WASINI MARITIME LTD

ENVIRONMENTAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED INTEGRATED GREEN SHIP RECYCLING & STEEL MAKING FACILITY IN KIBUYUNI, KWALE COUNTY

(4^0 38' 25.54" S, 39^0 19' 27.79" E)

FINAL REPORT

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October, 2019

CERTIFICATION PAGE

Certification by Firm of Experts:

We hereby certify that this Environmental and Social Impact Assessment Study report has been prepared in accordance with the Environmental (Impact Assessment and Audit) Regulations, 2003 and the methodology and content reporting conform to the requirements of the Environmental Management and Coordination Act, 1999 (Amended 2015).

Certification by Proponent

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Certificate of Registration No **5194**

TABLE OF CONTENTS

EXECUTIVE SUMMARY ix

1. INTRODUCTION 1

1.1 Background 1
1.2 Project definition and objectives 1
1.3 Description of Project Activities 1
1.5 Project Location 2
1.6 Project Proponent 3
2. PROJECT DESIGN AND ALTERNATIVES 4

2.1 Project design 4
2.2 Layout concept of ship recycling 4
2.2.1 Asbestos, PCB (Polychlorinated Biphenyl's) and liquids removal 4
2.2.2 Ship accessories removal 4
2.2.3 Ship Superstructure Removal 5
2.2.4 Dismantling and Slicing 5
2.2.5 Scrap Storage Areas 5
2.2.6 Steelmaking Plant 5
2.2.7 Electrical Power 5
2.2.8 Administration and Warehousing 5
2.2.9 Site Access Considerations 5
2.3 Project Alternatives 6
2.3.2 Steel Production Alternatives 9
3. METHODOLOGY AND SCOPE OF EIA 13

3.1 Background 13
3.2 Detailed EIA study. 13
3.3 Preparation of the EIA study report 14
3.4 Terms of Reference for EIA Study 15
3.5 Detailed EIA Study 15
4.0 POLICY AND LEGAL FRAMEWORK 16

4.1 Legal Framework 16
4.1.1 Constitution of Kenya, 2010 16
4.1.2 Environmental Management and Coordination Act, 1999 16
4.1.3 Fisheries Management and Development Act No 35, 2016 16
4.1.4 Forest Conservation and Management Act, 2016 17
4.1.5 Water Act, 2016 17
4.1.6 Physical Planning Act, Cap 286, 1996 17
4.1.7 The Merchant Shipping Act No. 4 of 2009 17
4.1.8 Energy Act, No. 2006 18
4.1.9 Kenya Maritime Authority Act (Cap. 370). 18
4.1.10 Tourism Act, 2011 18
4.1.12 Employment Act, 2007 19
4.1.13 HIV and AIDS Prevention and Control Act 2006 19
4.2 Policies and Regulations 20
5. SOCIO ECONOMIC AND DEMOGRAPHIC PROFILE 23

5.1 Introduction 23
5.2 Livelihood and Employment 23
5.3 Socio Demographic Characteristics 25

5.4 Water Sanitation and hygiene 26
5.5 Housing and Living Conditions 27
5.6 Assets and Property Ownership 28
5.7 Land Tenure 29
5.8 Access to Healthcare Services 30
6. THE MARINE ENVIRONMENT 31
6.1 Corals 31
6.1.1 *Acropora formosa* 33
6.1.2 *Pavona decussata* 34
6.1.3 *Favia stelligera* 34
6.1.4 *Favites abdita* 34
6.1.5 *Stylophora pistillata* (Smooth cauliflower coral) 34
6.2 Fish and other related species 36
6.3 Crustacean Diversity 39
6.4 Diversity of Molluscs 44
6.5 Echinodermata 48
6.6 Marine Reptiles 53
6.6.1 Order Squamata: Scincidae 53
6.6.1.1 Coral Rag skink, Cryptoblepharus buchananii africanus 53
6.6.2 Marine Turtles 53
6.6.2.1 Green Turtle, *Chelonia mydas* 53
6.6.2.2 Loggerhead turtle, *Caretta caretta* 54
6.7 Annelids 55
6.7.1 Indo-Pacific scaleworm, *Iphione muricate* 55
6.7.2 *Sthenelais boa* 56
6.7.3. Iridescent fireworm, *Eurythoe complanata* 56
6.7.4 Feather duster worm, *Sabellastarte spectabilis* 56
6.8 Platyhelminthes 56
6.8.1 Orange-margined flatworm, *Callioplana marginata* 57
6.8.2 Racing-stripe flatworm, *Pseudoceros bifurcus* 57
6.8.3 Triple-stripped flatworm, *Pseudoceros tristriatus* 57
6.9 Seaweeds 57
6.9.1 Crowded Sea bell, *Turbinaria ornate* 58
6.9.2 Double-bladed Sargassum, *Sargassum cristaefolium* 58
6.9.3 Sea lettuce, *Ulva intestinalis* 59
6.9.4 Red asperagus, *Asparagopsis taxiformis* 59
6.9.5 Sea bell, *Turbinaria conoides* 59

6.9.6 Seaweed Farming 60
6.10 Seagrass Species 61
7. TERRESTRIAL ENVIRONMENT 62
7.1 Terrestrial Flora baseline 62
7.1.1 Introduction 62
7.1.2 Method of survey 62
7.1.3 Terrestrial flora survey findings 63
7.1.4 Secondary bushland 64
7.1.5 Mangrove forest 65
7.1.6 Uses of some of the flora species observed 67
7.1.7 Cultural importance of some of the flora species observed 68
7.2 Terestrial fauna baseline 74
7.2.1 Terrestrial coastal mammal species diversity 74
7.2.2 Terrestrial coastal amphibian and reptilian species diversity 80
7.2.3 Terrestrial invertebrate diversity 89
7.3 Terestrial Avifauna 94
7.3.1 Background Information 94
7.3.2 Objectives of the Survey 95
7.3.3 Study Area 96
7.3.4 Material and Methods 97
7.3.5 Results 97
8. CHEMICAL ENVIRONMENT 103
8.2 Air Quality Monitoring 103
8.2.1 Background information on air quality 103
8.2.2 Monitoring Objectives 104
8.2.3 Monitoring Methods 104
8.2.3.1 Active and Continuous Sampling for gases 104
8.2.3.2 Tools and Equipment used 104
8.2.4 Monitoring Frequency 105
8.2.5 Monitoring Location 105
8.2.6 Description of terrain features. 105
8.2.8 Results. 107
8.2.9 Discussion 109
8.3 Noise Level Monitoring 109
8.3.1 Background information on Noise 109
8.3.2 Monitoring Objectives 110
8.3.3 Monitoring Methodology 110
8.3.4 Tools and Equipment 110
8.3.5 Monitoring Frequency 111
8.3.6 Monitoring Location and Map 111
8.3.7 Regulatory framework relevant to noise emission and exposure limits. 111
8.3.8 Analysis and Discussion of findings of Noise Levels: 113
8.3.8.1 Noise Results Interpretation and further discussions 115
8.3.8.2 Parameters and Score Criteria 115
8.3.8.3 Procedure of Significance Evaluation 115
8.3.9 Discussions. 116

8.3.10 Conclusions 117
9. STAKEHOLDER CONSULTATIONS AND PUBLIC PARTICIPATION 120
9.1 Introduction 120
9.2 *Stakeholder* Mapping 120
9.2.1 Invitations and notices 121
9.3 Workshops 121
9.3.1 Workshop with the County Government of Kwale 121
9.3.2 Key Stakeholders' Workshop at Amani Tiwi Beach Resort 122
9.3.3 Stakeholders' Workshop with Kwale County Environmental Committee 124
9.4 Public Barazas 126
9.4.1 Summary of proceedings of the first public Baraza 126
9.4.2 Summary of proceedings of the second public Baraza 128
9.4.3 Summary of proceedings of the third public Baraza 129
10. POTENTIAL IMPACTS AND PROPOSED MITIGATION MEASURES 130
10.1 Impact identification and predication 130
10.2 Potential socioeconomic impacts 130
10.2.1 Employment opportunities 130
10.2.2 Business spinoffs 131
10.2.3 Transfer of skills and technology to local people 131
10.2.4 Labour influx 131
10.2.5 Increased risk of communicable diseases and burden on local health services 132
10.2.6 Impacts on Lifestyle of Local Communities 132
10.2.7 Child labour and school dropout 133
10.2.8 Disruption of livelihood of Kibuyuni seaweed faming activities 133
10.3 Potential Environmental Impacts 134
10.3.1 Impacts on Water Quality 134
10.3.2 Impacts on Air Quality 135
10.3.3 Noise 136
10.3.4 Impacts on Marine Environment 137
10.3.4.4.1 Mitigation Measures 140
10.3.4.5 Potential negative impacts on corals 140
10.3.4.6 Potential negative impacts on fishery diversity and catch 141
10.3.4.7 Potential negative impacts on established Local Marine Management Areas 141
10.3.4.8 Potential negative impacts on Kisite-Mpuguti Marine National Park 142
10.3.4.9 Potential negative impacts on Kibuyuni seaweed farming 142
10.3.4.10 Impacts of accidental oil spillon marine habitats 143
10.3.4.11 Potential discharge of ballast water at the operations phase 143
10.3.5 Impacts on Health and Safety 143
10.3.5.1 Accidental Injuries at site: 143
11 ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN 145
11.1 Introduction 145
11.2 Purpose of ESMP 147
11.3 Water Quality Management 147
11.3.1 Sources of Impacts 147
11.3.2 Monitoring Objectives 147
11.3.3 Monitoring Methods 147
11.3.4 Monitoring Locations 148
11.3.5 Monitoring Frequency 148
11.3 Air Quality Monitoring 148

11.3.1 Sources of Impact 148
11.3.4 Monitoring Methods 148
11.3.6 Monitoring Locations 148
11.4 Noise Level Monitoring 148
11.4.1 Sources of Impacts 148
11.4.2 Methodology for Noise Level Measurement 149
11.4.4 Parameters to be monitored 149
11.4.5 Locations for Noise Level Measurement 149
11.4.6 Monitoring Frequency 149
11.5 Monitoring of Marine Environment 149
11.5.1 Marine Water Quality Monitoring 149
11.5.2 Monitoring Suspended Solids Content and other parameters 150
11.6 Monitoring of HIV / Aids Prevalence 151
11.6.1 Sources of Impacts 151
11.6.2 Indicators of Impacts 151
11.6.3 Monitoring Objectives 152
11.6.4 Monitoring Methods 152
11.6.5 Monitoring Frequency 152
11.7 Responsibility and Timeframe of ESMP 152
12. REFERENCES 154
13. APPENDICES 158

TABLES

Table 1: Policy Framework and Regulations applicable to the Project 20
Table 2: Internal agreement, convention and World Bank Policies reviewed 22
Table 3: Occupation of the head of households and main source of livelihood for the households (n=152) 23
Table 4: Number of household members engaged in livelihood on income generating activities (n=150) 24
Table 5: Specific marine related income generated activities members of the household are involved (n=108) 25
Table 6: Socio Demographic Characteristics of the household heads (n=152) 25
Table 7: Main water sources for the households (n=152) 26
Table 8: Main material of the floor, roof and walls of the main dwelling units of the households (n=140) 27
Table 9: Household's land ownership status (n=136) 29
Table 10: List of coral (Cnidarian) species diversity 35
Table 11 - Fish diversity in Kibuyuni 38
Table 12 - Crustaceans species diversity in Kibuyuni 41
Table 13 - Mollusc species diversity in Kibuyuni 46
Table 14 - Echinodermata species diversity in Kibuyuni 51
Table 15: List of Mangrove species at Kibuyuni 65
Table 16: IUCN Status 66
Table 17: Plant checklist observed during baseline survey 68
Table 18: Terrestrial mammal species diversity 77
Table 19- Terrestrial amphibians and reptiles species diversity 83
Table 20: List of terrestrial arthropod taxa from different taxonomic groups 90
Table 21; Threatened species observed 97
Table 22: Biome species recorded during the survey: 98
Table 23: List of bird species recorded in KIbuyuni area with bush land surrounding farmland and shoreline during the survey 98

FIGURES

Figure 1: Proposed project site and neighbourhood as viewed from Google Erath 3

Figure 2: Plots to be used for the proposed project 12
Figure 3: Main type of fuel used by the household for cooking (n=150) 28
Figure 4: Items owned by households (n=152) 29
Figure 5: Items owned by at least one member of the household (n=152) 29
Figure 6: Eviction from home status in the last 5 years (n=134) 30
Figure 7 - Cnidarian diversity by order 32
Figure 8 - IUCN Red List categories for coral species in Kibuyuni 33
Figure 9 - Fishes diversity by order in Kibuyuni 37
Figure 10 - Crustaceans species composition by order in Kibuyuni 39
Figure 11 - Mollusc species composition by classes 45
Figure 12 Echinodermata diversity by order in Kibuyuni 48
Figure 13 - Threatened echinoderm species according to IUCN Red List categories 50
Figure 14: Google earth view location of seaweed farming at Kibuyuni 60
Figure 15: Distribution of dominant families of terrestrial flora species 63
Figure 16: Lannea schweinfurthii var. stuhlmanii 63
Figure 18: Vitex ferruginea 64
Figure 18: Uvaria acuminata 64
Figure 19: Diversity of terrestrial coastal mammals 75
Figure 20- Number of mammal species listed by the IUCN Red List 76
Figure 21 - Diversity of terrestrial coastal amphibians and reptiles 80
Figure 22 - Number of amphibians and reptiles species listed by the IUCN Red List 81
Figure 23- Composition by order of the terrestrial arthropod taxa recorded across all sites 89
Figure 24: Stakeholder analysis tool 121

PLATES

Plate 1: Photographs of coral species in Kibuyuni 32
Plate 2: Common fish species in Kibuyuni 36
Plate 3: Some of the crustaceans 40
Plate 4: Common mollusk species in Kibuyuni 45
Plate 5: Common Echinoderm species in Kibuyuni 49
Plate 6: Red algae 59
Plate 7: Species of seaweeds farmed at Kibuyuni 60
Plate 8: Seagrass species observed at Kibuyuni 61
Plate 9: Some of flora species observed at Kibuyuni 64
Plate 10: A section of vegetation of secondary growth at the proposed project site 65
Plate 11: Some of the mangrove species observed within the intertidal zone at Kibuyuni 66
Plate 12: Some of the species observed at the coral rag section of the site 67
Plate 13: Some of the plants useful to the fishing community 67
Plate 14: Olive baboon 76
Plate 15: Some of the reptile observed at the proposed project site 82
Plate 16: Habitat of avifauna survey 96
Plate 17: Stakeholders workshop at Amani Tiwi Beach Resort 124
Plate 18: Kwale County Environment Committee Workshop at Leopard Beach Resort 126
Plate 19: Proceedings of the first public baraza 128
Plate 20: Proceedings at the second public baraza 128
Plate 21: Proceedings of the third public baraza 129

EXECUTIVE SUMMARY

Wasini Maritime Limited proposes to construct a modern ship recycling facility and a scrap melting steel plant with supporting infrastructure and equipment to supply high quality steel for the Kenyan and entire East Africa Community economy. The proposed plant will be located at Kibuyuni near Shimoni in Kwale County (Coordinates **4^0 38' 25.54" S, 39^0 19' 27.79" E**). The manufacturing process will involve recovery of scrap from old ships, recycling the scrap by melting and production of new steel by hot rolling. Steel mills are categorized as high risk projects under section 58 (2) of the Environmental Management and Coordination Act (EMCA) 1999 hence proponents must undertake an Environmental Impact Assessment Study and submit the EIA Report to NEMA for approval.

The proponent proposes to use a totally pollution free concept for the ship recycling and steel rolling mill. The ship scrapping facility will enable the recovery of vessels from the ocean via a ship lift for transfer to dedicated shore berths. The proposed project will consist of a jetty, floating dry dock, dry berth for demolition of old ships to recover scrap, recycling of the recovered scrap by melting and production of new steel by hot rolling. In addition the following utility services will be included: Oxygen and Nitrogen Plants, Acetylene Plant, Desalination Plant, Effluent Treatment Plant and Sewage Treatment Plant.

The facility is planned to produce 300,000 metric tonnes of finished steel per year or 1000 t/day. The scrap generation rate to match this target will be 1200 t per day. To meet this scrap generation target a minimum of 3 ships (2 ships of Panamax Class plus one ships of Handymax Class) will have to be cut per month. The operation would consist of a floating dry dock for lifting the ship at sea and transferring it to hard standing where the ship will be sliced into several blocks of about 1200 - 1500 tonnes. On arrival at the Shimoni harbor the ship will be cleared by port & custom authorities. Inventory of Hazardous Material (IHM) will be verified jointly by concerned authorities. The ship will then be placed on the floating dry dock (FDD) that will be moved with the assistance of tugs to the dry berth. Thereafter the ship will be transferred using a system of self-propelled railed transporters from the FDD to the land side. On the land side the ship will be sliced into several mega blocks of 1200/1500 t weight and disintegrated further into smaller pieces. Various services such as Centrifuges, pumps, Oxygen Plants, Acetylene Plants, Air compressors, Fire Fighting plants will be provided on land for facilitating various processes involved in the ship cutting. Cutting activity afloat or discharge of any material from the ship to sea will be strictly prohibited. The steel plant will be based on melting furnaces of either Induction or Electric Arc furnace type and will not use any fossil fuel thus avoiding environmental pollution.

To support the above processes, following off-shore and near shore infrastructure will be created:

- Offshore reinforced concrete berth supported by reinforced concrete piles, approximately 400 m away from the shore for berthing of ships. Natural depth at the berth will be -10.0 m with datum as 0.0 tide.
- Shore Protection wall with sheet pile.
- 70m long sea facing pier at the edge of the dry berth with reinforced concrete diaphragm wall.

- A 50x70m underwater reinforced concrete apron at a depth of 00 level. To create such apron a temporary sheet pile coffer dam will be erected. Minimal dredging will be required in this area. The dredged material will be utilized for levelling the ground given that chemical analysis has indicated that the dredged material shall be free of contamination.

For operation and management of this facility, a total of approximately 2500 people consisting of managers, engineers, supervisors, skilled and unskilled personnel are envisaged to be employed.

This EIA Study report has been prepared to ensure that the project is implemented in an environmentally responsible manner in compliance with the provisions of the Environmental Management and Coordination Act 1999 (Revised 2015) and includes the following:

- Project Description: Location, objectives of the project; technology, procedures and processes to be used in implementation of the project.
- Baseline information such as descriptions of the natural, social and operational environment,
- Current policy and legal framework and the administrative arrangement under which the project will operate.
- Alternative technologies and processes available and reasons for preferring the chosen technology and processes.
- The wastes to be generated by the project and ways of handling it.
- The environmental effects of the project: including the social and cultural effects and the direct, indirect, short term and long term effects anticipated.
- Occupational Safety and Health arrangements: Provision of an action plan for the prevention and management of foreseeable accidents and hazardous activities, measures to prevent health hazards and to ensure security
- An Environmental and Social Management Plan (ESMP) proposing measures for eliminating, minimizing or mitigating adverse impacts on the environment, while enhancing the positive effects; including responsibility for implementing these measures.
- An Environmental and Social Monitoring Plan (ESMP) with responsibilities to ensure the proposed mitigation measures are implemented and desired affects achieved;
- Public participation and stakeholder consultation mechanisms;
- A non-technical summary outlining the key findings, conclusions and recommendations of the study.

The EIA study has been carried out by Heztech Engineering Services, a firm of experts registered and licenced by NEMA (Reg No. 5194, Appendix 4). Air quality and marine water quality sampling and analysis was carried out by Polucon Services Kenya Limited, a NEMA accredited Laboratory (appendix 5). Key documents that informed part of the EIA Study are the feasibility study reports prepared by Maritime & Transport Business Solutions (MTBS) of the Netherlands and EA SYST Engineering (I) PVT. LTD of India, Bathymetric Survey carried out by Damen Shipyards Limited, Geotechnical Survey carried out by M/s Aven Premier International and Topographical Survey carried out by Kimoland Surveyors.

Terms of reference (ToR) for the Environmental Impact Assessment (EIA) Study for the proposed project were developed and submitted to the National Environment Management Authority and were approved on 20th June 2019.

Positive Impacts identified from the study are as follows:

- Employment opportunities - Implementation of the proposed project will require the services of various professionals including designers, surveyors, marine engineers, electrical, mechanical and civil engineers and suppliers of construction materials and labour to the project
- Business spinoffs - The multiplier effect of the implementation of the proposed project is likely to stir business spinoffs at Kibuyuni, Kikirini, Shimoni and its environs.
- Transfer of skills and technology to local people - Implementation of the proposed project will involve the services of expatriates who will be implementing the project. Local staff who will be working in the project during its implementation will learn valuable skills and technology from the expatriates.

Potential negative socioeconomic impacts and mitigation measures proposed are as follows:

Potential Socioeconomic Impact	**Mitigation Measures**
Labour influx - Implementation of the proposed project will require highly skilled labour resulting into competition for social services such as housing and health services, and thereby escalation of prices.	• The contractor to source construction labour locally unless required skills not available locally • The labour force to be sourced locally to include women and youth of both gender • Numbers of women employed in the construction site to be monitored to ensure they remain proportionate to those of their male counterparts. • Local youths and women with capacity to supply construction materials should be given priority.
Increased risk of communicable diseases such as sexually transmitted diseases (STD)s and HIV/AIDS	• Sensitization programs on issues HIV/AIDS for the project staff to be developed and carried out at the construction site by peer educators. • Management to provide for medical facilities for their staff • A condom dispenser always stocked with condoms to be availed at the project site • Contractor to arrange for convenient and free voluntary counselling and testing services for project staff.
Impacts on community dynamics: Interactions between incoming workers and the host community may significantly change community lifestyles considering the composition of the local community most of whom are poor and some falling under the Vulnerable and Marginalised Groups (VMGs).	• No underage (below eighteen years) should be allowed to work either directly or indirectly • Parents and guardians to ensure their children remain in school • Parents and guardians should not use their children to prepare food to be sold at the project site

Child Labour: Increased opportunities for the host community to sell goods and services to the incoming workers may lead to child labour to produce goods and services, which in turn can lead to enhanced school dropout.	• No underage (below eighteen years) should be allowed to work either directly or indirectly • Parents and guardians to ensure their children remain in school • Parents and guardians should not use their children to prepare food to be sold at the project site

Potential negative **environmental impacts** and mitigation measures proposed are as follows:

Potential Environmental Impact	**Mitigation Measures**
Impacts on water quality resulting from the storage and handling of chemical products during construction activities	• Have in place an effective preventive maintenance programme for equipment and vehicles in order to avoid breakdowns and the subsequent spillage of oil and fuel. • Maintenance of equipment and vehicles to be carried out in designated areas and on impermeable surface with adequate drainage and reception facilities for any oil spills. • In cases of hydrocarbon spills, the spill must be controlled and absorbed by absorbent material. • Storage areas for fuel and other chemicals must be located at least 50 m from the sea. Such storage areas must be provided with impermeable containment basins • Oil spill control measures should be adopted as per the National Oil Spill Response Contingency plan. Prompt reporting systems would be key to prevention of oil dispersal. • Marine environmental monitoring as per environmental monitoring programme should be carried out at the recommended points and periods and compared with baseline levels during entire rehabilitation period.
Potential Impact on air quality resulting from site operations such as emissions from ships as they enter the site for scrapping and emissions from the steel plant during recycling.	• Prohibit use of heavy diesel oil as fuel and promotion of the use of low sulphur diesel fuel could reduce pollutants emissions. • Truck speed regulation and prohibition of trucks movement outside the designated routes. • Periodic cleaning of cargo spills, equipment and transport vehicles to remove accumulated dirt and hence reduce air-borne dust during dry seasons • Environmental awareness and training should be carried out to all personnel involved in port operations • Monitoring of air quality to ensure compliance with EMCA (Air quality regulations).
Impact on air quality resulting from construction activities such as demolition, excavation, ground levelling, that may generate dust and emit particulates into the atmosphere	• Dusty construction materials carried in vehicles and stock piles of construction material within the site should be properly covered. • Loading and unloading of bulk construction materials should be in areas protected from the wind and carried out in calmer conditions.

	• Vehicle speed restrictions should be adhered to in the construction site to reduce agitation of air-borne dust. • High moisture content on exposed surface and roads should be maintained by spraying dusty areas with water. • Maintenance programme for construction vehicles should be adhered to ensure for optimum performance and reduced emissions.
Direct loss of native vegetation abundance and biodiversity due to the clearing of vegetation within the proposed project area	• Large mature trees at the proposed project site to be preserved • Proponent to support tree planting initiatives within Kibuyuni area and the wider Shimoni to compensate for vegetation that could be lost from proposed project site • Proponent to maintain pockets of vegetation within the project site • Proponent to only cut trees and clear vegetation in areas where structures of the proposed project will be constructed. • Ensure no oil spills from any of the proposed project activity • Ensure no disposal of effluent and any other waste from the proposed project into the local terrestrial environment
Potential negative impacts on local mangrove swamps due to clearance of some of the mangroves to create room for the floating dock	• As a compensatory measure the proponent should plant 1.5 times the area of cleared mangroves in neighbouring areas not targeted for future development and in degraded mangrove forest areas • Consult with Kenya Forest Services (KFS), on any intended use of intertidal zone area before commencement of any proposed project activity • Observe the legal requirements stipulated in the Forest Act 2019 in line with any potential use of mangrove areas within the intertidal zone
Potential negative impacts on sea grass beds due to sedimentation during construction	• Use appropriate civil engineering technologies such as silt curtains where possible to limit sedimentation • Minimise sedimentation from upstream into the seagrass beds by ensuring that the 50 meter riparian zone from the high water mark is kept intact with vegetation that will filter sediments from upstream sources. • Maintain mangroves trees within the inter-tidal zone for further filtering of sediments from upstream
Potential smothering effect on corals arising from sedimentation upstream due to construction works may result in deposition of suspended materials in the Wasini channel causing on corals	• Maintain a healthy mangrove ecosystem within the intertidal zone • Maintain healthy seagrass beds • Minimise sedimentation into the seagrass beds by use of appropriate civil engineering technologies during construction
Potential negative impacts on established Local Marine Management Areas such as Community Conservation Areas at Kibuyuni, Shimoni, Wasini and Mkwiro;	• There should be no installation and or construction of any of the proposed project structures such as floating dry dock and jetty within or at close proximity to any of the identified and all other LMMAs or the Marine Park

and at Kisite – Mpunguti Marine Park	• Ensure no oil spills from ships destined for scrapping including while on transfer to the land side or even while on the floating dry dock • There should be no disposal of effluent and any other waste from the proposed project into the marine environment
Potential negative impacts on Kibuyuni seaweed farming due to construction activities and in the event of oil spill during operation	• Avoid installation and operation of any of the structures such as floating dry dock and jetty within or at close proximity to areas used for seaweed farming at Kibuyuni • Ensure no oil spills from any of the ships and operational activities that could spread oil into the seaweed farming areas • There should be no disposal of effluent and any other waste from the proposed project into the marine environment including areas used for seaweed farming
Potential discharge of ballast water at the operations phase	• Compliance with KMA and KPA policy which prohibits discharge of ballast water. • Abide by the interim provisions of the Management of Ballast Waters in Port states currently under development by IMO; ratify and implement the Ballast water convention.
Accidental Injuries at site during the construction stage due to use of hand tools, trip and fall hazards as well as overhead hazards.	• Undertake job safety analysis prior to commencement of construction works so that all workers are familiar with safe procedures for undertaking their tasks • Safety awareness and training should be carried out to all personnel during the construction phase and in port operations • Engage a trained and experienced safety officer at the site on full-time basis to enforce KPA safety rules and drive the safety awareness, training and motivation campaign • Avail a fully equipped first aid box manned by trained first aid personnel at all times during construction works • Ensure an effective accident reporting and investigation procedure is in place and investigation recommendations are implemented to prevent recurrence
Potential increase in road traffic accidents due to increased volume of traffic upon commissioning of the project	• Installation of safety signs to warn motorists, pedestrians and residents of the hazards at the sites during the construction stage; • Erection of speed control bumps where required; • Installation of access control devices such as barricade tapes to prevent unauthorised persons from accessing construction areas where they could be prone to accidental injuries.

An Environmental and Social Management and Monitoring Plan (ESMP) has been prepared to ensure that the mitigation measures proposed above are implemented and the desired effects achieved.

Elaborate public participation was conducted during the ESIA study involving members of the public and the following institutions:

- Kwale County Government,
- State Corporations: Kenya Ports Authority, Kenya Wildlife Service, Kenya Maritime Authority, Kenya Navy, Kenya Fisheries Services, Kenya Wildlife Service, National Museums of Kenya, Ministry of Lands, National Environment Management Authority, Coast Development Authority, Kenya Marine and Fisheries Research Institute;
- Local Beach Management Units,
- Community Groups: Local Boat operators, fish processors, fish mongers, hotel operators, local learning institutions, local business community, South Coast Residents Association, Shimoni community, Kibuyuni Community, Wasini Community, local conservation groups, local women group and local youth groups.

The concerns raised by the public and the institutions as well as the responses given by the proponent and the ESIA consultants have been highlighted in the minutes of meetings attached as appendices to this report.

1. INTRODUCTION

1.1 Background

Wasini Maritime Limited proposes to construct a state of the art Integrated Green Ship Recycling and Steel Making Plant at Kibuyuni near Shimoni in Kwale County, south coast of Kenya (Coordinates **4^0 38' 25.54" S, 39^0 19' 27.79" E**). The manufacturing process will consist of demolition of old ship to recover scrap, recycling of the recovered scrap by melting and production of new steel by hot rolling. In line with section 58 (2) of the Environmental Management and Coordination Act, (EMCA), 1999 and Legal notice number 150 of 2016 part 2(2) 9 (p), construction of steel mills are categorized as high risk projects and hence proponents must undertake an Environmental Impact Assessment Study and submit the EIA Report to NEMA for approval.

1.2 Project definition and objectives

The objective of the proposed project is to build a modern ship recycling facility and a scrap melting steel plant with supporting infrastructure and equipment to supply high quality steel for the Kenyan and entire East Africa Community economy. The ship scrapping facility will enable the recovery of vessels from the ocean via a ship lift or other suitable modern system for transfer to dedicated shore berths. The process of demolishing vessels will be environmentally friendly and designed to facilitate the storage and recycling of materials and the collection and handling of all hazardous wastes.

1.3 Description of Project Activities

The proposed project will consist of a jetty, floating dry dock, dry berth for demolition of old ship to recover scrap, recycling of the recovered scrap by melting and production of new steel by hot rolling. The proposed project will include the following utility services; Oxygen and Nitrogen Plant, Acetylene Plant, Desalination Plant, Effluent Treatment Plant and Sewage Treatment Plant.

The proponent proposes to use a unique concept for totally pollution free ship recycling approach and a steel melting and rolling mill. The entire facility is planned to produce 300,000 metric tonnes of finished steel per year or 1000 t/day. The scrap generation rate to match this target will be 1200 t per day. To meet this scrap generation target a minimum of 3 ships (2 ships of Panamax Class plus one ships of Handymax Class) will have to be cut per month hence one ship every 10 days will have to be demolished completely for feeding steel scrap into the steel melting furnace. Such a high rate for scrap generation would require a floating dry dock for lifting the ship at sea and then transferring it to hard standing. The ship will be sliced thereafter into several blocks of say 1200/1500 t weight and individual blocks thereafter will be transferred to various dry berths for further cutting into smaller units and then to plates. The plates will further be cut into small pieces of steel by semi-automatic gas cutting and shearing machines, which can be fed into steel melting furnace directly. The entire plant will be placed on land at a level of 2.5m above high water level on non-permeable reinforced concrete hard stand. No affluent or slag/residue of molten steel generated during steel cutting process will be discharged into the sea.

The sequence of ship recycling will be as follows:

a. Ship on arrival at the Shimoni harbor will be cleared by port & custom authorities. Inventory of Hazardous Material (IHM) will be verified jointly by concerned authorities. The ship will then be placed on the floating dry dock (FDD). The FDD will then be moved with the assistance of tugs to the dry berth. Thereafter, the ship will be transferred, using a system of self-propelled railed transporters from the FDD to the land side.
b. The ship on the land side will be sliced into several mega blocks of 1200/1500 t weight and disintegrated further into smaller pieces.
c. Various services such as Centrifuges, pumps, Oxygen Plants, Acetylene Plants, Air compressors, Fire Fighting plants will be provided on land for facilitating various processes involved in the ship cutting.
d. Cutting activity afloat or discharge of any material from the ship to sea will be strictly prohibited.
e. The steel plant will be based on melting furnaces of either Induction or Electric Arc furnace type and will not use any fossil fuel thus avoiding environmental pollution.

To support the above processes, following off-shore and near shore infrastructure will be created.

a) Offshore reinforced concrete berth supported by reinforced concrete piles, approximately 400 m away from the shore has been planned for berthing of ships. Natural depth at the berth will be -10.0 m with datum as 0.0 tide.
b) Shore Protection wall will be with sheet pile.
c) 70m long sea facing pier at the edge of the dry berth with reinforced concrete wall.
d) At a depth of 00 level a 50x70m underwater reinforced concrete apron has been planned. To create such apron a temporary sheet pile coffer dam will be erected. Minimal dredging will be carried out in this area. The dredged material will be utilized for levelling the ground.

For operation and management of this facility, a total of approximately 2500 people consisting of Managers, Engineers, and supervisors, skilled and unskilled personnel are envisaged to be employed.

1.4 Project Location

The proposed project will be located at Kibuyuni area of Shimoni within Kwale County partly at the water front (figure 1) and more on land parcels 598, 374, 377, 378, 773, 589, 387, 386, 383, 382, 379, 635, 691 and 610 (figure 2 & appendix 1). The facility is to be built on the said parcels of land with a water frontage of the Wasini channel of approximately 1.2 km. A total of 266 acres of land has been acquired by the proponent of which 174 acres is proposed to be utilized for this facility and 92 acres reserved for future project use by the client. In addition, about 5 acre area in the form of jetty is being planned away from land into the sea.

Figure 1: Proposed project site and neighbourhood as viewed from Google Erath

1.6 Project Proponent

The project proponent is Wasini Maritime Ltd, a private incorporated limited company. A copy of certificate of incorporation for the company are attached in Appendix 2.

2. PROJECT DESIGN AND ALTERNATIVES

2.1 Project design

The design of the ship recycling and steel making facility is based on the size of ships to be scrapped and the level of steel production and scrap generation. The sizes of the ships to be scrapped are forecasted to be the following:

- ✓ Available ships for scrapping by the year 2031: Cape size bulk carrier, Suezmax tanker/Post Panamax container vessels with LOA 300m, beam of 50m and 30,000-ton LDT;
- ✓ Available ships for scrapping prior to 2031: Panamax vessels with LOA of maximum 230m, beam of 32.5m and maximum LDT of 15,000 ton.

Therefore the facility will be designed to cater at least to the size of cape size vessels.
The facility is planned to produce approximately 300,000 ton of finished steel products annually. A factor of 1.2 has been applied for the conversion of scrap to finished steel, to account for process losses at various stages of steel melting, rolling and other contingencies during steel production. The annual scrap requirement is therefore 360,000 ton, and assuming 300 working days per year, the initial scrap generation capacity would be 1,200 ton a day. For generating 1,200 ton a day, approximately two Panamax and one Handymax type vessels should be processed in one month.

2.2 Layout concept of ship recycling

The layout concept of the ship recycling facility is based on the progressive and logical stages which the ship dismantling process progresses through. These are:

- Asbestos, PCB and liquids removal
- Ship accessories removal
- Ship Superstructure Removal
- Dismantling & Slicing
- Scrap Storage
- Steelmaking
- Power Generation
- Gas and Oxygen Generation and LPG storage
- Administration and Warehousing

2.2.1 Asbestos, PCB (Polychlorinated Biphenyl's) and liquids removal

This is carried out by manual removal on the eastwards jetty. Materials will be placed in a transport vehicle positioned at the jetty platform and then transported to the on-shore handling area where incineration or preparation and transfer to a landfill area will be made.

2.2.2 Ship accessories removal

Similar to the Asbestos and PCB Removal, accessories on board of the ship, including furniture, appliances, small-scale piping, wiring, cables etc. are removed by manual labour alongside the jetty. The materials are placed in a transport vehicle positioned at the jetty platform and then transported to the on-shore handling area and prepared for storage/warehousing.

2.2.3 Ship Superstructure Removal

Ship superstructures will be removed mechanically and flame cut from the ship when it is in the quayside mooring westwards of the jetty. Shore-based cranes will lift larger steel sections cut from the ship and place them in the primary cutting area. These will subsequently be reduced in size by flame cutting and the smaller sections then transferred to the secondary cutting area.

2.2.4 Dismantling and Slicing

After clearance by port authorities the ship would be moved into a floating dry dock (FDD) which will then be moved with the assistance of tugs to the dry berth. The FDD will be berthed head-on to the dry berth and the ship will be transported to land by a roll-off operation using Rail Transporters ("RTP")At the dry berth fluids, oils, ballast water, deck machinery shall be removed after which the ship will be sliced into 10m/15m long ring blocks in the parallel mid-body region. The fore body and stern block will be separated and transported to cutting bays for dismantling and cutting down. The blocks would be transported to cutting bays I, II and III, for cutting the steel blocks. Eventually, the steel plates shall be cut to size 30 cm by 30 cm at the scrap preparation area.

2.2.5 Scrap Storage Areas

The removed material and equipment will be stored at a storage area of approximately 10,000 m^2, including non-ferrous material, cast steel, pipes, valves, winches, deck cranes, anchors etc. The operation of the demolition process will be executed with proper planning and monitoring for operational uses of cranes, transfer systems and special tools and equipment in these areas reduced sections of scrap will be graded in size and quality in preparation for EAF charge load sequencing. Tracked vehicles and magnetic grab cranes will sort the scrap sections and place it in graded areas. This facilitates the loading of steel charge to the EAF.

2.2.6 Steelmaking Plant

The steel making plant will be located in the northern part of the plot and is positioned to accept the scrap from cutting/storage operations and be convenient to accept electrical power and gas supply routing. The scrap inputs are fed into the steel plant area from the south-western corner and the steel making process will output products in the area of the main site access gate.

2.2.7 Electrical Power

Electricity will be sourced from the national grid. To overcome power outages, that occur relatively often in Kenya, it is proposed to include backup generators in the project's layout. These backup generators will be supported by switchboards and a synchro condenser to counteract grid instability.

2.2.8 Administration and Warehousing

A warehouse for hazardous material storage will be located in the west of the landfill area together with maintenance and site supervision offices. Site entrance/security and administration offices will be local to the main gate.

2.2.9 Site Access Considerations

A new access route to the site will be required to allow heavy transport vehicles to access the site for regular steel exports. This is proposed to be to the north of the site and to link to an existing local

road network. The shoreline will need to be prepared for vessels up to 300m long and 30,000 LDT to approach and be moored. There appears to be sufficient water depth to support the draft of such vessels and jetties will allow offshore mooring in adequate water depths. A quay wall will be constructed, probably by sheet piling, for a mooring during superstructure removal operations. Soil excavated from the landfill areas may be used as a backfill if it is of the correct quality. In other areas, the shoreline will need to be prepared concrete overlay areas by installing a shoreline revetment wall and backfilling to the required level.

2.3 Project Alternatives

Alternatives considered include:

- Alternative methods of ship recycling
- Alternative methods of steel production

2.3.1 Ship Recycling Alternatives

2.3.1.1 Pier breaking and slipway method

With the pier breaking method, often also referred to as the alongside, or floating method, the vessel is moored alongside a quay, jetty or wharf, and is dismantled vertically. After the hazardous materials on the inside of the ship have been removed, decommissioning starts with structures on deck and gradually continues downwards until the bottom of the hull (sometimes referred to as the "canoe") remains. The "canoe" is moved towards the slipway and hauled in with a winch. While alongside the quay, large pieces of the vessel (that are cut by means of blowtorches or hydraulic shears) are lifted from the ship into the cutting area. The canoe is hauled in with a large winch. Large hydraulic and mechanical scrap shears are used to cut the steel from the vessel and "canoe".

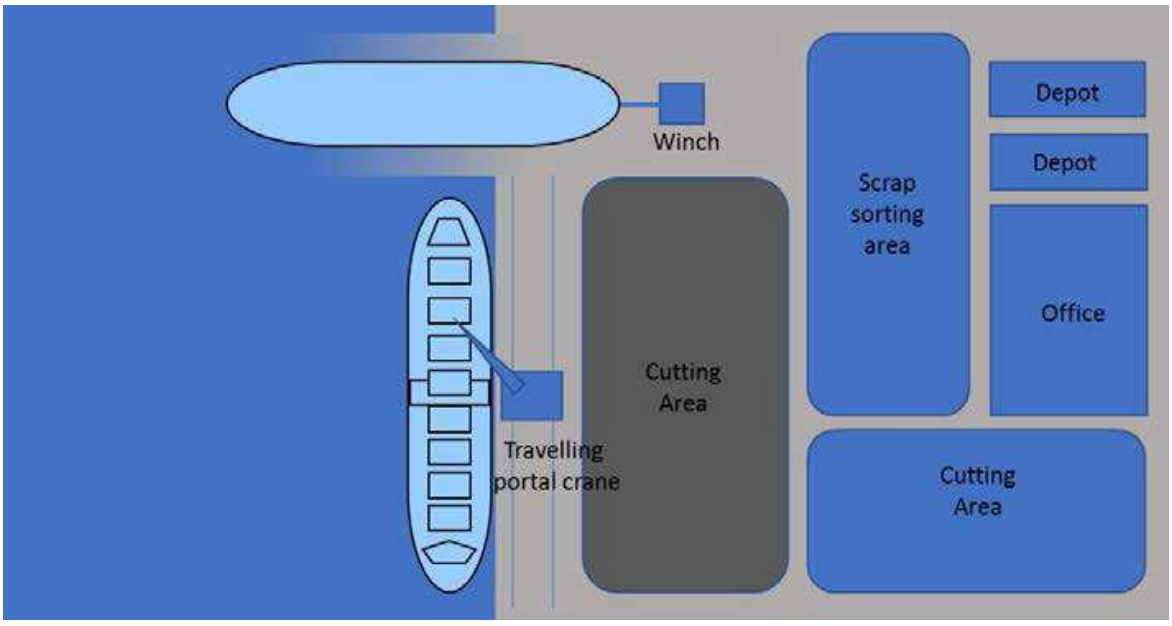


Figure 2: Pier breaking + slipway method

Given the structured approach towards dismantling and the fact that the hull of the ship remains intact until the very end of the process, the pier-breaking method is often considered a rather "green" method of ship breaking. Obviously, there is still the risk of spillages and local pollution, but through constructing impermeable concrete floors alongside the quay and slipway, these can mostly be contained.

2.3.1.2 Slipway only / Landing

Slipway landing, landing or slip landing involves the stepwise landing of a vessel, whereby a vessel is gradually pulled up on to the concrete slipway as it becomes lighter. The aft of the vessel remains afloat for quite some time, while the vessel is broken up starting from the stern. In contrast to the beaching method, which is applied in areas with a high tidal difference, this method is usually applied in the area where the tidal difference is low. The use of a concrete slipway allows for the application of cranes and other heavy machinery. By means of a heavy winch, the vessel is gradually pulled onto the slipway. The most important equipment used in the slipway method is the heavy-duty winch, for hauling in the vessel, and the crawler crane(s) that are used to carry the large blocks/sheets of steel from the vessel to the cutting area(s). Smaller equipment, such as bull-dozers, hydraulic shears, low-torches, etc. will also be required. Although the landing method breaks down most of the ship while at least part of it is still afloat, there seems to be a risk of heavy metals and liquids spilled on the slipway, which eventually ends up in the water. However, since the method is generally only applied in areas with little to no tidal difference, it is assumed that "the lack of racing tides provides an element of control and means that any accidental spillages have a reasonable chance of being contained." (Lloyd's Register, 2011) It should be noted, however, that the method does not fully contain any spillages and because the vessel, while being worked on, is not fully horizontal, some occupational risks may occur.

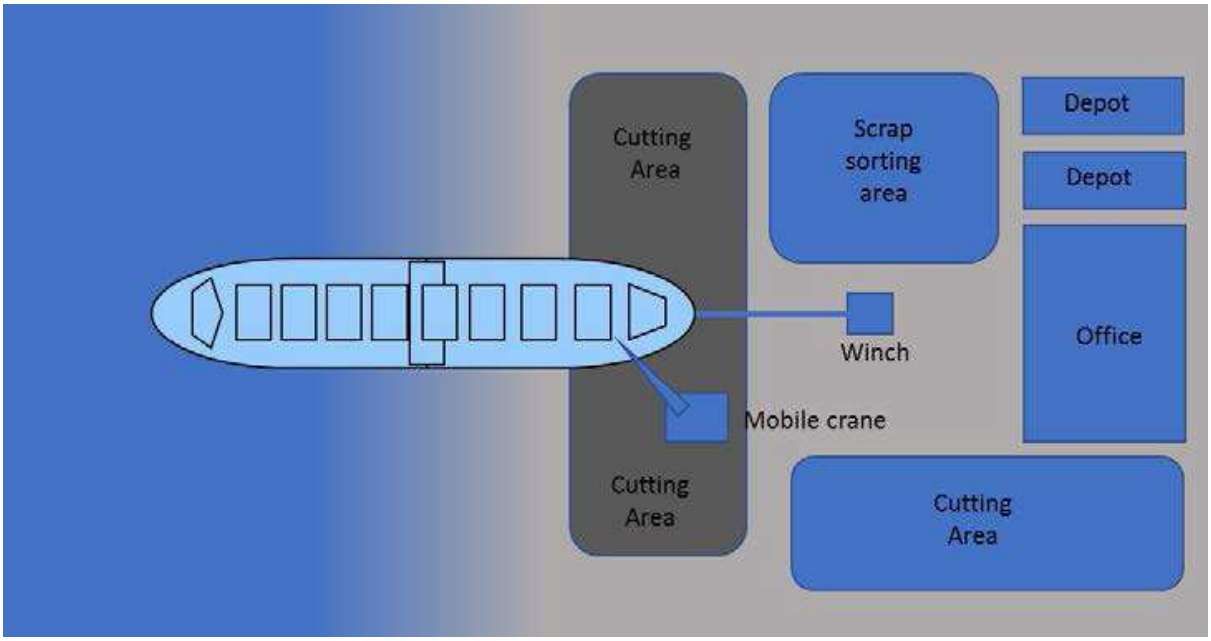


Figure 3: Layout of slipway landing

2.3.1.3 Pier breaking and Floating dock

With the pier breaking method, often also referred to as the alongside, quayside or floating method, the vessel is moored alongside a quay, jetty or wharf, while the vessel is dismantled vertically. After the hazardous materials on the inside of the ship have been removed, decommissioning starts with structures on deck and gradually continues downwards until the bottom of the hull (sometimes referred to as the "canoe") remains. In the case of the floating dock method, the "canoe" is transported onto the floating dock and elevated above the water. The "canoe" is scrapped on the floating dock and steel structures are carried to the quayside with the portal cranes. While alongside the quay, large pieces of the vessel (that are cut by means of blowtorches or hydraulic shears) are lifted from the ship into the cutting area. Large hydraulic and mechanical scrap shears are used to cut the steel from the vessel and "canoe". In this method, the floating dock is obviously an important piece of equipment. Given the structured approach towards dismantling and the fact that the hull of the ship remains in-tact until the very end of the process, the pier-breaking method is often considered a rather "green" method of ship breaking. Obviously, there is still the risk of spillages and local pollution, but through constructing impermeable concrete floors alongside the quay and slipway, these can mostly be contained. The construction of a quay wall, travelling portal crane(s) and the floating dock are considered the most relevant capital expenditures.

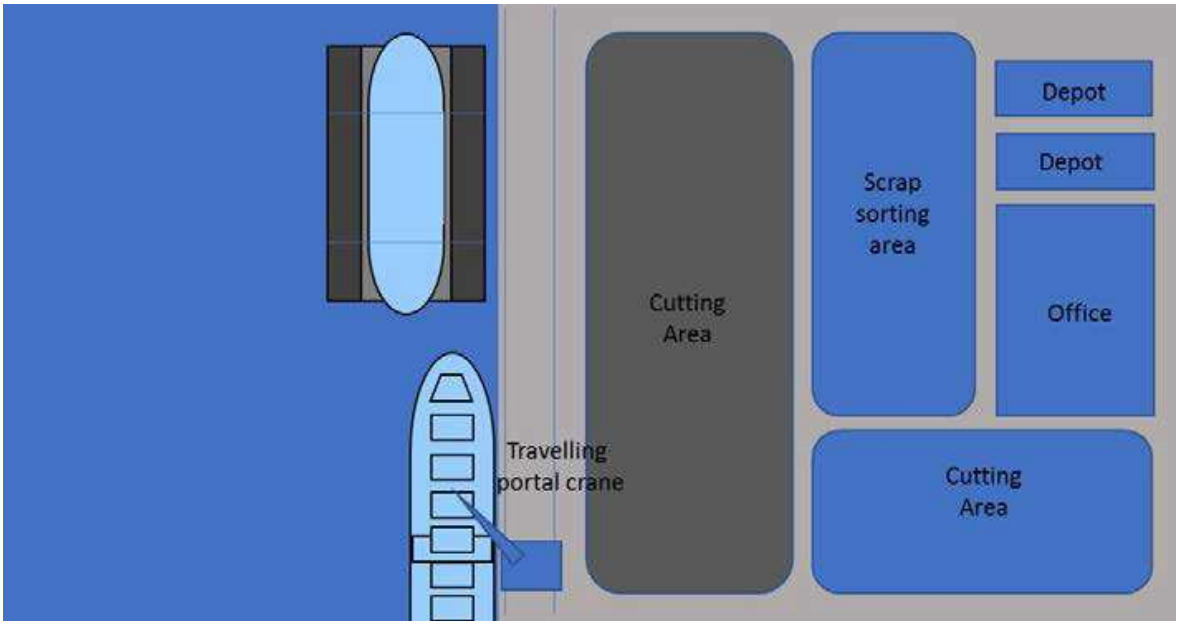


Figure 4: Layout of Pier breaking and Floating doc

2.3.1.4 Dry Dock Method

The dry dock method involves sailing the vessel into a dock, after which a lock gate is closed. The water in the dock is pumped out, while the vessel is stabilized on blocks of wood. By means of a wide travelling portal crane, blocks and pieces of the vessel that are cut-off, are transported to the cutting area. In this method, the vessel is broken-up from top to bottom. The most important equipment used in this method is the wide portal crane. Like other methods, blowtorches and hydraulic shears are used to cut the steel. Because the vessel is fully contained in this method, and a

structured approach is usually applied, the dry dock method is considered the most environmentally friendly sound and most safe way to recycle vessels. The construction of a dry dock, including lock gate and wide portal crane, make this the most expensive ship breaking option.

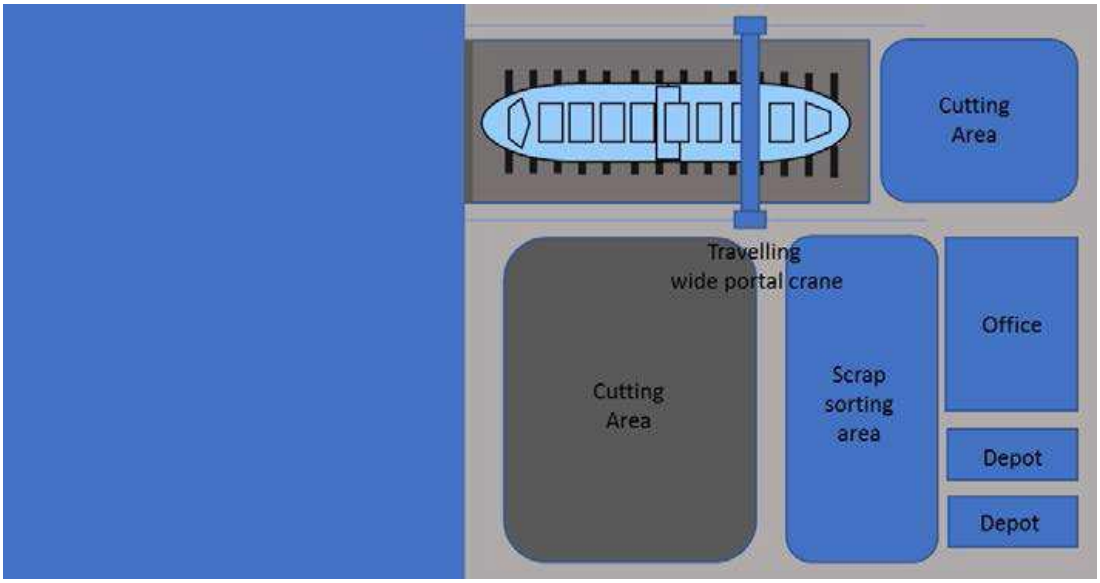


Figure 5: Layout of the dry dock method

2.3.2 Steel Production Alternatives

As part of the Wasini project, the Client wishes build a modern steel making plant, which will use scrap steel retrieved from the demolished vessels to produce steel products. Generally there are two modern methods of producing steel:

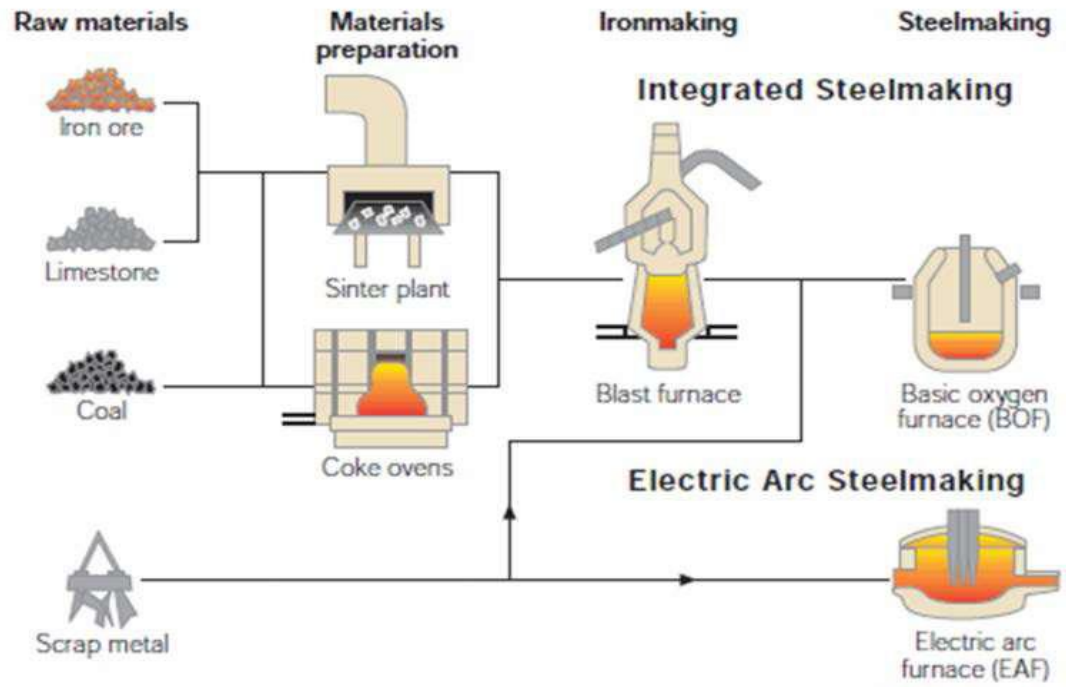


Figure 6: Process of steel making through either of these methods

- The Blast Furnace and Basic Oxygen Furnace (BF/BOF)
- The Electric Arc Furnace (EAF).

The above figure shows the ingredients and the high-level process of making steel through each of these methods. Where the BF/BOF method is largely based on raw materials such as iron ore, limestone and coal, while scrap metal has a relatively small share in the process, the EAF method is almost entirely based on scrap metal melting.

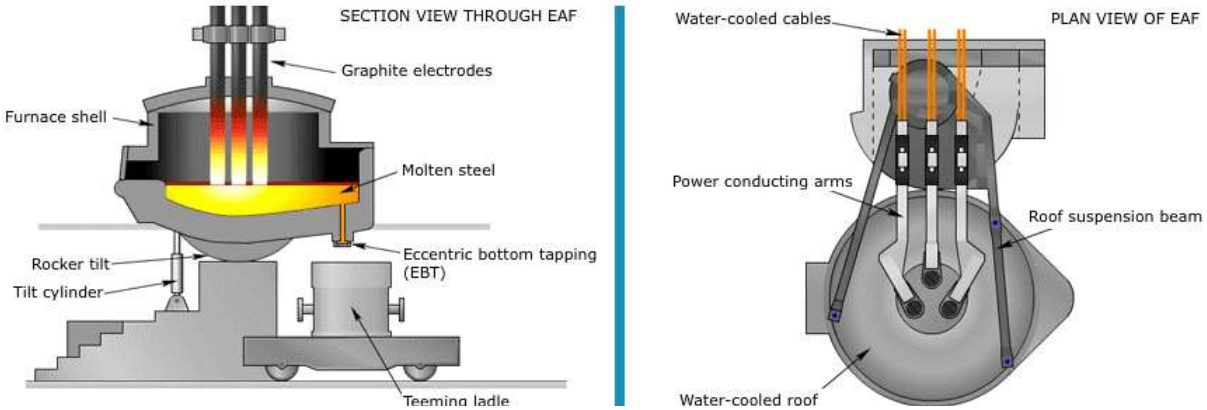


Figure 7: Plan view of Electric Arc Furnace

Contemporary steelmaking can be divided into six steps:

- ✓ Production of iron: In the first step, the raw materials iron ore, coke, and lime are melted in a blast furnace. The resulting molten iron still encompasses 4-4.5% carbon and other impurities that make it brittle. The EAF method skips this first step.
- ✓ Production of steel: Primary steelmaking methods differ between BF/BOF and EAF methods. The BF/BOF method add recycled scrap steel to the molten iron in a converter. At high temperatures, oxygen is blown through the metal, reducing the carbon content to between 0-1.5%. In the EAF method, alternatively, recycled steel scrap is melted through the use of high power electric arcs (temperatures up to 1650 °C), after which it is converted it to high-quality steel.
- ✓ Secondary Steelmaking: The molten steel is treated as part of the secondary steelmaking process. It involves treating the molten steel produced from both BF/BOF and EAF routes to fine-tune the steel composition. This is done by adding or removing certain elements and/or manipulating the temperature and production environment.
- ✓ Continuous Casting: Subsequently, the molten steel is cast into a cooled mould causing a thin steel shell to solidify. The shell strand is withdrawn using guided rolls and fully cooled and solidified. The strand is cut into desired lengths depending on application; slabs for flat products (plate and strip), blooms for sections (beams), billets for long products (wires) or thin strips.
- ✓ Primary Forming: The steel that is cast is subsequently formed into various shapes, often by hot rolling, a process that eliminates cast defects and achieves the required shape and surface quality.

Hot rolled products are divided into flat products, long products, seamless tubes, and speciality products.

- ✓ Manufacturing, Fabrication, and Finishing: Finally, secondary forming techniques give the steel its final shape and properties.

2.3.3 Preferred Steel Production Option – Electric Arc Furnace

Wasini Green Ship Recycling Project would align with the use of Electric Arc Furnace (EAF) melting equipment which is typically applied at this level of output. The EAF produces melting energy from the resistive heat generated when an electric arc is produced between graphite electrodes which project into the furnace and the scrap metallic charge. The electrical inputs are precisely controlled to modulate the furnace heating. The feedstock may be of various qualities of steel scrap which is graded for content and size. Smaller quantities of Direct Reduced Iron (DRI) are also sometimes used to adjust the composition of the final steel by supplementing the iron content. The EAF process generally operates in a batch mode producing heats of molten steel with tap times for modern furnaces of less than 60 minutes. A typical furnace scrap heat load would be in the region of 40 t for a 300,000 t/y plant rising to 60 t for a 600,000t/y plant.

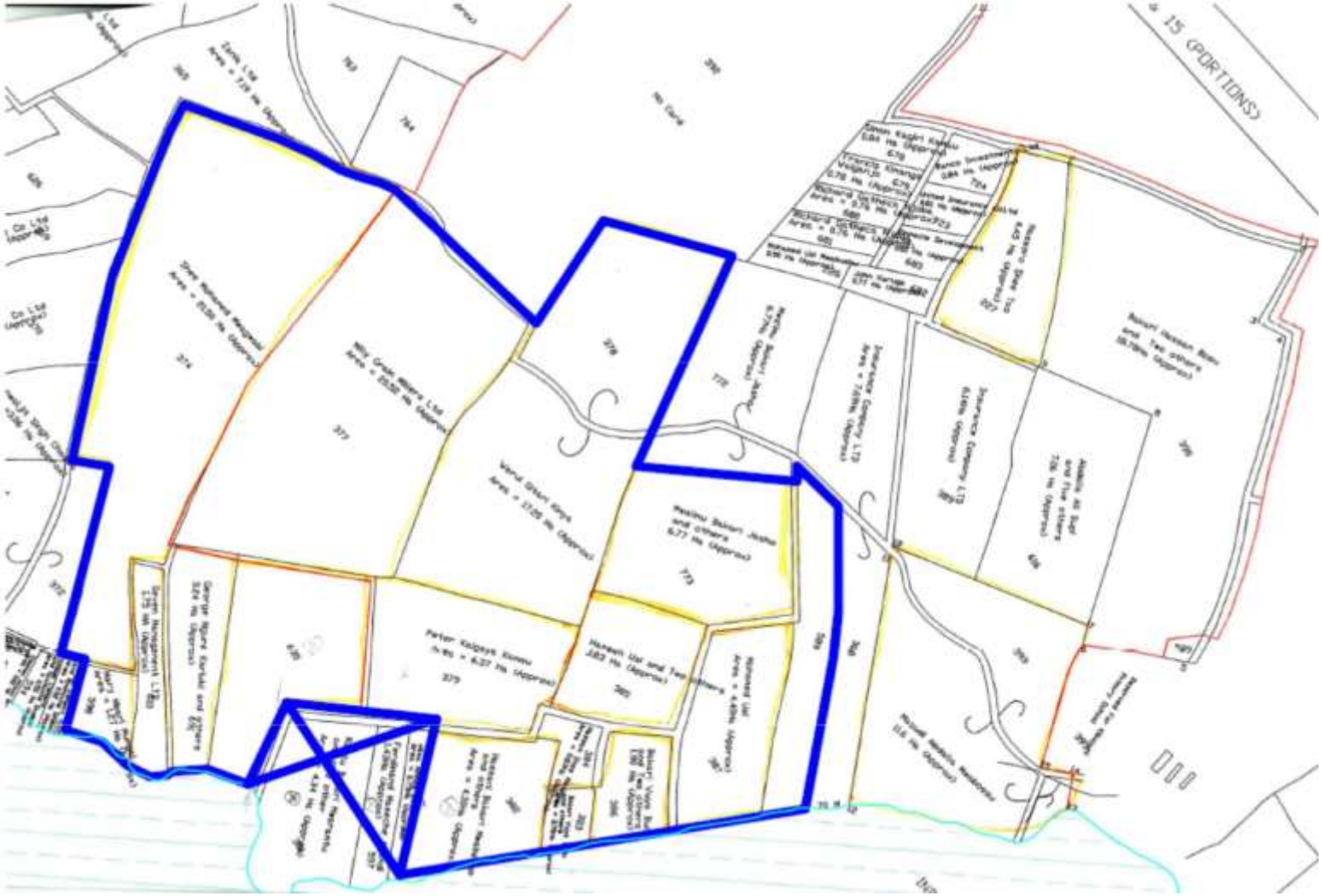


Figure 8: Plots to be used for the proposed project

3. METHODOLOGY AND SCOPE OF EIA

3.1 Background

Environmental Impact Assessment (EIA) refers to a critical examination of the effects of a proposed project on the environment before its implementation. Impacts describe any negative and positive environmental influence caused by a project and is applied on the basic principle that the effect of a project on the environment needs to be established before it is implemented. The basic assumption is that if a proper EIA is carried out then the sustainability of the environment can be properly managed during the projects implementation, commissioning, operation and decommissioning. The term environment is used in its broadest possible sense to embrace not only physical and biological systems but also socio-economic systems and their inter-relationships. The EIA process hence takes into account operational, social, cultural, economic, legal and administrative considerations. The process involves the following:

- Collection of baseline data and information;
- Description of affected environments;
- Public participation and stakeholder consultation;
- Identification and assessment of potential impacts (both negative and positive) of the project to the environment;
- Proposal of possible mitigation measures to curb any potential negative impacts, while outlining interventions to enhance the positive impacts;
- Development of an appropriate Environmental Management and Monitoring Plan (EMMP).

3.2 Detailed EIA study.

This EIA study was carried out as provided for in the Environmental (Impact Assessment and Audit) Regulations, Legal Notice 101 of 2003. The study investigated the following issues among others as outlined in the second schedule of the said regulations:

1. Ecological Considerations

(a) Biological diversity including

(i) Effect of proposal on number, diversity, breeding habits, etc. of wild Animals and vegetation;

(ii) Gene pool of domesticated plants and animals e.g. monoculture as opposed to wild types.

(b) Sustainable use of natural resources, including:

(i) Effect of proposal on soil fertility

(ii) Breeding populations of fish, game or wild animals

(iii) Natural regeneration of woodland and sustainable yield

(iv) Wetland resource degrading or wise use of wetlands.

(c) Ecosystem maintenance including:

(i) Effect of proposal on food chains

(ii) Nutrient cycles
(iii) Aquifer recharge, water run-off rates
(iv) Real extent of habitats
(v) Fragile ecosystems

2. Social considerations including
(a) Economic impacts
(b) Social cohesion or disruption
(c) Effect on human health
(d) Immigration or emigration
(e) Communication - roads opened up, closed, rerouted
(f) Effects on culture and objects of culture value

3. Landscape
(a) Views opened up or closed
(b) Visual impacts (features, removal of vegetation, etc.
(c) Compatibility with surrounding area
(d) Amenity opened up or closed, e.g. recreation possibilities.

4. Land uses
(a) Effects of proposal on current land uses and land use potentials in the project area.
(b) Possibility of multiple uses
(c) Effects of proposal on surrounding land uses and land use potentials.

5. Water:
Important aspects considered are the effects of the proposal on:
(a) Water sources (quantity and quality) -
(i) Rivers;
(ii) Springs;
(iii) Lakes (natural and man-made);
(iv) Underground water;
(v) Oceans.
(b) Drainage patterns / drainage systems.
5. Traffic management
6. Dust management
7. Sources of production materials.

3.3 Preparation of the EIA study report

EIA study report includes the following:

- Project Description: Location, objectives of the project; technology, procedures and processes to be used in implementation of the project.
- Baseline information such as descriptions of the natural, social and operational environments,
- Current policy and legal framework and the administrative arrangement under which the project will operate.

- Alternative technologies and processes available and reasons for preferring the chosen technology and processes.
- The wastes to be generated by the project and ways of handling it.
- The environmental effects of the project: including the social and cultural effects and the direct, indirect, cumulative, irreversible, short term and long term effects anticipated.
- Occupational Safety and Health arrangements: Provision of an action plan for the prevention and management of foreseeable accidents and hazardous activities, measures to prevent health hazards and to ensure security
- An Environmental and Social Management Plan (ESMP) proposing measures for eliminating, minimizing or mitigating adverse impacts on the environment, while enhancing the positive effects; including the cost, time frame, and responsibility to implement these measures.
- An Environmental and Social Monitoring Plan (ESMP) with responsibilities to ensure the proposed mitigation measures are implemented and desired affects achieved
- A non-technical summary outlining the key findings, conclusions and recommendations of the study.

3.4 Terms of Reference for EIA Study

Terms of reference (ToR) for the Environmental Impact Assessment (EIA) Study for the proposed project were developed and submitted to the National Environment Management Authority for approval. Appendix 3 is acknowledgement letter from NEMA on the approval of the ToR.

3.5 Detailed EIA Study

The EIA study was carried out by Heztech Engineering Services firm of experts registered and licenced by NEMA (Reg No. 5194, Appendix 4). Air quality and marine water quality sampling and analysis was carried out by Polucon Services Kenya Limited, a NEMA accredited Laboratory (appendix 5). Key documents that informed part of the EIA Study are the feasibility study reports prepared by Maritime & Transport Business Solutions (MTBS) of the Netherlands and EA SYST Engineering (I) PVT. LTD of India, Bathymetric Survey carried out by Damen Shipyards Limited, Geotechnical Survey carried out by M/s Aven Premier International and Topographical Survey carried out by Kimoland Surveyors.

4.0 POLICY AND LEGAL FRAMEWORK

4.1 Legal Framework

Legislative provisions applicable to the proposed project are:

4.1.1 Constitution of Kenya, 2010

The current constitution was promulgated in 2010 establishing a system of devolved government based on counties. The key constitutional provisions relevant to the proposed project are:

- Article 10 on national values and principles of governance including 10(2a) on democracy and participation of people;
- Fourth Schedule Article 10 on implementation of specific national government policies on natural resources and environmental conservation;
- Fourth Schedule Article 22 under national government on the protection of the environment and natural resources with a view to establishing a durable and sustainable system of development;
- Bill of rights Article 42 which states that every person has the right to a clean and healthy environment;
- Article 196 on public participation.

4.1.2 Environmental Management and Coordination Act, 1999

This is an Act of Parliament to provide for the establishment of an appropriate legal and institutional framework for the management of the environment. The Act established the National Environment Management Authority (NEMA) as the regulatory authority in charge of environmental matters.

Relevant Provisions include mandates given to NEMA such as:

1. Section 2(a): Co-ordination of environmental management activities and promotion and integration of environmental considerations into development projects.

2. Section 2(d): Examination of land use patterns to determine their impact on the quality and quantity of natural resources;

3. 2(e): Carry out surveys to assist in the proper management and conservation of the environment;

4. 2(l): Monitor and assess activities carried out by proponents in order to ensure that the environment is not degraded by such activities, that environmental management objectives are adhered to, and adequate early warning on impending environmental emergencies is given.

4.1.3 Fisheries Management and Development Act No 35, 2016

This is an Act of Parliament is to provide for the conservation, management and development of fisheries and other aquatic resources to enhance the livelihood of communities dependent on fishing, and to establish the Kenya Fisheries Services; and for connected purposes.

Relevant provisions include:

- Section 5(1): protect, manage, use and develop aquatic resources in a manner that is consistent with ecologically sustainable development and to uplift the living standards of fishing communities;
- Section 7 which provides for the establishment of Kenya Fisheries Service as the state agency responsible for conservation, management and development of Kenya's fisheries resources.

4.1.4 Forest Conservation and Management Act, 2016

This Act established the Kenya Forest Service (KFS) and supportive institutions for management and conservation of all types of forests. This Act mandates the KFS to conserve and manage all forests and sets out the roles and responsibilities of communities in managing forests. In line with Section 23 of the Act KFS would take keen interest in forest lands where:

- land is an important catchment area, a source of water springs, or is a fragile environment;
- land is rich in biodiversity or contains rare, threatened or endangered species;
- forest is of cultural or scientific significance; or
- the forest supports an important industry and is a major source of livelihood for the local community.

4.1.5 Water Act, 2016

The Water Act 2016 makes provision for the conservation, control and use of water resources in Kenya and for incidental and connected purposes. This Act aims at providing for harmonized and streamlined management of water resources, water supply and sewerage services.

The Water Resource Management Authority was established under this Act to regulate and protect resources from adverse impacts. The Water Act provides for the conservation and controlled use of water resources in Kenya. Under the Ministry of Water the Act prohibits pollution of water resources and controls the discharge of industrial and municipal effluents into the ocean and other water bodies. The proposed project would impact on sea water due to dredging and disposal of dredged material and hence is subject to the provisions of the Water Act.

4.1.6 Physical Planning Act, Cap 286, 1996

The Act provides for preparation of regional and local physical development plans and grants local authorities (now County Governments) powers to control development within the area under their jurisdiction. Relevant sections are:

- Section 36**:** If in connection with a development application a local authority (now County) is of the opinion that proposals for industrial location, dumping sites, sewerage treatment, quarries or any other development activity will have injurious impact on the environment, the applicant shall be required to submit together with the application an environmental impact assessment report.

4.1.7 The Merchant Shipping Act No. 4 of 2009

This is an Act of Parliament to make provision for the control, regulation and orderly development of merchant shipping and related services; and to consolidate the law relating to shipping and for

connected purposes. It aims to make provision for the registration and licensing of Kenyan ships, to regulate proprietary interests in ships, the training and the terms of engagement of masters and seafarers and matters ancillary thereto; to provide for the prevention of collisions, the safety of navigation, the safety of cargoes, carriage of bulk and dangerous cargoes, the prevention of pollution, maritime security, the liability of ship owners and others, inquiries and investigations into marine casualties.

4.1.8 Energy Act, No. 2006

The Energy Act, No. 12 was enacted in 2006 and has consolidated the law relating to energy whilst simultaneously focusing on improved management and delivery of energy services. The Act brought forth the Energy Regulatory Commission (ERC).

Relevant provisions of this legislation include Section 14 which states that ERC shall, in granting or rejecting an application for a license or permit, take into consideration:-
(a) the impact of the undertaking on the social, cultural or recreational life of the community;
(b) the need to protect the environment and to conserve the natural resources in accordance with the Environmental Management and Coordination Act of 1999.

4.1.9 Kenya Maritime Authority Act (Cap. 370).

An Act of Parliament to provide for the establishment of the Kenya Maritime Authority as a body with responsibility to monitor, regulate and coordinate activities in the maritime industry and for all other matters connected therewith. Relevant sections include the following functions of the Authority:

- to ensure, in collaboration with such other public agencies and institutions, the prevention of marine source pollution, protection of the marine environment and response to marine environment incidents;
- to regulate activities with regard to shipping in the inland waterways including the safety of navigation; and
- to implement and undertake co-ordination in maritime security.

4.1.10 Tourism Act, 2011

This Act provides for the development and management of stainable tourism and tourism-related activities and services, and for connected purposes. Mombasa County is a popular tourist destination and plans developed have to comply with the Act. Under Section (5) of the Act the Authority responsible for regulation of tourism activities shall, in considering license applications, have regard to:

a) the protection of fragile environmental resources, ecosystems and habitats as provided for by the ministry for the time being responsible for matters relating to the environment;
b) an environmental impact assessment license issued under Part VI of the Environmental Management and Co-ordination Act, 1999 (No. 8 of 1999);
c) any representations received from members of the public.

The Act prohibits discharge of any dangerous materials, substances or oil into a designated tourism development area and pollution of wildlife habitats and ecosystems, or discharge of any pollutant detrimental to the environment contrary to the provisions of this Act or any other law.

4.1.11 Occupational Safety and Health Act, 2007

This is an Act of Parliament to provide for the safety, health and welfare of workers and all persons lawfully present at workplaces. The provisions of the Act relevant to engineering construction works are contained in the Abstract of the Act for Building Operations and Works of Engineering Construction Rules. These rules specify the minimum safety and health measures to be taken during construction works which include that the proponent should:

- Give notice of particular operations or works;
- Such notice should be sent in writing to the Occupational Health and Safety Officer, not later than seven days after commencement of construction;
- Post printed copies or prescribed abstracts of the Occupational Safety and Health Act at the site of operations or works;
- Provide sufficient and suitable sanitary conveniences for persons employed. These must be kept clean and well lit.

The purpose of the Act is to secure the safety, health and welfare of persons at work; and protect persons other than persons at work against risks to safety and health arising out of activities of persons at work.

4.1.12 Employment Act, 2007

This is an Act of Parliament to declare and define the fundamental rights of employees, to provide basic conditions of employment of employees, to regulate employment of children, and to provide for connected matters. In accordance with the Act it shall be the duty of the Minister, labour officers and the Industrial Court to promote equality of opportunity in employment in order to eliminate discrimination in employment; and to promote and guarantee equality of opportunity for a person who, is a migrant worker or a member of the family of the migrant worker, lawfully within Kenya.

The Act states that no employer shall discriminate directly or indirectly, against an employee or prospective employee or harass an employee or prospective employee on grounds of race, colour, sex, language, religion, political or other opinion, nationality, ethnic or social origin, disability, pregnancy, mental status or HIV status.

4.1.13 HIV and AIDS Prevention and Control Act 2006

The object and purpose of this Act is to (a) Promote public awareness about the causes, modes of transmission, consequences, means of prevention and control of HIV and AIDS; (b) Extend to every person suspected or known to be infected with HIV and AIDS full protection of his human rights and civil liberties by - (i) Prohibiting compulsory HIV testing save as provided in this Act; (ii)

Guaranteeing the right to privacy of the individual; (iii) Outlawing discrimination in all its forms and subtleties against persons with or persons perceived or suspected of having HIV and AIDS; (iv) Ensuring the provision of basic health care and social services for persons infected with HIV and AIDS; (c) Promote utmost safety and universal precautions in practices and procedures that carry the risk of HIV transmission; and (d) Positively address and seek to eradicate conditions that aggravate the spread of HIV infection.

4.2 Policies and Regulations

The table below highlights some of the relevant policies and their overall provisions as related to the proposed development:

Table 1: Policy Framework and Regulations applicable to the Project

Policy and regulation	Provision Applicable to Proposed Project
Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003	These Regulations were created to give effect to EMCA by providing guidance on the procedure for conducting ESIA studies and detailing the issues to be addressed during the study, as well as the parameters to be evaluated and guidelines for development of environmental management and monitoring plans. In addition the regulations provide guidelines for conducting annual environmental audits.
Environment Impact Assessment Guidelines And Administrative Procedures, 2002	These guidelines were developed to support the Environmental Impact Assessment (EIA) and Environmental Audit (EA) processes and assist in the integration of environmental and social concerns in economic development to foster sustainable development in Kenya.
Kenya Vision 2030	Kenya Vision 2030 is a long-term development blueprint for the country to create a globally competitive and prosperous country with a high quality of life by 2030. It aims at transforming Kenya into "a newly-industrializing, middle income country providing a high quality of life to all its citizens in a clean and secure environment".
National Environment Policy and Guideline 2013	Upon the promulgation of Constitution of Kenya 2010, it was found necessary to review the draft policy of 2008 to accommodate any new developments due to time lapse and to align it to the Constitution.
National Tourism Strategy 2013-2018	The national tourism strategy is a culmination of extensive stakeholders' involvement and participation besides fulfilment of the Tourism Act 2011, Section 3. The main aim of this strategy is to address national issues affecting Kenya's tourism sector and focus the players in the sector on sustainable tourism.
Environmental Management and Coordination (Water Quality) Regulations, 2006	These are described in Legal Notice No. 120 of 2006 and provide for protection of ground and surface water from

	pollution, quality standards for sources of domestic water and the limits and parameters of pollutants in treated waste water which can be discharged into the aquatic environment.
Environmental Management and Coordination (Noise and Excessive Vibration (Pollution Control)) Regulations, 2008 (Legal Notice No 61)	These regulations apply to operation of equipment or machinery and engagement in commercial or industrial activity that is likely to emit noise or excessive vibrations. The regulations specify the limits or levels within which these shall be undertaken. The Regulations also stipulate in the second schedule that construction activities undertaken during the night should not emit excessive noise beyond the permissible levels.
Environmental Management and Coordination (Waste Management) Regulations, 2006 (Legal Notice No 121)	These regulations outline the responsibility of the waste generator and prescribe proper mechanisms for handling all waste through segregation, recycling and reuse.
Environmental Management and Coordination (Air Quality) Regulations, 2009	These regulations provide for prevention, control and abatement of air pollution from premises, processes, operations or works, and prescribes exposure limits of air pollutants and emission levels of hazardous substances.
Fisheries (Beach Management Unit) Regulations, 2007	These regulations aim to support the Fisheries Act by: (a) strengthening the management of fish-landing stations, fishery resources and the aquatic environment; (b) ensuring achievement of high quality standards with regard so fish and fishery products; (c) building capacity of the members for the effective management of fisheries in collaboration with other stakeholders; and (d) preventing or reducing conflicts in the fisheries sector. The regulations recognize the roles played by different sections of the community, including women, in the fisheries sector. The overall aim is to combine elements from all management levels in a common, participatory approach thereby creating a link and partnership between the government level and artisanal fishermen.
Environmental (Prevention of Pollution in Coastal Zone and other Segments of the Environment) Regulations 2003	Regulates wastewater and ballast water discharge from ships.

- Development Plans: Kwale County Integrated Development Plan 2018-2012
- International agreements, Conventions, and WB Policies:

Table 2: Internal agreements, Conventions and World Bank Policies related to project

Sector	Convention / Policy
International Development	Agenda 21, World Commission on Environmental and Development (The Burtland Commission) signed/ratified 1987,
EIA	World Bank Operational Policy 4.01(Environmental Assessment)
Water Quality	Ballast water management regulations (IMO Convention)
Marine pollution prevention	• London convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter(1972) • International Convention for the Prevention of Pollution From Ships, 1978.(Marpol 73/78) • World Bank Technical Paper Number 126 • (Environmental Considerations for Port and Harbor Development)
Endangered Species	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) – ratified 1978,
Wetlands	Convention on Wetland of International Importance (Ramsar, 1971)
Biodiversity	Convention on Biological Diversity (1992) WB OP 4.04: Natural Habitats
Hazardous Waste	Basel Convention on the Control of Trans-boundary Movement of Hazardous Wastes (1989)
Oil Spill	International Convention on Oil Pollution Preparedness, Response and Cooperation(1990)

Conventions related to Ship recycling

- ✓ HKC Hong Kong Convention on Environmentally Sound Ship Recycling
- ✓ Basal Convention on Trans-border Shipment of Hazardous Material
- ✓ Bamako Convention: Embargo by African Countries on Import of Hazardous Material
- ✓ EU Regulation Certification of Ship Breaking Facilities.

5. SOCIO ECONOMIC AND DEMOGRAPHIC PROFILE

5.1 Introduction

The field survey was carried out from 5th to 10th May 2019. A total of 12 villages were sampled and a total of 150 household heads were interviewed.

This situational analysis provides findings from household survey conducted across 152 households in Kibuyuni area. Kibuyuni[1] is situated in Pongwe/Kikoneni ward, Lunga Lunga Sub County, Kwale County in Kenya. The area has an estimated population of approximately 41,098 inhabitants and covers an area of approximately 223.50 Sq. Km. It comprises Majoreni, Mzizima, Shimoni, Wasini/Mwakiro and Bumbani sub-locations. In this survey, 9 villages were sampled around the proposed project site and interviews conducted. These villages were: Anziwani (10, 7%), Changai (22, 14%), Chiromo (10, 7%), Fikirini (22, 14%), Guraya (4, 3%), Magogoni (6, 4%), Mtimbwani (34, 22%), Shimoni (32, 21%) and Utsamba (10, 7%).

5.2 Livelihood and Employment

Most of the household heads depended wholly on single economic activities for their income and support for their households. These were generally in cognizance of the available economic activities in the surrounding areas. About 36% of the household heads were fishermen which was relied upon by 42% of the households for livelihood; 22% were crop farmers and 20% were involved in small trade. About 20% and 9% of the households relied in these economic activities in that order. Of note also is that just 1% of the household heads were involved in animal husbandry and rearing yet 15% of the households depended on it as source of livelihood as table 1 further provides.

Table 3: Occupation of the head of households and main source of livelihood for the households (n=152)

Economic Activities:	Occupation of the head of households (n=152)	Main Source of livelihood for the households (n=152)
Fishing	54 (36%)	64 (42%)
Crop farming	34 (22%)	30 (20%)
Sea weed farming	2 (1%)	2 (1%)
Animal husbandry and rearing	2 (1%)	24 (16%)
Trading and Shop keeping	30 (20%)	14 (9%)
Casual Labor employment	16 (11%)	4 (3%)
Combination of farming, fishing and casual labor	8 (5%)	8 (5%)
Others	6 (4%)	6 (4%)

[1] https://informationcradle.com/kenya/pongwe-county-assembly-ward/

The average estimated household monthly income in the area was KES 5000. Households earned between KES 4,000 and KES 5,000 at minimum and maximum respectively. The median total annual income estimate was KES 60,000 with the minimum being KES 60,000 and maximum being KES 72,000.

The differences between household head's main occupation and the reliance of the proportions of households depending on the same occupation for livelihood maybe explained partly the number of household members that were confirmed to be engaged in livelihood or income generating activities in the area under study. Whereas in majority of the households (51%) had only one member actively engaged in an economic activity, the remaining 49% of the households had more than one person engaged in a livelihood or income generating activities from which the house could be supported (39% - I member, 10% - between 3 and 6 members) as table 1 shows.

Table 4: Number of household members engaged in livelihood on income generating activities (n=150)

Number of household members engaged in livelihood or income generating activities:	Households (n=150)	Proportion of Households (%)
1	76	51%
2	58	39%
3	6	4%
4	8	5%
6	2	1%

Different households had different people engaged in multiple activities at the same time as source of livelihood. More specifically, 58% were involved in fishing or fish processing, 30% were involved in farming, 29% were involved in business, 14% in casual labor, 5% in formal employment, 3% in tailoring and 1% each in car wash, block making, deep sea diving, masonry and plumbing.

The analysis also establishes from the survey that that someone from 71% (108) of the 152 households sampled was engaged in an economic activity dependent on marine resources. More specifically, 81% of the households had someone engaged as a fisherman while in the remaining 19% of the households, someone was engaged as a sea weed farmer, fish monger, fish trade middleman or fish boat owner as table 3 shows. The distribution of the members of the households involved in a marine resource exploitation activity was such that in 52% of the households, only one member was involved, in 35% there were 2 members involved, in 7% households, there were 4 members involved, in 4% there were 5 members and in 2% there were three members.

Table 5: Specific marine related income generated activities members of the household are involved (n=108)

Household involvement in marine related activities:	Households (n=108)	Proportion of Households (%)
Directly as a fisherman:	88	81%
Directly as a sea weed farmer:	6	6%
As a fish monger in the local market:	4	4%
As a fish trade middleman:	6	6%
As a fishing boat owner:	4	4%

5.3 Socio Demographic Characteristics

In terms of the socio demographic characteristics of the household heads from the selected households, majority of the household heads interviewed were aged between 25 and 49 years (70%) with 26 beyond 49 years and 5% less than 25 years but above 18 years. About 7 in 10 households are headed by a male. About 92% of the household heads were either married or had ever been married (currently married – 82%, divorced – 3% and widowed – 7%). Only 8% were unmarried. Nearly 40% of the male and 39% of the female household heads in the area have no formal education. Nearly 36% of the male and 52% female heads households reached primary level of education. About 24% of the males compared to 8% of the female head of households had gone beyond primary level of households. These findings point to high illiteracy levels among the heads of the households with higher proportion of females reaching primary level compared to males and more males moving beyond primary level of schooling. All these are shown in table 4. In terms of household membership, each of the household sampled had on average 1 male 2 males under 25 years; 2 males and 1 female between 25 and 39 years; 1 male and female between 40 and 55 years.

Table 6: Socio Demographic Characteristics of the household heads (n=152)

Socio Demographic Characteristics of the household heads:	Households (n=152)	Proportion of Households (%)
Age of spouse (in years) (n=122):		
19-24	6	5%
25-34	42	34%
35-49	44	36%
50-60	16	13%
Over 60	14	11%
Gender of household head (n=152):		
Female	46	30%
Male	106	70%
Marital Status of household head (n=148):		
Married	122	82%
Divorced	4	3%
Unmarried	12	8%

Widowed	10	7%
Highest level of education of male household head (n=90):		
None	36	40%
Primary	32	36%
Secondary	20	22%
Middle Colleges	2	2%
Highest level of education of female household head (n=46):		
None	18	39%
Primary	24	52%
Secondary	2	4%
University	2	4%

4.4 Water, Sanitation and Hygiene

5.4 Water Sanitation and hygiene

Majority of the households in and around the proposed site rely on either protected or unprotected wells for their drinking water (96%) and water for other purposes (94%). Only 1% of the households have access to piped water for drinking and for other purposes. Also, 4% of the households rely on rain water for other needs within the households as table 5 shows.

Table 7: Main water sources for the households (n=152)

Main source of water for the household:	Households (n=152)	Proportion of Households (%)
Drinking water		
Public tap/standpipe	2	1%
Protected well	82	54%
Unprotected well	64	42%
Bottled water	2	1%
Others (specify)	2	1%
Water for other purposes		
Public tap/standpipe	2	1%
Protected well	74	49%
Unprotected well	70	46%
Rainwater collection	6	4%

Across 98% of the households sampled, water for the household consumption was fetched by mainly adult women over 15 years from the source. As figure 2 shows, adult man over the age of 15 years and female children under 15 years were the main people responsible for fetching water in 1% of the households each. The median length of time (in minutes) from the household to the source, getting water and coming back was estimated at 5 minutes with some households taking up to 30 minutes on the maximum. In terms of availability and use of toilet facilities in the area, 47% of the

households confirmed that they did not use toilet facility and instead used the bush or field. Of the 53% (80) of the households that used toilet facility, 50% used pit latrine with a slab and 23% used each of flush to pit larine and pit latrine without a slab/open pit as figure 3 shows.

5.5 Housing and Living Conditions

On average, each of the households sampled had 2 rooms within the household being used for sleeping. On physical observation of the dwelling units of the households sampled, 57% of the household's dwelling units had a floor made of earth or sand; roof made of thatch or leaves; about 40% of the walls made of mud and 39% of the walls made of cement or cement blocks as table 7 shows.

Table 8: Main material of the floor, roof and walls of the main dwelling units of the households (n=140)

Main material of the dwelling units':	Households (n=140)	Proportion of Households (%)
Floor:		
Earth/Sand	80	57%
Ceramic tile/Mosaic	2	1%
Cement	56	40%
Carpet	2	1%
Roof:		
Thatch/Sod/Leaf	68	49%
Rustic mat/Plastic sheet/Polythene	6	4%
Palm/bamboo	14	10%
Metal	44	31%
Cement	8	6%
Walls:		
Cane/Palm/Trunks/Leaf/Jute stick/Sod	6	4%
Dirt/Mud	56	40%
Stone with mud	2	1%
Tin Sheet	2	1%
Cement/Cement block	54	39%
Bricks	20	14%

On the description of the dwelling and its surrounding, 26% of the 138 of the households who responded to the question on the location of the dwelling confirmed that their dwelling units were located in safer areas within the region. About 41% confirmed that their dwelling was in a flood prone area while 25% confirmed that their dwelling unit was along a busy road from the sea among many others as figure 6 shows.

Majority (79%) of the sampled households used wood for fuel for household cooking. LPG gas and kerosene were used only by 3% and 1% of the households respectively as figure 3 shows. In 81% of

the households, food was prepared in open fire while in 16% and 3% of the households, food was prepared in open and closed stove respectively. Also, cooking was done in the house, in a separate building and outdoors in 43%, 29% and 29% of the households.

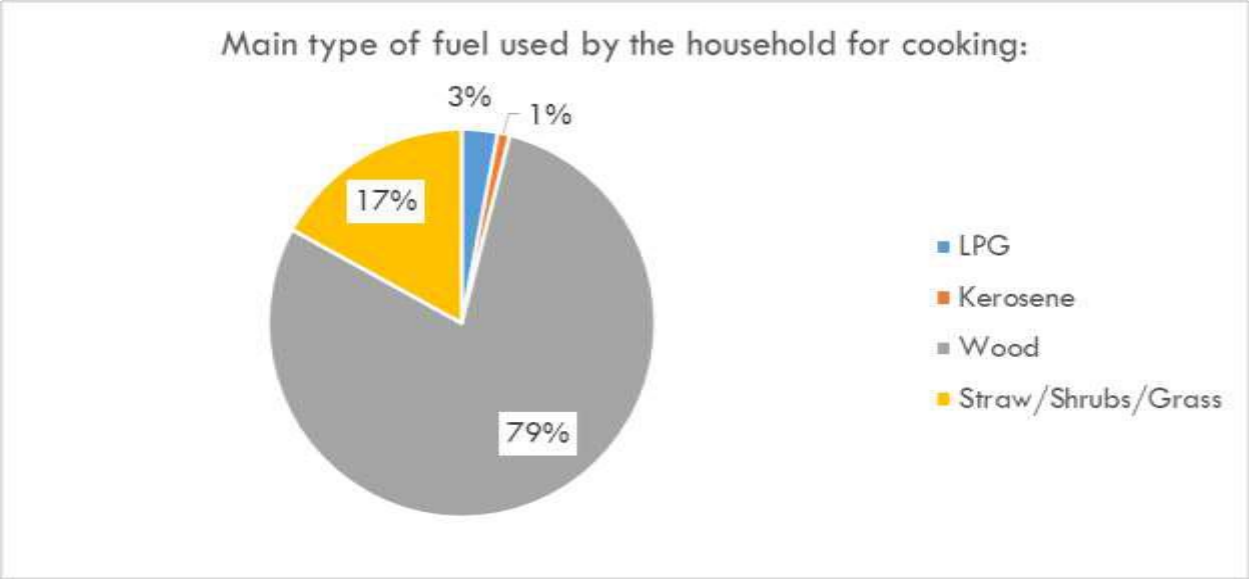


Figure 9: Main type of fuel used by the household for cooking (n=150)

5.6 Assets and Property Ownership

The study also sought to find out about the kinds of assets and properties owned by the households sampled in the area under study. Each household owned a number of different kinds of assets. Mobile phone was owned by 72% of all the 152 households sampled; radio was owned by 52%, television set by 20%. Electricity coverage was at 17% of the households. Refrigerator and electric fan were each owned by 1% of the households as figure 4 shows.

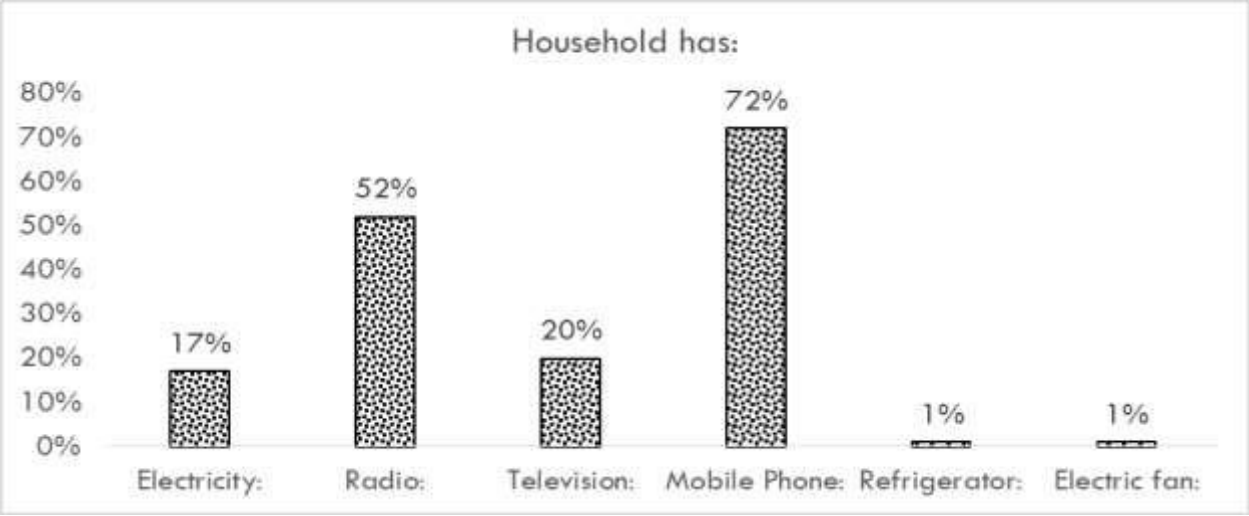


Figure 10: Items owned by households (n=152)

At least one member of the 32% of the household was in possession of a bicycle, 25 % in possession of a watch, 17% were in possession of motorcycle or scooter. Boat with a motor/trawler and a sofa was owned by at least a member of 3% and 5% of the households respectively. Figure 5 shows the household ownership of selected items.

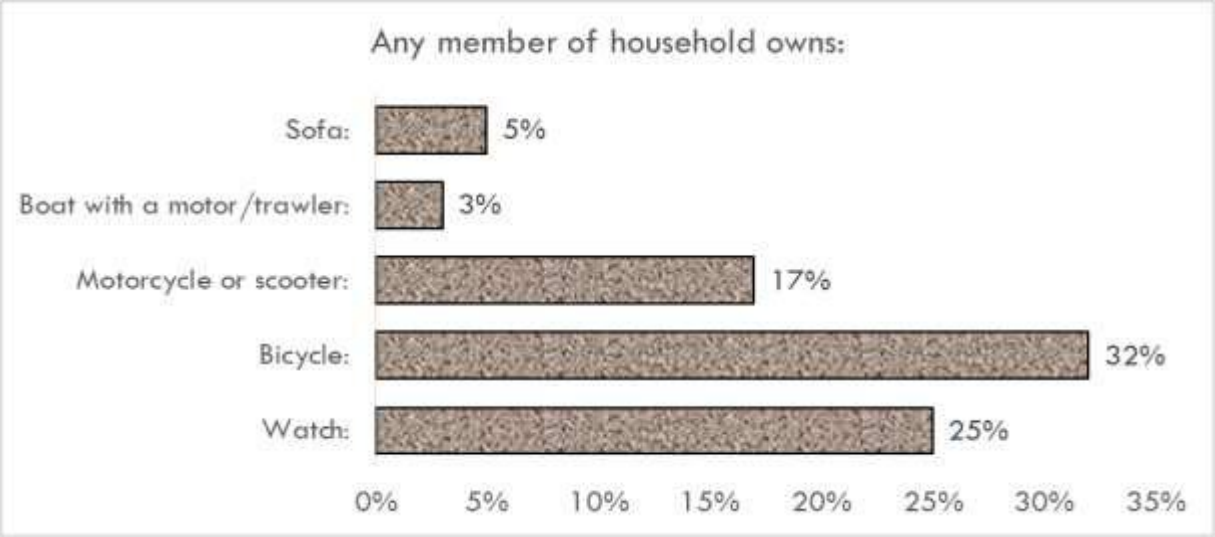


Figure 11: Items owned by at least one member of the household (n=152)

5.7 Land Tenure

On average, majority of the households have lived in the villages for period of 30 years. About 90% of the 136 households that answered questions on security of tenure for their dwelling places, confirmed that they owned the land or property in which they were staying. The other 10% stayed in rented parcels of land as table 9 shows. Among the households that owned their various pieces of land, only 26% of them owning a title deed and 7% having allotment letters for the land where their household was staying. About 67% of the household that considered themselves the owners of the pieces of land where their households were staying did not have any document to confirm ownership of the land or property. None of those who rented the space where their household was dwelling had any written document to confirm the rental status and agreement between them and the land owners.

Table 9: Household's land ownership status (n=136)

Self or someone in the household owns the land/property:	Households (n=136)	Proportion of Households (%)
Owns	122	90%
Rent	14	10%

On security of tenure, it was established that about 9% of the 134 households that had answered the question on eviction from their residential places within the last 5 years confirmed that they had ever

been evicted from their homes. The other 91%, as figure 6 shows, had never been evicted from their homes at any given time within the last 5 years before the study. It was however confirmed that 60% of the households felt secure from evictions. The other 40% did not feel secure from evictions.

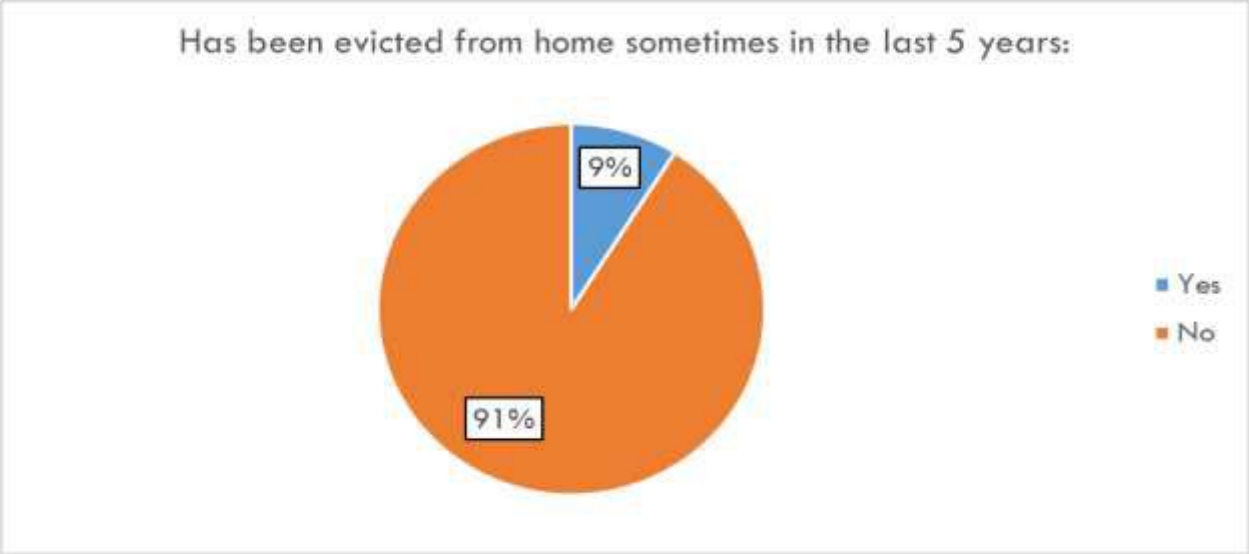


Figure 12: Eviction from home status in the last 5 years (n=134)

5.8 Access to Healthcare Services

On access to healthcare services, it was established that in the last one year preceding the study, children under the age of 18 years had gotten injured through accidents or had drowned in 8% of the 142 households that responded to this question. The other 92% had not experienced any such events as figure 14 further shows. It is only in 4 out of the 12 households that children who got an accident or drowned did recover. The average distance (in km) to the nearest and the most accessible and visited health facility by the household was estimated at within 2-kilometer radius. However, there were households that were within 58-kilometer radius at maximum to a health facility.

6. THE MARINE ENVIRONMENT

6.1 Corals

Corals form coral reefs and these are irreplaceable ecological features in the marine ecosystem. With a distribution dictated by temperature (20-28°C) and light penetration depth (<46m), reefs are among the most unique and important habitat for marine biodiversity. All forms of life exploit these environments, forming distinct associations among different species which ultimately add up to a balanced ecosystem with sorted ecological functions. The reefs are breeding ground, foraging ground and nursery for visiting deep sea species of fish while it is a host to a myriad of resident species. The productivity of the coral reefs is often compared to that of tropical rain forests because of the diverse assemblage of biodiversity playing distinct role.

Coral reefs are of great importance to man because they provide fishing ground for a wide variety of fish both for food and aquaria, the aesthetic value of the reefs makes them a tourism magnet which in turn sustains the economies of many coastal towns and islands. The reefs also protect the coasts from extremes of tides and storms making such beaches more hospitable for human occupation.

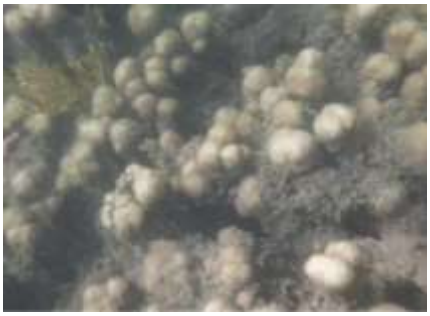
Corals face serious threats from man both directly and indirectly. Since the position of coral reefs is influenced by temperature and light regime, it follows that their continued existence in the face of global warming and climate change remains at risk. This of course with the additional interest of man to the resources available in the reefs including the beautiful creatures found there and even the corals themselves create a bleak future for the coral reefs and the species that depend on them, both visitors and the residents. Other threats include overexploitation of the available resources, destructive harvesting methods such as dredging, trawling and the use of explosives within the reefs. Pollution from both land and sea is a major concern to the persistence of the corals because as a system in which biological interactions and associations are critical, what affects one species will have a rippling effect on the other elements of the system and ultimately lead to a collapse of the entire ecosystem.

In Table below (Table 9), the preliminary findings indicate that a total of 20 species of scleractinian coral, 4 species of actiniarian and two species of zoanthids were found during the survey (Plate 1). The Cnidarians are represented by three orders namely Scleractinia (77%), Actiniaria (15%) and Zontharia (8%) (Fig. 7**).** The Order Scleractinia has the highest number of families namely Acroporidae (4 species), Agariciidae (2 species), Dendrophyllidae (1 species), Faviidae (1 species), Fungiidae (Merulinidae (1 species), Pocillopporidae (2 species), and Poritidae (1 species) and Stichodactylidae (1 species). The order Actiniaria contains two families; Actiniidae repsented by one species and Stichodactylidae resented by 2 species. The order Zoantharia has two families; Fungiidae and Sphenopidae each equally represented by one species.

Acropora hyacinthus

Fungi sp. [Indet.]

Herpolitha limax



Favia stelligera

Goniastrea retiformis

Psammocora contigua

Montiopora aequituberculata

Platygyra sp. [Indet.]

Montastrea curta

Plate 1: Photographs of coral species in Kibuyuni

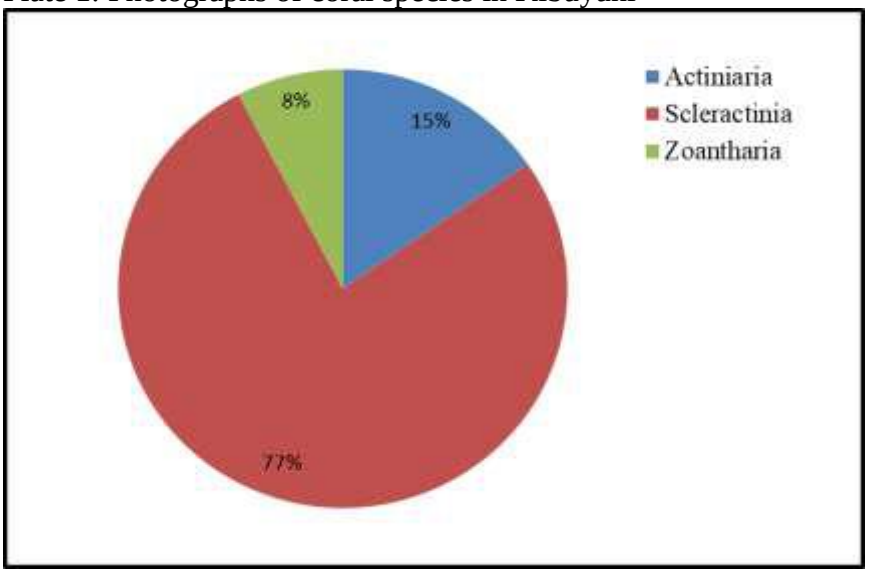


Figure 13 - Cnidarian diversity by order

Of the twenty six species that were collected, one stony coral is classified as Vulnerable (*Pavona decussate*), four hard coral species (*Acropora formosa, Favites abdita, Favia stelligera and Stylophora pistillata*) are classified as Near Threatened by the IUCN Red List (Fig. 8) (Hodgson 1998, DeVantier et. al., 2014a&b, Hoeksema et. al., 2014a&b) and also included in CITES Appendix II, in which the international trade in coral and live rock products is not banned, where sustainability of the harvest can be demonstrated, and the products are accompanied by relevant CITES documentation (CITES, Art. II (2)). There is no species specific population data available for each of these species in eastern Africa. However, there is evidence that overall coral reef habitats are declining in the region. The main anthropogenic threats to these species were identified as overexploitation of resources, destructive fishing practices, coastal development, runoff from improper land-use practices and climate change, particularly the extreme El Niño events (Shleyer 2004).

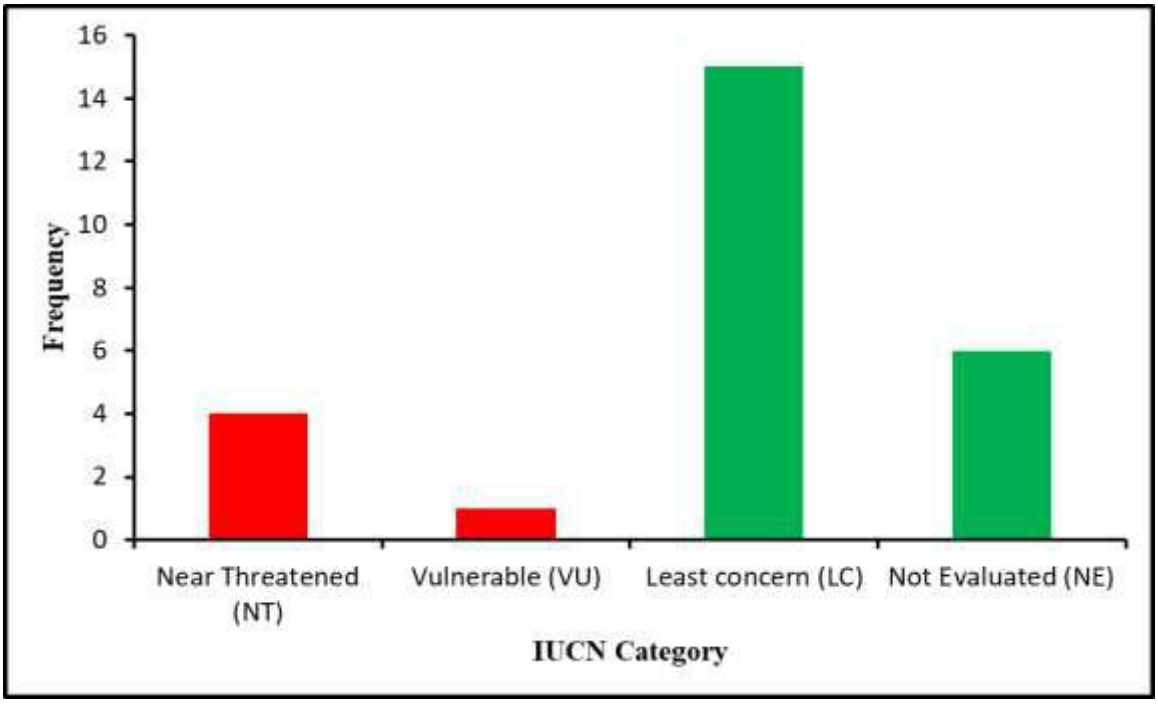


Figure 14 - IUCN Red List categories for coral species in Kibuyuni

Below are some of the coral species that are threatened and thus the species that utilize them. Key conservation initiatives that has been put in place is the listing of all corals under Appendix II of CITES, which regulates their commercial exploitation.

6.1.1 Acropora formosa

The species is listed as **Near threated** by the IUCN Red list and is also covered by the CITES Appendix II. This coral also has a wide distribution covering the Red Sea and the Gulf of Aden, the south-west and north-west Indian Ocean, the Arabian/Iranian Gulf, the northern Indian Ocean, the central Indo-Pacific, Australia, Southeast Asia, Japan and the East China Sea, the oceanic west Pacific, and the central Pacific. Its occurrence within the neritic zone of the ocean is from depths of

5m to 30m (Richards et. al., 2014). The population trend is on the decline due to threats similar to *Montiopora aequituberculata* above.

6.1.2 Pavona decussata

This coral is found between 3-15m depth of the neritic zone of the Ido-Pacific region. It is said to be common in its range but is listed as **vulnerable** by the IUCN (Hoeksema et. al., 2014). Though there is a general decline in corals and their habitat, this species narrow range of suitable habitat (3-15 in comparison to the other species like which occupies between 5-30m) makes it more vulnerable to the present and future threats. The threats and management measures that have been put in place are similar to those put for *Montiopora aequituberculata* above.

6.1.3 Favia stelligera

Favia stelligera is a species of corals exploiting the shallow waters of the ocean in the subtidal and rocky reefs between 0 to 20m. It shows preference for areas exposed to strong wave actions within the tropical reef habitats. It is listed under the **Near Threatened category** of the IUCN and also shares threats with the other corals discussed. However, its vulnerability to disease together with the exposed nature due to the depth of distribution puts it more at risk hence its status.

6.1.4 Favites abdita

This coral also has a wide distribution covering the entire Indo-Pacific region. Preferred depth is between 1-15m but can be found at depths of 18-40 in some parts of its range. It is a beautiful coral that is actively harvested for aquarium trade, a factor which has contributed significantly to its listing as **Near Threatened** by the IUCN (DeVantier et. al., 2014). Threats and protection are shared with the other corals.

6.1.5 *Stylophora pistillata* (Smooth cauliflower coral)

Considered a main reef-builder, the smooth cauliflower coral has a wide distribution across the Indo-Pacific region where it is found in the shallows between 1-15m depths. This coral is susceptible to bleaching and consequential death, factors which have contributed to its listing in the **Near Threatened**.

Table 10: List of coral (Cnidarian) species diversity

common name	Class	Order	Family	Genus	Species	Status
Zoanthid	Anthozoa	Zoantharia	Sphenopidae	Palythoa	*Palythoa natalensis*	Not Evaluated
Encrusting pore coral	Anthozoa	Scleractinia	Acroporidae	Montipora	*Montiopora aequituberculata*	Least concern
Finger coral	Anthozoa	Scleractinia	Acroporidae	Montipora	*Montipora digitata*	Least concern
Star corals	Anthozoa	Scleractinia	Acroporidae	Astreopora	*Astreopora myriophthalma*	Least concern
Honeycomb coral	Anthozoa	Scleractinia	Agariciidae	Gardineroseris	*Gardineroseris planulata*	Least concern
Shoulderblade coral	Anthozoa	Scleractinia	Agariciidae	Pavona	*Pavona clavus*	Least concern
Bracket coral	Anthozoa	Scleractinia	Fungiidae	Podabacia	*Podabacia crustacea*	Least concern
Hemit coral	Anthozoa	Scleractinia	Fungiidae	Cycloseris	*Cycloseris cyclolites*	Least concern
Tongue coral,slipper coral, Mole coral	Anthozoa	Zoantharia	Fungiidae	Herpolitha	*Herpolitha limax*	Least concern
Lasser knob coral,stony coral	Anthozoa	Scleractinia	Merulinidae	Cyphastrea	*Cyphastrea Serailia*	Least concern
lesser valley coral	Anthozoa	Scleractinia	Merulinidae	Platygyra	*Platygyra daedalea*	Least concern
Ruffled Coral,	Anthozoa	Scleractinia	Merulinidae	Merulina	*Merulina ampliata*	Least concern
Cauliflower coral, rasp coral	Anthozoa	Scleractinia	Pocillopporidae	pocillopora	*Pocillopora verrucosa*	Least concern
Hump coral	Anthozoa	Scleractinia	Poritidae	Porites	*Porites nigrescencens*	Least concern
Solid coral	Anthozoa	Scleractinia	Poritidae	Porites	*Porites solida*	Least concern
Haddon's sea anemone	Anthozoa	Scleractinia	Stichodactylidae	Stichodactyla	*Stichodactyla haddoni*	Least concern
Staghorn coral	Anthozoa	Scleractinia	Acroporidae	Acropora	*Acropora formosa*	Near Threatened
Stony coral	Anthozoa	Scleractinia	Faviidae	Favia	*Favia stelligera*	Near Threatened
Larger star coral	Anthozoa	Scleractinia	Merulinidae	Favites	*Favites abdita*	Near Threatened
Smooth cauliflower coral	Anthozoa	Scleractinia	Pocillopporidae	Stylophora	*Stylophora pistillata*	Near Threatened
Bubble-tip anemone	Anthozoa	Actiniaria	Actiniidae	Entacmaea	*Entacmaea quadricolor*	Not Evaluated
Mertens' carpet sea anemone	Anthozoa	Actiniaria	Stichodactylidae	Stichodactyl	*Stichodactyl mertensii*	Not Evaluated
Magnificent sea anemone	Anthozoa	Actiniaria	Stichodactylidae	Heteractis	*Heteractis magnifica*	Not Evaluated
Actinarian	Anthozoa	Actiniaria	Stichodactylidae	Stichodactyla	*Stichodactyla tapetum*	Not Evaluated
Tree coral	Anthozoa	Scleractinia	Dendrophyllidae	Dendrophyllia	*Dendrophyllia robusta*	Not Evaluated
Leaf coral	Anthozoa	Scleractinia	Agariciidae	Pavona	*Pavona decussata*	Vulnerable

6.2 Fish and other related species

A total of 16 species of fishes belonging to 9 families were observed during the survey (Table 10). The Perciformes formed the majority (81%) of the total collection. Myliobatiformes, Orectolobiformes and Rhinopritiformes formed (6%) in equal proportions. The Order Perciformes has the highest number of species (13) represented by eight families; Pomacentridae, Acanthuridae, Aspidontus, Balistidae, Chaetodontidae, Acanthuridae, Pamacanthidae, Balistidae (Fig. 9). Myliobatiformes, Orectolobiformes and Rhinopritiformes are each represented by 1 family equally. The Whale Shark *Rhincodon typus)* listed as endangered in the *IUCN Red List of Threatened Species* (Pierce & Norman. 2016), and are also protected under Appendix 2 of the Convention on the International Trade of Endangered Species of Wild Flora and Fauna (CITES) (CITES 2002). Local population declines in catches or sightings have been attributed partly to overexploitation targeted fisheries (Theberge & Dearden 2006, Rohner et al., 2013).

The White-spotted Wedge fish (*Rhynchobatus djiddensis*) is classified by the IUCN Red List of Threatened Species as Vulnerable globally due to population declines driven by overfishing in artisanal and commercial fisheries, exacerbated by limited management throughout most of both species range (Schaeffer 2004; Pierce et al., 2008, Barrowclift et al., 2017). The species is widespread in the Western Indian Ocean and is reported to occur in coastal and continental shelf waters to depths of 70 m. It is commonly taken in gillnet, long line and trawl fisheries as highly valued by catch, and coastal development (Jabado et al 2017). The family Rhinidae (also known as wedgefishes) has been identified as the third most threatened family of chondrichthyans globally (Dulvy et al., 2014). In eastern Africa region, very little information is known about their basic biology and ecology, and therefore, a coordinated conservation measures are urgently needed for the wedgefishes to prevent further population declines and localized extinctions throughout their range (Moore 2017).

Dascyllus aruanus

Amphiprion akallopisos

Latjanus fulviflamma

Plate 2: Common fish species in Kibuyuni

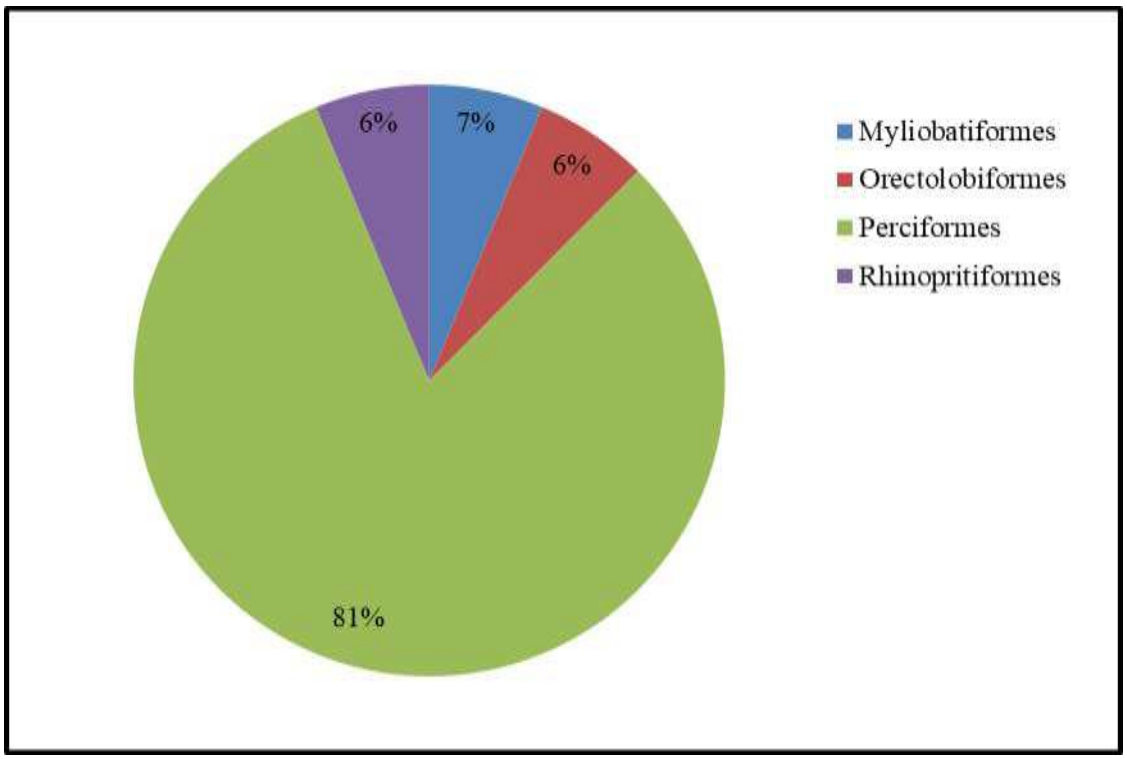


Figure 15 - Fishes diversity by order in Kibuyuni

Table 11 - Fish diversity in Kibuyuni

	COMMON NAME	CLASS	ORDER	FAMILY	GENUS	*SPECIES*	Status
1.	Bluespotted ribbontail	Chondrichthyes	Myliobatiformes	Dasyatidae	Taeniura	*Taeniura lymma*	Not Evaluated
2.	Whale shark	Chondrichthyes	Orectolobiformes	Rhincodontidae	Rhincodon	*Rhincodon typus*	Endangered
3.	Allard's anemonefish	Actinopterygii	Perciformes	Pomacentridae	Abudefduf	*Abudefduf allardi*	Least concerned
4.	Scissortail Sergent	Actinopterygii	Perciformes	Pomacentridae	Abudefduf	*Abudefduf sexfasciatus*	Least concerned
5.	Powderblue	Actinopterygii	Perciformes	Acanthuridae	Acanthurus	*Acanthurus leucosternon*	Least concerned
6.	Cleanerfish Mimic	Actinopterygii	Perciformes	Aspidontus	Aspidontus	*Aspidontus taeniatus*	Least concerned
7.	Orange-lined triggerfish	Actinopterygii	Perciformes	Balistidae	Balistapus	*Balistapus undulatus*	Not Evaluated
8.	Thredafin butterflyfish	Actinopterygii	Perciformes	Chaetodontidae	Chaetodon	*Chaetodon auriga*	Least concerned
9.	Scrawled butterflyfish	Actinopterygii	Perciformes	Chaetodontidae	Chaetodon	*Chaetodon meyeri*	Least concerned
10.	Lineated butterflyfish	Actinopterygii	Perciformes	Chaetodontidae	Chaetodon	*Chaetodon trifasciatus*	Least concerned
11.	Vagabond Butterflyfish	Actinopterygii	Perciformes	Chaetodontidae	Chaetodon	*Chaetodon vagabundus*	Least concerned
12.	Humbug damselfish	Actinopterygii	Perciformes	Pomacentridae	Dascyllus	*Dascyllus aruanus*	Not Evaluated
13.	Spotted unicornfish	Actinopterygii	Perciformes	Acanthuridae	Naso	*Naso brevirostris*	Least concerned
14.	Emperor angelfish	Actinopterygii	Perciformes	Pamacanthidae	Pomacanthus	*Pomacanthus imperator*	Least concerned
15.	Black bar triggerfish	Actinopterygii	Perciformes	Balistidae	Rhinecanthus	*Rhinecanthus aculeatus*	Not Evaluated
16.	Giant Guitarfish	Chondrichthyes	Rhinopritiformes	Rhinidae	Rhynchobatus	*Rhynchobatus djiddensi*	Vulnerable

6.3 Crustacean Diversity

A total of 30 species of crustaceans belonging to 19 families were collected during the survey (Table 11). The decapods comprised the majority (87%) of the total collections, followed by stematopods (7%), lysiosquillids (3%) and mysids (3%) (Fig.10). Four of the most diverse families were Diogenidae (4 species), Ocypodidae (4 species) and Portunidae (3 species). Palinuridae and Penaeidae had 2 species each, and the remaining 14 families had one species each. All of the species with known distributions are widespread along the western Indian Ocean; none is endemic to coastal Kenya. Habitat destruction, shoreline development, and chemical toxicants are all thought to be major issues impacting crustaceans and their habitats.

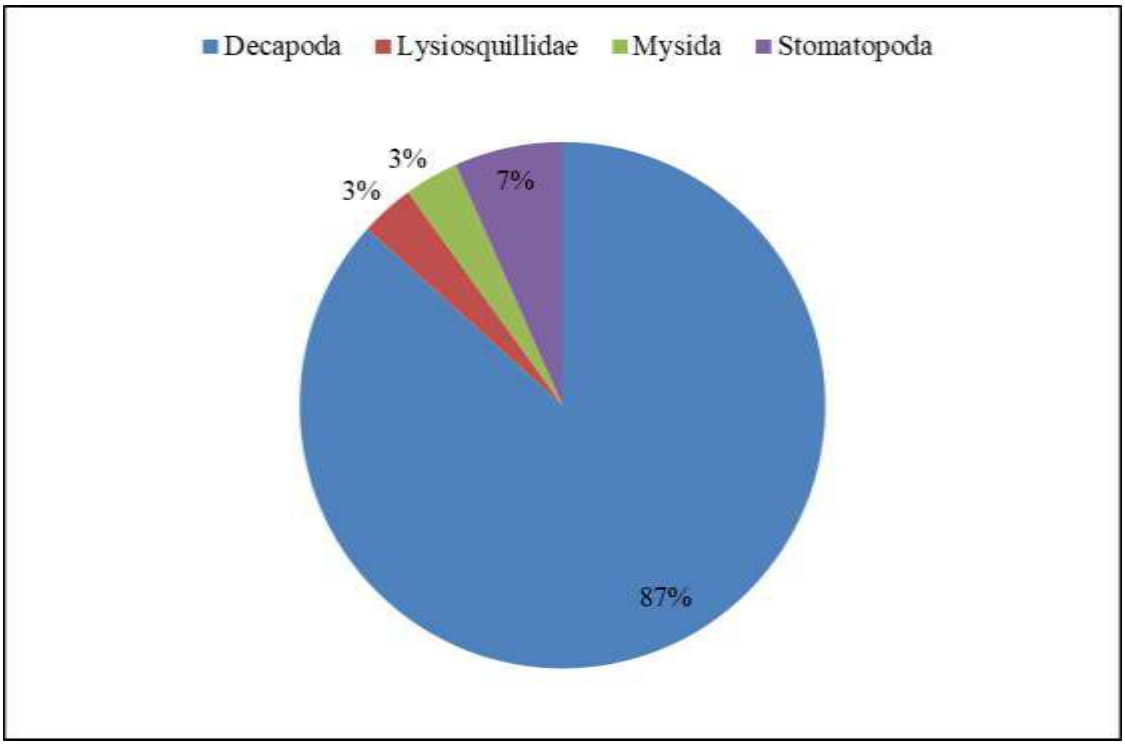


Figure 16 - Crustaceans species composition by order in Kibuyuni

Macrophthalmus boscii

Red-eyed Reef Crab *Eriphia ferox*

Uca inversa inversa

Plate 3: Some of the crustaceans

Table 12 - Crustaceans species diversity in Kibuyuni

Common name	Order	Family	Species	Status	Habitat	Food Habits	Economic uses
Hairy river prawns	Decapoda	Palaemonidae	*Macrobrachium rude*	Not Evaluated	Muddy sand or sandy bottoms at 20-50 m depth in offshore waters	Omni vore	Fishery and Aquaculture
Giant tiger prawn	Decapoda	Penaeidae	*Penaeus monodon*	Not Evaluated	Young prawns are found in estuaries, lagoons and mangroves of salinity levels from 2-30 ppt. Adults move into deeper waters and live on rocky or muddy bottoms, ranging in depth from 0-110 m	Carnivore/ Omnivore/ Planktivore/ Detrivore	Aquaculture
Blue Fiddler Crab	Decapoda	Ocypodidae	*Uca urvillei*	Not Evaluated	Muddy, organic sediments in estuarine mangroves	Carnivore/ Detrivore	
Blue-striped hermit crab	Decapoda	Diogenidae	*Clibanarius longitarsus*	Not Evaluated	Mangrove forest	Scavenger	
Blue crab	Decapoda	Portunidae	*Portunus armatu*	Not Evaluated	Sandy, muddy, algal and seagrass habitats in estuaries, sheltered bays and offshore waters up to 50 metres deep	Omnivore	Fishery
Dwarf Zebra Hermit Crab	Decapoda	Carpiliidae	*Carpilius convexus*	Not Evaluated	Sandy, muddy, algal and sea grass habitats	Herbivore	Marine aquarium trade
Blue-eyed hermit crab	Decapoda	Diogenidae	*Calcinus laevimanus*	Not Evaluated	Rocky reefs, rock and coral rubble	Detrivore	Marine aquarium trade
Floral egg crab	Decapoda	Xanthidae	*Atergatis floridus*	Not Evaluated	Neritic zone, prefers coral and rubble	Carnivore	
Mangrove crab	Decapoda	Portunidae	*Scylla Serrata*	Not Evaluated	Mangrove zone	Scavenger	Aquaculture
Common hairy crab	Decapoda	Pilumnidae	*Pilumnus verspertilio*	Not Evaluated	Benthic; depth range 0 - 3 m	Detrivore	Marine aquarium trade
Indian white prawn	Decapoda	Penaeidae	*Fenneropenaeus indicus*	Not Evaluated	Bottom mud or sandy at depths of 2 – 90 metres	Omnivore/ detrivore	Fishery and Aquaculture
Long legged spiny lobster	Decapoda	Palinuridae	*Panulirus longipes*	Not Evaluated	Rocky and coral reefs, usually at depths less than about 18 m	Carnivore	Fishery
Peacock mantis shrimp	Stomatopoda	Odontodactylidae	*Odontodactylus scyllarus*	Not Evaluated	Loose substrate near the bases of coral reefs in water ranging from 3 to 40 metres	Carnivore	Marine aquarium trade

Mottle lightfoot crab	Decapoda	Grapsidae	*Grapsus albolineatus*	Not Evaluated	Rocky depths and in coral reefs	Omnivore	
Natal lightfoot crab	Decapoda	Grapsidae	*Grapsus tenuicrustatus*	Not Evaluated	Rocky intertidal or littoral shorelines	omnivorous/detrivore	Recreational - bait for shoreline sport fishing
Opossum shrimp	Mysida	Mysidae	*Mysis diluviana*	Not Evaluated	Deep and cold waters with sufficient dissolved oxygen, below thermocline	Omnivorous/detrivore	Food for aquaculture/ water quality indicators
Orange Fiddler crab	Decapoda	Ocypodidae	*Uca vocans*	Not Evaluated	Sand and mud areas of lagoon beaches, High tide area	Detrivore	Marine aquarium trade
Ornate spiny lobster	Decapoda	Palinuridae	*Palinuris ornata*	Not Evaluated	Sandy and muddy substrates, rocky and coral reefs, from 1 to 8 m depths	Carnivore	Fishery and Aquaculture
Purple spot mantis shrimp	Stomatopoda	Gonodactylidae	*Gonodactylus smithii*	Not Evaluated	Reef flats, dead and live coral	Omnivore	Marine aquarium trade
Red Hermit Crab	Decapoda	Diogenidae	*Aniculus ursus*	Not Evaluated	Shallow tropical reefs to intertidal waters to depths of 200m	Omnivore	Pets
Red nippers	Decapoda	Ocypodidae	*Geograpsus stormi*	Not Evaluated	Rocky shores. Also found in mangroves. Stands on rocky substrate.		
Reef box crab	Decapoda	calappidae	*Calappa hepatica*	Not Evaluated	Rocky and coral reefs, on sand or muddy-sand bottoms, from shallow subtidal zone to 50 m	Carnivore	
Sand bubbler crabs	Decapoda	Sesarmidae	*Selatium elongatus*	Not Evaluated	Sandy beaches	Detrivore	
Sculptured mitten lobster	Decapoda	Scyllaridae	*Parribacus antarcticus*	Not Evaluated	Coral and stone reefs, with sandy bottom habitats between 0-20 metres deep	Carnivore	
Depressed red rock crab	Decapoda	Plagusiidae	*Plagusia tuberculata*	Not Evaluated	Rocky turbulent and breezy seashores	Carnivore/scavengers	Prey to commercial fishes
Tiger mantis	Lysiosquillida	Lysiosquillina	*Lysiosquilla*	Not Evaluated	shallow water, from shore to a depth	Carnivores	Fishery and

shrimp	e		*maculata*		of about 25m		Aquaculture
Tetragonal Fiddler Crab	Decapoda	Ocypodidae	*Uca tetragonon*	Not Evaluated	Intertidal sandbars, mudflats, mangrove forests, tidal creeks	Detrivore	
Viola land hermit crab	Decapoda	Coenobitidae	*Coenobita violascens*	Not Evaluated	Inner estuarine of river, near mangrove forest	Carnivore	
Littoral hermit crab	Decapoda	Diogenidae	*Clibanarius danai*	Not Evaluated	Sand flats	Omnivore/Scavenger	Unimportant species for fisheries in E. Africa
Wrinkled swimming crab	Decapoda	Portunidae	*Charybdis natator*	Not Evaluated	Rocky-sandy substrates or broken shelly bottoms or near reefs, from low intertidal zone to 50 m depth	Carnivore	Fishery and Aquaculture

6.4 Diversity of Molluscs

A total of 50 species of molluscs belonging to 5 classes namely Gastropoda (72%), Bivalvia (18%), Cephalopoda (6%), Plyplacophora and Polyplacophora each represented by 2% (Fig. 11). The detailed results of species composition are presented in Table 12. The Order Caenogastropoda has the highest number of species (14) represented by six families; Cassidae, Cerithiidae, Conidae, harpidae, potamididae, Terebridae, Turbinellidae. This is followed by the order Heterobranchia represented by 10 species belonging to 9 families namely Aglajidae, Aplustridae, Aplysiidea, Dendrodoridae, Discodoridae, Hexabranchidae, Phyllidiidae, Plakobranchidae and Pleurobranchidae. The order Neogastropoda is represented by 4 families; Fasciolariidae, Mitridae, Mlongenidae and Muricidae. Globally, two species *Tridacna squamosa and Tridacna maxima* listed as Lower Risk/Conservation Dependent in the *IUCN Red List of Threatened Species* and are also protected under Appendix 2 of the Convention on the International Trade of Endangered Species (CITES). The main causes of population declines are overexploitation (Andréfouët et. al., 2005, Apte et. al., 2010).

Cypraea tigris

Chicoreus ramosus

Cerithium nodulosum

Anodontia edentula

Atrina vexillum

Tridacna squamosa

Calpurnus verrucosus

Morula granulata

Terebralia palustris

Plate 4: Common mollusk species in Kibuyuni

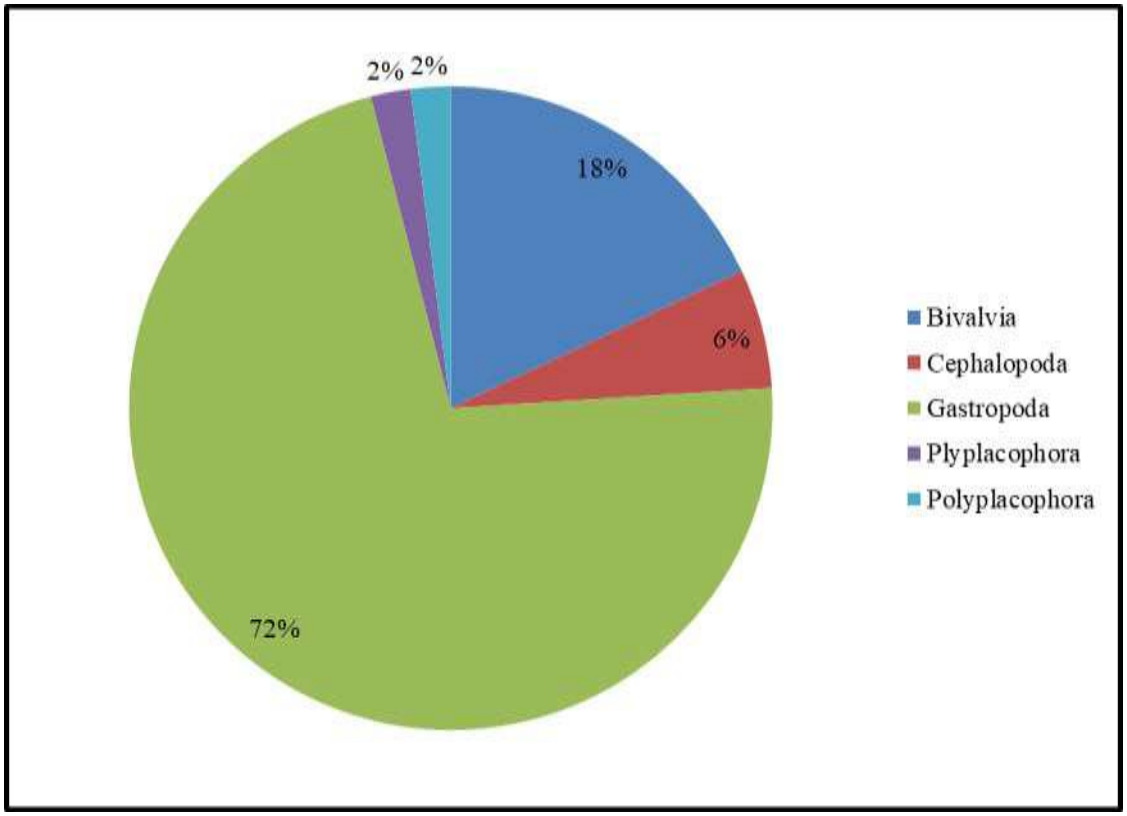


Figure 17 - Mollusc species composition by classes

Table 13 - Mollusc species diversity in Kibuyuni

Common name	Class	Order	Family	*Species*	Status
Giant cockle	Bivalvia	Cardiida	Cardiidae	*Plagiocardium pseudolima*	Not Evaluated
Fluted giant clam	Bivalvia	Cardiida	Cardiidae	*Tridacna squamosa*	Lower Risk/conservation dependent
Small giant clam	Bivalvia	Cardiida	Cardiidae	*Tridacna maxima*	Lower Risk/conservation dependent
Flag pen shell	Bivalvia	Pteriida	pinnidae	*Atrina vexillum*	Not Evaluated
Pacific Toothed Oyster	Bivalvia	Pteriida	pinnidae	*Isognomon*	Not Evaluated
Black-lip pearl oyster	Bivalvia	Pteriida	pinnidae	*Pinctada margaritifera*	Not Evaluated
Radiately-ridged Trough shell	Bivalvia	Veneroida	mactridae	*Meropesta nicobarica*	Not Evaluated
Comb venus	Bivalvia	Veneroida	Veneridae	*Gafrarium pectinatum*	Not Evaluated
Rooster venus	Bivalvia	Veneroida	Veneridae	*protapes sinuosa*	Not Evaluated
Gastropoda	Gastropoda	Littorinimorpha	Littorinidae	*Littoraria glabrata*	Not Evaluated
Big blue octopus	Cephalopoda	Octopoda	Octopodidae	*Octopus cyanea*	Not Evaluated
Cuttlefish	Cephalopoda	Sepiida	sepiidae	*Cuttle bone*	Not Evaluated
Pharaoh cuttlefish	Cephalopoda	Sepiida	sepiidae	*Sepia pharaonis*	Data deficient
Horned helmet	Gastropoda	Caenogastropoda	Cassidae	*Cassis cornuta*	Not Evaluated
Bullmouth helmet	Gastropoda	Caenogastropoda	Cassidae	*Cypraecassis rufa*	Not Evaluated
Grey bonnet	Gastropoda	Caenogastropoda	Cassidae	*Phalium glaucum*	Not Evaluated
Giany knobbed cerith	Gastropoda	Caenogastropoda	Cerithiidae	*Cerithium nodulosum*	Not Evaluated
Livid cone	Gastropoda	Caenogastropoda	Conidae	*Conus lividus*	Not Evaluated
Conus textile	Gastropoda	Caenogastropoda	Conidae	*Conus generalis*	Not Evaluated
Geography cone	Gastropoda	Caenogastropoda	Conidae	*Conus geographus*	Not Evaluated
Textile cone	Gastropoda	Caenogastropoda	Conidae	*Conus textile*	Not Evaluated
True harp or the noble harp	Gastropoda	Caenogastropoda	Harpidae	*Harpa harpa*	Not Evaluated
Giant mangrove whelk	Gastropoda	Caenogastropoda	Potamididae	*Terebralia palustris*	Not Evaluated
Crenulate auger	Gastropoda	Caenogastropoda	Terebridae	*Terebra crenulata*	Not Evaluated
Orange Auger	Gastropoda	Caenogastropoda	Terebridae	*Terebra dimidiata*	Not Evaluated
Ceramic vase or heavy whelk	Gastropoda	Caenogastropoda	Turbinellidae	*Vasum ceramicum*	Not Evaluated
Turns shell	Gastropoda	Caenogastropoda	Tonnidae	*Tonna canaliculata*	Not Evaluated

Headshield slug	Gastropoda	Heterobranchia	Aglajidae	*Chelidonura electra*	Not Evaluated
Striped paper bubble	Gastropoda	Heterobranchia	Aplustridae	*Hydatina physis*	Not Evaluated
Wedge sea hare	Gastropoda	Heterobranchia	Aplysiidea	*Dolabella auricularia*	Not Evaluated
Black dendrodoris	Gastropoda	Heterobranchia	Dendrodoridae	*Dendrodoris nigra*	Not Evaluated
Fragile Discodoris	Gastropoda	Heterobranchia	Discodoridae	*Discodoris fragilis*	Not Evaluated
Spanish dancer	Gastropoda	Heterobranchia	Hexabranchidae	*Hexabranchus marginatus*	Not Evaluated
Nobbed sea slugm	Gastropoda	Heterobranchia	phyllidiidae	*Phyllidia varicosa*	Not Evaluated
Ornate leaf slug	Gastropoda	Heterobranchia	plakobranchidae	*Elysia ornata*	Not Evaluated
Eastern emerald elysia	Gastropoda	Heterobranchia	plakobranchidae	*Plakobranchus ocellatus*	Not Evaluated
Side-gilled Slugs	Gastropoda	Heterobranchia	Pleurobranchidae	*Pleurobranchus semperi*	Not Evaluated
Triton's/giant trumpet	Gastropoda	Hypsogastropoda	Littorinimorpha	*Charonia tritonis*	Not Evaluated
Short spined murex	Gastropoda	Hypsogastropoda	Muricidae	*Murex brevispina*	Not Evaluated
Trapezium horse conch/Stripped fox conch	Gastropoda	Neogastropoda	Fasciolariidae	*Pleoroploca trapezium*	Not Evaluated
Nut mitre	Gastropoda	Neogastropoda	Mitridae	*Pterygia nucea*	Not Evaluated
Pear Melongena	Gastropoda	Neogastropoda	Mlongenidae	*Volema pyrum*	Data deficient
Ramosa/branch murex	Gastropoda	Neogastropoda	Muricidae	*Chicoreus ramosus*	Data deficient
Plecate nerite	Gastropoda	Neritimorpha	Neritidae	*Nerita plicata*	Not Evaluated
Polished Nerite	Gastropoda	Neritimorpha	neritoidae	*Nerita polita*	Not Evaluated
Toothed Top Shell	Gastropoda	Trochida	Trochidae	*Monodonta labio*	Not Evaluated
Maculated Top Shell	Gastropoda	Trochida	Trochidae	*Trochus maculatus*	Not Evaluated
Ruppell's keyhole limpet	Gastropoda	Vertigastropoda	Fissurellidae	*Diodora ruppellii*	Not Evaluated
Jewel spiny chiton	Plyplacophora	Neoloricata	Chitonidae	*Acanthopleura gemmata*	Not Evaluated
Short Hired Spiny Chiton	Polyplacophora	Chitonida	Chitonidae	*Acanthopleura brevispinosa*	Not Evaluated

6.5 Echinodermata

Thirty-five (35) species of echinoderms have been detected in the study area (Table 13). The echinoderms are represented by 11 orders namely Holothuriida (26%), Valvatida (23%), Camarodonta (11%), Synallactida (11%), Cidaroida (9%), Ophiurida (9%), Amphilepidida, Diadematidae, Diadematoida and Spinulosida each contributed (3%) equally (Fig. 12**).** A total of six out of the 35 species are threatened according to the IUCN Red List categories (Fig. 13). Two sea cucumbers (Holotharians) con-specifics, the black teat fish (*Holothuria nobilis*) and Golden sandfish (*Holothuria scabra*) are endangered species (Conand et al., 2013, Hamel et al 2013). The species are distributed mainly in shallow coral reef areas, on reef flats, slopes and shallow sea grass beds. These species are highly valuable commercial fisheries and are therefore is overexploited (Conand 2008, Choo 2008, Toral-Granda 2007) through their ranges. Fishing pressure has dramatically increased in the past five decades, and the trend is expected to continue with the rapidly increasing human populations.

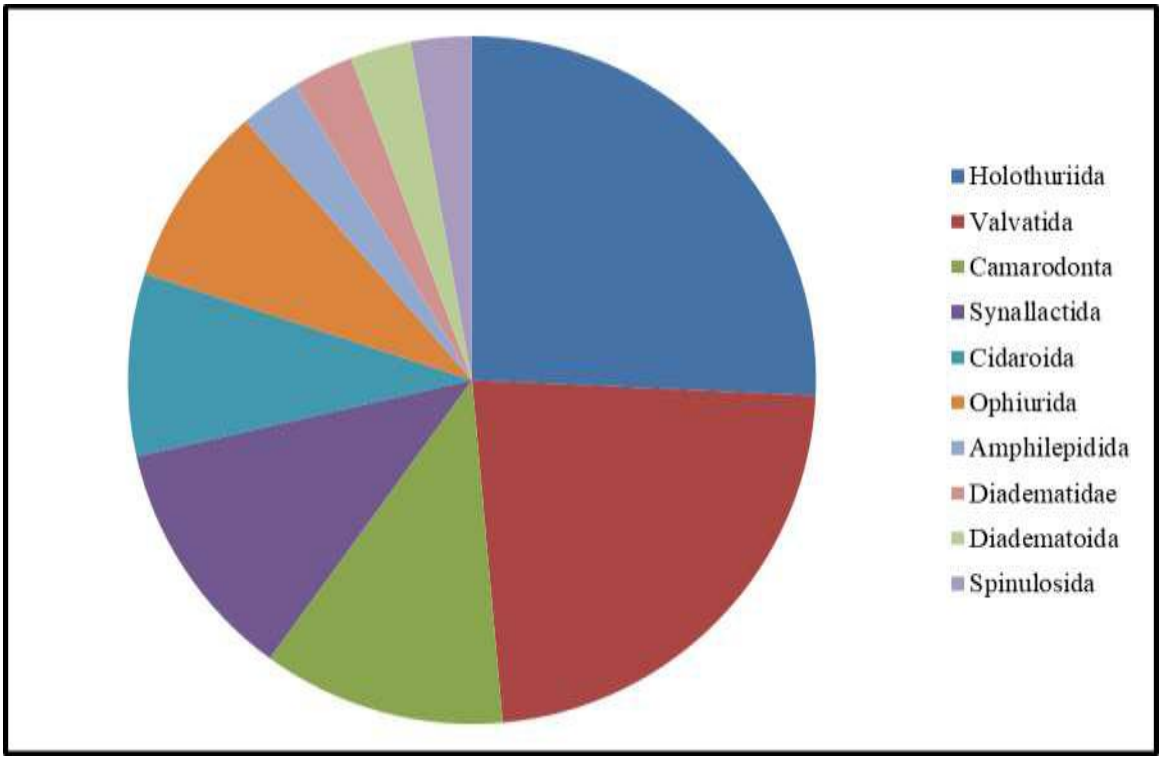
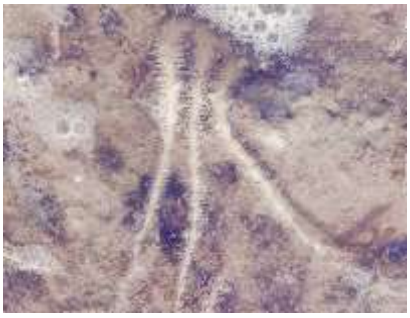


Figure 18 Echinodermata diversity by order in Kibuyuni

Three other sea cucumber species *Actinopyga echinites, Actinopyga miliaris* and *Stichopus horrens* populations are in decline due excessive commercial harvest for the international trade in sea cucumber (Conand 2004, Toral-Granda *et al.* (2008). *Actinopyga miliaris* is actively fished in Kenya and are estimated to contribute approximately 17% of total sea cucumber catches (Conand 2008).

Acanthaster planci

Ophiocoma scolopendrina



Ophionereis dubia

Astropyga radiata

Parasalenia gratiosa

Echinometra mathaei

Stichpus herrmanni

Plate 5: Common Echinoderm species in Kibuyuni

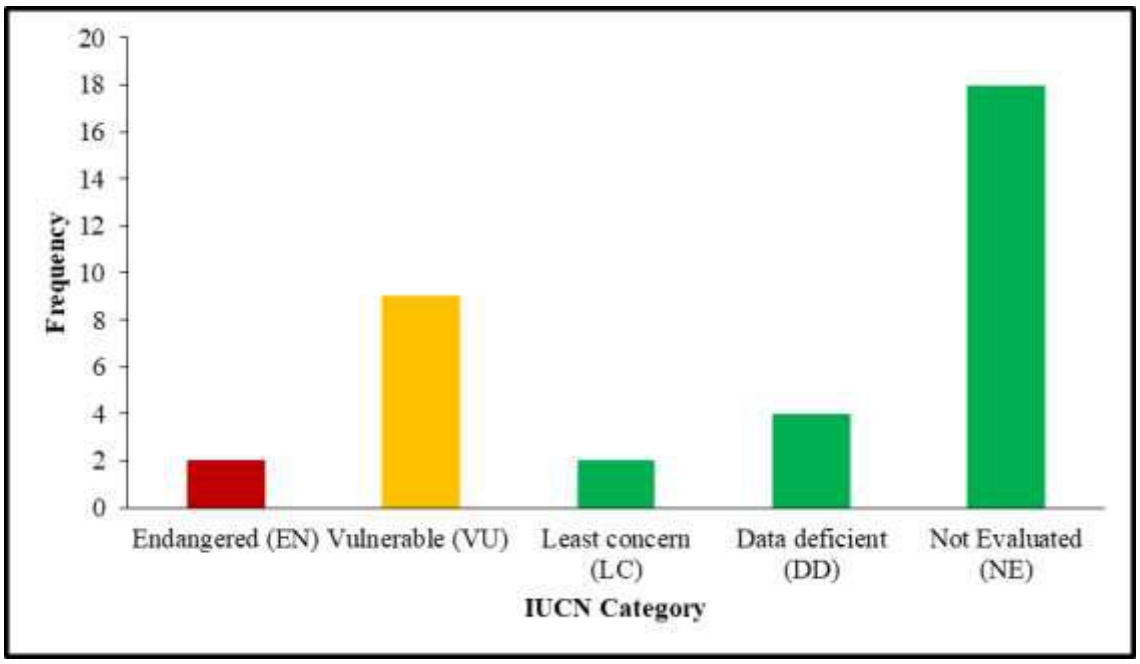


Figure 19 - Threatened echinoderm species according to IUCN Red List categories

Table 14 - Echinodermata species diversity in Kibuyuni

	COMMON NAME	CLASS	ORDER	FAMILY	SPECIES	STATUS
1.	Brown fish	Holothuroidea	Holothuriida	Holothuriidae	*Actinopyga echinites*	Vulnerable
2.	Hairy Black fish	Holothuroidea	Holothuriida	Holothuriidae	*Actinopyga miliaris*	Vulnerable
3.	Sand sea star	Asteroidea	Valvatida	Archasteridae	*Archaster augulatus*	Not Evaluated
4.	Star fish	Asteroidea	Valvatida	Asterinidae	*Asterina sp*	Not Evaluated
5.	Brown sand fish	Holothuroidea	Holothuriida	Holothuriidae	*Bohadschia vitiensis*	Data deficient
6.	Leopardfish	Holothuroidea	Holothuriida	Holothuriidae	*Bohadschia subrubra*	Data deficient
7.	Tigerfish	Holothuroidea	Holothuriida	Holothuriidae	*Bohadschia atra*	Data deficient
8.	Spiny cushion star	Asteroidea	Valvatida	Oreasteridae	*Culcita schmideliana*	Not Evaluated
9.	Sea urchin	Echinoidea	Diadematidae	Diadematidae	*Diadema setosum*	Least concern
10.	Orange Sea Star	Asteroidea	Spinulosida	Echinasteridae	*Echinaster purpureus*	Not Evaluated
11.	Burrowing urchin	Echinodea	Camarodonta	Echinometridae	*Echinometra mathaei*	Not Evaluated
12.	Diadema urchin or blue-black urchin	Echinodea	Diadematoida	diadematidae	*Echinothrix diadema*	Not Evaluated
13.	Ten-lined Urchin	Echinoidea	cidaroida	cidaridae	*Eucidaris metularia*	Not Evaluated
14.	Slate pencil urchin or red slate pencil urchin	Echinodea	Camarodonta	Echinometridae	*Heterocentrotus trigonarius*	Not Evaluated
15.	Black teatfish	Holothuroidea	Holothuriida	Holothuriidae	*Holothuria nobilis*	Endangered
16.	Golden sand fish	Holothuroidea	Holothuriida	Holothuriidae	*Holothuria scabra*	Endangered
17.	Red snake fish/Lollyfish/Sand sea cucumber	Holothuroidea	Holothuriida	Holothuriidae	*Holothuria conusalba*	Data deficient
18.	Common comet star, Guilding's sea star	Asteroidea	valvatida	Ophidiasteridae	*linckia guildingi*	Not Evaluated
19.	Long-armed brittle star	Ophiuroidea	Amphilepidida	Ophiotrichidae	*macrophiothrix longipeda*	Not Evaluated
20.	Nail Sea Star	Asteroidea	valvatida	Mithrodiidae	*Mithrodia clavigera*	Not Evaluated
21.	Horned sea star	Asteroidea	valvatida	oreasteridae	*Monachaster sanderi*	Not Evaluated
22.	Koi snake tail	Ophiuroidea	Ophiurida	Ophiothrichidae	*Ophiothela danae*	Not Evaluated
23.	Common brittle star	Ophiuroidea	Ophiurida	Ophiuridae	*Ophiothrix trilineata*	Not Evaluated
24.	Dark Red-Spined Brittle Star	Ophiuroidea	Ophiurida	Ophiuridae	*Ophiothrix purpurea*	Not Evaluated
25.	Black spooted cucumber/Flowerfish	Holothuroidea	Holothuriida	Holothuriidae	*Pearsonothuria graeffei*	Least concern
26.	Asteroid	Asteroidea	Valvatida	Oreasteridae	*Pentaceraster mammillatus*	Not Evaluated
27.	Sputnik urchin	Echinodea	cidaroida	Cidaridae	*Phyllacanthus imperialis*	Not Evaluated
28.	Crown-spined pencil urchin	Echinodea	Cidaroida	Cidaridae	*Prionocidaris baculosa*	Not Evaluated
29.	Red-knobbed sea star	Asteroidea	Valvatida	Oreasteridae	*Protoreaster linckii*	Least concern
30.	Dragonfish sea cucumber	Holothuroidea	Synallactida	Stichopodidae	*Stichopus horrens*	Vulnerable

31.	Greenish sea cucumber	Holothuroidea	Synallactida	Stichopodidae	*Stichopus chloronotus*	Data deficient
32.	Spotted worm sea cucumber	Holothuroidea	Synallactida	Synaptidae	*Synata maculata*	Not Evaluated
33.	Black sea urchin	Echinodea	Camarodonta	Temnopleuridae	*Temnopleurus toreumaticus*	Not Evaluated
34.	Amber fish/Backwater hard clam/Black fish	Holothuroidea	Synallactida	Stichopodidae	*Thelenota rubralineata*	Data deficient
35.	Collector urchin	Echinodea	Camarodonta	Temnopleuridae	*Tripneustes gratilla*	Not Evaluated

6.6 Marine Reptiles

6.6.1 Order Squamata: Scincidae

Scindidae is a squamate family of skinks known for the small, shiny and smooth scales (Spawls et. al., 2018). Members have a wide distribution from the coastal sea level where we have the Coral Rag skink, to high altitudes above 3000 say for the *Trachylepis irregularis, T. alleni and T. masavaensis.*

6.6.1.1 Coral Rag skink, Cryptoblepharus buchananii africanus

This small skink is among the few that have managed to adopt to the life in the intertidal zones of the ocean where large conglomerations can be found on emergent rocks and walls. The species is salt tolerant, which has seen it disperse easily to various islands by rafting in the water (Spawls et. al., 2018). Ii is also quick to adapt to human presence being that it uses buildings as part of its habitat. The skink breeds by laying two eggs above the coral rag whereas feeding is done across the intertidal zone. This species therefore relies on the intertidal zone for foraging while the habitat around is used for resting and breeding. Though the species is under the Least Concern Category of the IUCN (Sanderson et. al., 2017), coastal development is among the major threats as these may affect both the foraging and resting grounds.

6.6.2 Marine Turtles

Sea turtles are among the reptiles with a protective shell covering the body. They have a double life where both the terrestrial and marine environment play key roles in their lives. Their lives begin on land when the females lay their eggs on the sandy beaches. After this, the hatchlings go to the deep sea where further growth and development occurs. Feeding, courtship and mating take place in the coastal water close to the beaches. The proximity to the land during these activities including the specific part of the water used varies with species. For example, the leatherback, *Demochelys coriacea* feeds on jellyfish and other soft bodied organisms (Wamukoya et. al., 1997) and so spend most of their time in the deep sea. Loggerheads, *Carretta carreta* on the other hand feeds mostly on bottom dwelling organisms such as mollusks, crustaceans, crabs and sponges (Spawls et. al., 2018) and therefore spend most of their time in the benthic environment. Similar behavior is shared with the Olive Ridley, *Lepidochelys olivacea* which prefers shrimps, snails and fish and the spongivorous Hawksbill, *Eretmochelys imbricata* which feeds mainly on sea sponges. The green turtle, *Chelonia mydas* on the other hand is an herbivore feeding on seaweed in the corals and seagrasses. All these species however migrate back to their natal beaches to lay their eggs. The nesting on the beaches and an adult life spent just between the corals and the beach makes these species especially vulnerable to anthropogenic exploitation probably to exhaustion.

6.6.2.1 Green Turtle, *Chelonia mydas*

The green turtle is one of the five turtle species found in Kenya (Okemwa et. al., 2004). This species is a herbivore and feeds mainly on the seaweeds and seagrass both of which are found between the

coastal beaches and the coral reefs. Like the other sea turtles, C. mydas lays the eggs in the natal coastal beaches, the hatchlings then migrate in the deep sea for the early development stages before coming back to the coastal waters as semi-adults to feed, court and breed (ooo). This species has a very long maturity period, taking between 25-35 years to reach sexual maturity (OO). This makes the protection of every nesting female very important because replacing a single one is very expensive in terms of time. Green turtles were traditionally hunted for meat, oil, and shell not leaving the eggs which are also a delicacy among the coastal communities. This species prefers to nest on open oceanic beaches, unlike the other related species that nest in vegetated beaches.

The green turtle is of high significance to human exploitation due to its many uses. For example, both the eggs and matures are a delicacy in most parts of its range. They are also used as sources of oil believed to cure respiratory problems such as asthma while their beauty makes them a valuable good used in trade and aesthetics (Wamukoya et. al., 1997). All these consequently mean the species is under so much pressure from man, a factor which threatens it continued existence.

The green turtle is listed as endangered under the IUCN Redlist (IUCN, 2018), and the population is also on a decreasing trend. Important threat agents are coastal development for tourism and recreation which destroy the species nesting grounds consequently impairing the species recruitment. The harvesting of marine resources has also led to decline of the species especially when the eggs and nesting mothers are collected from the beaches, and also the adults in the waters are harvested through fishing activities within the corals. Others are; habitat degradation in the form of increased effluents and contaminants; incidental catches and entanglement in fishing nets. Contaminants and effluents have been implicated in the cause and spread of diseases such as fibropapillona among turtles (George, 1997). Beach developments with introduction of artificial lights has also served to confuse the hatchlings so that instead of moving seawards after hatching, they move towards the developments and may die in the process (Witherington, 1992).

Some of the conservation measures that have been put in place to protect the green Turtle include the listing under the Appendix 1 of CITES, which illegalizes any form of harvesting and trade of the animal or parts globally and Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA). Bycatch has been reduced by the introduction of Turtle Excluder Devices (TEDs) which allow the turtles to exit the fishing gears when they are trapped (Wamukota et. al., 1994). In Kenya, all the sea turtles are protected under the Fisheries Act Cap. 378 and the wildlife act, cap. 376.

6.6.2.2 Loggerhead turtle, *Caretta caretta*

The loggerhead on the other hand is known for the large heads and strong jaws for crushing the prey. They occur in tidal and subtidal coral and rocky reef habitats where their prey is found in abundance. Common prey are the benthic invertebrates such as crabs, sponges and mollusks. Though the species has not been recorded to breed in the Kenyan coast, it is known to use the Kenyan coast as a foraging ground (Frazier, 1976; Okemwa et. al., 2004). Caretta also have a very long period to mature, from 10 to 39 years. They also nest and hatch in the beaches after which the

young migrate into the oceanic zone to grow until they are also mature. They then migrate back to the neritic zone for sexual maturity and breeding. The migrations have been found to vary with population and sexes some females have been known to live in the oceanic zone and only come to the neritic zone for the males, then to the beach for nesting and again back to the oceanic zone (Eder et. al., 2013).

Human uses of the species include tourism and it is considered a delicacy in parts of the Atlantic coast. This therefore means that the species is more vulnerable to indirect effects of human activities in most of its distribution range unlike the other species hunted for shells, oil, trade, meat and aesthetics in addition to habitat destruction.

The loggerhead is listed as Endangered by the IUCN, flagging it for concerted protection and conservation. Important threats in addition to those found for *Chilonia mydas* are climate change and invasive species and disease (IUCN, 2018). Climate change has resulted into extreme temperatures, storms and floods which destabilize the species habitats like the estuaries.

6.7 Annelids

Annelids are worms defined by two features, segmented bodies and setae (Cheatae) (Westheide et. al., 1999; Rouse et. Al., 2002). Segmented bodies refer to a series of repeated units running all through the bodies with each segment being physiologically independent i.e. having complete set of organs that can function independent of the next segment (Jamieson, 1981; Hessling and Westheide, 2002). Setae are circular structures that develop within the bodies as follicles. They may take the form of long, thin structures or short multipronged structures. These comprise earthworms and leaches which exploit terrestrial and fresh water environments. The third group, Polycheats comprise the widest diversity of annelids and are found in marine environments where they occupy the habitat ranges from the coast to the deep waters both in the benthic habitats and the pelagic habitats (Westheide et. al., 1999).

The diversity of the sea annelids is so diverse and cases of endemism are equally high. For example, Coral reef-associated species are estimated to be around 8,000 species (Stella et. al., 2011) with varying distributions leading to classification of cosmopolitan species and endemic species. In Philippines for example, 20% of the annelids are cosmopolitan while 36% are endemic (Knox, 1957).

6.7.1 Indo-Pacific scaleworm, *Iphione muricate*

The Indo-Pacific scaleworm is one of the eight species in the genus Iphione known to superficially resemble chitons (Piotrowski, 2011a). It inhabits the intertidal and shallow water of the coast and even the corals (Piotrowski, 2014). I. muricate has a very wide distribution all along the indo-Pacific region having being reported in Philippines, Australia, Korea, Mexico and the Indian Ocean specifically in Mauritius where the type specimen was collected (Wehe, 2006; Salazar-Silva, 2006). Goren et. al., (2017) however recorded it in shallow waters in the Israeli coast and reported it to be

invasive in this area being that the Israel coast is out of the previously documented range for the species. The species exhibits defensive behavior similar to chitons (mollusks) which tend to hold on to hard surfaces or curl up instead of moving away when threatened. Since cases of cryptic groupings have been reported for members of this genus (Peyrot-Clausade, 1974), it is important that every population is protected because they may be a different group altogether.

6.7.2 Sthenelais boa

Sthenelais boa is an annelid of the family Aciculata. The species has a wide distribution covering the Indo-west Pacific, Atlantic Ocean and the Mediterranean seas, a distribution that mostly covers the eastern shores of the waters. It prefers fine and coarse sediments that are partially enriched with mud, such as that characteristic of estuarine and inshore areas of the coasts (Gusso et. al., 2001). S. boa is a carnivore but also scavenges on other animal carcasses when available.

Conservation wise, the species is yet to be evaluated by the IUCN nor the CITES.

6.7.3. Iridescent fireworm, *Eurythoe complanata*

This annelid has a wide distribution covering the Indo-Pacific region, Atlantic Ocean and the Mediterranean Sea in both the tropical and subtropical regions. It exploits the benthic habitat from the shore to depths of 1100m into the sea Gibbs, 1978). These worms are carnivorous ad the array of prey include sponges, coal polyps, ascidians among others. The species is yet to be assessed by the IUCN and is not evaluated for CITES protection.

6.7.4 Feather duster worm, *Sabellastarte spectabilis*

The Feather duster worm is an annelid native to the tropical water but its hardiness and mobility has seen it extend its distribution to cover extensive parts of the world such as Mozambique beyond the tropics Mexico and Hawaii in the Americas. It can grow to lengths of 8cm and widths of 1.2cm. This species often assumes a sedentary life, living within a tube from where many tentacles extend to collect organic matter in the water currents.

Exploited habitats within the coastal environments are coral reefs, rocky shores and among the algae where it constructs a burrow. The beautiful color of the worm has seen it being used in aquaria where it also serves to clean the water through its filter feeding behavior (ooo).

6.8 Platyhelminthes

Platyhelminths are the simplest form of living organisms as they are multicellular yet they lack specialized organs and organ systems. They don't have the body cavity (hence acoelomates) and have only one entry which serves as the entry point for the food material and exit point for waste. The lack of organs and organ systems has necessitated the development of a flat body formation because direct diffusion is the only way cells can exchange materials from the environment. The flatness increases the proximity of every cell to the environment and thus facilitates diffusion. The digestive system is equally multi-branched to maximize exchange of materials between the gut and

the cells. There are three groups of flatworms: Turbellaria which are free living aquatic and semiaquatic species while Trematoda and Cestoda are both made of parasitic flatworms.

6.8.4 Orange-margined flatworm, *Callioplana marginata*

This free-living marine flatworm has a characteristic orange band and a white line at the marginal area of the flat body hence the name. The remaining parts of the body are of different color, either brown, black or cream.

6.8.5 Racing-stripe flatworm, *Pseudoceros bifurcus*

The racing-striped flatworms are blue flatworms with a unique white/yellow stripe in the dorsal region that turns orange/red in the head region (Ong and Tong, 2018). It is a scavenger feeding on plant and animal matter as well as sessile invertebrates like sponges and ascidians and also slow-moving ones like barnacles. They are also preyed upon by crustaceans and fish hence their ecological importance in the food chains as both prey and predator. To reduce predation, the racing-stripe flatworms have evolved bright colors which serve to warn off potential predators (Selfaith, 2002). The species is yet to be assessed by the IUCN, but being a reef resident, then potential threats towards the reefs as a habitat will indirectly threaten this species.

6.8.6 Triple-stripped flatworm, *Pseudoceros tristriatus*

This flatworm is very similar to *P. triastrum* in both behavior and habitat it exploits. It is small in size ranging between 2 and 4cm in length. They are white in color but the telling trait are the three stripes in the dorsal region with a pair of tentacles in the cephalic region.

6.9 Seaweeds

Seaweeds are large multicellular algae in the Kingdom Chrimista. They can be mistaken for higher plants by untrained eyes because of their body organization and some characteristics such as being primary producers. However, algae are simple forms of life with one structure, thallus. The thallus is then divided into parts such as the lamina, a parallel of leaves in higher plants, a holdfast and haptera which are parallel to roots in higher plants. They reproduce asexually by means of spores in structures known as sorus while suspension/floatation in the water column is facilitated by kelps and focus which serve as air bladder.

The ecology of the seaweeds is defined by presence of the saline water, light availability and also a substrate for anchorage. These have thus limited the distribution of algae to within the littoral zone of the ocean. They have shown preference for rocky substrata to sandy substrata because the rocks are more stable/permanent. This reduces the likelihood of being washed away by the water currents.

There are different types of seaweeds depending on the photosynthetic material which determines the specific wavelengths of light the used for photosynthesis. These are the brown algae

(Phycophyta), red algae (Rhodophyta), Gold/yellow algae (Chrysophyta) and green algae (Chlorophyta) (pppp). Since the natural light penetrates water at different wavelengths, the distribution of the algae inside the water is also dependent on the photosynthetic material such that the green chlorophyta occupy the surface and shallow parts whereas the rhodophyta occupy the greatest depths.

Algae are of great importance both to man and the ecosystems. Some of the uses include being food for man and other animals (Garcia-Vaquero and Hayes, 2016). Algae are primary producers and therefore provide a means by which energy from the sun can reach the other trophic levels in the food chain (Hay, 1997). Algae also serve in water filtration where they trap solid matter within their network and also utilize some compounds like nitrates, phosphates and iron from the water through their physiological activities (Harrison and Hurd, 2001; Bracken and Stachowicz, 2006). The kelp forests formed by the algae provides a unique habitat for many species of marine animals both pelagic and littoral species. Some pelagic species use the kelp forests as nursery for their young because of the availability of food, fewer predators and slower moving currents because of the abstraction resulting from the algae. Algae are important link in carbon dioxide sequestration and are therefore critical in climate change mitigation (Diaz-paludo et. al., 2011). Man has exploited the seaweed for medicine, fodder for livestock, compost manure for agriculture and source of raw material for industrial production of dyes, glue and bioethanol among others *(*Kazłowski et. al., 2012; Chen et. al., 2015*)*.

6.9.4 Crowded Sea bell, *Turbinaria ornate*

This is a brown algae with an Indo—Pacific distribution where it occurs in depths ranging from 0 to 50m. Preferred substrate is the rocky strata within the intertidal zone. *Turbinaria ornate* has been exploited by man mostly in medical properties such as antioxidant, antifungal and antibacterial properties of its extracts (Kumari and Misra, 2012; Vijayabaskar and Shiyamala. 2011, 2012; Sun et. al., 2014). It is also used as an insect repellant. This species however is yet to be evaluated by either the IUCN or CITES and thus its conservation status is unknown.

6.9.5 Double-bladed Sargassum, *Sargassum cristaefolium*

This is a large brown alga that utilizes the coral rocks in areas exposed to waves in the intertidal to shallow subtidal areas. It shows seasonal variation in biomass (equivalent to deciduous in higher plants) where the high biomass is seen from November to January while the lows are observed from February to May. Some of the uses include being used as food by both man and livestock, medicinal herb and source of industrial raw materials such as alginate for the food industry. The species has not yet been evaluated by the IUCN and CITES so its conservation status remains unknown.

Plate 6: Red algae

6.9.6 Sea lettuce, *Ulva intestinalis*

Sea lettuce is a green alga with a global distribution occurring in the depths from 0 to 20m in the subtropics. Its attaches itself to rocky substrates in the lower intertidal to shallow subtidal zones of the ocean. Also found in shallow pools exposed to the air during low tides and sandy areas as long as attachment to rocks is possible (Björk et. al., 2004). This alga is able to reproduce all year round. In terms of conservation, the sea lettuce has not yet been assessed by the IUCN and the CITES.

6.9.7 Red asperagus, *Asparagopsis taxiformis*

This is a red algae and is perhaps the most popular edible algae that has been exploited for food. It has a global distribution where it occurs to greater depths of over 50m. It is also known to have invasive properties alongside other members of the genus. This species has also drawn a lot of research attention due its ability to reduce the amount of methane released buy animals once they consume the algae (Kinley et. al., 2016). It has also not yet been assessed by the IUCN.

6.9.8 Sea bell, *Turbinaria conoides*

This is a yellowish to brown algae distributed in the Indo-Pacific region from 0 to 7m depths. It attaches to sandy coralline substrata in areas that are not subject to excessive water turbulence. It

also occurs in shallow lagoons and tide pools in the subtidal areas not prone to strong wave action. It is used as food, fertilizer and insect repellent.

6.9.9 Seaweed Farming

Two species of seaweeds are cultured by the local community in the shallow shores of Kibuyuni (plate 7 and figure 14). These are *Gracillaria canaliculata* and *G. Salicornia* from the group of Rhodophyta (Red algae). The species are grown for their agar which are used commercially for biological experiments and culture.

Gracillaria canaliculata

Gracillaria salicornia

Plate 7: Species of seaweeds farmed at Kibuyuni

Figure 20: Google earth view location of seaweed farming at Kibuyuni

6.10 Seagrass Species

Seagrass are marine flowering plants and constitute 60 species in four families. They superficially resemble the terrestrial grass but these have undergone evolutionary adaptation which enabled them to thrive in salty waters. Being photosynthetic, the distribution of seagrass is limited to the shallow parts of the ocean where light can reach the ocean floor. Their distribution also appears to favor sheltered coasts where they grow attached to the sandy and muddy substrata. They grow in mats that can be made up of a single species or multiple species.

Seagrass perform very critical roles in the ecosystem. First, as primary producers, they are able to convert solar energy into a form that can be utilized up the trophic levels. In the process of photosynthesis, they release oxygen gas which dissolves in the water column thus oxygenating the water. This process also sees the plants use nutrients from the water column and in so doing reduce their concentration in the environment. The adverse root and rhizome network in the sand serves to hold the sand and mud together thereby reducing the chances of erosion while also supplying respiratory gases to the living organisms therein. The seagrass also provides a habitat for other animals which use it for nursery, foraging or refuge. It is estimated that up to 10% of the carbon dioxide in the oceans is sequestered by the seagrass and are therefore vital in limiting the amount of carbon dioxide in the environment.

Some of the threats facing the seagrass are of human origin since evolution has seen them tolerant and resilient to natural stress. The sea grass meadows are recorded to be declining all around the world and some species have been projected to go into extinction in the next 30 years if nothing is done to protect them. Three major threats are eutrophication, habitat destruction and overfishing.

Syringodium isoetifolium

Thalassodendron ciliatum

Plate 8: Seagrass species observed at Kibuyuni

7. TERRESTRIAL ENVIRONMENT

7.1 Terrestrial Flora baseline

7.1.1 Introduction

Coastal forests in eastern Africa are recognized globally for harboring a high number of endemic plants and animals. Of Kenya's threatened forest-dependent plants, at least 50 % are in the coastal forests (Matiku, 2004). Coastal forests are also known to be among the most diverse ecosystems. Particularly, the maritime scrubs forests of the Zanzibar-inhambane coastal mosaic. These forests form part of the Archipelago-like regional sub-centre of endemism in the Swahili regional center of endemism and the Swahili/Maputaland regional transition zone along the eastern coast of Africa. The floristic composition indicate that coastal forests are dominated by tree species whose global distribution is limited to the eastern African coastal area. Hence the need for a thorough understanding of species composition to be able to initiating appropriate conservation and restoration measures.

The rock types and the landscape topography indirectly influence the characteristics of the vegetation that grows on them through their effect on the chemical composition and the particle size of the parent material from which the local soils are derived. The proposed project site is predominantly marine /estuarine sedimentary rocks. The mangrove forests are among the world's most productive ecosystems and provide many natural products and a wide range of ecological, environmental and socio-economical services while occupying only 0.12% of the world's total land area. However, they face many anthropogenic threats. Mangroves provide natural products such as timber (poles) for house building and firewood for cooking. The ecological services provided by mangroves include*;* primary nursery areas for commercially important species of fish, crustaceans such as prawns and habitats for insects, acting as traps for particulate matter, storage and recycling of organic matter and nutrients. Mangroves provide shoreline protection against floods; erosion control and tsunamis Mangroves are important carbon sinks and can sequester up to 25.5 million tonnes of carbon per year. Mangroves provide biophysical support to other coastal ecosystems such as sea grasses and coral reefs

7.1.2 Method of survey

The plot-less method developed by Hall and Swaine (1981) and used in modification by Mwachala, *et al.* (2004), will be used to capture plant diversity in the various habitat types. The survey method involves random walks through the various habitats or patches. To ensure complete and representative observations, sampling will be stopped after considerable time, usually two hours or when the discovery of unrecorded species is less than one in two minutes. In addition, collections will be recorded randomly where possible to cover the edges and other unique habitats. All the vascular plant species encountered were recorded in each of the habitat and specimens selectively using standard methods (Foreman & Bridson, 1992).Species uniqueness (endemism, rarity, threat i.e. vulnerable, endangered) will be determined through literature review, voucher specimens and databases at the EA Herbarium based on LEAP (Knox & Berghe,1996) as well as using experienced botanical experts. The field collected plant specimens were processed and identified at the East

African Herbarium in the National Museums of Kenya using herbarium collections, relevant literature and available expertise. In addition, high-resolution images of the area and interesting plants in flower were taken. A Geographical Positioning System-GPS were used to record the locations of plots in the field.

7.1.3 Terrestrial flora survey findings

The surveyed area was in two distinct habitat types

i) Secondary bushland
ii) Mangrove forest

The proposed area has a high plant diversity with total of 224 species were recorded in 62 families. The following graph shows the distribution of the dominant families.

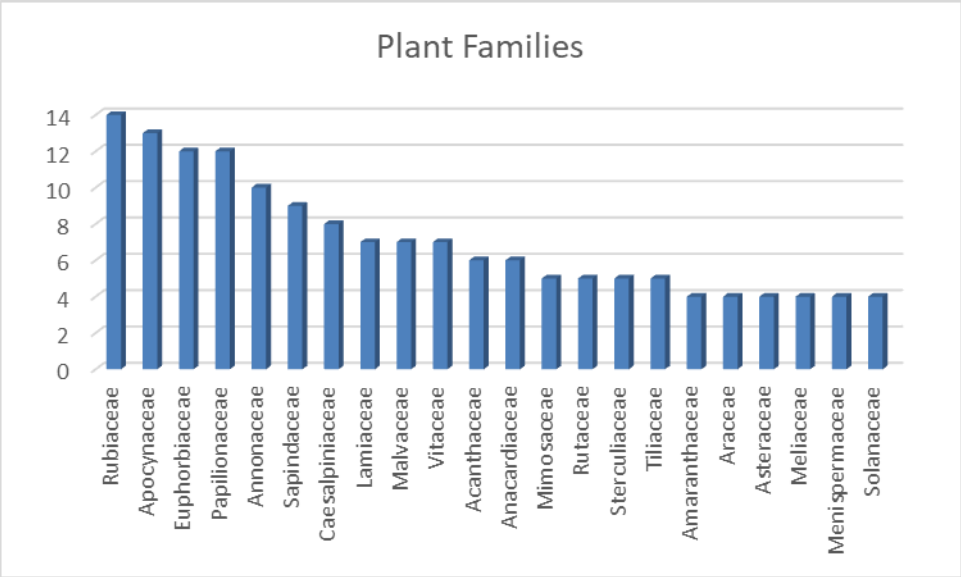


Figure 21: Distribution of dominant families of terrestrial flora species

The dominant tree species are *Ziziphus mauritiana* and *Trichilia emetica Lannea sweinfurthii*, while the dominant shrubs were *Carpodiptera africana, Mallotus oppositifolius* ,*Harrisonia abysinica* , *Ochna thomasii* and *Uvaria acuminata*

Figure 22: Lannea schweinfurthii var. stuhlmanii

Harrisonia abysinica

Ochna thomasii

Mallotus oppositifolius

Carpodiptera africana

Plate 9: Some of flora species observed at Kibuyuni

7.1.4 Secondary bushland

The proposed project lies in the maritime scrub forest on coral rag which is unprotected, small, fragmented and surrounded by a relatively impoverished rural community with a high and growing demand for, and dependence on the natural resources. The proposed site is mainly a secondary forest with few open patches. The community in Kibuyuni area are fishermen and the adjacent forest provides the traditional fishing nets


Plate 10: A section of vegetation of secondary growth at the proposed project site

7.1.5 Mangrove forest

Mangroves are one of the most prominent coastal ecosystems in tropical and many subtropical areas around the world, it is likely that that the impact by climate change on mangroves will have greater economic and social significance when compared to the effects of climate change on most other coastal ecosystems because of their location.

Increase in sea level, changes in wind, wave, current and storm patterns are the changes likely to affect mangrove ecosystems. Mangal vegetation is essentially dynamic and as accretion takes place and soil levels is raised so changes occur in soil type, water relations and salinity, and these are reflected in vegetation changes as new species invade and replace the original occupants.


Rhizophora mucronata


Avicennia marina

Plate 11: Some of the mangrove species observed within the intertidal zone at Kibuyuni

Table 15: List of Mangrove species at Kibuyuni

No	Family	Species
1	Rhizophoraceae	*Rhizophora mucronata* Lam.
2	Verbanacea	*Avicinnia Marina* (Forssk.) Vierh
3	Rhizophoraceae	*Ceriops tagal* (Pers.) C.B.Rob
4	Lythraceae	*Sonneratia alba* Sm.

At the edge of the coral rag forest bordering the sea the following were the dominant species: - *Sideroxylone inerme ,Delbergia vaccinifolius,* and *Comiphora edulis* .Further seaside are the species of mangrove like *Heritiera litoralis ,Xylocarpus granatum*

Table 16: IUCN Status

Family	Species	IUCN status	Source
Anacardiaceae	*Lannea welwitschii var. ciliolata*	Near threatened	IUCN, 2009
Annonaceae	*Lettowianthus stellatus*	Near threatened	IUCN, 2009
Annonaceae	*Ophrypetalum odoratum*	Vulnerable	IUCN, 2009
Annonaceae	*Uvariodendron kirkii*	Vulnerable	IUCN, 2009
Araceae	*Gonatopus marattioides*	Endangered	IUCN, 2009
Araceae	*Zamioculcas zamiifolia (Lodd.) Engl.*	Near threatened	CITES
Icacinaceae	*Iodes usambarensis*	Endangered	EAPLA
Moraceae	*Milicia excelsa*	Near threatened	IUCN, 1988
Papilionaceae	*Erythrina sacleuxii*	Near threatened	IUCN, 2012
Papilionaceae	*Ormocarpum sennodes ssp. zanzibaricum*	Vulnerable	IUCN, 1998
Rhamnaceae	*Ziziphus robertsoniana*	Endangered	IUCN, 1998
Rubiaceae	*Afrocanthium pseudoverticillatum ssp. pseudoverticillatum*	Vulnerable	IUCN, 2006
Rubiaceae	*Coffea pseudozanguebariae*	Vulnerable	IUCN, 1998
Rutaceae	*Vepris sansibarensis*	Vulnerable	IUCN, 1998

Rutaceae	*Zanthoxylum holtzianum*	Vulnerable	IUCN, 1998

Ziziphus robertsoniana

Zamioculcas zamiifolia

Plate 12: Some of the species observed at the coral rag section of the site

7.1.6 Uses of some of the flora species observed

The people surrounding the study site are fisher men and they derive most of the resources from the vegetation observed for fishing nets and poles *eg Carpodiptera* which is dried and split into thin strips and woven into a fishing trap. One trap costs 1000ksh and it can be used for two months before replacement. This harvesting frequency is very high.

Mildbraedia caprinifolia is used to specifically hunt for octopus from the crevices in the polyps. This shrub is cut and sharpened and placed on fire to make it firm so that it can bend but not break.

Fishing net made from 'uzio'

Maytenus heterophylla used for hunting octopus

Plate 13: Some of the plants useful to the fishing community

7.1.7 Cultural importance of some of the flora species observed

Through the survey there was only one mention of *Cordia goetzei* that is feared and the locals do not cut or used as it is said to bring problems to the house.

Table 17: Plant checklist observed during baseline survey

Family	Species	Life Form
Acanthaceae	*Asystasia gangetica* (L.) T.Anderson	H
Acanthaceae	*Barleria maritima* I. Darbysh.	H
Acanthaceae	*Blepharis maderaspatensis* Heine ex Roth ssp. maderaspatensis	H
Acanthaceae	*Ecbolium amplexcaulis* S.Moore	H
Amaranthaceae	*Achyranthes aspera* L.	H
Amaranthaceae	*Gomphrena celosioides* Mart.	H
Amaranthaceae	*Pupalia lappacea* (L.) A.Juss. var. *glabrescens* C.C.Towns.	H
Amaranthaceae	*Pupalia lappacea* (L.) A.Juss. var. *velutina* (Moq.) Hook.f.	H
Anacardiaceae	*Lannea schweinfurthii* (Engl.) Engl. var. *stuhlmanni*i (Engl.) Kokwaro	T
Anacardiaceae	*Lannea welwitschii* (Hiern) Engl. var. *ciliolata* Engl.	T
Anacardiaceae	*Mangifera indica* L.	T
Anacardiaceae	*Rhus natalensis* Krauss	T
Anacardiaceae	*Sorindeia madagascariensis* DC.	T
Annonaceae	*Artabotrys modestus* Diels	C
Annonaceae	*Lettowianthus stellatus* Diels	T
Annonaceae	*Annona acuminata*	
Annonaceae	*Monanthotaxis fornicata* (Baill.) Verdc.	S
Annonaceae	*Monanthotaxis trichocarpa* (Engl. & Diels) Verdc.	S
Annonaceae	*Monodora grandidieri* Baill.	S
Annonaceae	*Ophrypetalum odoratum* Diels	S
Annonaceae	*Uvaria acuminata* Oliv.	S
Annonaceae	*Uvariodendron kirkii* Verdc.	S
Annonaceae	*Xylopia parviflora* (A.Rich.) Benth.	T
Apocynaceae	*Ancylobothrys petersiana* (Klotzsch) Pierre	H
Apocynaceae	*Baissea myrtifolia* (Benth.) Pichon	C
Apocynaceae	*Hunteria zeylanica* (Retz.) Gardn. ex Thwaites var. *africana*	T
Apocynaceae	*Marsdenia rubicunda* (K. Schum.) N. E. Br.	H

Apocynaceae	*Parquetina nigrescens* (Afzel.) Bullock	C
Apocynaceae	*Pentarrhinum inspidum* E.Mey.	C
Apocynaceae	*Pergularia daemia* (Forssk.) Blatt. & MacOwan	C
Apocynaceae	*Pleiocarpa pycnantha* (K.Schum.) Stapf	T
Apocynaceae	*Secamone parvifolia* (Oliv.) Bullock	C
Apocynaceae	*Secamone punctulata* Decne.	C
Apocynaceae	*Pleurostelma cernuum* (Decne.) Bullock	H
Araceae	*Gonatopus boivinii* (Decne.) Engl.	H
Araceae	*Gonatopus marattioides* (Peter) Bogner	H
Araceae	*Stylochiton salaamicus* N.E.Br.	H
Araceae	*Zamioculcas zamiifolia* (Lodd.) Engl.	H
Asparagaceae	*Asparagus africanus* Lam.	S
Asteraceae	*Psiadia punctulata* (DC.) Vatke	S
Asteraceae	*Solanecio cydoniifolius* (O.Hoffm.) C.Jeffrey	C
Asteraceae	*Synedrella nodiflora* Gaertn.	H
Asteraceae	*Vernonia hildebrandtii* Vatke	S
Bombacaceae	*Adansonia digitata* L.	T
Boraginaceae	*Bourreria nemoralis* (Gürke) Thulin	S
Boraginaceae	*Cordia goetzei* Gürke	T
Boraginaceae	*Cordia sinensis* Lam.	T
Burseraceae	*Commiphora sp.*	T
Burseraceae	*Commiphora edulis* (Klotzsch) Engl. ssp. *boiviniana* (Engl.) Gillett	T
Caesalpiniaceae	*Afzelia quanzensis* Welw.	T
Caesalpiniaceae	*Caesalpinia bonduc* (L.) Roxb.	S
Caesalpiniaceae	*Caesalpinia volkensii* Harms	C
Caesalpiniaceae	*Cassia afrofistula* Brenan	S
Caesalpiniaceae	*Delonix regia* (Hook.) Raf.	T
Caesalpiniaceae	*Peltophorum ferrugineum* Benth.	H
Caesalpiniaceae	*Senna occidentalis* L.	S
Caesalpiniaceae	*Tamarindus indica* L.	T
Capparaceae	*Capparis erythrocarpos* Isert var. *erythrocarpos*	S
Capparaceae	*Capparis tomentosa* Lam.	S
Capparaceae	*Maerua triphylla* A.Rich.	T
Celastraceae	*Maytenus undata* (Thunb.) Blakelock	T
Celastraceae	*Salacia elegans* Oliv.	C

Celastraceae	*Salacia stuhlmanniana* Loes.	C
Combretaceae	*Combretum paniculatum* Vent.	C
Combretaceae	*Terminalia boivinii* Tul.	T
Combretaceae	*Terminalia sambesiaca* Engl. & Diels	T
Commelinaceae	*Commelina sp.*	H
Convolvulaceae	*Ipomoea obscura* (L.) Ker Gawl. var. *obscura*	C
Cyperaceae	*Kyllinga cartilaginea* K.Schum.	H
Cyperaceae	*Scleria lithosperma* (L.) Sw.	H
Dennstaedtiaceae	*Pteridium aquilinum* (L.) Kuhn	H
Dichapetalaceae	*Dichapetalum madagascariense* Poir.	T
Dichapetalaceae	*Tapura fischeri* Engl.	T
Dichapetalaceae	*Dichapetalum sp.*	S
Dioscoreaceae	*Dioscorea astericus* Burkill	S
Dioscoreaceae	*Dioscorea dumetorum* (Kunth) Pax	S
Ebenaceae	*Diospyros abyssinica* (Hiern) F.White ssp. *abyssinica*	T
Ebenaceae	*Diospyros squarrosa* Klotzsch	T
Ebenaceae	*Euclea racemosa* Murr ssp. *schimperi* (A.DC.) F.White	T
Erythroxylaceae	*Nectaropetalum kaessneri* Engl.	
Euphorbiaceae	*Acalypha fruticosa* Forssk.	H
Euphorbiaceae	*Flueggea virosa* (Willd.) Voigt	T
Euphorbiaceae	*Dalechampia scandens* L. var. *cordofana* (Webb) Muell. Arg.	C
Euphorbiaceae	*Mallotus oppositifolius*Radcl.-Sm	
Euphorbiaceae	*Excoecaria madagascariensis* (Baill.) Müll.Arg.	T
Euphorbiaceae	*Jatropha gossypiifolia* L.	S
Euphorbiaceae	*Mildbraedia carpinifolia* (Pax) Hutch.	H
Euphorbiaceae	*Phyllanthus ovalifolius* Forssk.	T
Euphorbiaceae	*Acalypha fruticosa* Forssk. var. *fruticosa*	S
Flacourtiaceae	*Flacourtia indica (Burm.f.) Merr.*	T
Flacourtiaceae	*Grandidiera boivinii* Jaub.	T
Hyacinthaceae	*Ledebouria boivinii* (Baker) Stedje & Thulin	H
Lamiaceae	*Hoslundia opposita* Vahl	S
Lamiaceae	*Hyptis suaveolens* Poit.	H
Lamiaceae	*Ocimum americanum* L.	H
Lamiaceae	*Plectranthus* sp.	S
Lamiaceae	*Premna resinosa* (Hochst.) Schauer ssp. *holsti*i (Gürke) Verdc.	S

Lamiaceae	*Vitex ferruginea* Schumach. & Thonn. ssp. *amboniensis* (Gurke) Verdc. var. *amboniensis*	T
Lamiaceae	*Rotheca myricoides* (Hochst.) Steane & Wabb.	S
Loganiaceae	*Strychnos madacascariensis* Poir.	T
Loganiaceae	*Strychnos spinosa* Lam.	T
Malpighiaceae	*Acridocarpus zanzibaricus* A.Juss.	S
Malpighiaceae	*Triaspis mozambica* A.Juss.	C
Malvaceae	*Hibiscus micranthus* L.f.	S
Malvaceae	*Hibiscus physaloides* Guill. & Perr.	H
Malvaceae	*Hibiscus sp. aff lunarifolius* Willd.	S
Malvaceae	*Sida acuta* Burm.f.	S
Malvaceae	*Sida cordifolia* L.	H
Malvaceae	*Abutilon mauritianum* (Jacq.) Sweet ssp. *zanzibaricum*	S
Malvaceae	*Hibiscus* sp.	S
Meliaceae	*Melia azedarach* L.	T
Meliaceae	*Turraea floribunda* Hochst.	T
Meliaceae	*Turraea nilotica* Kotschy & Peyr.	T
Meliaceae	*Turraea wakefieldii* Oliv.	T
Menispermaceae	*Dioscoreophyllum volkensii* Engl.	C
Menispermaceae	*Jateorhiza palmata* (Lam.) Miers	C
Menispermaceae	*Tiliacora funifera* (Miers) Oliv.	C
Menispermaceae	*Triclisia sacleuxii* (Pierre) Diels	C
Mimosaceae	*Acacia brevispica* Harms ssp. *brevispica*	T
Mimosaceae	*Adenanthera pavonina* L.	T
Mimosaceae	*Albizia versicolor* Welw. ex Oliv.	T
Mimosaceae	*Dichrostachys cinerea* (L.) Wight & Arn.	T
Mimosaceae	*Leucaena latisiliqua* (L.) Gillis	T
Moraceae	*Antiaris toxicaria* Lesch. ssp. *welwitschii* (Engl.) C.C.Berg var. *usambarensis* (Engl.) C.C.Berg	T
Moraceae	*Milicia excelsa* (Welw.) C.C.Berg	T
Moringaceae	*Moringa oleifera* Lam.	T
Nyctaginaceae	*Boerhavia diffusa* L.	H
Ochnaceae	*Ochna* sp. aff *macrocalyx* Oliv.	T
Ochnaceae	*Ochna thomasiana* Engl. & Gilg ex Engl.	T
Palmae	*Cocos nucifera* L.	T
Palmae	*Hyphaene coriacea* Gaertn.	T

Palmae	*Phoenix dactylifera* L.	T
Papilionaceae	*Crotalaria laburnoides* Klotzsch var. *laburnoides*	H
Papilionaceae	*Desmodium tortuosum* (Sw.) DC.	H
Papilionaceae	*Desmodium triflorum* (L.) DC.	H
Papilionaceae	*Dolichos* sp.	H
Papilionaceae	*Indigofera hirsuta* L.	H
Papilionaceae	*Indigofera trita* L.f. var. *subulata*	H
Papilionaceae	*Ormocarpum sennoides* (Willd.) DC. ssp. *zanzibaricum* Brenan & Gillett	S
Papilionaceae	*Rhynchosia viscosa* (Roth) DC. ssp. *viscosa* var. *breviracemosa* (Hauman) Verdc.	C
Papilionaceae	*Tephrosia pumila* (Lam.) Pers. var. *aldabrensis*	H
Papilionaceae	*Tephrosia purpurea* (L.) Pers.	H
Papilionaceae	*Teramnus labialis* (L.f.) Spreng. ssp. *arabicus* Verdc.	C
Papilionaceae	*Vigna unguiculata* (L.) Walp.	C
Passifloraceae	*Adenia gummifera* (Harv.) Harms	C
Polygalaceae	*Polygala stenopetala* Klotzsch	H
Polygonaceae	*Antigonon leptopus* Hook. & Arn.	H
Polypodiaceae	*Phymatosorus scolopendria* (Burm.f.) Pic.Serm.	H
Portulacaceae	*Portulaca oleracea* L.	H
Rhamnaceae	*Ziziphus mauritiana* Lam.	T
Rhamnaceae	*Ziziphus robertsoniana* Beentje	T
Rhizophoraceae	*Bruguiera gymnorrhiza* (L.) Lam.	T
Rhizophoraceae	*Ceriops tagal* (Perr.) C.B.Rob.	T
Rubiaceae	*Afrocanthium pseudoverticillatum* (S. Moore) Lantz	S
Rubiaceae	*Chazaliella abrupta* (Hiern) Petit & Verdc. var. *abrupta*	S
Rubiaceae	*Coffea pseudozanguebariae* Bridson	S
Rubiaceae	*Coptospermum nigrescens* (Hook.f.) Hiern	S
Rubiaceae	*Keetia zanzibarica* (Klotzsch) Bridson ssp. *zanzibarica*	S
Rubiaceae	*Oldenlandia corymbosa* L.	H
Rubiaceae	*Oxyanthus goetzei* K.Schum. ssp. *keniensis* Bridson	T
Rubiaceae	*Pavetta crebrifolia* Hiern var. *crebrifolia*	S
Rubiaceae	*Polysphaeria parvifolia* Hiern	T

Rubiaceae	*Pseudocanthium pseudosetiflorum* Bridson	S
Rubiaceae	*Spermacoce laevis* Lam.	H
Rubiaceae	*Triainolepis africana* Hook.f. ssp. *hildebrandtii* (Vatke) Verdc.	S
Rubiaceae	*Tricalysia ovalifolia* Hiern var. *ovalifolia*	S
Rubiaceae	*Vangueria randii* S.Moore ssp. *acuminata* Verdc.	S
Rutaceae	*Toddalia asiatica* (L.) Lam.	C
Rutaceae	*Vepris eugeniifolia* (Engl.) Verd.	S
Rutaceae	*Vepris sansibarensis* (Engl.) W. Mziray	S
Rutaceae	*Zanthoxylum holtzianum* (Engl.) P.G.Waterman ssp. *holtzianum*	S
Rutaceae	*Vepris robertsonae* Q. Luke	S
Salvadoraceae	*Azima tetracantha* Lam.	S
Salvadoraceae	*Salvadora persica* L. var. *cyclophylla*	S
Sapindaceae	*Blighia unijugata* Baker	T
Sapindaceae	*Chytranthus prieurianus* Baill. ssp. *longiflorus* (Verdc.) Halle	T
Sapindaceae	*Dodonaea viscosa* (L.) Jacq. var. *viscosa*	S
Sapindaceae	*Haplocoelum inopleum* Radlk.	T
Sapindaceae	*Lecaniodiscus fraxinifolius* Baker ssp. *vaughanii* (Dunkley) Friis	T
Sapindaceae	*Lepisanthes senegalensis* (Poir.) Leenh.	T
Sapindaceae	*Majidea zanguebarica* J.Kirk	T
Sapindaceae	*Pancovia golungensis* (Hiern) Exell & Mendonca	T
Sapindaceae	*Zanha golungensis* Hiern	T
Sapotaceae	*Manilkara sansibarensis* (Engl.) Dubard	T
Sapotaceae	*Manilkara sulcata* (Engl.) Dubard	T
Sapotaceae	*Sideroxylon inerme* L. ssp. *diospyroides* (Baker) J.H.Hemsl.	S
Simaroubaceae	*Harrisonia abyssinica* Oliv.	T
Solanaceae	*Capsicum frutescens* L.	S
Solanaceae	*Solanum campylacanthum* Hochst. Ex A. Rich.	S
Solanaceae	*Solanum usambarense* Dammer	S
Solanaceae	*Solanum zanzibarense* Vatke	S

Sonneratiaceae	*Sonneratia alba* Sm.	T
Sterculiaceae	*Hermannia exappendiculata* (Mast.) K.Schum.	H
Sterculiaceae	*Heritiera littoralis* Aiton	T
Sterculiaceae	*Melhania velutina* Forssk.	H
Sterculiaceae	*Sterculia africana* (Lour.) Fiori	T
Sterculiaceae	*Sterculia appendiculata* K.Schum. ex Engl.	T
Sterculiaceae	*Waltheria indica* L.	H
Thymelaeaceae	*Synaptolepis kirkii* Oliv.	S
Tiliaceae	*Carpodiptera africana* Mast.	T
Tiliaceae	*Corchorus aestuans* L.	H
Tiliaceae	*Corchorus trilocularis* L.	H
Tiliaceae	*Grewia glandulosa*Vahl	T
Tiliaceae	*Grewia plagiophylla* K.Schum.	S
Ulmaceae	*Celtis philippensis* Blanco	T
Ulmaceae	*Trema orientalis* (L.) Blume	T
Verbenaceae	*Avicinia marina* (Forssk.) Vierh.	T
Verbenaceae	*Premna chrysoclada (*Bojer) Gürke	S
Verbenaceae	*Vitex ferruginea* Schumach. & Thonn*. ssp. amboniensis (*Gurke) Verdc*. var. amboniensis*	S
Vitaceae	*Cissus intergrifolia* (Baker) Planch.	C
Vitaceae	*Cissus quadrangularis* L.	C
Vitaceae	*Cissus quinquangularis* Chiov.	C
Vitaceae	*Cissus rotundifolia* (Forssk.) Vahl var. *ferrugineo-pubescens*	C
Vitaceae	*Cissus sciaphila* Gilg	C
Vitaceae	*Cissus sylvicola* Masinde & L.E.Newton	C
Vitaceae	*Cyphostemma adenocaule* A.Rich.	C
Zygophyllaceae	*Tribulus terrestris* L.	H

7.2 Terestrial fauna baseline

7.2.1 Terrestrial coastal mammal species diversity

A total of 56 species of terrestrial mammal species were encountered (table 17). These consisted of six orders represented by 59% Chiropterans, 16% Rodentia, 14% Primates, 7% Carnivora, 2% Artidactyla and Erinaceomorpha each (Figure 17). Chiropterans were the most abundant group

represented with 33 individual collected that are represented in nine families Emballonuridae (3 species), Hipposideridae (6 species), Megadermatidae (1 species), Miniopteridae (2 species), Molossidae (2 species), Nycteridae (3 species), Pteropodidae (7 species), Rhinolophidae (2 species) and Vespertilionidae (7 species). Rodents are the second most diverse group represented by three families: Muridae (5 species), Nesomyidae (1 species and Sciuridae (3 species). Primates are represented by two families Cercopithecidae (6 species) and Galagidae (2 species). Carnivores are represented by three families: Felidae (1 species), Herpestidae (2 species) and Viverridae (1 species). The least represent groups were the Artiodactyla under one family Bovidae (1 species) and Erinaceomorpha under one family Erinaceidae (1 species).

Two bat species, the African Straw-coloured Fruit-bat (*Eidolon helvum) and* Striped Leaf-nosed Bat (*Hipposideros vittatus*) are classified as Near Threatened by the IUCN Red List (Figure 18). Both species are severely overhunted for bush meat in West and Central Africa. Being a fruit eater, the African Straw-coloured Fruit-bat species is also persecuted because it often damages fruit plantations, while the larger insectivorous Striped Leaf-nosed Bat is highly sensitive to disturbance of its roosts especially by guano mining (Monadjem et al. 2010, Webala et al. 2014). Hildegarde's Tomb Bat (*Taphozous hildegardeae) is classified as Vulnerable by the IUCN Red List (*Mickleburgh et al 2008). *This bat i*s found inhabiting the subtropical or tropical dry forests and caves with very restricted coastal ranges in Kenya and Tanzania. Habitat loss may probably be one of the primary reasons for its vulnerability.

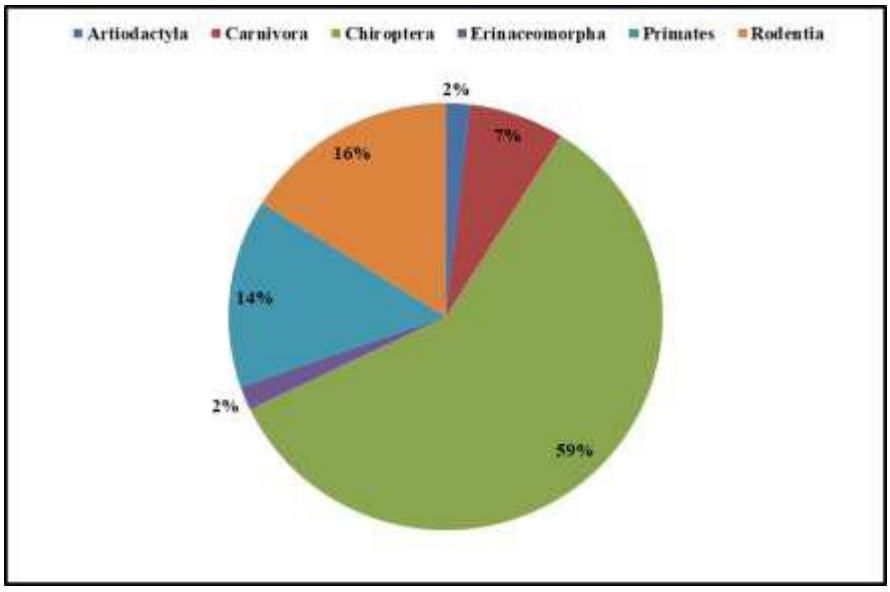


Figure 25: Diversity of terrestrial coastal mammals

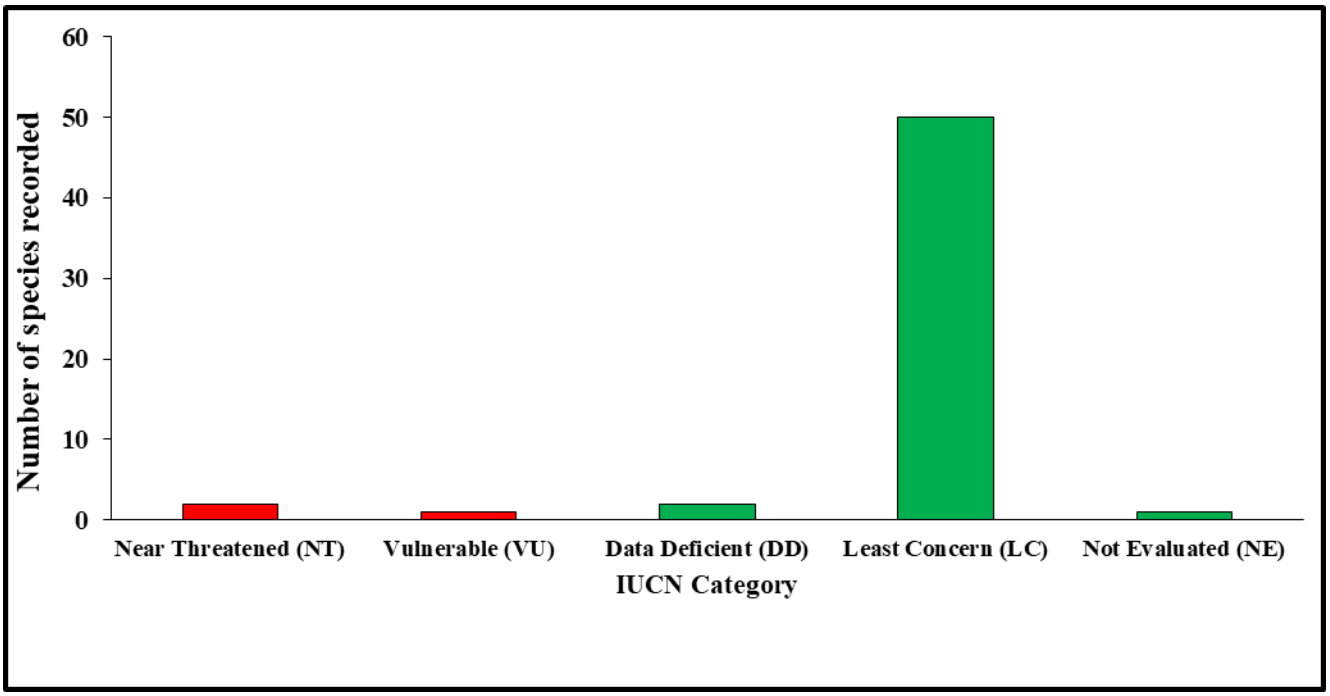


Figure 26- Number of mammal species listed by the IUCN Red List

Plate 14: Olive baboon

Table 18: Terrestrial mammal species diversity

Common Name	Order	Family	Scientific	Conservation status	Feeding Habit
African Civet	Carnivora	Viverridae	*Civettictis civetta*	Least Concern (LC)	Carnivore
African giant Squirrel	Rodentia	Sciuridae	*Protoxerus stangeri*	Least Concern (LC)	Herbivore
African Sheath-tailed Bat	Chiroptera	Emballonuridae	*Coleura afra*	Least Concern (LC)	Insectivore
African Straw-coloured Fruit-Bat	Chiroptera	Pteropodidae	*Eidolon helvum*	Near Threatened (NT)	Folivore
Rufous trident bat	Chiroptera	Hipposideridae	*Triaenops persicus*	Least Concern (LC)	Insectivore
African trident bat	Chiroptera	Hipposideridae	*Trienops afer*	Least Concern (LC)	Insectivore
African yellow Bat	Chiroptera	Vespertilionidae	*Scotophilus dinganii*	Least Concern (LC)	Insectivore
Angolan Mops Bat	Chiroptera	Molossidae	*Mops condylurus*	Least Concern (LC)	Insectivore
Bocage's Mouse-eared Bat	Chiroptera	Vespertilionidae	*Myotis bocagii*	Least Concern (LC)	Carnivore
Bushy-tailed Mongoose	Carnivora	Herpestidae	*Bdeogale crassicauda*	Least Concern (LC)	Carnivore
Cape Long-eared Bat	Chiroptera	Nycteridae	*Nycteris thebaica*	Least Concern (LC)	Insectivore
Commerson's roundleaf Bat	Chiroptera	Hipposideridae	*Hipposideros commersonii*	Not Evaluated (NE)	Carnivore
Common Duiker	Artiodactyla	Bovidae	*Sylvicapra grimmia*	Least Concern (LC)	Herbivore
Egyptian Fruit Bat	Chiroptera	Pteropodidae	*Rousettus a. aegyptiacus*	Least Concern (LC)	Frugivore
Egyptian Fruit Bat	Chiroptera	Pteropodidae	*Rousettus a. lanosus*	Least Concern (LC)	Frugivore
Egyptian Fruit Bat	Chiroptera	Pteropodidae	*Rousettus a. leachii*	Least Concern (LC)	Frugivore
Egyptian Tomb Bat	Chiroptera	Emballonuridae	*Taphozous perforatus*	Least Concern (LC)	Insectivore
Eloquent Horseshoe Bat	Chiroptera	Rhinolophidae	*Rhinolophus eloquens*	Least Concern (LC)	Carnivore
Ethiopian Epauletted Fruit Bat	Chiroptera	Pteropodidae	*Epomophorus labiatus*	Least Concern (LC)	Frugivore

Fiery Spiny Mouse	Rodentia	Muridae	*Acomys ignitus*	Least Concern (LC)	Omnivore
Four-toed Hedgehog	Erinaceomorpha	Erinaceidae	*Atelerix albiventris*	Least Concern (LC)	Omnivore
Fringe-tailed Gerbil	Rodentia	Muridae	*Tatera robusta*	Least Concern (LC)	Granivore
Black and rufous elephant shrew	Macroscelidea	Macroscelididae	*Rhynchocyon petersi*	Least Concern (LC)	
Garnett's Greater Galago	Primates	Galagidae	*Otolemur garnettii*	Least Concern (LC)	Omnivore
Greater Long-fingered Bat	Chiroptera	Miniopteridae	*Miniopterus inflatus*	Least Concern (LC)	Carnivore
Greenish yellow Bat	Chiroptera	Vespertilionidae	*Scotophilus viridis*	Least Concern (LC)	Insectivore
Grivet Monkey	Primates	Cercopithecidae	*Chlorocebus aethiops*	Least Concern (LC)	Omnivore
Hairy slit-faced Bat	Chiroptera	Nycteridae	*Nycteris hispida*	Least Concern (LC)	Insectivore
Heart-nosed Bat	Chiroptera	Megadermatidae	*Cardioderma cor*	Least Concern (LC)	Frugivore
Hildegarde's Tomb Bat	Chiroptera	Emballonuridae	*Taphozous hildegardeae*	Vulnerable (VU)	Insectivore
Lander's horseshoe bat	Chiroptera	Rhinolophidae	*Rhinolophus landeri*	Least Concern (LC)	Carnivore
Large-eared slit-faced bat	Chiroptera	Nycteridae	*Nycteris macrotis*	Least Concern (LC)	Carnivore
Least Long-fingered Bat	Chiroptera	Miniopteridae	*Miniopterus minor*	Least Concern (LC)	Insectivore
Lesser Pouched Rat	Rodentia	Nesomyidae	*Beamys hindei*	Least Concern (LC)	Omnivore
Lesser Yellow Bat	Chiroptera	Vespertilionidae	*Scotophilus borbonicus*	Data Deficient (DD)	Carnivore
Light-winged Lesser House Bat	Chiroptera	Vespertilionidae	*Scotoecus albofuscus*	Data Deficient (DD)	Insectivore
Little Free-tailed Bat	Chiroptera	Molossidae	*Chaerephon pumilus*	Least Concern (LC)	Insectivore
Mantled guereza	Primates	Cercopithecidae	*Colobus guereza*	Least Concern (LC)	Folivore
Multimammate Mouse	Rodentia	Muridae	*Mastomys natalensis*	Least Concern (LC)	Omnivore
Peter's Angolan Colobus	Primates	Cercopithecidae	*Colobus angolensis ssp. palliatus*	Least Concern (LC)	Folivore

Peters's Epauletted Fruit Bat	Chiroptera	Pteropodidae	*Epomophorus Bennett*	Least Concern (LC)	Frugivore
Randall's Serotine Bat	Chiroptera	Vespertilionidae	*Eptesicus rendalli*	Least Concern (LC)	Insectivore
Red Bush Squirrel	Rodentia	Sciuridae	*Paraxerus palliatus*	Least Concern (LC)	Herbivore
Short-eared trdent bat	Chiroptera	Hipposideridae	*Cloeotis percivali*	Least Concern (LC)	Insectivore
Striped bush squirrel	Rodentia	Sciuridae	*Paraxerus flavovittis*	Least Concern (LC)	Herbivore
Striped leaf-nosed Bat	Chiroptera	Hipposideridae	*Hipposideros vittatus*	Near Threatened	Insectivore
Sundevall's Round-leaf Bat	Chiroptera	Hipposideridae	*Hipposideros caffer*	Least Concern (LC)	Insectivore
Sykes' Monkey	Primates	Cercopithecidae	*Cercopithecus albogularis*	Least Concern (LC)	Omnivore
The Black Rat	Rodentia	Muridae	*Rattus rattus*	Least Concern (LC)	Omnivore
The black-tailed Gerbil	Rodentia	Muridae	*Gerbilliscus nigricaudus*	Least Concern (LC)	Omnivore
The Cat	Carnivora	Felidae	*Felis domesticus*	Least Concern (LC)	Carnivore
Thick-tailed Greater Galago	Primates	Galagidae	*Otolemur crassicaudatus*	Least Concern (LC)	Omnivore
Tiny pipistrelle Bat	Chiroptera	Vespertilionidae	*Pipistrellus nanulus*	Least Concern (LC)	Insectivore
Vervet Monkey	Primates	Cercopithecidae	*Chlorocebus pygerythrus*	Least Concern (LC)	Omnivore
Wahlberg's Epauletted Fruit Bat	Chiroptera	Pteropodidae	*Epomophorus wahlbergi*	Least Concern (LC)	Frugivore
White-tailed Mongoose	Carnivora	Herpestidae	*Ichneumia albicauda*	Least Concern (LC)	Carnivore
Yellow Baboon	Primates	Cercopithecidae	*Papio cynocephalus*	Least Concern (LC)	Omnivore

7.2.2 Terrestrial coastal amphibian and reptilian species diversity

A total of 68 species were recorded jointly for both communities (See Table 18), separated into three major groups of the Anurans 27%, Squamata 69% and Testudines 4% (Figure 19). Amphibians were represented by eighteen species from nine families and fourteen genera (Afrixalus, Amietophrynus, Arthroleptis, Chiromantis, Hyperolius, Kassina, Kassina, Leptopelis, Mertensophryne, Phrynobatrachus, Phrynomantis, Ptychadena, Pyxicephalus and Xenopu). Reptiles were represented by fourteen families, constituting 32 genera and 50 species. In the IUCN Red List (Figure 4), only one reptile species Green Keel-bellied Lizard (*Gastropholis prasina) is under the category of Near Threatened (Spawls et al 2015).* This species diurnal, secretive and arboreal that prefers forest, woodland and coastal thicket. The major threats are habitat fragmentation due to expansion of Cashew plantations.

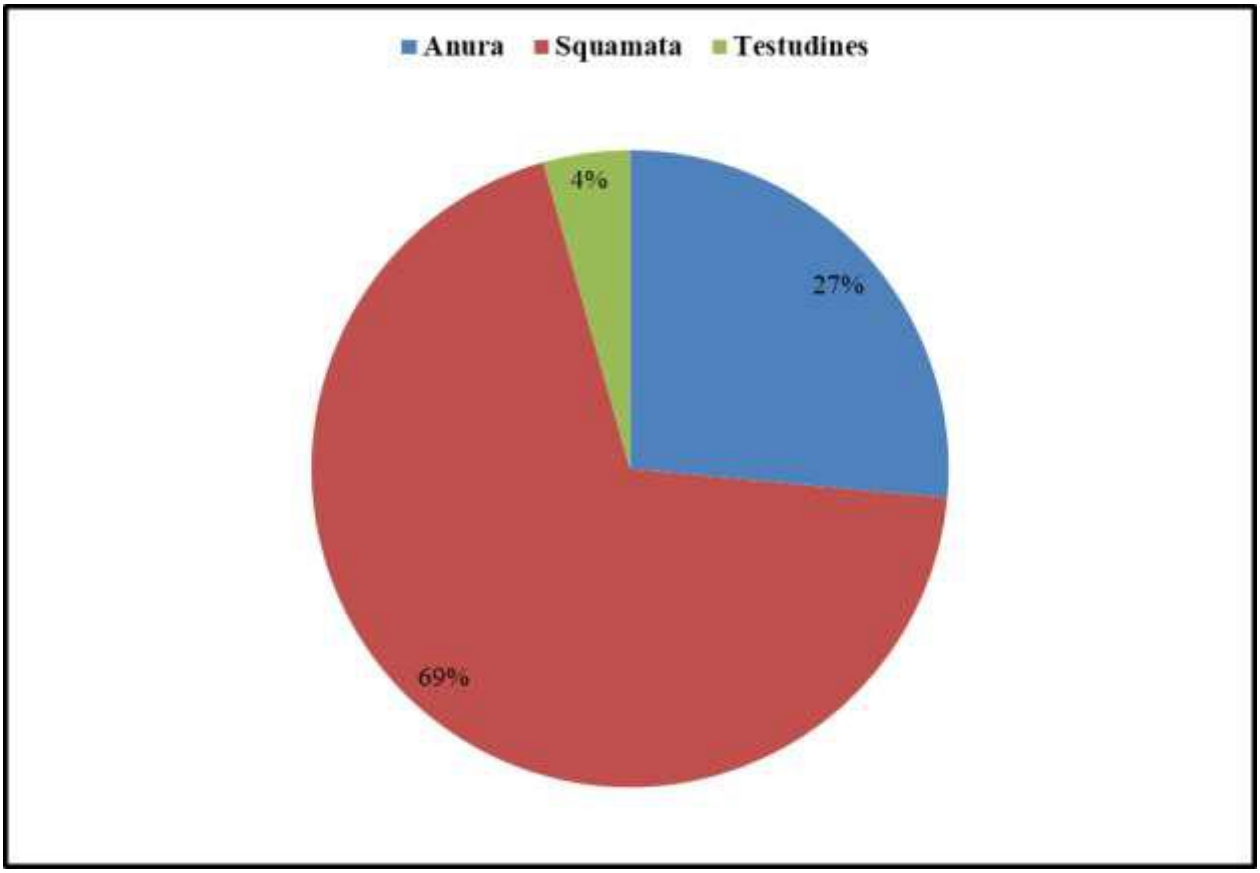


Figure 27 - Diversity of terrestrial coastal amphibians and reptiles

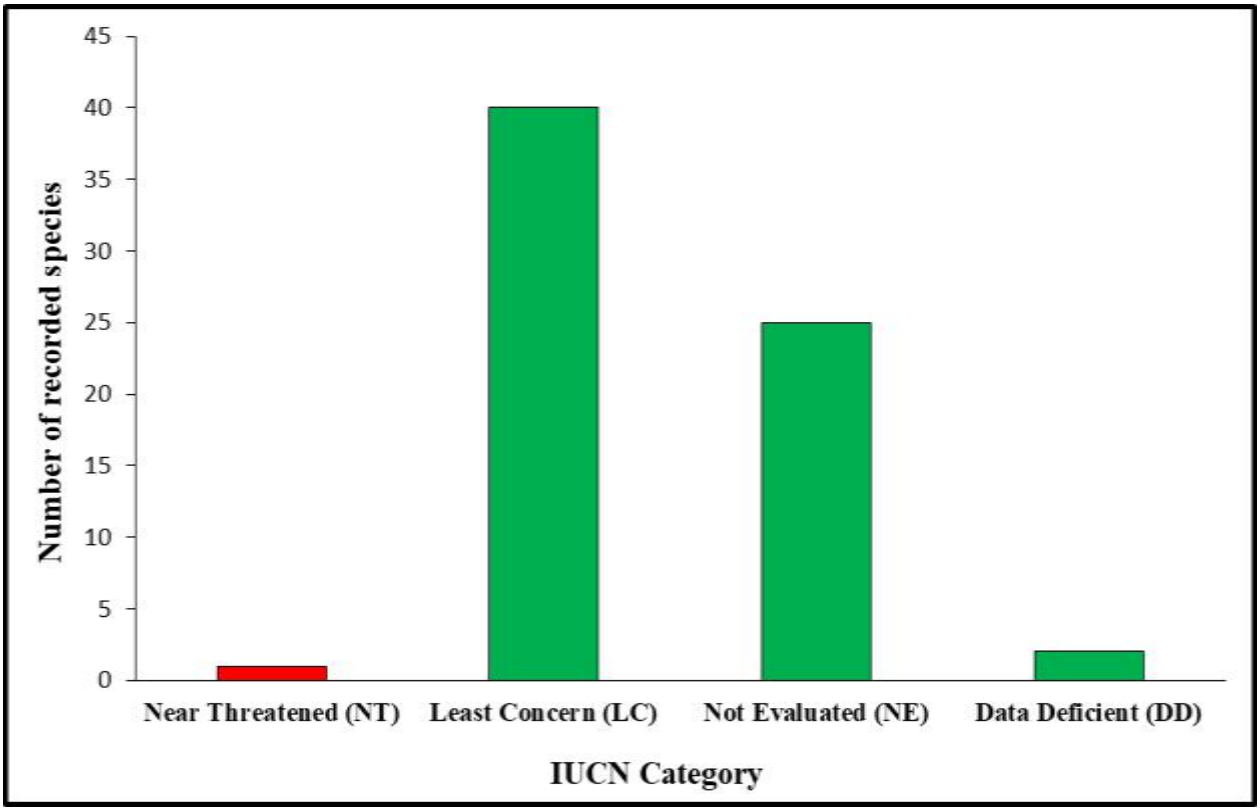


Figure 28 - Number of amphibians and reptiles species listed by the IUCN Red List

Gecko (*Hemidactylus sp.*)

Speckle-lipped Skink

Yellow-throated Plated Lizard

Plate 15: Some of the reptile observed at the proposed project site

Table 19- Terrestrial amphibians and reptiles species diversity

Common Name	Chart	Family	Scientific Name	Conservation status	Feeding Habit
Dune Squeaker	Anura	Arthroleptidae	*Arthroleptis stenodactylus*	Least Concern (LC)	Carnivore
Silvery Tree Frog	Anura	Arthroleptidae	*Leptopelis argenteus*	Least Concern (LC)	Insectivore
Guttural Toad	Anura	Bufonidae	*Amietophrynus gutturalis*	Least Concern (LC)	Insectivore
Loveridges Snouted Toad	Anura	Bufonidae	*Mertensophryne micranotis*	Least Concern (LC)	Insectivore
Delicate Leaf-folding Frog	Anura	Hyperoliidae	*Afrixalus delicatus*	Least Concern (LC)	Insectivore
Fornasini's Spiny Reed Frog	Anura	Hyperoliidae	*Afrixalus fornasini*	Least Concern (LC)	Insectivore
African Reed Frog	Anura	Hyperoliidae	*Afrixalus stuhlmanni*	Least Concern (LC)	Insectivore
Argus Reed Frog	Anura	Hyperoliidae	*Hyperolius argus*	Least Concern (LC)	Insectivore
Long-nosed Reed Frog	Anura	Hyperoliidae	*Hyperolius nasutus*	Least Concern (LC)	Insectivore
Water Lily Reed Frog	Anura	Hyperoliidae	*Hyperolius pusillus*	Least Concern (LC)	Insectivore
Red-legged Kassina	Anura	Hyperoliidae	*Kassina maculata*	Least Concern (LC)	Insectivore
Senegal Land Frog	Anura	Hyperoliidae	*Kassina senegalensis*	Least Concern (LC)	Insectivore

Common Name	Chart	Family	Scientific Name	Conservation status	Feeding Habit
Banded rubber frog	Anura	Microhylidae	*Phrynomantis bifasciatus*	Least Concern (LC)	Insectivore
East African Puddle Frog	Anura	Phrynobatrachidae	*Phrynobatrachus acridoides*	Least Concern (LC)	Insectivore
Marsabit Clawed Frog	Anura	Pipidae	*Xenopu borealis*	Least Concern (LC)	Carnivore
Plain Grass Frog	Anura	Ptychadenidae	*Ptychadena anchietae*	Least Concern (LC)	Insectivore
Lesser Bull-frog	Anura	Pyxicephalidae	*Pyxicephalus edulis*	Least Concern (LC)	Carnivore
African frog	Anura	Rhacophoridae	*Chiromantis xerampelina*	Least Concern (LC)	Insectivore
Red-headed Rock Agama	Squamata	Agamidae	*Agama lionotus*	Least Concern (LC)	
Flap-Necked Chameleon	Squamata	Chamaeleonidae	*Trioceros dilepis*	Least Concern (LC)	Insectivore
Red-lipped Snake	Squamata	Colubridae	*Crotaphopeltis hotamboeia*	Least Concern (LC)	Carnivore
East African Egg-eater Snake	Squamata	Colubridae	*Dasypeltis medici*	Least Concern (LC)	Carnivore - exclusively birds' egg
Common Egg-eater Snake	Squamata	Colubridae	*Dasypeltis scabra*	Least Concern (LC)	Carnivore - feeds exclusively on eggs
Spotted Green Snake	Squamata	Colubridae	*Philothamnus punctatus*	Least Concern (LC)	Carnivore
Spotted bush Snake	Squamata	Colubridae	*Philothamnus semivariegatus*	Least Concern (LC)	Carnivore

Common Name	Chart	Family	Scientific Name	Conservation status	Feeding Habit
African tiger Snake	Squamata	Colubridae	*Telescopus semiannulatus*	Least Concern (LC)	Largely lizards, small rodents, fledgeling birds and bats
Savanna vine Snake	Squamata	Colubridae	*Thelotornis capensis*	Least Concern (LC)	Lizards, frogs, and birds
Eastern vine Snake	Squamata	Colubridae	*Thelotornis mossambicanus*	Least Concern (LC)	Lizards, frogs, and birds
Eastern green Mamba	Squamata	Elapidae	*Dendroaspis angusticeps*	Not Evaluated (NE)	Birds and their eggs, small rodents, bats, and arboreal lizards
East African Garter Snake	Squamata	Elapidae	*Elapsoidea loveridgei*	Not Evaluated (NE)	
Ashe's spitting Cobra	Squamata	Elapidae	*Naja ashei*	Not Evaluated (NE)	
House Gecko	Squamata	Gekkonidae	*Hemidactylus angulatus*	Not Evaluated (NE)	Insectivore
Tropical house Gecko	Squamata	Gekkonidae	*Hemidactylus mabouia*	Not Evaluated (NE)	Insectivore
Moderate Leaf-toed Gecko	Squamata	Gekkonidae	*Hemidactylus modestus*	Data Deficient (DD)	Insectivore
Flat-headed tropical house Gecko	Squamata	Gekkonidae	*Hemidactylus platycephalus*	Data Deficient (DD)	Insectivore
Tornier's Leaf-toed Gecko	Squamata	Gekkonidae	*Hemidactylus squamulatus*	Least Concern (LC)	Insectivore
Broadley's dwarf Gecko	Squamata	Gekkonidae	*Lygodactylus broadleyi*	Not Evaluated (NE)	Insectivore
White-headed dwarf Gecko	Squamata	Gekkonidae	*Lygodactylus mombasicus*	Least Concern (LC)	Insectivore

Common Name	Chart	Family	Scientific Name	Conservation status	Feeding Habit
Painted Dwarf Gecko	Squamata	Gekkonidae	*Lygodactylus picturatus*	Least Concern (LC)	Insectivore
Great-plated Lizard	Squamata	Gerrhosauridae	*Broadleysaurus major*	Least Concern (LC)	Insectivore
Yellow-throated Plated Lizard	Squamata	Gerrhosauridae	*Gerrhosaurus flavigularis*	Not Evaluated (NE)	Insectivore
Green Keel-bellied Lizard	Squamata	Lacertidae	*Gastropholis prasina*	Near Threatened (NT)	Insectivore
Eastern serrate-toed tree lizard	Squamata	Lacertidae	*Holaspis laevis*	Not Evaluated (NE)	Insectivore
Jackson's Centipede-eater	Squamata	Lamprophiidae	*Aparallactus jacksonii*	Not Evaluated (NE)	Feeds mainly on centipedes
Malindi Centipede-eater	Squamata	Lamprophiidae	*Aparallactus turneri*	Least Concern (LC)	Feeds mainly on centipedes
Brown house Snake	Squamata	Lamprophiidae	*Boaedon capensis*	Not Evaluated (NE)	Rodents
African house Snake	Squamata	Lamprophiidae	*Boaedon fuliginosus*	Not Evaluated (NE)	Small mammals (mice, shrews, etc.), reptiles, amphibians and birds
Eastern Bark Snake	Squamata	Lamprophiidae	*Hemirhagerrhis nototaenia*	Not Evaluated (NE)	
Eastern Stripe-bellied Sand Snake	Squamata	Lamprophiidae	*Psammophis orientalis*	Not Evaluated (NE)	
Goggle-eyed Worm Snake	Squamata	Leptotyphlopidae	*Leptotyphlops macrops*	Least Concern (LC)	Mainly diet is ant and termite larvae
African rock Python	Squamata	Pythonidae	*Python natalensis*	Not Evaluated (NE)	Carnivore-terrestrial vertebrates e.g. birds, mammals, reptiles

Common Name	Chart	Family	Scientific Name	Conservation status	Feeding Habit
East-African Snake-eyed Skink	Squamata	Scincidae	*Cryptoblepharus africanus*	Not Evaluated (NE)	Larger invertebrates e.g. crickets, moths, slaters, earthworms, flies, grubs and caterpillars, grasshoppers, cockroaches, earwigs, slugs, dandelions, small spiders, ladybeetles and many other small insects
Snake-eyed Skink	Squamata	Scincidae	*Cryptoblepharus boutonii*	Not Evaluated (NE)	
Peters Writhing Skink	Squamata	Scincidae	*Lygosoma afrum*	Least Concern (LC)	
Pemba Island Writhing Skink	Squamata	Scincidae	*Lygosoma pembanum*	Least Concern (LC)	
Pygmy Limbless Skink	Squamata	Scincidae	*Melanoseps pygmaeus*	Not Evaluated (NE)	
Speckle-lipped Skink	Squamata	Scincidae	*Trachylepis maculilabris*	Not Evaluated (NE)	
Tree Skink	Squamata	Scincidae	*Trachylepis planifrons*	Not Evaluated (NE)	
African striped Skink	Squamata	Scincidae	*Trachylepis striata*	Not Evaluated (NE)	
Variable Skink	Squamata	Scincidae	*Trachylepis varia*	Not Evaluated (NE)	
Nile Monitor	Squamata	Varanidae	*Varanus niloticus*	Not Evaluated (NE)	Carnivore
Mount Kenya bush Viper	Squamata	Viperidae	*Atheris desaixi*	Not Evaluated (NE)	Opportunistic- amphibians, rodents and small mammals

Common Name	Chart	Family	Scientific Name	Conservation status	Feeding Habit
Puff Adder	Squamata	Viperidae	*Bitis arietans*	Not Evaluated (NE)	Carnivore - small invertebrates
Snouted night Adder	Squamata	Viperidae	*Causus defilippii*	Least Concern (LC)	
Velvety-green night Adder	Squamata	Viperidae	*Causus resimus*	Not Evaluated (NE)	
Bell's hinge-back Tortoise	Testudines	Testudinidae	*Kinixys belliana*	Least Concern (LC)	Omnivore
Speke's hinge-back Tortoise	Testudines	Testudinidae	*Kinixys spekii*	Least Concern (LC)	Omnivore - special preference for milipedes
Leopard Tortoise	Testudines	Testudinidae	*Stigmochelys pardalis*	Least Concern (LC)	Herbivore

7.2.3 Terrestrial invertebrate diversity

A total of 88 species of arthropods belonging to 5 orders and 19 families were observed. The morphospecies collected and corresponding taxa of the voucher specimens are shown in table 19. Figure 21 shows the most groups were the Lepidoptera (56%) and Diptera (35%), and least represented groups were the Hymenoptera (6%), Araneae (2%) and Copeoptera (1%). Lepidoptera was the most diverse group represented by 49 species in 10 families, followed by Diptera with 31 species in 5 families, while the least were Araneae represented by 2 families, Coleoptera and Hymenoptera were each equally represented by one family. The families were represented by Tephritidae (15 genera), Geometridae (14 genera) and Sphingidae (10 genera), Culicidae (9 genera), Asilidae (5 genera), Blastobasidae (5 genera), Cerambycidae (1 genera), Culicidae (9 genera), Formicidae (5 genera), Glossinidae (1), Hesperiidae (1), Hyblaeidae (1), Nymphalidae (1), Papilionidae (6), Pieridae (2), Syrphidae (1), Tetragnathidae (1), Tortricidae (5), Uraniidae (2) and Zodariidae (1). No species of arthropod was found listed in the IUCN Red List. However, three species are vectors of tropical diseases affecting human. *Glossina brevipalpis* is a vector of a trypasome that causes sleeping sickness. *Aedes aegypti* is a vector of yellow fever, dengue fever and worms responsible for lymphatic filariasis (elephantiasis) and *Anopheles gambiae* transmit plasmodium that causes malaria. Members of the family Tephritidae are an important pest in agriculture. The Asian fruit fly (*Bactrocera invadens*) is non-native from Sri Lanka introduced in the country through horticultural trade.

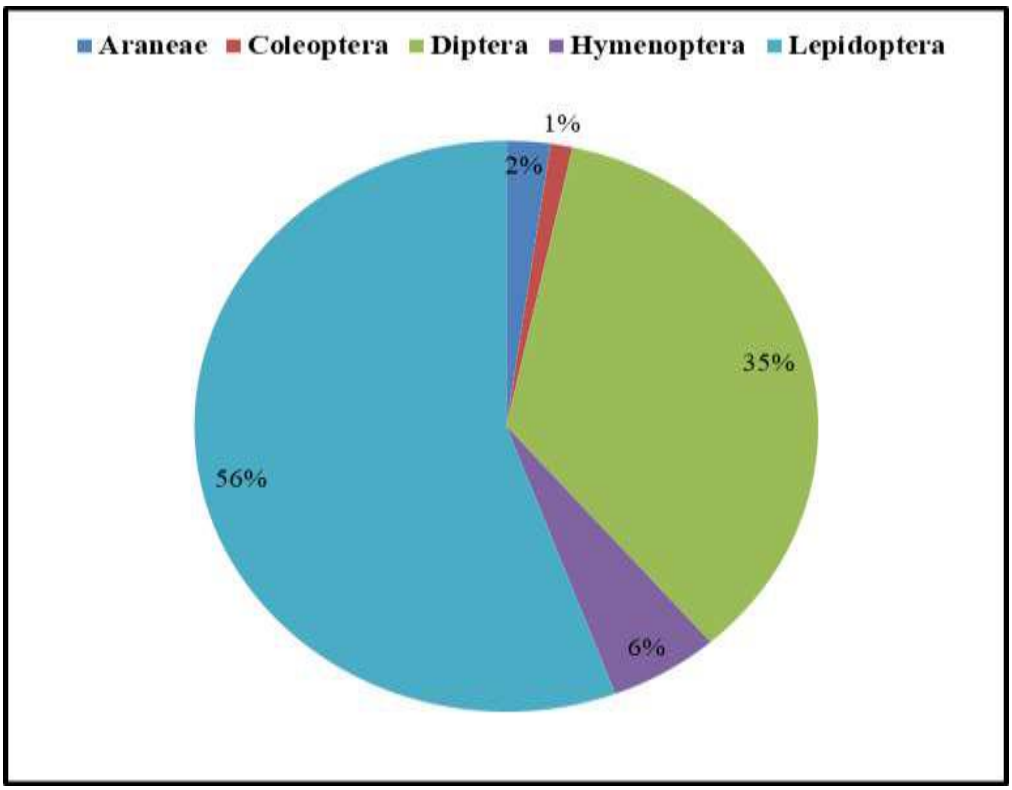


Figure 29- Composition by order of the terrestrial arthropod taxa recorded across all sites

Table 20: List of terrestrial arthropod taxa from different taxonomic groups

Common Name	Order	Family	Genus	Scientific	IUCN Status
African Joker	Lepidoptera	Nymphalidae	Byblia	*Byblia anvatara*	NE
African mocker swallowtail	Lepidoptera	Papilionidae	Papilio	*Papilio dardanus*	NE
Ant eating Spider	Araneae	Zodariidae	Mallinella	*Mallinella spp.*	NE
Asian fruit fly	Diptera	Tephritidae	Bactrocera	*Bactrocera invadens*	NE
Black Carpenter Ant	Hymenoptera	Formicidae	Camponotus	*Camponotus jeanneli*	NE
Blue Pansy	Lepidoptera	Nymphalidae	Junonia	*Junonia oenone*	NE
Calypso white	Lepidoptera	Pieridae	Belenois	*Belenois calypso dentigera*	NE
Carpenter Ant	Hymenoptera	Formicidae	Camponotus	*Camponotus Mayr*	NE
Citrus swallowtail	Lepidoptera	Papilionidae	Papilio	*Papilio demodocus*	NE
Coastal Swordtail	Lepidoptera	Papilionidae	Graphium	*Graphium porthaon*	NE
Coppery Swordtail	Lepidoptera	Papilionidae	Graphium	*Graphium latreillianus*	NE
Flat-faced longhorns beetle	Coleoptera	Cerambycidae	Ceroplesis	*Ceroplesis spp.*	NE
Flower Fly	Diptera	Syrphidae	Graptomyza	*Graptomyza triangulifera*	NE
	Diptera	Tephritidae	Dacus	*Dacus arcuatus*	NE
	Diptera	Tephritidae	Dacus	*Dacus ciliatus*	NE
	Diptera	Tephritidae	Dacus	*Dacus humeralis*	NE
	Diptera	Tephritidae	Trirhithrum	*Trirhithrum culcasiae*	NE
	Diptera	Tephritidae	Trirhithrum	*Trirhithrum divisum*	NE
	Diptera	Tephritidae	Trirhithrum	*Trirhithrum nigerrimum*	NE
	Diptera	Tephritidae	Trirhithrum	*Trirhithrum senex*	NE
Giant Robber Fly	Diptera	Asilidae	Promachus	*Promachus ssp.*	NE

Common Name	Order	Family	Genus	Scientific	IUCN Status
Grass mosquito	Diptera	Culicidae	Aedes	*Aedes aegypti*	NE
Grass mosquito	Diptera	Culicidae	Aedes	*Aedes calceatus*	NE
Grass Mosquito	Diptera	Culicidae	Aedes	*Aedes fulgens*	NE
Grass mosquito	Diptera	Culicidae	Aedes	*Aedes haworthi*	NE
Hooked Thorn moth	Lepidoptera	Geometridae	Plegapteryx	*Plegapteryx anomalus*	NE
Large Striped Swordtail	Lepidoptera	Papilionidae	Graphium	*Graphium antheus*	NE
Larger Robber Fly	Diptera	Asilidae	Microstylum	*Microstylum ssp.*	NE
Litchi moth	Lepidoptera	Tortricidae	Cryptophlebia	*Cryptophlebia peltastica*	NE
Malaria mosquitoes	Diptera	Culicidae	Anopheles	*Anopheles arabiensis*	NE
Malaria mosquitoes	Diptera	Culicidae	Anopheles	*Anopheles gambiae*	NE
Malaria mosquitoes	Diptera	Culicidae	Anopheles	*Anopheles merus*	NE
Mango Fruit Fly	Diptera	Tephritidae	Ceratitis	*Ceratitis cosyra*	NE
Mediterranean fruit fly	Diptera	Tephritidae	Ceratitis	*Ceratitis capitata*	NE
Morgan's sphinx moth	Lepidoptera	Sphingidae	Xanthopan	*Xanthopan morganii*	NE
Mosquito	Diptera	Culicidae	Eretmapodites	*Eretmapodites silvestris*	NE

Common Name	Order	Family	Genus	Scientific	IUCN Status
Mosquito	Diptera	Culicidae	Uranotaenia	*Uranotaenia balfouri*	NE
Narrow green-banded swallowtail	Lepidoptera	Papilionidae	Papilio	*Papilio nireus*	NE
One-pip Policeman	Lepidoptera	Hesperiidae	Coeliades	*Coeliades anchises*	NE
Ornate emerald	Lepidoptera	Geometridae	Allochrostes	*Allochrostes biornata*	NE
Predaceous Ant	Hymenoptera	Formicidae	Platythyrea	*Platythyrea cribrinodis*	NE
Robber fly	Diptera	Asilidae	Clinopogon	*Clinopogon nicobarensis*	NE
Round-winged Orange Tip	Lepidoptera	Pieridae	Colotis	*Colotis euippe*	NE
Shining Red Charaxes	Lepidoptera	Nymphalidae	Charaxes	*Charaxes zingha*	NE
Silver Vlei Spider	Araneae	Tetragnathidae	Leucauge	*Leucauge medjensis*	NE
Small Rober Fly	Diptera	Asilidae	Stichopogon	*Stichopogon spp.*	NE
Small sugar Ant	Hymenoptera	Formicidae	Lepisiota	*Lepisiota depressa*	NE
Spiny Sugar Ant	Hymenoptera	Formicidae	Polyrhachis	*Polyrhachis viscosa*	NE
Toothed Cream Stripe	Lepidoptera	Sphingidae	Centroctena	*Centroctena imitans*	NE
Tsetse Fly	Diptera	Glossinidae	Glossina	*Glossina brevipalpis*	NE
	Diptera	Tephritidae	Ceratitis	*Ceratitis ditissima*	NE
	Diptera	Tephritidae	Ceratitis	*Ceratitis pinax*	NE
	Diptera	Tephritidae	Ceratitis	*Ceratitis rosa*	NE
	Diptera	Tephritidae	Ceratitis	*Ceratitis stipula*	NE
	Diptera	Tephritidae	Dacus	*Dacus vertebratus*	NE

Common Name	Order	Family	Genus	Scientific	IUCN Status
	Diptera	Asilidae	Euscelidia	*Euscelidia tsavo*	NE
	Lepidoptera	Geometridae	Acanthovalva	*Acanthovalva inconspicuaria*	NE
	Lepidoptera	Geometridae	Antharmostes	*Antharmostes papilio*	NE
	Lepidoptera	Tortricidae	Anthozela	*Anthozela psychotriae*	NE
	Lepidoptera	Geometridae	Archichlora	*Archichlora viridimacula*	NE
	Lepidoptera	Blastobasidae	Blastobasis	*Blastobasis acirfa*	NE
	Lepidoptera	Blastobasidae	Blastobasis	*Blastobasis catappaella*	NE
	Lepidoptera	Blastobasidae	Blastobasis	*Blastobasis kenya*	NE
	Lepidoptera	Geometridae	Chiasmia	*Chiasmia feraliata*	NE
	Lepidoptera	Geometridae	Colocleora	*Colocleora spuria*	NE
	Lepidoptera	Tortricidae	Cryptophlebia	*Cryptophlebia semilunana*	NE
	Lepidoptera	Uraniidae	Epiplema	*Epiplema spp.*	NE
	Lepidoptera	Sphingidae	Hippotion	*Hippotion roseipennis*	NE
	Lepidoptera	Hyblaeidae	Hyblaea	*Hyblaea Fabricius*	NE
	Lepidoptera	Geometridae	Isturgia	*Isturgia catalaunaria*	NE
	Lepidoptera	Tortricidae	Lobesia	*Lobesia vanillana*	NE
	Lepidoptera	Geometridae	Lophorrhachia	*Lophorrhachia palliata*	NE
	Lepidoptera	Sphingidae	Macropoliana	*Macropoliana scheveni*	NE
	Lepidoptera	Geometridae	Menophra	*Menophra spp.*	NE
	Lepidoptera	Blastobasidae	Neoblastobasis	*Neoblastobasis wangithiae*	NE

Common Name	Order	Family	Genus	Scientific	IUCN Status
	Lepidoptera	Blastobasidae	Neoblastobasis	*Neoblastobasis ximeniaella*	NE
	Lepidoptera	Sphingidae	Neopolyptychus	*Neopolyptychus compar*	NE
	Lepidoptera	Sphingidae	Nephele	*Nephele bipartita*	NE
	Lepidoptera	Sphingidae	Nephele	*Nephele rosae*	NE
	Lepidoptera	Sphingidae	Praedora	*Praedora marshalli*	NE
	Lepidoptera	Geometridae	Scopula	*Scopula spp.*	NE
	Lepidoptera	Geometridae	Sphingomima	*Sphingomima spp.*	NE
	Lepidoptera	Tortricidae	Stenentoma	*Stenentoma sorindeiae*	NE
	Lepidoptera	Sphingidae	Temnora	*Temnora marginata*	NE
	Lepidoptera	Sphingidae	Temnora	*Temnora sardanus*	NE
	Lepidoptera	Uraniidae	Urapteroides	*Urapteroides recurvata*	NE
	Lepidoptera	Geometridae	Xenimpia	*Xenimpia fletcheri*	NE
	Lepidoptera	Geometridae	Zamarada	*Zamarada spp.*	NE

7.3 Terestrial Avifauna

7.3.1 Background Information

The East Africa coast regions form unique and critically important ecosystem for biodiversity. It comprises mangrove forests, coastal shoreline, coastal forests, estuaries and deltas. The high diversity of habitats and ecosystems account for high species diversity and designation of some of the habitats as important for conservation of biodiversity. The ecosystem forms hot spot area for biodiversity hence support country's tourism industry, one of leading foreign exchange earner. Some of the coastal forest forms important water catchment areas for the rivers and streams on which the local people in the coastal areas depend on. On avifauna community and other biodiversity the dynamic habitat structure forms centres of endemism for a wide variety of globally threatened fauna and flora.

Birds are very good indicators of environmental health. They survive prolifically where conditions are favourable and avoid habitats that are not conducive for their survival. Habitats provide the various needs of birds including food, shelter, cover, roosting, and breeding. In any given habitat, each species or an assemblage of species will occupy a given niche depending on the habitat selection preference. These includes innate and learned behavioral responses of birds that allow them to distinguish among various components of the environment resulting in the disproportional use of environmental conditions to influence survival and ultimate fitness of individuals.

Habitat use is the manner in which a species uses a collection of environmental components to meet life requisites. It is no wonder that in a given habitat, there will be a mixture of species comprising of different feeding guilds because each species will specialize on a given food material as a mechanism to avoid competition. Bird families and genera often occupy a breadth of habitats and have broad geographical ranges, yet many individual species are specialized in their requirements and have narrow distributions. Birds are mobile and responsive to environmental changes. There are enough bird species to show meaningful patterns, yet not so many as to make identification itself a challenge.

This development projects are key to improving economies and people's livelihoods, create employment opportunities, market for scrap metal, revenue from exports, tax, opportunities for managing and recycling of wrecked ship, business opportunities for other products and raw material during the recycling process among other positive impacts. Notable negative impacts include disturbance of local fauna, destruction and removal of flora from site, destruction, disturbance and or alteration of local habitats for fauna including avifauna, change in local aesthetics, loss of farming land disruption and or fragmentation of local social fabric, change in local air quality, noise and dust emissions.

The need to strike a balance between the positive and negative impacts is very important. These projects have the potential to negatively change the integrity of ecosystems including the ecological structure and function. All development have to demonstrate compliance with existing legal frameworks (e.g. EMCA, 2018 Amendment), which have provisions for identifying, documenting, avoiding or minimizing negative impacts, and to optimizing positive impacts.

Birds being good indicators of the state of the environment, documenting the species diversity at the site becomes critical in the EIA process and the Environmental Monitoring and Management Plan implementation. Information of bird diversity and their conservation status is very important in understanding the negative impacts that are likely to accrue from the execution of the proposed project, prescription of the requisite mitigation measures and provide a baseline for subsequent monitoring during the EMMP implementation.

In this view, a rapid biodiversity, survey was carried out at the proposed site for the Wasini Green Ship Recycling and Steel Making Facility project at Mabuyu Village Shimoni sub county Kwale county, on April 5 -10th 2019.

7.3.2 Objectives of the Survey

The objectives of this survey were as follows:

i. Provide information on avian diversity and use of the project site that is useful in evaluating potential impacts from the proposed project.
ii. generate the baseline data that form part of a comprehensive Environmental and Social Impact Assessment (ESIA) for the proposed project;
iii. identify the species of global conservation concern
iv. Document the potential impact of the proposed project on avifauna

v. Provide recommendations for further monitoring studies and potential mitigation measures.

7.3.3 Study Area

The surveyed study was conducted in Kibuyuni Village of Kwale County. Being a field, bordering coastal Marine ecosystem it is characterised by a mosaic of different habitat types. The avifaunal survey was done in three habitats (see plate 16) namely; seashore with mangroves, bush land with forest remains, and farmlands that are under shift cultivation. The data collection was done from water shoreline of the sea to the upper part of the terrestrial land. But the habitat surveyed was categorized according to their state and composition of the habitat structure at the time of survey.

Plate 16: Habitat of avifauna survey

The site comprised Mangrove forest, open shoreline, Terrestrials field with full of thick bushes, shrubs and herbs. The terrestrial habitat comprised of scant scattered distributed baobab tree the only large tree one could see. The adjacent to the bush land along the marine shoreline there was

a Mangrove forest with gaps of opening used by fish men as landing beaches. On terrestrial land, farmland, settlement and an urban market centres surrounding the bush land. All this microhabitat creates unique niches which are occupied with diverse and unique avifauna composition.

7.3.4 Material and Methods

7.3.4.1. Equipment

The survey was done by a pair of binocular, pen and a pencil and a note book. In marking survey transect a pair of GPS was used to mark the geographical coordinates.

7.3.4.2 Methods

Point counts surveys were conducted, whereby each point was within fixed width, of 25m radius in a length of 200m from one point to the next. A set of 6 point counts along each human path (transect), set at least 200m apart were surveyed. Transects were 1 km long and from the sea shore to the deeper part of terrestrial land. Along each transect, 6 point counts were conducted at intervals of 200 m and each point permanently marked with a GPS. The marking was for consistency in order for future monitoring of the birds species. At every point observers waited for 2 minute (settling us and birds) before we start recording and counting all the birds seen or heard within a period of 10 minutes. Opportunistic observation were made in between other activities in and around the site to help build up the species checklist. This method was mostly applied along the seashore line and species heard were not recorded.

7.3.5 Results

Overall, 101 bird species were recorded over 5-day survey in Shimon Mabuyu Village in a mixed habitat, ocean shore, bush land, farmlands and its environs (table 20-22). The site proved to be a stopover for passerine migrant's birds where the Great Reed Warbler, Marsh Warbler and Willow Warbler were recorded in the local bushes. The Red-backed shrike was frequently spotted perching on the dry twigs like in every part of the farm. Along the shore within the fish landing beaches species that like scavenging e.g. Marabou Stork and Black Kite were common and fish eating birds from African Fish Eagle and five species of Kingfisher were recorded within the study site. On species of conservation concern, the two tables illustrates the species of conservation interest

Table 21: Threatened species observed

COMMON NAME	SCIENTIFIC NAME	IUCN STATUS
Plain-backed Sunbird	*Anthreptes reichenowi*	Near-Threatened
Madagascar Pond Heron[2]	*Ardeola idae*	Endangered

[2] This species is part of the Malagasy migration system whereby species move between mainland Africa and the Madagascar Island

Table 22: Biome species recorded during the survey:

COMMON NAME	SCIENTIFIC NAME	BIOME SPECIES
African Citril	*Crithagra citrinelloides hyposticus*	Afrotropical Highlands
Brown-headed Parrot	*Poicephalus cryptoxanthus*	East African Coastal forest EBA
Mombasa Woodpecker	*Campethera mombassica*	East African Coastal forest EBA
Little Yellow Flycatcher	*Erythrocercus holochlorus*	East African Coastal forest EBA
Black-bellied Starling	*Lamprotornis corruscus*	East African Coastal forest EBA
Long-tailed Fiscal	*Lanius cabanisi*	Somali-Masai
African Grey Flycatcher	*Bradornis microrhynchus*	Somali-Masai
Golden Palm Weaver	*Ploceus bojeri*	Somali-Masai

Table 23: List of bird species recorded in KIbuyuni area with bush land surrounding farmland and shoreline during the survey

Status: IUCN Red list. EN-Endangered; VU-Vulnerable; NT-Near-threatened, LC=Least Concern

Migrants; am- afro tropical migrant; PM=Palaearctic migrant; mm-Malagasy migrant

COMMON NAME	SCIENTIFIC NAME	IUCN	MIGRANTS
Numididae: guineafowl			
Crested Guineafowl	*Guttera pucherani*	LC	
Phasianidae: quails, francolins, spurfowl and allies			
Crested Francolin	*Francolinus sephaena*	LC	
Common Quail	*Coturnix coturnix*	LC	pm
Podicipedidae: grebes			
Little Grebe	*Tachybaptus ruficollis*	LC	
Ciconiidae: storks			
Yellow-billed Stork	*Mycteria ibis*	LC	
Marabou Stork	*Leptoptilos crumeniferus*	LC	
African Openbill	*Anastomus lamelligerus*	LC	
Threskiornithidae: ibises and spoonbills			
Sacred Ibis	*Threskiornis aethiopicus*	LC	
Hadada Ibis	*Bostrychia hagedash*	LC	
Ardeidae: herons, egrets and bitterns			
Black headed Heron	*Ardea melanocephala*	LC	
Squacco Heron	*Ardeola ralloides*	LC	am pm
Cattle Egret	*Bubulcus ibis*	LC	am
Madagascar Pond Heron	*Ardeola idae*	EN	mm
Scopidae: Hamerkop			
Hamerkop	*Scopus umbretta*	LC	
Accipitridae: diurnal birds of prey other than falcons			
Black Kite	*Milvus migran*	LC	Pm am
African Harrier Hawk	*Polyboroides typus*	LC	

Great Sparrowhawk	*Accipiter melanoleucu*	LC	
Common Buzzard	*Buteo buteo*	LC	
Long crested Eagle	*Lophaetus occipitalis*	LC	
Rallidae: rails and relatives			
Black Crake	*Amaurornis flavirostra*	LC	
Dromadidae: Crab-plover			
Crab-plover	*Dromas ardeola*	LC	PM
Charadriidae: plovers		LC	
Little Ringed Plover	*Charadrius dubius*	LC	PM
Greater Sand Plover	*Charadrius leschenaultii*	LC	PM
Scolopacidae: sandpipers and relatives			
Common Sandpiper	*Actitis hypoleucos*	LC	PM
Columbidae: pigeons and doves			
Red eyed Dove	*Streptopelia semitorquata*	LC	
Ring necked Dove	*Streptopelia capicola*	LC	
Emerald spotted Wood Dove	*Turtur chalcospilos*	LC	
African Green Pigeon	*Treron calvus*	LC	
Psittacidae: lovebirds and parrots			
Brown headed Parrot	*Poicephalus cryptoxanthus*	LC	
Cuculidae: cuckoos and coucals			
Diederik Cuckoo	*Chrysococcyx caprius*	LC	
White browed Coucal	*Centropus superciliosus*	LC	
Jacobin Cuckoo	*\Clamator jacobinus*	LC	*Clamator jacobinus*
Red-chested Cuckoo	*Cuculus solitarius*	LC	*Cuculus solitarius*
Klaas's Cuckoo	*Chrysococcyx klaas*	LC	
Apodidae: swifts			
African Palm Swift	*Cypsiurus parvus*	LC	
Mottled Spinetail	*Telecanthura ussheri*	LC	
Little Swift	*Apus affinis*	LC	
Coliidae: mousebirds			
Speckled Mousebird	*Colius striatus*	LC	
Coraciidae: rollers			
Lilac breasted Roller	*Coracias caudatus*	LC	
Alcedinidae: kingfishers			
Grey headed Kingfisher	*Halcyon leucocephala*	LC	
Pied Kingfisher	*Ceryle rudis*	LC	
Mangrove Kingfisher	*Halcyon senegaloides*	LC	
Malachite Kingfisher	*Alcedo cristata*	LC	
African Pygmy Kingfisher	*Ceyx pictus*	LC	Am
Giant Kingfisher	*Megaceryle maxima*	LC	
Meropidae: bee-eaters			

White throated Bee	*Merops albicollis*	LC	
Northern Carmine Bee-eater	*Merops nubicus*	LC	Am
Upupidae: Hoopoe		LC	
Hoopoe	*Upupa epops*	LC	
Phoeniculidae: wood-hoopoes			
Green Wood hoopoe	*Pheoniculus purpureus*	LC	
Bucerotidae: hornbills		LC	
Crowned Hornbill	*Tockus alboterminatus*	LC	
Capitonidae: barbets and tinkerbirds			
White eared Barbet	*Stactolaema leucotis*	LC	
Red fronted Tinkerbird	*Pogoniulus pusillus*	LC	
Indicatoridae: honeyguides			
Lesser Honeyguide	*Indicator minor*	LC	
Greater Honeyguide	*Indicator indicator*	LC	
Picidae: wrynecks and woodpeckers			
Mombasa Woodpecker	*Campethera mombassica*	LC	
Platysteiridae: batises, wattle-eyes and relatives			
Chin-spot Batis	*Batis molitor*	LC	
Malaconotidae: helmetshrikes, bushshrikes, tchagras and puffbacks			
Brown crowned Tchagra	*Tchagra australis*	LC	
Brubru	*Nilaus afer*	LC	
Tropical Boubou	*Laniarius aethopicus*	LC	
Laniidae: shrikes			
Common Fiscal	*Lanius collaris*	LC	
Red-backed Shrik Lanius collurio	*Lanius collurio*	LC	*Lanius collurio*
Oriolidae: orioles			
Black headed Oriole	*Oriolus larvatus*	LC	
Dicruridae: drongos			
Common Drongo	*Dicrurus adsimilis*	LC	
Monarchidae: monarch flycatchers			
African Paradise Flycatcher	*Terpsiphone viridis*	LC	
Corvidae: crows and allies			
House Crow	*Corvus splendens*	LC	
Pied Crow	*Corvus albus*	LC	*Corvus albus*
Hirundinidae: saw-wings, swallows and martins			
Barn Swallow	*Hirundo rustica*	LC	PM
Lesser Striped Swallow	*Cecropis abyssinica*	LC	
Wire tailed Swallow		LC	

Red-rumped Swallow	*Cecropis daurica*	LC	
Lesser Striped Swallow	*Cecropis abyssinica*	LC	*Cecropis abyssinica*
Cisticolidae: cisticolas and allies			
Rattling Cisticola	*Cisticola chiniana*	LC	
Winding Cisticola	*Cisticola galactotes*	LC	
Tawny-flanked Prinia	*Prinia subflava*		
Grey backed Camaroptera	*Camaroptera brachyura*	LC	
Pycnonotidae: bulbuls			
Common Bulbul	*Pycnonotus barbatus*	LC	
Terrestrial Brownbul	*Phyllastrephus terrestris*	LC	
Sylviidae: Old World warblers			
Great Reed Warbler	*Acrocephalus arundinaceus*	LC	*Acrocephalus arundinaceus* PM
Marsh Warbler	*Acrocephalus palustris*	LC	PM
Willow Warbler	*Phylloscopus trochilus*	LC	*Phylloscopus trochilus* PM
Sturnidae: starlings and oxpeckers			
Black-bellied Starling	*Lamprotornis corruscus*	LC	
Kenrick's Starling	*Poeoptera kenricki*	LC	
Turdidae: thrushes		LC	
African Bare-eyed Thrush	*Turdus tephronotus*	LC	
Muscicapidae: chats, wheatears and Old World flycatchers			
White browed Robin Chat	*Cossypha heuglini*	LC	
African Grey Flycatcher	*Bradornis microrhynchus*	LC	
Spotted Flycatcher	*Muscicapa striata*	LC	
Ashy Flycatcher	*Muscicapa caerulescens*	LC	
Nectariniidae: sunbirds			
Plain backed Sunbird	*Anthreptes reichenowi*	NT	
Collared Sunbird	*Hedydipna collaris*	LC	
Scarlet chested Sunbird	*Chalcomitra senegalensis*	LC	
Variable Sunbird	*Cinnyris venustus*	LC	
Passeridae: sparrow weavers, Old World sparrows and petronias		LC	
Grey-headed Sparrow	*Passer griseus*	LC	
Ploceidae: weavers, bishops and widowbirds			
Spectacled Weaver	*Ploceus ocularis*	LC	
Golden Palm Weaver	*Ploceus bojeri*	LC	
Village Weaver	*Ploceus cucullatus*	LC	
Estrildidae: waxbills		LC	
Crimson rumped Waxbill	*Estrilda rhodopyga n*	LC	
Red cheeked Cordon	*Uraeginthus bengalus*	LC	

Peters's Twinspot	*Hypargos niveoguttatus*	LC	
Bronze Mannikin	*Spermestes cucculatus*	LC	
Black andwhite Mannikin	*Spermestes bicolor*	LC	
Motacillidae: wagtails longclaws and pipits		LC	
African Pied Wagtail	*Motacilla aguimp*	LC	
Fringillidae: canaries, citrils, seedeaters and relatives		LC	
Yellow-fronted Canary	*Crithagra mozambica*	LC	
African Citril	*Crithagra citrinelloides*	LC	

8. CHEMICAL ENVIRONMENT

8.1 Background

Air quality monitoring and Noise levels measurements was carried out within four points within the specified area. This points being at Tswaka primary and secondary, at Mzizima dispensary, near Hauwenizi Food (EPZ) company and near Kibuyuni Seaweed farmers hall (BMU). The measured parameters were as per anticipated main pollutants that may arise due to the proposed project. The objective of the baseline study was to determine the current conditions of air quality and noise scenarios as it is, before commencement of any proposed works. Active and Continuous Sampling was used for gaseous pollutants and particulate matter parameters. Active sampling involves the use of an air sampling pump to actively pull air through a collection device such as a filter and is pretty much independent of wind speed.

Sampling of gases was done by use of a real time machine Aeroqual portable air monitors. The Aeroqual uses a mix of sensor technologies; we selected it based on rigorous testing and depending on the target pollutant and application. Sampling was done for Nitrogen dioxide, particulate matter (dust particles), Carbon monoxide and Sulfur Dioxide using the gas sensitive electrochemical sensors. The levels of particulate matter were recorded during the 1hr time weighted average period and were thereafter compared to EMC Air Quality Act 2014.

Noise monitoring was achieved using a direct and continuous noise analyzer meter. The objective of this survey was to determine the present ambient noise levels before the commencement of the proposed works and quantify the generated noise levels at nearby noise-sensitive locations if there be resulting before operations proceed.

Air Quality and Noise monitoring was conducted before commencement of the site works on the 8th June 2019 and thereafter it should be done every 3 months of the year or quarterly when the prosed facility will be operational.

8.2 Air Quality Monitoring

8.2.1 Background information on air quality

The air quality assessment was done as per the following legislation and guidelines;

1. The Environmental Management and Coordination (Air Quality Regulations), 2014
2. WHO air quality guidelines for particulate matter, nitrogen dioxide, hydrogen sulfide and sulfur dioxide, (Global update 2005).

As per EMCA (Air Quality Standards) Regulations, 2014, the objective is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. Part 65 and 66 details the requirements on monitoring and assessment of ambient air quality, part 85 shows the need for establishment of baseline levels of priority air pollutants listed in the first schedule of the guideline and include; particulate matter, nitrogen dioxide and sulfur dioxide. The measurements were done to evaluate concentrations of the following: particulate matter (PM),

Nitrogen dioxide (NO_2, Sulfur Dioxide (SO_2) and Carbon monoxide in the vicinity of the development in relation to the applicable guidelines provided by the Air Quality 2014 guidelines.

8.2.2 Monitoring Objectives

I. To measure concentrations of dust and gaseous emissions at selected location surrounding the project area and results compared to the Air quality regulations 2014.
II. To ensure that the air pollution controls and management measures to be adopted will be effective.

8.2.3 Monitoring Methods

Fixed-Point Monitoring was used. Air samples were collected at area within the site where the sampler and gas sensors were positioned. It was useful for identifying the source(s) of air impurities determining their distribution at the site. Prior to commencement of works the following health and safety measures were implemented to prevent any incidents while on site.

- Familiarization with the safety requirements while on site;
- Communication with the site manager on the proposed work plan; and
- Familiarization with the site.

Air monitoring was conducted over 1hr time weighted average period and a calculated 24hr time weighted average period for the measurements of Particulate Matter, Nitrogen dioxide (NO_2), Sulfur Dioxide and Carbon monoxide.

8.2.3.1 Active and Continuous Sampling for gases

Sampling of gases was done by use Aeroqual portable air monitors. Aeroqual uses a mix of sensor technologies; we select each one based on rigorous testing and depending on the target pollutant and application.

Sampling for Nitrogen Dioxide, Carbon monoxide, Sulfur Dioxide and Particulate matter was done using the gas sensitive electrochemical methods of active and continuous sampling. Dust sampler using the laser particle sensors were used for monitoring particulate suspended matter.

The laboratory results and sampling duration information are used to calculate the gases concentrations.

8.2.3.2 Tools and Equipment used

Below is the equipment used during air monitoring survey:

1. Aeroqual portable air monitors S500 series:

- The Aeroqual gas meter series, a state-of-the-art gas analyzer sensor was used to measure the Particulate Matter (PM) levels.
- Our gas sensitive semiconductor (GSS) sensor uses proprietary sensing material, built in automatic baseline correction (ABC) and interference rejection. This combination results in ppb resolution and a highly linear response.
- The gas sensitive electrochemical (GSE) sensors generate nano-amp currents proportional to the gas concentration. Aeroqual uses low noise electronics to capture these signals resulting in low detection levels.

- The non-dispersive infrared (NDIR) sensor uses infra-red light, a narrow band-pass filter and photodiode to measure the intensity of light at the gas absorption band. The light intensity is proportional to the gas concentration.

2. GPS

8.2.4 Monitoring Frequency

Air quality monitoring was conducted once before commencement of the works (Baseline Survey) on 8th June 2019.

8.2.5 Monitoring Location

Air quality monitoring was conducted around the proposed site and near sensitive receptors.

AREA MONITORED	Parameters Tested	G.P.S Coordinates
Mzizima dispensary area	NO_2, SO_2, CO, $PM_{2.5}$, PM_{10}	N -4.49909278 E 39.2438608
Tswaka primary and secondary	NO_2, SO_2, CO, $PM_{2.5}$, PM_{10}	N -4.54233355 E 39.36622153
Near Hauwenizi Food (EPZ) company	NO_2, SO_2, CO, $PM_{2.5}$, PM_{10}	N -4.6483044 E 39.3717262
Near Kibuyuni Seaweed farmers hall (BMU).	NO2, SO_2, CO, $PM_{2.5}$, PM_{10}	N -4.6372885 E 39.38066748

8.2.6 Description of terrain features.

The proposed site is primarily rural and is characterized by, scattered community settlements.

8.2.7 Legislation and Standards

Air quality guidelines have the objective to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. The standard used here is the Environmental Management and Co-Ordination (Air Quality) Regulations, 2014. Part 65 and 66 of the regulations detail the requirements on monitoring and assessment of ambient air quality, part 85 shows the need for establishment of baseline levels of priority air pollutants listed in the first schedule of the guideline and include; particulate matter and the volatile organic compounds as the gasses of interest. The limits included in the Air quality guidelines are shown in the tables below.

First Schedule: Ambient Air Quality Tolerance Limits

	Pollutant	Time weighted Average			
			Industrial area	Residential, Rural & Other area	Controlled areas***
1.	Respirable particulate matter (<10 µg/m^3) (RPM)	Annual Average*	70 µg/m^3	50 µg/m^3	50 µg/m^3
		24 hours**	150µg/Nm^3	150µg/Nm^3	75µg/Nm^3

2	$PM_{2.5}$	Annual Average	35 µg/m^3		
		24 hours	75 µg/m^3		
3	Total VOC	24 hours**	600 µg/m^3		
4	Nitrogen Dioxide	Annual Average	150 µg/m^3	0.05 PPM	
		Month average		0.08 PPM	
		24 hours	100 µg/m^3	0.1 PPM	
		One Hour peak		0.2 PPM	
		Instant peak		0.5 PPM	
5	Carbon monoxide / carbon dioxide	One Hour	10 mg/m^3	10 mg/m^3	10 mg/m^3

Extract of the Ambient Air Quality (Tolerance Limits)

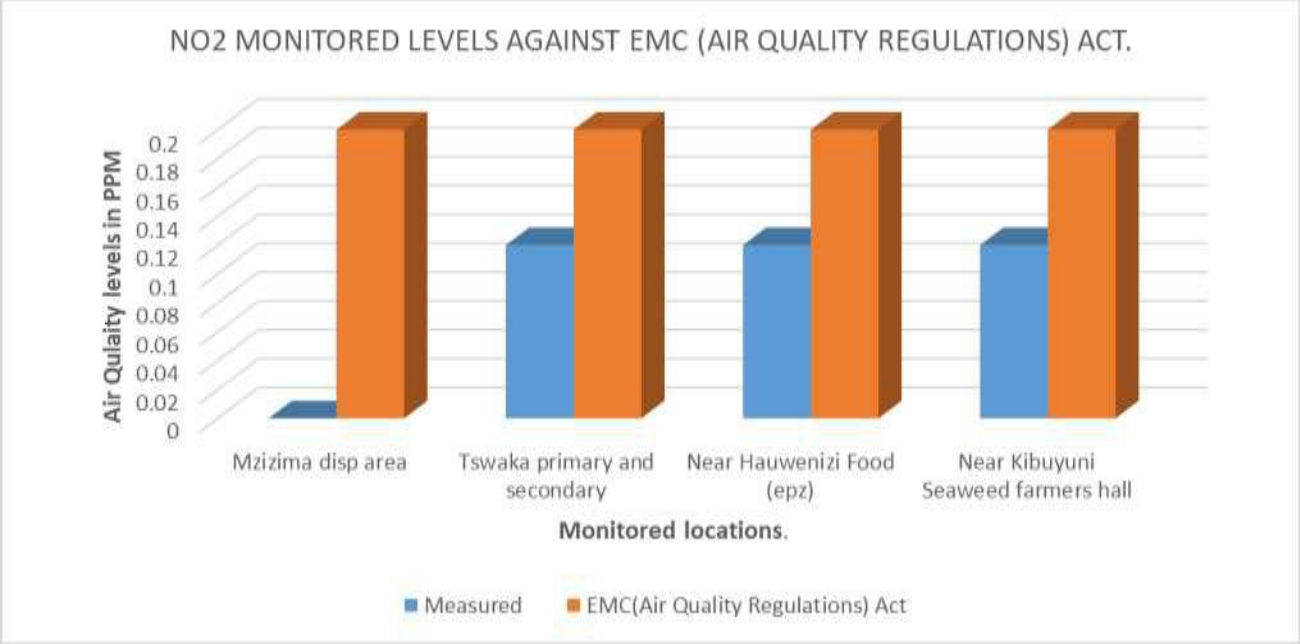
8.2.8 Results.

Observations made during air monitoring survey included the weather conditions. During the survey period, day temperatures attained a high of 30°C.

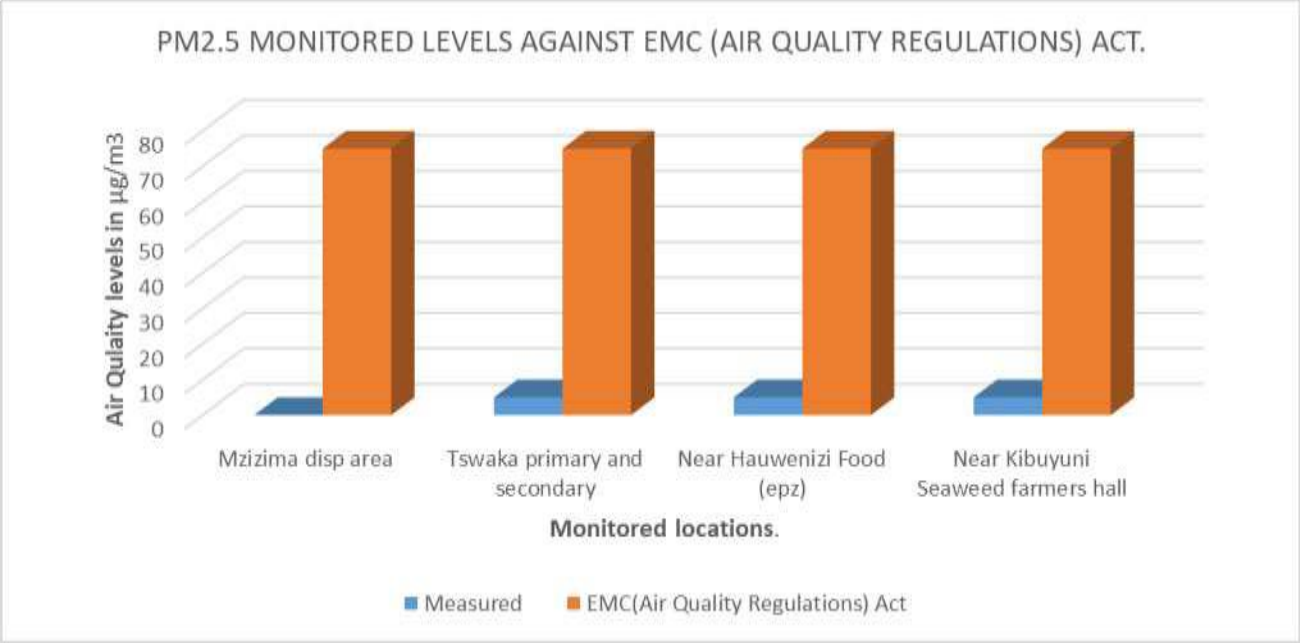
Location		NO_2 ppm	SO_2 mg/m^3	CO mg/m3	PM2.5 µg/m^3	PM_{10} (µg/m^3)	Date / Time
Mzizima dispensary area	N -4.49909278 E 39.2438608	0.121	BDL	BDL	6.00	15	8/06/2019 (14:01hrs)
Tswaka primary and secondary	N -4.54233355 E 39.36622153	0.120	BDL	BDL	5.00	20	8/06/2019 (15:18hrs)
Near Hauwenizi Food (EPZ) company	N -4.6483044 E 39.3717262	0.120	BDL	BDL	5.00	20	8/06/2019 (15:18hrs)
Near Kibuyuni Seaweed farmers hall (BMU).	N -4.6372885 E 39.38066748	0.120	BDL	BDL	5.00	15	8/06/2019 (15:44hrs)
EMC (Air Quality) Regulations 2014		**0.2ppm** **1-hour mean average**		**-**	**75µg/N m3**	**150 µg/Nm3**	
WHO Air quality guidelines Global update 2005; WHO Ambient Air Quality Guidelines			200µg/ m^3 1-hour mean 40 µg/m^3 Annual mean	20 µg/m3 (24-hour mean) 500 µg/m3 (10-minute mean)	25 µg/m3 10 µg/m3	50 µg/m^3 20 µg/m^3	

Graphical Representations

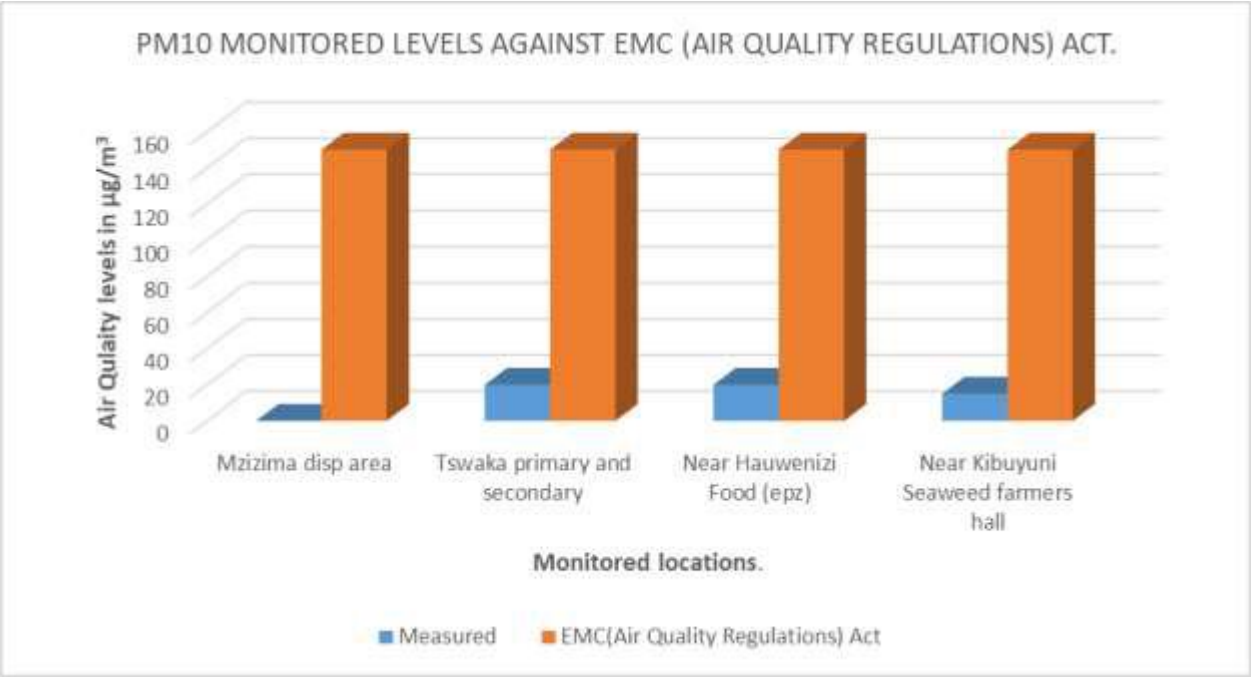
Graph 1: Measured Nitrogen Dioxide against Regulatory Limit.



Graph 2: Measured PM2.5 against Regulatory Limit.



Graph 3: Measured PM10 against Regulatory Limit.



8.2.9 Discussion

- As depicted from the graphs above, the measured parameters show that ambient air quality levels agree with the stipulated EMCA standards. It's important to note that the measured levers of Sulfur dioxide and Carbon monoxide were below detectable limits indicated as (BDL) of the machine used.
- The levels of particulate matter were recorded during the 1hr time weighted average period and were thereafter compared to EMC Air Quality Act 2014. The results showed that the concentrations of particulate matter were significantly below the stipulated limits.
- The results obtained at the time of monitoring further revealed that the levels of the measured a gaseous pollutants, namely NO_2, CO and SO_2 at the monitoring site were within the EMC Air Quality Act 2014,
- It is true to note that the monitoring area is primarily rural and was characterized by, scattered community settlements. It was also noted that there were no industrial activities going on when the monitoring was done. This statement can explain for the low levels of the air pollutants in the area.

8.3 Noise Level Monitoring

8.3.1 Background information on Noise.

Environmental Management and Coordination Act (EMCA) under the Noise and Excessive Vibration Pollution Control Regulations, 2009 (Legal Notice No. 61) states that, residential, institution and educational areas and health facilities noise levels should not exceed 65 dB during the

day and 35 dB during the night. These regulations also provide that any person carrying out construction, demolition, mining or quarrying work shall ensure that the vibration levels do not exceed 0.5 centimeters per second beyond any source property boundary or 30 meters from any moving source. Results of the noise levels at various monitoring locations were noted at the following distances from source - L5, L50, and L95. Noise sources were noted.

8.3.2 Monitoring Objectives

I. To identify other sources of noise if any within and around the proposed site other than the project source.
II. Inspection of the measurement area and the implicated activities.

8.3.3 Monitoring Methodology

The noise measurements were done in relation to the following:

- Inspection of the monitoring points and the implicated activities associated with the area.
- Identification of perimeter points.
- Verification/Calibration of the sound level meter before and after the measurements.
- Noise levels are determined using a Sound analyzer Meter raised above the ground at a distance of 1.5 - 2 meters above ground level with a built-in ϖoctave / octave band filter which does real time 1/1 and 1/3 octave analysis. It is also fitted with a ½" electrets condenser microphone with a measurement range of between 30 - 130dB and a frequency range and weighting of 25Hz – 10KHz and A,C, & Z respectively.
- Ensuring the sound level meter is up to date calibrated in accordance with applicable center calibration procedures. For all measurements taken to establish the ambient noise levels, the equivalent noise level (LAeq), the sound pressure level at 5%, 50% & 95% (L_5), (L_{50}), ($L9_5$) respectively during that measurement period are every one hour interval. The port noise level is measured in terms of the A-weighted equivalent continuous sound pressure level Leq.
- At the same time as each individual measurement was taken, the nature of the noise climate in the area was assessed and recorded. This comprised an auditory observation by the surveyor, as well as identifying those noise incidents which influenced the sound level meter readings during that measurement period

8.3.4 Tools and Equipment

The following instruments were used during monitoring works:

- ❖ Noise level meter TES 1358 C

8.3.5 Monitoring Frequency

Noise monitoring was conducted once before commencement of the site works on the 8th June 2019 and thereafter it will be done every 3 months of the year or quarterly when the prosed facility will be operational.

8.3.6 Monitoring Location and Map

Noise level monitoring was conducted at the same location (The coordinates above-mentioned).

8.3.7 Regulatory framework relevant to noise emission and exposure limits.

The legislative controls relevant to noise emissions associated with any development is outlined in the Legal Notice No.61, Environmental Management and Coordination (Noise and Excessive Vibration Pollution) Regulations, 2009 by the Kenya Government. The regulation recognizes the fact that any person emitting noise in excess of noise emission standards commits an offence. It legalizes the process of Environmental Impact Assessment and compliance with the set emission goals, permissible standards, and control strategies and technologies for noise emission as mandatory. With the establishment of noise emission standards, it will be a requirement to obtain temporary permits from the National Environmental Management Authority (NEMA) allowing for emissions of noise in excess of established standards for a period not exceeding three months.

A: Environmental Management Co-ordination Act (noise and excessive vibration pollution control, 2009) Legal Notice 61 First Schedule Extract.

ZONE		*Sound Level Limits dB (A)* L_{eq}, *14 h*		*Noise Rating Level (NR)* L_{eq}, *14 h*	
		DAY	NIGHT	DAY	NIGHT
A	Silent Zone	40	35	30	25
B	Place of worship	40	35	30	25
C	Residential: Indoor	45	35	35	25
	Outdoor	50	35	40	25
D	Mixed Residential (with some commercial and places of entertainment)	55	35	50	25
E	Commercial	60	35	55	25

Source: EMCA noise and excessive vibration pollution control, 2009.

B: International Ambient Noise Levels (World Bank and World Health Organization Noise permissible levels)

Receptor	Maximum allowable Leq (hourly) in dB(A)			
	World Bank		World Health Organization	
	Day time 0700-2200 Hrs.	Night time 2200 – 0700 Hrs.	Day time 0700-2200 Hrs.	Night time 2200 – 0700 hrs.
Residential, Institutional and Educational	55	45	50	45
Industrial and Commercial	70	70	85	85

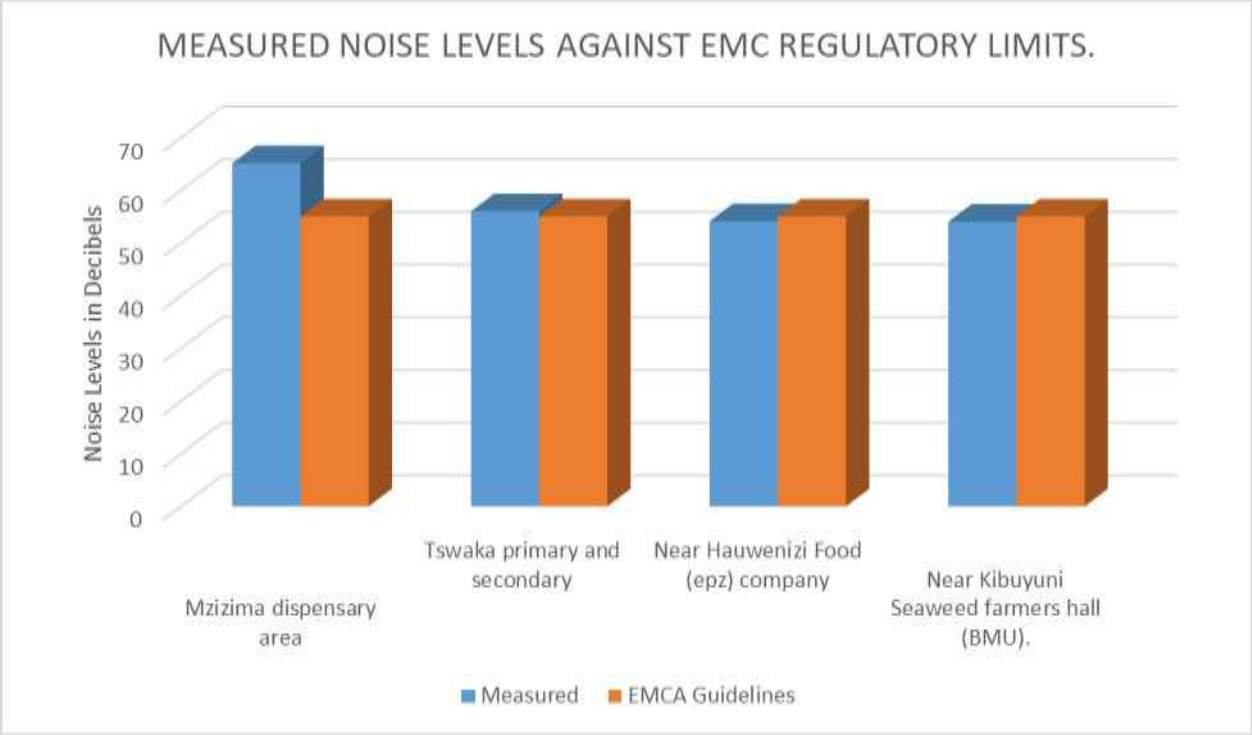
8.3.8 Analysis and Discussion of findings of Noise Levels:

Location	LAeq (dBA)	L5 (dBA)	L50 (dBA)	L95 (dBA)
Mzizima dispensary area	65.1	51.5	71.2	44.6
Tswaka primary and secondary	53.3	59.6	46.8	42.6
Near Hauwenizi Food (EPZ) company	48.5	58.6	44.8	41.4
Near Kibuyuni Seaweed farmers hall (BMU).	54.0	58.4	50.4	47.8

Measurement Site	Measured Sound Pressure Level (Noise) (dBA)			EMCA Guidelines	SITE NOTES.
	Daytime Period			Day time	
	L_{Aeq}	L_{max}	L_{min}	LAeq	
Mzizima dispensary area	65.1	85.1	38.5	55	The measurements were taken at Mzizima dispensary area. Being holiday there was no activity going on at the facility at the monitoring time. Audible noise source from the shopping center could be heard at this location. The resulting average readings shows that **LAeq** tested above the EMCA levels day. Ambient conditions were in existence.

Tswaka primary and secondary	56.0	85.1	38.4	55	The measurements were taken at Tswaka primary and secondary schools' playground. Being a holiday there was no learning activity going on at the monitoring time. The resulting average readings shows that **LAeq** tested below the EMCA levels day. Ambient conditions were in existence.
Near Hauwenizi Food (EPZ) company	54.1	81.6	38.4	55	The measurements were taken at Near Hauwenizi Food (EPZ) company. The company was under construction at the time of monitoring. The resulting average readings shows that **LAeq** tested below the EMCA levels day. Ambient conditions were in existence.
Near Kibuyuni Seaweed farmers hall (BMU).	54.0	81.1	44.3	55	The measurements were taken near Kibuyuni Seaweed farmers hall (BMU).. The company was under construction at the time of monitoring. The resulting average readings shows that **LAeq** tested below the EMCA levels day. Ambient conditions were in existence.

Graphical representation of the measured noise levels against requlatory limits



8.3.8.1 Noise Results Interpretation and further discussions

The noise levels monitoring was conclusive for all the monitoring points. The readings plotted were the averages from the four points which were within the compared limits, this may have resulted from the fact that the area of monitoring is primarily rural and is characterized by, scattered community settlements. The slight pick observed at the dispensary area may have resulted from a passing vehicle as the dispensary is beside the main road to Kibuyuni area.

8.3.8.2 Parameters and Score Criteria

After finding various activities, aspects and impacts, identification of the significant aspects was done. It entirely depends on the management of the system or industry to give scaling factor. **Table below** shows six factors naming as A to F (top row) and column 1 to 6 shows rating scheme with minimum as 1 and maximum marks as 10 depending upon their severity.

8.3.8.3 Procedure of Significance Evaluation

For evaluation processes, the various activities of the measurement sites are rated on the basis of parameters and score criteria given in Table 13 and a benchmark of 75 units is taken as a deciding factor. If the total unit of any particular aspect for an activity comes out to be more than 75, then the aspect can be considered as significant otherwise insignificant.

Parameters and score criteria

A-Quantity 1-5	B-Occurrence 1-6	C-Impact 1-6	D-Detection 1-5	E-Controls 1-5	F-Legislation 1and10
5-High	6-Continuous	6-Fatal to human life	5-More than 24 hours	5-Absence or no effective controls	10-Not meeting legislation/ control limits
3-Moderate	5-Several times a day	5-Health effects	4-Within 24 hours	4-Mechanism in place but not reliable	1-In Compliance
1-Low	4-Once a day	4-Affects flora and fauna	3-Within 8 hours	3-Control needs human intervention	---
---	3-Once a week	3-Resource consumption	2-Within 1 hour	2-Has in-built secondary control	---
---	2-Once a month or less frequent	2-Discomfort, Acid rain, nuisance	1-Immediately	1-Available and effective at source.	---
---	1-Very Rare	1-Negligible visual impacts.	---	---	---

Determination of significance of identified aspects

MEASUREMENT SITE	ASPECT	CONDITION/ A	IMPACT	QUANTITY A	OCCURRENCE	IMPACTS	DETECTION	CONTROL	LEGISLATION	TOTAL A*B*C*D	REMARKS SIG/INSIG
Mzizima dispensary area	Noise	N	Hearing impairment	1	6	1	1	1	1	6	INSIG
Tswaka primary and secondary	Noise	N	Hearing impairment	1	6	1	1	1	1	6	INSIG
Near Hauwenizi Food (epz) company	Noise	N	Hearing impairment	1	6	1	1	1	1	6	INSIG
Near Kibuyuni Seaweed farmers hall (BMU).	Noise	N	Hearing impairment	1	6	1	1	1	1	6	INSIG

8.3.9 Discussions.

- From the graphical representation and noise levels significance evaluation table the following can be deduced:

- At Mzizima dispensary area audible noise recorded could be attributed to noise from the nearby shopping center as well as prevailing natural conditions. It is true to state that therefore there was ambient noise conditions in existence at this area during monitoring time
- Tswaka primary and secondary playground, prevailing natural noise source can be attributed to the recorded noise levels. No other noise audible noise source could be observed at this point.
- At Hauwenizi Food (EPZ) company area, no exceedance of any sort on noise levels was observed/ recorded. Natural noise source accounts for the noise levels recorded at the monitoring time.
- The community social forum ongoing at Kibuyuni Seaweed farmers' hall (BMU) at the monitoring time and natural prevailing conditions accounts for the recorded noise.

8.3.10 Conclusions

- After analysis of noise levels measured were compared against applicable legal standards including amongst them, the EMCA standards (1400hrs – 1545hrs) Legal Notice 61.
- The noise survey results depicted by the tables above indicate that there was ambient noise condition in existence at the time of monitoring.
- The objective of this survey was to determine the present ambient noise levels before the commencement of the proposed works and quantify the generated noise levels at nearby noise-sensitive locations if there be resulting before operations proceed.

PICTORIALS

Fig 1: Noise monitoring at Mzizima dispensary

Fig 2 Air quality monitoring at Mzizima dispensary

Fig 4: Noise monitoring at Tswaka Schools' Playground

Fig 5: Air quality monitoring at Tswaka Schools' playground

Fig 6: Noise monitoring at Hauwenizi Food (epz) Company area.

Fig 7: Air quality monitoring at Hauwenizi Food (EPZ) Company area.

Fig 8: Noise monitoring Near Kibuyuni Seaweed Farmers' hall (BMU).

Fig 9: Air quality monitoring at Kibuyuni Seaweed Farmers' hall (BMU).

9. STAKEHOLDER CONSULTATIONS AND PUBLIC PARTICIPATION

9.1 Introduction

The Constitution of Kenya 2010 recognizes the sovereignty of the people and that people possess the power to guide development within their areas either directly or indirectly through their leaders. Consultation with stakeholders that are likely to be affected and those that are likely to have an interest in the proposed project was therefore conducted in accordance with the Constitution and in line with Regulation 17 of the Environmental (Impact Assessment and Audit) Regulations, 2003. The consultation served to:-

- Inform stakeholders including the local community especially those drawn from the proposed project site of the proposed development within their locality.
- Explain to the stakeholders the nature of the proposed project, its objectives and scope.
- Give stakeholders an opportunity to present their views regarding the proposed project so that these are taken into account during implementation of the project.
- Obtain suggestions from the stakeholders on possible ways of effectively mitigating potential impacts and engaging the stakeholders on how they can be involved in the project cycle to ensure their interests are addressed.

9.2 *Stakeholder* Mapping

Mapping of key stakeholders was done to determine the individual, groups and institutions that will likely be affected by and have an interest in the proposed project. The first step in the Stakeholder Analysis involved identifying who the stakeholders of the proposed project are. The next step involved understanding their power, influence and interest in the proposed project. This is vital in order to know who should be focused on. The final step was to develop a good understanding of the most important stakeholders and predict how they are likely to respond to the proposed project, in order to work out how their views and concerns will be addressed to win their support. The following tool was used to analyse the stakeholders.

IMPORTANCE	**HIGH**	**LOW**
INFLUENCE		
HIGH	**A: High importance, high influence** These stakeholders are the most important ones for the proposed project. The proponent must consider their interests and expectations in order to ensure effective coalition and support.	**B: Low importance, high influence** These stakeholder are a potential source of risk, they require careful monitoring and management
LOW	**C: Low influence, high importance** These stakeholder should be adequately informed about the development of the	**D:Low influence, low importance** These stakeholder are of

	proposed project to protect their interest but they only require limited monitoring and management	low priority and they require limited monitoring and management

Figure 30: Stakeholder analysis tool

The following institutions and groups were identified to have a stake in the proposed project:

- State Corporations: Kenya Ports Authority, Kenya Wildlife Service, Kenya Maritime Authority, Kenya Navy, Kenya Fisheries Services, Kenya Wildlife Service, National Museums of Kenya, Ministry of Lands, National Environment Management Authority, Coast Development Authority, Kenya Marine and Fisheries Research Institute;
- Kwale County Government,
- Local Beach Management Units,
- Community Groups: Local Boat operators, fishermen, fish mongers, hotel operators, local learning institutions, local business community, South Coast Residents Association, Shimoni community, Kibuyuni Community, Wasini Community, local conservation groups, local women group and local youth groups.

9.2.1 Invitations and notices

Invitation letters and notices to stakeholders were sent out prior to planned stakeholder fora. Invitation letters were sent to County Government of Kwale, Kwale County Environmental Committee and Lead Agencies (appendix 6). A public notice inviting members of the public to attend public barazas as part of the ESIA process for the project was advertised on print media prior to holding the barazas (appendix 7).

9.3 Workshops

9.3.1 Workshop with the County Government of Kwale

A workshop was held at the County Government of Kwale offices on 25th July 2019 to explain to the County Government the details of the proposed project and obtain their views, concerns and suggestions on the proposed project.

9.3.1.1 Summary of the views raised by County Government of Kwale

The following were the main views, issues, concerns and/or suggestions that emanated from this workshop:

- Proponent to declare the procedure used in acquiring the 300 acres he intends to use for the project;
- Proponent to clarify the sustainability of sources of raw material given that the intention is to scrap ships. Would this source sustain the steel plant?
- Concern as to whether the proponent has conducted adequate risk analysis with regard to environmental protection;
- The proponent was applauded for sharing their blue economy proposal with the County and urged to work closely with relevant County departments

- The County Government has opened its doors for consultation with the investor;
- There is room for continuous engagement to iron out all the grey areas so as to move the project forward;
- The role of the County Government would be to create an enabling environment for the investor.

Responses by the proponent were as follows:

- Environmental risk analysis is currently underway through Environmental Impact Assessment. Baseline studies are ongoing and consultation with the County Government commences the public participation process;
- Market analysis has been done considering supply and demand for both raw materials and product;
- Regarding land, all due process was followed during the acquisition and the land is free of squatters. Records are available at the lands office for perusal;
- The investor will work closely with the National Environment Management Authority to address all environmental concerns.

Appendix 8 is the attendance list and the minutes of this workshop.

9.3.2 Key Stakeholders' Workshop at Amani Tiwi Beach Resort

A Key Stakeholders' workshop was held at Amani Tiwi Beach Resort on 8th August 2019. Stakeholders invited to the workshop included Kenya Ports Authority, Kenya Wildlife Service, Kenya Navy, Kenya Fisheries Service, National Museums of Kenya, Ministry of Lands, National Environment Management Authority, Coast Development Authority, Kenya Marine and Fisheries Research Institute, the Regional Commissioner Coast Region, the Deputy County Commissioner Lunga Lunga Sub-County, Assistant County Commissioners, Senior Chiefs, Assistant Chiefs, World Wildlife Fund-Kwale, Nature Kenya, CORDIO East Africa, Kenya Tourism Federation, South Coast Residents Association, Kenya Association of Hotel Keepers and Caterers, Kwale Natural Resources Forum.

The purpose of the workshop was to introduce to the stakeholders the proposed project and obtain their views, concerns and suggestions on the proposed project. Some of the stakeholders that attended included the County Executive Committee Member- Environment and Natural Resources, County Government of Kwale, Chief Officer-Environment and Natural Resources, County Government of Kwale EIA, representation from the Blue Economy Forum, the Ministry of Lands, the Kwale County Environmental Committee, the Coast Development Authority, Kwale County Natural Resources Network, South Coast Residents Association, County Director of Agriculture Kwale County, Kenya Maritime Authority, the Director-Fisheries Kwale, Base Titanium, National Museums of Kenya, Kenya Wildlife Service, WWF-KE, Kwale County Natural Resources Network, and Kenya Forest Service.

9.3.2.1 Summary of issues raised at Key Stakeholders' Workshop

The following were the main views, concerns and/or suggestions that emanated from this workshop:

- ✓ Whether the proposed project would impact on the Kisite-Mpunguti Marine Reserve.
- ✓ Whether the proposed project will involve dredging.
- ✓ Whether project activities have already commenced on site.
- ✓ Management of solid waste resulting from the proposed project
- ✓ Accommodation plans for employees to be absorbed in the proposed project.
- ✓ The company's hiring policy.
- ✓ Ownership of the land for the proposed project.
- ✓ The funding magnitude for the proposed project and the source of the funding.
- ✓ The proposed project may lead to congestion at the Shimoni jetty.
- ✓ The proposed project may lead to traffic snarl-ups along the Lunga Lunga-Likoni Road.
- ✓ The proposed project may conflict with other development projects in the area, an alternative site should be found elsewhere for the proposed project.
- ✓ The size and ownership of the land for the proposed project location.
- ✓ Has the proponent already signed MoUs with shipping lines to be able to supply them with the ship wrecks?
- ✓ The EIA team ought to have a Marine Engineer in it.
- ✓ Has the proponent already applied to the Kenya Forest Service to be allowed to use the land that is on mangroves?
- ✓ Impacts of the proposed project on sea weed farmers that are predominantly in Kibuyuni.
- ✓ There was need for the project proponent to continually engage with the County Government of Kwale in order to harmonize the proposed project with the Kwale County Spatial Development Plan and the Kwale County PDP.
- ✓ The government through various Agencies such the Coast Development Authority has initiated projects in the area that focus on preserving the ecosystem of the area and developing livelihoods from such ecosystems. How will impacts of the proposed project on such livelihood projects shall be mitigated?
- ✓ Sacred areas within the proposed project area such as Kayas should be preserved.
- ✓ There is need for a Heritage and Archeological assessment as part of the EIA process.
- ✓ Plans to incorporate renewable energy within the proposed project.
- ✓ The company's Corporate Social Responsibility policy.
- ✓ Need for a site visit by stakeholders.
- ✓ Ownership of the proposed project, is it purely private on the government and other stakeholders have a stake in it.
- ✓ Whether the proponent is already a member of the International Ship Recycling Association.
- ✓ Need for the proponent to continually engage with stakeholders and to involve the County Government Public Administration especially when organising *Wananchi* Barazas.

Participants at the workshop

The EIA Team Leader making a presentation

Mr. Japheth Moroa of CDA making remarks

Ms. Saumu Beja, the CEC Member- Environment and Natural Resources, County Government of Kwale making her remarks

Plate 17: Stakeholders workshop at Amani Tiwi Beach Resort

Appendix 9 is the attendance list and the minutes of this stakeholders' workshop.

9.3.3 Stakeholders' Workshop with Kwale County Environmental Committee

A workshop was held with the Kwale County Environmental Committee at Leopard Beach Resort in Diani on 6th September 2019. The purpose of the workshop was to explain to the County Environment Committee the proposed project, obtain their views, concerns and suggestions on the proposed project.

9.3.3.1 Summary of the concerns from the Kwale County Environment Committee

The following is a summary of the main views, concerns and/or suggestions that emanated from this workshop:

- ✓ The cost per acre at which the proponent acquired land for the proposed project.
- ✓ A site visit by members of the County Environment Committee.

- ✓ Considering the project is to sit on a large parcel of land (266 acres), are there sufficient plans in place to compensate against affected individual and ecosystems?
- ✓ Waste management plans in place both onshore and offshore.
- ✓ Water and energy sources to the project.
- ✓ Impacts of the proposed project on the flora and fauna.
- ✓ Impacts of the proposed project on air quality.
- ✓ The preliminary findings of the baseline studies to be shared with stakeholders even pending the conclusion of the EIA process.
- ✓ A livelihood plan for the community including the sea weed farmers in the area.
- ✓ A special use license would be required to enable proponent to use the belt of mangroves.
- ✓ Housing plans for the workers to be absorbed by the project
- ✓ The scale of the proposed project, and other auxiliary business that would come up amounts to setting up a special economic zone in the area and that adequate plans on the same are required.
- ✓ Need for inclusion of a Green Star Expert in the EIA team so as to ensure that the idea of "green ship recycling" is backed up by expert opinion.
- ✓ Timelines on when the EIA shall be concluded and ground breaking done.
- ✓ A comprehensive waste management plan to be developed and shared with the stakeholders so that it can be harmonised.
- ✓ The EIA team was urged to carry out a very good EIA process involving all the stakeholders including key opinion leaders from around the proposed project area.
- ✓ Plans to train youth from around the proposed project area on maritime studies.
- ✓ The proponent and the EIA team were urged to continuously have on board members of the Kwale County Environment Committee on specific sectors of the EIA that touch on their specialties.
- ✓ The Kwale County Government department of Environment and Natural Resources should be engaged throughout the EIA process and the EIA shared with the department before it is submitted to NEMA.
- ✓ The Kwale County Government Department of Environment and Natural Resources to access all land agreements between the proponent and members of the community.
- ✓ All plans by the proponent to be shared with the Kwale County Government Department of Environment and Natural Resources for synchronization with the department's plans and policies.
- ✓ The Kwale County Government Department of Environment and Natural Resources is in the process of documenting a waste management policy and that proponent should look out for it.
- ✓ All social safeguards should be agreeable with the Kwale County Government Department of Environment and Natural Resources.
- ✓ The development should have a sustainability plan.
- ✓ That the proponent should bring on board an expert who has previously worked in the ship recycling field.

Participants at the workshop

The EIA Team Leader making a presentation

Mr. Onesmus Macharia making remarks

Dr. Aungo moderating proceedings

Plate 18: Kwale County Environment Committee Workshop at Leopard Beach Resort

Appendix 10 is the attendance list and the minutes of this stakeholders' workshop.

9.4 Public Barazas

Three public barazas were held all within Lunga Lunga Sub-County to explain to the residents of the Sub-County the proposed project, obtain their views, concerns and/ or suggestions on the proposed project. The first public baraza was held on the 26th September 2019 in Kibuyuni at the Fikirini Mzida CBO Hall, the second Public Baraza was held on 26th September 2019 in Shimoni at the Shimoni Slave Cave Hotel while the third Public Baraza was held 1st October 2019 in Majoreni at the Mwazo CBO Hall.

9.4.1 Summary of proceedings of the first public Baraza

The following were the main issues and concerns that emanated from the first baraza:

- ✓ How will negative impacts of the project are mitigated.
- ✓ Fears that the project may displace some members of the community, and the compensation plans in place.

- ✓ The proposed project may have negative impacts on the marine life and specifically to the sea weed farmers and fishermen in the area.
- ✓ Will the project involve dredging, and if yes, will there be impacts on the seaweed farms and how shall such impacts be mitigated?
- ✓ How will resulting waste water be managed, considering that the project is next to the sea.
- ✓ How will emissions and excessive noise be prevented and/or managed?
- ✓ Need for a ship marshal plan to avoid conflict with the small boats used by the fishermen.
- ✓ The proponents of the project should see to it that the project does not bring health complications to women which may bring complications even at births.
- ✓ The project should employ all the latest technology to see to it that operations of the project do not negatively affect members of the community.
- ✓ County government to ensure that by the time of fruition of this proposed project the County can produce enough manpower.
- ✓ Proponent to ensure that negative impacts likely to be caused by the project are adequately mitigated and that positive ones are magnified.
- ✓ There should be a proper investor – community relations plan.
- ✓ Members of the community to make good use of the technical training institutes and vocational training institutes in the area. The government has subsidized school fees in these institutions and also gives loans to students through the Higher Education Loans Board.

Lunga Lunga DCC addressing the Baraza

Members of the Community following proceedings

Eng. Adala, the EIA Team Leader following proceedings of the Baraza

Proceedings at the Baraza

Plate 19: Proceedings of the first public baraza

Appendix 11 is the attendance list and the minutes of first public baraza.

9.4.2 Summary of proceedings of the second public Baraza

The following were the main views, issues and concerns that emanated from the second baraza.

- ✓ Most of the people from the Shimoni area are marginalized and vulnerable, and should be therefore be given preferential treatment when it comes to job opportunities.
- ✓ Why is Wasini Maritime Limited using the name 'Wasini' without consulting Wasini residents?
- ✓ Waste management measures in place.
- ✓ Will there be impacts on the aquatic ecosystem and seaweed farms and how shall such impacts be mitigated?
- ✓ How is the project going to benefit the elderly in the community?
- ✓ How is the project going to benefit the youth in the community?
- ✓ The National Government through the DCCs office in collaboration with the County government, shall be sponsoring youth from the area to study in local polytechnics and the Lunga Lunga Technical Training Institute.

Members of the Community following proceedings

The Assistant Chief making remarks at the baraza

A member of the community making her remarks at the Baraza

Proceedings at the Baraza

Plate 20: Proceedings at the second public baraza

Appendix 12 is the attendance list and the minutes of the second public baraza.

9.4.3 Summary of proceedings of the third public Baraza

The following were the main issues and concerns that emanated from the third baraza.

- ✓ How will heat from the factory be managed so that it does not affect neighbors?
- ✓ How are impacts on marine life to be prevented and/or managed?
- ✓ Wasini Maritime Limited should consider building schools for the Majoreni Community.
- ✓ What are the indirect employment opportunities likely to emanate from the proposed project?
- ✓ That once the project takes off, the proponent should liaise with the local administration when hiring from the community.
- ✓ What corporate social responsibility plans does the company have for the Majoreni community?
- ✓ How will noise from the factory be managed?
- ✓ The local community should be given first priority when hiring.
- ✓ Members of the community hould prepare well by taking their children to school to acquire relevant skills.

The EIA team leader addressing the baraza

The Assistant Chief addressing the baraza

Members of the community following proceedings

A member of the community making his remarks at the Baraza

Plate 21: Proceedings of the third public baraza

Appendix 13 is the attendance list and the minutes of the third public baraza.

10. POTENTIAL IMPACTS AND PROPOSED MITIGATION MEASURES

10.1 Impact identification and predication

The type, scale and location of the proposed project guided the scope of the impact identification. The ESIA study has considered direct and indirect project-related environmental and social impacts likely to result from implementation of the project. The extent of impact covers the project site, specific project activity at particular period and affected areas beyond the project site. Duration in which the impact takes place is also considered in the evaluation of the impact.

10.2 Potential socioeconomic impacts

The following are the potential positive socioeconomic impacts from implementation of the proposed project.

- Employment opportunities
- Business spinoffs
- Transfer of skills and technology to local people

Potential negative socioeconomic impacts were identified as follows:

- ✓ Labour influx
- ✓ Influx of additional population (followers)
- ✓ Increased risk of communicable diseases and burden on local health services
- ✓ Impacts on community dynamics
- ✓ Gender-based violence
- ✓ Child labour and school dropout
- ✓ Disruption of family business livelihood from Kibuyuni seaweed faming activities

These impacts have been analysed in detail as follows:

10.2.1 Employment opportunities

Implementation of the proposed project will require the services of various professionals including designers, surveyors, marine engineers, electrical, mechanical and civil engineers and suppliers of construction materials and labour to the project. Collectively all these professionals and suppliers who will be engaged would have gained some form of employment as a result of the project. In addition the proposed project would employ both skilled and unskilled personnel at the operations phase

Nature of Impact: Positive
Duration: During construction and operation
Significance: High

Measures to enhance impact:

- Competent people from the project area to be given first priority to benefit in direct employment opportunities.

- There should be no sourcing of unskilled labour force from outside the project area unless local capacity is insufficient
- Develop local capacity by sponsoring youths to attend craft courses such as welding, carpentry, plumbing.

10.2.2 Business spinoffs

The multiplier effect of the implementation of the proposed project is likely to stir business spinoffs at Kibuyuni, Fikirini, Shomoni and its environs. Small business such as outside catering, transportation businesses, accommodation businesses and entertainment business are some of the likely incidental businesses to be realised.

Nature of Impact: Positive
Duration: During construction and operation
Significance: High

Measures to enhance impacts

- Local youths and women who will benefit from direct and indirect employment opportunities to invest part of their earnings in starting small businesses locally or inject more capital to their already existing businesses to scale up them up.
- Priority to be given to local youths of both genders and local women who have the capacity to supply required construction material as per the required specifications.

10.2.3 Transfer of skills and technology to local people

Implementation of the proposed project will involve the services of expatriates who will be supervising the project. Local staff who will be working in the project during its implementation will learn valuable skills and technology from the expatriates. Prior to operational phase local workers will be trained on how they will be maintaining the facility to ensure proper use.

Nature of Impact: Positive
Duration: During construction and operation
Significance: High

Measures to enhance impact:

The project to provide for internship and attachment for learners from local institutions to access the project site and learn from experienced expatriates and other professionals

10.2.4 Labour influx

Implementation of the proposed project will require highly skilled labour force in the construction, operation and maintenance of the facility. In the event that the required skilled workforce cannot be obtained locally the required labour force (total or partial) may be sourced from outside the project area. In such a scenario, there is a potential for skilled and qualified workers migrating from outside the project area and settling around the project area.

Social risks associated with such labour influx may include the following:-

- ✓ Increased demand and competition for local social and health services, as well as for goods and services, which can lead to crowding out of local consumers.
- ✓ Immigrant workers will seek for convenient accommodation close to the project site. This will increase pressure on available accommodation facilities. Further due to increased demand for accommodation there may be increase of rent and crowding out of local residents.
- ✓ Local inflation of commodity prices: Labour influx may result in a significant increase in demand of goods and services at the project area and its environs; this may result in local price hikes and/or crowding out of community consumers.
  Nature of Impact: Negative
  Duration: During construction and operation
  Significance: High

Mitigation Measures

- The contractor to source construction labour locally unless required skills not available locally
- The labour force to be sourced locally to include women and youth of both gender
- Numbers of women employed in the construction site to be monitored to ensure they remain proportionate to those of their male counterparts.
- Local youths and women with capacity to supply construction materials should be given priority.

10.2.5 Increased risk of communicable diseases and burden on local health services

The influx of people into the proposed project area may bring communicable diseases to the project area, including communicable diseases such as sexually transmitted diseases (STD)s and HIV/Aids. Incoming workers may also be exposed to diseases to which they have low resistance. This can result in an additional burden on local health resources. Local health facilities may also be overwhelmed and/or ill-equipped to address industrial accidents that may occur during the course of the project.

Nature of Impact: Negative
Duration: During construction and operation
Significance: High

Mitigation Measures:

- Sensitization programs on issues HIV/AIDS for the project staff to be developed and carried out at the construction site by peer educators.
- Management to provide for medical facilities for their staff
- A condom dispenser always stocked with condoms to be availed at the project site
- Contractor to arrange for convenient and free voluntary counselling and testing services for project staff.

10.2.6 Impacts on Lifestyle of Local Communities

Shimoni and Kibuyuni area is home to Vulnerable and Marginalised Groups (VMGs) such as the Wachwaka and the Wakifundi Communities. These VMGs have their own unique culture and

system of operation. Interactions between incoming workers and the host community may change their lifestyles significantly, bearing in mind the composition of the local community, and with it the community dynamics.
Nature of Impact: Negative
Duration: During construction
Significance: High

Mitigation Measures

- Incoming labour from outside the community to respect local community culture
- Interactions of incoming labour force with local labour force to be on mutual respect and active partnership

10.2.7 Child labour and school dropout

Increased opportunities for the host community to sell goods and services to the incoming workers may lead to child labour to produce goods and services, which in turn can lead to enhanced school dropout.
Nature of Impact: Negative
Duration: During construction and operation
Significance: High

Mitigation Measures

- No underage (below eighteen years) should be allowed to work either directly or indirectly
- Parents and guardians to ensure their children remain in school
- Parents and guardians should not use their children to prepare food to be sold at the project site

10.2.8 Disruption of livelihood of Kibuyuni seaweed faming activities

There exists a seaweed faming project located at Kibuyuni involving members of the Kibuyuni Beach Management Unit. The project is a dependable primary source of livelihood to the participating households. Revenue from seaweed family is vital in addressing social needs such as medicare, shelter, food and education at family level. Owing to the close proximity of the proposed project to the location of the Kibuyni seaweed faming site, implementation of the proposed project will potentially result in disruption of the activities of seaweed faming in the area and hence result in disruption of Kibuyuni community seaweed farming family livelihoods.
Nature of Impact: Negative
Duration: During construction and operation
Significance: High

Mitigation Measures

- Exhaustive consultations between the proponent and the Kibuyuni seaweed farmers to be undertaken prior to project implementation
- Ensure existing seaweed faming sites are protected from potential encroachment of activities of proposed project.

- Proponent to facilitate Kibuyuni seaweed farmers to develop new seaweed faming sites away from the neighbourhood of the proposed project in compensation for any seaweed farms that could be negatively impacted by the proposed project.

10.3 Potential Environmental Impacts

The implementation of the proposed project will result in potential negative environmental impacts as follows:

10.3.1 Impacts on Water Quality

10.3.1.1 Impacts on water quality resulting from the storage and handling of chemical products during construction activities

The storage and handling of chemical products such as fuel, lubricants, cement and paint could result in localized pollution which may enter the ocean during rainy seasons with subsequent impacts on water, sediment and biota quality. Possible impacts may arise from spills during the transport of chemical products and spills during the maintenance/repair of vehicles and other machinery.

Duration: Construction and Operation phases

Magnitude: Moderate

Significance: Moderate

Proposed mitigation measures

1. Have in place an effective preventive maintenance programme for equipment and vehicles in order to avoid breakdowns and the subsequent spillage of oil and fuel.
2. Use of qualified and experienced staff for maintenance and operation exercise is a pre-cautionary approach of dealing with accidents and spills.
3. Maintenance of equipment and vehicles to be carried out in designated areas and on impermeable surface with adequate drainage and reception facilities for any oil spills.
4. In cases of hydrocarbon spills, the spill must be controlled and absorbed by absorbent material. The absorbent material should then be placed in the open air to allow the hydrocarbons to evaporate.
5. Storage areas for fuel and other chemicals must be located at least 50 m from the sea. Such storage areas must be provided with impermeable containment basins that retain and permit the collection of possible spills. The areas should have appropriate signs in English and Kiswahili showing the contents.
6. Oil spill control measures should be adopted as per the National Oil Spill Response Contingency plan. Prompt reporting systems would be key to prevention of oil dispersal.
7. Marine environmental monitoring as per environmental monitoring programme should be carried out at the recommended points and periods and compared with baseline levels during entire rehabilitation period.

10.3.1.2 Impact on water quality resulting from domestic and non-hazardous construction waste

During the construction stage significant amount of construction and domestic wastes will be produced including packaging waste, empty drums, scrap metal, building rubble etc. If not managed correctly, this kind of waste may contaminate the adjacent water through surface runoff.

Extent: Local
Duration: Construction Phase
Magnitude: Low
Significance: Moderate
Proposed mitigation measures

1. All employees involved at site must trained on waste management procedures
2. The working areas must be kept clean and waste disposed appropriately in designated bins.
3. Concrete and cement waste should be re-used whenever possible to reduce the amount of waste.
4. Periodical clean-up of floating wastes (marine debris) should be carried out to ensure port water quality.
5. Scrap metal must be removed from the area and promptly recycled
6. Waste containers with lids must be placed in strategic locations in working areas. They must be in sufficient number and have sufficient capacity for the estimated amount of waste to be produced. Biodegradable and non-biodegradable wastes must be placed in separate waste bins which are labelled accordingly.
7. Discharge of waste into sea shall remain prohibited and adequate wastewater management facilities including biodigesters should be provided.

10.3.2 Impacts on Air Quality

10.3.2.1 Potential Impact on air quality resulting from site operations

Sources of air pollution at the project site include emissions from ships as they enter the site for scrapping and emissions from the steel plant during recycling. Motor vehicles and trucks would also generate pollutants as they access the site both from exhaust emissions and dust generation along access roads. These sources may result in SO_2, NOx, CO, VOC and particulate emissions and may have a negative impact on ambient air quality.
Extent of Impact: Local
Duration: Construction and operation phases
Magnitude: Low
Significance: Moderate
Proposed Mitigation measures:

- Prohibit use of heavy diesel oil as fuel and promotion of the use of low sulphur diesel fuel could reduce pollutants emissions.
- Truck speed regulation and prohibition of trucks movement outside the designated routes.
- Periodic cleaning of cargo spills, equipment and transport vehicles to remove accumulated dirt and hence reduce air-borne dust during dry seasons
- Environmental awareness and training should be carried out to all personnel involved in port operations
- Monitoring of air quality to ensure compliance with EMCA (Air quality regulations).

10.3.2.2 Impact on air quality resulting from Construction works

Construction activities such as demolition, excavation, ground levelling, etc generate dust and emit particulates into the atmosphere. Presence of potentially dusty construction materials in the project site is also a potential source of air pollutants especially dust. In addition, exhaust emissions from construction vehicles and equipment typically include particulates (including PM_{10}), carbon monoxide (CO), nitrogen oxides (NOx), and sulphur dioxide (SO_2).
Duration: Construction Phase
Magnitude: Low
Significance: Medium
Proposed Mitigation Measures:

- Dusty construction materials carried in vehicles and stock piles of construction material within the site should be properly covered.
- Loading and unloading of bulk construction materials should be in areas protected from the wind and carried out in calmer conditions.
- Vehicle speed restrictions should be adhered to in the construction site to reduce agitation of air-borne dust.
- High moisture content on exposed surface and roads should be maintained by spraying dusty areas with water.
- Maintenance programme for construction vehicles should be adhered to ensure for optimum performance and reduced emissions.

10.3.3 Noise

10.3.3.1 Noise resulting from Construction works

Potential sources of noise and vibration would be activities such as movement of construction vehicles, operation of construction equipment such as concrete mixers and poker vibrators as well as noise and vibration related to piling activities.
Duration: During Construction
Magnitude: Medium
Significance: Medium
Proposed Mitigation measures:
The project is to be undertaken in a low populated area. Overall, it is expected that the rehabilitation works are likely to result in minor and temporary noise effects. However, the following mitigation measures should be put in place:-

- Minimize the generation of noise through the use of machinery, equipment, motors, etc., with characteristics of sound generation that complies to the recommended standards
- Adherence to a good and regular maintenance:
- Procurement of machinery/ construction equipment should consider specifications that conform to low source noise levels.

- Personnel exposed to noise levels beyond threshold limits should be provided with protective gear like earplugs, muffs, etc.

10.3.3.2 Noise resulting from operations activities

The potential sources of noise and vibration after commissioning include:

- operational noise from ship cutting and welding activities;
- noise from the steel plant during scrap recycling;
- operational noise impacts from traffic flows on access roads resulting from trucks accessing or leaving steel plant

Extent: Local to site
Duration: During Operation
Magnitude: Medium
Significance: Low

Proposed mitigation measures

- Minimize the generation of noise through the use of machinery, equipment, motors, etc., with characteristics of sound generation obeying the standards recommended nationally and internationally, and with a good and regular maintenance;
- Procurement of machinery/ construction equipment should consider specifications that conform to low source noise levels;
- Personnel exposed to noise levels beyond threshold limits should be provided with protective gear like earplugs, muffs, etc.
- Ambient noise levels should be maintained below threshold levels and monitored at regular intervals for conformity to EMCA (Noise and Excessive Vibration Control) Regulations.

10.3.4 Impacts on Marine Environment

The proposed project site is rich in natural resources which are also habitats to diverse terrestrial and marine flora and fauna. The terrestrial flora include trees, shrubs, herbs, climbers, grasses and sedge while terrestrial fauna include coastal mammals, amphibians, reptiles, invertebrates and avifauna. Marine flora including mangrove trees, seaweeds and sea grasses and marine fauna include marine invertebrates, marine vertebrates, corals, marine fishes, marine reptiles, marine mammals, arthropods and echinoderms.

Implementation of the proposed project will potentially results in negative impacts to the rich natural resource base within the proposed project site and its environs.

10.3.4.1 Potential negative impacts on local terrestrial vegetation

Vegetation at the proposed project site includes trees, shrubs, herbs, climbers, grasses and sedge. Implementation of the proposed project will require that some of the vegetation at the proposed project site be cleared to pave way for the implementation. Clearing of the vegetation at the

proposed project site will result in loss of environmental and ecological services derived from the vegetation. The environmental services that will be lost include reduction in local carbon sink, loss of local shade and loss of local wind break. Ecological services likely to be lost include loss of soil conservation as tree roots bind soil aggregates thus minimizing soil erosion, nitrogen fixing, and windbreak. Potential negative environmental impacts likely to result from vegetation clearing from the proposed project site will include:-

- ✓ Direct loss of native vegetation abundance and biodiversity due to the clearing of vegetation within the proposed project area
- ✓ Direct and indirect loss of fauna abundance and biodiversity through habitat loss resulting from vegetation clearance.
- ✓ Diminishing of local carbon sink resulting in reduced area capacity of carbon sequestration.
- ✓ Destruction and fragmentation of fauna and avifauna habitats that may result in migration of the affected species that will disrupt local food chain.
- ✓ Overall reduction of flora in the area and overall loss and/or reduction of ecological and economic services derived from the lost floral species.
- ✓ Loss and / or reduced foliage for local fauna species that will negatively impact on the growth, reproduction and development of the affected faunal species.

Extent: Local to site
Duration: During Operation
Magnitude: Medium
Significance: Low

Mitigation Measures

- Large mature trees at the proposed project site to be preserved
- Proponent to support tree planting initiatives within Kibuyuni area and the wider Shimoni to compensate for vegetation that could be lost from proposed project site
- Proponent to maintain pockets of vegetation within the project site
- Proponent to only cut trees and clear vegetation in areas where structures of the proposed project will be constructed.
- Ensure no disposal of effluent and any other waste from the proposed project into the local terrestrial environment

10.3.4.2 Potential negative impacts on local terrestrial fauna

Fauna at the proposed project site include mammals, amphibians, reptiles, invertebrates and avifauna among others. Implementation of the proposed project will involve activities that might negatively affect ecological fauna species within the proposed project site. Project activities such as vegetation clearing, excavation and removal of top soil, trenching, compaction and levelling will significantly modify the ecological environment which the fauna species depend on for shelter, cover, nesting, roosting, feeding and reproduction. Potential negative impacts to local ecological fauna as a result of implementation of the proposed project will include:-

- ✓ Direct and indirect loss of ecological fauna abundance and biodiversity through habitat loss resulting from vegetation clearance.
- ✓ Noise disturbances to fauna from project tools and machinery and vibration impacts as a result of machinery operation and construction related noise that will affect feeding, roosting and reproduction of the ecological fauna.
- ✓ Ecosystem modification will result in disruption and / or alteration of the feeding chains and feeding webs of ecological fauna species. Such disruption and or alteration will contribute to change in reproductive pattern and frequency of the affected fauna species.
- ✓ Direct restriction and hindrance of free movement of ecological fauna within the project site and its neighborhoods. Such hindrances will affect access to feeding, roosting and areas used for reproduction purposes by the ecological fauna.

Mitigation Measures

- No capturing of any fauna or avifauna species resident on transiting through the site
- Any identified critical habitats for fauna including nesting areas to be preserved Maintain as much vegetation as possible on the site
- Ensure no disposal of effluent and any other waste on terrestrial environment which is a habitat for terrestrial fauna

10.3.4.3 Potential negative impacts on local mangroves

There are mangrove trees within the intertidal zone of a section of the proposed project site. Implementation of the proposed project may necessitate clearing of some of the mangroves to create room for infrastructure of the floating dock section of the proposed project. Potential impacts that will result from cutting of local mangrove trees include the following:

- ✓ Mangroves are important in coastal protection as they trap sediments from land and rivers. This helps stabilize the coastline and prevents coastal erosion. Mangroves also protect coral reefs and seagrass meadows from being smothered in sediment. Cutting of mangroves located at the coastline of the proposed project site will thus contribute to coastal erosion and sedimentation of seagrass beds and corals.
- ✓ Mangroves are important fish spawning grounds therefore cutting of any mangroves will automatically translate to damaging breeding areas of marine fisheries.
- ✓ Mangrove ecosystem is important in carbon sequestration; cutting of mangrove trees will negatively affect carbon sequestration in the area.
- ✓ Mangroves trees are important habit roosting, patching and feeding grounds for water birds, if cut this function will be lost.

All mangrove areas in Kenya are gazetted and are protected under the Forest Conservation and management Act 2016, including the Mangrove swamps at Kibuyuni site. The proponent should therefore consult with Kenya Forest Services prior to concluding on project design.

Mitigation Measures

- Consult with Kenya Forest Services (KFS), on any intended use of intertidal zone area before commencement of any proposed project activity
- Observe the legal requirements stipulated in the Forest Act 2019 in line with any potential use of mangrove areas within the intertidal zone
- Ensure no oil spills from any of the proposed project activities into the mangrove swamps within the inter-tidal zone
- Ensure no disposal of effluent and any other waste from the proposed project into the inter-tidal zone.
- As a compensatory measure the proponent should plant 1.5 times the area of cleared mangroves in neighbouring areas not targeted for future development and in degraded mangrove forest areas

10.3.4.4 Potential negative impacts on sea grass beds

Sea grass beds harbour a diverse array of associated plant and animal species. These includes species of macroalgae, algal epiphytes, benthic invertebrates especially gastropods and bivalves, sea cucumbers, sea urchin species, various shrimp, lobster and crab species and fish. Development of the vegetated land which is upstream of the Wasini Channel might open up the land for erosion that will result in sedimentation of downstream Wasini channel and expose the sea grass beds to sedimentation hence resulting in the sea grass meadows being smothered in sediments. This will negatively affect the biodiversity supported by the sea grass beds.

Mitigation Measures

- Minimise sedimentation from upstream into the seagrass beds by ensuring that the 50 meter riparian zone from the high water mark is kept intact with vegetation that will filter sediments from upstream sources.
- Maintain mangroves trees within the inter-tidal zone for further filtering of sediments from upstream
- Ensure no oil spills from any of the proposed project activities
- There should be no disposal of effluent and any other waste from the proposed project into the marine environment.

10.3.4.5 Potential negative impacts on corals

Sedimentation from upstream due to construction works may result in deposition of suspended materials in the Wasini channel causing smothering effect on corals. This will potentially affect coral habitat by decreasing the coral species diversity, species population, and cover in the habitat. Among the coral species recorded, five species were listed under the IUCN red list of threatened species. Species that prefers inhabiting shallow areas will be affected more than those that occur in slightly deep areas. However, about three species Favites abdita, Stylophora pistillata, Favia stelligera which

occur between 1-15m deep will are likely to be affect negative from the activities of construction and operation of the proposed project.

Mitigation Measures

- Maintain a healthy mangrove ecosystem within the intertidal zone
- Maintain healthy seagrass beds
- Minimise sedimentation into the seagrass beds
- There should be no oil spills from any of the proposed project activity

10.3.4.6 Potential negative impacts on fishery diversity and catch

Fish species will potentially be affected during the construction phase. Installation and anchorage of the floating dry dock and the jetty will contribute to turbidity of marine waters around construction areas, potentially affecting foraging behaviour of fish thus they will temporarily move away from the affected areas during the construction period.

10.3.4.6.1 Mitigation Measures

- Ensure fish spawning grounds such as mangrove areas are preserved and protected from upstream sedimentation and pollution
- Ensure fish foraging areas such as seagrass beds are not smothered from sedimentation from upstream
- Ensure corals and coral reefs are not destroyed but preserved
- There should be no oil spills from any of the proposed project activity
- There should be no disposal of effluent and any other waste from the proposed project into the marine environment

10.3.4.7 Potential negative impacts on established Local Marine Management Areas

Community established and managed areas also known as Community Conservation Areas (CCAs) or Local Marine Management Areas (LMMAs) are set aside areas previously used for fishing grounds for protection by local communities through consultations with relevant stakeholders. The community CCAs are established to protect biodiversity, ecological and cultural values with the aim of managing activities of a section of the sea by restricting exploitive and damaging human impacts. There are CCAs at Shimoni, Wasini and Mkwiro that may be affected by the prosed project. There is Kibuyuni CCA used for seaweed farming which is close to the proposed project site. Across the harbour is Wasini CCA that is a coral reef restoration site. Still at Wasini is Mkwiro seaweed farming another CCA. Implementation of the proposed project may temper with the existence of Kibuyuni CCA, affect the quality of coral reef restoration at Wasini CCA and sea weed farming activity at Mkwiro CCA.

Mitigation Measures

- There should be no installation and or construction of any of the proposed project structures such as floating dry dock and jetty within or at close proximity to any of the identified and all other LMMAs
- Ensure no oil spills from ships destined for scrapping including while on transfer to the land side or even while on the floating dry dock
- There should be no disposal of effluent and any other waste from the proposed project into the marine environment

10.3.4.8 Potential negative impacts on Kisite-Mpuguti Marine National Park

Implementation of the proposed project will involve installation of a floating dry dock for berthing and transfer of ship (to be scrapped) and a jetty parallel to the sea-facing plots. Installation of these facilities could contribute to minor turbidity of the marine waters. Such turbid waters generated at area of activity could spread to the Kisite-Mpunguti Marine Park by effects of tides and currents within the Wasini Channel. Noting that the marine park is rich in marine flora and fauna, increase in turbidity will negatively affects the marine flora and fauna within the marine park. Given that the project will involve only minor dredging the impact on the marine park is expected to be insignificant.

10.3.4.8.1 Mitigation Measures

- Ensure that the 50 meter riparian zone from the highest water mark is maintained with indigenous vegetation to contain sedimentation from upstream into the Wasini channel
- Mangrove ecosystem within the intertidal zone that is vital in filtering sediments that could have escaped through the riparian zone should be maintained healthy and intact
- There should be no oil spills from any of the ship destined for scrapping including while on transfer to the land side or even while on the floating dry dock
- There should be no disposal of effluent and any other waste from the proposed project into the marine environment

10.3.4.9 Potential negative impacts on Kibuyuni seaweed farming

The South-West corner of the proposed project site i.e. plot numbers 598 – 691 would be utilised for the floating dry dock berthing and ship transfer because this area is relatively sheltered from Wasini channel's cross currents. Also, the natural level of the land here is suited for the floating dry dock's depth and tide conditions. Further, sea facing plots towards the south and the peripheral plots on the east will partly be used for a jetty while utility services requiring sea suction have been assigned parts of plot numbers 691 and 635. These structures will be both within the shallow areas of currently used for Kibuyuni seaweed farming activities and at close proximity to these areas. Implementation of the proposed project will thus disrupt the on-going seaweed farming at Kibuyuni. The net result will be potential significant reduction in output of the quantity and quality of seaweed farmed at Kibuyuni. Further considering that seaweeds are food for marine fisheries and that the seaweed farming gardens have attracted lots of fish within the farming areas, reduction in the seaweed farming activity will also potentially contribute to reduction in fish productivity in the area. The result will be reduced catch for the fisher folk in the area.

Mitigation Measures

- Avoid installation and operation of any of the structures such as floating dry dock and jetty within or at close proximity to areas used for seaweed farming at Kibuyuni
- Ensure no oil spills from any of the ships and operational activities that could spread oil into the seaweed farming areas
- There should be no disposal of effluent and any other waste from the proposed project into the marine environment including areas used for seaweed farming

10.3.4.10 Impacts of accidental oil spill on marine habitats

Accidental and/or operational oil spills from vessels during operations phase may affect marine habitats such as seagrass beds and mangroves as well as marine organisms due to oiling;
Duration – During Operation
Status of impact – Negative;
Significance – High in the event of a spill but risk level low due to low frequency of ship calls;

Mitigation Measures

- Seek to reduce probabilities of accidental and/or operational spills through enforcement of vessel traffic and oil spill management systems.
- Put in place best practice procedures such as activation of the National Oil Spill Response Contingency Plan in the event of a spill.
- Compensation by restoration of degraded habitats that are identified.

10.3.4.11 Potential discharge of ballast water at the operations phase

Discharge of ballast water may occur during ship berthing and scrapping activities, with potential introduction of alien invasive species
Duration – During Operations
Probability – Unlikely, since KMA and KPA prohibits discharge of ballast water within port areas
Significance – Medium: currently.

Mitigation Measures

- Compliance with KMA and KPA policy which prohibits discharge of ballast water.
- Abide by the interim provisions of the Management of Ballast Waters in Port states currently under development by IMO; ratify and implement the Ballast water convention.

10.3.5 Impacts on Health and Safety

The study noted that the following health and safety impacts would accrue:

10.3.5.1 Accidental Injuries at site:

At the construction site there would be risk of injuries due to use of hand tools, trip and fall hazards as well as overhead hazards.
Duration – During Construction and Operations
Probability – Likely

Significance – Medium
Mitigation Measures

- Undertake job safety analysis prior to commencement of construction works so that all workers are familiar with safe procedures for undertaking their tasks
- Safety awareness and training should be carried out to all personnel during the construction phase and in port operations
- Engage a trained and experienced safety officer at the site on full-time basis to enforce KPA safety rules and drive the safety awareness, training and motivation campaign
- Avail a fully equipped first aid box manned by trained first aid personnel at all times during construction works
- Ensure an effective accident reporting and investigation procedure is in place and investigation recommendations are implemented to prevent recurrence

10.3.5.2 Road Traffic Accidents:

Increased volume of traffic would create risk of road traffic accidents.

Duration – During Construction and Operations
Probability – Likely
Significance – Medium
Mitigation Measures

- Installation of safety signs to warn motorists, pedestrians and residents of the hazards at the sites during the construction stage;
- Erection of speed control bumps where required;
- Installation of access control devices such as barricade tapes to prevent unauthorised persons from accessing construction areas where they could be prone to accidental injuries.
- Ensuring that at all times there are traffic guides dressed in visible clothing to control traffic and guide motorists within the site and its approaches.

11 ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

11.1 Introduction

This ESMP has been designed as part of the environmental review process to ensure that mitigation measures proposed in this ESIA Study report are implemented during project implementation to protect the environment from adverse impacts that may occur. EMCA 1999 defines Environmental and Social Management Plan (ESMP) as "*all details of project activities, impacts, mitigation measures, time schedule, costs, responsibilities and commitments proposed to minimize environmental and social impacts of a project*".

A summary of key impacts and mitigation measures identified during this ESIA study are as follows:

Table 11.1: Summary of key impacts and mitigation measures

Project Phase	Potential Impact	Significance	Mitigation
Construction	Dust from construction activities such as particulate emission into the atmosphere during transportation of construction material, demolition, excavation and dusty construction material at the project	Medium	• Construction materials carried in vehicles should be properly covered, • Enforce speed restrictions within the construction site. • Sprinkle water on exposed surface and roads to maintain high moisture content • Erect temporary barriers where practicable to trap dust
	Noise from on-site construction activities such as excavation, piling, and from vehicles hauling construction material	Medium	• Use only equipment complying with recommended standards • Adherence to a good and regular maintenance • Provide exposed personnel with protective gear like earplugs, muffs, etc.
	Direct loss of mangroves and other flora within the intertidal zone in the proposed project area	High	• Consult with Kenya Forest Services (KFS), and observe the legal requirements stipulated in the Forest Act 2019 on intended use of mangroves before commencement of the project • Ensure no oil spills from any of the proposed project activities into the mangrove swamps within the inter-tidal zone • Ensure no disposal of effluent and any other waste from the proposed project into the inter-tidal zone. • As a compensatory measure the proponent should plant 1.5 times the

			area of cleared mangroves in neighbouring areas not targeted for future development and in degraded mangrove forest areas
	Occupational safety and health – Potential for accidental injuries to workers in the course of undertaking construction works	Medium	• Undertake job safety analysis prior to commencement of construction works • Deploy a Safety Officer to the site on full-time basis to enforce safety rules • Avail a fully equipped first aid box manned by trained first aid personnel at all times during construction works • Employee training and safety awareness • Initiate an effective accident reporting and investigation program
	Interaction with migrant workers may result into spread of communicable diseases such as HIV/Aids	High	• Support HIV / Aids sensitization programs • Avail and equip a Voluntary Counselling and Testing (VCT) Centre during the construction period.
Operation	Accidental oil spills and discharge of ship waste from vessels	High	• Apply IMO, KMA's and KPA's port and shipping regulations. • Activate National Oil Spill Response Contingency Plan in the event of spill.
	Potential rise in discharge of ballast water in the harbour	Medium	• Enforce KPA policy that prohibits discharge of ballast water • Compliance with IMO regulations on management of ship waste
	Marine debris such plastic water bottles and packaging waste from site operations and seafront activities	Low	• Compliance with IMO regulations on management of ship waste • Periodical shoreline clean up
Water Pollution	Water pollution from sewage and other domestic effluent	Low	Installation of biodigesters for treatment of effluent
	Water pollution from land based oil spill and effluent from maintenance	Low	Installation of interceptors / Oil-water separators

11.2 Purpose of ESMP

The purpose of the ESMP is to ensure that measures are taken to protect the environment by mitigating adverse impacts that occur during execution of the works. The ESMP outlines monitoring and mitigation measures that would be undertaken to restore and maintain environmental and social parameters at acceptable levels. The ESMP would focus on the following:

11.3 Water Quality Management

11.3.1 Sources of Impacts

Key potential sources of water pollution were identified as:

- Land based oil spill and effluent from maintenance - leakage of oils, lubricants and chemicals from storage yards and maintenance areas during operations;
- Water pollution from sewage and other domestic effluent Mitigation

Measures have been proposed to minimize negative impacts of project activities during construction and operation phases of proposed project as outlined below:

11.3.2 Monitoring Objectives

- To assess the variation in water turbidity and chemical properties due to project activities which could alter the physical or chemical characteristics of the Mombasa port area, offshore dumping area and offshore sand borrow pit;
- To assess the effectiveness of environmental management programs designed to minimize surface water contamination.

11.3.3 Monitoring Methods

Water quality monitoring shall be done at the prescribed monitoring points using a water quality meter. Turbidity and chemical characteristics of the water shall be of the sea water shall be monitored at locations and frequency prescribed by the engineer. Monitoring shall commence at least 2 weeks before commencement of the reclamation works, so that the prevailing baseline conditions prior to commencement of the project can be documented.

Parameters to be monitored include:

- Total Suspended Solids, TSS;
- pH;
- Chemical Oxygen Demand, COD;
- Dissolved Oxygen, DO;
- Turbidity

11.3.4 Monitoring Locations

It is proposed that water quality monitoring be carried at not less than 3 points near sensitive receptors such as seaweeds. The exact locations of the monitoring points would be specified by the Engineer.

11.3.5 Monitoring Frequency

Both turbidity and chemical properties (TSS, PH, COD, DO) shall be monitored every 3months for a period of 2 years. If at any time measurements indicate the turbidity levels or chemical parameters are exceeded the proponent shall take reasonable measures to ensure that these parameters are restored to baseline levels.

11.3 Air Quality Monitoring

11.3.1 Sources of Impact

Sources of impact on air quality would be:

- mobilization of equipment,
- particulate and dust escape during material haulage;
- site clearance and earthworks during the construction phase;
- dust generation as a result of trucks ferrying goods within and around the project area;
- emission from exhaust of haulage trucks and other construction equipment.

11.3.4 Monitoring Methods

Air quality sampling and analysis will be done by a contracted laboratory approved by NEMA to ensure that adopted air pollution control and management measures are effective. Air monitoring parameters will include 24-hour readings of the following parameters on a scheduled basis:

- Hydrogen Sulphide, H_2S;
- NO_2;
- CO;
- SO_2;
- SPM (Suspended Particulate Matter).

Air quality monitoring will be conducted once before commencement of the works and every 3 months thereafter.

11.3.6 Monitoring Locations

Air quality monitoring shall be conducted at active construction areas and near sensitive receptors as would be determined in consultation with the Engineer

11.4 Noise Level Monitoring

11.4.1 Sources of Impacts

- On-site construction activities such as demolition, casting of concrete, grinding, piling;

- ❖ Vehicles hauling construction material during the construction phase;
- ❖ Noise from manufacturing operations at the steel plant.

11.4.2 Methodology for Noise Level Measurement

The noise measurements would be carried as follows:

- ❖ Inspection of the measurement area and the implicated activities.
- ❖ Identification of perimeter points.
- ❖ Verification/Calibration of the sound level meter before measurements.
- ❖ Recording of the meteorological conditions during the measurement such as temperature, wind speed and relative humidity;

All the measurements would be taken in diurnal schedule.

11.4.4 Parameters to be monitored

The measurements results would be expressed as follows:

- ❖ **Lmax**, Maximum sound pressure level obtained during the measurement period;
- ❖ **Lmin,** Minimum sound pressure level obtained during the period of measurements;
- ❖ **Leq,** Value of A - weighted sound pressure level of a continuous steady sound that has the same mean square sound pressure as a sound under consideration whose level varies with time;
- ❖ **Noise levels** at the following distances from source – L5, L50, L95;
- ❖ **Vibration velocity –** maximum value during 10 minutes hourly;
- ❖ Record of noise and vibration source.

11.4.5 Locations for Noise Level Measurement

Noise level measurement shall be conducted at the same locations as for air quality monitoring as determined by the Engineer

11.4.6 Monitoring Frequency

Noise level monitoring will be conducted every 3 months during the construction period.

11.5 Monitoring of Marine Environment

Monitoring of marine environment will be necessary to track changes in the quality of marine flora and fauna in the course of implementation of the proposed project. Monitoring to be done will include but not limited to the following:

- Marine water quality monitoring
- Monitoring of coral reefs
- Monitoring of marine flora (sea weeds and sea grass) and fauna (corals)

11.5.1 Marine Water Quality Monitoring

Monitoring of marine water quality will be necessary to determine if the proposed project has:-

- Impacts on aquatic biota (plankton, benthos, and fish) as a consequence of decline in water quality and sedimentation.
- Releases of sediment into the water column, creating turbid plumes which can migrate

away from the initial activity area and onto nearby sensitive habitats. The suspended sediments can reduce light, clog filtering and feeding apparatus, and settle onto benthic organisms, including ecologically important, habitat forming groups such as corals and therefore pose an environmental hazard.

Monitoring Locations

Water quality monitoring shall be done at the pre-determined monitoring points within the Wasini Channel. The monitoring points shall be located as follows

- six points within the Kibuyuni sea weed farming area
- six points within the Wasini Coral Reef Community restoration area
- three points to be the same as those where water samples were extracted during the EIA study.

Monitoring Methods

- Water quality monitoring will be done at the pre-determined locations using a turbidity meter which will be well calibrated. It will first involve establishing baseline conditions by monitoring turbidity of the sea water with the approved equipment, every day for at least 2 weeks before the commencement of the any works of the proposed project.
- At each of the points the monitoring will be at 50cm, 3m, and 6m below the surface. Chemical characteristics of the water shall be monitored every 10 days.
- Visual observation will also be undertaken as a means of gauging the perspective degree of turbidity levels at any given time.
- To complement the approved meter water samples shall be extracted once every three months and taken to a NEMA approved laboratory for analysis.

11.5.2 Monitoring Suspended Solids Content and other parameters

- The concentration of suspended solids (SS) in the sea water shall be monitored so as to ensure that the SS concentration at 50cm, 3m, 6m below surface at 100 meters in any direction from the working points were there will be a floating jetty and any other structures associated with the project that will be located within the marine environment not to exceed the target, +60mg/L from the baseline conditions within the Wasini Channel and + 2mg/L from the baseline conditions outside the Wasini Channel towards marine protected areas. Measurements shall be made of "mg/L of total suspended solids" using a direct-reading portable turbidity meters.

- Measurements shall be conducted 2 times a day at each location so as to cover a range of tidal and current conditions. Other parameters that shall also be monitored will be PH, COD, DO, temperature & Salinity at the same points and the same depth.

11.5.3 Monitoring of coral reefs

Monitoring of coral reef is important in order to maintain coral reef ecosystems in a desired "healthy" state. While the definitions of coral reef health vary based on location and context, in

general, a healthy coral reef is one that has moderate to high hard coral cover in a range of colony sizes and species; low macro algal cover; and abundant fish populations across all trophic and functional groups. A reef that can maintain these qualities over time is considered stable. The principal vulnerability of coral reef organisms to silt/sediment is settlement on their surfaces, increasing metabolic costs for breathing and feeding, resisting diseases, and eventually suffocation. Suspended sediments cut down light, reducing energy production in corals and other autotrophic organisms. To monitor the health of coral reefs the following key variables will be observed:

- Sediments present on hard/soft coral tissue;
- Tissue condition of hard/soft corals:
    - Mucus sheaths and their condition (on porites and soft corals)
    - Bleaching (partial/full)
    - Mortality (partial/full).

Baseline condition of the coral reefs will be determined prior to commencement of the project. Thereafter monitoring will be done once per month for the first twelve months. Thereafter if monitoring results show no change from the baseline, monitoring will reduce to quarterly for the second year and then from the third year biannually.

11.5.4 Monitoring of marine flora and fauna

Monitoring of marine fauna (coral reef benthic communities) will be done to understand ecological drivers of natural differences in community structure or to observe direct and indirect shifts in benthic community composition related to major disturbance. Population processes such as recruitment; competition, predation and mortality fluctuations naturally in response to environmental conditions and levels of disturbance. Monitoring of marine flora (sea grass and sea weeds) will be done to document any changes in the diverse array of associated plant and animal species they harbour. Visual census (UVC) method will be used in the survey for monitoring the marine flora (sea grasses) and fauna (corals) in shallow lagoons. The UVC protocol to be used will be belt transects. A ten meter transect will be laid at each monitoring location and major substrate categories along the transect recorded at each study location. Photographic samples will be collected and later analysed for qualitative and quantitative parameters including benthic fauna and flora.

11.6 Monitoring of HIV / Aids Prevalence

11.6.1 Sources of Impacts

Interaction between local people and migrant workers with disposable incomes staying away from their families.

11.6.2 Indicators of Impacts

Increase in reported cases of new HIV /Aids infections

11.6.3 Monitoring Objectives

- To mitigate the impacts anticipated from influx of construction workers and other immigrants into surrounding residential areas;
- To increase HIV / Aids awareness among construction workers and neighbouring communities thereby promoting behavior change in order to minimise cases of new HIV / Aids infections

11.6.4 Monitoring Methods

A reputable NGO with experience in administration of HIV/Aids programs would be engaged to drive the HIV monitoring programme. Among the parameters to be monitored are:

- Level of awareness campaign – campaign materials distributed, meetings / training sessions held and topics discussed;
- Evidence of acceptance of HIV status for those who are HIV positive, and reduction of stigmatization;
- Reduction in numbers of new infections
- Provision and equipping of Voluntary Counselling and Testing centre;
- Condom Access

11.6.5 Monitoring Frequency

Monitoring of HIV prevalence would be done and reported on monthly basis.

11.7 Responsibility and Timeframe of ESMP

A summary of responsibilities, timeframe and main items that need to be monitored to ensure successful implementation of the ESMP is as outlined in Table 11.2 below:

Table 11.2 Responsibility and Timeframe of ESMP

No.	Component / Issue	Phase	Responsibility	Monitoring Items
1.	Water Quality	Construction	Contractor	Turbidity, Chemical Composition
		Operation	Wasini Maritime	Oil Pollution, Ballast water
2.	Air Quality	Construction	Contractor	Dust, Particulates
		Operation	Wasini Maritime	Ship emissions, Fugitive dust
4.	Critical Ecosystems (Coral, Mangroves, Nesting Grounds)	Construction	Contractor	Abundance, Presence/Absence,
		Operation	Wasini Maritime	Regeneration, Size.
5.	Noise & Vibration	Construction	Contractor	Construction noise - Levels, Frequency, Times of exposure
		Operation	Wasini Maritime	Noise from ships, haulage trucks, container handling equipment
6.	Effluent	Operation	Wasini Maritime	Effluent Quality, Biodigester efficiency

8.	HIV/AIDS & STI Prevalence	Construction	Wasini Maritime	Awareness, Prevalence, Cases, Condom Access
9.	Oil Spill	Construction	Contractor	Spill from construction equipment, maintenance activities
		Operation	Wasini Maritime	• Spill from marine accidents - ship collisions, ships running aground, ships colliding with berthing structures • Review sufficiency of oil pollution control equipment • Preparedness of oil spill response staff
10	Occupational safety and health	Construction	Wasini Maritime	• Accident reports / statistics and investigation records • Provision and use of PPE • Availability of first aid facilities / trained first aid personnel • Safety training and awareness
11	Fires	Operation	Wasini Maritime	• Availability of firefighting equipment • Training of fire brigade • Fire drills / emergency response simulations

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13. APPENDICES

Appendix 1 Practicing licence of the Firm of Experts

Appendix 2 Practicing License of Team Leader

Appendix 3 Practicing License of Natural Resources Specialist

Appendix 4 ToR Approval Letter from NEMA

Appendix 5 Certificate of Incorporation for Wasini Maritime Limited

Appendix 6 Public Newspaper notice for public barazas

Appendix 8 Minutes of Stakeholder Consultation with Kwale County Government Executive Committee

Appendix 9 Minutes and attendance list of second stakeholder workshop involving key stakeholders

Appendix 10 Minutes and attendance list of third stakeholder workshop involving the Kwale County Environmental Committee (CEC)

Appendix 11 Minutes and attendance list of the first Public baraza

Appendix 12 Minutes and attendance list of the second Public baraza

Appendix 13 Minutes and attendance list of the third Public baraza

Appendix 1 Practicing License of Firm of Experts

FORM 7 (r 15(2))

nema

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/9877

Application Reference No: NEMA/EIA/EL/13459

M/S **HEZTECH ENGINEERING SERVICES**
(individual or firm) of address

P.O. Box 42269, Mombasa

is licensed to practice in the

capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Firm of Experts**
registration number **5193**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **2/28/2019** Expiry Date: **12/31/2019**

Signature....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001 : 2008 Certified

Appendix 2: Practicing License of Lead Experts

FORM 7

(r 15(2))

nema

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/9876

Application Reference No: NEMA/EIA/EL/13458

M/S **HEZEKIA ADALA**
(individual or firm) of address

P.O. Box 42265-80100, MOMBASA

is licensed to practice in the

capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert**
registration number **0094**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **2/28/2019**

Expiry Date: **12/31/2019**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001 : 2008 Certified

Appendix 2: Practicing License of Lead Experts

FORM 7 (r.15(2))

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)
THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/8790
Application Reference No: NEMA/EIA/EL/12289

M/S **PHILIP MANYI OMENGE**
(individual or firm) of address

P.O. Box 569-80100 Mombasa

is licensed to practice in the

capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert**
registration number **1559**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **1/7/2019** Expiry Date: **12/31/2019**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001: 2008 Certified

Appendix 4: ToR Approval Letter from NEMA

nema
mazingira yetu | uhai wetu | wajibu wetu

NEMA/TOR/5/2 Date: 21st June 2019

Wasini Maritime Ltd

RE: ACKNOWLEDGEMENT AND APPROVAL OF TERMS OF REFERENCE (TOR) FOR THE ENVIRONMENTAL IMPACT ASSESSMENT STUDY

We acknowledge receipt of the TOR for the above subject.

Pursuant to the Environmental Management and Coordination Act Cap 387 Legal Notice 150 and the Environmental (Impact Assessment and Audit Regulations 31 and 25, your terms of reference for the Environmental Impact Assessment (EIA) study for the proposed Integrated Green Ship Recycling & Steel making Facility has been approved.

You shall submit ten (10) copies and one electronic copy of your report prepared by a registered expert to the Authority.

BONFACE MAMBOLEO
EIA SECTION HEAD

Appendix 5 Certificate of Incorporation for Wasini Maritime Limited

No. CPR/2015/219704

CERTIFICATE OF CHANGE OF NAME

I hereby CERTIFY, that -

SHIMONI PORTS LIMITED

having, with the sanction of a **Special Resolution** of the said Company, and with the approval of the REGISTRAR OF COMPANIES, changed its name, and is now called:-

WASINI MARITIME LIMITED

and I have entered such new name in the Register accordingly.

GIVEN under my hand at Nairobi this **13 th** day of **June** Two Thousand and **Sixteen**.

Registrar of Companies

No. CPR/2015/219704

CERTIFICATE OF INCORPORATION

***I hereby CERTIFY,** that -*

SHIMONI PORTS LIMITED

is this day Incorporated under the Companies Act (Cap. 486) and that the Company is **LIMITED**.

GIVEN under my hand at Nairobi this **5 th** day of **January** Two Thousand and **Sixteen**

Registrar Of Companies

Appendix 6 Public Newspaper notice for public barazas

Wasini Maritime Limited
Zanzibar Road Shimanzi
P.O.BOX 83907-80100
Mombasa-Kenya
Email: madnan@wasinimaritime.com
Mobile 0723118071

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED INTEGRATED GREEN SHIP RECYCLING & STEEL MAKING FACILITY

INVITATION TO STAKEHOLDERS MEETING

Wasini Maritime Limited plans to construct an Integrated Green Ship Recycling & Steel Making Facility at Kibuyuni area of Kwale County.

Pursuant to section 58 of the Environmental Management and Coordination Act, 1999 (Amended 2015) and Regulation 10 of the Environmental (Impact Assessment and Audit) Regulations 2003, Wasini Maritime Limited has initiated an Environmental Impact Assessment study for the proposed development.

As part of Public Participation process, we wish to invite residents and other interested parties to Public meetings as follows:

DATE	TIME	VENUE
Thursday 26th September 2019	0900 Hrs	Fikirini MZIDA CBO Hall
Thursday 26th September 2019	1400 Hrs	Shimoni at Slaves Cave Hotel
Tuesday, 1st Oct 2019	0900 Hrs	Majereni at Mwazo CBO

The purpose of the meeting is to explain the project to members of the public and ensure that their concerns are addressed during the EIA process.

All are welcome.

M Adnan
Executive Coordinator
Wasini Maritime Ltd

Appendix 8 Minutes of Stakeholder Consultation with Kwale County Government Executive Committee

MINUTES OF COUNTY EXECUTIVE COMMITTEE MEETING HELD ON MOND
15 TH JULY 2019 AT THE HEALTH BOARDROOM, KWALE HOSPITAL.

MEMBERS PRESENT

NAME	DESIGNATION/PORTFOLIO
1 H.E Salim Mvurya	Governor Chairperson
2 H.E FatumaAchani	Deputy - governor
3 HemedMwabudzo	Roads and public works
4 Saumu Beja	Environment and Natural Resources
5 Joanne Nyamasyo	Agriculture, Livestock and Fisheries
6 Francis Gwama	Health Services
7 Mangale Munga	Education Services
8 Martin Anyange	Water Services
9. Omar Nasib Nyahi	Trade and enterprise development
10 Sylvia Chidodo	Public Service Administrations
11. Martin M Mwaro	County Secretary (Taking minutes)

IN ATTENDANCE

1. ChimvuaKombo	Principal Administrative Secretary
2. Alex Onduko	Chief Officer Finance
3. Anthony Mwamunga	Chief Office Tourism
4. Hassan Chuphi	Chief Officer Trade
5. Ali Mwachirabi	Chief Officer Roads
6. Dr. Salim Mbete	Chief Officer Health
7. Nuru Mboga	Chief Officer Environment
8. Juma Nzao	Chief Officer PSA
9. Musyoko Mutua	Chief Officer Water
10. Francica Kilodzo	Chief Officer Community
11. Philip Omunge	Consultant
12. Maqbul Adnan	Consultant
13. Hezekiah	Consultant

AGENDA

1 Approval of proposed investment by Wasini Maritime Investment
2 Approved Budget 2019/2020
AOB

CHAIRPERSONS OPENING REMARKS

The chairman called the meeting to order at 10.30 am. He informed members that the directors of the company had sought audience with his office to explain their interest in investing in the county. The chair informed members he advised the company to prepare a presentation for the County Executive Committee so that the committee could appreciate the proposed investment. The company was registered as Wasini Maritime investment. The chairperson invited the team leader Engineer …… to address the county executive committee.

MIN 1/CEC/01/2019 /2020 - PROPOSED INVESTMENT BY WASINI MARITIME AUTHORITY

The team leader expressed his gratitude for the opportunity to be granted an opportunity to explain the company's proposed investment venture. He informed the committee that Wasini Maritime Investment intended to establish a steel making plant at Shimoni by recycling ship scrape. He further informed the committee that this technology is currently in use in a number of countries. The company assured the committee that it intended to put in place adequate measures to protect and conserve the fragile marine ecosystem and had secured support of marine organizations in several European Union countries.

The company reported having discussed with ship owners around the world and wanted to make its operations 100% green and would be the first of its kind the world over. Negotiations had been started to acquire about three hundred acres of land around Kibuyuni in Shimoni area. The company also reported having further discussed with Kenya power and KETRACO and they were at an advanced stage in planning for provision of power to the proposed site of the investment.

The county executive committee raised a number of concerns in regard to the proposed investment. Members of the executive specifically wanted to know how what plans the investor had to ensure the proposed steel plant will sustain acquisition of raw materials if it was relying only on ship scrape. The committee wanted clarification regarding the procedure the investor was using to acquire the 300 acres of land. Further there was concern over environmental protection and whether the investor had conducted adequate risk analysis/

The investor assured the executive committee that detailed market analysis had been done, considering both the demand and availability. If need be the company would also use other raw materials from around the region.Regarding the acquisition of land, the investor had followed due process and that most of the land being acquired was near free of squatters.

The investor promised to work closely with the National Environmental Management Authority to address all environmental related matters.

The deputy governor applauded the effort by the investor to come forward and share their proposal to invest in the blue economy sector in the county. She advised the investor to work closely with relevant county departments. The chairman informed the investor that the county government had opened its doors for consultation. He assured the company that there was room for continued engagement to iron out any grey areas for the benefit of taking the project forward. He reiterated that the role of the county government will be to create an enabling environment for the investors to play their part. He encouraged them to take all the challenges as work in progress.

The chairperson directed that all newly appointed chief officers be issued with the letters designation as accounting officers. There being no other business, the meeting ended at 12.30 PM

Chairman.....**signature**.....

Secretary.....**signature**.....18/10/2019

Appendix 9: Minutes and attendance list of second stakeholder workshop involving key stakeholders

MINUTES OF KEY STAKEHOLDER MEETING HELD ON 8TH AUGUST 2019
VENUE: AMANI TIWI BEACH RESORT

Agenda

1. Stakeholders consultation to gather views, concerns and suggestions regarding the proposed Integrated "Green" Ship Recycling & Steel Making Facility.

2. A.O.B

LIST OF PARTICIPANTS
As attached
MIN 01/08/2019: OPENING PRAYERS
The meeting was called to order by the Team Leader of the EIA team Mr. Hezekiah Adala at 0951 hours. Opening prayers were then conducted by Mr. Suleiman S. Malumbo.

MIN/02/08/2019: REMARKS FROM THE EIA TEAM LEADER.

- Introduced the agenda of the day as a stakeholders consultation meeting to gather views, concerns and suggestions as part of an environmental impact assessment study for a proposed Integrated "Green" Ship Recycling & Steel Making Facility.
- Welcomed the representative of Wasini Maritime Limited Captain T. Khamis to give project presentation.

MIN 03/08/2019: REMARKS FROM WASINI MARITIME LIMITED BY CAPTAIN KHAMIS

- Gave a brief background of Wasini Maritime Limited, including when it was formed.
- Gave a presentation of the proposed project, first in a brief video and then on power point. He said Kibuyuni area was selected as being suitable for the proposed project because it is in line with the Government's plans to develop the Shimoni Port and that the ongoing Dongo-Kundu by-pass will open up the larger South Coast.
- Highlighted existing similar ship recycling facilities around the world and noted that this was the first of its kind in Africa.
- Explained the proposed project activities including the number of people to be employed and noted that feasibility studies have already been conducted.
- Informed stakeholders that as per the requirement of the environmental laws Wasini Maritime Limited is carrying out an environmental impact assessment for the proposed project and that the meeting was convened to consult the stakeholders on the proposed project.

- Encouraged all present to actively participate and present the views and concerns during the plenary session.
- Stated that the environmental impact assessment team would elaborate on the legal requirements of the proposed project as far as EIA is concerned, as well as approach to EIA.

MIN 04/10/17: PRESENTATION BY THE EIA TEAM

Hezekiah Adala - EIA Team Leader

- Explained that the Constitution of Kenya 2010 and Environmental Management and Coordination Act (EMCA) No. 8 of 1999 (Amended 2015) requires that planned projects must undergo Environmental Impact Assessment (EIA) before implementation.
- Stated that proposed Integrated "Green" Ship Recycling & Steel Making Facility is no exception and thus the reason why the company is undertaking the environmental impact assessment for the proposed project.
- Highlighted that regulation 17 of legal notice number 101 of 2003 provides for public participation during the EIA process. He urged all the people present to participate fully in the meeting by presenting their views, suggestions and concerns so these are taken into account during the EIA process.

Philip Manyi Omenge –Natural Resources Specialist

- Presented the progress made in the EIA study, explaining that detailed baseline survey studies has been going on and stakeholder consultation has also began;
- Noted that a consultation forum had already been held with the Executive Committee of the County Government of Kwale and that this was the second of a series of stakeholder meetings to be held.
- Stated that stakeholder engagement is the single most important item of the EIA process and that it is a requirement under various international treaties that Kenya has ratified, as well as the Constitution of Kenya 2010, the Environmental Management and Coordination Act, 1999 (Amended) 2015 and its subsidiary legislations particularly the Environmental (Impact Assessment and Audit) Regulations, 2003 (Amended) 2019.

MIN 04/08/2019: PLENARY SESSION

Onesmus K. Macharia - Member Kwale County Environment Committee and Member of the South Coast Residents Association

Noted that the proposed project was a good project but noted that its implementation should not infringe on the rights of other people. He raise the following reservations:-

1. Wanted to know how far the proposed project location is relative to the Kisite-Mpunguti Marine Reserve.

2. Wanted to know whether dredging will take place in the course of development of the proposed project.
3. Said that he was "reliably" informed that bush clearing and removal of overburden at the proposed project site was already ongoing. He wanted this clarified.
4. Wanted to know what solid and liquid waste will be generated from the proposed project and what measures are in place to handle such.
5. Noted that the number of people that would be employed in the project was huge and wanted to know how they will be accommodated.
6. Wanted to be briefed on the hiring policy in the proposed project is like.
7. Wanted the owner of the land where the proposed project is going to be set up is.
8. Wanted to know the funding magnitude for the proposed project and the source of the funding.
9. Was concerned that the proposed project would lead to congestion at the Shimoni jetty.
10. Raised concerns on the transportation of manufactured steel and the possibility of traffic snarl-ups along the Lunga Lunga-Likoni Road.

Martin Kiongora - Director Fisheries, Kwale County and Member of the Kwale County Environment Committee:

Mr. Kiogora wanted clarification on how "virgin" the area was as he noted there were a number of projects ongoing and some coming up in the area. He was concerned that the proposed project may conflict with other development projects in the area. He suggested that alternative land should be found for the proposed project.

Stellamaris Muthike - Kenya Maritime Authority:

Wanted clarification on the following issues

1. Where exactly is the proposed project located?
2. Is the channel able to accommodate the vessels to be handled during implementation of the proposed project?
3. Who owns the land where the proposed project will be put up?
4. She also wanted to know which shipping lines the proponent has signed MoUs with to supply them with the ship wrecks.
5. She also proposed that the EIA team ought to have a Marine Engineer in it.

Blessingtone C. Maghanga - Snr. Forester Kenya Forest Service:

Wanted clarification on the following issues.

1. Has the proponent already applied to the Kenya Forest Service to be allowed to use the land that is on mangroves?
2. Wanted to know how the sea weed farmers that are predominantly in Kibuyuni are going to be taken care of.
3. Noted that there was need for the proponent to continually engage with the County Government of Kwale in order to harmonize the proposed project with the Kwale County Spatial Development Plan and the Kwale County Integrated Development Plan.

Japheth Moroa - Coast Development Authority:

-Acknowledged that the proposed project area was prestine and that livelihoods in the area are depended on nature. He noted that the government through various agencies including the Coast Development Authority has initiated projects in the area that focus on preserving the ecosystem of the area and developing livelihoods from such ecosystems. He therefore wanted to know how impacts of the proposed project on such livelihoods shall be mitigated.

Arthur Musau Sua - Ministry of Lands:

Wanted to be furnished with information on the parcels of land to be covered by the proposed project, whether cadastal survey was done and by who and who sold the land to the proponent.

Mwanahawa Salim - Chair Person Kwale County Natural Resources Network:

Raised the following concerns:

1. Are there Kayas within the proposed project area?
2. Was concerned that NEMA Kwale County Office was not represented in this particular forum.

Ambrose Kiyade – Curator, National Museums of Kenya:

Noted that the larger Kibuyuni and Shimoni area was a conservation area with a number of protected sites, some of which are known to the public and some are not known. He noted for example that there is a cemetery nearby the proposed project site and that it is considered a protected area. He therefore emphasized the need for a heritage and archeological assessment in the EIA process.

Sofia Kabibi-WWF-Kenya:

Raised the following questions:

1. Are there plans to incorporate renewable energy within the proposed project?
2. Has the proponent developed a Corporate Social Responsibility policy?

Khamis Mwachili - Kwale County Natural Resources Network:

Wanted to know the funding magnitude and the source of the funding.

Jackline Mureithi - Environmental Officer Base Titanium:

Wanted to know whether there are graves within the proposed project site.

Wanje Ziro-County Director of Agriculture, Kwale:

Wanted to know the size of land acquired, what fraction would be put under the proposed project and plans for the remaining parcels if any.

James Mathenge - Kenya Wildlife Service:

Raised concerns that the proposed project activities may spill over to the Kisiti-Mpunguti Marine Reserve. He also wanted clarification on how benefits will be shared with the community. He then requested for a site visit by stakeholders.

C. Muthoni - South Coast Residents Association:

Wanted to know the ownership details of the proposed project land - is it purely private, or the government and other stakeholders have a stake in it?

Tonny Cheruiyot - Kenya Maritime Authority:

Mr. Cheruiyot wanted to know whether the proponent is already a member of the International Ship Recycling Association.

Philip Wanyama -National Museums of Kenya:

Noted with concern that archelogical studies had not been factored in as part of the baseline studies to be undertaken. He said he was convinced that archaeological studies and heritage assessments are necessary since the area is mostly a protected area and there might be sunken ships in the channel at Shimoni and he said that ship wrecks that have been sunken for years are also considered heritage.

MIN. 5/08/2019. RESPONSES FROM THE PROPONENT AND CONSULTANTS

Responses by Captain T. Khamis -Wasini Maritime Limited

On how far the proposed project location is relative to the Kisite-Mpunguti Marine Reserve - It is over 9km away.

1. **On whether dredging will take place in the course of development of the proposed project** - The channel depth is sufficient for vessels to be handled and therefore no dredging would take place.
2. **On whether the proponent is already on site** - Clarified that the proponent has not undertaken any project activity onsite but noted that there could be other developments on nearby parcels of land by other developers.
3. **On handling solid and liquid waste** - Clarified that the proposed design incorporates measures to handle all waste to be generated including waste oil and asbestos if any, in compliance with the Environmental Management and Coordination (Waste management) Regulations, 2006 and international requirements..
4. **On where staff will be accommodated**, he noted that about 30-40 acres have been acquired and shall be dedicated to developing housing for staff.
5. **On the hiring policy** - They are in the process of developing a hiring policy that would conform to the Kenya Laws.
6. **On owner of the project land** - The land belongs to Wasini Maritime Limited (the proponent).
7. **On the funding magnitude and the source of the funding** - The project is envisaged to cost about 250m USD and that it shall be financed by both local and international banks that the proponent has already approached and partly by the proponent themselves.

8. **On issues of congestion** at the Shimoni jetty - Vessels shall be handled from the dry land and that what will be in the water is a floating dock only and therefore they don't envisage congestion.
9. **On the parcels of land** to be put under the proposed project and whether cadastal survey was done - All details on the land shall be availed to relevant offices.
10. **On whether there are plans to incorporate renewable energy,** Captain Khamis noted they shall require at least 80 MW and that studies were underway on the suitable energy mix to be used and renewable energy was strongly considered.
11. **On whether the channel is able to handle such vessels** - Studies were done and the channel was found to be sufficient.
12. **On the ownership of the project -** The project is entirely privately owned, but it would operate in compliance with the Hong Kong Convention on Ship Recycling and cognisant of all the relevant agencies in Kenya including KMA, KPA, NEMA etc. The proponent has already signed MoUs with a number of shipping companies for recycling of their ships.
13. **On whether they have already joined the International Ship Recycling Association,** he said that they have not joined yet but would join prior to commencement of operations.

Responses by the EIA Team

1. **On reference to area as "virgin" land** - Mr. Adala noted that he meant that this is the first project of its nature in the area and that it is out of character with current undertakings.
2. **On how the sea weed farmers that are predominantly in Kibuyuni are going to be taken care of**, Mr. Omenge said that baseline studies are underway to establish the extent of the impact on the seaweed folk and appropriate mitigation measures shall be proposed.
3. **On how impacts of the project on general livelihoods shall be mitigated** Dr. Aungo noted that baseline studies conducted shall inform the appropriate measures that shall be proposed to mitigate against impacts on livelihoods.
4. **On the need for an archeological and heritage assessment**, Mr. Adala noted that this shall be informed by the extent of heritage and artefacts that will be encountered during preliminary assessments.
5. **On the involvement of National Environment Management Authority**, Kwale County Office on this forum, Mr. Adala noted that the office had been invited to the meeting.

MIN. 6/08/2019: CLOSING REMARKS

Remarks by the EIA Team Leader Mr. Hezekiah Adala

Thanked all participants for actively participating and urged stakeholders to be open in engaging with the proponent even in the future so as to make sure that the project is implemented in an environmental sustainable manner.

Remarks by the Wasini Maritime Limited Representative - Captain Khamis

Captain Khamis thanked all participants for actively participating and making the meeting a success. He noted that nearly 5m USD has already been spent in various studies including the feasibility study. He urged the stakeholders to be open to further engagements.

Remarks by Ms Saumu Beja, County Executive Committee Member - Environment and Natural Resources, County Government of Kwale

Commended Wasini Maritime Limited for their willingness to engage with stakeholders. She noted that, the proponent together with the team of the EIA Experts had already met the County Government including the Governor in a previous meeting and consulted them about the proposed project. She urged the proponent to continually engage with stakeholders and to involve the County Government Public Administration especially when organising *Wananchi* Barazas.

MIN 6/08/2019: ADJOURNMENT

There being no any other business, the meeting was adjourned at 13:07 hours with a word of prayer from Mr. Blessingtone Maghanga.

W

WASINI MARITIME LTD

ENVIRONMENTAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED INTEGRATED GREEN SHIP RECYCLING & STEEL MAKING FACILITY

KEY STAKEHOLDER MEETING

Date: 8th August 2019 **VENUE: AMANI TIWI BEACH RESORT**

ATTENDANCE REGISTER

	NAME	Designation (ORG)	Email Address	Signature
1	WILSON FREDRICK LUMBERA	Blue Economy S. Forum	wmerkwilson@gmail.com	[signature]
2	ARTHUR MUSAU SUA	Ministry of Land	suamamico@yahoo	[signature]
3	SULEIMAN S. MALUMBO	KWALE CEC	0722433406	[signature]
4	Japhet Mora	C.D.A. – MSA	japhetmora@gmail.com	[signature]
5	MOHAMED S. JUMADARI	KWALE – CEC	msjumadari@yahoo.com	[signature]
6	Mirarnahawa Salim	Chair Kenrd	mirarnahawa.salim@gmail.com	[signature]
7	ONESMUS K. MACHARIA	CEC – KWALE MEMBER	Kiarii.macharia2004@yahoo.com	[signature]
8	G Mohboh	SCA	mohboh179@gmail.com	[signature]
9	Wanje Ziro	County Director Agric	[illegible]@gmail.com	[signature]
10	JUSTUS AUNGO	SOCIOLOGIST (CONSULTANT)	consultant@[illegible].co.ke	[signature]
11	PHILIP OMENGE	EIA LEAD EXPERT	philipomenge@gmail.com	[signature]
12	Hezekiah Adala	Team Leader EIA	hezadala@gmail.com	[signature]
13	Jonnathan Yeri	EIA Team	jonathanyeri@gmail.com	[signature]
14	Tonny Cheruiyot	KMA	tcheruiyot@kma.go.ke	[signature]
15	Stellamaris Mutike	KMA	smutike@kma.go.ke	[signature]
16	NURU M. MBOGAH	C.O – ENV. CGK	nuru@kwale.go.ke	[signature]
17	Agnes Odhiro Otieno	CEC KWALE	agnesodhiro@gmail.com	[signature]
18	Kiogora Martin	Director – Fisheries	fisheries kwale@gmail.com	[signature]
19	JACKLINE W. MUREITHI	Base Titanium Env Officer	JMureithi@basetitanium.com	[signature]
20	Ambrose Kiraodo	Curator	ambrose.kigo@museums.or.ke	[signature]
21	PHILIP WANYAMA	ARCHAEOLOGIST	pmwanyama@ymail.com	[signature]
22	SAID JUMA	NMK		[signature]
23	James Mathenge	KWS	jmathenge@kws.go.ke	[signature]
24	Capt. T. Clemis	Wasini	tclemis@wasinimaritime.com	[signature]
25	Magdul M Aduan	Wasini	maduan@wasinimaritime.com	[signature]
26	SOFIA HABIBI	WWF-KE	shabibi@wwfkenya.org	[signature]
27	MAPENZI NGALA	WWF-KE	mngala@wwfkenya.org	[signature]
28	KHAMIS MWACHILI	KCNRN	kmwachili@gmail.com	[signature]
29	Mohamed Said	KN	mahomsie@yahoo.com	[signature]
30	Blessingtone C. Maghanga	Snr. Forester KFS	mblessingtone@yahoo.com	[signature]
31	SAMMY BETA	CECM – ENV'T	sammybeta@gmail.com	[signature]
32	GABRIEL K. MAJEKE	CEC Kubacece	gabriel.kubo@gmail.com	[signature]
33	LODONYO L. NGUSO	CEC KWALE	LODONYO.L.NGUSO	[signature]
34				
35				
36				
37				

Appendix 10 Minutes and attendance list of third stakeholder workshop involving the Kwale County Environmental Committee

MINUTES OF STAKEHOLDERS WORKSHOP WITH KWALE COUNTY ENVIRONMENTAL COMMITTEE
Date: 6TH SEPTEMBER 2019 VENUE: LEOPARD BEACH RESORT

Agenda

3. Stakeholders consultation to gather views, concerns and suggestions from County Environmental Committee members regarding the proposed Integrated Green Ship Recycling & Steel Making Facility.

4. A.O.B

LIST OF ATTENDEES
As attached
MIN 01/09/2019: OPENING OF MEETING
The meeting was called to order by the Master of Ceremonies Dr. Justus Aungo at 1010 hours. Opening prayers were then conducted by all members present.

MIN/02/09/2019: REMARKS FROM THE EIA TEAM LEADER.

Welcomed all present and briefly introduced the agenda of the day as a follow of the stakeholder meeting held on 8th of August 2019 to gather views, concerns and suggestions as part of an environmental impact assessment study for a proposed project.

Explained that the EIA was still ongoing and it is currently at the stakeholder consultation stage.

MIN 03/09/2019: REMARKS FROM WASINI MARITIME LIMITED BY CAPTAIN KHAMIS

- Thanked the County Government of Kwale and the County Executive Committee Member- Environment and Natural Resources in particular for their cooperation.
- Explained that Wasini Maritime Limited proposes to put up an Integrated "Green" Ship Recycling & Steel Making Facility at Kibuyuni area of Kwale County to cater for the global demand for a green ship recycling.
- Gave a presentation of the proposed project, first in a brief video and then on power point.

- Explained that Kibuyuni area was selected as being suitable for the proposed project because it is in line with the Government's plans to develop the Shimoni Port and that the ongoing Dongo-Kundu by-pass will open up the larger South Coast.
- Existing similar ship recycling facilities around the world are found in India, Pakistan, China, Bangladesh and Turkey and this is the first of its kind in Africa.
- The proposed project would be developed on 266 acres of land already acquired and would produce approximately 300,000 tonnes of steel per year.
- As per the requirement of the environmental laws Wasini Maritime Limited is carrying out an environmental impact assessment for the proposed project.
- This meeting was therefore convened to consult the committee on the proposed project and all present should actively participate and present the views.

MIN 04/09/2019: PRESENTATION BY THE EIA TEAM

PHILIP OMENGE-EIA LEAD EXPERT & NATURAL RESOURCES SPECIALIST

- Detailed baseline survey studies had commenced and were ongoing and stakeholder consultation had also began.
- Consultation forum had already been held with the County Government of Kwale and with Key Stakeholders at Amani Tiwi Beach Resort on the 8th of August 2019 and that this was the third of a series of stakeholder meetings to be held.
- Stakeholder engagement is the single most important item of the EIA process and that it is a requirement under various international treaties that Kenya has ratified. It is also a requirement under the Constitution of Kenya 2010 and under the Environmental Management and Coordination Act, 1999 (Amended) 2015 and its subsidiary legislations particularly the Environmental (Impact Assessment and Audit) Regulations, 2003 (Amended) 2019.
- He urged all present to participate fully by airing their issues, concerns and suggestions.

MIN 05/09/2019: OPEN PLENARY

Onesmus K. Macharia-Member Kwale County Environment Committee and Member of the South Coast Residents Association:

- Informed the meeting that he had given a brief on the proceedings of the previous meeting to members of the South Coast Residents Association and he said he noted sceptism among the members.
- Urged those present in this forum to share the information about the project with other members who have not had the opportunity to attend.
- Wanted the proponent to disclose the cost per acre at which they acquired the land. He was seconded by Binti Said Vyombo and Mr Juma Nzao on this.
- Requested that the committee be taken to the proposed project site so as to appreciate the existing conditions and make more informed decisions.

Mohammed Ali-Member of the Kwale County Environment Committee:

- Considering the project is to sit on a large parcel of land (266 acres), are there sufficient plans in place to compensate against affected individual and ecosystems?
- What are the waste management plans in place both onshore and offshore?
- What are the water and energy sources to the project? This point was reiterated by Mr Ali Chalala.

Mwanahawa Salim-Chair Person Kwale County Natural Resources Network:

- Appreciated that, having been part of the previous forum, the project is becoming more and more clearer to them.

Neema Suya:

- Wanted to know what the water sources to the project are and whether it will conflict the current uses of water by the members of the local community.
- Raised concerns on how the project will impact on the flora and fauna in the area and how impacts will be mitigated.

Mohammed Juma Dari:

How will impacts on air quality be mitigated?

Francis Kangumo:

Wanted the preliminary findings of the baseline studies to be shared with stakeholders even pending the conclusion of the EIA process.

Bintisaidi Vyombo:

Is there a livelihood plan for the community including the sea weed farmers?

George Wara:

Advised the proponent that a special use license would be required to enable them to use the belt of mangroves. He also wanted to know whether there are housing plans for the workers to be absorbed by the project.

Anthony Mwamunga:

Noted that, the scale of the proposed project, and other auxiliary business that would come up amounts to setting up a special economic zone in the area and that adequate plans on the same are required.

Ali M. Joto; Chief Officer-Roads, County Government of Kwale:

- Acknowledged that the idea of a "green" ship recycling facility is a good and one, but called for inclusion of a Green Star Expert in the EIA team so as to ensure that the idea is backed up by expert opinion.
- Raised concerns that there are no clear timelines on when the EIA shall be concluded and ground breaking done.
- Called for a comprehensive waste management plan to be shared with the stakeholders so that it can be reviewed.

Juma Nzao Chief Officer-Public Service and Administration,

Urged the EIA team to carry out a very good EIA process involving all the stakeholders including key opinion leaders from around the proposed project area.

Hassan Chuphi-Chief Officer-Trade,

Are there plans to train youth from around the proposed project area on maritime matters?

MIN. 6/09/2019. RESPONSES

Responses by Captain Khamis-Wasini Maritime Limited Representative

1. **On stakeholders site Visit:** Captain Khamis said that arrangements shall be put in place to have stakeholders visit the site.
2. **On handling solid and liquid waste**: The proposed design incorporates measures to handle all waste including waste oil and asbestos if any in compliance to the Environmental Management and Coordination (Waste management) Regulations, 2006 and international requirements..

3. **On where staff will be accommodated**: About 30-40 acres have been acquired and shall be dedicated to developing housing for staff.
4. **On issues of congestion at the Shimoni jetty**: Vessels shall be handled from the dry land and what will be in the water is a floating dock only and therefore no congestion is envisaged.
5. **On the acquisition process of the parcels of land:** All details on the land shall be availed to relevant offices.
6. **On whether there are plans to incorporate renewable energy:** Large amount of energy shall be used hence studies were underway on the suitable energy mix to be used and renewable energy was strongly considered.

Responses by the EIA Team

6. **On how the sea weed farmers that are predominantly in Kibuyuni are going to be taken care of**: Mr. Omenge clarified that baseline studies are underway to establish the extent of the impact of the seaweed folk and appropriate mitigation measures shall be proposed.
7. **On how impacts of the project on general livelihoods shall be mitigated** Dr. Aungo noted that baseline studies conducted shall inform the appropriate measures that shall be proposed to mitigate against impacts on livelihoods.
8. **On the Impacts of the project on air quality and the ecosystems,** Mr. Omenge said that the baseline conditions had been documented and reports are being compiled. This he noted will inform what kind of mitigation measures shall be proposed.

MIN 7/09/2019: CLOSING REMARKS

Remarks by the EIA Team Leader Mr. Hezekiah Adala

- Thanked all participants for actively participating and urged stakeholders to be open to engaging with the proponent even in the future so as to make sure that the project is implemented in an environmental sustainable manner.
- Assured the stakeholders that this was just one of many stakeholder engagement meetings yet to come.

Remarks by the Wasini Maritime Limited Representative-Captain Khamis

Thanked all participants for actively participating and making the meeting a success and urged the stakeholders to be open to further engagements.

Remarks by the Chief Officer, Environment and Natural Resources, County Government of Kwale

Commended Wasini Maritime Limited for their willingness to engage with stakeholders.

Noted that as a department, they are committed to make sure that the people of Kwale are well represented and urged the proponent and the EIA team to continuously have on board members of the Kwale County Environment Committee on specific sectors of the EIA that touch on their specialties.

Proposed seven areas of engagement and improvement between the department and the proponent as follows:-

1. That, the department should be engaged throughout the EIA process and the EIA shared with the department before it is submitted to NEMA.
2. The department to be privy to all land agreements between the proponent and members of the community.
3. All plans by the proponent to be shared with the department for synchronization with the department's plans and policies.
4. The department is in the process of documenting a waste management policy and that proponent should look out for it.
5. All social safeguards should be agreeable with the department.
6. The development should have a sustainability plan and shared with the department.
7. That the proponent should bring on board an expert who has previously worked in the ship recycling field.

MIN 8/09/2019: ADJOURNMENT

There being no any other business, the meeting was adjourned at 12:30 hours by a word of prayer from Maqbul M. Adnan.

WASINI MARITIME LTD

ENVIRONMENTAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED INTEGRATED GREEN SHIP RECYCLING & STEEL MAKING FACILITY

FOCUS GROUP DISCUSSION WITH COUNTY ENVIRONMENT COMMITTEE

Date: 6th September 2019 VENUE: LEOPARD BEACH HOTEL

	NAME	Designation	Tel. No	Signature
1	George Wara	E/C - KFS	0714239194	[signature]
2	Bintisaidi Vyombo	County Coordinator CDA	0721226911	[signature]
3	MAPENZI NGALA	WWF-INTERN	07274615??	[signature]
4	NEEMA SUYA		0790939932	[signature]
5	FRANCIS RANGUNU	CDF-Livestock	0722865117	[signature]
6	ALI CHALALA	CWD	0722659149	[signature]
7	Mwanahawa Salim	CEC Member	0723453911	[signature]
8	MOHAMED S. JUMABARI	CEC-WAUA	0712047283	[signature]
9	MOHAMED ALI	CEC	0723661989	[signature]
10	ONESMUS K. MACHARIA	CEC MEMB	0720731073	[signature]
11	AGNES ODIRA OTIENO	CEC Member	0722960616	[signature]
12	MWANAHUBA YETA	CEC MEMBER	0716760464	[signature]
13	SULEIMAN MALUMBO	CEC MEMBER	0722433406	[signature]
14	Mwanasha Mwadzuda	CEC-Member	0714960601	[signature]
15	Juma Nzao	Chief Officer PSA	0413 797766	[signature]
16	Hassan Chizondi	Chief Officer Trade	0722-744234	[signature]
17	Ali M. Foto	Chief officer Road	0723556679	[signature]
18	Nuru Mohammed	Chief Officer Env	0757555656	[signature]
19	ANTHONY MWAMUNGA	Chief Tourism	0721160310	[signature]
20	MULEI S. NGUI	Forest Officer	0715688990	[signature]
21	GABRIEL K MABOLE	CEC	0713149986	[signature]
22	LODONYO L NAUSO	CEC	07032040??	[signature]
23	Dr Justus Aunda	Consultant	0712662323	[signature]
24	Hezekiah Adala	Consultant	0722 752646	[signature]
25	Capt Kahindi	Wasini	0722 45??	[signature]
26	Maqbul M Adnan	Wasini	0728118011	[signature]
27	Philip Mang Onkaye	EIA Lead Expert	0722493777	[signature]
28	Jonathan Keri	EIA Expert	0719579828	[signature]
29				

Appendix 11: Minutes and Attendance Register of the 1st PUBLIC Meeting

MINUTES OF THE FIRST PUBLIC BARAZA, HELD AT KIBUYUNI AT THE FIKIRINI MZIDA CBO HALL ON THE 26TH SEPTEMBER 2019

MIN 09/09/2019: OPENING PRAYERS

The meeting was called to order by the Mzizima Chairman Mr. Kassim Zengwa at 1128 hours. Opening prayers were then conducted by Mr. Jabir Bakari.

MIN/10/09/2019: REMARKS FROM THE EIA TEAM LEADER.

Welcomed all present and introduced the agenda of the day as a public baraza to gather views of stakeholders as part of an environmental impact assessment study for the proposed Integrated "Green" Ship Recycling & Steel Making Facility.

Handed over to the Area Chief, Mr. Rashid Kassim Mwinyihaji who welcomed the Deputy County Commissioner - Lunga Lunga Sub-County, Mr. Josephat Biwott to make his opening remarks.

MIN 11/09/2019: REMARKS FROM THE DEPUTY COUNTY COMMISSIONER-LUNGA LUNGA SUB-COUNTY, MR. JOSPHAT BIWOTT

- Acknowledged that Wasini Maritime Limited is a private investor who wants to put up a project within the Kibuyuni area.
- Noted that this public baraza was a requirement under the law as part of an ongoing environmental impact assessment.
- Urged members of the community to ask as many questions as possible and give considered views about the project, saying that the project may have a lot of benefits to them.
- Assured members of the community that such a project has to adhere to the law and standards set by the government prior to it being set up and in the course of its operations.
- Urged members of the community to embrace education, put their papers right for opportunities opening up in the area such as the proposed project.

MIN 12/09/2019: REMARKS FROM THE SUB-COUNTY ADMINISTRATOR-LUNGA LUNGA SUB-COUNTY, MS. RIZIKI MWASOZA

- Noted that Kwale as a County had very limited industries and that this was an opportunity for the County to add onto its limited number of industries.
- Acknowledged that the proposed project was in line with the Jubilee Government's big four agenda of food security, affordable housing, manufacturing, and affordable healthcare for all.
- Urged members of the community to prepare adequately to be absorbed in opportunities to come up as a result of the proposed project. She called for those present to contribute freely.

MIN 13/09/2019: OPEN PLENARY

Teddy Bakari Usi and Juma Bamira Juma -Kibuyuni Residents:

- Wanted to know what the negative impacts of the project and what measures are proposed to mitigate them.
- Expressed fears that the project may displace some members of the community and that clear compensation measures should be put in place.

Mohammed Hassan Gasho - Kibuyuni Resident and Chair Kibuyuni BMU
Was concerned that the proposed project is bound to have negative impacts on the marine life and specifically to the sea weed farmers in the area and wanted to know how such impacts will be prevented and/or mitigated.

Sub-County Administrator, Lunga Lunga Sub-County, Ms. Riziki Mwasoza:

- Will the project involve dredging, and if yes, will there be impacts on the seaweed farms and how shall such impacts be mitigated?
- How will resulting waste water be managed, considering that the project is next to the sea.
- How will emissions and excessive noise be prevented and/or managed?

Kiruwa Mohammed-Kibuyuni Resident: Second Ms. Mwasoza on questioning how impacts on the seaweed farms will be mitigated.

Omar Sudi-Kibuyuni Resident and a Fisherman:
There are fish aggregating devices offshore as well as areas reserved as Community Conservation areas and as the fisher community they fear the proposed project may impact on them negatively. He wanted to know measures in place to mitigate against any negative impacts on the fishermen.

Maulid Omar Kidide - Kibuyuni Resident and a Fisherman: Is there a ship marshal plan and how will it not conflict with the small boats used by the fishermen? Will the project involve dredging, and if yes, will there be impacts on the seaweed farms and how shall such impacts be mitigated?

Fatuma Mohammed - Kibuyuni Resident: The proponents of the project should ensure that the project does not bring health complications to women which may bring complications even at birth.

Saumu Bakari - Kibuyuni Resident: The project should employ the latest technology to ensure that operations of the project do not negatively affect members of the community.

Mariam Mohammed - Kibuyuni Resident: The project may affect the sea life, what they rely on for their day to day life.

Juma Safari-Kibuyuni Resident:-What efforts is the County Government making to ensure that by the time of commencement of this proposed project the County can produce enough manpower.

Hassan Ali Jabir-Kibuyuni Resident and former Councillor: - Mr Jabir said that what is important is to ensure that negative impacts likely to be caused by the project are adequately mitigated and that positive ones are magnified.

Abdillahi Ng'anzi-Kibuyuni Resident: There should be a proper investor-community relations plan.

Abdul Mwinyihamisi-Kibuyuni Resident: Urged members of the community to make good use of the technical training institutes and vocational training institutes in the area in preparation for the project. He noted that the government has subsidized school fees in these institutions and also gives loans to students through the Higher Education Loans Board.

MIN. 14/09/2019. RESPONSES TO QUESTIONS

9. **On how the sea weed farmers that are predominantly in Kibuyuni are going to be taken care of** - Baseline studies are underway to establish the extent of the impact of the seaweed folk. Focused Group Discussions are going to be held with various affected and interested groups including the seaweed farmers and appropriate mitigation measures shall be proposed. – *P. Omenge, Natural Resources Specialist, EIA Team*

10. **On the company and community relations and whether the project is going to displace people and compensation plans on the same -** Baseline studies currently underway shall inform the appropriate policy on investor-community relations. However the land on which the project is to be set up is vacant and hence to displacement of people. – *Dr. J. Aungo Sociologist, EIA Team*

11. **On the Impacts of the project on air quality and Noise,** Baseline conditions had been documented and reports are being compiled. This he noted will inform what kind of mitigation measures shall be proposed putting into consideration the relevant regulations and standards set by these regulations. – *P. Omenge, Natural Resources Specialist, EIA Team*

12. On the County Government's plans on education, Ms. Riziki said that the County has a bursary programme that is run by the ward bursary committee, urging the community to take advantage of this and pursue important courses.

MIN 15/09/2019: CLOSING REMARKS

Remarks by the EIA Team Leader Mr. Hezekiah Adala

In his closing remarks, Mr. Adala thanked all participants for actively participating. He said once data collection was completed, his team will compile an environmental impact assessment study report which will be submitted to the National Environment Management Authority. He said that the Authority will call for comments on the report from the public and he urged the residents once they read the notices on the Kenya Gazette and the local daily papers to access the report, read it and present their comments to the Authority.

Remarks by Davis Mwazinga-Constituency Manager, Lunga Lunga Constituency

Mr. Davis Mwazinga thanked all participants for actively participating and making the meeting a success. He said that once the report is completed and submitted to NEMA, the community should discuss the findings of the report, put across comments and submit them to NEMA. He told members of the community that they should embrace the challenge of taking their children to school to acquire relevant skills.

Remarks by Josephat Biwott - Deputy County Commissioner; Lunga Lunga Sub-County

The Deputy County Commissioner urged members of the community to divorce politics from development projects such as the proposed one, posing that the government cannot allow impunity in development. He urged those present to share with friends and relatives the discussions of this meeting.

MIN 16/09/2019: ADJOURNMENT

There being no any other business, the meeting was adjourned at 14:23 hours by a word of prayer from Mr. Jabir Mohammed.

WASINI MARITIME LTD

ESIA STUDY FOR THE PROPOSED INTEGRATED GREEN SHIP RECYCLING & STEEL MAKING FACILITY

PUBLIC STAKEHOLDER MEETING AT KIBUYUNI

Date: 26th September 2019 **VENUE:** FIKIRINI MZIDA CBO HALL

	NAME	ID No	Signature
1	JOSPHAT [illegible]	11721790	
2	RIZIKI MWASOZA	10769156	
3	YUSNI R'MNYETTOH	9395769	
4	KUNGA MULI	11426291	
5	ELIAS KIPTOO	9329870	
6	SHARIF MOHAMED AHMED	5423637	
7	RASHID KASSIM MWAYMAHAJI	0757715661	
8	ABDALLA KARIM	23190121	
9	DAVIS MWAZIMAYE	23169588	
10	Abdul Mwinyihamisi	27727061	
11	MAZERA TOMA	27341135	
12	HASSAN BAKARI	32271451	
13	MOHAMED KASSIM	27341391	
14	KIRWANA HASSAN	27138385	
15	ABDALLA SULEIMAN	27125115	
16	CHAKURE OMARI	22385195	XXXX
17	MWAJUMBE TWAHIRI		XXXX
18	ABDALLA RASHID SHEE	32294242	
19	MWANAKOMBO NGARE		
20	JIMA MOHAMED SHEE	4616602	
21	Athumani Mwasupi	23386389	
22	MWAKULIWA MAKULU	23966318	
23	MARINDA ALI		
24	MWANAULU BAKARI		XXXX
25	Esha Hamisi	35261660	
26	FATUMA HAMISI	29607954	FHM
27	SIMON MKALA	32920751	
28	MOHAMED SHEE	11713162	
29	HAMADI NASSORO	4616527	
30	NASSORO MWACHOMBO	1162206	
31	HASSAN ALI JABIRI	2466599	
32	MAJANI FRANSIC	32121532	
33	ABDALLA BAKARI	25726026	

	NAME	ID No	Signature
1.	JENIFER JULIUS MBURU	85383388	[signature]
2.	Ali Bakari Juma	20411473	[signature]
3.	IIMA SALIM SHEE		[signature]
4	SHEE ZUBAKARI	93947 07	[signature]
5	Jonnathan Peri	27922743	[signature]
6	BAKARI NASSORO	4619918	[signature]
7	OMARI MZEE	0797526287	[signature]
8	HASSAN ALI KASSIMU	14437774	[signature]
9	SHEE MKULU	27162329	[signature]
10	Omari SAFARI RASHID	4612121	[signature]
11	KIBUWA MOH'D MWINYIHAJI	26016187	[signature]
12	OMARI BAKARI DIWAN	9633482	[signature]
13	KIRUA SUBIRA KIRUA	32296223	[signature]
14	Mohamed Abdalla	0790676218	[signature]
15	IDD ALI	0728 177313	[signature]
16	Salim Tuwalizi	8419930	StM
17	Bakari Mbega	14619668	[signature]
18	Abdala Bausari	26001254	Bausr.
19	MKULU Mohammed	34245094	[signature]
20	Mwalimu Hassan	23201903	[signature]
27	MAZOMBA NGALA	6726382	[signature]
28	Mzee Ali Dunga	27098562	[signature]
29	Bakari Kanuni	23373707	[signature]
30	JABIRI MOHAMMED	14437815	[signature]
31	mohammed Shee	34245996	[signature]
32	Shee Nassoro Ali	23378963	[signature]
33	Hamad Komombo	27121805	[signature]
34	JUMA SAFARI	84211/09	[signature]
35	ZAINA BAKARI BAMIRO	31277556	[signature]
36	Shee Rashid Shee		[signature]
	Hassan Nassoro Abdalla	0708428898	H
	Omari Shee	11783122	[signature]
	PHILIP MANYI OMENGE	12530095	[signature]
	[signature]	1168887	[signature]
	KHAMIS MWATONGO	21097817	[signature]
	RASHID K. MWINYIHAJI (SNR CHIEF, PONGWE KIDIMU LOCATION)	10769708	[signature]
	Hezekiah Adala	8781318	[signature]

NAME	ID No	Signature
Mwanamisi Darusi	26243027	
Mwajumbe Umbwega		
ANISA ALI MWANJIA	29403998	
ASHA HEMED SETU	27120923	
AMINA MOHAMED		
MWANAISHA BAKARI		
BAHA HASSAN SHEE		
MWANATUMU MOHAMED		
Mwanakombo Salimu	232012287654	
Time Mwalimu Jabiri	23201132	
Fatuma Mohd Diwani		
Mwalimbo Bakari Tsumo		
Fatuma Mohd Usi	4616370	
Tima Mkulu Shee		
Mwanasha Abdallah A		
Mwanasha Abdalla		
Baya Shee		
TIMA MGALU		
Saumu Bakari		
Tel Bakari Usi		
Kassimu Bamiro Jabiri		
MATANO MOHAMED		
DARUSI KASSIM HAMISI		
mohammed mnyeto mwakosi	25726042	
GOSHI IDI	0720502040	
Ali Abdalla Kassimu	27385141	
Kombo		
JUMA M. BAMIRU	11772456	
Tima Omari	31376330	
Swaleh Abdalla Mkuu	20379579	
Mariam Supi		
Juma Mohamed Tandi	11773132	
Marinda Mohd darusi		
Masika Alawi		
Jabiri bakari		
Saumu Bakari SHEE	3137685	
Bakari Bamiro Jabiri	8434511	
Masudi Hassani Jasho	33107149	
Kassim Shee Kanuni	4516333	

NAME	ID No	Signature
Salim mwagombe Shee	2157671Y	[signature]
Ibb. mashudi	~~[illegible]~~	[signature]
Ibon Ali	1773921	[signature]
Alawi Masoud Supi	13418776	[signature]
Shee Mohamed Kassim	8419970	[signature]
Bakari [illegible]	1165695	[signature]
Shee Mohamed Mwadama	28767540	[signature]
Malumuge Salim	245678	[signature]
Bakari Shee	4617013	[signature]
Shee Kassim Mwinyi		[signature]
Aslan Mwadondo	13418790	[signature]
Mwatonga Mwinyiau		[signature]
Dari Mamadi		
FAWSA ABDALLA NGAZI		
Rashid Kassim	27132129	[signature]
Hassani Mrai	31092688	[signature]
Kidila Bego	29068283	[signature]
Juma Chogoh	3601149	[signature]
Ali Athuman	—	
Samini Salim Mwanauzeni	21576174	[signature]
Mpweke Sobo	31705578	[signature]
Mwanashaka Kibanda	11244940	[signature]
Mwanauw Abdalla		
Mwanasiti Darusi		
Mayasa Ali		
~~[illegible]~~		
Tima Kibwana		
Chamwaka Juma Darusi		
Rehema Bakari Zumo	~~[illegible]~~ 27121120	
Mwajumbe Moh'd Shee		
Tima Sango		
Ali B. Suleiman	1177318	[signature]
Kassim Hamisi	4616220	[signature]
Hamisi Mwenyi	8372918	[signature]
Gati Nyamari		
Bakari Nassoro	0412843489	[signature]
Omari Bakari	0416841335	[signature]
Bakari Abdalla	21119717	[signature]
Nassoro Mkulu		[signature]
Mohamed	Ali	[signature]

Appendix 12: Minutes and Attendance Register of the 2nd PUBLIC Meeting

MINUTES OF THE SECOND PUBLIC BARAZA, HELD AT SHIMONI AT THE SHIMONI SLAVE CAVE HOTEL ON THE 26TH SEPTEMBER 2019

Agenda

5. Stakeholders consultation to gather views, concerns and suggestions regarding the proposed Integrated "Green" Ship Recycling & Steel Making Facility.

6. A.O.B

LIST OF ATTENDEES
As attached
MIN 17/09/2019: OPENING PRAYERS
The meeting was called to order by the Area Assistant Chief-Shimoni Sub-Location, Adini Miyingo Mgeni at 1511 hours. Opening prayers were then conducted by Mr. Mahabub Abdul.

A self-introduction of the environmental impact assessment team members then followed.

MIN/18/09/2019: REMARKS FROM THE EIA TEAM LEADER.

In his opening remarks, the EIA Team Leader first apologised for arriving late. He welcomed all present. He then went further to briefly introduce the agenda of the day as a public baraza to gather views, concerns and suggestions as part of an environmental impact assessment study for a proposed Integrated "Green" Ship Recycling & Steel Making Facility. The Team Leader then handed over to the Area Assistant Chief who welcomed the Deputy County Commissioner-Lunga Lunga Sub-County, Mr. Josephat Biwott to make his opening remarks.

MIN 19/09/2019: REMARKS FROM THE DEPUTY COUNTY COMMISSIONER-LUNGA LUNGA SUB-COUNTY, MR. JOSPHAT BIWOTT

In his opening remarks, the Deputy County Commissioner acknowledged that Wasini Maritime Limited is a private investor who wants to put up a project within Kibuyuni area. He said that this public baraza was a requirement under the law as part of an ongoing environmental impact assessment. He urged members of the community to ask as many questions as possible and give considered views about the project, saying that the project may have a lot of benefits to them. He assured members of the community that such a project, has to adhere to the law and standards set by the government prior to it being set up and in the course of its operations. He told the members of the community to embrace education, put their papers right for opportunities opening up in the

area such as the proposed project. He said that new roads being opened up in the area, will attract even more developments and hence more opportunities will open up.

MIN 20/09/2019: REMARKS FROM DAVIS MWAZINGA-CONSTITUENCY MANAGER, LUNGA LUNGA CONSTITUENCY

Mr. Davis Mwazinga asked all attendants to actively participate in the baraza. He asked members of the community to take their children to school to acquire relevant skills, saying that they should not shy away from asking for help from government offices in educating their children.

MIN 21/09/2019: OPEN PLENARY

Dr. Justus Aungo, opening the open plenary, called for tolerance of the various views by the participants in the meeting.

Abdul Amir-Shimoni Resident: Mr. Amir noted that most of the people from the Shimoni area are marginalized and vulnerable, and should be therefore be given preferential treatment when it comes to job opportunities.

Amini Shebwan-Wasini Resident: Mr. Wasini raised the following issues

i. Why is Wasini Maritime Limited using the name Wasini" without consulting the Wasini residents?
ii. Why is there not a NEMA officer in the meeting to explain to us the negative environmental impacts of the project?

Mgeni Menza-Shimoni Resident: Mr. Mgeni wanted to know the waste management measures in place.

Mbwana Mohamed Mbwana-Shimoni Resident: Mr Mbwana raised the following issues:-

i. Will there be impacts on the aquatic ecosystem and seaweed farms and how shall such impacts be mitigated?

Richard Odak-Shimoni Resident: How is the project going to benefit the elderly in the community?

Asha Mohammed-Wasini Resident: How is the project going to benefit the youth in the community?

MIN. 22/09/2019. RESPONSES TO SOME OF THE QUESTIONS

On the marginalization and vulnerability of the Community, Dr. Aungo the baseline report will capture this and appropriate measures will be recommended.

On why Wasini Maritime Limited is using the name Wasini" without consulting the Wasini residents, Eng. Adala said that any conflict on the same should be followed up with the Kenya Intellectual Property Authority..

On why NEMA is not presented in the forum, Eng. Adala said that NEMA was invited by form of letter in previous stakeholder engagements as part of this EIA. He said this particular baraza was advertised in the local dailies and NEMA as the regulatory Authority is at liberty to/not to attend public barazas.

On waste management measures in place, Mr. Omenge said that appropriate waste management measures shall be proposed in the environmental impact assessment report as per the Environmental Management (Waste Management) Regulations, 2006 and the Environmental Management (Water Quality) Regulations, 2006.

On the impacts on the aquatic ecosystem and seaweed farms and how shall such impacts be mitigated, Mr. Omenge said that baseline studies are underway to establish the extent of the impact of the seaweed folk. Further to this, Mr. Omenge said that focused group discussions are going to be held with various affected and interested groups including the seaweed farmers and appropriate mitigation measures shall be proposed.

MIN 23/09/2019: CLOSING REMARKS

Remarks by the EIA Team Leader Mr. Hezekiah Adala

In his closing remarks, Mr. Adala thanked all participants for actively participating. He said once data collection was completed, his team will compile an environmental impact assessment study report which will be submitted to the National Environment Management Authority. He said that the Authority will call for comments on the report from the public and he urged the residents once they read the notices on the Kenya Gazette and the local daily papers to access the report, read it and present their comments to the Authority.

Remarks by Josephat Biwott-Deputy County Commissioner; Lunga Lunga Sub-County

The Deputy County Commissioner urged members of the community to divorce politics from development projects such as the proposed one, posing that the government cannot allow impunity in development. He urged those present to share with friends and relatives the discussions of this meeting.

He said that in collaboration with the County government, they shall be sponsoring youth from the area to study in local polytechnics and the Lunga Lunga Technical Training Institute. He asked the ward administrator and the area assistant chief to come up with a list of the first 50 youth to benefit from the arrangement.

MIN 24/09/2019: ADJOURNMENT

There being no any other business, the meeting was adjourned at 16:44 hours by a word of prayer from Mr. Mahabub Abdul.

WASINI MARITIME LTD

ESIA STUDY FOR THE PROPOSED INTEGRATED GREEN SHIP RECYCLING & STEEL MAKING FACILITY

PUBLIC STAKEHOLDER MEETING AT SHIMONI

Date: 26th September 2019 **VENUE: SLAVES CAVE HOTEL**

	NAME	ID No	Signature
1	ADINI MWONGO MGENI	9875267	
2	JUMA MWAZIRO	23489892	
3	MBWANA USAMA NAHODHA	27380667	
4	HASSAN KOPA	22743162	
5	BARSLIM YUSUF	30092829	
6	JUMA MBWAMBOJE [illegible]	37610650	
7	ZUHURA SALIM MWAMANGU	24174080	
8	AHMED NASSER	29404555	
9	Juma Hassan	33723728	
10	ALI M. BANDA	32303016	
11	ELIAS KIPTOO	9329870	
12	JOSPHAT BIWOTT	11731790	
13	KUNGA MULI	11426291	
14	SHARIF NEPAD AHMED	[illegible]	
15	PHILIP OMENGE	12530095	
16	SAID SHEE M.	10577612	
17	KHAKIM A. MWATONDO	21097817	
18	Hezekiah Adala	8781318	
19	[illegible]	11688887	
20			
21			
22			
	ABDUSWAMAD AMIR	11626011	
	Maem Menzah	32117916	
	Hassan Omar	29581323	
	ABDILLAHI MOHASA KOPA	259346641	
	OMARI MWEMANGA	35357319	
	ATHUMAN M. MBWANA	29611542	
	William Otieno	8995430	
	Richard Opar	13186138	
	Samuel Mwangi	11366357	
	Mutinda Kenama	5598198	

	NAME	ID No	Signature
1	HUSSEIN SALIM	10505941	[illegible]
2	SALIM OMAR, CHONGA	07[illegible]360	[illegible]
3	Rashidi Abdhallah	11600829	[illegible]
4	Sammand Simiyu	17839189	[illegible]
5	WILSON MWAMBURI	9318326	[illegible]
(6)	ALICE W. MAIMBA	13728866	[illegible]
7	SWALEH JUMA	37070190	[illegible]
8	Khamis Kitime	13630896	[illegible]
9.	KAME BADAM		[illegible]
10	HASHIM HAMISI	23902735	[illegible]
11	MOHAMED NDAKU	23371145	[illegible]
12	Omari ALI		[illegible]
13	FATUMA .M. MBWANA	34307133	[illegible]
14	Adrian Richard	26957424	[illegible]
15	Juma Hassan	31606675	[illegible]
17	Isa. Mohammed	30770447	[illegible]
18	Aslam Mohammed	6745599	[illegible]
19	Rashid J. Hamisi	26269057	[illegible]
20	Hassan Bakari	32271481	[illegible]
21	ALI MZAWA	25473646	[illegible]
22	Tombo Said	27614561	[illegible]
23	Sulemana Hussein	32007536	[illegible]
20	ABDALLAH MWAEGO.	33394716	[illegible]
25	Christopher Murithi Njeru	20039631	[illegible]
26	ABDALLA SULEIMAN [illegible]	21125115	[illegible]
27	HAMADI SULEIMAN	09411823	[illegible]
28	NDORO MASUD	28466443	[illegible]
29	MWABUZI SIMBA	8434950	[illegible]
30	MAHABUB ABDU	9394766	[illegible]

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2	ESHA MOHAMED	35316247	
3	HAMISI MANGALE	33103930	
4	Jonnathan Yeri	27922743	
5	MBWANA MOHAMED	28879987	
6	MWINYI KISHOMANGA	20969121	
7	ABDU DULABDALA	0772043888	
8	HASSAN J. SALIM	0705858285	
9	YUSUF HASSAN	0748291017	
10	BAKARI MOHAMED	0790594413	
11	JUMA NASSORO	0721212699	
12	OMAR RASHID	0748790246	
13	MASOUD LALI	0726059843	
14	MWANAMIKAZI ALI	0705296042	
15	FATUMA ROPA	0711611045	
16	Abdallah Khatibu	0713075950	
17	HASSAN ALI	~~07~~ 31499983	
18	SHABAN ALFANI	~~07~~ 27552989	
19	Dominic MUCOKI	22705824	
20	TUMA NIWARARU	33684976	
21	HABIBU OMARI	27463678	
22	MASUD SALIM	23396250	
23	NDALU MSHEE	46161556	
24	Amini Shabani	23375164	
25	Mohammed Pandu	23202112	
26	BOHOA ALLAN	2554112	
27	MAendeleo Maicemic	12490352	
28	MeJumaa omari	27103443	
29	Salima omari	0700198961	
30	Madoua Mohamed	27513920	

Appendix 13: Minutes and Attendance Register of the 3rd Public Meeting

MINUTES OF THE THIRD PUBLIC BARAZA, HELD AT MAJORENI AT THE MWAZO CBO HALL ON THE 1ST 2019

Agenda

7. Stakeholders consultation to gather views, concerns and suggestions regarding the proposed Integrated "Green" Ship Recycling & Steel Making Facility.

8. A.O.B

LIST OF ATTENDEES
As attached
MIN 01/10/2019: OPENING PRAYERS
The meeting was called to order by the Majoreni Chairman Mr. Masudi Mwalimu at 1057 hours. Opening prayers were then conducted by Mr. Said Mwadani.

A self-introduction of the environmental impact assessment team members then followed.

MIN 02/10/2019: REMARKS FROM THE MAJORENI SNR. CHAIRMAN MR. MASUDI MWALIMU.

In his opening remarks, the Majoreni Chairman Mr. Masudi Mwalimu asked members of the community to feel free and ask all the questions they have about the project and pass the message to be discussed here to those who have not had the opportunity to attend.

MIN 03/10/2019: REMARKS FROM THE MWAZO CBO CHAIRMAN MR. SALIM ALI KITOA.

In his opening remarks, Mr. Kitoa called for calmness and tolerance ahead of the discussions.

MIN 04/10/2019: REMARKS FROM THE ASSISTANT CHIEF MR. OMAR M. BANDA.

In his opening remarks, the assistant chief welcomed all present and called for calmness and tolerance ahead of the discussions. He issued apologized from the Deputy County Commissioner, saying that he was held up somewhere else on official duty. He called on members of the community to participate freely.

MIN 04/10/2019: REMARKS FROM THE EIA TEAM-DR JUSTUS AUNGO.

In his opening remarks, the Sociologist in the EIA Team first apologised for arriving late. He welcomed all present. He then went further to briefly introduce the agenda of the day as a public

baraza to gather views, concerns and suggestions as part of an environmental impact assessment study for a proposed Integrated "Green" Ship Recycling & Steel Making Facility. He said this was the third public baraza. The previous two had been conducted in Kibuyuni and Shimoni.

MIN 05/10/2019: OPEN PLENARY

Dr. Justus Aungo, opening the open plenary, called for tolerance of the various views by the participants in the meeting.

Samuel Musau-Majoreni Resident: How will heat from the factory be managed so that it does not affect neighbours?

Salim Kitoa-Mwazo CBO Chair and Majoreni Resident: How are impacts on marine life be prevented and/or managed? Wasini Maritime Limited should consider building schools for the Majoreni Community.

Omar M. Banda; Assistant Chief-Majoreni Sub-Location: What indirect employment opportunities are likely to emanate from the proposed project?

Hassan Matano Nyuni-Village Administrator-Majoreni Village: Mr. Nyuni raised the following issues:-

i. That once the project takes off, the proponent should liaise with the local administration when hiring from the community.
ii. What corporate social responsibility plans does the company have for the Majoreni community?
iii. How noise from the factory be managed?

Mwanasiti Hassan Mbwana-Majoreni Resident: The local community should be given first priority when hiring.

Miraj Mwalimu-Majoreni Resident: The local community should be given first priority when hiring.

MIN. 06/10/2019. RESPONSES TO SOME OF THE QUESTIONS

13. **On how excessive heat will be managed**, Eng. Adala said that once data collection is complete, the environmental and social impact assessment study report will be compiled. The report will recommend a detailed health and safety management plan including technologies to manage excessive heat.

14. **On impacts of the project on marine life**, Mr. Omenge said that baseline studies are underway to establish the current state of marine life and predict impacts. Further to this, Mr. Omenge said that focused group discussions are going to be held with various affected and interested groups including the seaweed farmers and fishermen. Appropriate mitigation measures shall then be proposed.
15. **On the company employment policy and community relations:** Dr. Aungo noted that baseline studies conducted shall inform the appropriate policy on hiring, emphasizing that the company's approach is always a participatory decision making approach.
16. **On the Impacts of the project on air quality and Noise,** Mr. Omenge said that the baseline conditions had been documented and reports are being compiled. This he noted will inform what kind of mitigation measures shall be proposed putting into consideration the relevant regulations and standards set by these regulations.

ATTENDANCE REGISTER

WASINI MARITIME LTD

ESIA STUDY FOR THE PROPOSED INTEGRATED GREEN SHIP RECYCLING & STEEL MAKING FACILITY

PUBLIC STAKEHOLDER MEETING AT MAJERENI

Date: 1ST October 2019 VENUE: MWAZO CBO HALL

	NAME	ID No	Signature
1	Hezekiah Adaka	8781318	[signature]
2	PHILIP OMENGE	12530095	[signature]
3	Jonnathan Teri	27922743	[signature]
4	OMARI. M. BANDA	29936811	[signature]
5	HASSAN M. NYUNI	23190671	[signature]
6	MASUDI MWALIMU	29715467	[signature]
7	MWANGOMBE OMAR	21349285	[signature]
8	Bagaye Fuji	9633740	[signature]
9	ISSA MOHAMED	[illegible]	[signature]
10	HASSAN A. KIRUA	[illegible]	[signature]
11	SAMUEL MUSAU	2206501	[signature]
12	HAMISI MWADANI	[illegible]	[signature]
13	JUMA M. MWATSUI	12997150	[signature]
14	Mwalimu Njerati	21848588	[signature]
15	MUHENDEDZE MADZANGO	2215111	[signature]
16	SHEE MOHAMED SHETI	21576158	[signature]
17	[illegible]	5423902	[signature]
18	SAMINI MWAMADI	27891367	[signature]
19	SHEE Suleman	23394539	[signature]
1	MWAKIO C. TUMNA	20883004	[signature]
2	VITERI Kibuna		[signature]
3	Mzaja Mwalimu	2088465[illegible]	[signature]
4	Masika Bashed	2[illegible]245549	[signature]
5	MWANAKOMBO S. SHETI	10788715	[signature]
6	MWAJUMBE ALI MWASI	20969292	[signature]
7	MARIAMU NGONYO MWAMUD	4627589	[signature]
8	MWANAKOMBO OMARI	—	[signature]
9	MISHI IDD DUNDU	4614240	[signature]
10	Andzazi Mwambe	—	[signature]

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	SALIM ALI KITOA	5464433	
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	HADIJA HAMADI	20909516	
	MATAKA KOMBO	20884418	
	IBRAHIM SHELL	33668650	
	thomas mwagonga	34517077	thomas
	MWATAMBWE MOHAMED	4619150	
	BAKARI TAMBWE	6760919	
	BAKARI HASSANI	30301926	
	PAMBO ABDALLA	0711139682	
	SULEIMAN ALI MATAJA	0723716574	
	KUDURA SHEE	0707926916	
	MWANAMTAMA BAKARI	32712395	
	MWANAMKUU MOHO	32712721	
	MAZERA TSUMA	27264135	
	HASSAN BAKARI MASSORO	32241145	
	ISENGA JULO MWABWANGA	13282000	
	HALIMA OMARI	33615376	
	ABDALLA SULEIMAN	27125115	
	KIRUA SUBRA KUCHA	3129623	
	NDEGWA P. NYAGI	20902656	
	HASSAN MASOUD MWALIM	31606861	
	SALIM HAMADI	0469792	
	Abdalla Juluodi	20987825	
	BOHARI OMARI	14y3b998	
	BAKARI SALIMU ZANI	21254327	
	PAUL MWABWANGA JULO	209092	
	JAMES MUUU MPATE	27100300	MPate
	HATIB HAJIRI		
	RASHID MASSORO		
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	Khalfan Kidonga	33175571	
	AMDANI ALI	20854532	
	ALI OMARI	26444.5493	

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2	Mwanasiti Hassani	21725082	
3	Asma Salim	33684163	
4	Mwanamkasi Salim	35144681	
5	Makata Said	33675758	
6	Nadzwa Mwanwa	31463281	
7	Sakina Hassani Sir.	12490350	
8	Kadzo Shaban	21205915	