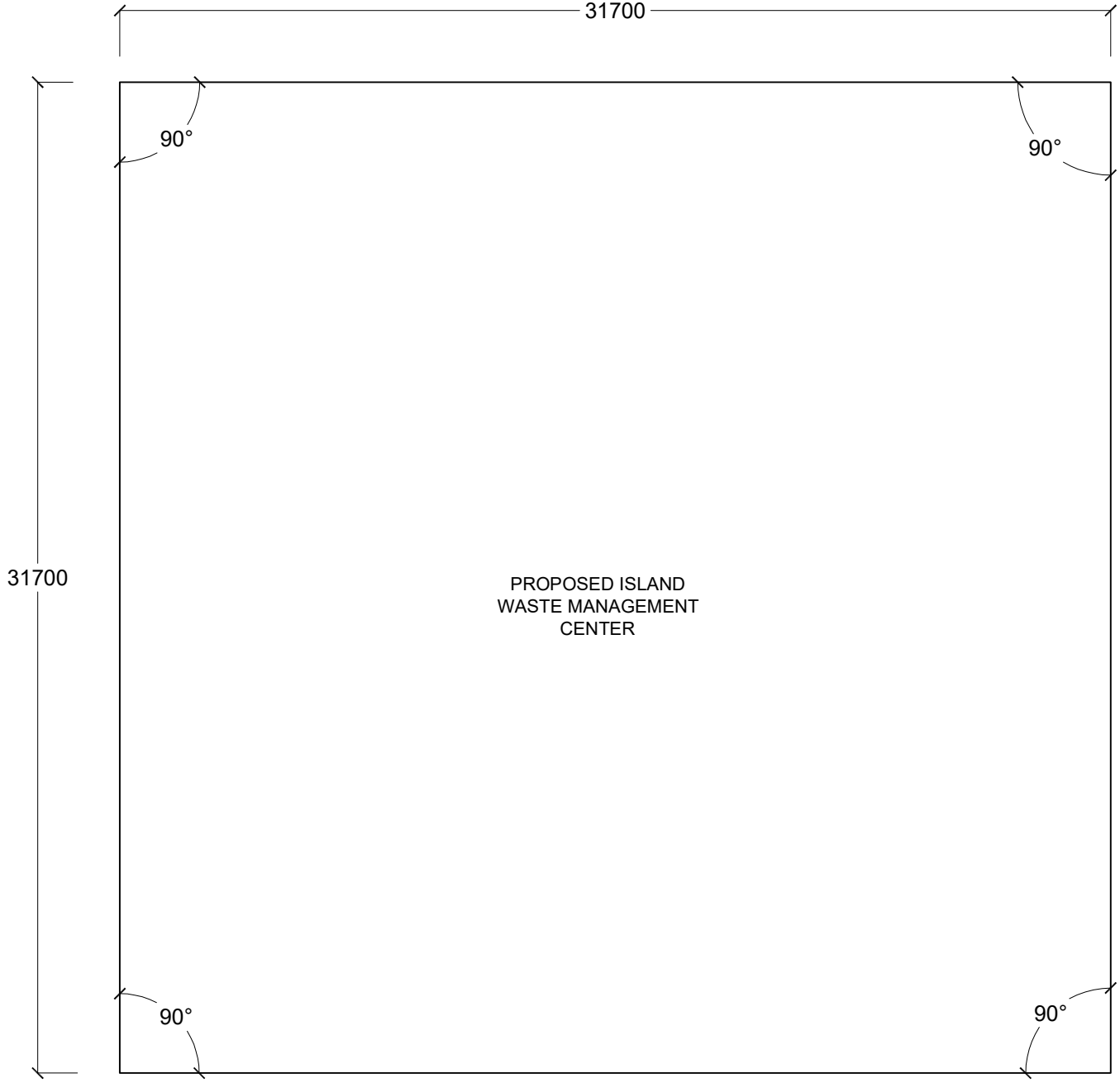
Email: secretariat@epa.gov.mv
Website: www.epa.gov.mv

PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT

H.A. DHIDHOO ISLAND WASTE MANAGEMENT CENTER

SOLID WASTE MANAGEMENT COMPONENT
OFID PROJECT
MINISTRY OF ENVIRONMENT AND ENERGY

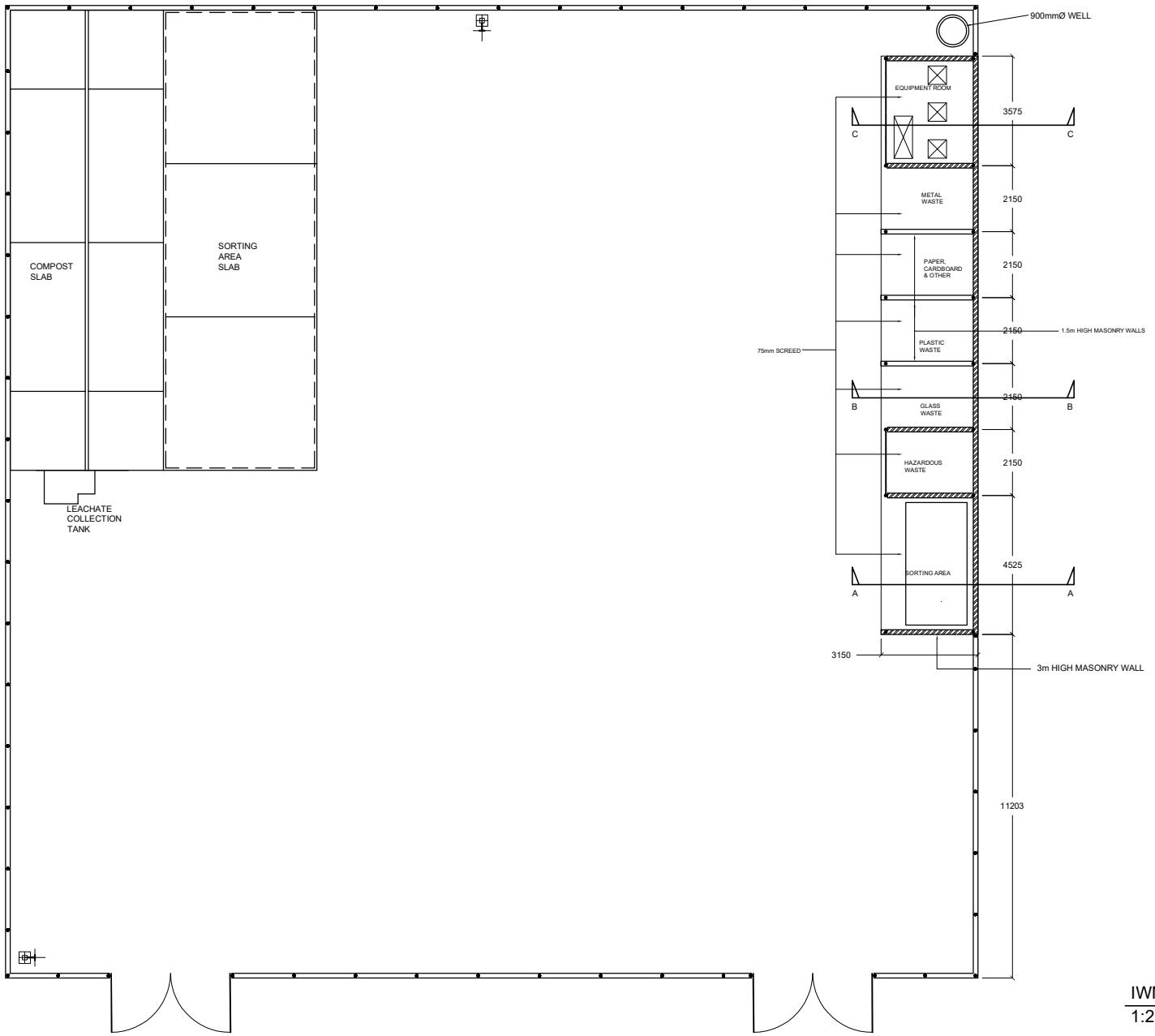
HANDHUVAREE HINGUN MALE' 20-01
REPUBLIC OF MALDIVES



SITE PLAN

1:200

PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT OPEC FUND FOR INTERNATIONAL DEVELOPMENT	PROJECT: H.A. DHIDHOO ISLAND WASTE MANAGEMENT CENTER	SCALE: AS SHOWN DATE: MAR 2017	SOLID WASTE MANAGEMENT COMPONENT OFID PROJECT MINISTRY OF ENVIRONMENT AND ENERGY HANDHUVAREE HINGUN MALE' 20-01 REPUBLIC OF MALDIVES



IWMC LAYOUT
1:200

PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT

OPEC FUND FOR INTERNATIONAL DEVELOPMENT

PROJECT:

H.A. DHIDHOO ISLAND WASTE MANAGEMENT CENTER

SCALE: AS SHOWN

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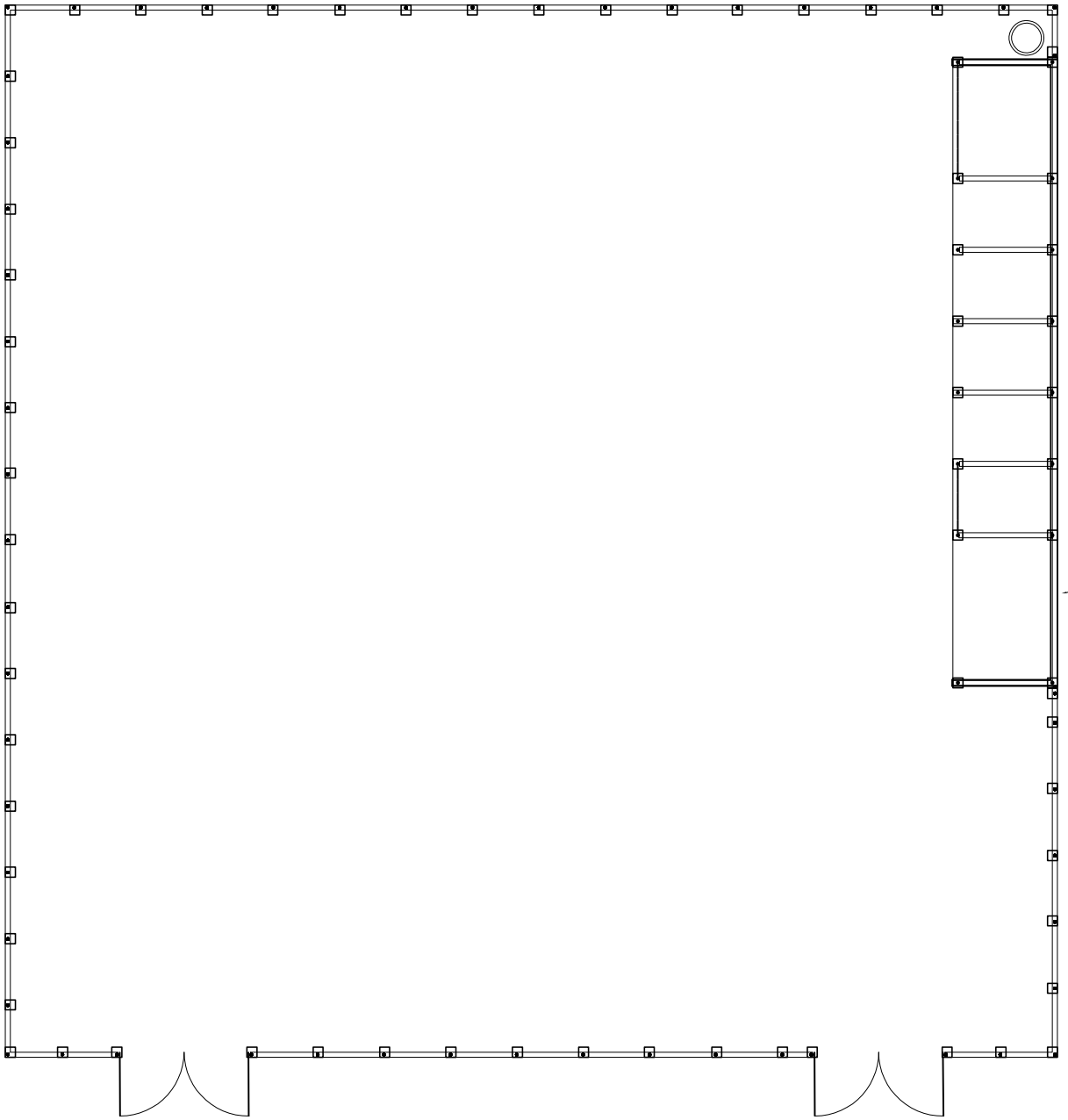

FENCE FOUNDATION AND COLLECTION AREA FOUNDATION

1:200

PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT

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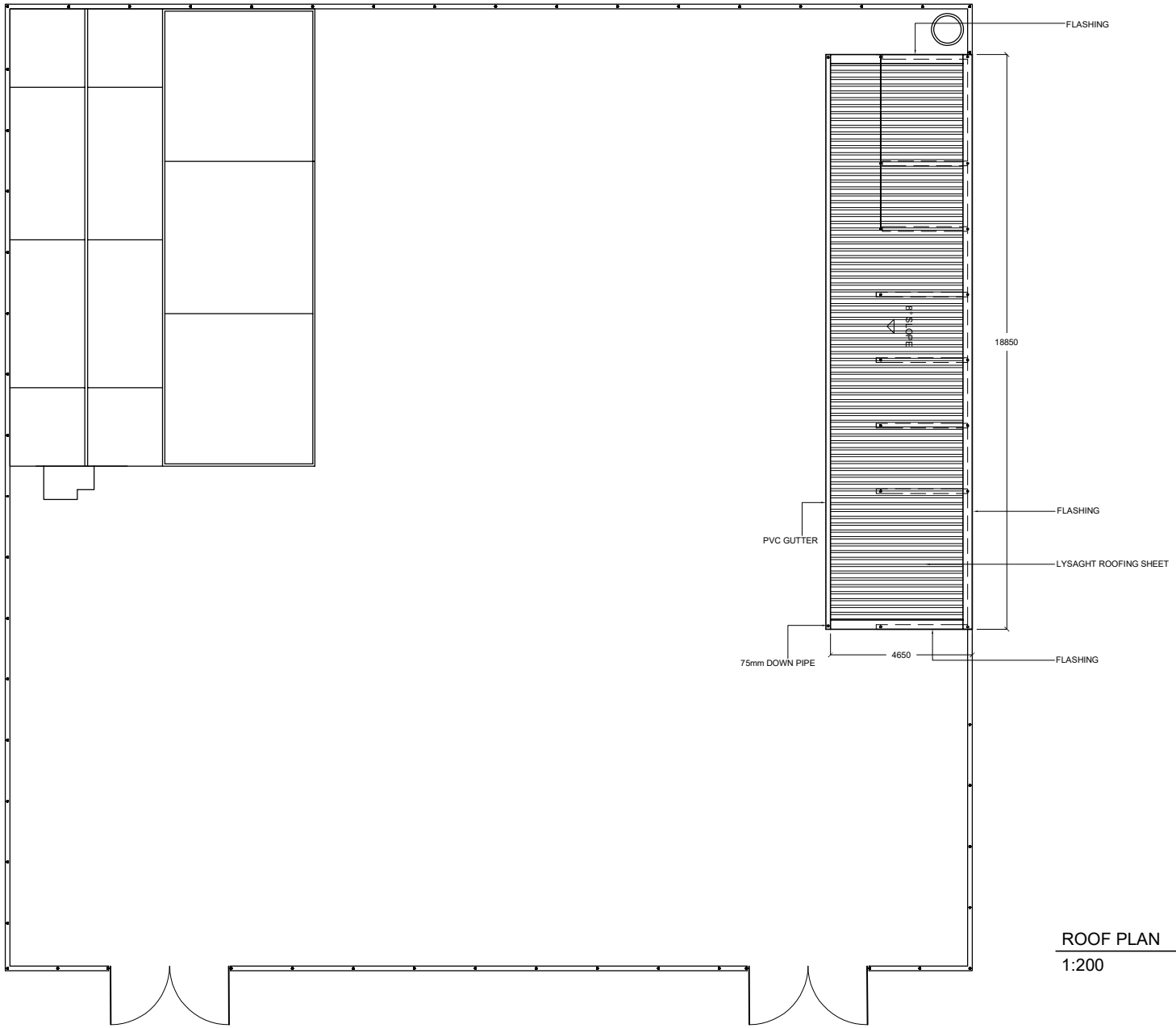

ROOF PLAN

1:200

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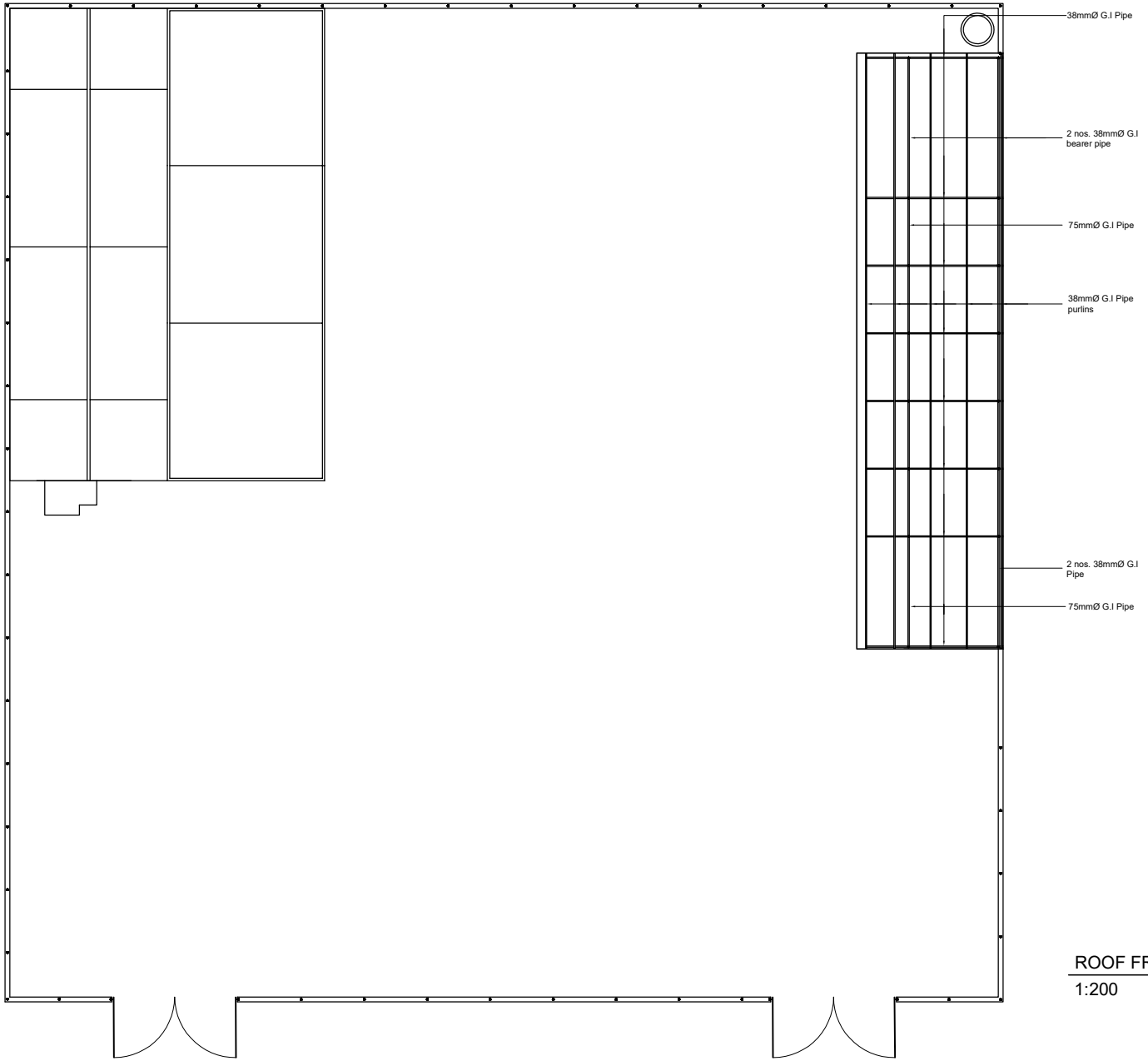

ROOF FRAMING PLAN

1:200

PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT

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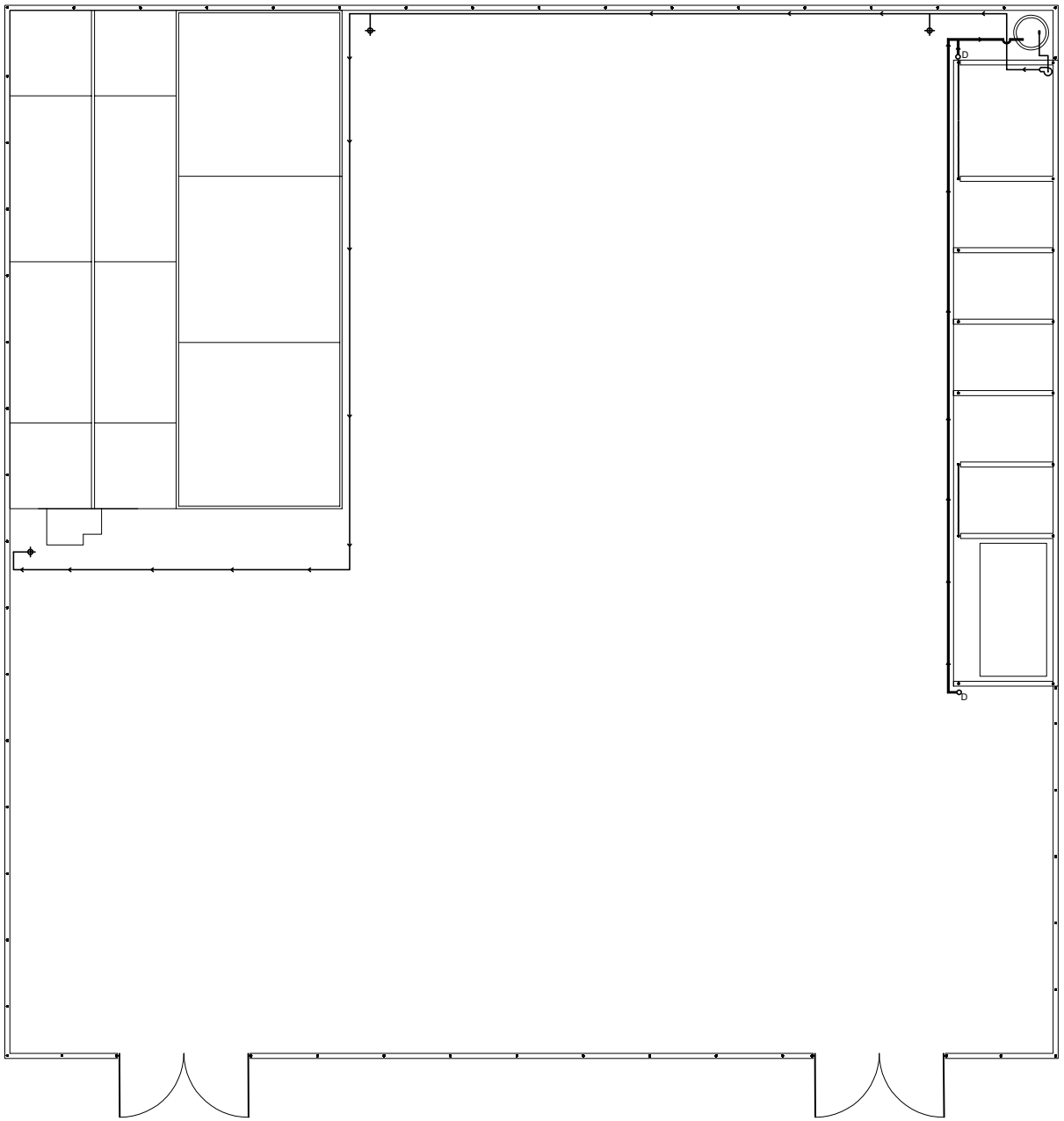

Metal tap

Shallow well pump (230 V, 550 W)

Foot valve

D Down pipe

75mm Conveyance pipe

PLUMBING LAYOUT
1:200

PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT

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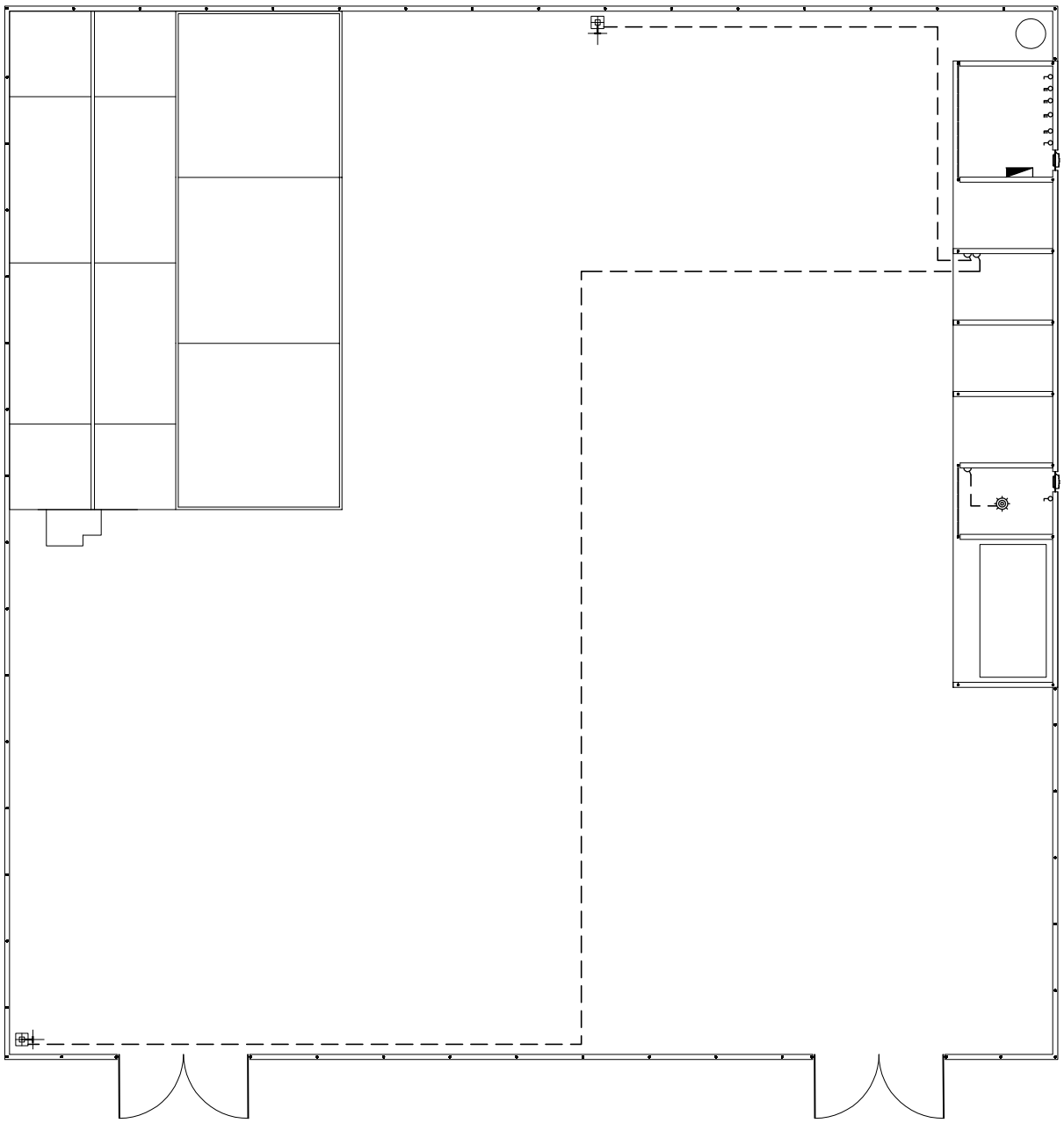

230 V, 250 W)
(14" blade diameter,
EXHAUST FAN

WEATHER PROOF SWITCH

[1.5m ABOVE GROUND]
1 PHASE POWER POINTS

[1.5m ABOVE GROUND]
3 PHASE POWER POINTS

100W ENERGY SAVING LIGHT

DISTRIBUTION BOARD

ELECTRICAL LAYOUT
1:200

PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT
OPEC FUND FOR INTERNATIONAL DEVELOPMENT

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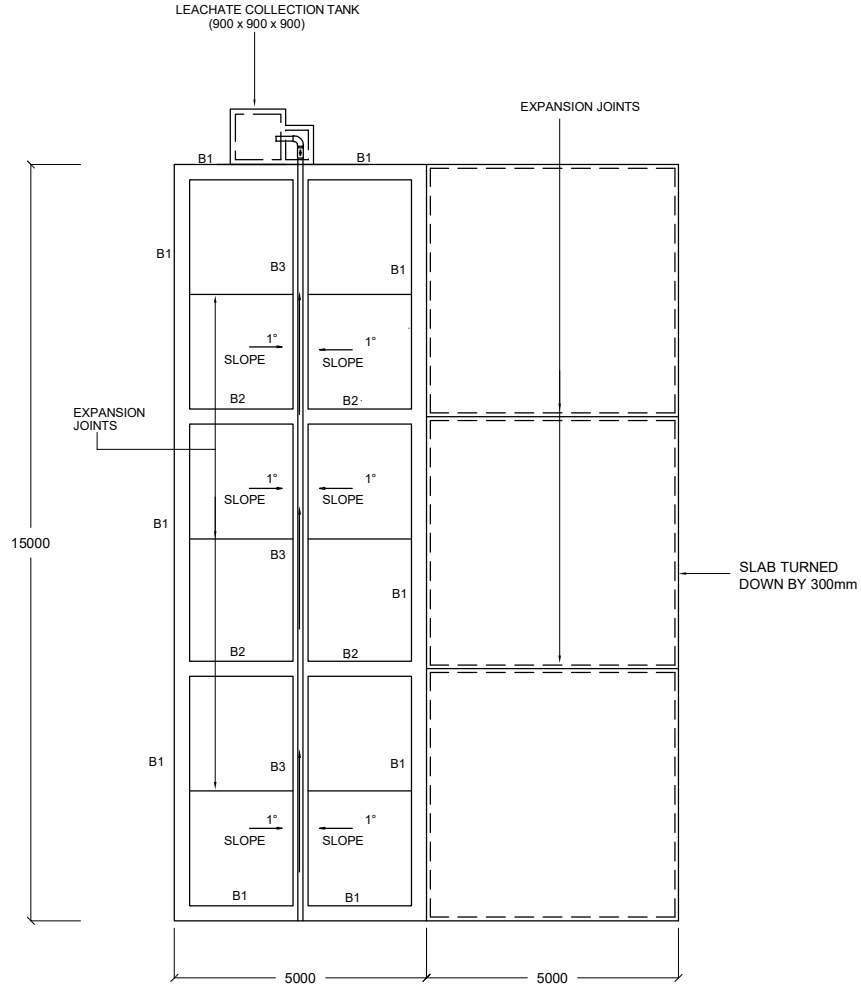
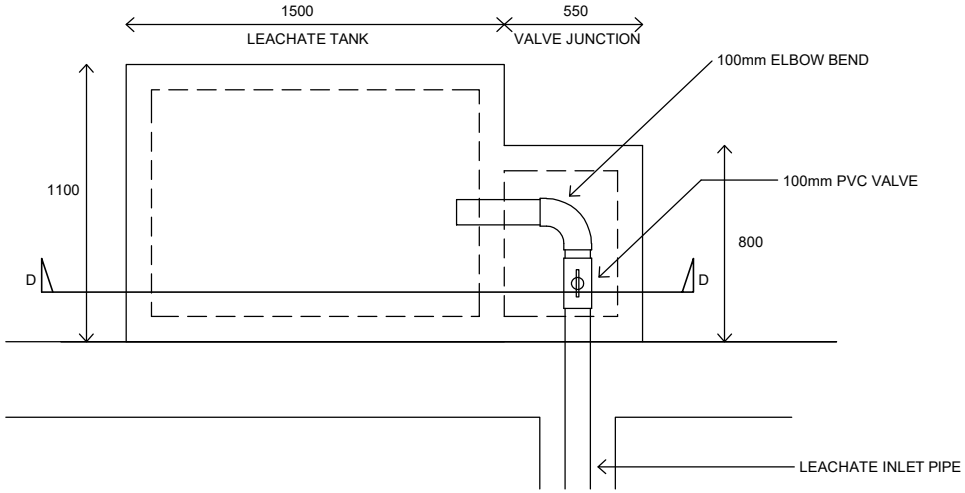


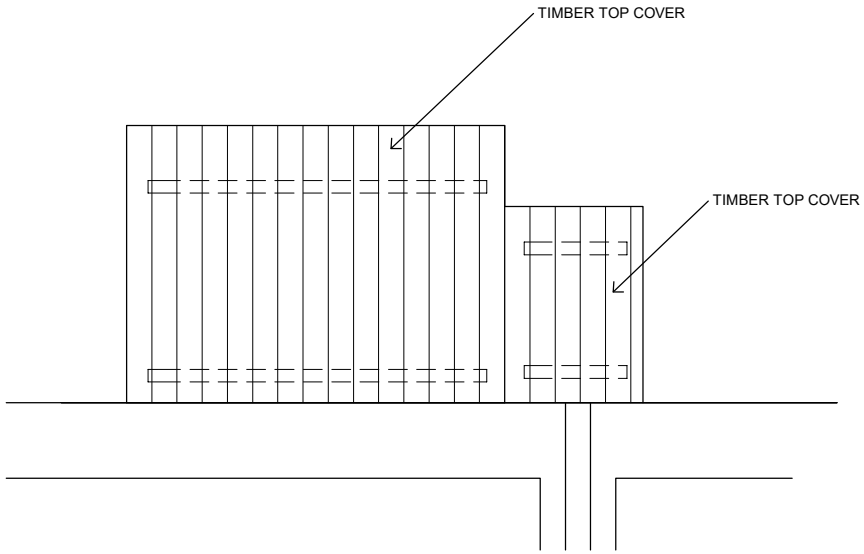
COMPOST SLAB AND SORTING AREA SLAB

1:150

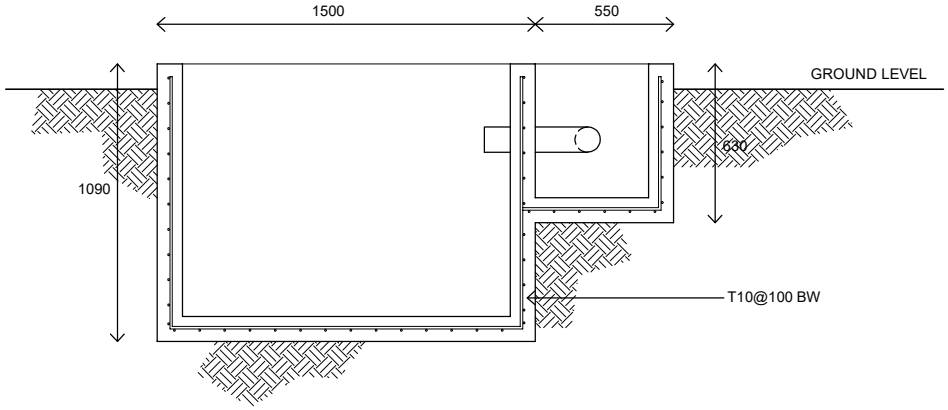
PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT OPEC FUND FOR INTERNATIONAL DEVELOPMENT	PROJECT: H.A. DHIDHOO ISLAND WASTE MANAGEMENT CENTER	SCALE: AS SHOWN DATE: MAR 2017	SOLID WASTE MANAGEMENT COMPONENT OFID PROJECT MINISTRY OF ENVIRONMENT AND ENERGY HANDHUVAREE HINGUN MALE' 20-01 REPUBLIC OF MALDIVES



LEACHATE TANK DETAIL
1:30

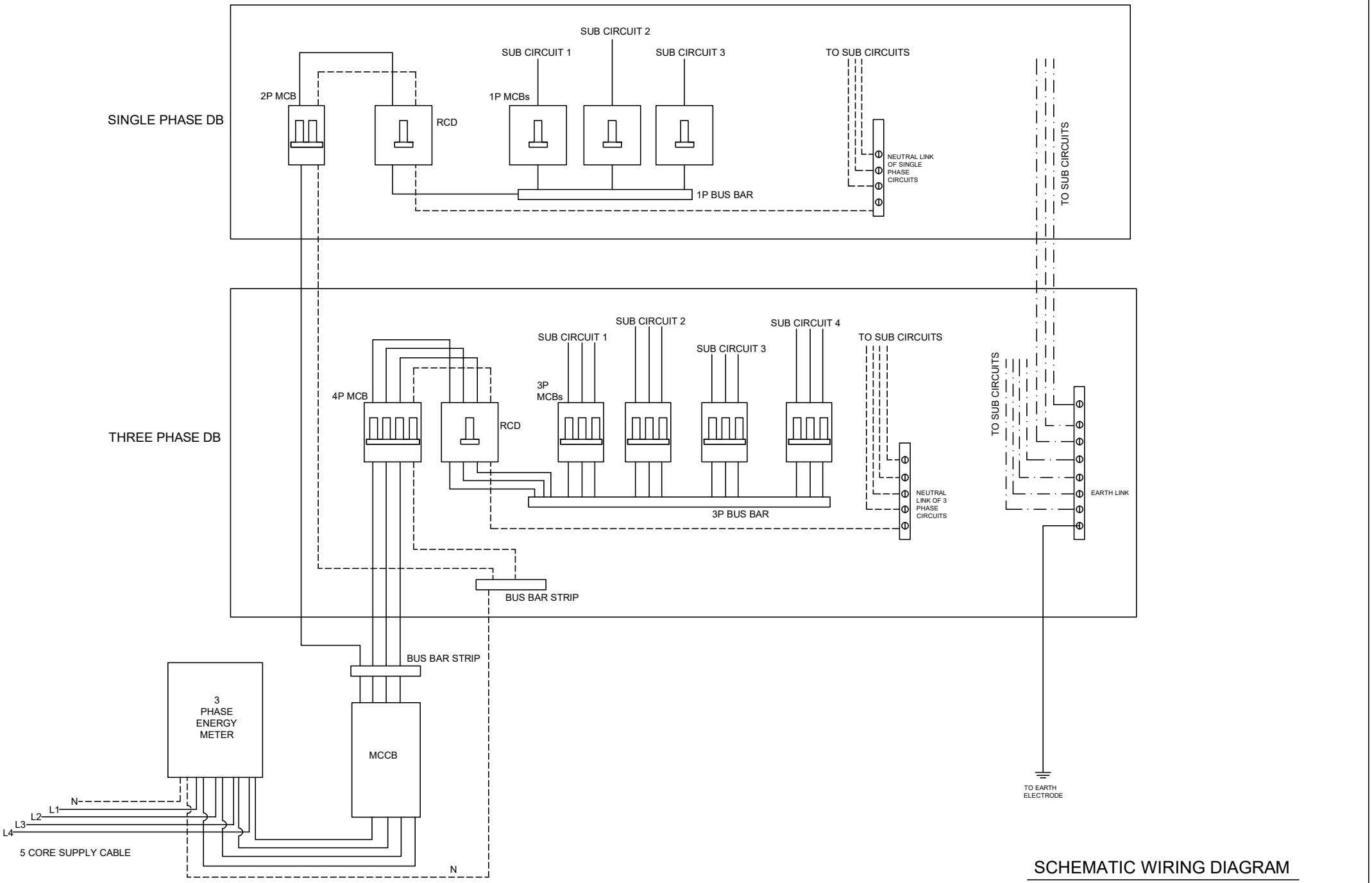


LEACHATE TANK COVER
1:30



SECTION D
1:30

PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT OPEC FUND FOR INTERNATIONAL DEVELOPMENT	PROJECT: H.A. DHIDHOO ISLAND WASTE MANAGEMENT CENTER	SCALE: AS SHOWN DATE: MAR 2017	SOLID WASTE MANAGEMENT COMPONENT OFID PROJECT MINISTRY OF ENVIRONMENT AND ENERGY HANDHUVAREE HINGUN MALE' 20-01 REPUBLIC OF MALDIVES



SCHEMATIC WIRING DIAGRAM

PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT OPEC FUND FOR INTERNATIONAL DEVELOPMENT	PROJECT: H.A. DHIDHOO ISLAND WASTE MANAGEMENT CENTER	SCALE: AS SHOWN DATE: MAR 2017

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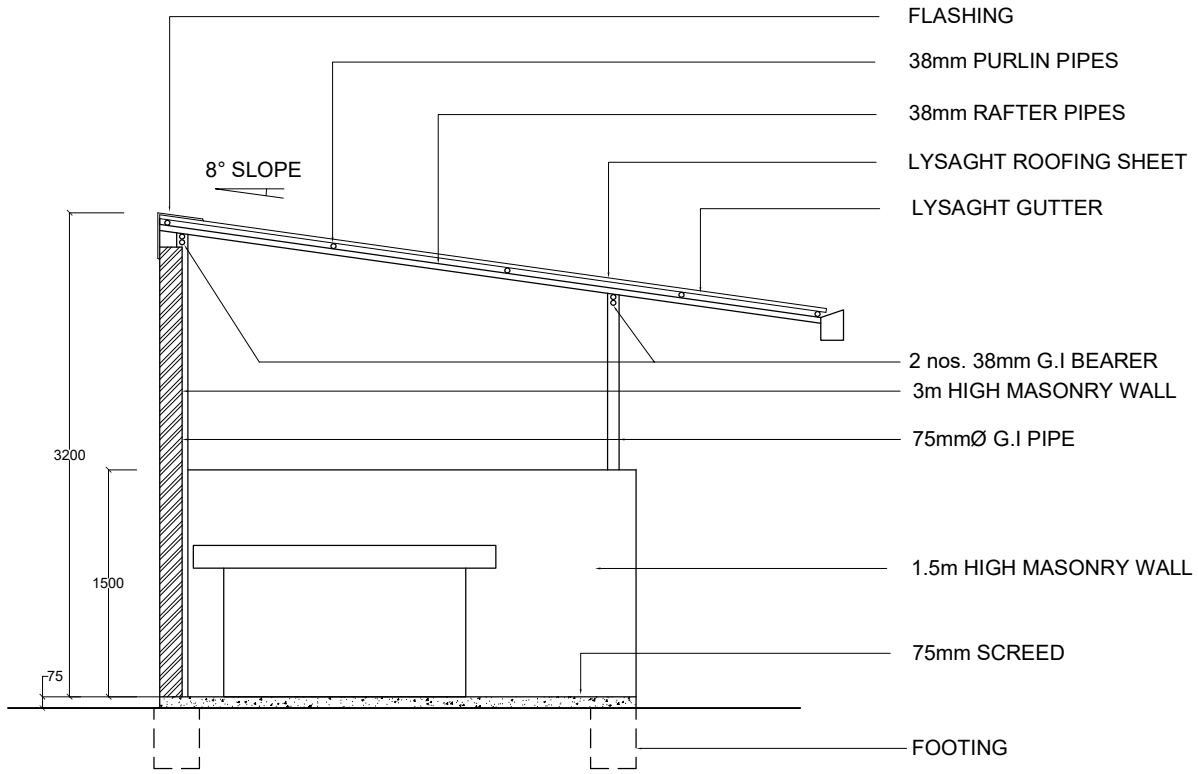
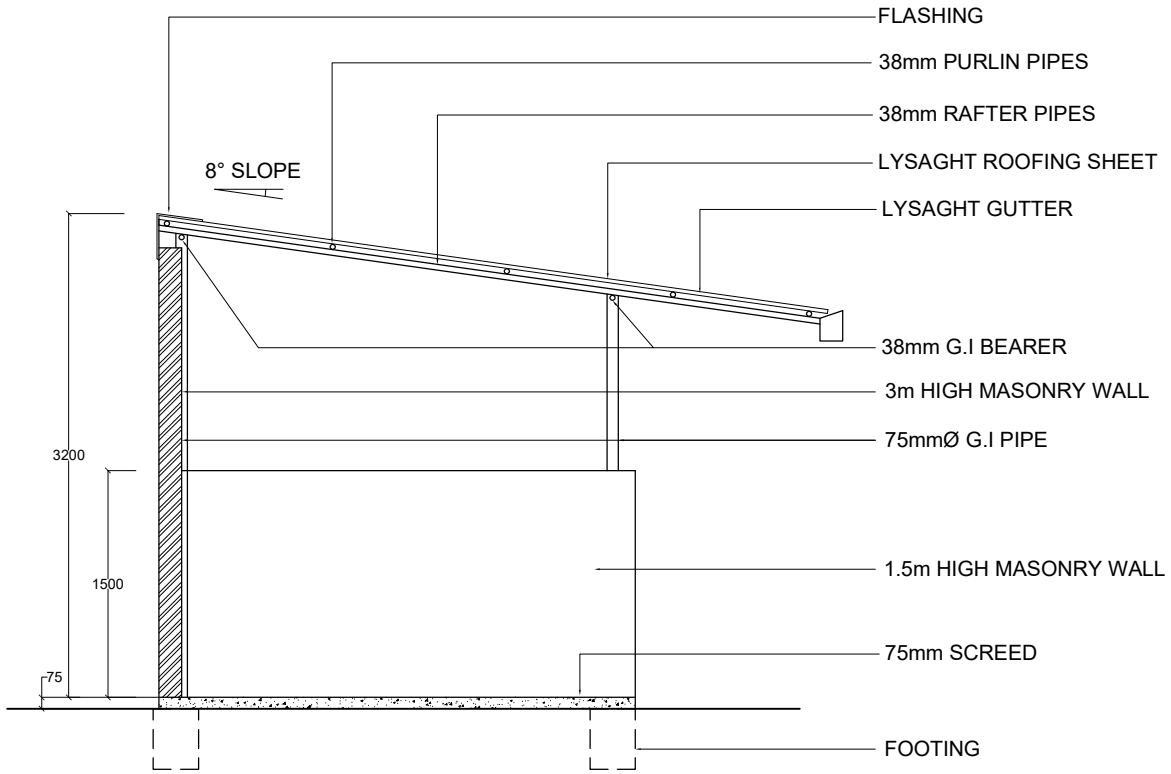


SECTION A

1:50

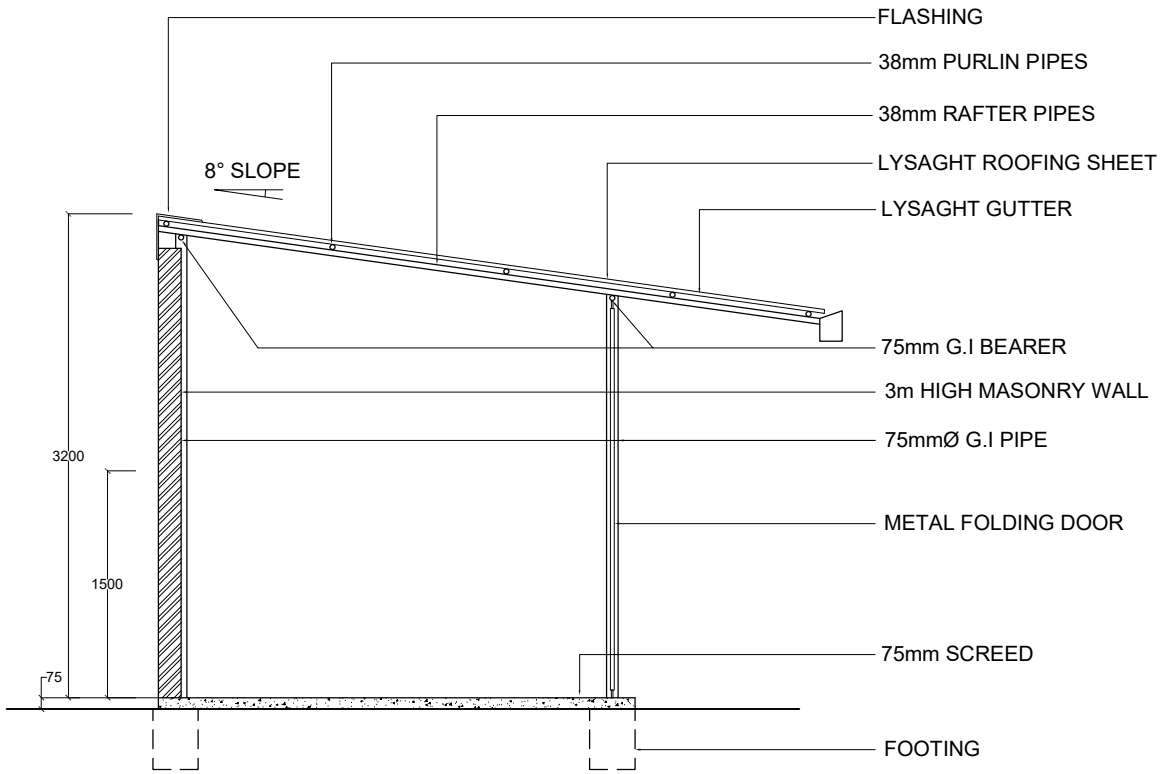
PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT OPEC FUND FOR INTERNATIONAL DEVELOPMENT	PROJECT: H.A. DHIDHOO ISLAND WASTE MANAGEMENT CENTER	SCALE: AS SHOWN DATE: MAR 2017	SOLID WASTE MANAGEMENT COMPONENT OFID PROJECT MINISTRY OF ENVIRONMENT AND ENERGY HANDHUVAREE HINGUN MALE' 20-01 REPUBLIC OF MALDIVES



SECTION B

1:50

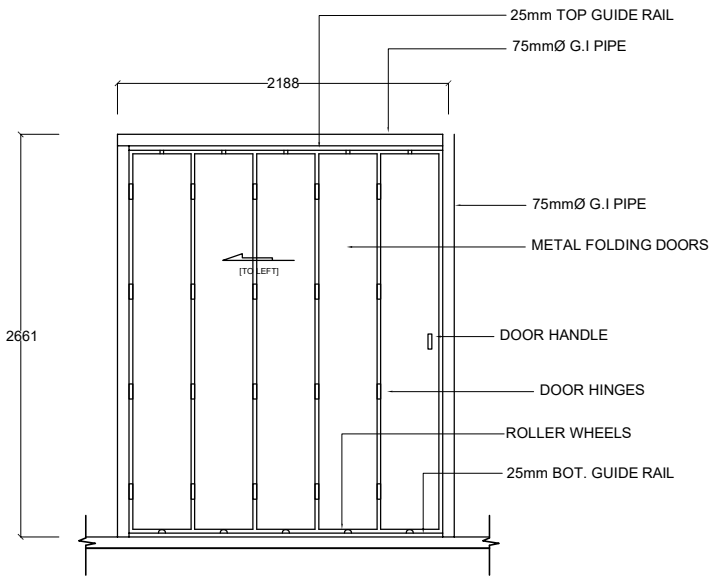
PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT OPEC FUND FOR INTERNATIONAL DEVELOPMENT	PROJECT: H.A. DHIDHOO ISLAND WASTE MANAGEMENT CENTER	SCALE: AS SHOWN DATE: MAR 2017	SOLID WASTE MANAGEMENT COMPONENT OFID PROJECT MINISTRY OF ENVIRONMENT AND ENERGY HANDHUVAREE HINGUN MALE' 20-01 REPUBLIC OF MALDIVES



SECTION C

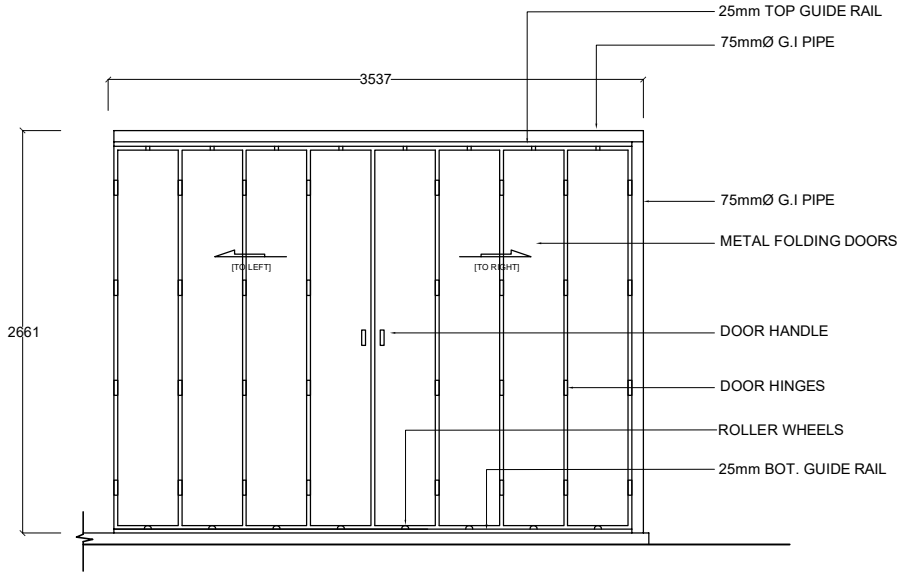
1:50

PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT OPEC FUND FOR INTERNATIONAL DEVELOPMENT	PROJECT: H.A. DHIDHOO ISLAND WASTE MANAGEMENT CENTER	SCALE: AS SHOWN DATE: MAR 2017	SOLID WASTE MANAGEMENT COMPONENT OFID PROJECT MINISTRY OF ENVIRONMENT AND ENERGY HANDHUVAREE HINGUN MALE' 20-01 REPUBLIC OF MALDIVES



HAZARDOUS WASTE AREA
FOLDING DOOR DETAIL

1:50



EQUIPMENT ROOM
FOLDING DOOR DETAIL

1:50

PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT

OPEC FUND FOR INTERNATIONAL DEVELOPMENT

PROJECT:

H.A. DHIDHOO ISLAND WASTE MANAGEMENT CENTER

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SOLID WASTE MANAGEMENT COMPONENT
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MINISTRY OF ENVIRONMENT AND ENERGY
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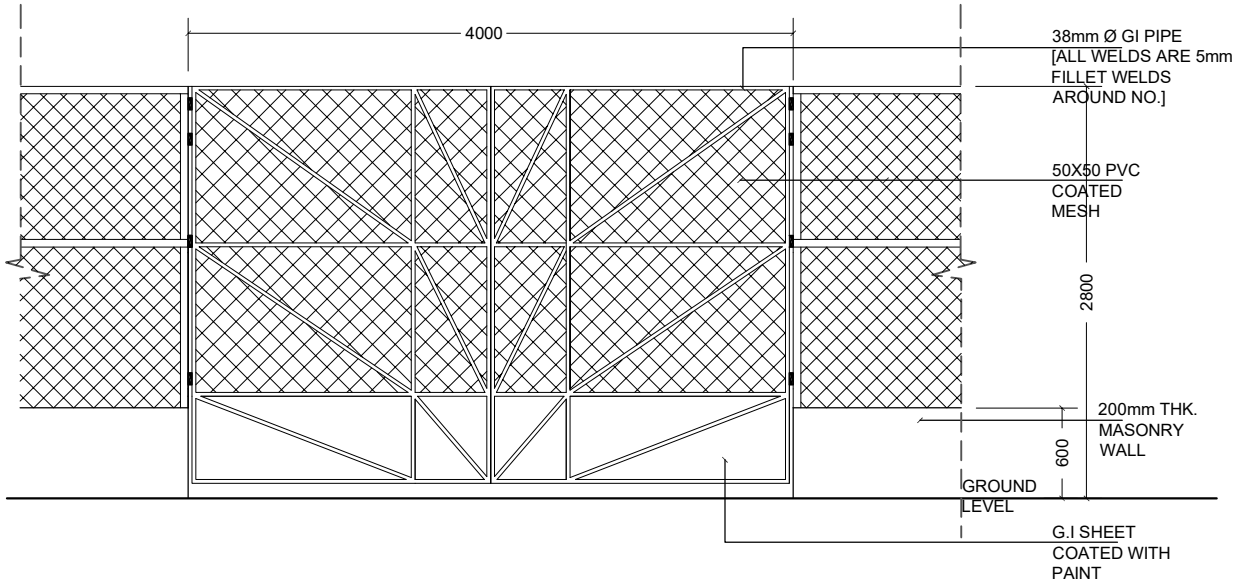
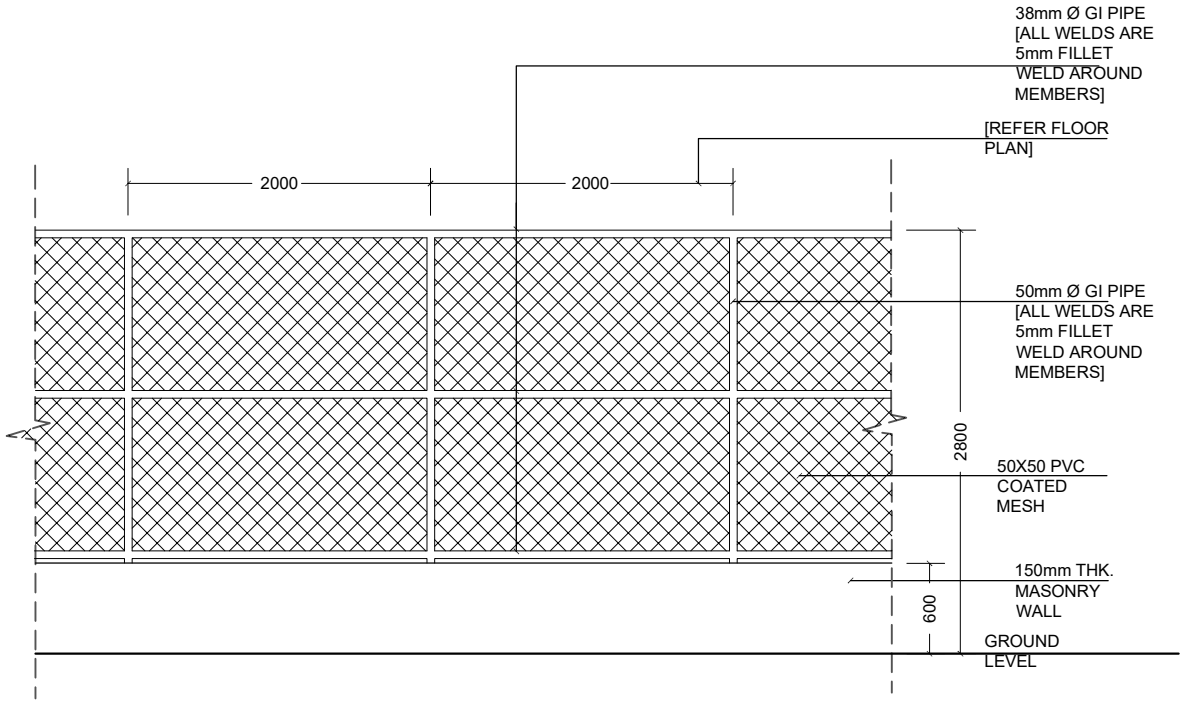


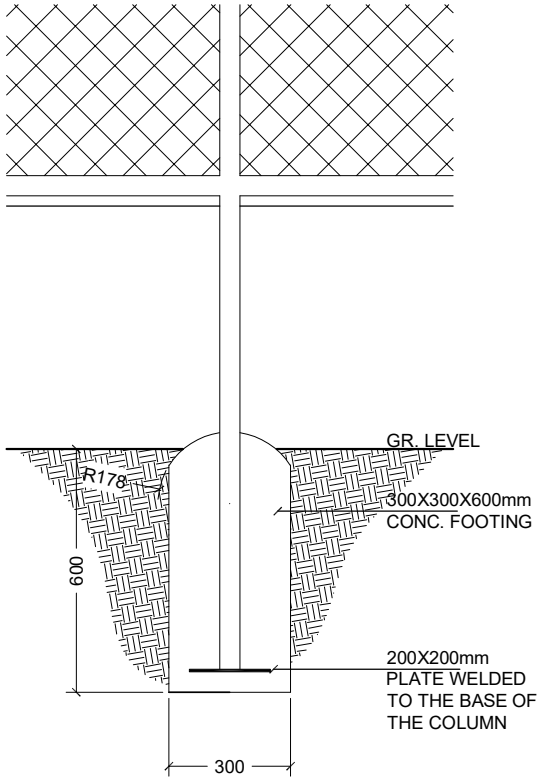
ENTRANCE / EXIT GATE
1:50

PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT OPEC FUND FOR INTERNATIONAL DEVELOPMENT	PROJECT: H.A. DHIDHOO ISLAND WASTE MANAGEMENT CENTER	SCALE: AS SHOWN DATE: MAR 2017	SOLID WASTE MANAGEMENT COMPONENT OFID PROJECT MINISTRY OF ENVIRONMENT AND ENERGY HANDHUVAREE HINGUN MALE' 20-01 REPUBLIC OF MALDIVES

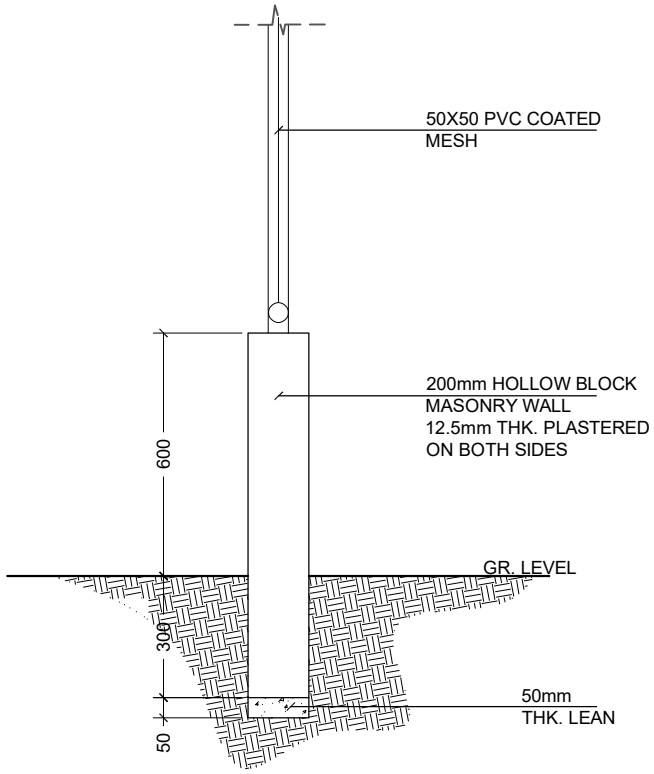


PERIMETER FENCE
1:50

PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT OPEC FUND FOR INTERNATIONAL DEVELOPMENT	PROJECT: H.A. DHIDHOO ISLAND WASTE MANAGEMENT CENTER	SCALE: AS SHOWN DATE: MAR 2017	SOLID WASTE MANAGEMENT COMPONENT OFID PROJECT MINISTRY OF ENVIRONMENT AND ENERGY HANDHUVAREE HINGUN MALE' 20-01 REPUBLIC OF MALDIVES

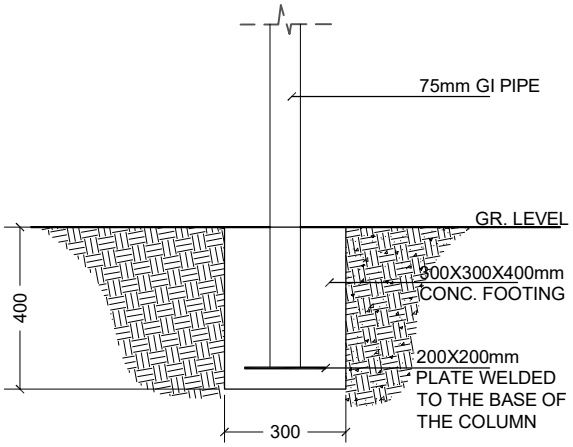


FENCE FOUNDATION DETAIL

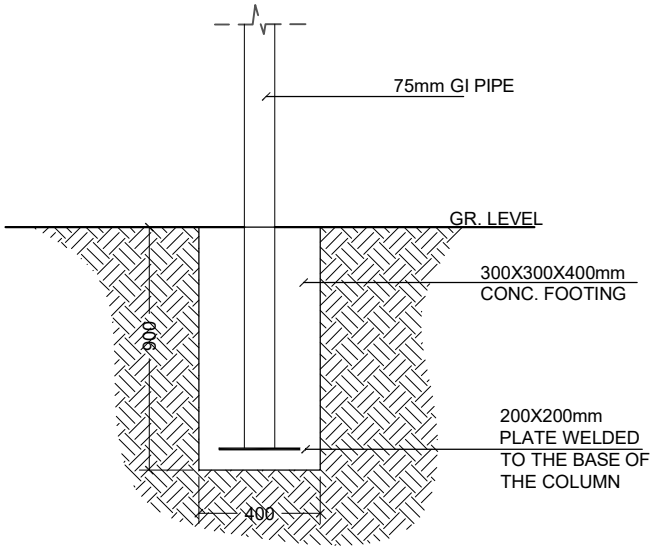


PERIMETER WALL
FOUNDATION DETAIL

PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT OPEC FUND FOR INTERNATIONAL DEVELOPMENT	PROJECT: H.A. DHIDHOO ISLAND WASTE MANAGEMENT CENTER	SCALE: AS SHOWN DATE: MAR 2017	SOLID WASTE MANAGEMENT COMPONENT OFID PROJECT MINISTRY OF ENVIRONMENT AND ENERGY HANDHUVAREE HINGUN MALE' 20-01 REPUBLIC OF MALDIVES

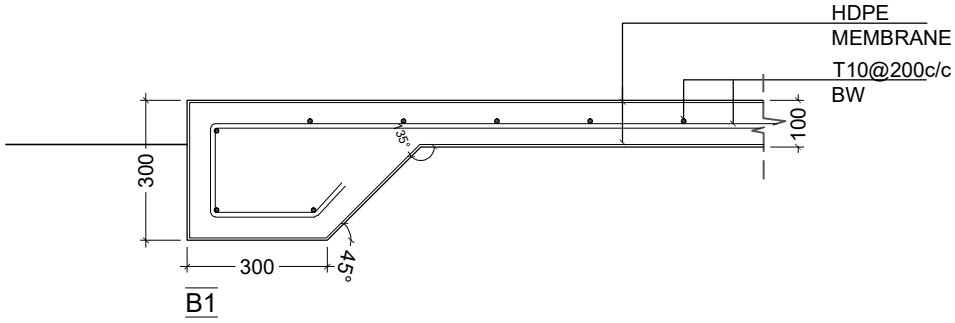


WASTE SORTING AREA
COLUMN FOUNDATION DETAIL

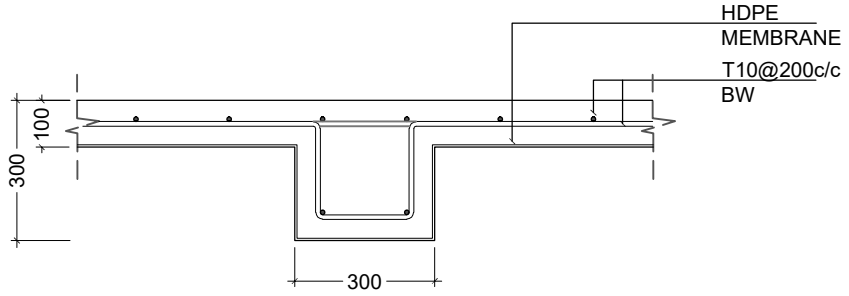


LIGHT POST FOUNDATION

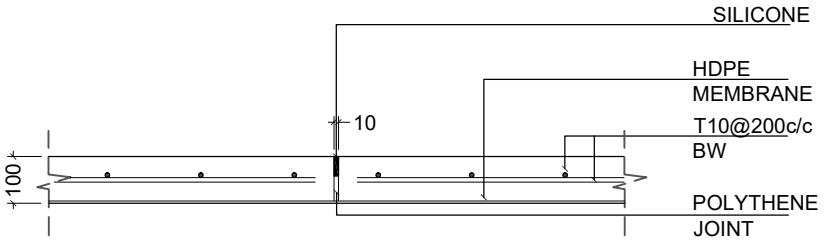
PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT OPEC FUND FOR INTERNATIONAL DEVELOPMENT	PROJECT: H.A. DHIDHOO ISLAND WASTE MANAGEMENT CENTER	SCALE: AS SHOWN DATE: MAR 2017	SOLID WASTE MANAGEMENT COMPONENT OFID PROJECT MINISTRY OF ENVIRONMENT AND ENERGY HANDHUVAREE HINGUN MALE' 20-01 REPUBLIC OF MALDIVES

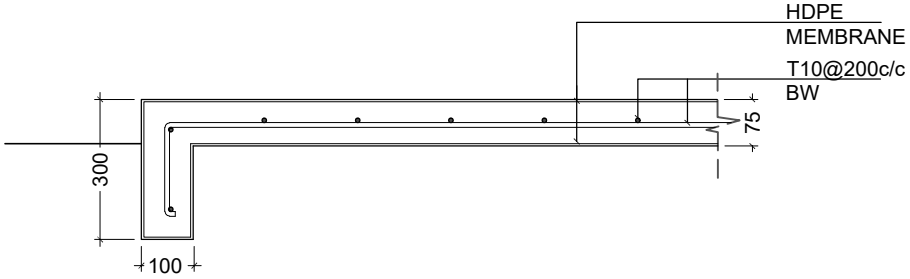


B1



B2





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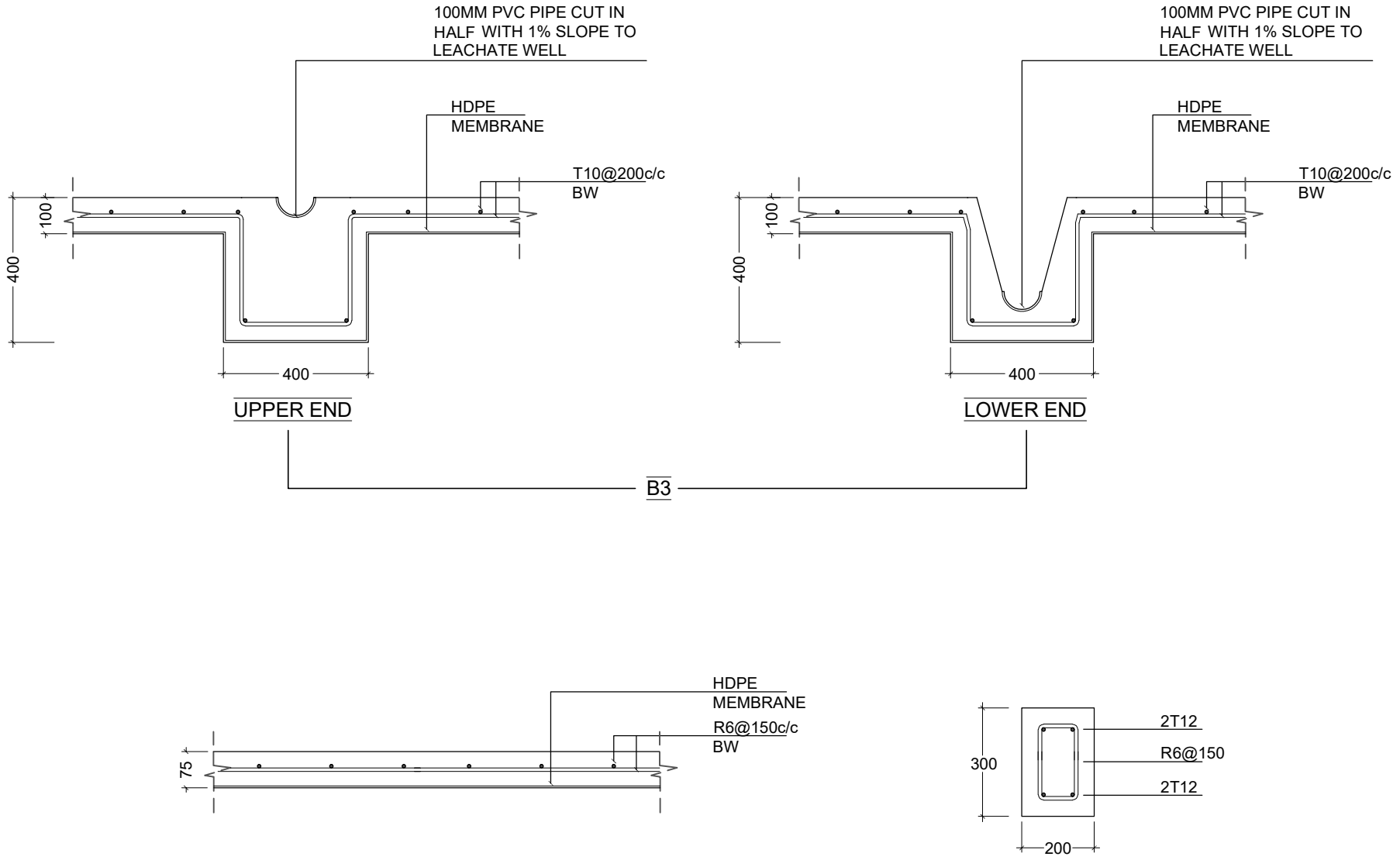
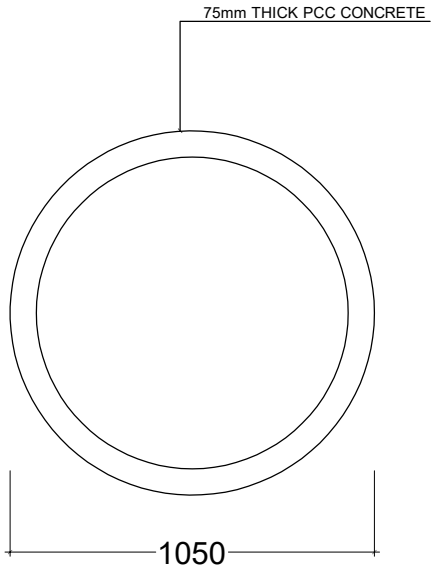
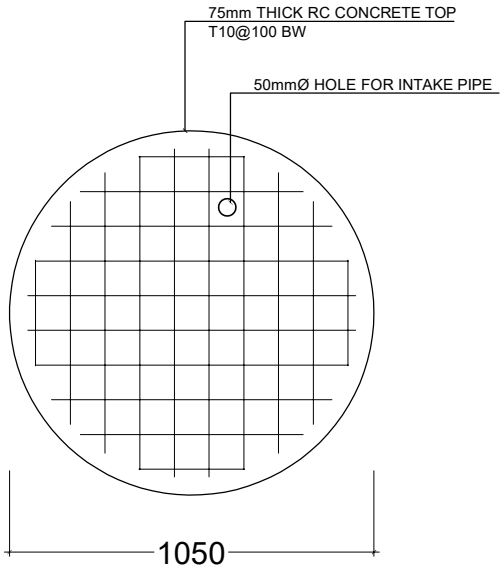


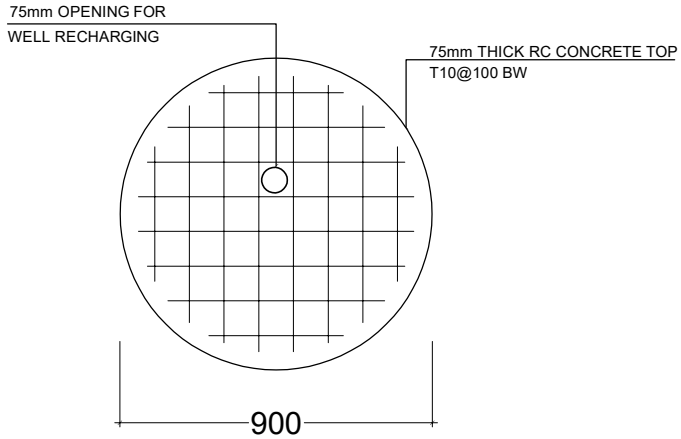
PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT OPEC FUND FOR INTERNATIONAL DEVELOPMENT	PROJECT: H.A. DHIDHOO ISLAND WASTE MANAGEMENT CENTER	SCALE: AS SHOWN DATE: MAR 2017	SOLID WASTE MANAGEMENT COMPONENT OFID PROJECT MINISTRY OF ENVIRONMENT AND ENERGY HANDHUVAREE HINGUN MALE' 20-01 REPUBLIC OF MALDIVES



GROUND WATER WELL

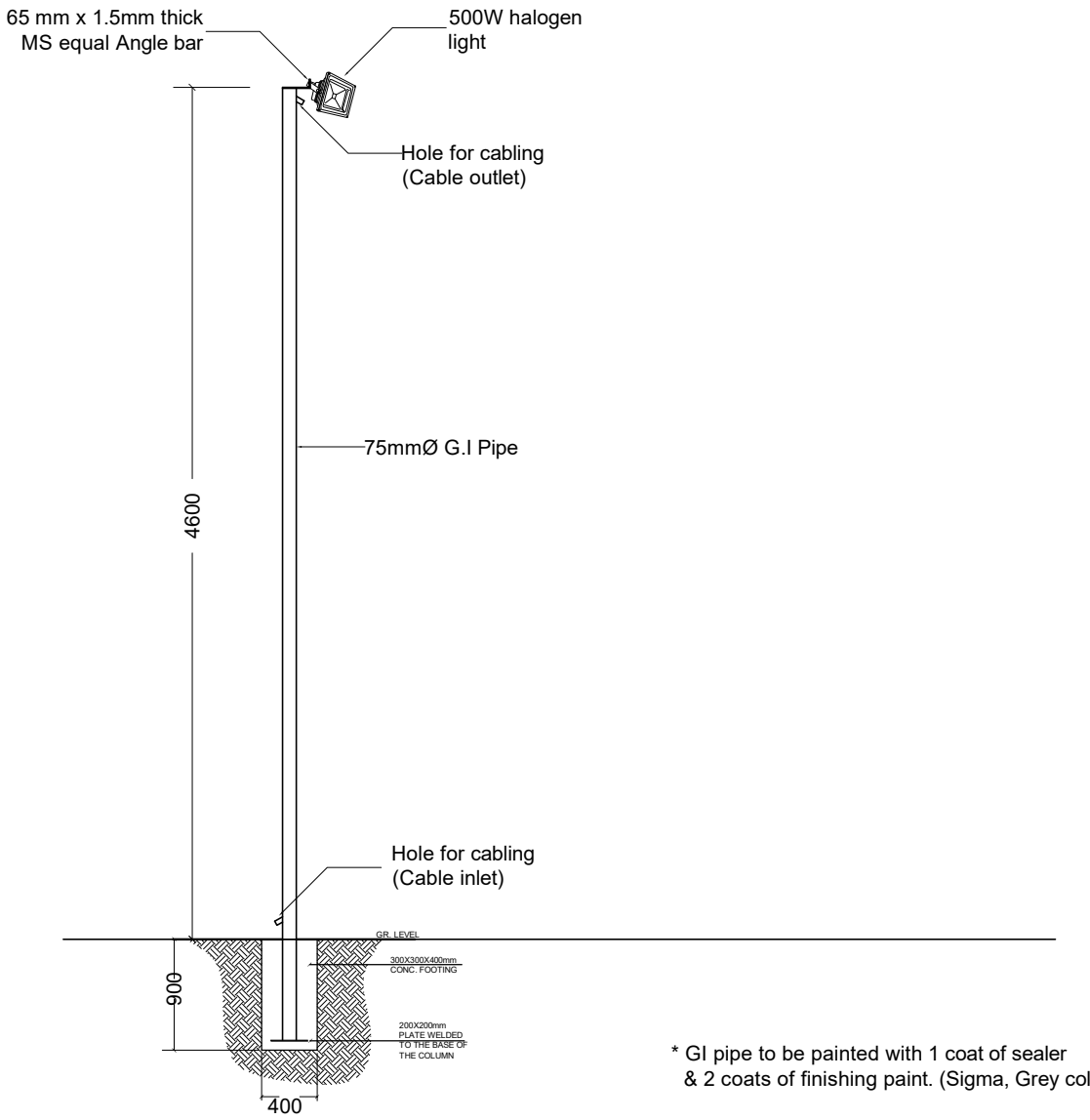


GROUND WATER WELL - TOP



GROUND WATER WELL - BASE

PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT OPEC FUND FOR INTERNATIONAL DEVELOPMENT	PROJECT: H.A. DHIDHOO ISLAND WASTE MANAGEMENT CENTER	SCALE: AS SHOWN DATE: MAR 2017	SOLID WASTE MANAGEMENT COMPONENT OFID PROJECT MINISTRY OF ENVIRONMENT AND ENERGY HANDHUVAREE HINGUN MALE' 20-01 REPUBLIC OF MALDIVES



* GI pipe to be painted with 1 coat of sealer
& 2 coats of finishing paint. (Sigma, Grey colour)

LIGHT POST DETAIL

PROVISION OF WATER SUPPLY SANITATION AND SOLID WASTE MANAGEMENT PROJECT OPEC FUND FOR INTERNATIONAL DEVELOPMENT	PROJECT: H.A. DHIDHOO ISLAND WASTE MANAGEMENT CENTER	SCALE: AS SHOWN DATE: MAR 2017	SOLID WASTE MANAGEMENT COMPONENT OFID PROJECT MINISTRY OF ENVIRONMENT AND ENERGY HANDHUVAREE HINGUN MALE' 20-01 REPUBLIC OF MALDIVES

بسم الله الرحمن الرحيم

MEECO
Reg. No: C-0333/2014

2nd Floor, Aakakaage-1, Galolhu.
Alikilegefaanu Magu, Male', 20129.
Republic of Maldives.

Meeting With:	Ha Uiigam community
Date:	5/5/17.
Time:	21:00 pm.
Venue:	
Subject	Re: IWMC WASTE MANAGEMENT PROJECT

Name	Post/Organisation	Contact Number	E-Mail Address	Signature
Mohamed Abdulla				
Hussain Nuseen				
Mohamed Maleeh				
Hassan Waheed				
Ibrahim Hussain				
Ahmed Naseer				
Shaheen				
Hassan Ahmed				
Mohamed Rasheed				
Waheeda Saeedh				
Shiuna				
Khadeeja Ali				
Ameend Idris				
Aiminath Ibrahim				
Shazilya Abdulla				
Aishath Adam				
Aroosha				
Ameena				
Saajidha				
Nasiha				

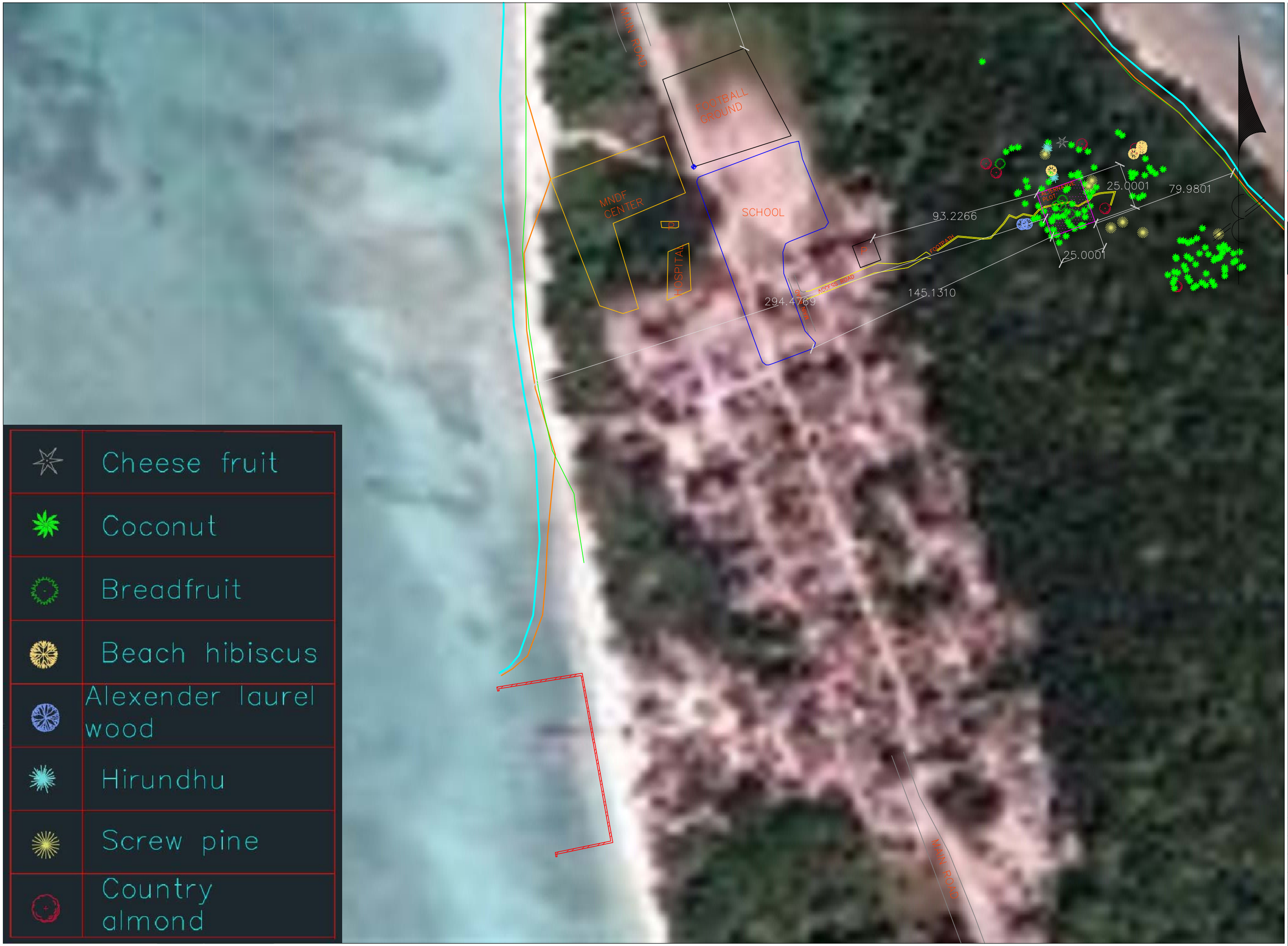
بسم الله الرحمن الرحيم

MEECO
Reg. No: C-0333/2014

2nd Floor, Aakakaage-1, Galolhu
Alikilegefaanu Magu, Male', 20129,
Republic of Maldives.

Meeting With:	HA. ULIGAM COUNCIL
Date:	4/5/2017
Time:	
Venue:	
Subject	Re: IWMC WASTE MANAGEMENT' PROJECT

Name	Post/Organisation	Contact Number	E-Mail Address	Signature
Imadh Abdwa	Council president	7934361	imaadhabdwa@gmail.com	
Ahmed Muqz	Councilor	7759261	a.muqz79@gmail.com	
Abu bakr Adam		7655865		



MEECO
2nd Floor, Aakakaage-1, Galolhu
Alikilegefaanu Magu
Male', 20129
Republic of Maldives
(960) 301-0855
(960) 301-0844
info@meeco.com.mv

Key Plan

Notes :

*UNITES ARE IN METERS.
*COORDINATES SYSTEM (UTM84-43N)

CP	NOTHING (m)	EASTING (m)	ELEVATION
01	783630.1245	270713.6866	1.45m
ULIGAM			

*PLOT SIZE=625sqm
*TREES TO BE REMOVED = 29 NOS (SURVEYED)
*DISTANCE TO MAIN ROAD = 145.13m
*DISTANCE TO SCHOOL = 145.13m
*DISTANCE TO CLOSEST BUILDING =93.23m

*DISTANCE FROM SHORE/VEGETATION LINE= (AVERAGE)

LHS	RHS
294.48m	79.98m

LEGEND

	HWL
	LWL
	VEGETATION
	SCHOOL
	MAIN ROAD
	ACCESS ROAD/FOOTPATH
	PERMANENT BUILDING
	HARBOUR
	PLOT

SCALE :	1:2000
SURVEYED BY :	DINAL (SURVEYOR)
DATE OF SURVEY :	2017/05/04
DRAWN BY :	DINAL (DRAUGHT MAN)
CHECKED BY :	DINAL (SURVEYOR / ENGINEER)
DATE OF SUBMIT :	2017/05/31

LOCATION
ULIGAM
HAA ALIFU ATOLL

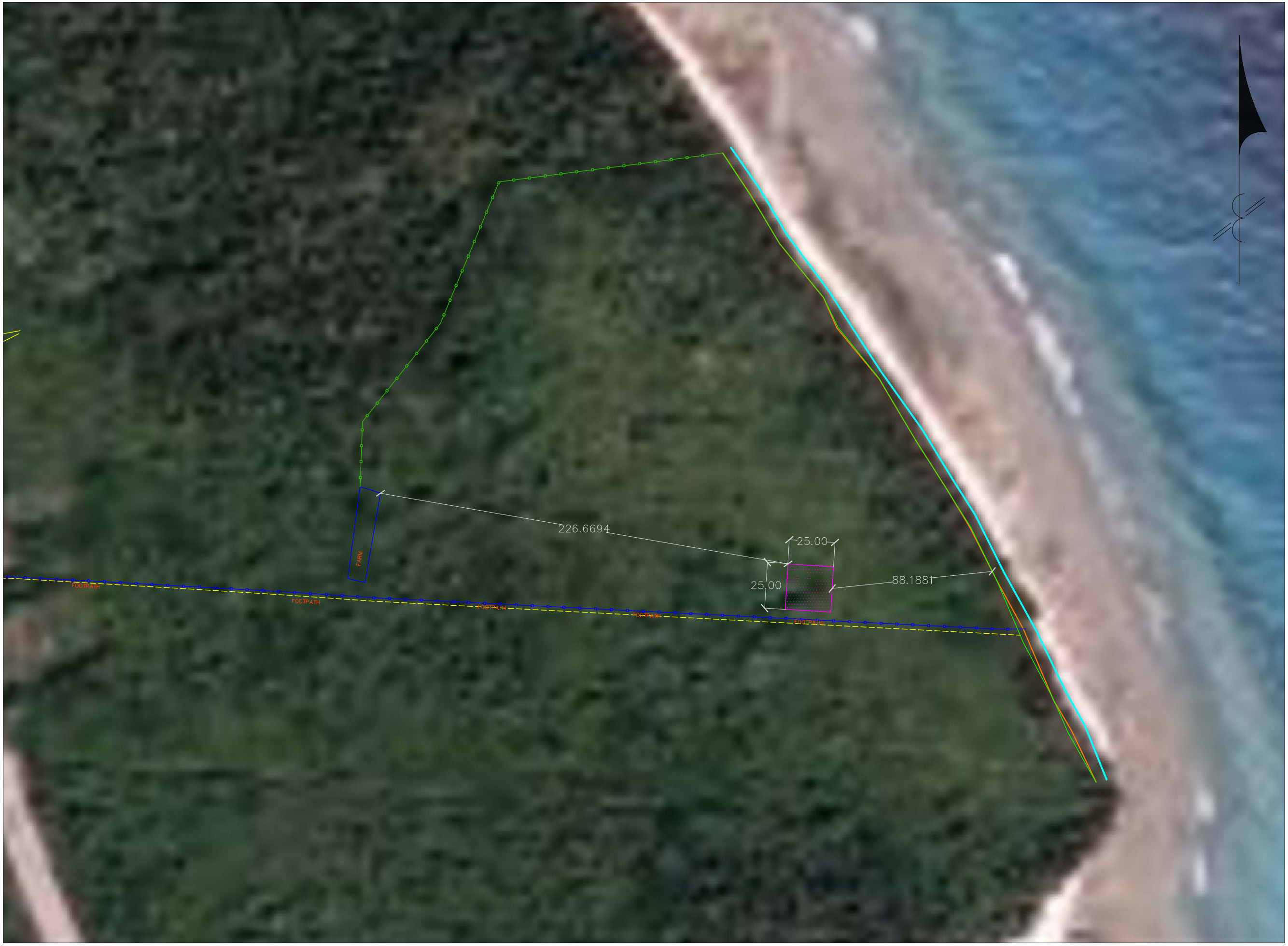
PROJECT : WASTE MANAGEMENT PROJECT ZONE 01

DRAWING TITLE : ALTERNATIVE AREA 01 DRAWING

DRAWING No :2017/055

SHEET No :03 OF 05

REV	DESCRICTION	BY	DATE



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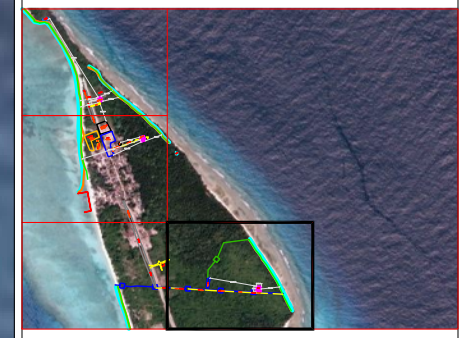
(960) 301-0844
info@meeco.com.mv

Key Plan



Notes :

*UNITES ARE IN METERS.
*COORDINATES SYSTEM (UTM84-43N)

CP	NOTHING (m)	EASTING (m)	ELEVATION
01	783630.1245	270713.6866	1.45m
ULIGAM			

*PLOT SIZE=625sqm

*DISTANCE TO CLOSEST FARM=226.66m

*DISTANCE FROM SHORE/VEGETATION LINE= (AVERAGE)

LHS RHS
88.18m

LEGEND

	HWL
	LWL
	VEGETATION
	FENCE
	FARM
	FARM BOUNDARY LINE
	FOOTPATH
	PLOT

SCALE :	1:2000
SURVEYED BY :	DINAL (SURVEYOR)
DATE OF SURVEY :	2017/05/04
DRAWN BY :	DINAL (DRAUGHT MAN)
CHECKED BY :	DINAL (SURVEYOR / ENGINEER)
DATE OF SUBMIT :	2017/05/31

LOCATION
ULIGAM
HAA ALIFU ATOLL

PROJECT : WASTE MANAGEMENT PROJECT ZONE 01

DRAWING TITLE : ALTERNATIVE AREA DRAWING 02

DRAWING No :2017/055

SHEET No :04 OF 05

REV	DESCRICTION	BY	DATE

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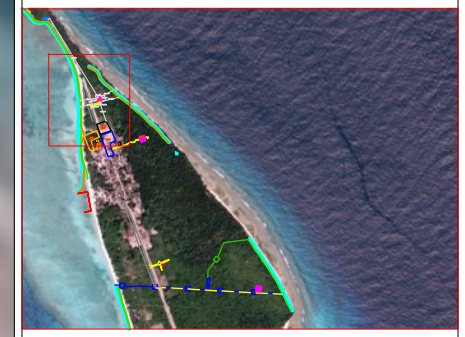
2nd Floor, Aakakaage-1, Galolhu
Alikilegefaanu Magu
Male', 20129
Republic of Maldives
(960) 301-0855
(960) 301-0844
info@meeco.com.mv

Key Plan



Notes :

*UNITES ARE IN METERS.
*COORDINATES SYSTEM (UTM84-43N)

CP	NOTHING (m)	EASTING (m)	ELEVATION
01	783630.1245	270713.6866	1.45m
ULIGAM			

*PLOT SIZE=625sqm
*TREES TO BE REMOVED = 0 NOS
*DISTANCE TO MAIN ROAD = 37.8m
*DISTANCE TO FOOTBALL GROUND/SCHOOL = 94.50m
*DISTANCE FROM SHORE/VEGETATION LINE = (AVERAGE)

LHS	RHS
80.68m	70.25m

LEGEND

HWL
LWL
VEGETATION
MAIN ROAD
SENSITIVE AREA
PLOT
FOOTBALL GROUND
SCHOOL
PERMANENT BUILDING
ACCESS ROAD

SCALE :	1:1540
SURVEYED BY :	DINAL (SURVEYOR)
DATE OF SURVEY :	2017/05/04
DRAWN BY :	DINAL (DRAUGHT MAN)
CHECKED BY :	DINAL (SURVEYOR / ENGINEER)
DATE OF SUBMIT :	2017/05/31

LOCATION
ULIGAM
HAA ALIFU ATOLL

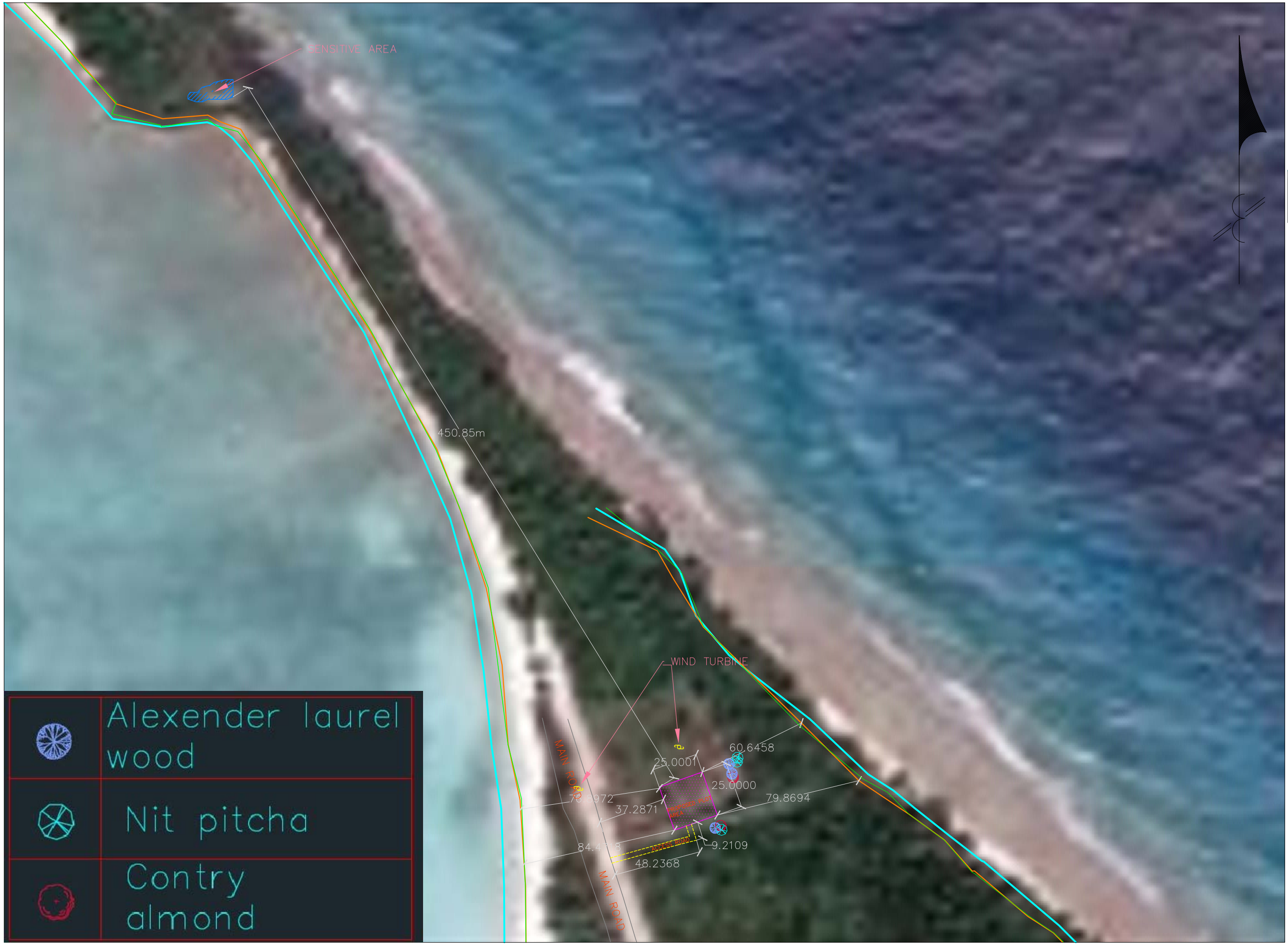
PROJECT : WASTE MANAGEMENT PROJECT ZONE 01

DRAWING TITLE : PROPOSED AREA DRAWING 02

DRAWING No :2017/055

SHEET No :05 OF 05

REV	DESCRIPTION	BY	DATE



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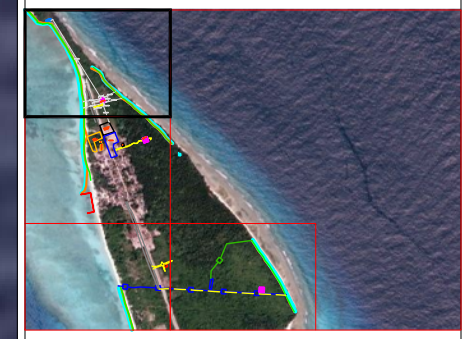
Alikilegefaanu Magu
Male', 20129
Republic of Maldives
(960) 301-0855
(960) 301-0844
info@meeco.com.mv

Key Plan



Notes :

*UNITES ARE IN METERS.
*COORDINATES SYSTEM (UTM84-43N)

CP	NOTHING (m)	EASTING (m)	ELEVATION
01	783630.1245	270713.6866	1.45m
ULIGAM			

*PLOT SIZE=625sqm
*TREES TO BE REMOVED = 0 NOS
*DISTANCE TO MAIN ROAD = 37.8m
*DISTANCE TO SENSITIVE AREA = 450.85m

*DISTANCE FROM SHORE/VEGETATION LINE = (AVERAGE)

LHS	RHS
80.68m	70.25m

LEGEND

	HWL
	LWL
	VEGETATION
	MAIN ROAD
	SENSITIVE AREA
	PLOT
	ACCESS ROAD

SCALE :	1:2000
SURVEYED BY :	DINAL (SURVEYOR)
DATE OF SURVEY :	2017/05/04
DRAWN BY :	DINAL (DRAUGHT MAN)
CHECKED BY :	DINAL (SURVEYOR / ENGINEER)
DATE OF SUBMIT :	2017/05/31

LOCATION
ULIGAM
HAA ALIFU ATOLL

PROJECT : WASTE MANAGEMENT PROJECT ZONE 01

DRAWING TITLE : PROPOSED AREA DRAWING

DRAWING No :2017/055

SHEET No :02 OF 05

REV	DESCRICTION	BY	DATE

بسم الله الرحمن الرحيم

Ministry of Environment and Energy
Male', Republic of Maldives.

މިނިސްޓްރީ އޮފް އެންވަޔަރަންމަންޓް އެންޑް އެނަރޖީ
މާލެ، ދިވެހިރާއްޖެ.

Date: 02nd August 2017

No: 438-WMPC/203/2017/96

Mr Ibrahim Naeem
Director General
Environmental Protection Agency
Handhuvaree Higun, Green Building,
Male', Maldives

Dear Sir,

<u>Sub: Commitment of the Proponent</u>

As the proponent of the proposed project, we confirm our commitment to finance and implement all construction and operational phase mitigation measures proposed in the EIA report and conduct the environmental monitoring program and overall management of the IWMC as specified in the report.

Yours Sincerely,

Ahmed Murthaza
Director General

MINISTRY OF ENVIRONMENT AND ENERGY
REPUBLIC OF MALDIVES

Green Building, Handhuvaree Hingun,
Maafannu, Male', 20392, Republic of Maldives.
+(960) 301 8300
+(960) 301 8301
www.environment.gov.mv

ގްރީން ބިލްޑިންގ، ހަނދުވަރީ ހިނގުން،
މާފަންނު، މާލެ، 20392، ދިވެހިރާއްޖެ.
secretariat@environment.gov.mv
www.twitter.com/ENVgovMV
www.facebook.com/environment.gov.mv

LED SAVES

EIA for construction of IWMC at Ha. Uligam

Print Cancel

M muslih.mujthaba@meeco.com.mv
Wed, 02 Aug 2017 13:44:24 +0500
To "haalifatollcouncil" <haalifatollcouncil@gmail.com>, "uligamcouncil" <uligamcouncil@gmail.com>
Cc "Ali Hammadh (Ali)" <ali.hammadh@meeco.com.mv>, "Maumoon Saleem (Maumoon)" <maumoon.saleem@meeco.com.mv>
Tags

External Images are not displayed

Dear Muaz,

Please find attached EIA report for construction of Island Waste Management Center at Ha. Uligam.

Regards,

Muslih Mujthaba
Assistant Surveyor

MEECO
Aakakaage, Galolhu, Alikilegefaanu Magu, Male', 20129, Maldives.
Mobile: +(960) 761 3449 | Tel: +(960) 301 0855 | Fax: +(960) 301 0844 | www.meeco.com.mv

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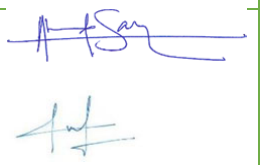
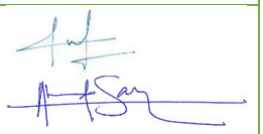
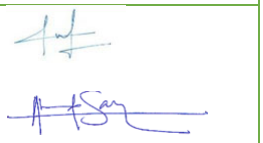
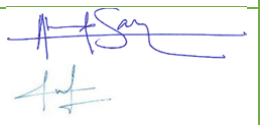
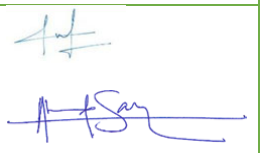
1 Attachments

Uligam - waste EIA v3.pdf

Chapter	Page Number	Names of Contributors	Consultant Number	Signature
1. Introduction	1	Ahmed Saleem Ali Hammadh	EIA 03/13 EIA T12/15	
2. Project Description	18	Ali Hammadh Maumoon Saleem	EIA T12/15	
3. Legislative	64	Ali Hammadh Ahmed Saleem	EIA T12/15 EIA 03/13	
4. Existing Environment	89	Ali Hammadh Muslih Mujtaba	EIA T12/15	
5. Impact and Mitigation	139	Ali Hammadh Ahmed Saleem Maumoon Saleem	EIA T12/15 EIA 03/13	
6. Stakeholder Consultation	114	Ali Hammadh	EIA T12/15	
7. Monitoring and Management Plan	179	Ahmed Saleem Ali Hammadh Maumoon Saleem	EIA 03/13 EIA T12/15	
8. Recommendation and Conclusion	199	Ali Hammadh Ahmed Saleem Maumoon Saleem	EIA T12/15 EIA 03/13	

بسم الله الرحمن الرحيم

ތިލަދުންމަތީ އުތުރުބުރީ އުލިގަމު ކައުންސިލްގެ އިދާރާ
އުލިގަން، ދިވެހިރާއްޖެ

ކުނިމެނޭޖުކުރުމާއި ބެހޭ ޕްލޭން

2021-2017

20 ސެޕްޓެމްބަރ 2016

ތަޢާރަފާއި ނަން .1

(ހ). މިއީ ޤާނޫނު ނަންބަރު 7/2011 (ދިވެހިރާއްޖޭގެ އިދާރީ ދާއިރާތައް ލާމަރުކަޒީ އުސޫލުން ހިންގުމުގެ ޤާނޫނު) ގެ 15 ވަނަ މާއްދާގެ (ނ) އިން ބާރުލިބިގެން އުފެދިފައިވާ ހއ.އުލިގަމުގެ ކައުންސިލް ބަޔާންކުރާ ގޮތެވެ.

(ށ). މި ޤާނޫނަށް ކިޔާނީ " ހއ.އުލިގަމުގެ ކައުންސިލުގެ ޤަވާޢިދު ބަޔާންކުރުން" އެވެ.

(ނ) ރަށުގެ ތަޢާރަފު:

ހއ.އުލިގަމަކީ ރާއްޖޭގެ އެންމެ އުތުރުގައިވާ ހއ.ތިލަދުންމަތީ އުތުރުބުރީގައި އޮތް ރަށެކެވެ. ރަށުގެ ދިގުމިނުގައި 8800 ފޫޓު ހުރެއެވެ. ފުޅާމިނުގައި 2600 ފޫޓު ހުރެއެވެ. ބޮޑުމިނުގެ ހިސާބުން ރާއްޖޭގެ ރަށްތަކުގެ ތެރޭގައި 15 ވަނަ އަށަށް ރަށުގައި މީހުން ވެރިން އުމުރުގެ 49 މީހުންނެވެ. އުލިގަމު ރައްޔިތުން އުޅުނުން ފޮނުވާ ފަސްގަނޑުގެ ދޫކުރުން އެވަގުތު ބަނދަރަށް ހއ.ދިއްދޫއަށެވެ.އުލިގަމު މިހުން ދިޔުމުގެ ބަދަލު ކުރަންފެށި ތާރީޚަކީ 1968 ވާ ބޮޑުސޯފާގައި ދުވަހުގެ. ރަށުންބޭރުގައި އުލިގަމުގެ ރައްޔިތުން 7 އަހަރުގައި 8 ދުވަސް މިބަދަލުކުރަނީ އަހަރުން އާބާދީ 1975 އޮގަސްޓް 4 ވަނަ ދުވަހެވެ. ރަށުން މިހުން ބާކީއަށް ރަށުގައި ހުރި 31 ގެއެވެ. އާބާދީގެ އާބާދީ އަދި 159 އެވެ. 7 އަހަރު ފުރުން އެންމެ އާއިލު އާބާދީއަށް 200 އެވެ.ހއ.އުލިގަމުގައި ކުރިން މަދަރުސާއަށް މިވަގުތު ރަށުން ދިރާސާކުރާ މަދަރުސާތަކުގެ ތަޢުލީމު އެންމެ ބޮޑު އެއްމަދަރުސާއެވެ. ކުރިން މަދަރުސާ މިހާ ބޮޑުވެފައިވަނީ ރަށުގައި އެކަށީގެންވާ ގޮތުގައި ކުރިމަތިލާކުރުން ގޮތުން ނަމޫނާގެ ސަރަޙައްދެވެ. މަދަރުސާ ހަރުދަނާކުރުން އަންނަނީ ރަށުގައި އެކަށީގެންވާ ރަނގަޅު ފެންވަރުގެ ކުރިއެރުމާއި ޚިދުމަތްދިނުމެވެ. ރަށުގެ ރައްޔިތުން މަގުތަކާއި ގޮނޑުދޮށުގައި ކުނި މަސައްކަތްތަކަށް ރަނގަޅު ފެންނަ، ފެންވަރުން، މަސްވެރިކަމާއި ދަނޑުވެރިކަމެވެ. ރަށުގައި ރަނގަޅު ފެންވަރުގެ ސިއްޙީ ހިދުމަތް ލިބެންހުރެއެވެ. އަދި ތަޢުލީމުގެ އިމާރާތް ރަށުގެ އަންނަ ބޮޑުގެ އުފެދުން ފުރަތަމަ ހިދުމަތް ދިނުމުގެ ކަސްބުގެ އާއި އިމާރާތްކުރުން އަދި ކޯޓު ހުރިހާ އެޗް.އެސް.ޖީ.ޑީގެ ހިދުމަތް ރަށުން ލިބެންހުރެއެވެ. އަދި ރަށުގައި އަމަލުތަކެއް ފައިދާކުރުމުގެ ކައުންސިލްގެ އިދާރާގެ ޖުމްލަ ޖެނެރަލް ކުރެވިފައިވެއެވެ. މިޤާނޫނުގެ މައިގަނޑު ކުރި ލާމަރުކަޒީކުރުމުގެ މިހާރު ދިރާސާކުރާ ގޮތުގެ ހިންގުމަށް ރަށުގެ ގޮތުގައި ރަށުގައި އުފެދިފައި ލާމަރުކަޒީކުރެވެ.

ތަސައްވުރު .2 ސާފު އުލިގަން

މިޝަން .3

- ➢ ހެދުންތަކުގައި ކައުންސިލް ކުރުމުގެ އަސާސީތަކުން ހޯދުމަށްފައިވާ ރައްޔިތުނަށް ދިރިއުޅޭ ރަނގަޅު ހެދުން
- ➢ ރަށުގެ ރައްޔިތުންނަށް ރަށުގެ ތިބިތަކުން ދުވެހުންނަށް މަސައްކަތް ކުރުމާއި ކަމުގައި ހެދުން
- ➢ ރައްޔިތުންނަށް ސާފު ތަރުކާއަށް ދިރިއުޅޭ ބައްޓަމުގައި ހެދުން
- ➢ މި ރަށުގެ މާހައުލަށް ނުފޫޒުން ސާފު ތަންތަނުގައި ހެދުން
- ➢ ސާފު ގޯތިތެރެ ހިފާ ރަށްޓަކައި ދުވަހުން

4. ޤާނޫނާއި ވާގި ތަޢާރުފު ކުރުން މި ގަވާއިދު ކުރިއަށްގެންދެވޭނީ ކައުންސިލުން ފާސްކުރާ ދުވަހުން ފެށިގެންނެވެ.

ވޭސްޓް މެނޭޖްމަންޓް ޕްލޭން ގާއިމް ކުރުން 5. މުއައްސަސާތަކުން ކުނިއުކާލާ ގޮތްބަދަލް، ރައްޔިތުންގެތެރޭގައި ކުނިއުކާލާ ގޮތްބަދަލް، ކައުންސިލުން ކުނިއުކާލާ ގޮތްބަދަލް (ޖުމްލަ 3)

ކުނިމެނޭޖް ކުރުމުގައި ރަށުގެ ސާފުތާ 6-

-1 ސާފުތާ އެތެރޭގެ ތަފްސީލް (ކުނިން، ކުނިމެނޭޖް ކުރުމުގައި ކުނިއުފެދުން ވަކިހާއްސަ ތަންތަން ކުނިއެޅުމަށް، ނަގަހުސް އެތަންތަނަށް އުފުލުން ވަކިވައްތަރުތަކަށް ހާއްސަކުރުވުމުގައި ނުވުމުގެ ސަބަބުން ތަންތަނަށް ކުނިތަކެއްޖާގަ އިތުރު ގޮނޑުދޮށް ސަރަހައްދުތަކަށް ބަދަލުވެފައިވޭ. މިދިޔަ ތަންތަނުގައި އަނދާލާ ބަލަދު ކުނި އަނދުން ފިޔަވާ އިތުރު ކަވެއްސުންކުރޫ، މިގޮތުން ދިރޭއުޅުމަށް ދިރިއުޅުމުގެ ފެންވަރަށް އަސަރުކުރުން ބަދަލުގެނެސް ބޭނުންކުރަނީ ބައްޓަންކުރަންޖެހޭ ތަކެއްޗަކީ އަލުން ފަހަރުކުރުމަށް ނަގާފުދޭ ނުކުރެވޭ ތަކެތި ކަރުދާސް އެތަކެތި ރައްޓަން ބަދަލުކޮށް އާއްސަކޮށްދޭ ނޫޅެނެފެދޭ.)

-2 ކުނިއުފެދޭ ތަންތަން: (ކުނި އުފެދުމަ މީހުން ދިރިއުޅޭ ގޭގޭ، ސަރުކާރުގެ މުއައްސަސާތައް، ވިޔަފާރިކުރާތަންތަން، މަގުމަތިން ، އިޖުތިމާއީ ސަރުކާރުން ކުނިކަރާގައި ނޫޅޭ ކުނި ، ދަނޑުވެރިކަން، ކުލިވަރު ކުނި ފަރާތްތަކުން އުފެދޭތަކެއްޗާ ކުނި، ކޮންސްޓްރަކްޝަން ސައިޓް).

-3 އުފެދޭ ކުނީގެ ބާވަތް: (ފަރާތްތަކުގެ ކުނި ފަތް ކުނި ، ބަރުގެ ކުނި، ދަނޑުވެރިގެ ބާވަތް، ދަގަނޑު، ފުޅި، ބިއްލޫރި ޕްލާސްޓިކް، ނުރައްކާތެރި ކުނި، އެހެނިހެން)..

-3 އުފެދޭ މިންވަރު: (މިރަށުގައި އުފެދޭ ކުނީގެ ނިސްބަތަށް ބަލާއިރު މާގަނޑު ކުނިބަޔަކީ، ފަތްކުނިއާ ދަގަނޑު ފުޅިއާއި ބަރުގެ ކުނިތަކެވެ.ދުވާލަކަށް މިރަށުގައި އުފެދޭ ކުނީ މިންވަރަކީ: ފަތްކުނި 0.06 ޓަނު،ބަރުގެ ކުނި 0.04 ޓަނު، ދަގަނޑު 0.012 ޓަނު، ފުޅި 0.0048 ޓަނު ،ދުވާލަކަށް ޖުމްލަ: 0.1168 ޓަނު،އަހަރަކަށް ޖުމްލަ 3.504 ޓަނު)

-4 އަލުން ބޭނުންކުރެވޭ ކުނީގެ މިންވަރު: (ސޯޓް ކުރުމަށް މަސައްކަތްކުރާ މުވައްޒަފުންނަށް ދެކިދާ ހަށްވިނަތަކުގެ ދަށުން ފިލުވައިލެވޭ ގޮތަށް ޤާއިމްކުރާ ފަރާތްތަކުގެ މަސައްކަތް ގިނަގުނަ ކުރުމުން އުފެދޭ ކުނީގެ 0.1 ޕަސެންޓު އަލުން ބޭނުންކުރެވެނީ.)

ކުނިމެނޭޖްކުރުމުގެ މަސައްކަތުގައި ކުނިއުކާލާނެ ތަނާއި ކުނިއެޅުއްވުން ހިނގާ ސަރަހައްދުގައި ކައުންސިލްގެ ބަރާބަރު ކުރުމަށް ބޭނުމިވާނެ މަސައްކަތްތަކުގެ ތާވަލު އަދި މަސައްކަތް ކުރުމުގައިވާ ކޮޓަރިއާ ބެހޭ މަސައްކަތް 7 .

ހަރަކާތްތައް	ވަސީލަތްތައް	ބައިވެރިވާ ފަރާތްތައް	ޒިންމާވާ ފަރާތް	އަމަލުކުރާ މުއްދަތު	ކުރިޔަ ވާ ބަރަދު	ޚަރަދު ބަޖެޓް ވާ ކޮސްޓް
1-ކުނި މެނޭޖް ކުރުމުގެ ތަފްސީލު ރަށުގައި ހުރި މުއައްސަސާތަކުގެ ވެރިންނާ ބައްދަލުކުރުން	ސިޓީ މަޢުލޫމާތު، މަދަރުސާ، އިސްކޫ ނަގާ، ކަސްޓަމްސް، އިމިގްރޭ ޝަން، އެމް އެން ޑީ އެފް	މުއައްސަސާ ތަކުގެ ވެރިން	ކައުންސިލް	17 އޮގަސްޓް 2016 ގައި ވަގުތު 10:00		
2.ކުނި މެނޭޖް ކުރުމުގެ ތަފްސީލު ރަށުގައި ހުރި މުއައްސަސާތަކުގެ މުވައްޒަފުންނާ ބައްދަލުކުރުން	(ސިޓީ މަޢުލޫމާތު، މަދަރުސާ، އިސްކޫ ނަގާ، ކަސްޓަމްސް، އިމިގްރޭ ޝަން، އެމް އެން ޑީ އެފް)	ރަށުގައި ހުރި މުއައްސަސާތަކުގެ މުވައްޒަފުން	ރަށުގައި ހުރި ސަރުކާރުގެ އޮފީސްތައް	އެ އޮފީސްތަކުން ކަނޑައަޅާ ތާރީހެއް		
3.ރަށުގައި މީހުން ދިރިއުޅޭ ގޭގޭގެ ޒިންމާދާރުންނާއި މަޢުލޫމާތު ފޯރު ކުރުން (ގޭގޭ ފެންވަރުގެ ބައްދަލުވުން)، (މި މަސައްކަތަކީ ކުރިއަށްދާ މަސައްކަތެކެވެ.)	ކައުންސިލްގެ މުވައްޒަފުން	ރަށުގައި ދިރިއުޅޭ ފެރިން މީހުން ގޭގެ	ކައުންސިލް	3 މަސް		
4-ކުނިމެނޭޖް ކުރުމުގައި		ކައުންސިލްގެ މުވައްޒަފުން ނާއި	ކައުންސިލް	ފާހަގަކުރެވޭ ވަގުތު ދަތުރުކުރާ ރަށްތަކުގައި		

އަމަލުކުރަންޖެހޭ ޤަވާއިދެއް އެކުލަވާލުން:		އެހެން މުއައްސަސާތަކާއި ފަރުދުން، ކައުންސިލް ، ޖަމްޢިއްޔާ		އިސްތިހާރުކުރެވޭ އެކުލަވާލެވިފައި، ޤަވާއިދުގެ ސްކޫލް ކޯޓު އަތޮޅުގެ މަދަރުސާ އަތޮޅު އަތޮޅުގެ ހެލްތު މަދަރުކަޒު އިސްތިހާރު ހަރަކާތްތެރި ފުރުސަތު ހުޅުވާލި ފޮނުވިފައި ވަނީ. މަދަރުސާއިން ވަނީ ގޮނޑުދޮށު ބޮޑުބޮޑު އިސްތިހާރާ އެކު ޤަވާއިދު ކައުންސިލްގެ ފޭސްބުކްގައި		
5-ކުނިމެނޭޖް ކުރުމާއި ކުނިނައްޓާލުމާބެހޭ ޤަވާއިދުގެ 15 ވަނަ މާއްދާގައި ބުނެފައިވާ ކުނި މެނޭޖް ކުރުމުގައި އަމަލުކުރަންޖެހޭ އުސޫލު އެކުލަވާލުން: (ކުނި މެނޭޖްކުރަންޖެހޭ އުސޫލެއް ވަނީ އެކުލަވާލެވިފައި)	ކައުންސިލްގެ މުވައްޒަފުން	ކައުންސިލްގެ މުވައްޒަފުން ނޫނީ އެހެން މުއައްސަސާތަކާއި ފަރުދުން، ކައުންސިލް ، ޖަމްޢިއްޔާ	ކައުންސިލް	؟		
6-ވޭސްޓްމެނޭޖްމަންޓް ސެންޓަރ ގާއިމުކުރާނެ ބިމެއް ކަނޑައެޅުން		ކައުންސިލްގެ މުވައްޒަފުން ނޫނީ އެހެން މުއައްސަސާތަކާއި ފަރުދުން، ކައުންސިލް ، ޖަމްޢިއްޔާ	ކައުންސިލް	ބިމެއްކަނޑައެޅި ބިމުގެ މައުލޫމާތު މިނިސްޓްރީއަށް ވަ ނީ ފޮނުވާލެވިފައި		
7-ވޭސްޓްމެނޭޖްމަންޓް ސެންޓަރ ގާއިމުކުރުން	ވަސީލަތެއް ނެތް	ކައުންސިލް/މިނިސްޓްރީ އޮފް އެންވަޔަރަމަންޓް އެންޑް އެނަރޖީ	މިނިސްޓްރީ އޮފް އެންވަޔަރަމަންޓް އެންޑް އެނަރޖީ/ކައުންސިލް	ބިން ކަނޑައެޅުން ފިހާރާ އިމާރާތް މަސައްކަތް ބިމުގައި ކުރުވިފައި ނުވާ		
8-ސެންޓަރު ގާއިމު ކުރުމަށްފަހު ސޮލިޑް ވޭސްޓް އަޅާނެ ތަނެއް ކަނޑައެޅުން		ކައުންސިލް/ރައްޔިތުން	ކައުންސިލް	؟		
9-ސޮލިޑް ވޭސްޓް އެޅުމަށް ކަނޑައެޅިތަނުގައި އެތަނަކަށް ހުރެސަކަރުވެފައިވާ އަށްބޮޑު އެއްގެންގަނޑެއް ކައުންސިލުން ބަލާ ގެ ޖަހަން،		ކައުންސިލް	ކައުންސިލް	؟		

ވޭސްޓްމެނޭޖްމަންޓް ސެންޓަރ ގާއިމުކުރާނެ ބިމެއް ކަނޑައެޅުން 8.

(ބިމެއްކަނޑައެޅި ބިމުގެ މައުލޫމާތު މިނިސްޓްރީއަށްވަނީ ފޮނުވާލެވިފައި)

ވޭސްޓްމެނޭޖްމަންޓް ސެންޓަރ ގާއިމުކުރުން 9.

ސްކޫލްބަސް ގާއިމުކުރުމާއި ސްކޫލްބަސް އާއި ގުޅޭގޮތުން ކުރަންޖެހޭ މަސައްކަތްތައް ކުރުން މިނިސްޓްރީ އޮފް
އެންވަޔަރަމަންޓް އެންޑް އެނަރޖީގެ ފަރާތުން ވަކި މިންގަނޑެއް ކަނޑައަޅާފައިވާނަމަ، އެފަރާތުގެ މަސައްކަތްތަކުގެ ކުރިއަށްދާނެ
)

ސްކޫލަށް ގާއިމު ކުރެވެންދެން ސަރުކާރު ޚާއްސަ އަޅާލުން ބޭނުންވާ ކަނޑައެޅުން 10.

ކ. ކައުންސިލުން ސަރުކާރު ޚާއްސަ އަޅާލުން ބޭނުންވާ ކަނޑައެޅުން،

ރ. ކައުންސިލުން އެކުލަވާލައި ބޭނުން ކުރުން،
ގުޅޭގޮތުން ކުރިޔާއި ވަކިން، ހާއްސަ ކުރުމަށްޓަކައި ކުރަންޖެހޭ ގޮތުން ކައުންސިލްގެ މަސައްކަތްތައް ވާ ގައި ހ.އ (ޕްރޮގްރާމް
އަންނަ ކުރިމަތިކުރާ ގޮތާއި އަމަލުކުރަން ޖެހޭ ގޮތަށް. އަދި ޔުނިޓު ކުރަންޖެހޭ ކަމަށް ތަކުރާރުކުރުމަށް. ޙާލަތުގައި ފުރިހަމަ ކުރުމަށް
ކުރެވޭނެ. އަދި މަސައްކަތްތަކުގެ ގޮތުގެ ކުރިއަށް ގެންދިއުމުގެ ކުރާނެގޮތް (ޕްރޮގްރާމް ކަމަށް ކުރެވޭނެ ގޮތް ވަނީ، ކުރިއަށް
ފުރިހަމަ ކުރެވޭގޮތް އެއްގޮތް ކުރުމަށް ދެމިހުރި ކުރުމަށް ކަމެއް. އިސްލާމް ދީނާ އަދި ޤާނޫނު އަސާސީގެ މަސައްކަތް
ކުރަމުން ފުރިހަމަ ކުރުން ކަމެއް.

11. ބަހައްޓާފައި ހުރުން ސްކޫލު މުވައްޒަފުން (މި މަސައްކަތް الله އިސްލާމީ ތަރުބިއްޔަތާ، ކައުންސިލުގެ ފުރިހަމަކަން ކުރުމަށް
ސްކޫލުގެ އަސާސީ ކުރުމަށް ކުރާ މަސައްކަތުގެ ގޮތުގެ. ކުރުމުގެ ގޮތުގައި ހިއްސާކުރާ ގޮތުގެ ކުރު ތަރުބިއްޔަތު،
ކައުންސިލްގެ އިދާރީ ހިންގުމަށް ކުރާ މަސައްކަތުގެ ގޮތުގެ. ކުރިމަތި ކުރުމަށް ކައުންސިލުގެ އަދާކުރާ. ކައުންސިލު
ކައުންސިލްގެ ފުރިހަމަ ފުރުޞަތު ހޯދައިދިނުމަށް ދަރިވަރުންގެ މަސައްކަތް ކުރުމަށް ކައުންސިލްގެ އަދާކުރާ. ހިއްސާކުރާ
ސަރުކާރުގެ ތަރުބިއްޔަތު ދިރާސީ ބޭނުމަށް ބަޔަކު ތަޢުލީމު ދިނުމާއި، ފުރުޞަތު، ބަލައި އެކުލަވާލުން ސްކޫލުގައި ފާހަގަ
ކުރުމަށް ހިއްސާކުރާ ގޮތަށް ކުރުމަށް. ތަރުބިއްޔަތު ކުރާ މަސައްކަތް ކުރިމަތި ކުރުމަށް އެކިފަރާތް ބަލައި
ކުރުމުގައި ތަރުބިއްޔަތު ގަވާއިދު ކުރުމަށް. މަސައްކަތް ކުރަން ތަޢުލީމީ ފުރުޞަތު ހޯދައިދިނުމަށް ދާއިރާ ދަރިވަރުން
ދަރިވަރުންގެ ބާރުދިނުން ކުރުމަށް ކުރުމުގެ ގޮތުގައި ކުރުމަށް. މަސައްކަތް ކުރުމަށް އެކުލަވާލާ ޚާއްސަ ތަޢުލީމީ ކަމާ
ތަރުބިއްޔަތު އެއްކޮށް ދަރިވަރުން ކުރުމަށް މަސައްކަތް ކުރުމަށް އެކިއެކި މަރުޙަލާ ތަޢުލީމު ދިނުމުގެ ކުރެވޭ
ކުރުމަށް އެކުލަވާލުން.)

ރ.5 މުވައްޒަފުން ހޮވުން، (ތަރުބިއްޔަތުގެ މަސައްކަތުގެ3،ސްކޫލުގެ އިދާރީ ކަންކަން ބަލަހައްޓައި 2)
ރ- މުވައްޒަފުން ބޭނުންކުރުން، (ކުރި ގާއިމުކުރުމުގެ މަސައްކަތުގެ ތަޢުލީމު ބޭނުންވާ ކުރުމުގެ ބަޔާން ކުރިއަށް
ގެންދިއުން)

ރ- މުވައްޒަފުންގެ މަސައްކަތް ހަވާލުކުރުން،
ޕީ ޓީއޭ މިންވަރާއި އުސޫލު: (ފިޔަވަޅު ކަނޑައެޅުމަށް އެކި ކަމެއްގައި ވިޔަސް ޕީ ޓީއޭގެ ފަރާތުން ،އެކުލަވާލި ޚާއްސަ
މުސާރަދިނުން ސްކޫލު ގާއިމު ކުރުމުގެ ސްކޫލްތަކުން ކުރި އެކުލަވާލާ ދިރާސާތައް ރަސްމީކޮށް ކުރިއަށް ގެންދިއުން. އަދި
ދިރާސާ ރަސްމީކޮށް ކުރިއަށް ކަމެއްގައިވިޔަސް ކަނޑައެޅުމަށް އުސޫލުގެ މަސައްކަތް ފިޔަވަޅު އަޅަނީ އެ ދިރާސާއިން އެކަށީގެން
ފާހަގަ ކުރުން. އެންމެ ފަހުގެ މަޢުލޫމާތު ގެންގުޅުމަށް ދާއިރާ އުސޫލުތަކެއް.)

1. ގޭ ބިސް: މަގުގެ 100 ރުފިޔާ
2. މުހިއްމު ރަސްމީ ކާނާ: ބައިފޮރުވާން ބޭނުންވާ މަގުގެ 100 ރުފިޔާ (ބައިފޮރުވާން ބޭނުން ކުރާތަކެތި
ގެން ދާ ތަކެތި ބޭނުންވާ ކުރަން ގެންދިއުން)
3. ފެން،ކާބޯ،ތަކެތި:މަގުގެ 200 ރުފިޔާ)
4. ސަރުކާރުގެ އިދާރާތައް: މަގުގެ 200 ރުފިޔާ)
5. ވަޒީފާ ކުރާތަން: މަގުގެ 150 ރުފިޔާ)
6. ދިރާސާ/ވަކިވަކި ސަރަޙައްދު: މަގުގެ 200 ރުފިޔާ)
7. ފެން ބޯ ތަރުކާރީ: މަގުގެ 200 ރުފިޔާ)
8. މިސްކިތް: މަގުގެ 200 ރުފިޔާ)
9. ފާހާނާ: މަގުގެ 150 ރުފިޔާ)
10. އިޖުތިމާޢީ ސަރަހައްދު ސާފުކުރާ ތަކެތި: މަގުގެ 200 ރުފިޔާ

12. ޒިންމާދާރު ބަހައްޓާފައި

ސޮފްޓްވެއަރ ގާއިމުކުރުވި މަސައްކަތްތަކަށް ކުރެވެންފެށުމުން ކަން ހިނގާނުހިގާތީ ޔޫސްބީ ފްލޭޝްޑްރައިވް ބޭނުން ފޯމެޓުކުރުން. ނަމަވެސް ކޮމްޕިއުޓަރުތަކުގެ އޮޕަރޭޓިން ސިސްޓަމް ބަދަލު ހިންގުމުގެ އެންމެ އިސް ފަރާތަކީ އުޅެގަތު ކައުންސިލްއެވެ. ނުވަތަ ކައުންސިލުން ހަވާލުކުރާ ފަރާތެއްކަމެވެ.

ޕްލޭން ބަޔާންކުރުމުގެ މަސައްކަތް ކުރިއަށް ގެންދިޔުން ގޮތް 13.

1- ކައުންސިލްގެ ފަރާތުން ރަށުގެ މުނިސިޕަލިޓީ ގެތަކަށް ޖާގަދޭކަން މައުލޫމާތު ފޯމުތަކެއް މައުލޫމާތު ގާއިމުކުރުން .

2- ބައްދަލުވުމުގެ ބޭއްވި ހިޔާލުހޯދުން.

Environmental Protection Agency

އެންވަޔަރަންމަންޓަލް ޕްރޮޓެކްޝަން އެޖެންސީ

ކައުންސިލަށް ރަށުގެ ސަރަހައްދުން ކަނޑައެޅުމާއި އެސަރަހައްދުން ވެލި ކަނޑަން ބޭނުންކުރާ ފޯމު

1	އާއްމު މައުލޫމާތު
ރަށް: [illegible]	އަތޮޅު: [illegible]
ރަށުގެ އާބާދީ: 513	ރަށުގެ ބޮޑުމިން (ހެކްޓަރު/ އަކަމީޓަރުން): 112 ހެކްޓަރ

ކައުންސިލަށް ދުސަރަހައްދު (އާއްމު ބޭނުން ބޭނުންވާ ސަރަހައްދާއި ދުވަހަކުން ބޭނުންވާ ސަރަހައްދު) ކަނޑައެޅުމުގައި އެދުމަށް އަނބުރާ ރަށުގެ ވެށީގެ ހާލަތު ހޯދާ ރަށުގެ މާހައުލުގައި ފާހަގަކުރެވޭ.

☑ އާއްމު ބޭނުން ބޭނުންވާ ސަރަހައްދު

☐ ދުވަހަކުން ބޭނުންވާ ސަރަހައްދު

ސަރަހައްދު ވަކިކުރުމުގައި ބަލާ ސަރުތުތައް

2	ރަށުގެ އާބާދީ އާ ގުޅޭ ބޮޑުމިނުގެ ހިސާބުން ދިމާވާ ބޮޑުން

ވާސްޓް މެނޭޖްމަންޓް ސެންޓަރ ގާއިމުކުރުމަށް ދިމާވާ ހިސާބުން ރަށުގެ އާބާދީއާ ގުޅޭ ބޮޑުމިނުގެ ސައިޒު (ހިރަގުނޑު ގޮތުގައި ފާހަގަކުރެވޭ ގޮތަށް ކޮންމެ ވެސް އިންޖީނިއަރިން ފޮރުވާ ބައްލަވާ)

އާބާދީ	ވާސްޓް މެނޭޖްމަންޓް ސެންޓަރ އަށް ބޭނުންވާ ބޮޑުމިން (އަކަމީޓަރުން)	
500 އިން ދަށް	500	
750-500	625	✓
1000-750	700	
1500-1000	750	
2000-1500	825	
2500-2000	950	
3000-2500	1000	

3	ވާފޯރުމުގެ ވަސީލަތަކާއި އަދި ރަށުތެރޭގައި އެއްގޮތްގައި ދުއްވުމަށް ބޭނުންކުރެވިދާނެ މިންވަރު	ފުރިހަމަ ވާ	ފުރިހަމަ ނުވޭ
	(ހ) ކޮންމެހެން، ބަނދަރު ހުވަތަ ދޯނި ފަދަ އުޅަނދުތަކުން ރަށަށް ވަސީލަތުން ބަނދަރުކުރެވޭތޯ؟	✓	
	(ށ) ވާސްޓް މެނޭޖްމަންޓް ސެންޓަރ ގާއިމުކުރުމަށް ކަނޑައަޅާ ސަރަހައްދުން ބަނދަރަށް، ދޯނި އަދި ލޯރީ ފަދަ އުޅަނދު ދުއްވަނުވާ އެއްވެސް ދަތިކަމެއް ނެތި ޒަމާނީ އުފުލުމަށް މަގު ހުރިތޯ؟		✓

4	ވާފޯރުމުގެ ވަސީލަތަކާއި އަދި ރަށުތެރޭގައި އެއްގޮތްގައި ދުއްވުމަށް ބޭނުންކުރެވިދާނެ މިންވަރު		
	(ހ) ކޮންމެހެން، ބަނދަރު ހުވަތަ ދޯނި ފަދަ އުޅަނދުތަކުން ރަށަށް ވަސީލަތުން ބަނދަރުކުރެވޭތޯ؟	✓	
	(ށ) ވާސްޓް މެނޭޖްމަންޓް ސެންޓަރ ގާއިމުކުރުމަށް ކަނޑައަޅާ ސަރަހައްދުން ބަނދަރަށް، ދޯނި އަދި ލޯރީ ފަދަ އުޅަނދު ދުއްވަނުވާ އެއްވެސް ދަތިކަމެއް ނެތި ޒަމާނީ އުފުލުމަށް މަގު ހުރިތޯ؟		✓

(1)

5	ބިމުގެ ފެންވަރަށް ރައްކާތެރިކުރުން		
	(ހ) ވޭސްޓް މެނޭޖްމަންޓް ސެންޓަރ ގާއިމުކުރުމަށް ސަރަހައްދު ކަނޑައެޅިފައިވަނީ ކުޑަ ރަށެއް ނަމަ ބަނދަރުން ވަރަށް ދުރުގައި މަދުވެގެން 30 މީޓަރު ދުރުގައި އޮންނަގޮތަށްތޯ؟	✓	
	(ށ) ވޭސްޓް މެނޭޖްމަންޓް ސެންޓަރ ގާއިމުކުރުމަށް ކަނޑައެޅިފައިވާ ސަރަހައްދާއި އެންމެ ކައިރީގައި ހުރި ގޮޅިއެއްގެ ފެންނަގާ ވަޅާ ދުރުމިން މަދުވެގެން 30 މީޓަރުގެ ދުރުމިން ހުރިތޯ؟	✓	
6	ގުދުރަތީ ބޭނުންތަކަށް ރައްކާތެރިކުރަންޖެހޭ ގޮތް އަދި ރަށުގައި ވާ ދަނޑުބިންތަކާއި		
	(ހ) ކުނިއެއްލުމަށް ކަނޑައެޅިފައިވާ ސަރަހައްދު ކުނިއެޅުމަށް ބޭނުންކުރާ އެއްޗެއް ބޭރަށް ނުދާނެ ގޮތަށް ގޮތްތަކެއް ހަމަޖެހިފައިވޭތޯ؟	✓	
	(ށ) ސަރަހައްދު ކުނިއެޅުމަށް ބޭނުންކުރުމުގެ ސަބަބުން އަދި ދިރުމަށް ގެއްލުމެއް ލިބިދާނެ ކަމަށް ބެލެވޭ ހާލަތެއް ދިމާވެފައިވޭތޯ؟	✓	
	(ނ) ސަރަހައްދަކީ ބޭނުން ވަނީ ހަވާލުވެފައިވާ ފަރާތުން ބަލަހައްޓާ ތަނެއްތޯ؟	✓	✗
	(ރ) ސަރަހައްދު އާއި ގުޅިފައިވާ ހުރަސް ގުޅިފައިވާ ބަޔަކު ނިގުޅައިގަނެވޭތޯ؟	✓	
	(ބ) ސަރަހައްދު އާއި ދުރުގެ ގޯތިތަކުން ހުރަސް ބޭނުންކުރުމުގައި ހުރަސް ހިފެހެއްޓުމަށް ފުރަގަސް މަދުވެގެން 15 މީޓަރު އެއްގޮތަށް ވަކިކުރެވޭތޯ؟	✓	
	(ޅ) ސަރަހައްދުގައި އެތަން ބަލަހައްޓާ ސަރަހައްދު ގޮތުގައި އެއްވެސް ގޮތަކުން ދިރޭ ހިސާބެއްގައިތޯ؟	✓	
7	މިރުން ދިރުމަށް ބިސާތު ކުނިއެޅޭ ސަރަހައްދު ހުރި ދުރުމިން		
	(ހ) ކުނިއެޅުމަށް ސަރަހައްދާ އެންމެ ކައިރި ގޯތި ހުރި ގެއާ ހުރަސް ދުރުމިން މަދުވެގެން 30 މީޓަރުގެ ދުރުމިން ހުރިތޯ؟ (ދުރުމިން ކައިރިގައި އޮތްނަމަ އިންސާފު)……………(މީޓަރު)……………	✓	
	(ށ) ގެއްލުން ދިރުން އެއްވެ އޮވޭ ސަރަހައްދު ވޭސްޓް މެނޭޖްމަންޓް ސެންޓަރ ގާއިމުކުރުމަށް ކުނިއެޅުމަށް ސަރަހައްދު ދުރުމިން މަދުވެގެން 40 މީޓަރުގެ ދުރުމިން ހުރިތޯ؟ ދުރުމިން ކައިރިގައި އޮތްނަމަ އިންސާފު……………(މީޓަރު)……………	✓	
8	ކުނިއެޅޭ ސަރަހައްދުގައި ހުސްބިމާއި އާއި މިންވަރު		
	(ހ) ސަރަހައްދަކީ ހުސްބިމެއް އާއި ބިމުއޮތީ؟ އަދި ކުނިގެ އެޅިފައިވާ ސަރަހައްދުގެ ބޮޑުމިނަކީ ……625.25……… އަކަ މީޓަރު	✓	
	(ށ) ސަރަހައްދުގައި ކުނިގެ ލެވެލް ދެމެހެއްޓުން ހުރިތޯ؟ ސަރަހައްދުގައި ކުނިގެ ލެވެލް ……—…… ފުޓް އަދި ……18…… ފޫޓު އުސްކޮށް	✓	
	(ނ) ސަރަހައްދުގައި ހުރި ކުނިގެ ލެވެލް ދަށްކުރަނީ ބަޔަކު ބަރުދު ދޫކުރާ ބައެއްތޯ؟	✓	
	(ރ) ސަރަހައްދުގައި ކުނިގެ ލެވެލް ދަށްކުރަން ބަރުދު ދޫކުރާނެ އިތުރު ގޮތް ……[illegible]…… ……………………	✓	
	(ބ) ސަރަހައްދުގައި ކުނިގެ ލެވެލް ދަށްކޮށް ހުރިގޮތަށް އެދުނު ކުނިގެ ސަރަހައްދު ސާފުކުރުން		
	(1) ރައްކާތެރި ގޮތަށް		
	(2) ބަރުދު ރައްކާތެރިކަން ކަނޑައެޅުން އިސްކުރުން.	✓	
9	ކުނިއެޅޭ ސަރަހައްދު މަތީގައި ބޯންކަންތައްތަކާއި ތާރީހަށް		

(1)

(ހ) މި ސަރަހައްދަކީ ކުރިންވެސް ކުނިއުކާލުން އަދި ސަރަހައްދެއް		✓
(ށ) މި ސަރަހައްދަކީ ދަނޑުވެރިކަމަށް ބޭނުންކުރާ ސަރަހައްދެއް		✓
(ނ) މިސަރަހައްދަކީ އެހެންކަމަކަށް ބޭނުންކުރާ ސަރަހައްދެއް. (އެކަމެއް ބަޔާންކުރޭ:		✓
10 **ސަރުކާރުން ވަކިބޭނުމަކަށް ޚާއްޞަކޮށްފައިވާ ސަރަހައްދުތަކާ ބެހޭ**		
(ހ) މި ސަރަހައްދަކީ ގޯތި ދިނުމަށް ސަރުކާރުން ކަނޑައަޅުއްވާފައިވާ ސަރަހައްދެއް		✓
(ށ) މި ސަރަހައްދަކީ ސިނާއީ މަސައްކަތް ކުރުމަށް ސަރުކާރުން ކަނޑައަޅުއްވާފައިވާ ސަރަހައްދެއް		✓
(ނ) ސަރުކާރުންވަނީ މިސަރަހައްދު އެހެންބޭނުމަކަށް ކަނޑައަޅުއްވާފައި، އަދި އެބޭނުމަކީ........................		✓

ވޭސްޓް މެނޭޖްމަންޓް ސެންޓަރ ގާއިމުކުރުމަށްޓަކައި މިސަރަހައްދު ކަނޑައެޅުމަށް ރަށުކައުންސިލާއި، އަންހެނުންގެ ތަރައްޤީއަށް މަސައްކަތްކުރާ ކޮމިޓީގެ ތާއީދު ލިބިގެން ރައްޔިތުންނާއި މަޝްވަރާކުރުމަށްފަހުގައެވެ. އެހެންކަމުން މިސަރަހައްދު އަކީ ވޭސްޓް މެނޭޖްމަންޓް ސެންޓަރެއް ގާއިމުކުރުމަށް ފުރިހަމަ ތިރީގައިވާ އިދާރާތަކުގެ އިއުތިރާފް ލިބިގެން ނަމެވެ.

އިދާރާ	ނަން	މަޤާމު	ސޮއި	ތާރީޚު
ރަށުކައުންސިލުގެ ރައީސް ނުވަތަ	[illegible]	ކައުންސިލްގެ ރައީސް	[signature]	20/12/2015
މިނިސްޓްރީ އޮފް ހައުސިންގ އެންޑް އިންފްރާސްޓްރަކްޗަރ އިން ރައީސް ނުވަތަ	[illegible]	[illegible]	[signature]	6/3/16
އެންވަޔަރަމަންޓަލް ޕްރޮޓެކްޝަން އެޖެންސީ	[illegible]	[illegible]	[signature]	[illegible]/16

މިފޯމާ ދީ ސަރަހައްދަށް (އެއްގެ ބޭރު ބޭނުންކުރާ ސަރަހައްދާއި ދުވަސްވަރު ބޭނުންކުރާ ސަރަހައްދު) ވަކިވަކިން ފުރިހަމަ ކޮށް ދަށު ބޭރުގެ ފުރިއްޔާގެ ސާރވެއަރއާ އެހީވެގެން ތައްޔާރުކޮށްފައިވާ، ސަރަހައްދު ދޭ ބޭރުގެ ސައިޓްޕްލޭން ހުށަހަޅާ ޝަރުތާއެކު. އަދި މިފޯމާއެކު ކުރިއްޔާވަރު ކަނޑައެޅިފައިވާ ދަށު ސަރަހައްދު ދަށުގެ ޖީޕީއެސް ކޯޑް ހިމެނޭ ޕްލޭން ދަށުގެ ސާވޭގައި ހިމެނޭ ސައިޓްޕްލޭން ވަނީ ފޮނުވާނީ އެވޭލިޕްސްގެ ހުށަހަޅަނުވާނެވެ.

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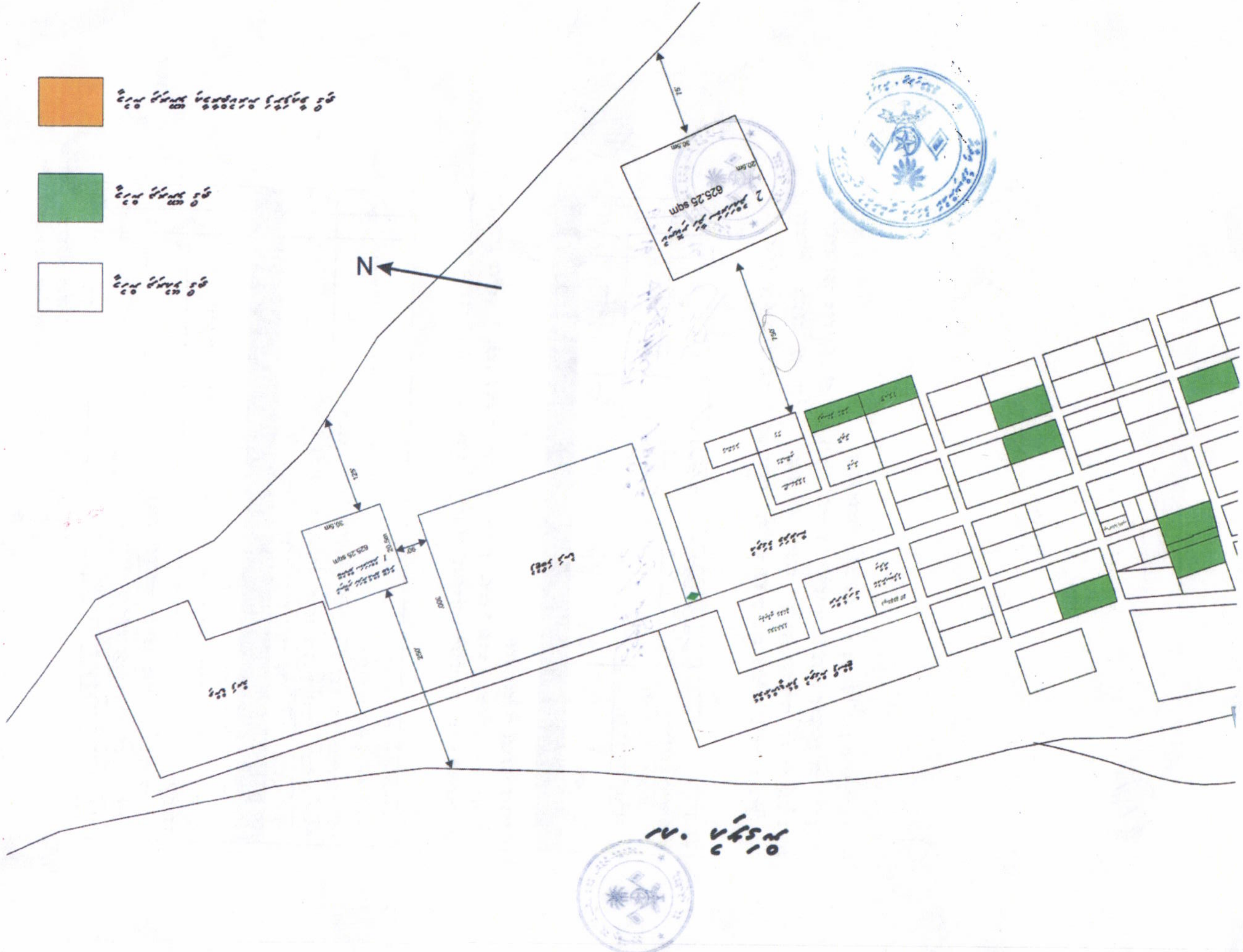

N
625.25 sqm
20.5m
30.5m
125'
250'
300'
75'
750'

Environmental Protection Agency

އެންވަޔަރަންމަންޓަލް ޕްރޮޓެކްޝަން އެޖެންސީ

ނަންބަރު: 203-EIARES/438/2016/80

ސްކްރީން ކުރުމަށްފަހު ނިންމިގޮތް

މިއީ ހއ. އުލިގަމު ސްޓޯމް ވޯޓަރ ޑްރެއިނޭޖް ސިސްޓަމް ގާއިމްކުރުމުގެ މަޝްރޫއާއި ގުޅޭގޮތުން ސްކްރީން ކުރުމަށްފަހު ނިންމިގޮތް އެންވަޔަރަމަންޓާއި މިނިސްޓްރީ އޮފް އެންވަޔަރަމަންޓް އެންޑް އެނަރޖީއަށް ފޮނުވި ރަސްމީ ލިޔުމެވެ.

V	މި މަޝްރޫއުގެ ސަބަބުން ތިމާވެށްޓަށް ނުރައްކާ ބޮޑު އަސަރެއް ކުރާނެ ކަމަށް ފެނުނުތީ. ވީމާ، ތިމާވެށްޓަށް އަސަރު ފޯރާނެ މިންވަރު ބަލާނެ ދިރާސާއެއް ހެދުމަށް ނިންމީމެވެ.
	މި މަޝްރޫއުގެ މަސައްކަތްތަކަށް ތިމާވެށީގެ ފުރަތަމަ ދިރާސާއެއް ހެދުމަށް ނިންމީމެވެ.
	މި މަޝްރޫއުގެ މަސައްކަތްތަކަށް ތިމާވެށީގެ މެނޭޖްމަންޓް ޕްލޭނެއް ހެދުމަށް ނިންމީމެވެ.
	މި މަޝްރޫއުގެ ސަބަބުން ތިމާވެށްޓަށް ނުރައްކާ ބޮޑު އަސަރެއް ކުރާނެ ކަމަށް ނުފެންނުމުން. ވީމާ، މަޝްރޫއުގެ މަސައްކަތްތަކަށް ހުއްދަ ދެވިދާނެ ކަމަށް ނިންމާލަމެވެ.
	މި މަޝްރޫއުގެ ސަބަބުން ތިމާވެށްޓަށް ކުރާނެ އަސަރުތަކަށް ބަލައިގެން މިނިސްޓްރީން އެކަމާ ގުޅިގެންވާ މަސައްކަތް ކުރުމަށް ނިންމާލަމެވެ.

ސްކްރީން ކުރި އިދާރާ: އެންވަޔަރަންމަންޓަލް ޕްރޮޓެކްޝަން އެޖެންސީ

ނަން: އިބްރާހީމް ނައީމް

މަޤާމު: ޑިރެކްޓަރ ޖެނެރަލް

ސޮއި: [signature]

ތާރީޚް: 5 ޖުލައި 2016

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