Environmental and Social Impact Assessment Study Report for the proposed hydrated limestone processing plant, quarries and auxiliary facilities in Pongwe-Kidimu area, Kwale County.

Proponent	Firm of Experts
Mzuri Mining Limited, P.O. Box 184-80400, Ukunda, Kwale.	Envasses Environmental Consultants Limited, Ralli House, P.O. Box 2013-80100, Mombasa, Kenya.

Version: Final Study Report
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CERTIFICATION

Certification by Lead Experts

We hereby certify that this Environmental and Social Impact Assessment Study Report has been done under our supervision and that the assessment criteria, methodology and content reporting conform to the requirements of the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya.

Signed: _____ _____

Names: **Mr. Simon Nzuki** (1350) **Ms. Jane Gitau** (2015)

Contact Details
Envasses Environmental Consultants Limited,
P.O. Box 2013-80100,
Mombasa, Kenya.
Tel: +254 722 347 155
Email: info@envasses.org

Certification by Proponent

We, **Mzuri Mining Limited**, confirm that this Environmental and Social Impact Assessment Study Report has been submitted to NEMA with our authority as the project proponent.

Signed for and on behalf of **Mzuri Mining Limited;**

Name: _____

Signature: _____ Date: _____

Proponent Contact Details
Mzuri Mining Limited,
P.O. Box 184-80400,
Ukunda, Kwale.

Official Rubberstamp or Seal

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EXECUTIVE SUMMARY

Mzuri Mining Limited proposes to construct and operate a hydrated limestone processing plant, quarries and auxiliary facilities in Pongwe-Kidimu area, Kwale County. The proposed project will feature an open cast mine, a hydrated limestone processing plant and auxiliary facilities such as power, water, site offices and sanitary facilities among others. The main process that will occur include ripping, loading and transportation of limestone boulders to the hydrated limestone processing plant for crushing, calcination and eventual hydration. The proposed limestone plant capacity will be 500 tonnes per day.

Pursuant to Section 58 of the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya, the nature of the proposed project is listed as high risk under the Second Schedule (1a, 2a, 6g and 15) and should therefore undergo an Environmental and Social Impact Assessment (ESIA) Study process. To fulfill this legal requirement, ensure sustainability of the development activities and improve its environmental performance, the proponent contracted Envasses Environmental Consultants Limited, to carry out the ESIA Study.

The methodology for preparing the ESIA report was guided by the Third Schedule of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. Site visits were undertaken in July 2021 for purposes of area reconnaissance, assessing the baseline and environmental risks associated with the proposed project as well as applicable environmental safeguards and standards. Environmental screening criteria was informed by the Second Schedule of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. As per this Schedule the issues considered by the experts included; ecological and socio-economic issues, landscape changes, land use character and water. Data collection methods included literature review of relevant documents, observations during site visits and photography. The stakeholder engagement strategy included administration of questionnaires to the neighbours, four community consultative meetings in Shimoni, Kibuyuni, Fikirini and Mkuyuni/Mwambao villages to obtain comments and concerns regarding the proposed project and providing information that will potentially influence the design of the proposed project and a stakeholder consultative meeting to review and validate the draft ESIA study report. Baseline Environmental data was collected on ambient air, noise levels, water quality and biological communities' assessment.

The findings of the ESIA demonstrate that proposed project will have both positive and negative impacts on the environment. The positive impacts included contribution towards industrial development coherent with Kenya's Vision 2030 – Economic and Macro Pillar, mitigating the national and regional demand for cement, improving livelihood and increasing income from employment opportunities, provision of a market for local goods and services, accruing income to the proponent and a source of revenue to the government to enable in financing its obligations to the county and country.

Negative impacts on the environment will occur throughout the project cycle. Prior to the construction phase, the proponent should obtain a change of user from the County Government of Kwale and the Ministry of lands and notify the farmers to seek alternative land for farming as this activity was noted by the ESIA team during the site visits.

The construction activities will require raw materials such as sand and cement, ballast, lining materials, steel bars / rods and the plant itself among others which will be sourced from the environment. These materials will have negative environmental impacts at their points of origin. To mitigate the impacts of the environmental risks associated with sourcing raw materials during construction, the contractor will procure quantities of construction materials in line with the Bill of

Quantities prepared by a Licensed quantity surveyor, source raw materials from sites that are licensed as per the EMCA Cap. 387 of the Laws of Kenya and recycle construction wastes where practical.

Some sections of the proposed project site will be cleared and some trees will be felled to pave way for excavation activities which will disrupt the macro habitat and the species they support. There are species that are resistant to such disturbances while others are adversely affected to the extent of completely disappearing from the excavation zone. To attenuate the impact on biodiversity, the contractor should obtain an authorization permit from Kenya Forest Service (KFS) and the County Government of Kwale prior to felling the trees, retain vegetation cover as far as practicable and rehabilitate the excavated areas by planting soil binding grasses and indigenous trees or approved exotic ones in collaboration with the KFS.

A section of the proposed project falls under sediment cell 28 (Shimoni-Vanga) whose objectives are to promote fisheries, conserve mangroves, corals reefs and seagrass habitats. Any construction activities within the project site will potentially contribute to sedimentation to the adjacent marine environment resulting in water quality degradation and in turn affect the biological communities. Recommended mitigation measures include complying with the 30m setback stipulated in the Water Resources Management Rules, 2007 and the Shoreline Management Strategy for Kenya, 2010. Additionally, the hydrated limestone processing plant, quarries and auxiliary facilities should be located away from the Shimoni channel.

The workforce, visitors and neighbors to the proposed project site will be exposed to potential safety and health risks during construction activities. The potential safety risks will be from the use of machinery, risks from moving machinery, falling objects or even falls, air and noise pollution among others. These risks can possibly cause disturbances, injuries, permanent disability or even death. To mitigate the occupational health and safety risks, the proponent will register the site as a workplace with the Directorate of Occupational Safety and Health Services (DOSHS), obtain insurance cover to the workforce, provide and enforce the use of Personal Protective Equipment (PPE), provide the correct equipment for the jobs assigned and train the employees on their use and comply with the provisions of the Occupational Safety and Health Act, 2007.

The construction works, delivery of construction materials by heavy trucks and the use of machinery will lead to high levels of noise and vibration within the construction site and the surrounding area. Additionally, air pollution will be as a result of dust generated during excavation, concrete mixing activities and exhaust fumes from heavy commercial vehicles accessing the project site. The proponent should comply with the provisions of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 and the First Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014.

Construction activities will utilize substantial quantities of water for mixing and casting concrete, drinking and sanitation purposes which will lead to an increased demand for water. Based on the projected workforce of 20 people at construction, domestic water demand will be approximately 0.4m^3 per day and will be sourced from water bowsers. Seventy percent (70%) of domestic water use will generate effluent which will need to be managed efficiently. To mitigate this, the contractor will sensitize the workers on the need to conserve water resources, procure and deliver to the site mobile toilets from a NEMA licensed waste contractor and ensure compliance with the Environmental Management and Coordination (Water Quality) Regulations, 2006.

Site preparation and construction activities are expected to generate significant quantities of solid waste such as overburden, rock rubbles, cuttings and rejected materials among others. Poor disposal of solid waste is an eyesore, can harbor pests and pathogens as well as pollute soil and groundwater.

To curb this, the proponent will procure and strategically place adequate solid waste collection bins with a capacity for segregation, procure the services of a NEMA licensed waste handler to dispose off the solid waste and comply with the provisions of the Environmental Management and Coordination (Waste Management) Regulations, 2006.

Machinery used for construction activities and vehicles delivering construction materials to the site will need petroleum products such as fuel, oils, lubricants etc. There is potential for leakage and spillage during fueling, servicing and maintenance of machinery and vehicles. A release of petroleum products to the environment threatens ground and surface waters thereby endangering drinking water supplies. To mitigate this, the proponent should procure oil spill containment kits and train the workforce on the use and contract a NEMA licensed waste oil handler to manage the waste oil from the construction site.

Land degradation will result from stripping of the topsoil and excavation to expose the rock strata. The proponent should treat the quarry faces by initializing stabilization of the quarry pits walls and restoring the affected areas through rehabilitation of decommissioned quarry pits. Quarry overburden if inappropriately disposed becomes an eyesore and can be a potential breeding ground for insects and disease-causing vectors. The proponent should use the overburden during quarry rehabilitation for backfilling.

Stockpiles and quarry waste piling have a negative effect on the landscape by causing visual intrusion. Quarrying activities usually destroy the original landscape of the affected area leaving behind huge depressions and a potential point of collecting water forming artificial ponds that can potentially be hazardous and pose a threat to health. Recommended mitigation measures include locating the plant, stockpiles, overburden, quarry waste and haul routes away from sensitive landscape and visual receptors.

Sections of the proposed site that will be cleared to pave way for excavation and other quarrying activities will disrupt the macro habitat and the species they support. Dust produced from quarrying activities also have physical effects on the surrounding vegetation such as blocking and damaging internal structures hence impacting on their physiological activities. To reduce the impacts of quarrying to the biodiversity, the proponent should retain vegetation cover where possible and rehabilitate the quarried areas by planting appropriate indigenous trees or approved exotic ones in collaboration with the Kenya Forest Service.

Quarrying activities pose potential threats to the health and safety of workers on site. This may be in the form of air and noise pollution, fumes from machinery and vehicles accessing the site, accidents from machinery and equipment, injuries that may result from excavation activities and accidental falls among others. The quarry pits may also pose a threat to community health and safety as they may become important breeding grounds for pathogens especially during the rainy seasons, and accidental falls of both human and livestock in the water pools could lead to drowning. To mitigate this impact, the proponent should provide adequate training to staff on health and safety and ensure use of correct machinery for each assignment given, provide and enforce the use of PPE, regulate access to the site by deploying adequate security measures and fencing where appropriate to protect workers, local community members and livestock from potential accidents, rehabilitate quarried areas and comply with the provisions of the Occupational Safety and Health Act, 2007.

Dust from quarrying activities, crushing of limestone boulders and vehicular movement will potentially present respiratory hazard, cause eye irritation and visual intrusion to the workers, visitors to the site as well as the neighbors if in excess of 100 $\mu g/m^3$. It will also reduce the growth of vegetation and hampers aesthetics of the area. This will be mitigated by sprinkling water at the quarry

sites, enforcing the use of PPE to all employees and visitors while at the facility, retaining existing vegetation in areas which are not earmarked for quarrying to act as dust screens and a buffer zone between the quarry area and the settlements and complying with the provisions of the Air Quality Regulations, 2014.

Quarrying involves several activities that generate significant amount of noise and vibrations which are a health hazard if above the stipulated Occupational Safety and Health limits. To mitigate the impact of noise, the proponent should locate the quarry facility as far as practicable from neighboring properties, enforce the use of earmuffs, conduct noise mapping to inform mitigation measures and comply with Noise and Excessive Vibration Pollution (Control) Regulations, 2009.

Fire risks and emergencies at the proposed facility can occur due to operational negligence, electrical faults and spillage of flammable materials. This can result to injuries, loss of lives and property. These can be mitigated through developing, clearly displaying and implementing a fire and emergency response action plan, providing firefighting equipment, training employees on the use of fire-fighting equipment and conducting annual fire safety audit and implementing the recommendations.

The key exposures to heat in a hydrated limestone processing plant occurs during the operation and maintenance of the kilns and other hot equipment and exothermic reaction. This will expose the workforce to lots of heat leading to heat exhaustion and stroke among other heat related illness. The proponent should use cooling towers before releasing heat to the environment, provide and enforce use of insulated gloves and shoes for personnel accessing high heat areas and implementing specific personal protection safety procedures to avoid potential exposure to exothermic reactions.

There is a potential for ground and surface water pollution during operations. Removal of the rock strata can cause the floor to heave and allow for water seepage and hence toxic materials from the quarry could seep into the ground water. The proponent should ensure that quarrying activities are not undertaken to the water table level and in the event of flooding, water will be pumped out of the mines. Additionally, the proposed site should be secured with an impermeable boundary wall to ensure that the mining tailings and overburden are contained within the site.

Water use at the facility will be mainly for dust suppression, cooling machines and general housekeeping. Water used for dust suppression and general housekeeping will seep into the ground thus the effluent generated will be domestic in nature. To mitigate this, the proponent should install a bio-digester, apply for and obtain an Effluent Discharge License (EDL) from NEMA and comply with the Environmental Management and Coordination (Water Quality) Regulations, 2006.

Solid waste during operations will consist of packaging materials, oil and grease containers, office waste and overburden among others. These have a potential of pollution if not disposed off appropriately. The proponent should therefore ensure proper management of solid waste during operations by sensitizing employees on solid waste management and its importance, procuring the services of a NEMA licensed waste contractor and complying with the Environmental Management and Coordination (Waste Management) Regulations, 2006.

During operations, waste oil at the facility will be generated from servicing and maintenance of vehicles and machinery. Oil spillages can cause potential contamination of the environment and potentially ground water pollution and runoff contamination during rainy seasons. The recommended mitigation measures include paving the maintenance area, installing drain systems with an oil interceptor around the maintenance area and putting in place an emergency response plan to handle accidental spills and leakages.

The quarries operation will exert pressure on energy for running the machinery and equipment and for lighting and powering of electrical appliances. The study recommends maintenance of machines and equipment to maximize their efficiency on fuel and undertaking energy audits after every 3 years and implementing the recommendations.

Once the quarry begins operations, there will be heavy commercial vehicles ferrying materials to different areas. Overloaded trucks may cause damage on the roads. To mitigate this impact the proponent and truck drivers will adhere to the axle load limits set by the Kenya Roads Board.

A decommissioning phase is possible in the event of closure by government agencies due to non-compliance with environmental and health regulations, end of project life, an order by a court of law due to non-compliance with existing regulations and Change of user. Key environmental and social concerns at this phase will be economic decline, creation of an ecologically vulnerable land, safety and health risks, waste generation and insecurity. The proponent should prepare and submit a due diligence decommissioning audit report to NEMA for approval at least 3 months in advance.

In conclusion, the proposed project is considered important and beneficial to the economy as it will contribute towards industrial development coherent with Kenya's Vision 2030, socio-economic growth of the area through employment creation, increased revenues and utilization of mineral resources. Despite these benefits, environmental concerns are expected to arise at all phases of the project cycle. The ESIA study proposes a suite of comprehensive Environmental and Social Management and Monitoring Plans to address the anticipated negative impacts during the entire project cycle and improve the environmental performance of the proposed project. It is on this basis that we recommend that the project be allowed to proceed alongside conditions which will ensure compliance with the provisions of the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya.

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ACRONYMNS

BMU	Beach Management Unit
BOD	Biochemical Oxygen Demand
$CaC0_3$	Calcium carbonate
CaO	Calcium Oxide
CIDP	County Integrated Development Plan
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
CSR	Corporate Social Responsibility
DO	Dissolved Oxygen
DOSHS	Directorate of Occupational Safety and Health Services
EDL	Effluent Discharge License
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
EPZ	Export Processing Zone
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GDP	Gross Domestic Product
GOK	Government of Kenya
GRM	Grievances Redress Mechanism
HCVs	Heavy Commercial Vehicles
ICZM	Integrated Coastal Zone Management
ITCZ	Inter-Tropical Convergence Zone
K_2O	Potassium Oxide
KFS	Kenya Forest Service
KNBS	Kenya National Bureau of Standards
KPH	Kilometers Per Hour
KWS	Kenya Wildlife Service
MgO	Magnesium oxide
MPA	Marine Protected Area
Na_2O	Sodium Oxide
NEMA	National Environment Management Authority
NMHC	Non-methylated Hydrocarbon
NO_x	Oxides of Nitrogen
OSHA	Occupational Safety and Health Act
PM	Particulate Matter
PPE	Personal Protective Equipment
SDGs	Sustainable Development Goals
SO_x	Oxides of Sulphur
TORs	Terms of Reference
TSS	Total Suspended Solids
TVOC	Total Volatile Organic Carbon
UVC	Underwater Visual Census
WRA	Water Resources Authority
WRUAs	Water Resources Users Associations
WSPs	Water Services Providers
WSTF	Water Sector Trust Fund

1 INTRODUCTION

1.1 Background information

In the recent past, there has been rapid population growth and an ever-increasing large number of projects requiring significant amounts of limestone. Limestone is a fundamental raw material in various industrial sectors including chemical, agricultural, construction industries among others. It is formed due to biochemical precipitation of calcium carbonate, and further compaction over long periods of time. A high market for limestone products and its use in a growing number of industries has led to its widespread exploration and excavation. The most widely adopted method of limestone mining is through opencast pits with bench formation. In Kenya, large deposits of limestone occur mainly in Kitui, Athi River, Kajiado, Kilifi, Mombasa and Kwale and this has supported the establishment of the main cement producing industries in the Country. A number of quarries for the production of raw material for lime and cement manufacturing are found in various locations. These include; those at Tiwi in South Coast where Coast Calcium produces hydrated lime; at Bamburi and Kikambala in North Coast where Bamburi Cement quarries limestone for raw material used in cement production; at Takaungu where Mombasa Cement, a new entrant to the cement manufacturing industry, quarries limestone for use in clinker production. Traditional production of lime by open fire burning is carried out at Manda Island in Lamu County.

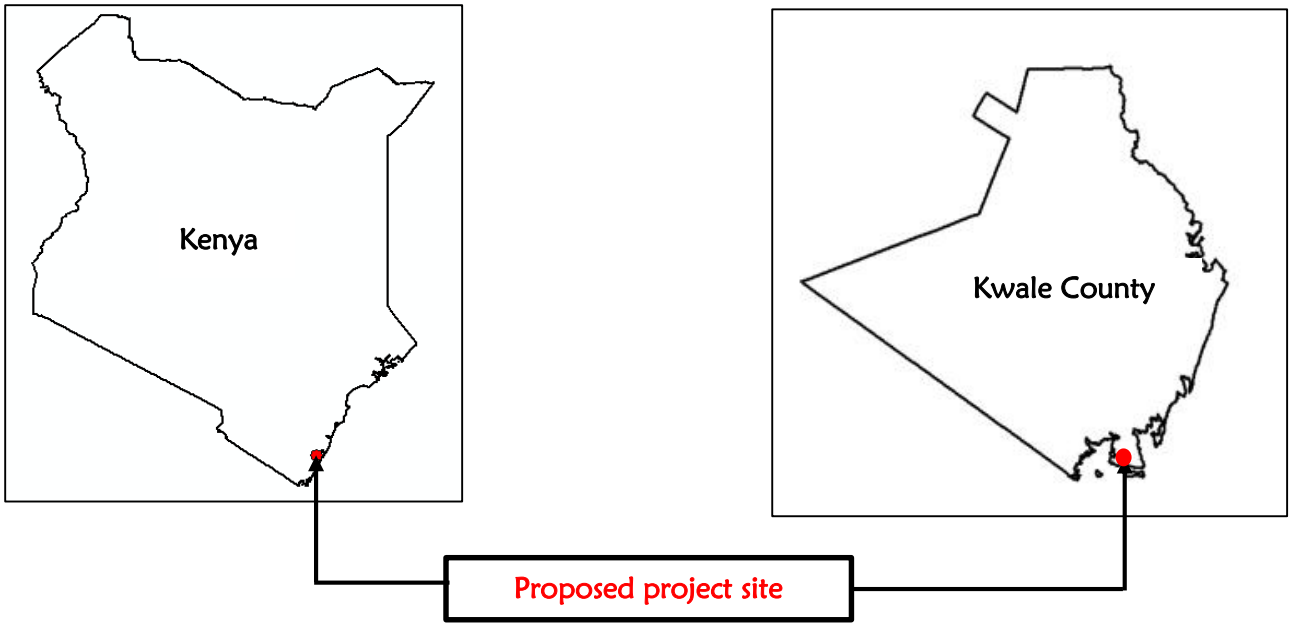
The proponent, Mzuri Mining Limited, proposes to set up several quarries and a hydrated limestone processing plant in Pongwe-Kidimu area, Kwale County. Geologically, the area is underlain by coral limestone composed mainly of calcite (calcium carbonate $CaC0_3$). The geological survey conducted in August 2012 to establish the mineral potential of the project area showed that the area has low values for the undesirable impurities of magnesia (MgO) as well as alkalis of Na_2O and k_2O in the limestone. The limestone is of good quality with high values of CaO in the range of 51.83 — 55.69% and can therefore be used for the manufacture of cement.

Pursuant to Section 58 of the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya, the nature of the proposed project is listed as high risk under the Second Schedule (1a, 2a, 6g and 15) and should therefore undergo an Environmental and Social Impact Assessment (ESIA) Study process. To fulfill this legal requirement, ensure sustainability of the development activities and improve its environmental performance, the proponent contracted Envasses Environmental Consultants Limited, which is a Firm of Experts Licensed by NEMA, to carry out the ESIA Study.

1.2 Project location

The project site will be located within Pongwe Kidimu area of Kwale County at **Latitude 4°37'00"S and Longitude 39°21'00"E**. The proponent has acquired thirty-eight (38) plots of land totaling 897.75 acres (Figure 1, Table 1) and is in the process of acquiring a total of 2000 acres of land within the area. The site is accessible by a murrum road off the Shimoni-Kanana road. Some of the plots are accessible by a vehicle via tracks but some can only be accessible on foot.

The dominant land use patterns for the immediate neighborhood features nucleated settlements, small scale commercial developments, industrial development such as Huawen Food (Kenya) EPZ Limited, health facilities such as Shimoni and Mzizima dispensaries and educational centers such as Tswaka Primary and Secondary School.



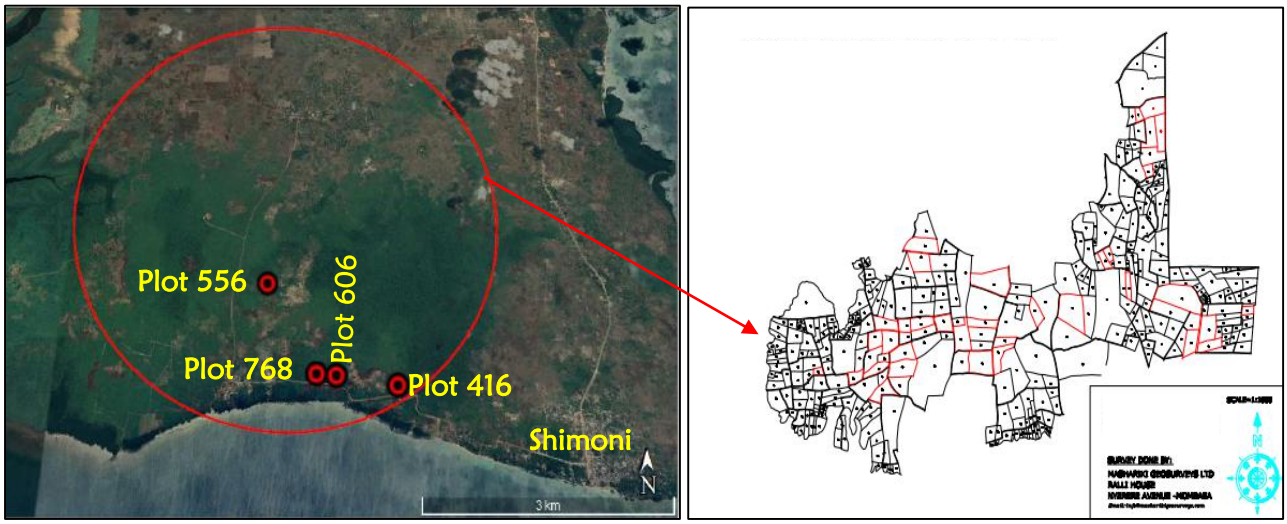


Figure 1: The location of the proposed project site (Source: Google Earth, July 2021 & Mashariki Geosurveys Limited).

Table 1: The acquired plots by the proponent and their acreage.

Plot Number	Acreage	
	Hectares	Acres
Kwale/Shimoni Adj./50, 51, 53, 54, 95, 198, 206, 222, 261, 265, 294, 335, 351, 354, 358, 362, 393, 427, 428, 444, 488, 489, 494, 729*5	109.64	270.92
Kwale/Shimoni Adj./220	6.64	16.40
Kwale/Shimoni Adj./224	21.83	53.94
Kwale/Shimoni Adj./272	3.39	8.37
Kwale/Shimoni Adj./300	27.32	67.50
Kwale/Shimoni Adj./323	3.19	7.88
Kwale/Shimoni Adj./350	10.64	26.29
Kwale/Shimoni Adj./409	5.19	12.82
Kwale/Shimoni Adj./416	21.51	53.15
Kwale/Shimoni Adj./475	4.88	12.05
Kwale/Shimoni Adj./491	38.72	95.67

Plot Number	Acreage	
	Hectares	Acres
Kwale/Shimoni Adj./542	4.35	10.74
Kwale/Shimoni Adj./556	60.79	150.21
Kwale/Shimoni Adj./606	10.30	25.45
Kwale/Shimoni Adj./758	34.95	86.36
TOTAL	**363.34**	**897.75**

1.3 Project site status

The proposed project site is currently undeveloped with 100% vegetation cover. Only a section of the project site is currently used for small scale subsistence farming by local residents authorized by the proponent (Figure 2). The vegetation of the project site is comprised of grasses, shrubs, herbs and trees including baobab, palm, neem and pine trees among others. Some sections of the project site have remains of quarry pits used for excavation of building blocks and aggregates by the residents and the activity is still ongoing illegally (Figure 3). A section of the project site is located along Shimoni Channel and is fringed by patchy mangrove stands.

Figure 2: Sections of the project site showing the vegetation cover (Source: Site visit, July 2021).

Figure 3: One of the existing quarry pits used illegally for excavation of building blocks and aggregates (left) and the excavated aggregates (right) within the project site (Source: Site visit, July 2021).

1.4 Project design and Limestone processing

The proposed project will feature several quarries, a hydrated limestone processing plant and auxiliary facilities such as power, water, site offices and sanitary facilities among others. Limestone will be mined via open cast mining method. The main process that will occur include ripping, loading and transportation of limestone boulders to the hydrated limestone processing plant for crushing, calcination and eventual hydration.

Ripping is a version of continuous mining where rock is extracted at the rate of production required by the crusher. When using Rip and Load method, the hydraulic excavator rips a certain quantity of rock and then loads this in order to clear the ground for the next ripping section.

At the crusher, limestone boulder is broken down into finer textures thus producing stock feed lime. The stock feed lime undergoes the calcination process ($CaCo_3+Heat=CaO+CO_2$) through progressive pre-heating at the kiln (temperatures of approximately 1000˚C) to a point at which dissociation is completed and the burnt lime is cooled so as to prevent possible re-carbonation. The technology to be employed for calcination will utilize a regenerative process involving use of a two-shaft vertical kiln with refractory lining, loading, charging devices, firing and control systems to obtain quicklime.

The quicklime produced will be combined with a specified amount of water to obtain hydrated lime i.e. $CaO+H_2O=Ca(OH)_2$, which is a dry powder. The hydration process will consist of three stages of reaction, mixing and seasoning. During the first stage quicklime will receive hydration from the water feed rack and will be subjected to strong mixing action. At the end of the first stage, the lime will fall into the second stage where the hydration reaction is wholly completed. During the transformation of the calcium oxide into hydrate, the apparent specific weight of the material will be reduced to half resulting in a volume twice as big as the one of the first stage. The third stage will be designed to further homogenise the finished product, or to allow extra retention time to complete reaction for those quicklime qualities featuring medium or low reactivity.

The proposed limestone plant capacity will be 500 tonnes per day.

In addition to the above, the proponent will engage the local artisanal miners to promote local economy and ensure better integrated rural development strategies.

1.5 Project budget

The total estimated cost of the proposed project is USD 15,000,000.

1.6 Study approach and methodology

1.6.1 Introduction

The methods adopted for preparing the ESIA study report were guided by the Third Schedule of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. The consultants prepared a scoping report and Terms of Reference (TORs) as required under Regulation 11 of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003 and submitted them to NEMA for consideration for approval. The scoping report and TORs were approved on 14th July 2021 and the consultants began preparation of the ESIA study report.

1.6.2 Data collection

The methods for carrying out the study included site visits and observations, literature review, baseline monitoring of water quality, monitoring of ambient air and noise level measurements, biological communities' assessment, and holding consultative meetings with stakeholders. Site visits were carried out in July 2021 for purposes of area reconnaissance, assessing the baseline environmental conditions of the proposed project site and screening of environmental risks associated with the proposed development as well as the applicable environmental safeguards and standards (Figure 4). Environmental screening criteria was informed by the Second Schedule of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. As per this schedule, the issues considered by the experts included ecological impacts, socio-economic issues, landscape changes, land use character and water (Table 2).

Figure 4: The ESIA study team carrying out a reconnaissance survey at the project site (Source: Site visit, July 2021).

Table 2: Summary of the results from the screening and scoping exercise.

Criteria	Results
Ecological impacts	– Excavation and vegetation clearance will occur – No endangered species of trees and plants found at the site – There is potential to impact negatively on the marine ecosystem if any activity is undertaken near Shimoni channel
Social-economic considerations	– Contribution of the project towards attainment of the Economic and Macro pillar of Kenya Vision 2030 – Market supply of limestone – Project will lead to influx of migrants into the area and this may change social structure and behavior of local community – Creation of employment opportunities – Income to the proponent – Revenue to the government through taxes & licenses – Workers and neighbors during construction and operational phases will be exposed to safety and health risks
Landscape impacts	– The landscape of the area will be altered and new views created
Land uses	– Land uses in Shimoni Adjudication area include residential, agricultural, commercial and recreational – Project is inconsistent with land uses in the area
Water	– The construction and subsequent operations of the proposed project will increase water demand and impact on water resources

1.6.1 Baseline environmental data

Baseline environmental data was collected on ambient air and noise levels, water quality and biological communities' assessment. The results will be used to provide a benchmark for implementing the Environmental Monitoring Plan proposed in the ESIA report. The approaches and methods used for sampling and analysis of baseline environmental media are discussed below.

1.6.1.1 Ambient air quality monitoring

Mobile, static and active monitoring was done by use of real time gas detector-pump suction equipment LB-MS4X (Figure 5) which integrates the main ambient gases and meteorological parameters.

The gas sensitive semiconductor sensor uses proprietary sensing material, built in automatic Correction (ABC) and interference rejection. This combination results in ppb resolution and a highly linear response. The gas sensitive electrochemical 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 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.

The laser particle counter for Particulate Matter measurements uses optimized signal processing using low noise electronics added algorithms to correct for interferences. An aerosol particle counter works on the principal of either light scattering or light blocking. An aerosol stream is drawn through a chamber with a light source (either Laser Based Light or White Light). When a particle is illuminated by this light beam, it is redirected or absorbed. Light scattered by a single particle in a specific direction in relation to the original direction has a unique signature which relates to the size of the particle. This allows for sizing and counting of individual particles

1.6.1.2 Baseline noise levels measurements

Noise emission survey (Figure 5) was achieved via initial examination of existing road traffic and other noise sources of significance. Noise levels was evaluated using a Sound Level Meter Model AWA 5636 IEC 61672 – 1:2013 class 2 with a built-in ϖoctave / octave band filters which does real time 1/1 and 1/3 octave analysis was mounted on at 2.0m above ground level and at least 3.5m away from any sound reflecting surfaces at a boundary position and measurements taken at timed intervals over 10 minutes and stored in SLM's memory. The sound level meter was placed on the microphone to reduce any wind interference during measurements. The sound level meters, were within its calibration period, at the time of monitoring. In addition, the equivalent noise level (LAeq), the maximum sound pressure level (Lmax) and the minimum sound pressure level (Lmin) during that measurement period were recorded. Factors to consider such as time, duration and predictability of the noise emission, amplitude and frequency of the noise emission, nature of the source, location of noise sensitive receptors, ambient and background noise level, nature and character of the locality, presence of special acoustic characteristics and the incongruity or familiarity of the noise during noise survey and site placement were put into consideration. Furthermore, as each individual measurement was being 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.

Figure 5: Ambient air quality and noise level monitoring at the proposed project site (Source: Lahvens Limited, July 2021).

1.6.1.3 Water quality sampling and analysis

The objective of the water quality sampling and analysis was to assess the variation in water turbidity and chemical properties due to potential construction activities near the Shimoni channel which could alter the physical or chemical characteristics of the water in the ocean; and to provide a baseline for assessing the effectiveness of the environmental management plans designed to minimize water contamination.

The baseline water quality sampling was carried out along the Shimoni channel by the consultants in collaboration with Lahvens Limited (Figure 6). Three samples were obtained at depths of -0.5m, -3m and -8m at Latitude 4°38'32.43"S and Longitude 39°21'31.76"E. The choice of sampling depths was based on the consultants' experience in the ongoing monitoring of similar projects along the Kenyan Coast. Each sample obtained from these locations and depths were analyzed for pH, turbidity, Dissolved Oxygen, Biological Oxygen Demand, Chemical Oxygen Demand, Total Suspended Solids and perspective degree. The test methods and equipment used are shown in Table 3 below.

Table 3: Water Quality Monitoring Methods and Equipment.

Tests	Test Methods	Equipment
pH Value, Dissolved Oxygen and Turbidity	Insitu	Water Quality Analyzer (AP-800/AM-200)
Biological Oxygen Demand, mg/l	AOAC Method 973.44	Model EZ-BOD
Chemical Oxygen Demand, mg/l	PQA/LIM/064	PF-12
Total Suspended Solids, mg/l	APHA Method 2540D	LSS-200

Figure 6: Baseline water quality monitoring carried out on 24th July 2021 along Shimoni channel (Source: Lahvens Limited, July 2021).

1.6.1.4 Biological communities' assessment

A baseline biological study was conducted focusing on flora and fauna in 3 communities: water column, soft sediment and hard substrate habitats, critical habitats and the Marine Protected Area.

Thus was carried out in order to ascertain the baseline status of the biological communities in the vicinity of the proposed project site. The following section details on the biological survey conducted.

1.6.1.4.1 Plankton surveys

1.6.1.4.1.1 Phytoplankton Distribution and Diversity

Samples were collected by filtering 20 litres of surface seawater through a 20-micron mesh phytoplankton net, and fixed using Lugol's reagent at the four sampling site and then analyzed in a laboratory. The analysis encompassed taxa identification and enumeration using the sedimentation technique as described by (Utermöhl, 1958; Arhonditsis G.B et al., 2004). In the laboratory, an Inverted microscope was used for observation and the phytoplankton genera identified using keys by Botes, (2003) and Carmelo, (1997). Whenever possible, identification was carried out to the species level, although in most cases, the keys identifications were limited to the genus level.

1.6.1.4.1.2 Zooplankton Distribution and Diversity

A zooplankton net of 250-micron mesh size and 30cm diameter fitted with a flowmeter on the mouth opening was towed horizontally at 6-10 m depth at 4 knots towing speed for 20 minutes. At the end of the tow, the flowmeter reading was recorded before emptying the sample for processing, and then a replicate tow was conducted. During sampling, zooplankton captured on the net cod end were washed thoroughly and transferred into a sample bottle and preserved in 5% v/v buffered formaldehyde and seawater solution for laboratory analysis. The Zooplankton samples were then identified to the lowest taxa possible with a stereo-microscope and referenced to identification kit "Guide to the coastal and surface zooplankton of the South-Western Indian Ocean" by (Conway, White, Hugues-dit-Ciles, Gallienne, & Robins, 2003).

1.6.1.4.2 Coral reef biodiversity

1.6.1.4.2.1 Introduction

Underwater Visual Census survey (UVC) were conducted using SCUBA gear (Figure 7), with clear focus on coral reef habitats lying between 5-14 m, spanning the depth range of the main coral reef habitats in the Shimoni/Wasini Channel. At each site, data on fish assemblage (abundance and diversity), benthic characteristics and invertebrates were collected using standard UVC techniques for coral reef biodiversity adopted from Samoilys and Carlos (1992), English et al, 1997 and Obura and Grimsditch (2009).

Three sites, namely Kibuyuni (MS2), Mkwiro (MS3) and Nyuli (MS4) were selected for the baseline survey based on the distribution of coral reefs and healthy benthic habitats from published literature (Bolton et. al, 2007; KWS, 2015a; 2015b). The three (3) sites were considered as representative of the coral reef ecosystems around the Shimoni Channel in terms of depth, habitat conditions and exposure, in addition to being in close proximity to the proposed project site.

Kibuyuni is sheltered and located at Latitude 04°38.640'S, Longitude 039°20.133'E south of Shimoni village and consisted of a shallow reef adjacent to the seaward farm. The reef is narrow strip and runs parallel to the shore and is bordered by fine sand/silt on the south seaward side and seagrass and high sediment areas towards the shore. Mkwiro is a sheltered shallow coral reef area located at Latitude 04°39.562'S, Longitude 039°23.369E adjacent to Mkwiro Village at Wasini Island. The main coral reef growing areas starts at a depth of about 5m to 8m and this changes to sandy habitat as you move to the deep areas towards the middle of Shimoni channel. Nyuli is an exposed site located at Latitude 04°41.438'S, Longitude 039°25.775E and consists of rich coral growing area (hard corals and soft corals) interspersed with sandy and rubble areas from depth of

8m to 15m. Kibuyuni and Mkwiro are within the community conservation areas of the Kibuyuni and Mkwiro BMUs, respectively while Nyuli is close to the reserve within Kisite Mpunguti Marine Park and Reserve.

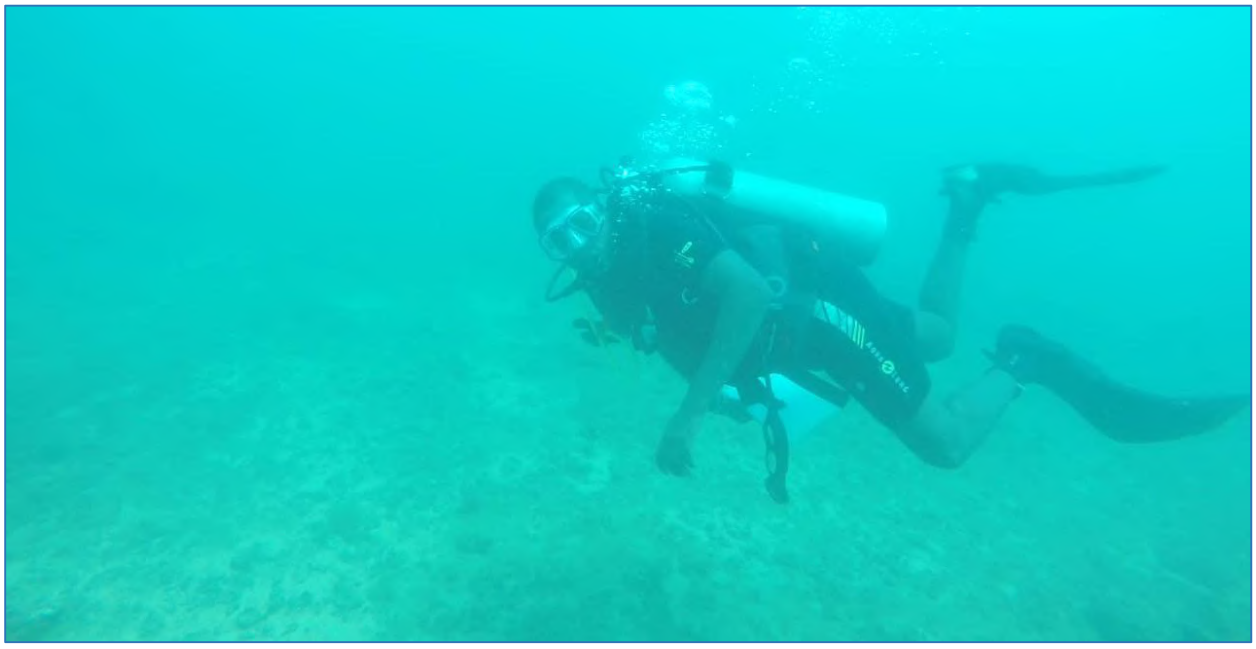


Figure 7: A diver carrying out baseline biological monitoring at Shimoni Channel (Source: Field survey, July 2021).

1.6.1.4.2.2 Fish abundance and diversity

For abundance data, a belt transects measuring 50 x 5m was placed randomly on the reef substrate. Along the transect, species from 13 preselected families were identified and enumerated. The 13 pre-selected families are known indicators of coral reef biodiversity (*Acanthuridae*, *Chaedontidae*, *Scarinae*, *Lutjanidae*, *Caesionidae*, *Balistidae*, *Kyphosidae* and *Pomacanthidae*), fishery importance (*Lethrinidae*, *Haemulidae*, *Siganidae* and *Nempteridae*) and large vulnerable families (*Serranidae*). These families also encompass various trophic groups that influence important ecological processes. Density was standardized to individuals per hectare. All other species encountered throughout the dive were recorded (not enumerated) to provide presence and absence data for fish community diversity. Species identifications were checked using taxonomic references (Lieske and Myers 1996).

1.6.1.4.2.3 Benthic characteristics

Point-intercept method was used in assessing the benthic characteristics, where the substrate directly below the transect tape was recorded every 50 cm along 25 m transect. This gave a total of 50 points per transect and a total of 150 points per site. Points were standardized to 100 giving the percentage cover of each benthic category. Major benthic categories namely hard coral, dead coral (defined as recently dead coral skeleton with intact corallite structure), soft coral, crustose coralline algae, fleshy macroalgae, turf algae, invertebrates, sand, rubble, silt and seagrass were recorded. Hard corals were surveyed to the genus level.

1.6.1.4.2.4 Benthic invertebrates

Belt transect measuring 50 x 5m was used to assess the diversity and abundance of invertebrates. All invertebrate taxa identified to the lowest level possible were counted. Underwater video transects were recorded using a GoPro Hero4 camera in an underwater housing on a medium field of view. The video was taken at approximately 1m above the substrate at a constant speed covering

a 50m transect in 5 minutes. The videos were analysed and all coral genera and fish species not recorded in the transects were recorded. This provided a coral general and species richness on a wider scope than the $25m^2$ and $250m^2$ respectively. A total of 3 transects and 18 quadrats were carried out across all the sites.

1.6.1.5 Stakeholder mapping

Prior to commencement of the ESIA process, the consultants conducted a stakeholder mapping and analysis to determine the individual, groups and institutions that will be affected by and have an interest in the project in consultation with the proponent, the County Government and the Ministry of Interior and Coordination of National Government. The consultants then prepared a comprehensive list of all the stakeholders in consultation with the proponent and categorized them based on the following:

- Low interest, low influence – those to keep informed
- High interest, low influence – those to involve and consult with
- Low interest, high influence – powerful stakeholders to engage
- High interest, high influence – partners to collaborate with

Nine key stakeholder categories were identified. These are;

1. County and National Government Representation
2. Lead Agencies and community organizations operating directly under them
3. Civil Society
4. Conservation Organisations
5. Local Community and Residents' Associations
6. Opinion leaders including political leaders
7. Faith Based Institutions
8. Special Interest Groups
9. Media

The consultant then identified the key contact persons within the stakeholder categories who will be engaged throughout the ESIA study process. The identification of the key contact persons was done in consultation with the proponent, lead agencies, the County Government of Kwale, Ministry of Interior Coordination of National Government, Residents Associations, Community Groups, Non-Governmental Organizations and Conservation groups.

Further, the consultant identified other stakeholders who may not be apparent but needed to be consulted and analyzing the role of each stakeholder in the ESIA study process as well as project implementation. Finally, the consultant determined the tools for engaging with each stakeholder including language of communication and allocation of resources to ensure meaningful participation of the stakeholders in the ESIA process.

Following the analysis, a series of community consultative meetings were held on 26th July 2021 in Shimoni and Kibuyuni villages and on 27th July 2021 in Fikirini and Mkuyuni/Mwambao villages.

2 ENVIRONMENTAL SETTING OF THE PROPOSED PROJECT SITE

2.1 Climate

The project site lies in the hot tropical region where the weather is influenced by the Migratory Inter-Tropical Convergence Zone (ITCZ) characterized by monsoon winds. Climate and weather systems are dominated by large-scale pressure systems of the Western Indian Ocean with two distinct monsoon periods. The weather is dominated by the Northeast Monsoon (Kaskazi) which is comparatively dry from November to early March. During March and April, the monsoon winds blow in an east to south-easterly direction (Kusi) with strong incursions of air from the Indian Ocean bringing heavy rains. Between May and August, the South-easterly monsoon gradually sets in and the weather becomes more stable comparatively cooler temperatures. There is a 1 – 2 month's transition period between the two seasons characterized by variable and weaker winds. Annual rainfall follows a strong seasonal pattern peaking between late March and early June. Another smaller peak of rain occurs between October and November but decreases rapidly from December to a minimum during January and February. The average annual rainfall for the area has been recorded as 940mm. Temperatures are fairly constant throughout the year ranging from 23°C to 28°C. The warmest temperatures are generally recorded during the months of November to April (mean daily temperature of 27°C) while slightly cooler temperatures are experienced from May to October (mean daily temperature of 24.5°C). Relative humidity is high all year round, reaching its peak during the wet months of April to July. The County's average annual temperature for the year 2020 ranged from 25°C to 30°C while the average annual rainfall ranged from 40mm to 250mm (Figure 8).

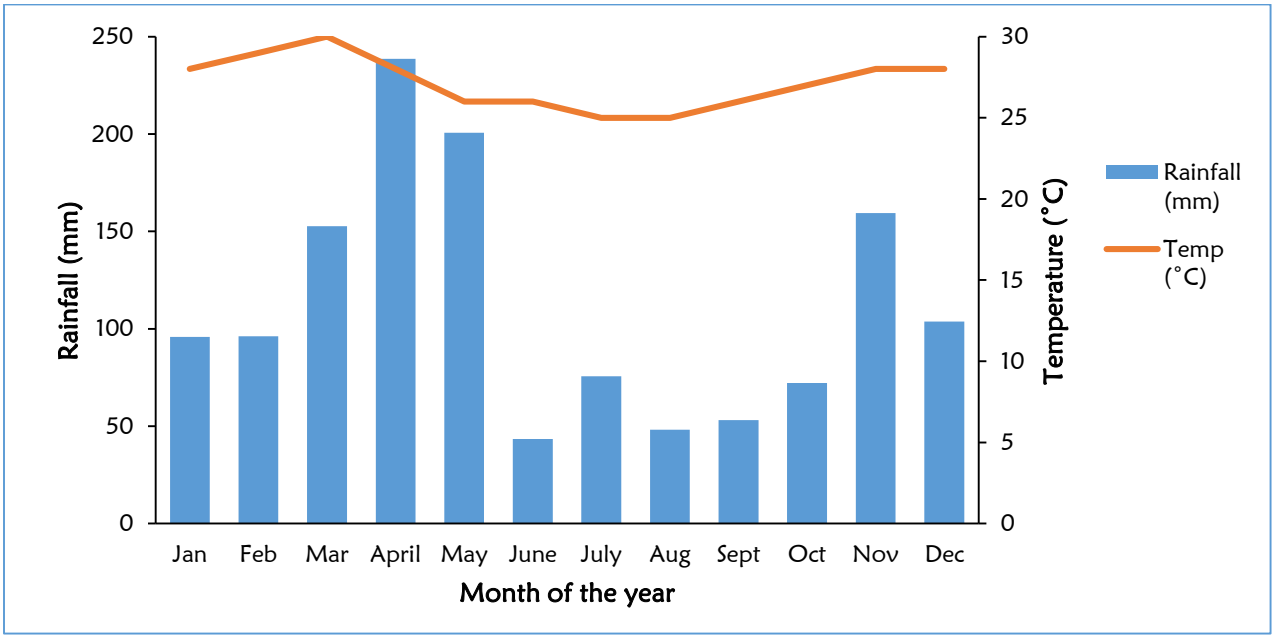


Figure 8: Average rainfall and temperature distribution for Kwale County in 2020 (Source: World Weather Online).

2.2 Geology

Kwale County is divided into four major topographic features namely the Coastal Plain, Foot Plateau, Coastal Uplands and Nyika Plateau. Shimoni area is located along the Coastal Plain underlain by coral limestone of the raised Pleistocene Coral Reef Complex (Figure 9). The limestone is the fossil remains of coral polyps that developed under favorable conditions in tropical sea water, as part of the fringing reef of the Quaternary coastline. The fresh coral limestone found in the Pongwe-Kidimu area is off white, porous but hard. The limestone is composed mainly of

calcite (calcium carbonate $CaC0_3$). Extensive deposits of the limestone are found along the coastline from slightly north of Vanga, Kwale County to Manda Island, Lamu County.

Figure 9: Coral limestone outcrops at the project site (Source: Site visit, July 2021).

2.3 Mining in the Coast Region

Mining accounts for only 2% of the economic development of the region, with principal economic activities at the coast include tourism (45%), ports and shipping (15%), agricultural industry (8%), fisheries (6%), agriculture (5%) and forestry (4%) (Source: Human Rights Agenda, 2014). Various types of minerals are found at the Kenyan coast. Some of these occur in significant quantities and only a few are being exploited. Mineral deposits that occur in economic quantities include salt, coral rock, titanium, pyrochlore, barites, gypsum, iron ore and clay. Lesser minerals are apetite, galena, and manganese. Some of the sand deposits in the Kwale that are currently exploited by Base Titanium Resources include Ilmenite, Rutile and Zircon.

Extensive limestone deposits occur along the coastal area from the Tanzanian border in the south to Malindi in the north. A 70 m thick and 4–8 km wide band of limestone runs parallel to the coast. Older limestone units occurs further inland in the north of Malindi but only a few isolated exposures of limestone are found between Malindi and Lamu. Exploitation of limestone is widespread and depends on local variation in the limestone's texture, composition and market demand. Coral limestone, the basic raw material for cement production, is excavated in shallow, heavily mechanized, opencast mines adjacent to the factories.

Weathered shale and iron ore are also required as secondary raw materials for the production of cement. Shale is available in large quantities in the Mombasa area, and is mined in open pits near Nguu Tatu, west of Bamburi. Iron ore is obtained from Kilifi. Small quantities of pozzolana and gypsum, which are also needed in the cement production process, are mined in small quantities in Kilifi County around Ganze and Jaribuni. In Tiwi, limestone is used to manufacture lime.

2.4 Environmental degradation

The main contributor to environmental degradation in the County is solid waste such as plastic bags; bottles; cans; garden and kitchen waste; vegetable waste and oil waste, logging (charcoal burning), bush fire (burning vegetation by farmers), overgrazing and dumping of solid waste by the hotels next to the ocean. Mining and sand harvesting also contribute to environmental degradation by leaving behind sites that are not rehabilitated as well as leaving mines and materials that have radioactive emissions. Therefore, there is need for the County government to come up with proper policies on waste management and quarry rehabilitation for biodiversity conservation and to provide other ecosystem services (Source: Kwale County Integrated Development Plan 2018-2022).

2.5 Land use and Land cover

The land-use/ land-cover within the project area comprises of built-up areas, agriculture, mangroves, mudflat, water body (Indian Ocean), vegetation (trees, shrubs and grass) and bare land as presented in the map below (Figure 10). The classification was done using a 2019 Landsat image downloaded from USGS earth explorer website and applied maximum likelihood algorithm with a supervised signature extraction. The proposed project site is 100% covered with vegetation.

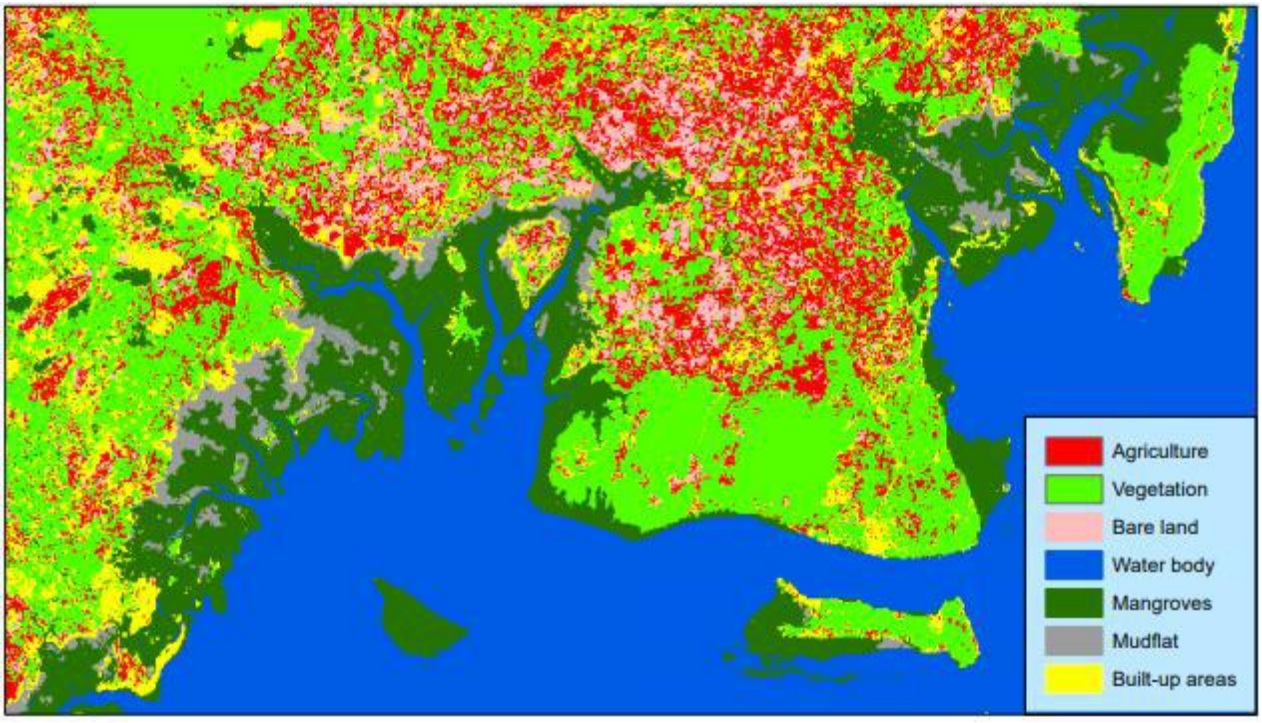


Figure 10: Land-use/ land cover within the project area (Source: Envasses Environmental consultants Limited, July, 2021).

2.6 Population

According to the Kenya Population Census Results released in November 2019, Kwale County has a population of 866,820 comprised of 425,121 males and 441,681 females. Msambweni Sub-county where Shimoni is located has a population of 177,690 comprised of 89,206 males, 88,480 females and 18 intersex people.

2.7 Livelihoods of the people within the project area

2.7.1 Introduction

The majority of the population within the project area rely heavily upon traditional fishing, tourism, marine curio trade, tour vending, subsistence agriculture and exploiting forest resources. The following section details on the livelihoods of the people within the project area.

2.7.2 Fishing activities

Fisheries form an important part of the livelihoods of the local community (GOK, 2018). The artisanal fishery in the area is dominated by the hand line fishery compared to other areas of the Kenyan Coast (GOK, 2012). Other common fishing gears used in the fishery include gill nets, reef net, basket traps, monofilament, spear gun, ring net, beach seine, fishing weir, basket trap and sail lining. The modes of access to the fishing grounds and fishing crafts employed in the fishery range from foot, dugout and plank canoes, double outrigger canoes, motorboats and fiberglass boats. Most of the vessels are individually owned.

Key fishing grounds in Shimoni include Nyuli, Waga, Kombeni, Kimundu, Mnazi, Mpunguti, Mwamba Mkuu, Mnazi, Nduwa and Wasini Channel. Fishers from most of the 19 landing site in Shimoni Vanga area often share the same fishing grounds. A section of the proposed project site neighbours Kijiweni landing site of Kibuyuni area. According to records from the State Department of Fisheries, Aquacultue and Blue Economy the total number of fishermen utilizing Shimoni area is estimated at 1000 (Catch Assessment Survey, 2016). Records from the Chairpersons of the Beach Management Units in Shimoni area estimate the number to about 1534 registered fishermen. It is however important to note that these figures are not an actual representation since there is uncaptured data on the number of unregistered fishermen who are involved in illegal fishing practices.

The main species of fish exploited include Scavengers (*Lethrinidae, Lutjanidae* and *Haemulidae*), parrot fish (*Scaridae*), rabbit fish (*Siganidae*), grunters (*Terapon* spp.) and pouters (Gerres spp.). Others include pelagic species such as Baracuda (*Sphyraena* spp.), Kingfish (*Scomberomorus* spp.) and Mullets (*Mugil* spp.). The crustacean fisheries are dominated by mangrove crabs (*Portunidae*) harvested in the shallow waters and mangroves areas. Spiny lobsters of the family *Palinuridae* are also caught in the shallow water fishing grounds although in small quantities. Cephalopod fisheries mainly target squids (*Loliginidae*) and octopus (*Octopodidae*).

2.7.3 Seaweed farming

Seaweed farming has been identified as a good prospect for social and economic development of coastal areas. It is aimed at diversifying livelihood opportunities for fishing communities whose source of income has been seriously put at risk by diminished capture of fish. The two major seaweed species farmed are *Eucheuma denticulatum* (spinosum) and *Kappaphycus alvarezii* (cottonii). Extracts of dried seaweed are used as food thickeners and in the global pharmaceutical and cosmetic industries. Seaweed has also been used as an additive to soils, mainly in coastal areas due to the high fibre content that acts as a soil conditioner and the mineral content as fertilizer.

In Kibuyuni village, there are 143 seaweed farmers each owning 6-10 blocks of seaweed farms. These farmers have received support on seaweed farming from various stakeholders including the Kenya Marine Fisheries Research Institute (research and technical support and training on seaweed production), Kenya Coastal Development Programme (up-scaling of seaweed farming, construction of drying racks, purchase of boat for seaweed value addition techniques) and County Government of Kwale (construction of seaweed store). Seaweed drying is done over open racks for about three days, then packed and stored in their storage facility. The farmers also practice value addition on

their seaweed produce through their processing facility to produce bar soaps, liquid soaps, shampoos, lotions, cakes and other products. The group exports dried seaweed to countries like China, Ireland and Malaysia through the Seaweed East Africa Company. Approximately 15-20 tonnes of seaweeds are sold quarterly to buyers from Tanzania (Kibuyuni).

There are other seaweed farmers in Shimoni, Wasini Island and Mwazaro areas who also practice seaweed farming as an alternative source of livelihood.

2.7.4 Coastal tourism

Tourism is one of the biggest and most diverse industries in Kenya, contributing 4.1% of national GDP in 2014 (KNBS, 2016). Coastal tourism is dependent on a range of niches i.e. national parks and reserves (both marine and terrestrial), coastal beaches, conferences and events segment, museums and historical sites, wildlife safari and ecotourism. The tourism industry drives economic activities in other sectors such as hotels, travel agents, airlines and other passenger transportation services. Hence stimulating the development in towns like Shimoni, Wasini, Ukunda, Diani, Mtwapa and Malindi among others. The number of tourists fluctuates seasonally reducing during the Southeast monsoon season. Additionally, the sector has been negatively impacted by insecurity after the insurgency of terrorism acts.

A section of the project site lies within the Shimoni Channel which connects to the Kisite-Mpunguti Marine Park and Reserve, a Marine Protected Area (MPA). The Marine park and Reserve was established to protect the scenic islands and special habitats of a wide range of endemic marine animals and breeding migratory birds. The marine park lies in the coral gardens south of Wasini Island and encompasses three small coral rag forest islands, each with considerable areas of fringing reef. Notably, the Shimoni Slave Caves and the Shimoni Slave Museum that is managed by a community-based organization and National Museums of Kenya respectively are also found within the project area. The caves were used as places of confinement of slaves before shipment to the slave market. The historical site constitutes a network of caves once reputed to be connected to underground routes extending about five kilometers inland (Figure 11). The caves were a sacred site used by Kaya elders for prayers and to offer sacrifices before the invasion of slave traders. The Shimoni Slave museum has collections of the local Digo people's cultural artifacts and others collected from the East African coastal areas like Pemba and Zanzibar, which were centres of the infamous Arab Slave Trade.

Figure 11: A section of the Shimoni caves (Left) and the remnant shackles that were used to secure slaves prior to shipment (Right) (Source: Zuru Kenya).

Across the Shimoni channel lies Wasini Island where there are various tourism attractions such as the coral garden (Figure 12), mangrove boardwalk (Figure 13), dolphin and whale watching, snorkeling, curio vending among other tourism related activities (Figure 14). Most of these activities are coordinated and operated by Wasini Beach Management Unit and Kisite Boat Operators. Most of the tourists come for day trips to the Marine Park and Reserve from hotels in and around Diani and Mombasa so as to snorkel, dive and watch dolphins.

Currently, there are approximately 200 tourist operators with 50 boats who operate in and around the Marine Park and Reserve, with the capacity to cater for more than 350 visitors a day (Source: Chaiman-Wasini and Kisite Community Boat Operator, September 2020). Both speed boats and the traditional wooded-sail boats are available to provide transport to tourists to attraction sites.

Figure 12: The coral garden at Wasini Island (Source: Google Images of Wasini Island).

Figure 13: The Wasini Women Group mangrove boardwalk (Source: Google Images of Wasini Island).

Figure 14: Tourism activities taking place within the Shimoni channel (Source: Kisite Boat Operators gallery).

2.7.5 Agriculture

Subsistence and cash crop farming is practiced in most of the villages within the project area. Many households that engage in fishing and small scale business as their main occupation also practice agriculture as a supplementary source of livelihood and income. The most common subsistence food crops planted in the area are Maize, Beans, Vegetables (kales, *mabenda, mkunde,* green grams and *mchicha*), millet, mangoes and bananas (Figure 15). Cash crops grown by farmers are the Coconuts and Cashew nuts. Livestock rearing is also an important occupation in the project area though practiced by few farmers. The farmers in the project area keep some livestock such as cattle, goats and poultry (Figure 16).

Figure 15: Subsistence farming within the project area (Source: Site visit, July 2021).

Figure 16: Livestock rearing within the project area (Source: Site visit, July 2021).

2.8 Infrastructure

2.8.1 Water resources

Water forms one of the basic natural resource for the sustainable development and human wellbeing. Kwale County is supplied with water from the Kwale Water and Sewerage Company (KWAWASCO) whose operations have been improved to strengthen its governance structures. Additionally, the County has sunk 79 boreholes with 13 of these being fully solar powered, 14 electricity powered and 34 using hand pumps. There are 16 dams and 22 water pans that serve both human and livestock needs. Other sources of water include rivers, lakes, springs, ground water aquifers, sand dunes and shallow wells. Notably, most of the rivers are seasonal thus cannot be relied upon to supply the much needed water in the county for both agriculture and household uses. Kwale Water and Sewerage Company is mandated by the Coast Water Services Board to supply/distribute, control and manage all the water supply schemes within the county. Private water service providers in liaison with the Kwale water services board have been supplying water to the community to ensure water is available for all.

2.8.2 Transport

Kwale County is served by a network of roads, airstrips and water transport. An international trunk road traverses the county from Mombasa to Lunga-Lunga and other feeder roads branching off the international trunk. The feeder roads are either murram roads, earth roads or tarmacked roads. On the northern side, the Mombasa – Nairobi Highway virtually forms the boundary of Kwale and Kilifi County. There are four airstrips at Ukunda/Diani, Shimba Hills National Reserve, Msambweni and Kinango although only Ukunda/Diani is operational. Air transport has contributed to the growth of tourism sector, which significantly contributes to the economic growth of the county. Other transport infrastructure include small port such as Shimoni port which is mostly used for water transport by boats. The project site is accessible by a murrum road off the Shimoni-Kanana road (Figure 17).

Figure 17: A section of the access earth road; Fikirini- Kibuyuni road (Source: Site visit, July 2021).

2.8.3 Energy

The most common source of energy in Kwale County is wood fuel used by 80.2% of households for cooking, and 0.5% for lighting. Paraffin is used by 5.7% and 95.5% for cooking and lighting respectively, whereas 11.5% of household use charcoal for cooking with 10.6% using electricity for lighting (Figure 18). Petroleum is used mainly in transport and households e.g. water pumps and generators. Kerosene is the main source of lighting in rural areas. It is also used for cooking in both urban and rural areas. The county has potential for solar (Shimoni), wind (Samburu and Kinango) and biogas (along the coastal strip) which has not been exploited.

Figure 18: Power supply lines near the proposed project site (Source: Site visit, July 2021).

2.8.4 Telecommunication

The proposed project area is well served with communication network including the main mobile phone services such as Safaricom, Airtel and Telkom.

2.9 Social amenities

Kwale County has a total of three (3) government hospitals, eight health centers and sixty-four (64) dispensaries located in Msambweni, Kwale and Kinango Sub-counties. The doctor and nurse population ratio stands at 1: 76,741 and 1: 3,133 respectively. In addition, the county has two (2) private hospitals both located in Diani town.

The County has a total of 820 Early Childhood Development centers, a total of 519 primary schools, 97 secondary schools and 42 tertiary institutions which includes universities, colleges, vocational training and adult centers. Most of the tertiary institutions offer courses related to hospitality, salon and beauty, computer and IT training, among others.

2.10 Baseline environmental data

2.10.1 Ambient air quality measurements

There were notable gaseous concentrations of ozone (O_3), Carbon Monoxide (CO) and Non-methane Hydrocarbons (NMHC) within the project site. Nitrogen dioxide (NO_2) and Sulfur dioxide (SO_2) concentrations remained below detection limits (<0.001ppm). Notable levels of particulate matter (PM_{10} and $PM_{2.5}$) were also detected. However, all the gaseous and particulate parameters measured were all within the stipulated standards under the First Schedule of Environmental Management and Coordination (Air Quality) Regulations, 2014 (Table 4).

The activities responsible for the release of particulates and gasses to atmosphere would however include: Particulate emissions generated due to wind erosion from exposed areas; Particulate emissions generated due to the mechanical action of equipment used for tilling and harvesting operations; Vehicle entrained dust on the unpaved road surfaces; Gaseous and particulate emissions due to ocean salt spray and exhaust gases from vehicular movement.

Table 4: Baseline air quality measurements for the proposed project site (Source: Lahvens Limited, July 2021).

Project site	NO_2 (ppm)	SO_2 (ppm)	O_3 (ppm)	CO (mg/m^3)	NMHC (ppm)	$PM_{2.5}$ ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)
Run 1	<0.001	<0.001	-	0.18	2.1	12	19
Run 2	<0.001	<0.001	-	0.33	1.5	07	15
Run 3	<0.001	<0.001	-	0.25	0.9	06	13
Run 4	<0.001	<0.001	-	0.21	1.7	07	16
Average	<0.001	<0.001	0.03	0.243		8.0	15.74
Standard deviation	0.00	0.00	-	0.065	0.5	2.71	2.5
EMCA (Air Quality) Regulations, 2014	**0.5**	**0.191**	**0.12**	**4**	**700 (ppb)**	**-**	**100**

2.10.2 Ambient noise level measurements

The results of noise level measurements were within the limits stipulated under the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 (Table 5). No activities were ongoing at the time of measurements. Wind and ocean breeze were the likely sources of noise emissions.

Table 5: Baseline noise level measurements for the proposed project site (Source: Lahvens Limited, July 2021).

Location	Measured Sound Pressure Level (Noise) (dBA) (1100Hrs-1200Hrs)			EMCA Guidelines (Day time)
	LAeq	Lmin	Lmax	
Proposed project site	50.7	40.9	80.8	55

2.10.3 Baseline water quality results

The objective of the water quality sampling and analysis is to provide a baseline for assessing the effectiveness of environmental and social management plans designed to minimize water contamination. The water sampled within the monitoring stations conformed to the standards prescribed under the Third Schedule of the Environmental Management and Coordination (Water Quality), Regulations, 2006 (Table 6).

Table 6: The baseline water quality monitoring results for the monitoring station (Source: Lahvens Limited, July 2021).

Monitoring station	Depth (m)	Temp.	pH	Turbidity (NTU)	DO (mg/L)	BOD (mg/L)	COD (mg/L)	TSS (mg/L)
Shimoni	0.5	25.90	8.23	1.1	6.94	7.13	18.65	24.00
	3.0	25.90	8.26	1.8	6.76	10.44	24.11	15.00
	8.0	25.90	8.27	3.0	6.52	9.90	19.71	8.00
	Mean	**25.90**	**8.25**	**1.97**	**6.74**	**9.16**	**20.82**	**15.67**
EMCA Standards	-	-	6.5-8.5	-	-	30	50	30

2.10.4 Baseline biological monitoring

2.10.4.1 Plankton surveys

Plankton play a fundamental role in marine ecosystems and especially coastal waters where nutrients are known to limit primary productivity rates. Furthermore, plankton populations are key indicators of water quality and affect community structure, biomass and productivity rates for the fisheries. Plankton demonstrates water quality through changes in its community composition, and distribution, and proportion of sensitive species. Species rarity is of specific significance in total structure of species diversity.

2.10.4.2 Phytoplankton distribution and diversity

Table 7 shows the genera of Phytoplankton found at the sampling sites, with presence (+) and absence (-) classification for all the monitoring sites (Figures 19 & 20).

Table 7: Presence(+) Absence (-) data for comparison of 67 Phytoplankton genera recorded in the four (4) monitoring sites and total number of genera at each site.

Class	Genera	MS-1 Shimoni Jetty	MS-2 Kibuyuni	MS-3 Mkwiro	MS-4 Nyuli
Diatom	Achnathidium	--	--	--	+
Dinoflagellate	Alexandrium	--	+	--	+
Dinoflagellate	Amphidinium	--	--	--	--
Diatom	Amphora	+	+	--	--
Diatom	Asterionellopsis	+	--	+	--
Diatom	Asteromphalus	+	--	--	--

Class	Genera	MS-1 Shimoni Jetty	MS-2 Kibuyuni	MS-3 Mkwiro	MS-4 Nyuli
Diatom	Bacteriastrum	+	+	+	+
Diatom	Biddulphia	--	--	--	--
Diatom	Bleakeleya	--	--	--	+
Diatom	Campylodiscus	--	+	--	--
Diatom	Cerataulina	+	+	+	+
Dinoflagellate	Ceratium	+	+	+	+
Diatom	Chaetoceros	+	+	+	+
Flagellate	Choanoflagellida	+	+	+	+
Diatom	Corethron	+	+	+	+
Dinoflagellate	Corythodinium	--	+	+	--
Diatom	Coscinodiscus	+	+	--	+
Diatom	Cyclotella	+	--	+	--
Diatom	Cymatopleura	--	--	+	--
Diatom	Dactyliosolen	+	--	+	+
Diatom	Dictyocha	+	+	+	+
Dinoflagellate	Dinophysis	--	+	--	--
Diatom	Diploneis	--	--	--	+
Diatom	Ditylum	+	--	+	--
Diatom	Entomoneis	+	+	--	+
Diatom	Eucampia	+	+	+	+
Flagellate	Eutreptiella	--	+	--	--
Diatom	Fragilaria	--	--	--	+
Dinoflagellate	Gambierdiscus	+	--	--	+
Dinoflagellate	Goniodoma	--	--	--	--
Dinoflagellate	Gonyaulax	--	--	--	--
Diatom	Guinardia	+	+	+	+
Dinoflagellate	Gymnodinium	--	+	--	--
Diatom	Haslea	+	+	+	+
Diatom	Hemiulus	--	+	+	+
Diatom	Lauderia	+	+	+	+
Diatom	Leptocylindrus	+	--	+	+
Diatom	Licmophora	--	--	--	+
Diatom	Melosira	+	+	+	+
Diatom	Meuniera	--	--	--	--
Diatom	Navicula	+	+	+	+
Diatom	Nitzschia	+	+	+	+
Silicoflagellate	Octactis	+	--	--	+
Diatom	Odontella	--	--	--	--
Cyanobacteria	Oscillatoria	+	--	--	+
Dinoflagellate	Ostreopsis	--	--	--	--
Dinoflagellate	Oxyphysis	--	--	--	+
Dinoflagellate	Peridinium	--	--	--	--
Dinoflagellate	Phalacroma	+	--	+	--
Diatom	Plagiodiscus	--	--	--	--
Diatom	Pleurosigma	+	+	+	+

Class	Genera	MS-1 Shimoni Jetty	MS-2 Kibuyuni	MS-3 Mkwiro	MS-4 Nyuli
Dinoflagellate	Prorocentrum	+	+	+	+
Dinoflagellate	Protoperidinium	+	+	+	+
Diatom	Pseudoguinardia	--	+	--	--
Diatom	Pseudo-nitzschia	+	+	+	+
Dinoflagellate	Pyrophacus	--	+	--	--
Diatom	Rhizosolenia	+	+	+	+
Diatom	Scenedesmus	+	--	--	--
Dinoflagellate	Scrippsiella	+	+	+	+
Diatom	Skeletonema	+	--	+	+
Diatom	Striatella	--	--	--	+
Diatom	Surirella	--	--	+	+
Diatom	Tabellaria	+	--	--	--
Diatom	Thalassionema	+	+	+	+
Diatom	Thalassiophysa	--	--	--	+
Diatom	Thalassiosira	--	+	+	+
Number of Genera (X/67)		37	34	33	41

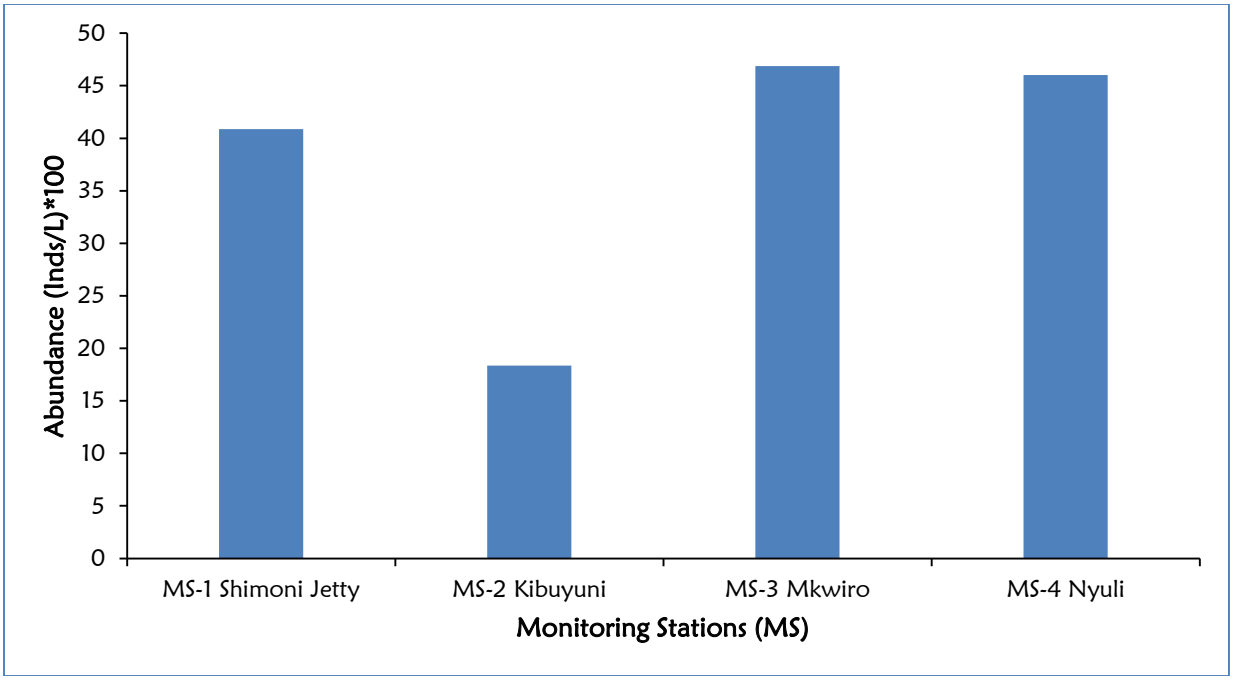


Figure 19: Abundance of Phytoplankton (inds./L) at the selected four monitoring stations was sampled for comparison.

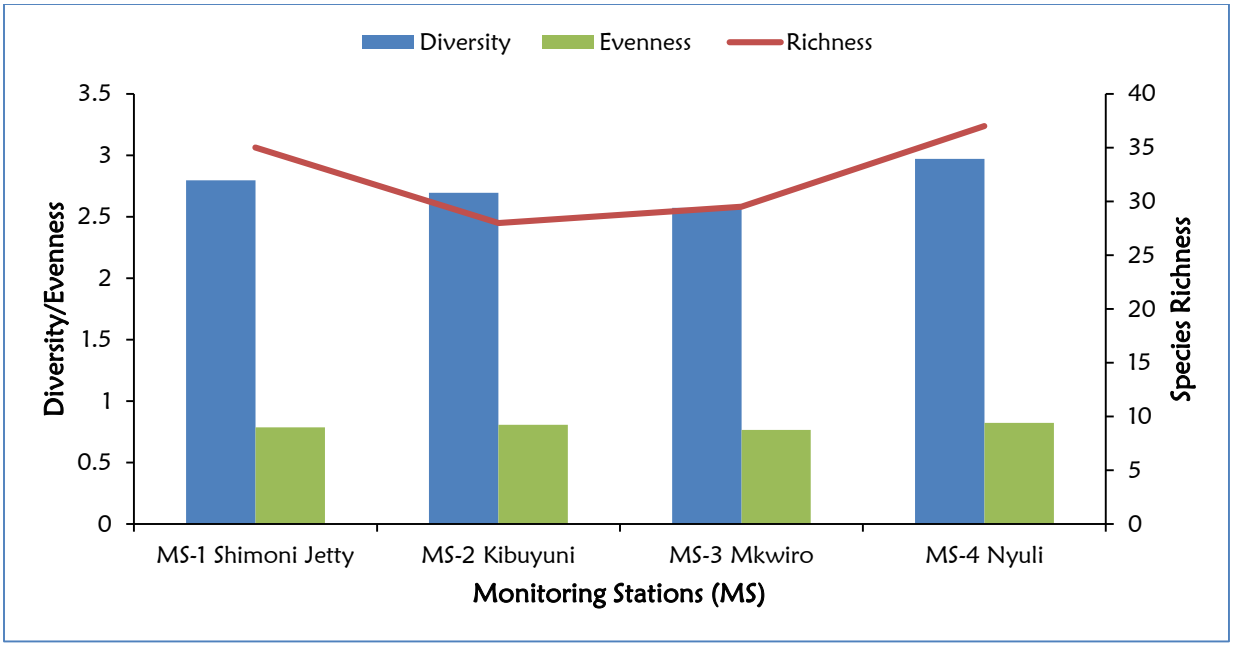


Figure 20: Phytoplankton Diversity, Evenness and Richness at selected four monitoring stations was sampled for comparison.

2.10.4.3 Zooplankton distribution and diversity

The zooplankton community is an important element of the marine food chain and act/ serve as intermediary species in the food chain, transferring energy from planktonic algae (primary producers) to the larger invertebrate predators and fish who in turn feed on them. Consequently, the zooplankton community is a key indicator of the health of the fisheries in coastal marine environments.

Analyses indicated that some zooplantkon taxa such Arcatia, Brachyura, Caridea, Chaetognatha, Corycaeus, Diphyes, Eucalanus, Fish eggs, Fish larvae, Gastropoda, Labidocera, Lucifer, Neocalanus, Oithona, Oncaea, Radiollaria, Stomatopoda and Temora occurring in all the four monitoring stations. Consequently, ecological monitoring for any impacts should take cognizance of any changes in these universally occurring taxa. However, some rare taxa such as Atlanta (family Atlantidae); Euchaeta and *Liriope tetraphylla* only recorded at the Nyuli site; Calanus, Cumacean and Megalopa at Kibuyuni; Megalopa (kibuyuni) and Tortanus at the Shimoni Jetty as shown in table 8 below.

Table 8: Presence(+) Absence (-) data for comparison of 57 Zooplankton genera recorded in the four (4) monitoring sites and total number of genera at each site.

Taxa	MS-1 Shimoni Jetty	MS-2 Kibuyuni	MS-3 Mkwiro	MS-4 Nyuli
Acartia	+	+	+	+
Acrocalanus	+	--	+	--
Amphipoda	+	--	--	--
Atlanta	--	--	--	+
Bassia	--	--	+	+
Bivalve	+	+	+	--
Brachyuran zoea	+	+	+	+
Bryzoa	+	--	+	+

Taxa	MS-1 Shimoni Jetty	MS-2 Kibuyuni	MS-3 Mkwiro	MS-4 Nyuli
Calanopia	--	+	+	--
Calanus	--	+	--	--
Callocalanus	+	--	+	+
Candacia	--	--	+	+
Caridea	+	+	+	+
Centropages	--	+	--	+
Chaetognatha	+	+	+	+
Cladocera	+	+	--	+
Clytemnestra	+	--	--	+
Copepodite	--	--	--	--
Copilia	--	--	--	+
Corycaeus	+	+	+	+
Creseis	--	--	--	+
Cumacean	--	+	--	--
Diphyes	+	+	+	+
Doliolida	--	--	--	--
Eucalanus	+	+	+	+
Euchaeta	--	--	--	+
Fish eggs	+	+	+	+
Fish larvae	+	+	+	+
Foraminifera	+	--	+	+
Gastropoda	+	+	+	+
Holothuria	--	--	--	--
Insecta	--	--	--	--
Labidocera	+	+	+	+
Liriope tetraphylla	--	--	--	+
Lucifer	+	+	+	+
Megalopa	--	+	--	--
Mysida	--	--	--	--
Nannocalanua	+	--	--	+
Neocalanus	+	+	+	+
Oikopleaura	+	+	+	--
Oithona	+	+	+	+
Oncaea	+	+	+	+
Pleaurobranchia		--	+	--
Ostracoda	--	+	--	--
Polychaeta larvae	+	+	+	--
Pontella	--	--	--	--
Pontellina	--	--	--	+
Pontellopsis	--	--	--	--

Taxa	MS-1 Shimoni Jetty	MS-2 Kibuyuni	MS-3 Mkwiro	MS-4 Nyuli
Porcellidium	+	--	+	--
Pseudodiaptomus	--	--	--	--
Radiollaria	+	+	+	+
Sapphirina	--	--	--	+
Stomatopoda	+	+	+	+
Temora	+	+	+	+
Tortanus	+	--	--	--
Turbellaria	--	+	+	+
Undinula	--	--	--	+

Results showed a fairly high species richness and diversity within all the surveyed stations, with Mean±SD at 54±6 taxa, with lowest richness in Kibuyuni (49 Taxa) while the Kisite Mpunguti Marine Park and Reserve at Nyuli recorded the highest taxa (63 Taxa), confirming the importance of the Marine protected area (MPA) as a refugia and bank for species within the wider shimoni ecosystem. Fifty-two (52) taxa were recorded at the Shimoni Jetty and Mkwiro community conservation area across the channel (Figure 21).

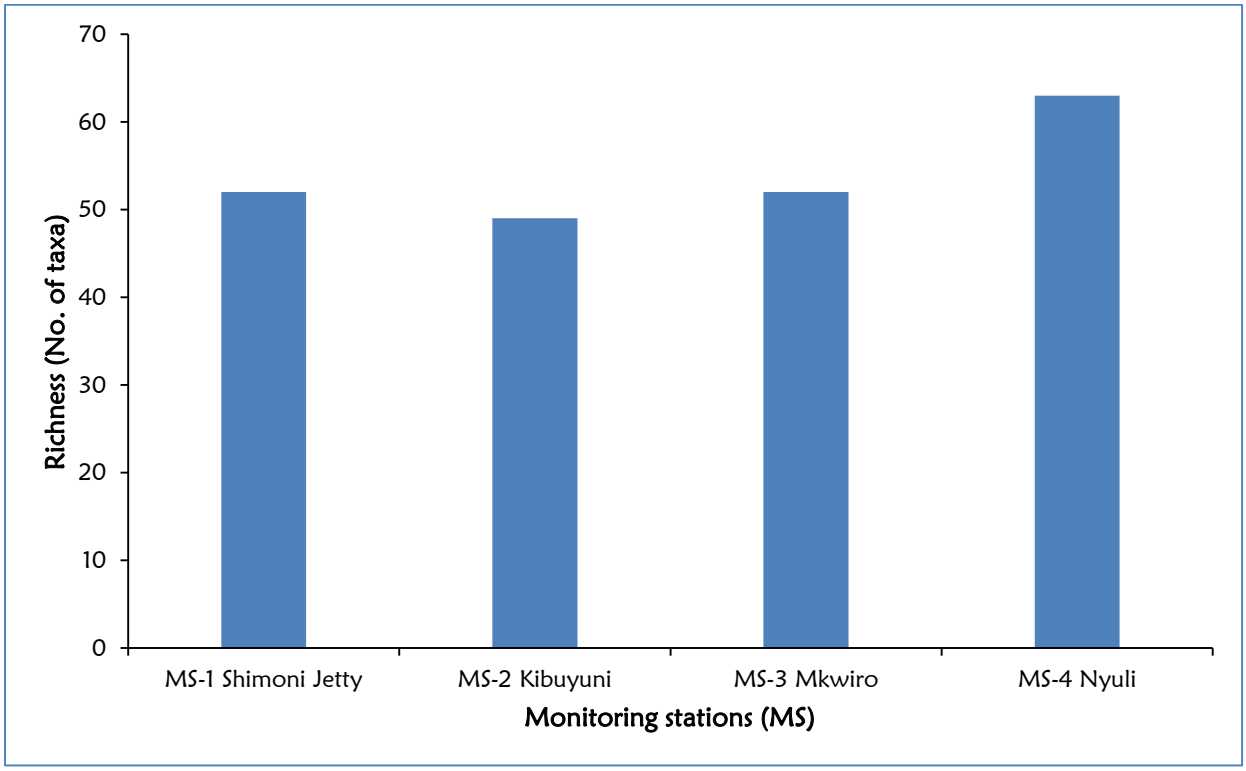


Figure 21: Zooplankton Species Richness at the four monitoring stations.

Similarly, species distribution showed higher abundance (inds./litre) at the Kisite Mpunguti Marine Park and Reserve Site at Nyuli with 305 inds./litre followed by Shimoni Jetty site with 86 inds./litre; Mkwiro community conservation site with 25 inds./litre and Kibuyuni coral reef site with 5 inds./litre (Figure 22).

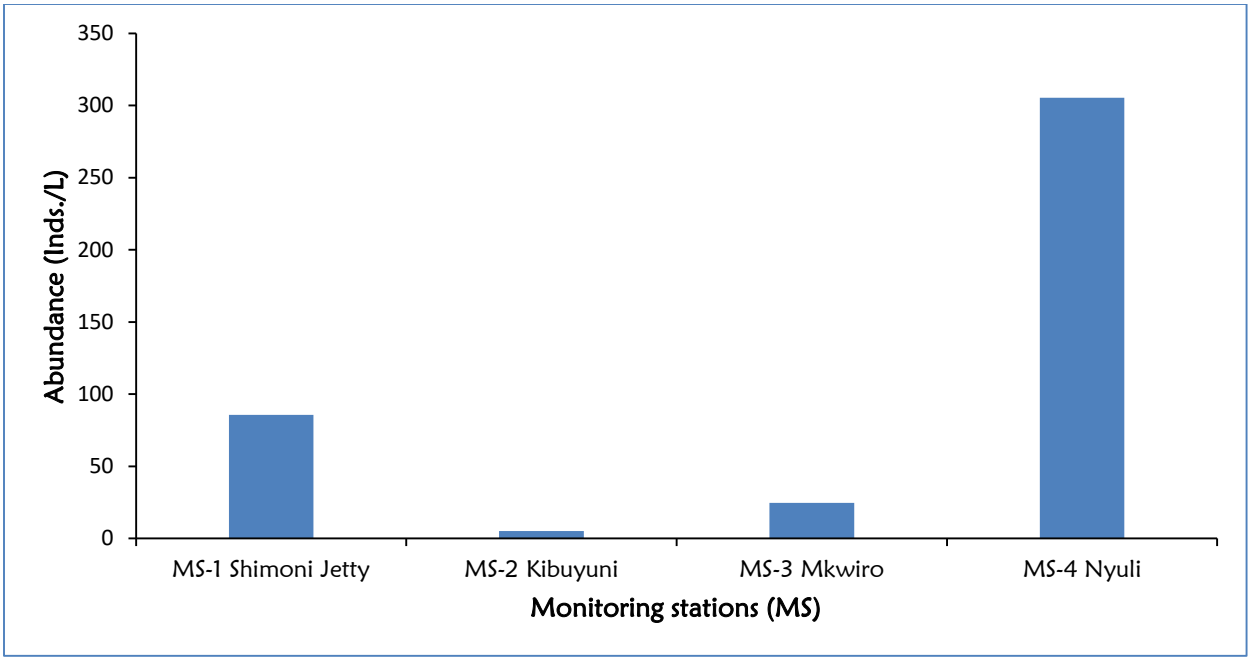


Figure 22: Zooplankton Abundance at the four monitoring stations.

2.10.4.4 Fisheries

A total of 96 fish species from the 25 families were recorded across the three sites in Shimoni during the field survey. The highest species richness was recorded at Mkwiro with 63 species while Nyuli and Kibuyuni recorded 51 and 41 species respectively, the common names are based on Lieske and Myers (2001) (Figure 23). The total fish density based on the 13 families was varied by sites ranging from highest of 4626.7 ± 451.6 Individuals/ha at Mkwiro to 2333.3 ± 275.5 and 2146.7 ±153.8 at Nyuli and Kibuyuni respectively (Figure 23). Pairwise test of significant difference using Tukey HSD test revealed significant difference between Mkwiro and Kibuyuni and Mkwiro and Nyuli ($p < 0.05$). The difference was not significant between Nyuli and Kibuyuni ($p = 0.91$).

Eight of the 13 pre-selected families were recorded in all the three sites. Haemulidae was recorded at Mkwiro and Kibuyuni while Serranidae was recorded at Nyuli and Kibuyuni. Balistidae, Siganidae and Kyphosidae were only recorded in one of the sites. Acanthuridae was the most abundant family in all the sites with mean densities of 1293.3 ± 246.9, 1106.7 ± 314.4 and 693.3 ± 209.5 at Mkwiro, Nyuli and Kibuyuni respectively. Other abundant families (>500 individuals/ha) were Lutjanidae at Mkwiro and Nyuli and Pomacanthidae and Scarinae at Mkwiro (Figure 24, Table 9). Common names are based on Lieske and Myers (2001).

The difference in density and richness recorded could likely be due to protection and coral reef condition. Mkwiro which recorded highest density is protected through community conserved area hence low fishing pressure compared to Nyuli that is open to fishing hence recorded lower density and richness. Although, the survey at Kibuyuni was within a community conserved area, the extent of coral dominated reef is small and has high sediment load hence lowest density and diversity. Acanthuridae (surgeonfishes) are common taxonomic group in coral reefs and span a range of trophic groups hence expected to be in higher densities in relatively healthy coral reefs. This suggests the coral reefs in a relatively health state.

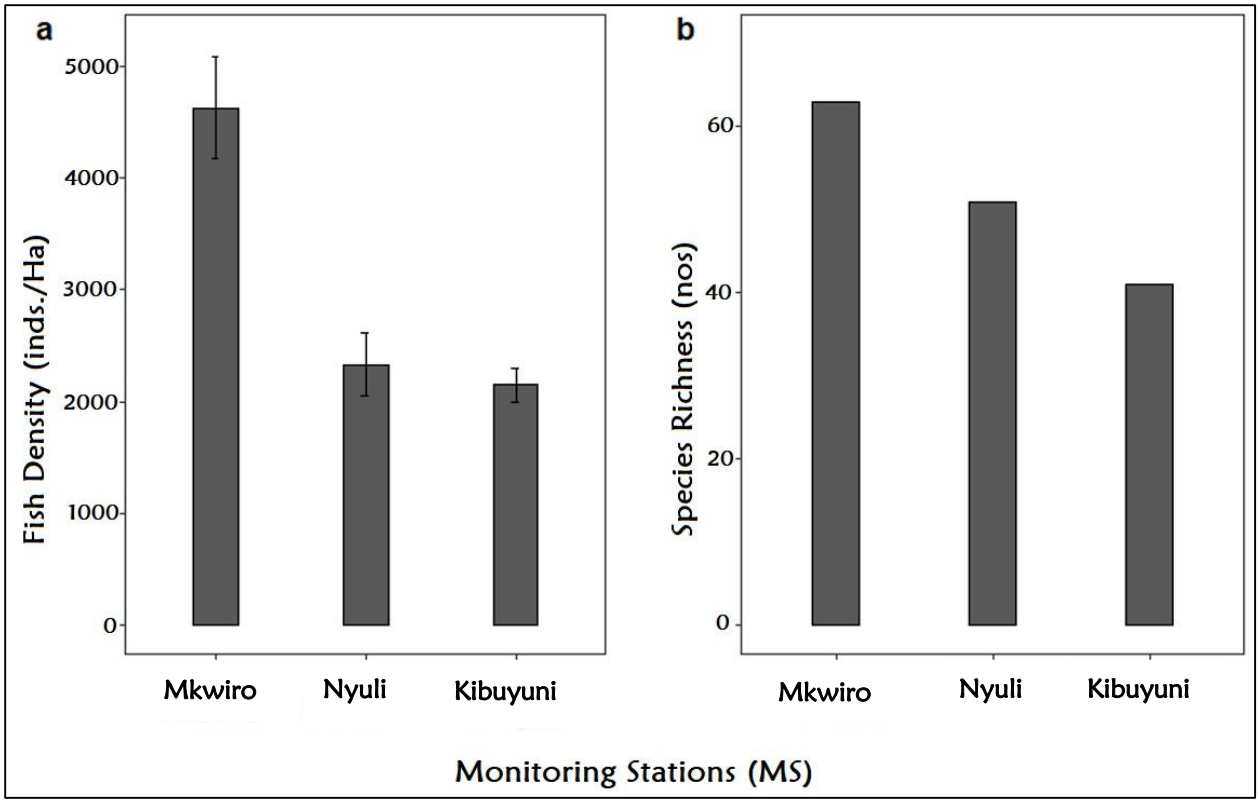


Figure 23: Barplot of Mean (se) of total fish density by sites (a) and Total number of species (absolute number) by sites (b).

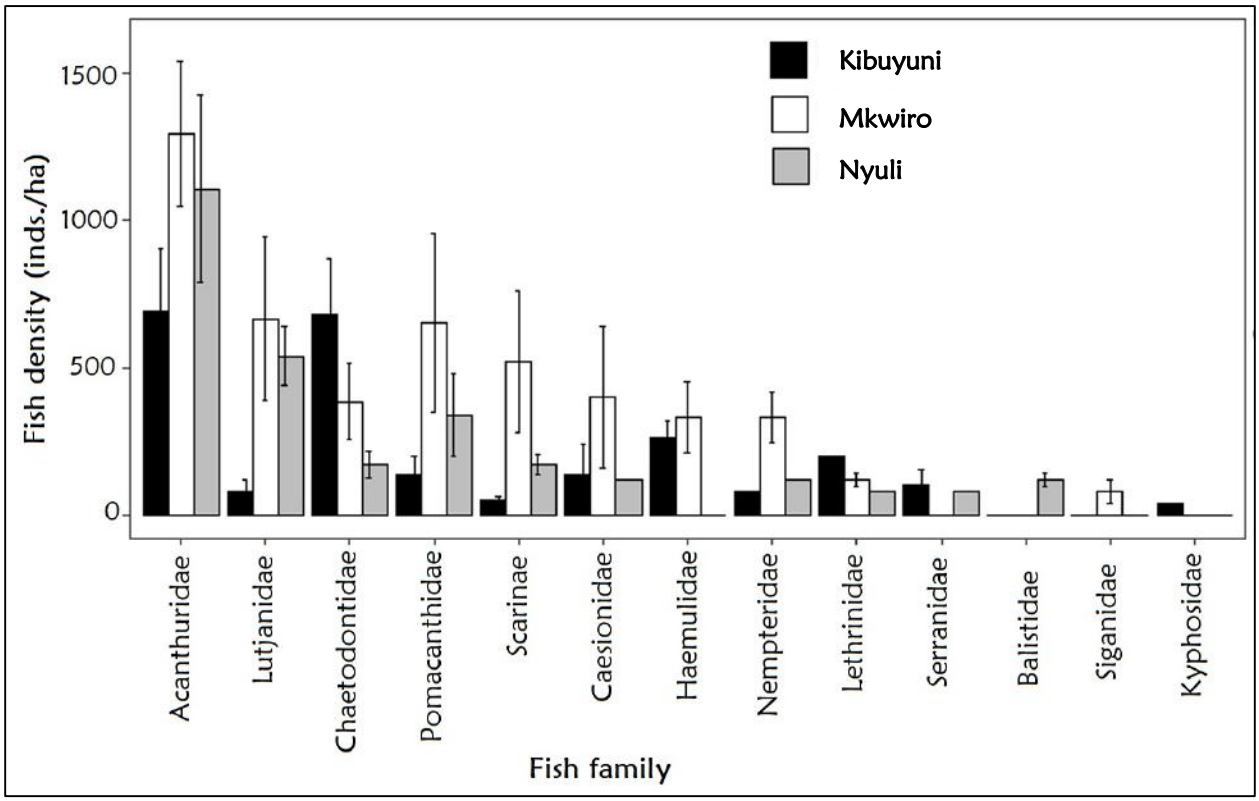


Figure 24: Fish family density at Kibuyuni, Mkwiro and Nyuli (Mean density ± SE) (Source: Field survey, July 2021).

Table 9: Presence (+) and absence (-) of coral reef fish species recorded in the 3 sites and total at each site (Source: Field survey, July 2021).

Family	Scientific name	Species common name	Kibuyuni (41)	Mkwiro (63)	Nyuli (51)
Holocentridae	*Neoniphon sammara*	Bloodspot squirrelfish	-	+	+
Holocentridae	*Sargocentron caudimaculatum*	Tailspot squirrelfish	+	+	+
Aulostomidae	*Aulostomus chinensis*	Trumpetfish	-	+	-
Serranidae	*Aethaloperca rogaa*	Redmouth grouper	+	-	-
Serranidae	*Cephalopholis argus*	Peacock grouper	+	-	+
Serranidae	*Cephalopholis boenack*	Chocolate hind	+	-	-
Serranidae	*Cephalopholis spiloparaea*	Strawberry grouper	-	-	+
Serranidae	*Epinephelus caeruleopunctatus*	White spotted grouper	+	-	-
Serranidae	*Epinephelus malabaricus*	Malabar grouper	+	-	-
Cirrhitidae	*Paracirrhites forsteri*	Freckled hawkfish	-	+	+
Priacanthidae	*Priacanthus hamrur*	Cresent-tail bigeye	+	+	-
Apogonidae	*Apogon cookii*	Blackbanded cardinal fish	+	+	-
Apogonidae	*Apogon aureus*	Ring-tailed cardinalfish	+	+	-
Lutjanidae	*Aprion virescens*	Green jobfish	-	-	+
Lutjanidae	*Lutjanus bohar*	Twinspot snapper	+	-	-
Lutjanidae	*Lutjanus fulviflamma*	Blackspot snapper	+	+	+
Lutjanidae	*Lutjanus lutjanus*	Bigeye snapper	-	-	+
Lutjanidae	*Lutjanus kasmira*	Bluelined snapper	-	-	+
Caesionidae	*Pterocaesio tile*	Bluestreal fusilier	+	+	-
Caesionidae	*Caesio caerulaurea*	Scissor-tail fusilier	-	+	-
Caesionidae	*Caesio lunaris*	Lunar fusilier	-	-	+
Caesionidae	*Caesio spp.*	Caesio spp.	-	+	-
Haemulidae	*Diagramma pictum*	Slatey sweetlips	+	-	-
Haemulidae	*Plectorhinchus flavomaculatus*	Gold-spotted sweetlips	+	-	-
Haemulidae	*Plectorhinchus gaterinus*	Blackspotted sweetlips	+	+	-
Haemulidae	*Plectorhinchus playfairi*	Whitebarred sweetlips	-	+	-
Nempteridae	*Scolopsis ghanam*	Arabian spinecheeck	+	+	+
Lethrinidae	*Lethrinus harak*	Blackspot emperor	-	+	+
Lethrinidae	*Lethrinus lentjan*	Pinkeye	+	-	-
Lethrinidae	*Lethrinus mahsena*	Sky emperor	+	+	-

Family	Scientific name	Species common name	Kibuyuni (41)	Mkwiro (63)	Nyuli (51)
Lethrinidae	*Lethrinus microdon*	Smalltooth emperor	-	-	+
Lethrinidae	*Monotaxis grandoculis*	Bigeye emperor	-	+	-
Mullidae	*Mulloidichthys vanicolensis*	Yellowfin goatfish	-	+	+
Mullidae	*Parupeneus macronema*	Longbarbel goatfish	-	+	+
Mullidae	*Parupneus barberinus*	Dash and dot goatfish	-	+	+
Kyphosidae	*Kyphosid spp.*	Kyphosid	+	-	-
Chaetodontidae	*Chaetodon auriga*	Threadfin butterflyfish	+	+	-
Chaetodontidae	*Chaetodon falcula*	Saddleback butterflyfish	+	-	-
Chaetodontidae	*Chaetodon interuptus*	Teardrop butterflyfish	+	-	-
Chaetodontidae	*Chaetodon kleinii*	Klein's butterflyfish	-	+	+
Chaetodontidae	*Chaetodon lunula*	Racoon butterflyfish	+	+	-
Chaetodontidae	*Chaetodon melannotus*	Blackbacked butterflyfish	+	+	-
Chaetodontidae	*Chaetodon meyeri*	Meyer's butterflyfish	-	+	+
Chaetodontidae	*Chaetodon trifascialis*	Chevroned butterflyfish	+	-	+
Chaetodontidae	*Chaetodon trifasciatus*	Redfin butterlfyfish	+	+	+
Chaetodontidae	*Chaetodon xanthocephalus*	Yellowhead butterflyfish	-	+	-
Chaetodontidae	*Chaetodon guttattisimus*	Spotted butterflyfish	-	-	+
Pomacanthidae	*Apolemichthys trimaculatus*	Three-spot angelfish	-	+	-
Pomacanthidae	*Centropyge multispinis*	Many-spined angelfish	+	+	+
Pomacentridae	*Plectroglyphidodon dicki*	Dick's damsel	-	+	-
Pomacentridae	*Abudefduf sparoides*	False-eye sergeant	-	+	-
Pomacentridae	*Chromis dimidiata*	Two-tone chromis	+	+	+
Pomacentridae	*Amphiprion akallopsis*	Skunk anemonefish	-	+	-
Pomacentridae	*Abudeduf sexfasciatus*	Scissor-tail sergeant	-	-	+
Pomacentridae	*Plectroglyphidodon lacrymatus*	Jewel damsel	+	+	+
Pomacentridae	*Dascyllus trimaculatus*	Three-spot dascyllus	-	+	+
Pomacentridae	*Dascyllus aruanus*	Humbug dascyllus	+	-	+
Labridae	*Labroides bicolor*	Bicolor cleaner wrasse	+	+	-
Labridae	*Bodianus axillaris*	Axilspot hogfish	-	+	+
Labridae	*Thalassoma hebraicum*	Goldbar wrasse	-	+	+
Labridae	*Thalassoma lunare*	Cresent wrasse	+	+	-

Family	Scientific name	Species common name	Kibuyuni (41)	Mkwiro (63)	Nyuli (51)
Labridae	*Gomphosus caeruleus*	Indian ocean bird wrasse	-	+	+
Labridae	*Cheilinus trilobatus*	Tripletail wrasse	-	+	+
Labridae	*Heliochores hortulans*	Checkerboard wrasse	-	+	+
Labridae	*Hemigymnus fasciatus*	Barred thicklip wrasse	-	+	-
Labridae	*Anampses lineatus*	Lined wrasse	-	+	-
Labridae	*Anampses twistii*	Yellowbreasted wrasse	-	+	-
Labridae	*Coris frerei*	Queen coris	-	-	+
Scarinae	*Calotomus carolinus*	Stareye parrotfish	-	-	+
Scarinae	*Chlorurus sordidus*	Bullethead parrotfish	-	+	+
Scarinae	*Scarus atrilunula*	Blackcresent parrotfish	-	+	-
Scarinae	*Scarus ghobban*	Bluebarred parrotfish	+	+	+
Scarinae	*Scarus psittacus*	Palenose parrotfish	-	-	+
Scarinae	*Scarus rubroviolaceus*	Redlip parrotfish	-	+	+
Pinguipedidae	*Parapercis hexophthalma*	Speckled sandperch	-	+	+
Zanclidae	*Zanclus cortunus*	Moorish idol	+	+	-
Acanthuridae	*Acanthurus gahm*	Black surgeonfish	+	+	+
Acanthuridae	*Acanthurus leucosternon*	Powder-blue surgeonfish	-	+	+
Acanthuridae	*Acanthurus lineatus*	Striped surgeonfish	-	-	+
Acanthuridae	*Acanthurus nigrofuscus*	Dusky surgeon fish	-	+	+
Acanthuridae	*Acanthurus thompsonii*	Thompson's surgeonfish	-	+	-
Acanthuridae	*Ctenochaetus binotatus*	Two-spot bristletooth	-	+	-
Acanthuridae	*Ctenochaetus striatus*	Striped bristletooth	+	+	+
Acanthuridae	*Ctenochaetus truncatus*	Goldring bristletooth	-	-	+
Acanthuridae	*Naso brevirostris*	Spotted unicornfish	-	+	-
Acanthuridae	*Naso thynnoides*	Singlespine unicornfish	-	-	+
Acanthuridae	*Zebrasoma desjardinii*	Desjardini's tailfin tang	+	-	-
Acanthuridae	*Zebrasoma scopas*	Sailfin tang	+	+	-
Acanthuridae	*Acanthurus blochii*	Ringtail surgeonfish	+	+	+
Siganidae	*Siganus stellatus*	Stellate rabbitfish	-	+	-
Siganidae	*Siganus sutor*	African whitespotted rabbitfish	-	+	-

Family	Scientific name	Species common name	Kibuyuni (41)	Mkwiro (63)	Nyuli (51)
Balistidae	*Sufflamen chrysopterus*	Halfmoon triggerfish	-	-	+
Balistidae	*Balistuphus undulatus*	Orange-stripped triggerfish	-	+	-
Ostraciidae	*Ostracion meleagris*	Spotted trunkfish	-	-	+
Tetraodontidae	*Canthigaster coronata*	Crown toby	+	-	+
Tetraodontidae	*Arothron hispidus*	White spotted puffer	-	-	+
Total			**41**	**63**	**51**

2.10.4.5 Benthic substrate

Benthic substrate indicates the state of reef condition and is used in assessing phase shifts of coral reef communities to other forms and their health status. Hard corals dominated the substrate cover at Kibuyuni and Mkwiro with mean cover of 59.3% ± 1.3 and 29.3% ± 1.8 respectively. Nyuli was dominated by soft corals with a mean cover of 24.0% ± 3.1. Hard coral cover at Nyuli was 20.7% ± 2.4. The coral cover at Mkwiro and Kibuyuni are higher than the average for the Kenyan coral reefs of about 20% while Nyuli is within the country average. Several recently dead corals were observed at all the sites and this is likely due to the recent bleaching events (April and May, 2020) or other factors such as sedimentation especially at Kibuyuni. Silt and seagrass were only recorded at Kibuyuni with a mean cover of 12.0% ± 1.2 and 7.3% ± 1.3 respectively (Figures 25 & 26). A total of 21 coral genera were recorded in the three sites. Kibuyuni recorded the highest richness with 19 genera while Nyuli recorded 14 and Mkwiro recorded 12 genera. Taxonomic names are based on Corals of the World (2020) (Table 10).

It was also noted that there are ongoing biodiversity conservation programmes in Shimoni, Wasini, Mkwiro and Kibuyuni where the local communities have Community Conservation Areas to conserve fisheries and marine resources. They have established coral nurseries on degraded sites, transplant the corals and create awareness on restoration of marine life.

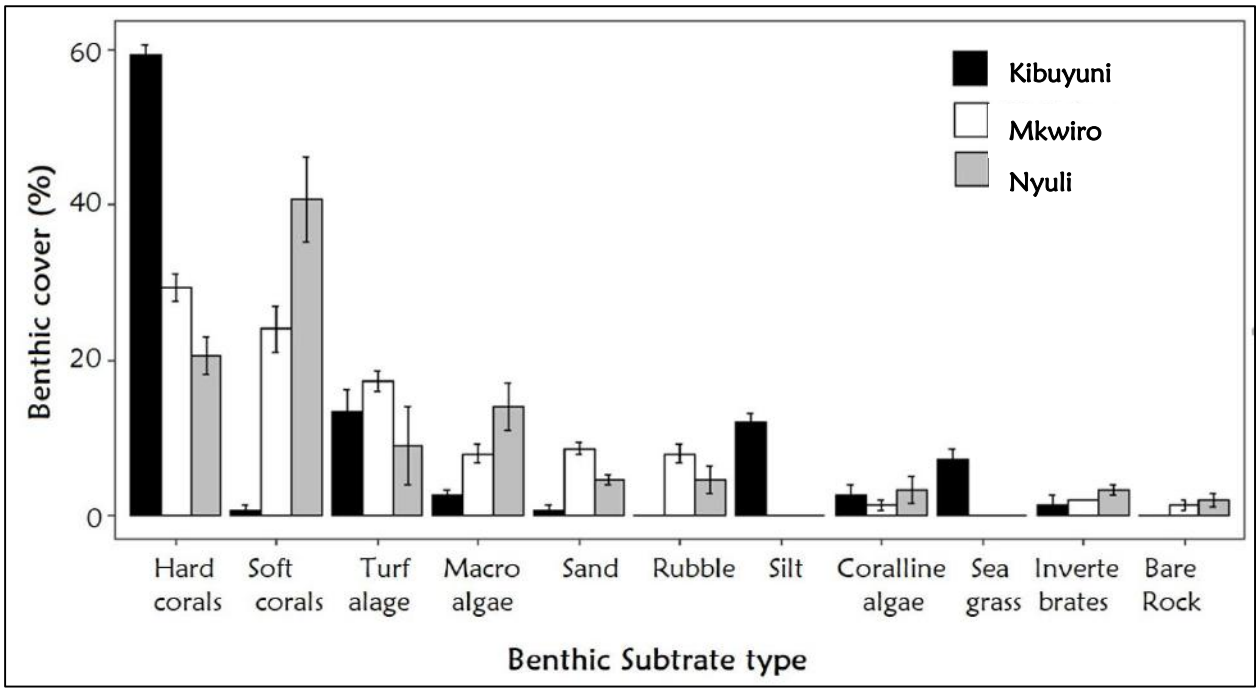


Figure 25: Benthic habitats Characterization for the biological monitoring sites; Kibuyuni, Mkwiro and Nyuli (Mean density ± SE).

Figure 26: Different benthic substrates of coral reefs in the three sites surveyed, Hard coral Acropora, Rubble Sand and Seagrass meadow.

Table 10: Presence (+) Absence (-) data for comparison of 21 coral genera recorded in the three (3) monitoring sites and total at each site.

Family	Genus	Kibuyuni	Mkwiro	Nyuli
Acroporidae	Acropora	+	+	+
Acroporidae	Montipora	+	+	+
Acroporidae	Isopora	-	-	+
Acroporidae	Asteopora	+	+	-
Pocilloridae	Pocillopora	+	+	+
Pocilloridae	Stylophora	+	-	-
Pocilloridae	Seriatopora	+	-	-
Fungiidae	Fungia	+	+	+
Fungiidae	Herpolitha	+	-	+
Faviidae	Favia	+	+	+
Faviidae	Favites	+	+	+
Faviidae	Echinopora	+	+	+
Faviidae	Platygyra	+	+	+
Faviidae	Diploastrea	+	-	-
Mussidae	Symphilia	+	+	+
Mussidae	Lobophylia	+	-	-
Merulidae	Merulina	+	-	-

Family	Genus	Kibuyuni	Mkwiro	Nyuli
Poritidae	Porites	+	+	+
Poritidae	Goniopora	+	+	-
Coscinaraeidae	Coscinaraea	-	-	+
Oculinidae	Galaxea	+	+	+

2.10.4.6 Benthic invertebrates

Benthic invertebrates are important indicators of benthic health as well as other external disturbances such as sedimentation. A total of 14 benthic invertebrates were recorded across the sites. Mkwiro recorded the highest species richness with 10 taxa observed while 7 taxa were recorded at both Kibuyuni and Nyuli. Only two taxa Asteroidea (seastar) and Sea anemone were recorded across all the sites. Nyuli recorded the highest mean density of 12.3 ± 4.1 individuals/250m^2, Mkwiro and Kibuyuni recorded mean densities of 7.6 ± 2.5 individuals/250m^2 and 6.1 ± 2.1 individuals/250m^2. Overall, the sea urchin species *Echinostrephus molaris* and *Echinothrix diadema* were the most abundant invertebrates with mean densities of 33.7 ± 8.2 individuals/250m^2 and 27.3 ± 8.0 individuals/250m^2 respectively (Table 11).

Table 11: Mean density and standard error of 14 benthic invertebrates taxa recorded by sites. Number in parenthesis indicate number of taxa (Source: Field survey, July 2021).

Benthic Invertebrates	Kibuyuni (7)		Mkwiro (10)		Nyuli (7)	
	Mean	SE	Mean	SE	Mean	SE
Asteroidea	2.7	1.8	8.7	1.8	16.7	2.9
Bivalves	0.0	0.0	2.0	2.0	4.0	2.0
C. tigris	0.0	0.0	1.3	1.3	0.0	0.0
Diadema savignyi	3.3	1.3	0.0	0.0	0.0	0.0
Diadema setossum	14.0	3.1	3.3	1.8	0.0	0.0
E. diadema	19.3	10.7	35.3	17.4	0.0	0.0
E. molaris	0.0	0.0	14.0	6.1	53.3	8.8
Egg shell	0.0	0.0	0.7	0.7	0.0	0.0
Gastropoda	0.0	0.0	4.0	2.0	4.7	1.3
Giant clam	0.0	0.0	0.7	0.7	0.7	0.7
Holothuria	0.7	0.7	0.0	0.0	0.0	0.0
Lobster	2.0	1.2	0.0	0.0	0.0	0.0
Sea anemone	0.7	0.7	6.0	3.5	6.0	1.2
Sea hare	0.0	0.0	0.0	0.0	0.7	0.7

3 IDENTIFICATION OF ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES

The proposed project will have both socio-economic benefits and attendant negative environmental and social impacts. One of the key objectives of the ESIA process is to systematically assess the value of the benefits against the environmental and social concerns and provide measures to avoid, prevent or reduce the magnitude of the impacts. The following section identifies, predicts and analyzes these impacts and proposes mitigation measures to address them. The mitigation measures are based several EIA principles such as the entitlement to a clean and healthy environment and duty to enhance and safeguard the environment, polluter pays principle, precautionary approach and stakeholder involvement in addressing environmental and social challenges of the proposed project.

3.1 Positive impacts of the proposed project

The project's direct benefits include but are not limited to the following;

1. **Simulation of industrial development coherent with Kenya's Vision 2030**
   Mining ensures industrialization and development through the utilization of the country's mineral resources to catalyze diversified industrial development. This is in line with the Kenya Vision 2030 which aims at harnessing the mineral resources for industrial development and transforming Kenya into a newly industrializing middle-income country.
2. **Mitigating the national and regional demand for cement**
   As Kenya strives for industrial and economic development, there is a corresponding increase in construction activities which has translated to high demands of construction materials such as cement. According to the Kenya National Bureau of Statistics, the nation's construction industry registered accelerated growth of 13.1% last year compared to 5.8% in 2013. The establishment of the quarries will increase production of limestone. Limestone is the most common form of calcium carbonate which is used extensively for the manufacture of cement.
3. **Providing employment opportunities**
   During the project planning and design, the project proponent has already employed consultants including architects, engineers and ESIA consultants. During the construction and operational phases, several skilled and unskilled personnel from within and outside the local community will be employed to provide different services. In addition, the proponent will engage artisanal miners to promote better integrated rural development strategies. As a result, many will benefit from improved livelihood and increased income from employment at the facility.
4. **Income to the proponent**
   The facility through its operations will accrue income to the proponent thus enabling expansion of business and creating more employment opportunities to the locals.
5. **A market for local goods and services**
   The proposed project will be a market base for various goods and services required to run its operations. Goods include cement, sand and aggregate for construction works among others while services include energy, telecommunication and environmental audits among others.
6. **Revenue to the government**
   The government will get revenue in terms of taxes generated during the acquisition of statutory licenses. The construction material to be used during construction will also be taxable. Through the revenues generated, the government will be capable of financing its obligations to the county and country.

3.2 Anticipated negative environmental and social impacts

Against the background of positive impacts, the proposed project is expected to result in a number of negative environmental and social impacts at the various stages of implementation. These impacts include change in land use, loss of arable land, environmental risks of obtaining raw materials, impact

on biodiversity, soil erosion and sedimentation, occupational safety and health risks, air and noise pollution, land degradation, quarry overburden management, effect on landscape and visual intrusions, thermal pollution, ground water pollution, water demand, effluent generation, fuel, oil and grease spills and leakages and energy demand.

3.2.1 Negative impacts at the construction phase of the proposed project

3.2.1.1 Change in land use

The current land use of the land is agricultural. However, the proponent proposes to set up several quarries and a hydrated limestone processing plant which is inconsistent with the current land use.

Recommended mitigation measure

1. The proponent should apply for and obtain a change of user from agricultural to industrial from the County Government of Kwale and the Ministry of lands

3.2.1.2 Loss of arable land

Some local residents have been allowed by the proponent to carry out subsistence farming of maize crops in some of the plots which is an important source of livelihoods. Implementation of the project would lead to total loss of the current maize crop grown and is therefore technically a threat to food security.

Recommended mitigation measure

1. Notify the local farmers to seek alternative land for farming prior to project implementation. This should be done prior to the next maize planting season.

3.2.1.3 Environmental risks of obtaining raw materials

Installation of the hydrated limestone plant and construction of auxiliary facilities will require raw materials such as the plant itself, sand and cement, ballast, lining materials and steel bars / rods among others which will be sourced from the environment. These materials will have negative environmental impacts at their points of origin.

Recommended mitigation measures

1. Source raw materials from sites that are licensed as per the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya
2. Have a procurement plan based on the Bill of Quantities prepared by a Quantity Surveyor to avoid potential oversupply of materials and wastage
3. Sensitize personnel on wastage of construction materials. Remnants should be collected each day and re-used accordingly

3.2.1.4 Impact on the biodiversity

Negative impacts on biodiversity at this phase will be evident. Sections of the proposed site will be cleared and some trees will be felled to pave way for excavation activities which will disrupt the macro habitat and the species they support. Vegetation cover at the site provides several environmental and socio-economic benefits which include carbon sequestration, provision of wood fuel to the local community, habitat for other organisms and prevention of soil erosion among others. There are species that are resistant to such disturbances while others are adversely affected to the extent of completely disappearing from the excavation zone. Endemic plants and animal species are most affected since they are very sensitive and they require specific environmental conditions, even the slightest disruption of their habitats can result in extinction or put them at high risk of being wiped out.

Recommended mitigation measures

1. Obtain an authorization permit from Kenya Forest Service (KFS) and the County Government of Kwale prior to felling the trees
2. Retain vegetation cover in areas that will not be excavated as far as practicable
3. Rehabilitate the excavated areas by planting soil binding grasses and appropriate indigenous trees or approved exotic ones in collaboration with the KFS

3.2.1.5 Soil erosion and sedimentation

A section of the proposed project falls under Cell 28 (Shimoni to Vanga) whose objectives are to promote fisheries, conserve mangroves, corals reefs and seagrass habitats (Figure 27). Any construction activities within this project site will create loose soils that are susceptible to erosion. This will contribute to sedimentation within the adjacent ocean waters. Soil erosion and subsequent sediment load would result in water quality degradation by reducing the availability of sunlight, dissolved oxygen and increased chemical oxygen demand. These would in turn affect biological communities such fish and benthic habitats. There is thus the need for appropriate development planning on the project site.

Recommended mitigation measures

1. Take into account the 30 meters setback as per the Water Resource Management Rules, 2007 and the Shoreline Management Strategy for Kenya, 2010.
2. Install the hydrated limestone processing plant, establish the quarries and construct site offices and auxiliary facilities in any of the other plots located away from the Shimoni channel and settlements.

Figure 27: A section of plot that lies along the Shimoni channel (Source: Site visit, July 2021).

3.2.1.6 Occupational health and safety risks

Workers undertaking installation of the hydrated limestone plant and construction of auxiliary facilities, visitors to the project site and neighboring properties will be exposed to potential safety and health risks during construction activities. The potential safety risks will be from the use of machinery, risks from moving machinery, falling objects or even falls, air and noise pollution among others. These risks have a potential to cause disturbances, injuries, permanent disability or even death.

Recommended mitigation measures

1. Register the site as a workplace with the Directorate of Occupational Safety and Health Services (DOSHS)
2. Obtain insurance cover for the workers at the site
3. Provide adequate and appropriate Personal Protective Equipment (PPE) and enforce their use for both workers and visitors
4. Provide employees with correct tools and equipment for the jobs assigned and train on their use
5. Ensure moving parts of machines and sharp surfaces are securely protected with guards to avoid unnecessary contacts and injuries
6. Provide first aid services and an emergency vehicle at the site
7. Regulate the entry of visitors to the construction site by deploying adequate security measures
8. Comply with the provisions of the Environmental Management and Coordination (Air Quality) Regulations 2014 and Noise and Excessive Vibration Pollution (Control) Regulations, 2009.
9. Comply with the provisions of the Occupational Safety and Health Act, 2007

3.2.1.7 Noise pollution

Disturbance or discomfort resulting from construction noise cannot be ruled out given that the proposed project site is located in proximity to residential areas. Though the level of discomfort caused by noise is subjective, the most commonly impacts of increased noise levels are interference in oral communication and disturbance in sleep or during resting time. Construction sites such as the proposed project can only emit noise levels of up to 60dB (A) during the day and 35dB (A) at night as per the Second Schedule of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

Recommended mitigation measures

1. Delivery of raw materials, excavation and construction work will be limited to day time hours only between 8am to 5pm
2. Locate machinery that are likely to produce noise as far as practical from neighboring properties
3. Provide and enforce the use of earmuffs to staff who will work within peak noise producing areas and visitors accessing peak noise producing areas
4. Sensitize truck drivers to avoid unnecessary hooting and running of vehicle engines
5. Comply with the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009

3.2.1.8 Air pollution

Air pollution during the construction phase will be in form of dust and emissions. Dust will emanate from excavation works and concrete mixing whereas emissions will be from machinery use and vehicles accessing the site. The most relevant pollutant considered is particulate matter because of its potentially significant increase during the construction phase. Respirable particulate matter may present respiratory diseases, cause eye irritation and visual intrusion to workers, visitors to the project site and the neighbors if it is in excess of 100 $\mu g/Nm^3$ as per the First Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014.

Recommended mitigation measures

1. Install dust screens around the project site during construction
2. Sprinkle water at the excavation areas to suppress dust
3. Use low sulphur fuels to power vehicles and site machinery
4. Use of serviceable machinery/equipment and trucks

5. Procure and enforce the use of dust masks to workers and visitors to the project site
6. Comply with the provisions of the Environmental Management and Coordination (Air Quality) Regulations, 2014

3.2.1.9 Water demand and effluent generation

The construction activities will utilize substantial quantities of water for mixing and casting concrete, drinking and sanitation purposes which will lead to an increased demand for water. Based on the projected workforce of 20 people at construction, domestic water demand will be approximately 0.4m^3 per day and will be sourced from water bowsers. Seventy percent (70%) of domestic water use will generate effluent which will need to be managed efficiently.

Recommended mitigation measures

1. Sensitize the workers on the need to conserve available water resources
2. Procure and deliver to the site one mobile toilets from a NEMA licensed waste contractor for use by the workers during the construction
3. Comply with the provisions of the Environmental Management and Coordination (Water Quality) Regulations, 2006

3.2.1.10 Solid waste generation

Site preparation and construction are expected to generate significant quantities of solid waste such as overburden, rock rubbles, cuttings and rejected materials among others. Workers at the site will generate domestic wastes such as food left overs, plastics and wrappings among others. Poor disposal of solid waste is an eyesore, can harbor pests and disease causing pathogens as well as pollute soil and groundwater.

Recommended mitigation measures

1. Procure and strategically place adequate solid waste collection bins with a capacity for segregation within the construction site
2. Procure a sizeable central solid waste collection bin with chambers to accommodate separated waste
3. Create awareness on best waste management practices among the workers i.e. on the process of solid waste collection, segregation and proper disposal
4. Procure the services of a NEMA licensed waste handler to dispose off the solid waste
5. Comply with the provisions of the Environmental Management and Coordination (Waste Management) Regulations, 2006

3.2.1.11 Fuel, oil and grease spills and leakages

Machinery used for construction activities and vehicles delivering construction materials to the site will need petroleum products such as fuel, oils, lubricants etc. There is potential for leakage and spillage during fueling, servicing and maintenance of machinery and vehicles. A release of petroleum products to the environment threatens ground and surface waters thereby endangering drinking water supplies.

Recommended mitigation measures

1. Prevent oil/grease spillages by employing skilled mechanics
2. Procure oil spill containment kits and train workers on the use
3. Contract a NEMA licensed waste oil handler to manage the waste oil from the construction site

3.2.2 Negative impacts at the operational phase of the proposed project

3.2.2.1 Land degradation

Land degradation mainly results from stripping of the topsoil and excavation to expose the rock strata. This will tamper with the soil structure exposing the site to possible landslides and soil erosion as well as interrupting the continuity of open space.

Recommended mitigation measures

1. Treat the quarry faces by initializing stabilization of the quarry pits walls to prevent erosion. This also reduces the risk of loose boulders falling from quarry faces
2. Restore the affected areas through rehabilitation of decommissioned quarry pits and planting of indigenous plant species which create a stable final landform with acceptable post-mining land use capability

3.2.2.2 Generation and disposal of quarry overburden

Establishment of the quarries will result in generation of overburden comprised of top soils, vegetation and rock rumble. If inappropriately disposed, the overburden becomes an eyesore apart from harboring insects and disease causing vectors.

Recommended mitigation measures

1. Enclose, cover or stabilize overburden and reuse it as backfilling material during site rehabilitation

3.2.2.3 Effects on landscape and visual intrusions

Stockpiles and quarry waste piling have a negative effect on the landscape by causing visual intrusion. Quarrying activities usually destroy the original landscape of the affected area leaving behind huge depressions and a potential point of collecting water forming artificial ponds. These water pools have a potential to be hazardous and pose a threat to health. There is also a huge possibility that many of the surface features that were present before quarrying activities cannot be replaced after the process has ended.

Recommended mitigation measures

1. Take into consideration the existing landforms and vegetative cover in siting before drilling and excavation
2. Locate the plant, stockpiles, overburden, quarry waste & haul routes away from sensitive landscape & visual receptors
3. Backfill the quarry pits where applicable using the overburden generated during excavation

3.2.2.4 Impact on biodiversity

Sections of the proposed site will be cleared to pave way for quarrying activities. Quarrying activities disrupts the macro habitat and the species they support. There are species that are resistant to such disturbances while others are adversely affected to the extent of completely disappearing from the quarrying zone. Endemic plant and animal species are most affected since they are very sensitive and they require specific environmental conditions, even the slightest disruption of their habitats can result in extinction or put them at high risk of being wiped out.

Dust produced will also have physical effects on the surrounding vegetation such as blocking and damaging internal structures hence impacting on their physiological activities. Vegetation provide habitat for organisms. They also protect ground surface from wind and water erosion and stabilizes other physical environmental attributes such as microclimate, water and soil moisture regimes which in turn influence organisms' abundance.

Recommended mitigation measures

1. Retain vegetation cover where possible within the site
2. Rehabilitate the quarried areas and plant appropriate indigenous trees or approved exotic ones in collaboration with the KFS

3.2.2.5 Occupational safety and health risks

Quarrying activities pose potential threats to the health and safety of workers on site. This may be in the form of air and noise pollution, fumes from machinery and vehicles accessing the site, accidents from machinery and equipment, injuries that may result from excavation activities and accidental falls among others. The quarry pits may also pose a threat to community health and safety as they may become important breeding grounds for disease causing pathogens especially during the rainy seasons, and accidental falls of both human and livestock in the water pools could lead to drowning.

Recommended mitigation measures

1. Register the site as a workplace with the DOSHS
2. Provide and enforce appropriate PPE among workers and visitors to the site
3. Provide a fully equipped first aid box, first aid services and emergency vehicle at the site
4. Provide adequate training to staff on health and safety
5. Provide the correct equipment to employees for the jobs assigned and trained on their use
6. Designate a fire assembly point within the facility
7. Regulate access to the site by deploying adequate security measures and fencing where appropriate to protect workers, local community members and livestock from potential accidents
8. Backfill the quarried areas to reduce the risk of becoming breeding ground for disease causing pathogens
9. Comply with the provisions of the Occupational Safety and Health Act, 2007

3.2.2.6 Air pollution

Air pollution will mainly result from dust emissions during quarrying, crushing of limestone boulders, vehicular movement. During quarrying and crushing activities, generation of particulate emissions is inherent. At the crusher, the emissions are most apparent at crusher feed, transfer points, screening sections and discharge points. In addition, exhaust fumes produced by the heavy machinery and HCVs accessing the site will increase air pollution. Fugitive dust and emissions present respiratory hazard, cause eye irritation and visual intrusion to the workers, visitors to the site as well as the neighbors if in excess of 100 $\mu g/m^3$. It also reduces growth of vegetation and hampers aesthetics of the area. The intensity of the dust emissions reaching the neighborhood is dependent on their location relative to the quarries, distance and the wind direction

Recommended mitigation measures

1. Locate the quarries and crushers as far as practical from neighboring properties
2. Retain existing vegetation in areas which are not earmarked for quarrying to act as dust screens and a buffer zone between the quarry areas and the settlements
3. Sprinkling water at the quarry sites and access road on a daily basis as often as necessary to minimize re-entrainment of fugitive particulate matter
4. Provide adequate dust masks to workers and enforce on their use
5. Restrict the speed of vehicles to 20KPH and place a signage at the main gate
6. Monitor fugitive emissions to ensure compliance with the limits set under the First Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014
7. Comply with the provisions of the Environmental Management and Coordination (Air Quality) Regulations, 2014
8. Comply with the provisions of the Occupational Safety and Health Act, 2007

3.2.2.7 Noise and excessive vibration pollution

Quarrying involves several activities that generate significant amount of noise. These include excessive vibrations mainly from drilling, quarrying, crushing, movement of HCVs and machinery operations during loading, offloading, feeding, vibration of screens and belt conveyor movement among others. The noise levels produced may be above the standards stipulated under the Third Schedule of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. This may lead to hearing impairments to workers, visitors to the site and neighbors. Notably, excessive vibrations may cause cracks and weakening of the neighboring buildings.

Recommended mitigation measures

1. Locate the plant and quarries as far as practical from neighboring properties
2. Provide and enforce the use of earmuffs to all workers and visitors accessing noisy areas of the facility
3. Ensure that the vibration levels do not exceed 0.5 centimeters per second beyond the source property boundary
4. Conduct noise mapping to inform mitigation measures
5. Comply with the provisions of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009

3.2.2.8 Fire risks and emergency preparedness

Fire risks and emergencies at the proposed facility can occur due to operational negligence, electrical faults and spillage of flammable materials. This can result to injuries, loss of lives and property. The proponent needs to put in place measures to prevent the fire incidences.

Recommended mitigation measures

1. Formulate a fire and emergency response action plan and communicate it to the staff
2. Provide suitable and adequate fire-fighting equipment such as fire extinguishers, fire hose reels, smoke detectors, fire alarms and fire hydrants at appropriate locations within the development
3. Fire-fighting equipment should be serviced quarterly by fire service providers
4. Provide fire exits within the development
5. Designate a fire assembly point within the facility
6. Conduct fire drills occasionally to ensure workers remain alert on what to do in the unfortunate incidences of fire outbreaks
7. Train workers on fire safety on an annual basis
8. Conduct inspection of electrical installations and maintain records of such inspections, faults detected and action taken
9. Comply with the provisions of the Occupational Safety and Health Act, 2007

3.2.2.9 Thermal pollution

The key exposures to heat in a hydrated limestone processing plant occurs during the operation and maintenance of the kilns and other hot equipment and exothermic reaction. During the calcination reaction, enormous amount of heat of approximately 1000˚C is required to breakdown limestone to calcium oxide and carbon (IV) oxide. Upon hydration, the quicklime (calcium oxide) releases large quantity of heat to form calcium hydroxide this will expose the workforce to lots of heat leading to heat exhaustion and stroke among other heat related illness.

Recommended mitigation measures

1. Use cooling towers before releasing heat to the environment

2. Reduce the amount of working hours for the employees operating around the kilns and its environs
3. Provide and enforce use of PPE such as insulated gloves and shoes for personnel accessing high heat areas
4. Shield surfaces where workers' proximity and close contact with hot equipment is expected
5. Implement specific personal protection safety procedures to avoid potential exposure to exothermic reactions

3.2.2.10 Ground and surface water pollution

Quarrying activities present potential ground and surface water pollution. The hydrogeology regime will be affected by the distinct aspects of surface mineral extraction and associated activities which will result in groundwater pollution. Removal of the rock strata can cause the floor to heave and allow for water seepage. Sometimes quarries are dug below the water table and hence toxic materials could seep into the ground water. Surface water pollution can be caused by acid mine drainage and loading of sediment, debris and impurities from soil erosion or surface runoff.

Recommended mitigation measures

1. Ensure that quarrying activity is not undertaken to the water table level. The geological survey conducted in August 2012 to establish the mineral potential of the project area showed that the possible maximum depth for quarry operation down to the groundwater table at the project site is 13m.
2. In the event of flooding, water should be pumped out of the mines to avoid acid rock drainage and dissolution. In case of any contamination, pumped water should be treated to neutralize the contaminants
3. Secure the site with an impermeable boundary wall to ensure that the mining tailings and overburden are contained within the site
4. Maintain maximum existing vegetation coverage to act as buffers

3.2.2.11 Water demand and effluent generation

The facility will exert pressure on water for drinking and sanitation purposes, cooling of machinery, dust suppression and general housekeeping. Seventy (70%) of the domestic water use will be generated as effluent while the rest will seep into the ground areas within the site. Effluent generated will need to be disposed off appropriately.

Recommended mitigation measures

1. Sensitize the staff on the need to conserve the available water
2. Install a bio-digester for proper treatment of the effluent
3. Contract a NEMA licensed laboratory to undertake quarterly monitoring of the quality of effluent to ascertain compliance with the standards for discharge into the environment
4. Apply for and obtain an EDL from NEMA
5. Comply with the provisions of the Environmental Management and Coordination (Water Quality) Regulations, 2006

3.2.2.12 Solid waste generation

The facility will generate solid waste mostly in form of packaging materials, oil and grease containers, office waste and overburden among others. These have a potential of pollution if not disposed off appropriately. The proponent should therefore ensure proper management of solid waste during the operation of the quarries through the following measures.

Recommended mitigation measures

1. Sensitize new employees on solid waste management and its importance

2. Use the receptacles procured during the construction phase of the project cycle
3. Utilize the central collection bins procured during the construction phase
4. Renew the contractual agreements with the solid waste contractor procured at the construction phase
5. Re-use quarry waste and soil materials piled at the site to refill (restore) the excavated areas
6. Comply with the provisions of the Environmental Management and Coordination (Waste Management) Regulations, 2006

3.2.2.13 Fuel, oil and grease spills and leakages

Waste oil at the facility will mainly be generated from the servicing and maintenance of vehicles and machinery. Other potential sources of waste oil spillages include leaks from machinery and vehicles during operations if not well maintained and poor onsite storage of oil and grease. Oil spillages can cause potential contamination of the environment and potentially ground water pollution and runoff contamination during rainy seasons.

Recommended mitigation measures

1. Pave the maintenance area to prevent possible soil and ground water contamination
2. Install drain systems with an oil interceptor around the maintenance area to prevent contamination of runoff
3. Shelter all oily materials from rain to prevent oil washout and possible runoff contamination
4. Ensure the company's waste oil is handled by a waste handler duly registered by NEMA and holds a valid license
5. Put in place an emergency response plan to handle accidental spills and leakages

3.2.2.14 Energy demand

The operations of the quarries will increase the demand on energy for running the machinery and equipment and for lighting and powering of electrical appliances. Energy supply for development will be obtained from the national grid and supplemented by a standby generator.

Recommended mitigation measures

1. Display energy saving conservation tips
2. Maintain machinery and equipment in a serviceable and good working order to maximize its efficiency on fuel consumption
3. Harness solar energy for lighting purposes
4. Conduct energy audits once every three years and implement the corrective measures

3.2.2.15 Impact of heavy trucks on roads

Once the quarries begin operations, there will be heavy commercial vehicles ferrying materials to different areas. Overloaded trucks may cause damage on the roads. To mitigate this impact the proponent and truck drivers will adhere to the axle load limits set by the Kenya Roads Board.

3.2.3 Negative impacts at possible decommissioning phase of the proposed project

The lifespan of the quarry is dependent on the quantities of the rock deposit, technology used to mine and financial sustainability of the business. In the event of end of project life/lifespan of the quarry, closure by government agencies due to non-compliance with environmental and health regulations, an order by a court of law due to non-compliance with existing regulations, natural calamities and change of user of land, the proponent should prepare and submit a due diligence decommissioning audit report to NEMA for approval at least three (3) months in advance.
The following environmental and social concerns will manifest at this phase;

1. Economic decline

2. Creation of an ecologically vulnerable land
3. Safety and health risks
4. Waste generation
5. Insecurity

3.2.3.1 Economic decline

Employment opportunities and the County and National economic gain from the investment activity will be lost in the event of decommissioning of the proposed project.

Recommended mitigation measures

1. Train employees on alternative livelihoods prior to decommissioning
2. Prepare and issue recommendation letters to employees to seek alternative employment opportunities
3. Review potential job opportunities in other ongoing contracts by the proponent and recommend the employees who qualify
4. Comply with labor laws by paying the employees their terminal dues

3.2.3.2 Creation of an ecologically vulnerable land

At this phase, destruction of various fauna and flora at the site is evident. Quarrying activities also have a direct impact on the land by leaving pits and heaps of waste material. It will also tamper with the soil structure exposing the site to possible landslides and soil erosion. Additionally, the terrain of the site would be against the topography of the area.

Recommended mitigation measures

1. Construct contour banks to protect disturbed areas from erosion prior to stabilization
2. Rip along the contoured slopes and immediate re-vegetation to increase slope stability
3. Promote re-vegetation through the encouragement of the natural process of secondary succession

3.2.3.3 Safety and health risks

Demolition of auxiliary facilities and dismantling of the hydrated limestone plant could pose safety and health risks to workers, neighbors and visitors to the site. These risks are likely to emanate from accidental falls and cuts, injuries from demolition and dismantling tools and machinery use as well as noise and air pollution. Additionally, possible dust emission and accidents during rehabilitation of the site could also pose a health and safety risks hazard to workers and general public.

Recommended mitigation measures

1. Obtain demolition permits from the County Government of Kwale
2. Contract a licensed construction company to carry out demolitions/ dismantling works
3. Ensure the process of rehabilitation is supervised by competent personnel
4. Install signage to warn person(s) of the ongoing activities
5. Provide adequate and appropriate PPE and enforce their use
6. Avail first aid kits on site
7. Give workers the correct hand tools and equipment for the jobs assigned
8. Comply with the provisions of the Occupational Safety and Health Act, 2007

3.2.3.4 Waste generation

Demolition, dismantling and rehabilitation activities will result in generation of both solid waste and effluent. The main sources of solid waste will include demolition waste from the auxiliary facilities and domestic waste from the workers. Effluent generated will also need to be disposed off appropriately.

Recommended mitigation measures

1. Recover the reusable and recyclable components of the plant and auxiliary facilities
2. All recyclable materials should be collected and sent to NEMA licensed recyclers
3. Sell off the plant machinery to other similar companies
4. Contract a NEMA licensed waste handler to handle and dispose both solid waste and effluent generated
5. Comply with the provisions of the Environmental Management and Coordination (Waste Management) Regulations, 2006

3.2.3.5 Insecurity

Insecurity will result from the site when it's abandoned succeeding the decommissioning. Unoccupied structures and uncovered pits within the site will act as criminal dens and the security boost that had been provided by the facility to the local community would be lost.

Recommended mitigation measure

1. Extend the tenure of contracted security firm during the operations of the facility

3.3 Impact analysis

Potential project impacts are predicted and quantified to the extent possible. The magnitude of impacts on resources such as water and air or receptors such as people, communities, wildlife species and habitats is defined. Magnitude is a function of the following impact characteristics;

1. Type of impact (direct, indirect, induced)
2. Size, scale or intensity of impact
3. Nature of the change compared to baseline conditions (what is affected and how)
4. Geographical extent and distribution (e.g. local, regional, international)
5. Duration and/or frequency (e.g. temporary, short-term, long term, permanent)

Magnitude describes the actual change that is predicted to occur in the resource or receptor. It takes into account all the various impact characteristics in order to determine whether an impact is negligible or significant. Some impacts can result in changes to the environment that may be immeasurable, undetectable or within the range of normal natural variation. Such changes can be regarded as essentially having no impact and are characterized as having a negligible magnitude (Table 12). The levels of impacts are defined using the following terms;

1. **Negligible impact (very low)** - Where a resource or receptor would not be affected by a particular activity or the predicted effect is deemed to be imperceptible or is indistinguishable from natural background variations.
2. **Less than significant impact (Low)** - Is a minor impact where a resource or receptor would experience a noticeable effect but the impact magnitude is sufficiently low (with or without mitigation) and /or the resource or receptor is of low sensitivity. In either case, a less than significant impact must be sufficiently below applicable standard threshold limits.
3. **Potentially significant impact (moderate)** - A moderate impact that meets applicable standards but comes near the threshold limit. The emphasis for such moderate impacts is to demonstrate that the impact has been reduced to a level that is as minor as reasonably practicable so that the impact does not exceed standard threshold limits.
4. **Significant impact (high)** - One where an applicable standard threshold limit would or could be exceeded or if a highly valued or very scarce resource would be substantially affected.

Table 12: Risk and impact significance matrix for the proposed project.

Environmental Impact	Magnitude of impact		
	Construction phase	Operational phase	Decommissioning phase
Change in land use	3	0	0
Loss of arable land	2	0	0
Environmental risks of obtaining raw materials	2	0	0
Impact on the biodiversity	3	3	1
Soil erosion and sedimentation	2	2	2
Land degradation	2	3	0
Generation and disposal of quarry overburden	0	3	0
Effects on landscape	2	3	0
Visual intrusions	1	2	0
Occupational safety and health risks	3	3	3
Air pollution	2	3	2
Noise and excessive vibration pollution	2	3	2
Fire risks and emergency preparedness	0	2	1
Thermal pollution	0	2	0
Ground water pollution	0	2	0
Water demand	2	2	2
Effluent generation	2	2	2
Solid waste generation	2	2	2
Fuel, oil and grease spills and leakages	1	2	1
Energy demand	2	3	2
Impact of heavy trucks on roads	1	2	1
Creation of an ecologically vulnerable land	0	3	3
Insecurity	0	0	2

Legend

Magnitude	Impact score
Negligible	0
Low	1
Moderate	2
High	3

3.4 Public and stakeholders consultations and findings

3.4.1 Introduction

Public and stakeholders participation in the ESIA process is a legislative requirement under Part 2, Section 69 (1d) of the Kenya Constitution 2010 and Regulation 17 of the Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003. The aim of public and stakeholders consultations was to obtain and document comments, views and concerns that the neighbors and stakeholders have regarding the proposed project. For the proposed project, public and stakeholders consultations were undertaken using two strategies i.e. administration of questionnaires and consultative meetings and specifically;

1. Administration of questionnaire to the community members and stakeholders
2. A series of community consultative meetings were held on 26th July 2021 in Shimoni and Kibuyuni villages and on 27th July 2021 in Fikirini and Mkuyuni/Mwambao villages.

Brief details of the comments obtained during administration of questionnaires and consultative meetings are discussed below. The filled in questionnaires and proceedings of all the meetings are annexed to this report.

3.4.2 Summary of comments obtained during administration of questionnaires

A total of 47 questionnaires were administered between 26th and 27th July 2021 and the main comments are summarized in Table 13 below. Due to the prevailing COVID-19 pandemic, the questionnaires were filled in by the interviewers where possible. Only six of the respondents interviewed objected to the proposal citing main reasons as air pollution from dust which will have health implication, noise pollution from quarrying activity, potential displacement of squatters and food insecurity due to potential low production of agricultural produce. The rest of the respondents cited the main positive impacts as;

1. Production of hydrated limestone
2. Employment opportunities
3. Development in the area
4. Land appreciation
5. Support to local businesses
6. Improved standards of living
7. Income to the proponent
8. Revenue to the government

The main potential negative impacts cited included;

1. Health and safety risks to workers
2. Health problems /implications will emerge due to dust and noise pollution
3. Potential relocation of some resident
4. There will be reduced agricultural produce due to air pollution
5. Climate change from deforestation

Notably, the ESIA has proposed measures to ensure that the proposed project possess minimal or no environmental and social impacts cited by the local communities. The measures proposed aim at;

- Prevention of environmental pollution
- Preventing health and safety risks
- Preventing fire risks
- Minimizing air and noise pollution
- Minimizing the use of environmental resources such as water and energy
- Waste management

Table 13: Summary of comments obtained from neighbors and stakeholders of the proposed project.

No.	Respondents profile			Comments
	Name	Tel contact	ID No.	
1.	Afya Mwadarusie	0101770123	27124819	Employment opportunities Development of the area Proponent to liaise with existing Community Based Organizations in the area. Air pollution from dust Potential health and safety of workers, neighbours and visitors; Provide PPEs , provide guards, provide Milk
2.	Hassan Idd	0720029227	14624319	Employment opportunities to the locals Improve infrastructure Development of area

No.	Respondents profile			
	Name	Tel contact	ID No.	Comments
				Production of hydrated limestone
3.	Shaban Omar	0715399071	31193881	Employment opportunities to the locals Improved Infrastructure
4.	Mwache Ali	0715946012		Employment opportunities to the locals Development of the area Potential relocation of squatters
5.	Musa Mohammed	0757402011	37070720	Employment opportunities Development of the area including improved infrastructure There will be health and Safety risks to workers and neighbors Employment opportunities should focus on the community Improve the health system in the area
6.	Rama Juma	0795057517	37642804	Employment opportunities Improved infrastructure Improve the health and education as part of CSR
7.	Jabir Mwangangurule	O701499119	30147562	Employment opportunities Improvement of road and other facilities within the community Provision of building materials Air and noise pollution Adopt advanced technologies that produce less dust Control the speed of trucks accessing the facility
8.	Hamadi Ali	0713 242119	24660178	Employment opportunities Development i.e. infrastructure within the community etc. roads ,hospitals, schools and mosques Acquire new skills in the field of mining in youths Health problems /implications will emerge due to dust and noise pollution Air pollution due to dust emission Potential relocation of some resident There will be reduced agricultural produce due to air pollution
9.	Salimu Hassan Mwalani	07088186601	6733733	Employment opportunities There will be improved standards of living Improve infrastructure Noise pollution due to heavy trucks and machines Air pollution which will affect the health of the residents

No.	Respondents profile			
	Name	Tel contact	ID No.	Comments
10.	Salim Hassan Juma	07142336119	34116695	Job opportunities for youths Infrastructure development Support local business within communities surrounding the facility Air pollution from dust will have health implications to human, animal and agricultural plants /tress Water pollution Noise Pollution Destruction of the physical environment Adopt cleaner technology to prevent dust and noise Provide enough water to suppress the dust Rehabilitate the destroyed area
11.	Rosalia Kimeu	0717 368111	9395730	Creation of job opportunities to locals Improvement of living standards Support to locals business Dust pollution-health implication to humans, plants and animals Food insecurity due to decreases production of farm produces Water pollution
12.	Hassan Timothy Simiyu	0794761796	35930169	Creation of job opportunities to locals Development of the area Health problems from Air/water pollution Climate change from clearing of trees Destruction of the physical environment Destruction of fishing activities dew to noise pollution Rehabilitation system after the project .i.e. planting of tress Adopt cleaner technology to prevent dust and noise
13.	Ann Kamwethya Mutie	0757448189	2182953	Employment opportunities to the locals Support the elderly PLWD within the community as part of CSR Support the local business Air pollution from dust Food insecurity due to potential low production of agricultural produce Water pollution
14.	Gaserego Mwanganzi	0725730971	9874926	Construction of hospitals and access road tarmacking as part of CSR Employment opportunities to the locals Air, water and noise pollution Plant more tress around the facility

No.	Respondents profile			
	Name	Tel contact	ID No.	Comments
15.	Kambi Mwinyi Mwaganguvu	0727637194	8279918	Employment opportunities Improvement of community infrastructure Air and noise pollution Food insecurity due to potential low production of agricultural produce
16.	Mohammed Omar Mwonyeka	0712336405	23190752	Employment opportunities Government will have more revenue [taxes] Air and noise pollution Climate change from tree felling Food insecurity due to potential low production of agricultural produce Impact on biodiversity
17.	Nassor Salim	0799509505	14436934	Employment opportunities Improved locals business Air pollution from dust Destruction of the physical environment Noise pollution
18.	Abdallah Mwalimu	0706659670	29491550	Social and economic activities will improve Construction of hospitals and access road tarmacking as part of CSR Improvement of infrastructure Employment opportunities Air and noise pollution Potential conflicts with the community due to land ownership
19.	Bakari Salim Mwazago	0716268159	14619668	Employment opportunities Improvement of health facilities i.e. Dispensary as part of CSR Support education by giving bursaries to students Improvement of infrastructure Air and noise pollution
20.	Juma Darusi	0723926405	14437703	Employment opportunities Security improvement Education improvement Improvement of infrastructure Impact on biodiversity Air and noise pollution
21.	Mohamed Mwaziwa	0721160971	21465892	Employment opportunities- Air and noise pollution
22.	Kassim Ramjis Bakari	0703613610	32065342	Employment opportunities Development of infrastructure Air and noise pollution Agricultural production will decreased

No.	Respondents profile			
	Name	Tel contact	ID No.	Comments
23.	Juma Hassan Shehe	0727674447	14437738	Employment opportunities Improvement of infrastructure Noise Pollution Agricultural production will decreases due to dust pollution
24.	Mohamed Mbwana	0724727681	4619261	Employment opportunities Improvement of infrastructure Land value will appreciate Air and noise pollution Agricultural production will decrease due to the impact of dust
25.	Shehe Zumo	07693361464	9394707	Objection to the proposed project Employment opportunities Air pollution from dust Potential displacement of people
26.	Hassan Mwaziwa Masudi	0719402527	27385213	Objection to the proposed project Impact of dust on agricultural produce Proximity to the site to the neighbors which may lead to eviction Employment opportunities
27.	Mohamed Bakari Usi	0710745352	27109232	Objection to the proposed project Employment opportunities Development of the area Improvement of infrastructure Improvement of health facilities Potential relocation of squatters Deforestation Noise pollution
28.	Salim Hamisi	0707177921	29432569	Employment opportunities Air and noise pollution Install bumps on the road to minimize dust
29.	Paragoa Mohammed	0748697999	28252846	Employment opportunities Improvement of infrastructure Air and noise pollution
30.	Omari Supi	0745190415	11773128	Improvement of infrastructure Potential relocation of residents Air and noise pollution
31.	Mohamed Musa	0727365702	14437759	Low cost of lime in our country Air pollution from dust Implement recommended measures to reduce the impact of the project activities to the community
32.	Rashid Adam Rashid	0702868465		Employment opportunities Implement recommended measures to reduce the impact of the project activities to the community
33.	Titus Karuga	0742667041	29071266	Employment opportunities

No.	Respondents profile			
	Name	Tel contact	ID No.	Comments
				Air and noise pollution
34.	Mwanahamisi Darusi	0703271015	26243027	Employment opportunities Improvement of infrastructure
38.	Bikombo Hamadi	0768492091		Local business will be boosted Air pollution from dust
39.	Samuel Bendera	0700348540	34510567	Employment opportunities
40.	Mwalulu Bakari Idd	0796766640	4616392	Improvement of infrastructure
41.	Bakari Kasim Bakari	0741927228	34118058	Employment opportunities Improvement of infrastructure
42.	Chengo Kifaru Fundo	0710263627	25525615	Employment opportunities Air pollution from dust
43.	Mwajumbe Masudi	011516480	23378930	Employment opportunities Improvement of infrastructure
44.	Mohamed Hussein Khalfan	0742704056	35484888	Objection to the proposed project Employment opportunities Improvement of infrastructure
45.	Mohamed H. Mohamed	0112299521	34244967	Employment opportunities
46.	Griffin	0717106632		Objection to the proposed project Air pollution from dust and gaseous emissions thus negative impact on health and agroforestry Loss of local livelihoods due to quarrying activity Acidification
47.	Jira Tsuma	0716925035	5478562	Objection to the proposed project Displacement of people and loss of livelihoods Air pollution from dust and gaseous emissions thus negative impact on health and agroforestry Potential groundwater pollution Habitat destruction

3.4.3 Community consultative meetings

The community consultative meetings were held on 26th July 2021 in Shimoni and Kibuyuni villages, and on 27th July 2021 in Fikirini and Mkuyuni/Mwambao Villages (Figure 28). Table 14 summarizes the impacts identified by the local communities and their recommended mitigation measures.

Table 14: Impacts identified by the local community and their recommended mitigation measures.

Impact identified by the local communities	Recommended mitigation measures proposed by the community
Air and noise pollution	- Implement measures to prevent air and noise pollution
Employment opportunities to the locals	- Prioritizing employment opportunities to the locals - Capacity building by offering trainings and scholarships to the local youths

	- Equipping learning facilities as part of Corporate Social Responsibility (CSR) to support education
Land disputes	- Undertake the land valuation process in a transparent manner when acquiring additional land for development - Compensation of squatters
Safety and health concerns to the workers	- Providing adequate and appropriate PPE - Ensure moving parts of machines and sharp surfaces are securely protected with guards to avoid unnecessary contacts and injuries
Impact from decommissioned quarry pits	- Rehabilitate the decommissioned quarry pits
Surface water pollution	- Secure the site with an impermeable boundary wall to ensure that the mining tailings and overburden are contained within the site

The community members and stakeholders proposed that the proponent develops a Memorandum of Understanding with the local community and the administration and implement it to the latter

Figure 28: The community members and stakeholders during the consultative meetings (Source: Community consultative meeting, July 2021).

3.4.4 Stakeholders meeting to review and validate the ESIA study report

Following incorporation of comments from the four community consultative meetings, a validation meeting with the community members and stakeholders was held on 24th August 2021 at Kibuyuni centre (Figure 29). During the meeting, the community members and stakeholders confirmed that all the issues they had raised during the consultative meetings had been addressed by the consultants after which the community members and stakeholders endorsed the ESIA study report for submission to the proponent and NEMA.

Figure 29: The community members and stakeholders during the consultative meeting (Source: Stakeholders' consultative meeting, August 2021).

3.4.5 Grievances Redress Mechanism

3.4.5.1 Introduction

The affected persons by the proposed project may raise their grievances and dissatisfactions about actual or perceived impacts in order to find a satisfactory solution. These grievances, influenced by their physical, situational and/or social losses, can emerge at the different stages of the project cycle. Not only should the affected persons be able to raise their grievances and be given an adequate hearing, but also satisfactory solutions should be found that mutually benefit both the affected persons and the project. It is equally important that the affected persons have access to legitimate, reliable, transparent and efficient institutional mechanisms that are responsive to their complaints.

3.4.5.2 Grievances prevention

Grievances cannot be avoided entirely, but much can be done to reduce them to manageable numbers and reduce their impacts. This will be achieved by;

1. Providing sufficient and timely information to communities. Many grievances arise because of misunderstandings; lack of information; or delayed, inconsistent or insufficient information. Accurate and adequate information about a project and its activities, plus an approximate implementation schedule, should be communicated to the communities, especially affected parties, regularly.
2. Conduct meaningful community consultations. The project proponent should continue the process of consultation and dialogue throughout the implementation of the project. Sharing information, reporting on project progress, providing community members with an opportunity to express their concerns, clarifying and responding to their issues, eliciting communities' views, and receiving feedback on interventions will benefit the communities and the project management.

3. Overall good management of the facility will ensure a reduction in potential conflicts with the local community and other stakeholders.

During the community consultative meetings, the community members and stakeholders suggested a committee between the proponent and the locals be formed and a liaison office be established to ensure the community's grievances are addressed.

3.4.5.3 Grievances Redress Mechanism Tool

The facility will have a more prompt and efficient resolution on individual and collective complaint and provision of feedback on any grievances and dissatisfaction from stakeholders during operations. The flow chart below (Figure 30) shows a complaint and proposal consideration mechanism for the facility that provides an accessible channel for submission of complaints and feedback to stakeholders.

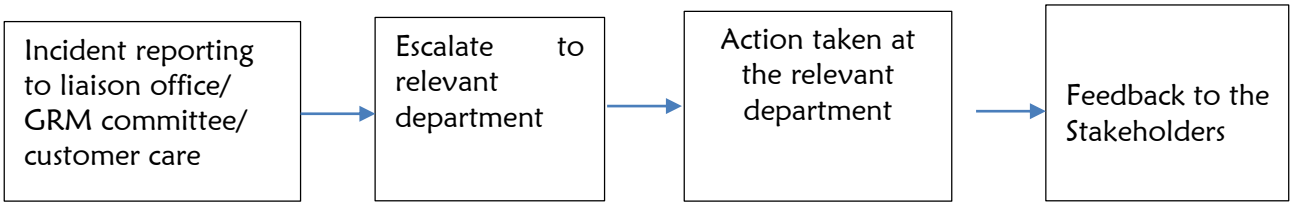


Figure 30: Grievances Redress Mechanism Tool flow chart

3.5 Analysis of project alternatives

3.5.1 Introduction

Analyzing project alternatives is important as it allows the proponent to evaluate possible project options that could mitigate the environmental risks identified during the ESIA process through prevention, elimination of the risks all together or reduction of the severity of an impact. The analysis will also assist NEMA and lead agencies in decision making by either approving the project as proposed or advising the proponent on the need for a particular alternative such as an alternative site or technological and design changes. In the current proposal, the alternatives identified are discussed in detail below.

3.5.2 The 'No Project' alternative

The 'No Project' alternative has the advantage of retaining the status quo, meaning that the predicted environmental and social impacts will not occur and is ideally the best case scenario for mitigation. The status quo however denies the proponent a chance to contribute towards the realization of the Kenya Vision 2030-Economic and Macro Pillar, the proponent and potential workers a source of income, the government a source of revenue and the market a supply of limestone. The 'No project' alternative is therefore not considered viable in the light of the benefits and deprivations of the project.

3.5.3 The "Yes Project" alternative

This alternative envisions that the proposed project will be implemented as proposed in its entirety. It is the best alternative in mitigating the potential loss of benefits to the proponent, the community and the Government of Kenya. In addition, the project will improve the development ranking of Pongwe- Kidimu area.

3.5.4 Alternative project site

An alternative site could be considered if the proposed project would present serious environmental challenges that cannot be effectively managed. However, the proposed mitigation measures are considered adequate to minimize the impacts to levels that do not warrant significant environmental damage.

Geologically, the area where the project site is located, is underlain by coral limestone of the raised Pleistocene Coral Reef Complex. The fresh coral limestone found in this area is off white, porous but hard. The limestone is composed mainly of calcite (calcium carbonate $CaC0_3$). The geological survey conducted in August 2012 to establish the mineral potential of the project area showed that the area has low values for the undesirable impurities of magnesia (MgO) as well as alkalis of Na_20 and k_20 in the limestone. The limestone is of good quality with high values of CaO in the range of 51.83 — 55.69% and can therefore be used for the manufacture of cement.

This alternative is therefore not viable.

3.5.5 Location analysis within the project site

The siting of quarries should be in harmony with other land uses and provide for defined buffer zone between quarries and other land uses. The following safety distances should be maintained in quarry operations as per the Integrated National Landuse Guidelines – NEMA, 2011:

a) For quarry operations without blasting:
- 500m to any aerodromes/landing ground,
- 100m to any shopping centre, school and hospital,
- 50m to any house irrespective of consent from the owner,
- 40m to any river, road reserve or rail

b) Quarry operations with controlled blasting

The technical officer (inspector of mines/explosives) to advice accordingly as provided for under Subsidiary Legislation 78 of Explosives Act and Mining Safety Regulations 90 of the Mining Act, 2016.

3.5.6 Alternative project

An alternative project such as a residential development, cottages, farm or a ranch could be possible in the event an industrial development is not feasible. There is availability of adequate land and substantial rock deposit quantities suitable for quarrying activities and this project is deemed economically viable compared to other project alternatives. Additionally, it suits the business needs of the proponent. Thus, an alternative project is not viable

3.5.1 Alternative quarrying methods

The proponent proposes to use Rip and Load method as an alternative to blasting. Ripping is a version of continuous mining where the rock is extracted at the rate of production required by the crusher by use of hydraulic excavator whereas blasting involves drilling of holes into the rock strata, loading and firing of explosives to obtain limestone boulders.

Blasting is associated with noise, ground vibrations, dust, safety and health of workers and security concerns. Due to this and the proximity of the project site to communities, vertical ripping is considered the most ideal quarrying method in terms of reducing cost, ground vibrations, dust, noise and safety and health risks. In addition, the project site is underlain by biochemical sedimentary rocks (limestone) which are usually the most easily ripped due to their bedding characteristics.

4 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN FOR THE PROPOSED PROJECT

4.1 Introduction

The preceding section identified and analyzed the potential environmental and social impacts of the proposed project and proposed mitigation measures to address the impacts. Under this section, three Environmental and Social Management Plans (ESMPs) are proposed to guide the proponent in implementing the mitigation measures. These are ESMPs for the construction, operational and possible decommissioning phases of the facility. Each of the ESMP is organized into five sections comprising of the environmental impact, the recommended mitigation measures, responsibility, timeframe and budget. The strategies for mitigation include preventing the impact from occurring in the first place, minimizing the impact, taking corrective action where impact occurs among others.

4.2 Environmental and Social Management Plan for the construction phase

At the construction phase, the focus on the ESMP is on addressing change in land use, loss of arable land, environmental risks of obtaining raw materials, impact on biodiversity, soil erosion and sedimentation, occupational safety and health risks, air and noise pollution, water demand, effluent generation, solid waste generation and fuel, oil and grease spills and leakages (Table 15). The timeframe for implementation is considered to be the time it will take for the proponent to complete the construction of the proposed project.

4.3 Environmental and Social Management Plan for the operational phase

The main issues of concern at operational phase of the project are land degradation, quarry overburden management, effect on landscape and visual intrusions, impact on biodiversity, occupational safety and health risks, air and noise pollution, thermal pollution, ground water pollution, water demand, effluent generation, solid waste generation, fuel, oil and grease spills and leakages, energy demand and impact of heavy trucks on roads (Table 16). The timeframe for implementation is considered to be the time the facility will be operational.

4.4 Environmental and Social Management Plan for the possible decommissioning phase

The focus of the decommissioning ESMP (Table 17) is on addressing the issues identified by the ESIA study. The main issues of concern at this phase of the project are economic decline, creation of an ecologically vulnerable land, safety and health risks, waste generation and insecurity.

Table 15: Environmental and Social Management Plan for the construction phase of the proposed project.

Environmental concerns	Recommended mitigation measures	Implementing party	Timeframe	Cost (KES)
Change in land use	Apply for and obtain a change of user from the County Government of Kwale and Ministry of Lands	Proponent	Prior to commencement	TBD
Loss of arable land	Notify the local farmers to seek alternative land for farming	Proponent/ contractor	Prior to commencement	Nil
Environmental risks of obtaining raw materials	Source raw materials from sites that are licensed by NEMA	Proponent/ contractor	During construction	Nil
	Have a procurement plan based on the Bill of Quantities	Proponent/ contractor	During construction	Nil
	Sensitize personnel on wastage of construction materials.	Proponent/ contractor	During construction	Nil
Impact on the biodiversity	Obtain an authorization permit from KFS and the County Government of Kwale	Proponent/ contractor	Prior to felling the trees	10,000
	Retain vegetation cover in areas that will not be excavated as far as practicable	Proponent/ contractor	During construction	Nil
	Rehabilitate the excavated areas	Proponent/ contractor	After decommissioning a quarry pit	Nil
Soil erosion and sedimentation	Take into account the 30 meters setback as per the Water Resource Management Rules, 2007 and the Shoreline Management Strategy for Kenya, 2010	Proponent/ contractor	During construction	Nil
	Install the hydrated limestone processing plant, establish the quarries and construct site offices and auxiliary facilities in any of the other plots located away from the Shimoni channel and settlements	Proponent/ contractor	During construction	Nil
Occupational safety and health risks	Register the site as a workplace with DOSHS	Proponent/ contractor	Prior to commencement	5,000
	Obtain insurance cover for the workers at the site	Proponent/ contractor	Prior to commencement	1,000,000
	Provide adequate and appropriate PPE and enforce their use for both workers and visitors	Proponent/ contractor	During construction	500,000
	Provide employees with correct tools and equipment for the jobs assigned and train on their use	Proponent/ contractor	During construction	Nil

Environmental concerns	Recommended mitigation measures	Implementing party	Timeframe	Cost (KES)
	Ensure moving parts of machines and sharp surfaces are securely protected with guards to avoid unnecessary contacts and injuries	Proponent/ contractor	During construction	Nil
	Provide first aid services and an emergency vehicle at the site	Proponent/ contractor	During construction	2,000,000
	Regulate the entry of visitors to the construction site by deploying adequate security measures	Proponent/ contractor	During construction	Nil
	Comply with the provisions of the Air Quality Regulations 2014 and Noise and Excessive Vibration Pollution (Control) Regulations, 2009	Proponent/ contractor	Throughout construction	Nil
	Comply with the provisions of the OSHA, 2007	Proponent/ contractor	Throughout construction	Nil
Noise pollution	Delivery of raw materials, excavation and construction work will be limited to day time hours (8am to 5pm)	Proponent/ contractor	During construction	Nil
	Locate machinery that are likely to produce noise as far as practical from neighboring properties	Proponent/ contractor	During construction	Nil
	Provide and enforce the use of earmuffs to workers and visitors	Proponent/ contractor	During construction	30,000
	Sensitize truck drivers to avoid unnecessary hooting and running of vehicle engines	Proponent/ contractor	During construction	Nil
	Comply with the Noise and Excessive Vibration Pollution (Control) Regulations, 2009	Proponent/ contractor	Throughout construction	Nil
Air pollution	Install dust screens around the project site	Proponent/ contractor	During construction	2,000,000
	Sprinkle water at the excavation areas to suppress dust	Proponent/ contractor	During construction	Nil
	Use low sulphur fuels to power vehicles and site machinery	Proponent/ contractor	During construction	Nil
	Use of serviceable machinery/equipment and trucks	Proponent/ contractor	During construction	Nil
	Procure and enforce the use of dust masks to workers and visitors to the project site	Proponent/ contractor	During construction	30,000

Environmental concerns	Recommended mitigation measures	Implementing party	Timeframe	Cost (KES)
	Comply with the provisions of the Air Quality Regulations, 2014	Proponent/ contractor	Throughout construction	Nil
Water demand and effluent generation	Sensitize the workers on the need to conserve available water resources	Proponent/ contractor	During construction	Nil
	Procure and deliver to the site one mobile toilets from a NEMA licensed waste contractor for use by the workers	Proponent/ contractor	Prior to commencement	200,000
	Comply with the provisions of the Water Quality Regulations, 2006	Proponent/ contractor	Throughout construction	Nil
Solid waste generation	Procure and strategically place adequate solid waste collection bins with a capacity for segregation	Proponent/ contractor	During construction	100,000
	Procure a sizeable central solid waste collection bin with chambers to accommodate separated waste	Proponent/ contractor	During construction	200,000
	Create awareness on best waste management practices among the workers	Proponent/ contractor	During construction	Nil
	Procure the services of a NEMA licensed waste handler to dispose off the solid waste	Proponent/ contractor	During construction	Tender
	Comply with the provisions of the Waste Management Regulations, 2006	Proponent/ contractor	Throughout construction	Nil
Fuel, oil and grease spills and leakages	Prevent oil/grease spillages by employing skilled mechanics	Proponent/ contractor	During construction	Nil
	Procure and train workers on the use of oil spill containment kits	Proponent/ contractor	During construction	10,000
	Contract a NEMA licensed waste oil handler to manage the waste oil from the construction site	Proponent/ contractor	During construction	Tender

Table 16: Environmental and Social Management Plan for the operational phase of the proposed project.

Environmental concerns	Recommended mitigation measures	Implementing party	Timeframe	Cost (KES)
Land degradation	Stabilization of the quarry pits walls	Proponent	Throughout operations	Nil
	Rehabilitation of decommissioned quarry pits	Proponent	Upon decommissioning of each quarry	Nil
Quarry overburden	Enclose, cover or stabilize overburden and reuse quarry overburden as backfilling material during site rehabilitation	Proponent	Throughout operations	Nil
Effect on landscape and visual intrusions	Take into consideration the existing landforms and vegetative cover in siting before drilling and excavation	Proponent	Before drilling and excavation	Nil
	Locate the plant, stockpiles, overburden, quarry waste & haul routes away from sensitive landscape & visual receptors	Proponent	Throughout operations	Nil
	Backfill the quarry pits where applicable using the overburden generated during excavation	Proponent	Upon decommissioning of each quarry	Nil
Impact on biodiversity	Retain vegetation cover where possible within the site	Proponent	Throughout operations	Nil
	Rehabilitate the quarried areas and plant appropriate indigenous trees or approved exotic ones	Proponent/KFS	Throughout operations	TBD
Occupational safety and health risks	Register the site as a workplace with the DOSHS	Proponent	Throughout operations	5,000
	Provide and enforce appropriate PPE among workers and visitors to the site	Proponent	Throughout operations	200,000
	Provide a fully equipped first aid box, first aid services and emergency vehicle at the site	Proponent	Throughout operations	2,000,000
	Provide adequate training to staff on health and safety	Proponent	Quarterly	Nil
	Provide the correct equipment to employees for the jobs assigned and trained on their use	Proponent	Throughout operations	Nil
	Designate a fire assembly point within the facility	Proponent	At construction	Nil
	Deploying adequate security measures and fencing where appropriate	Proponent	Throughout operations	Tender

Environmental concerns	Recommended mitigation measures	Implementing party	Timeframe	Cost (KES)
	Backfill the quarried areas to reduce the risk of becoming breeding ground for disease causing pathogens	Proponent	Upon decommissioning of each quarry	Nil
	Comply with the provisions of the OSHA, 2007	Proponent	Throughout operations	Nil
Air pollution	Locate the quarries and crushers as far as practical from neighboring properties	Proponent	Throughout operations	Nil
	Retain existing vegetation in areas which are not earmarked for quarrying to act as dust screens and a buffer zone between the quarry areas and the settlements	Proponent	Throughout operations	Nil
	Sprinkling water at the quarry sites and access road on a daily basis as often as necessary	Proponent	Throughout operations	Nil
	Provide adequate dust masks to workers and enforce on their use	Proponent	Throughout operations	50,000
	Restrict the speed of vehicles to 20KPH and place a signage at the main gate	Proponent	Throughout operations	Nil
	Monitor fugitive emissions	Proponent	Quarterly	30,000
	Comply with the provisions of the Air Quality Regulations, 2014	Proponent	Throughout operations	Nil
	Comply with the provisions of the OSHA, 2007	Proponent	Throughout operations	Nil
Noise and excessive vibration pollution	Locate the plant and quarries as far as practical from neighboring properties	Proponent	Throughout operations	Nil
	Provide and enforce the use of earmuffs to all workers and visitors	Proponent	Throughout operations	50,000
	Ensure that the vibration levels do not exceed 0.5 cm/s beyond the source property boundary	Proponent	Throughout operations	Nil
	Conduct noise mapping to inform mitigation measures	Proponent	Quarterly	30,000
	Comply with the provisions of the Noise and Excessive Vibration Pollution (Control) Regulations, 2009	Proponent	Throughout operations	Nil

Environmental concerns	Recommended mitigation measures	Implementing party	Timeframe	Cost (KES)
Fire risks and emergency preparedness	Formulate a fire and emergency response action plan and communicate it to the staff	Proponent	Prior to operations	Nil
	Provide suitable and adequate fire-fighting equipment at appropriate locations within the development	Proponent	Prior to operations	Tender
	Service fire-fighting equipment	Proponent/ fire service providers	Quarterly	Tender
	Provide fire exits within the development	Proponent	Prior to operations	Nil
	Designate a fire assembly point within the facility	Proponent	Prior to operations	Nil
	Conduct fire drills	Proponent	Quarterly	Nil
	Train workers on fire safety	Proponent	Annually	20,000
	Conduct inspection of electrical installations and maintain records of such inspections	Proponent	Throughout operations	Nil
	Comply with the provisions of the Occupational Safety and Health Act, 2007	Proponent	Throughout operations	Nil
Thermal pollution	Use cooling towers before releasing heat to the environment	Proponent	Throughout operations	Nil
	Reduce the amount of working hours for the employees operating around the kilns and its environs	Proponent	Throughout operations	Nil
	Provide and enforce the use of PPE	Proponent	Throughout operations	200,000
	Shield surfaces where workers' proximity and close contact with hot equipment is expected	Proponent	Throughout operations	Nil
	Implement specific personal protection safety procedures to avoid potential exposure to exothermic reactions	Proponent	Throughout operations	Nil
Ground water pollution	Ensure that quarrying activity is not undertaken to the water table level (beyond 13m)	Proponent	Throughout operations	Nil
	In case of flooding, pump water out of the mines to avoid acid rock drainage and dissolution	Proponent	Throughout operations	Nil
	In case of any contamination, pumped water should be treated	Proponent	Throughout operations	Nil

Environmental concerns	Recommended mitigation measures	Implementing party	Timeframe	Cost (KES)
	Secure the site with an impermeable boundary wall to contain mining tailings and overburden	Proponent	Prior to operations	In project costs
	Maintain maximum existing vegetation coverage to act as buffers	Proponent	Throughout operations	Nil
Water demand and effluent generation	Sensitize the staff on the need to conserve the available water	Proponent	Throughout operations	Nil
	Install a bio-digester for proper treatment of the effluent	Proponent	Prior to operations	200,000
	Contract a NEMA licensed laboratory to undertake quarterly monitoring of the quality of effluent	Proponent	Quarterly	10,000 per sample point
	Apply for and obtain an EDL from NEMA	Proponent	Annually	NEMA fees
	Comply with the provisions of the Water Quality Regulations, 2006	Proponent	Throughout operations	Nil
Solid waste generation	Sensitize new employees on solid waste management and its importance	Proponent	Throughout operations	Nil
	Use the receptacles procured during the construction phase of the project cycle	Proponent	Throughout operations	Nil
	Utilize the central collection bins procured during the construction phase of the project cycle	Proponent	Throughout operations	Nil
	Renew the contractual agreements with the solid waste contractor procured at the construction phase	Proponent	Throughout operations	Tender
	Re-use quarry waste and soil materials piled at the site for backfilling	Proponent	During decommissioning	Nil
	Comply with the provisions of the Waste Management Regulations, 2006	Proponent	Throughout operations	Nil
Fuel, oil and grease spills and leakages	Pave the maintenance area to prevent possible soil and ground water contamination	Proponent	Prior to operations	In project costs
	Install drain systems with an oil interceptor around the maintenance area to prevent contamination of runoff	Proponent	Prior to operations	TBD
	Shelter all oily materials from rain to prevent oil washout and possible runoff contamination	Proponent	Throughout operations	Nil

Environmental concerns	Recommended mitigation measures	Implementing party	Timeframe	Cost (KES)
	Ensure the company's waste oil is handled by a waste handler duly registered by NEMA and holds a valid license	Proponent	Throughout operations	Tender
	Put in place an emergency response plan to handle accidental spills and leakages	Proponent	Throughout operations	Nil
Energy demand	Display energy saving conservation tips	Proponent	Throughout operations	Nil
	Maintain machinery and equipment in a serviceable and good working	Proponent	Throughout operations	Internal costs
	Harness solar energy for lighting purposes	Proponent	Prior to operations	200,000
	Conduct energy audits and implement the corrective measures	Proponent	Once every three years	50,000
Impact of heavy trucks on roads	Adhere to the axle load limits set by the Kenya Roads Board	Proponent	Throughout operations	Nil

Table 17: Environmental and Social Management Plan for the decommissioning phase of the proposed project.

Environmental concerns	Recommended mitigation measures	Implementing party	Timeframe	Cost (KES)
Economic decline	Train employees on alternative livelihoods	Proponent	Prior to decommissioning	50,000
	Prepare and issue recommendation letters to employees to seek alternative employment opportunities	Proponent	Prior to decommissioning	Nil
	Review potential job opportunities in other ongoing contracts by the proponent and recommend the employees who qualify	Proponent	Prior to decommissioning	Nil
	Comply with labor laws by paying the employees their terminal dues	Proponent/ workers	Prior to decommissioning	Nil
Creation of an ecologically vulnerable land	Construct contour banks to protect disturbed areas from erosion prior to stabilization	Proponent/ contractor	After decommissioning	Nil
	Rip along the contoured slopes and immediate re-vegetation to increase slope stability	Proponent/ contractor	After decommissioning	Nil
	Promote re-vegetation through the encouragement of the natural process of secondary succession	Proponent/ contractor	After decommissioning	Nil
Safety and health risks	Obtain demolition permits from the County Government of Kwale	Proponent/ contractor	Prior to demolition	5,000
	Contract a licensed construction company to carry out demolitions/ dismantling works	Proponent	During decommissioning	Tender
	Ensure the process of rehabilitation is supervised by competent personnel	Proponent/ contractor	During rehabilitation	Nil
	Install signage to warn person(s) of the ongoing activities	Proponent/ contractor	During decommissioning	10,000
	Provide adequate and appropriate PPE and enforce their use	Proponent/ contractor	During decommissioning	50,000
	Avail first aid kits on site	Proponent/ contractor	During decommissioning	20,000
	Give workers the correct hand tools and equipment for the jobs assigned	Proponent/ contractor	During decommissioning	Nil
	Comply with the provisions of the OSHA, 2007	Proponent/ contractor	Throughout decommissioning	Nil

Environmental concerns	Recommended mitigation measures	Implementing party	Timeframe	Cost (KES)
Waste generation	Recover the reusable and recyclable components of the plant and auxiliary facilities	Proponent/ contractor	During decommissioning	Nil
	All recyclable materials should be collected and sent to NEMA licensed recyclers	Proponent/ contractor	During decommissioning	Nil
	Sell off the plant machinery to other similar companies	Proponent/ contractor	During decommissioning	Nil
	Contract a NEMA licensed waste handler to handle and dispose both solid waste and effluent generated	Proponent/ contractor	During decommissioning	Tender
	Comply with the provisions of the Waste Management Regulations, 2006	Proponent/ contractor	During decommissioning	Nil
Insecurity	Extend the tenure of contracted security firm during the operations of the facility	Proponent	During decommissioning	Tender

5 TYPICAL PROPOSED QUARRY REHABILITATION PLAN

5.1 Re-profiling

The objective of re-profiling is to reinstate soils to a more stable landform, which includes:

1. Re-establishing surface drainage lines
2. Reinstating the land surface that is visually consistent with surrounding land
3. Features re-profiling to original contours and established drainage lines
4. Minimizing the potential for subsidence/ erosion gullies to occur
5. Replacing top soil over subsoil

5.2 Contouring the site

Land form reinstatement involves surface contouring to create a stable land formation consistent with the surrounding land form. This ensures water flow over the surface is in cohesion with the surrounding landscape and minimizes the risk of potential erosion. It also ensures that the final landform is consistent with the surrounding land features. Surface contouring should be completed prior to re-spreading of topsoil.

5.3 Ripping and scarification

This will be undertaken along contours to assist with binding of the soil layers, increase retention time of water on the slope, aid water infiltration into the soil increasing the opportunity of seed germination success while reducing the volume and velocity of runoff generated from the slope. Ripping will be excluded from under the drip lines of retained vegetation to avoid impacts on the root systems of adjacent vegetation. Scarification can be achieved by ploughing of the sub-surface material prior to topsoil reinstatement

5.4 Top soil re-spreading

This involves the reapplication of topsoil accumulated from the original clearing. Top soil will be re-spread to the following specifications:

1. Re-spread over watered and scarified or ripped subsoil's in even layers at a thickness appropriate for the intended land use of the area to be rehabilitated
2. Spread back over in an even layer and left "rough" (rather than smooth. and compacted) to minimize potential erosion, increase water infiltration and to trap seed.
3. Topsoil will cover the entire width of the disturbed area so that there is no exposed sub-surface material. This ensures seeding and germination has the best opportunity to take, enabling establishment of groundcover
4. Topsoil application will only take place following initial reinstatement of the subsoil, construction of contour banks on steep slopes and compaction of subsoil's to account for subsidence
5. Topsoil stockpiled for extended periods will be turned over and mixed prior to replacement.
6. Vehicle movement will be restricted following topsoil re-spreading

5.5 Re-vegetation

The re-vegetation of the site will involve direct seeding of native species. This species selection is guided by soil conditions, micro-climate and aspect of the new land form. The ground cover will consist of native grasses or sterile exotic grasses to ensure exotic grasses do not become established.
Initial re-vegetation with suitable sediment binding ground cover is essential to provide soil stability. Final slopes and surface contours will approximate native gradients and will blend with adjacent topography. Consequently, subsidence and erosion from areas re-profiled and rehabilitated will be monitored.

6 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLANS

6.1 Introduction

Effective implementation of the Environmental and Social Management Plans requires the development and implementation of a suite of monitoring plans for the environmental media and socio-economic issues identified by the study. The objective of the monitoring plans is to enhance the environmental performance of the proposed project by providing data and information on compliance with legislative standards, conservation and preservation of the environment and determining the levels of deviation from the values obtained during the baseline monitoring. This in turn informs the corrective measures if any that need to be implemented to comply with the legislative standards and environmental restoration. For the proposed project, seven monitoring plans are proposed. These are;

1. Health and safety monitoring plan
2. Air quality monitoring plan
3. Noise monitoring plan
4. Water quality monitoring plan
5. Solid waste monitoring plan
6. Rehabilitation and biodiversity monitoring plan
7. Energy monitoring plan

6.1.1 Health and Safety monitoring plan

6.1.1.1 Introduction

The health and safety risks associated with the operations of the facility are likely to be in form of accidents from air and noise pollution, fumes from machinery and vehicles accessing the site, accidents from machinery and equipment, injuries that may result from excavation activities and accidental falls among others. These risks have a potential to cause respiratory diseases, injury, permanent disability or even death. The purpose of the health and safety monitoring plan is to assess the existing controls alongside potential health and safety risks in order to develop an effective plan of action and to ensure compliance with the Occupational Safety and Health Act, 2007.

6.1.1.2 Monitoring strategy

The facility should be committed to ensuring, as far as is reasonably practicable, the health and safety of the workers, visitors and neighbors is not put at risk from the operations of the facility. This will be achieved by;

- Conducting occupational safety and health reviews and reports.
- Hazard identification by analyzing activities that can be an immediate threat or cause harm over a period of time.
- Ensuring that all accidents and incidents occurring at the site are promptly reported and investigated.
- Keeping statistics of accidents, incidents and dangerous occurrences and ensuring that reportable cases are filed with the HSE officer.
- Administration of safety awareness and motivation scheme.
- Routine inspections of the facility and equipment.
- Visual inspection as well as interviewing key personnel to identify areas of improvement.
- Undertaking and reviewing of fire, energy and risk assessment reports
- Review of safety awareness, fire drills and fire safety training requirements.
- Evaluation of the effectiveness of health and safety training to the workforce.
- Action plans related to significant findings of the risk assessment.

The responsibility for implementing this monitoring plan is vested in the Department of Occupational Safety and Health and the overall management.

6.1.1.3 Indicator of success

The ideal indicators of success will include zero accidents and fatalities and reduction in the number of incidents and accidents at the site.

6.1.2 Air quality monitoring plan

6.1.2.1 Introduction

Air pollution will mainly result from dust emissions during quarrying, crushing of limestone boulders and vehicular movement. In addition, exhaust fumes produced by the heavy machinery and HCVs accessing the site will increase air pollution. Fugitive dust and emissions present respiratory hazard, cause eye irritation and visual intrusion to the workers, visitors to the site as well as the neighbors if in excess of 100 $\mu g/m^3$. It also reduces growth of vegetation and hampers aesthetics of the area. The purpose of the air quality monitoring plan is to therefore measure the concentrations of dust and gaseous emissions emanating from the facility's activities. The results will be used to evaluate if the adopted air pollution controls and management are effective.

6.1.2.2 Monitoring parameters

The monitoring parameters and standard specified target values for the purpose of environmental monitoring and protection are stipulated under the First Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014 as shown in table 18 below.

Table 18: Ambient air quality tolerance limits as per the First Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014.

Pollutant	Time weighted average	Residential, Rural and other area	Controlled areas***
Sulphur Oxides (SO_x)	Annual Average*	60 $\mu g/m^3$	15 $\mu g/m^3$
	24 hours**	80 $\mu g/m^3$	30 $\mu g/m^3$
	Annual Average	0.019 ppm/50 $\mu g/m^3$	
	24 hours	0.048 ppm/125 $\mu g/m^3$	
	Instant Peak (10 min)	500 $\mu g/m^3$	
Oxides of Nitrogen (NO_x)	Annual Average*	60 $\mu g/m^3$	15 $\mu g/m^3$
	24 hours	80 $\mu g/m^3$	30 $\mu g/m^3$
	Annual Average	0.2 ppm	
	Month Average	0.3 ppm	
	24 hours	0.4 ppm	
	One hour	0.8 ppm	
	Instant Peak	1.4 ppm	
Nitrogen Dioxide	Annual Average	0.05 ppm	
	Month Average	0.08 ppm	
	24 hours	0.1 ppm	
	One Hour peak	0.2 ppm	
	Instant peak	0.5 ppm	
Suspended Particulate Matter	Annual Average	140 $\mu g/m^3$	70 $\mu g/m^3$
	24 hours	200 $\mu g/m^3$	100 $\mu g/m^3$
	Annual Average ****	100 $\mu g/m^3$	
	24 hours	180 $\mu g/m^3$	
Respirable particulate matter (< 10μm)	Annual Average*	50 $\mu g/m^3$	50 $\mu g/m^3$
	24 Hours**	150 $\mu g/Nm^3$	75 $\mu g/m^3$
Lead (Pb)	Annual Average*	0.75 $\mu g/Nm^3$	0.50 $\mu g/m^3$
	24 hours**	1.00 $\mu g/m^3$	0.75 $\mu g/m^3$

Pollutant	Time weighted average	Residential, Rural and other area	Controlled areas***
	Month Average	2.5	
Carbon monoxide/ carbon dioxide	8 hours	2.0 mg/m³	1.0 mg/m³
	One hour	4.0 mg/m³	2.0 mg/m³
Ozone	One hour	0.12ppm	
	8 hour (Instant Peak)	1.25ppm	

6.1.2.3 Monitoring location

Air quality monitoring should be conducted within the proposed project site and near controlled areas such as residential, health centers, parks and any other area declared by the NEMA from time to time.

6.1.2.4 Monitoring frequency

Air quality monitoring should be done on a quarterly basis in collaboration with a NEMA designated laboratory.

6.1.3 Noise monitoring plan

6.1.3.1 Introduction

Quarrying involves several activities that generate significant amount of noise. These include excessive vibrations mainly from quarrying, crushing, movement of HCVs and machinery operations during loading, offloading, feeding, vibration of screens and belt conveyor movement among others. This may lead to hearing impairments to workers, visitors to the site and neighbors. The purpose of noise monitoring plan is to therefore ascertaining the extent of the impact due to the construction and subsequent operation of the proposed project in compliance with the maximum permissible noise levels stipulated under the Environmental Management and Coordination (Noise and Excessive Vibrations pollution) (control) Regulations, 2009 (Tables 19 & 20).

Table 19: Maximum permissible levels for construction sites as stipulated under the Second Schedule of Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

Zone		Maximum Noise Level Permitted (Leq) in db(A)	
		Day	Night
(i)	Health facilities, educational institutions, homes for disabled etc.	60	35
(ii)	Residential	60	35
(iii)	Areas other than those prescribed in (i) and (ii)	75	65

Table 20: Maximum permissible noise levels (mines and quarries) as per the Environmental Management and Coordination (Noise and Excessive vibrations) Regulations, 2009

Facility		Limit Value in dB (C) Max
1.	For any building used as a health facilities, educational institutions, convalescent home, old age home or residential building	109 dB (C)
2.	For any building in an areas used for residential and one or more of the following purposes: Commerce, small-scale production, entertainment, or any residential apartment in an area that is used for purpose of industry, commerce or small-scale production or any building used for the purposes of industry, commerce or small-scale production	114 dB (C)

6.1.3.2 Monitoring location
Noise monitoring should be conducted within the project site and sensitive receptors.

6.1.3.3 Monitoring frequency
Noise level measurements should be carried out on a quarterly basis in collaboration with a NEMA designated laboratory.

6.1.4 Water quality monitoring plan
6.1.4.1 Introduction
Water at the facility will be required for drinking and sanitation purposes, cooling of machinery, dust suppression and general housekeeping. Seventy percent (70%) of the domestic water use will be generated as effluent from sanitation facilities. The proponent should put in place a consistent water quality monitoring plan targeting the quality of effluent discharging from the proposed bio-digester. The objective of the monitoring plan is to provide data and information to improve water quality and management of the effluent in order to comply with the standards prescribed under the Third Schedule of the Environmental Management and Coordination (Water Quality) Regulations, 2006.

6.1.4.2 Monitoring parameters
Effluent from the proposed bio-digester should be monitored pursuant to the Third Schedule of the Environmental Management and Coordination (Water Quality) Regulations, 2006 (Table 21).

Table 21: Water Quality Monitoring Parameters and the standards prescribed under the Third Schedule of Environmental Management and Coordination (Water Quality) Regulations, 2006

Parameter	EMC (Water Quality) Regulations, 2006 Standards
pH Value	6.5-8.5
Biochemical Oxygen Demand; mg/L	30max
Chemical Oxygen Demand; mg/L	50 max
Total Suspended Solids; mg/L	30 max
Ammonia-NH^{+}; mg/L	100 Max
Total Dissolved Solids; mg/L	1200 Max
E. *Coli* Colonies; count/100ml	Nil
Total coliform; count/100ml	1000/100ml

6.1.4.3 Monitoring location
Effluent sampling should target the discharge point of the proposed biodigester.

6.1.4.4 Monitoring frequency
The frequency of wastewater monitoring should be quarterly in collaboration with a NEMA designated laboratory.

6.1.4.5 Indicator of success
Apart from implementing measures to meet the legal standards, obtaining an EDL from NEMA will also form part of the indicators of success of the water quality monitoring plan.

6.1.5 Solid waste monitoring plan
6.1.5.1 Introduction
Site preparation and construction activities are expected to generate significant quantities of solid waste such as domestic waste from workers and visitors to the site as well as cuttings and rejected materials among others. Notably, during operations solid waste will be generated in form of packaging materials, oil and grease containers, office waste and overburden among others. Poor

disposal of the waste will cause odour problems and environmental pollution and therefore a health risk to the workers, visitors to the facility and neighbors. The purpose of the monitoring plan is to therefore ensure solid waste is managed in such a way that it protects both the public health and the environment.

6.1.5.2 Monitoring frequency

The frequency of solid waste monitoring will differ from the collection to the disposal stage in order to ensure reduced odours and accumulated heaps of waste. Table 22 describes the outline for which the activity will be monitored but can be adjusted depending on the amount generated.

Table 22: Sample outline for solid waste monitoring plan

Parameter	Frequency	Critical levels (Tons)	Target	Responsibility
Collection	Daily			
Storage	Daily			
Management	Daily			
Disposal	Weekly			
Backfilling	Upon decommissioning of each quarry			

6.1.5.3 Monitoring strategy

The solid waste monitoring plan will document the collection, storage and disposal of solid waste from the proposed development. There is need to code each of the collection points, note the capacity and critical levels, frequency of disposal and the personnel and contractor responsible. In addition, it will be important to characterize the waste streams at the collection points to inform investments in segregation infrastructure.

6.1.5.4 Indicator of success

Indicators of success will include timely collection and disposal of waste by the NEMA licensed contractors and having a waste disposal tracking documents.

6.1.6 Rehabilitation and biodiversity monitoring plan

6.1.6.1 Introduction

Quarrying activities will lead to creation of ecologically vulnerable land by tampering with the soil structure leaving pits and exposing the site to possible landslide and soil erosion, and destruction of various flora and fauna. A rehabilitation and biodiversity monitoring plan will ensure the site is restored to its near natural productive state and it will inform continual improvement of the ecological state after rehabilitation.

6.1.6.2 Monitoring frequency

The proponent should ensure monitoring is carried out annually.

6.1.6.3 Monitoring strategy

Monitoring will entail documenting on the flora and fauna species and ecological communities present at monitoring sites, monitoring of subsidence and erosion from areas re-profiled and rehabilitated and providing recommendations where necessary to enable continual improvement of the ecological management of the project area.

6.1.7 Energy monitoring plan

6.1.7.1 Introduction

The proposed development will exert an extra demand on energy mainly electricity for powering machine and equipment and for lighting purposes. The aim of the monitoring plan is to inform substantial practical guidelines for continuous improvement of consumption efficiency and identifying cost saving opportunities in energy efficiency.

6.1.7.2 Monitoring frequency

The monitoring frequency should be conducted once every three years by an energy expert certified by Energy and Petroleum Regulatory Authority.

6.1.7.3 Monitoring strategy

Energy consumption should be monitored through power bills from the Kenya Power and the fuel consumption by the standby generators and other machinery on a monthly basis.

7 GOVERNANCE FRAMEWORKS

7.1 Introduction

The Third Schedule of EIA/EA Regulations requires that environmental guidelines and standards which include Kenya government policies and strategies, national legislation and the institutional arrangements to render them should be incorporated in an ESIA report. The legal and institutional frameworks provide important safeguards for protection and conservation of fragile environments and vulnerable communities and enhance the implementation of the Environmental and Social Management Plans. Under this section, the ESIA will therefore review the applicable sets of laws, and institutions which environmental compliance requirements for the proposed hydrated limestone processing plant, quarries and auxiliary facilities.

7.2 Policy Framework

7.2.1 The National Environment Policy, 2013

The National Policy aims to provide a framework for an integrated approach to sustainable management of Kenya's environment and natural resources. In particular, it proposes to strengthen:

- Legal and institutional framework for good governance
- Integrate environmental management with economic growth, poverty reduction and improving livelihoods
- Research and capacity development
- Promote new environment management tools
- Promote collaboration and cooperation and partnerships in environment management
- Promote domestication, co-ordination and maximization of benefit from Strategic Multilateral Environment Agreements

Chapter 4 of the Policy discusses Management of Ecosystems and Sustainable Use of Natural Resources and part 4.8 elaborates on sustainable utilization of minerals. Chapter 6 of the policy elaborates on environmental quality and health and the need to ensure a clean and health environment for all. The relevant policy statements for the proposed project include: 1) Ensure formulation and implementation of the mineral resources development and exploitation policy; 2) Promote and implement mechanisms for sustainable harvesting of sand and mining activities; 3) Ensure rehabilitation and restoration of all mining sites including quarries and 4) Encourage equitable exploitation and sound management of mineral resources while ensuring local participation and involvement of indigenous enterprises for investment in mining sector.

7.2.2 The National Industrialization Policy, 2012

This policy is aligned to the Kenya Vision 2030 which aspires to transform Kenya into a middle income rapidly-industrializing country, "a globally competitive and prosperous nation, offering a high quality of life to all its citizens" in a secure and healthy environment. This policy framework focuses on value addition for both primary and high valued goods; and linkages between industrial sub-sectors and other productive sectors to drive the industrialization process and aims at providing strategic direction for the sector growth and development.

7.2.3 The Mining and minerals Policy, 2016

The overall goal of the Mining and Minerals Resources Policy is to set out frameworks, principles, and strategies to provide for exploration and exploitation of mineral resources for the country's socio-economic development. It strengthens the institutional framework and addresses governance and operational issues, environmental protection, equity, mineral value addition, post-mine closure activities, capacity building and mainstream artisanal and small-scale mining. The policy promotes the use of appropriate technology in order to enhance information on the country's mineral potential and increase investment in the mining sector.

7.2.4 The National Health Policy 2014 - 2030

The goal of the Policy is to attain the highest possible standard of health in a responsive manner. The health sector aims to achieve this goal by supporting equitable, affordable, and high-quality health and related services at the highest attainable standards for all Kenyans. This Policy has six objectives which include; to eliminate communicable conditions, to halt and reverse the rising burden of non-communicable conditions and mental disorders, to reduce the burden of violence and injuries, to provide essential healthcare, to minimize exposure to health risk factors and to strengthen collaboration with private and other sectors that have an impact on health. This policy takes into account the functional responsibilities between the two levels of government (county and national) with their respective accountability, reporting and management lines. It proposes a comprehensive and innovative approach to harness and synergise health services delivery at all levels.

7.2.5 The National Forest Policy, 2014

The overall goal of this Policy is to ensure sustainable development, management, utilization and conservation of forest resources and equitable sharing of accrued benefits for the present and future generations of the people of Kenya. The Policy provides a framework for improved forest governance, resource allocation, partnerships and collaboration with the state and non-state actors to enable the sector contribute in meeting the country's growth and poverty alleviation goals within a sustainable environment.

The objectives of this Policy are to: -

- Increase and maintain tree and forest cover of at least ten percent of the land area of Kenya.
- Establish an enabling legislative and institutional framework for development of the forest sector.
- Support forestry research, education, training, information generation and dissemination, and technology transfer for sustainable development.
- Promote public, private and community participation and partnership in forest sector development.
- Promote investment in commercial tree growing, forest industry and trade.
- Enhance management of forest resources for conservation of soil, water biodiversity and environmental stability.

7.2.6 The National Water Services Strategy, 2004

This strategy was prepared so as to ensure sustainable access to adequate and affordable water and sewage services to all Kenyans through rehabilitated and expanded water supply and sewage systems and through efficient, responsive institutions. It aims to increase the urban and rural water supply from current coverage, reduce the unaccounted for water due to both technical and social losses and to increase the urban and rural water borne sewage collection, treatment and disposal coverage.

7.2.7 The National Energy and Petroleum Policy, 2018

This Policy aims to ensure sustainable, adequate, affordable, competitive, secure and reliable supply of energy at the least cost geared to meet national and county needs while protecting and conserving the environment. It has twenty objectives that include but not limited to providing an environment conducive for the development and provision of energy services and ensuring that prudent environmental, social, health and safety considerations, as well as issues of climate change are factored in energy and petroleum sector developments.

7.2.8 The National Land Policy, 2009

The National Land Policy guides the country towards efficient, sustainable and equitable use of land for prosperity and posterity. The Mission of the Policy aims at: promoting positive land reforms for

the improvement of the livelihoods of Kenyans through the establishment of accountable and transparent laws, institutions and systems dealing with land. The overall objective of the Policy is to secure rights over land and provide for sustainable growth, investment and the reduction of poverty in line with the Government's overall development objectives. Specifically the policy offers a framework of policies and laws designed to ensure the maintenance of a system of land administration and management that will provide: a) All citizens with the opportunity to access and beneficially occupy and use land; b) Economically viable, socially equitable and environmentally sustainable allocation and use of land; c) Efficient, effective and economical operation of land markets; d) Efficient and effective utilization of land and land-based resources; and e) Efficient and transparent land dispute resolution mechanisms. Sustainable land use practices are key to the provision of food security and attainment of food self-sufficiency.

7.2.9 Integrated Coastal Zone Management Policy, 2017

The National Environment Policy statements tasks NEMA to develop and implement a harmonised ICZM Policy and Integrated Ocean Management Policy, Strategy and Action Plan. This policy statement has since been developed and is the process of being implemented in line with Sec. 55 of the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya. Considerable progress in ICZM implementation in Kenya have been made recently with the release of the Second State of the Coast report in 2017, highlighting the status, trends, threats and impacts to Kenya's coastal and marine environment; and the formulation of the ICZM Policy which addresses the conservation and protection the various coastal ecosystems and outlines institutional arrangements for the management of coastal and marine resources. The overall objective of the ICZM Policy is to guide the management and utilisation of the coastal and marine environment and its resources to ensure sustainable livelihoods and development through seven strategic areas which have been identified and prioritised for action in the ICZM Policy. These strategic areas include conservation of the Coastal and Marine Environment – conserve the coastal and marine resources and environment for sustainable development.

Based on the strategic areas identified and prioritised for action in the ICZM Policy, a National Plan of Action for the coastal and marine environment of Kenya, 2019 - 2023 has also been developed to promote sustainable development in the coastal zone. Its main objectives include cconservation and restoration of critical habitats and biodiversity, sustainable utilization of coastal and marine resources, prevention and control of pollution in the coastal and marine environment, protection and mitigation of shoreline change and conservation and restoration of cultural and heritage sites. A strategy for the shoreline management planning process has also already been developed (GOK, 2010).

7.2.10 The Shoreline Management Strategy for Kenya, 2010

NEMA developed a shoreline management plan consistent with the Environment and ICZM policies. The strategy firstly identifies the key shoreline management issues in Kenya on a systematic basis using sediment cells, recommends shoreline management policies and objectives in response to these observed issues and finally outlines strategies to achieve these policies and objectives. A total of 29 sediment cells have been identified in the strategy. The project area is listed under sediment cell 28 (Shimoni to Vanga) (Table 23).

Table 23: An extract of Sediment Cell 28 where one of the project site is listed under the Shoreline Management Strategy for Kenya including the conservation objectives and strategies (Source: Shoreline Management Strategy for Kenya, 2010).

Cell	Objectives	Strategies
Cell 28 Shimoni to Vanga	Promote fisheries	• Maintain fish landing sites within the cell • Planning and enforcement to ensure against encroachment or illegal allocation of fish landing sites • Empower BMU
	Conserve mangroves, coral reefs, seagrass habitats	• Enforce laws related to use of destructive fishing gear • Control/reduce water pollution. • Appropriate development planning on adjacent shorelines (i.e. no highly polluting industries) • Develop harvesting plans for mangroves and rehabilitate degraded areas • Promote nature-based tourism
	Protect against flooding in Umba River	• Catchment / river basin management plan

7.2.11 Kenya Vision 2030

The Kenya Vision 2030 is the national long-term development blueprint to create a globally competitive and prosperous nation with a high quality of life by 2030 in a clean and secure environment. It aims to transform Kenya into a newly industrializing middle-income country. The Vision is anchored on the economic, social, and political pillar. The proposed project falls under the economic pillar which aims to achieve an economic growth rate of 10% per annum and sustaining the same until 2030 in order to generate more resources to address the Sustainable Development Goals.

7.2.12 Kwale County Integrated Development Plan 2018-2022

The overall aim of the County Integrated Development Plan (CIDP) is to increase and expand sustainable development opportunities and build people's capacities to enable them create wealth and transform their lives for growth and prosperity in line with the Kenya's Vision 2030, Big Four Agenda and the Sustainable Development Goals. The CIDP acknowledges the potential for mineral exploitation such as Titanium, Gemstones, Silica Sands, Zinc, Lead, Copper, Beryte, Coal, Sandstones, Limestone and coral rocks within the County and regulates quarrying activities.

7.2.13 United Nations Sustainable Development Goals

The Sustainable Development Goals (SDGs) were adopted by all United Nations Member States in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. The proposed project will meet SDG 9; industry, innovation and infrastructure.

7.3 Legal framework

7.3.1 The Constitution of Kenya, 2010

The Constitution of Kenya 2010 is the supreme law of the land. Under Chapter IV, Article 42 provides for the right to a clean and healthy environment for all. Further, Chapter V of the Constitution deals with Land and Environment. Specifically, Part 2 elaborates on the obligations of the proponent in respect to protection of the environment and enforcement of environmental rights.

Relevance to the proposed project

- The proponent should ensure that project's operations do not infringe on the right to a clean and healthy environment for all.
- The proponent must ensure that the operations are carried out in an ecologically, economically and socially sustainable manner.
- The proponent is entitled to a fair administrative decision-making process from NEMA and other State organs.

7.3.2 The Environmental Management and Co-ordination Act Cap. 387 of the Laws of Kenya

The Act is the framework environmental law and aims to improve the legal and administrative co-ordination of the diverse sectoral initiatives in the field of environment so as to enhance the national capacity for its effective management. The Act harmonizes the sector specific legislations touching on the environment in a manner designed to ensure greater protection of the environment in line with the National Environment Policy, 2013.

Relevance to the proposed project

Section 58 of the Act requires proponents of a development likely to have deleterious effects on the environment to prepare and submit an ESIA report to NEMA for consideration for decision making. This study report is prepared to comply with the provisions of this section. In addition, several Regulations have been enacted by the line Ministry to operationalize the Act as discussed below.

1. **Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003**

It describes how experts should conduct the ESIA process including guidelines and standards to be met by reports. The regulations were reviewed in 2016 to align them to the Kenya Constitution 2010. They were also recently amended (2019) to address challenges that have been reported since they were gazetted. This report complies with the provisions of these Regulations.

2. **Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009**

These Regulations were gazetted to manage noise levels to levels that do not cause a disturbance to the public. The operations at the sites are likely to generate noise above the acceptable limits within the neighborhood. Noise level measurements were obtained on July, 2021 to provide a benchmark for continued monitoring. Appropriate PPE should be provided for employees engaged in activities that may produce noise above the acceptable limits within the facility.

3. **Environmental Management and Coordination (Air Quality) Regulations, 2014**

These regulations were aimed at controlling, preventing and abating air pollution to ensure clean and healthy ambient air. Potential sources of emissions during the operation of the proposed project would include emissions from quarrying, crushing of boulders as well as vehicular movement. Air Quality measurements were obtained on July, 2021 to provide a benchmark for continued monitoring. The proponent should therefore undertake quarterly air quality monitoring.

4. **Environmental Management and Coordination (Water Quality) Regulations, 2006**

Water Quality Regulations are meant to address the challenges of pollution of water resources as well as their conservation. They consist of VI parts and Eleven Schedules dealing with protection of sources of water to miscellaneous provisions. Part II, 6, (a) specifies the need for an Effluent Discharge Licence. It states in part that "No person shall discharge any effluent from sewage treatment works, industry or other point sources without a valid effluent discharge license issued in accordance with the provisions of the Act. Part III, 12 (1 & 2), 13 and 14 sets out the need for adherence to the discharge standards specified in the Third, Fifth and Sixth Schedules. The proponent should construct

a bio-digester to manage effluent from sanitation facilities and waste water from the production operations.

5. **Environmental Management and Coordination (Waste Management) Regulations, 2006**

The Regulations focus on management of solid wastes, industrial wastes, hazardous wastes, pesticides and toxic substances and radioactive substances. The regulations are aimed at addressing the impact of pollution from wastes on the environment which become important sources of pathogens. In compliance with these Regulations, the proponent will ensure proper waste disposal throughout the project cycle and procure the services of a NEMA licensed contractor for solid waste management.

6. **Environmental Management and Coordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009**

These Regulations were enacted pursuant to the provisions of Section 42 (3) of EMCA. One of the key objectives of the Regulations is to facilitate the sustainable utilization and conservation of resources on river banks, lake shores, and on the seashore by and for the benefit of the people and community living in the area. The proponent should comply with the provisions of this Regulations.

7.3.3 The Mining Act, 2016

It is an Act of Parliament that provides for prospecting, mining, processing, refining, treatment, transport and any dealings in minerals and for related purposes. The mining Act makes provision for land set suitable for mining. This Act guides the identification of land meant for mining and protects the ecologically fragile areas.

Relevance to the proposed project

The proponent should familiarize with the requirements spelt out in the Act and obtain authority from the Department for Mining to operate the quarries.

7.3.4 The Kwale County Quarrying Act, 2016

It is an Act of Kwale County Assembly to regulate quarrying activities in the county and to ensure the safe and sustainable utilization of Land and Environment and for connected purposes. The Act elaborates the environmental and social considerations during mining and licensing provisions for quarrying activities within the county.

Relevance to the proposed project

The proponent should apply for and obtain a quarrying permit from the County Government of Kwale prior to commencement of operations.

7.3.5 The Forest Conservation and Management Act, 2016

It is an Act of parliament that gives effect to Article 69 of the constitution with regard to forest resources, to provide for the development and sustainable management and rational utilization of all forest resources for the socio-economic development of the country and for connected purposes. Forests between low and high water are categorized as public forests wherein lies the mangrove forests. Provisions of Section 42 of the Act relate to conservation of the indigenous forests. Additionally, both the national and county governments have roles on forest management.

Relevance to the proposed project

The proponent should apply for and obtain permits from the Kenya Forest Service and the County Government of Kwale for felling of trees and protect and conserve mangroves bordering the project site.

7.3.6 The Wildlife Conservation and Management Act, 2013

It is the law charged with the responsibility of providing for the protection, conservation, sustainable use and management of wildlife in Kenya and for connected purposes. It designates protected areas, lists and provides for the protection of endangered, vulnerable and protected species as well as invasive species. It is critical in the study of biodiversity as it is the most comprehensive database alongside the International Union for Conservation Nature red list of endangered species.

Relevance to the proposed project

A section of the proposed project sites lies along the Shimoni Channel which connects to the Kisite-Mpunguti Marine Park and Reserve, a Marine Protected Area gazetted under the Wildlife Conservation and Management Act, 2013. The MPA harbours a rich marine ecosystem that includes marine species of international importance such as the endangered sea turtles and dolphins and open sea marine resources among others. The proponent should implement measures to prevent pollution from the project's operations which would degrade water quality and affect the wildlife.

7.3.7 The Fisheries Management and Development Act, 2016

The Act provides the framework for the development, management, exploitation, utilization and conservation of fisheries and for connected purposes. The overall objective of this Act is to provide for the conservation, management and development of fisheries and other aquatic resources to enhance the livelihood of communities' dependent on fishing. As part of the implementation of the Act and to improve community participation in the conservation and management of fisheries, the Kenya Government gazetted the Beach Management Units (BMUs) Regulations in 2007.

Relevance to the proposed project

The proponent should comply with Section 49 (1) of the Act which has provisions for the prevention of pollution and protection of fish and their habitats and collaborate with the local BMU to ensure that the local fisher community has information on project scope to avoid conflicts which are likely to arise from interference with the landing sites.

7.3.8 The Public Health Act, 2012

The Act aims at prohibiting activities that may be injurious to the general public. It outlines the responsibilities for the County Government to maintain a safe and clean environment by controlling the operation activities of any facility.

Relevance to the proposed project

The proponent should ensure compliance with the Act by providing clean, healthy and safe environment during construction and subsequent operation of the hydrated limestone processing plant, quarries and auxiliary facilities.

7.3.9 The Occupational Safety and Health Act, 2007

It is an Act of Parliament to provide for the safety, health and welfare of workers and all persons lawfully present at workplaces. Although the Occupational Safety and Health Act (OSHA), 2007 repealed the Factories and Other Places of Work Act Cap. 514 of the Laws of Kenya, it inherited all the subsidiary legislation issued under Cap. 514. Examples of subsidiary legislation inherited include:

- Docks Rules L.N. 306 of 1962
- Eyes Protection Rules L.N. 44 of 1978
- Building Operations and Works of Engineering Construction Rules L.N. 40 of 1984
- Electric Power Special Rules L.N. 340 of 1979
- First Aid Rules L.N. 87 0f 1964
- Cellulose Solutions Rule L.N. 87 of 1964
- Health and Safety Committee Rules L.N. 31 of 2004

- Medical Examination Rules L.N. 24 of 2005
- Noise Prevention and Control Rules L.N. 25 0f 2005
- Fire Risk Reduction Rules L.N. 59 0f 2007
- Hazardous Substances Rules L.N. 60 of 2007

Relevance to the proposed project
Under OSHA, the proponent should register the site as a workplace with the DOSHS and ensure timely renewal of the same. In addition, the proponent should provide the workers with adequate and appropriate PPE and enforce their use at work, and carry out occupational safety and health audit annually.

7.3.10 The Physical and Land Use Planning Act, 2019
The Act provides for the planning, use, regulation and development of land and for connected purposes. It was enacted to ensure that every person engaged in physical and land use planning shall promote sustainable use of land and livable communities which integrates human needs in any locality. The Act allows the County Government to prepare a local physical and land use development plan in respect of a County, Sub-County, or unclassified urban area.

Relevance to the proposed project
The proponent should apply for and obtain a Change of User from agricultural land to industrial use for the quarries and the plant. Additionally, the proponent should also obtain approvals of the plans for the hydrated limestone processing plant, quarries and auxiliary facilities and operational licenses from the County Government of Kwale.

7.3.11 The Occupiers Liability Act, 2012
It is an Act to amend the law as to the liability of occupiers and others for injury or damage resulting to persons or goods lawfully on any land or other property from dangers due to the state of the property or to things done or omitted to be done there.

Relevance to the proposed project
The proponent is mandated to warn the visitors of the likelihood of dangers within his premises to enable the visitor to be reasonably safe.

7.3.12 The Water Act, 2016
The Constitution acknowledges access to clean and safe water as a basic human right and assigns the responsibility for water supply and sanitation service provision to the 47 established counties. The purpose of the 2016 Water Act is to align the water sector with the Constitution's primary objective of devolution. The Act establishes several organs to ensure development and sustainable use of water resources. These include the Water Resources Authority (WRA), the Water Sector Trust Fund (WSTF), Water Resources Users Associations (WRUAs), Water Services Providers (WSPs) and Water Works Development Agencies among others.

Relevance to the proposed project
The Water Act provides for the management, conservation, use and control of water resources and for the acquisition and regulation of rights to use water, to provide for the regulation and management of water supply and sewerage services.

7.3.13 The Energy Act, 2019
The Act stipulates the electrical supply requirements one has to meet and offenses related to supply and use of electricity.

Relevance to the proposed project

The proponent is required to ensure that the energy supplied is consumed in accordance to the provisions of the Act and energy audits carried out after every three years.

7.3.14 The County Government Act, 2012

The new constitution grants County Governments the powers to grant or to renew business licenses or to refuse the same. To ensure implementation of the provisions of the new constitution, the County Governments are empowered to make by-laws in respect of all such matters as are necessary or desirable for the maintenance of health, safety and well-being of the general public.

Relevance to the proposed project

The Act gives the right to access all property at all times by the County Government officers and servants for inspection purposes. The proponent will be under obligation to allow County officers and inspectors at the premises and comply with the by-laws of the County.

7.4 Institutional arrangements to implement the legal framework

To implement the above legal framework, the government has established a number of institutions with varying mandates of implementation as shown in Table 24.

Table 24: Institutions and their legislative mandate as it applies to the proposed project.

Institution	Legislative mandate
National Environment Management Authority	To implement the Environmental Management and Coordination Act and Associated Regulations
Department for Mining	To implement the Mining Act, 2016
County Government of Kwale	To implement the County Government Act, 2012, its by-laws, the Kwale County Quarrying Act, 2016, the Public Health Act, 2012, the Physical and Land Use Planning Act, 2019 and the Occupiers Liability Act, 2012
Kenya Forest Service	To implement the Forest Conservation and Management Act, 2016
Kenya Wildlife Service	To implement the Wildlife Conservation and Management Act, 2013
State Department of Fisheries, Aquaculture and Blue Economy	To implement the Fisheries Management and Development Act and subsidiary regulations
Directorate of Occupational Safety and Health Services	To implement the Occupational Safety and Health Act, 2007 alongside the subsidiary legislation
Water Resources Authority	To implement the Water Act, 2016
Energy and Petroleum Regulatory Authority	To implement the Energy Act, 2019

8 CONCLUSION AND RECOMMENDATIONS

8.1 Conclusion

The proposed project will ensure industrialization and development through the utilization of the country's mineral resources to catalyze diversified industrial development coherent with Kenya's Vision 2030. It is in line with the Kwale County Integrated Development Plan whose overall aim is to increase and expand sustainable development opportunities and build people's capacities to enable them create wealth and transform their lives for growth and prosperity. In addition, the proposed project will serve an already growing limestone market in Kenya and other regions where the demand is high, contribute towards the socioeconomic growth of the area through employment creation and revenue generation to the county and national governments in terms of taxes generated during the acquisition of statutory licenses. The key concerns that will result from the implementation of the proposed project include air pollution from dust, noise pollution, impact on biodiversity, land degradation, quarry overburden management, effect on landscape and visual intrusions, thermal pollution, ground water pollution, water demand, effluent generation and safety and health risks. The ESIA study proposes a suite of comprehensive Environmental and Social Management and Monitoring Plans to address the anticipated negative impacts during the entire project cycle and improve the environmental performance of the proposed project.

8.2 Recommendations

The main recommendation of the ESIA is the need for concerted implementation of the Environmental Management and Monitoring Plans by the proponent. The specific key ones include;

1. Apply for and obtain a change of user from agricultural to industrial from the County Government of Kwale and the Ministry of lands
2. Register the site as a workplace with DOSHS
3. Obtain an authorization permit from KFS and the County Government of Kwale prior to felling the trees
4. Locate the plant and quarries as far as practical from neighboring properties and the Shimoni channel
5. Regulate access to the site by deploying security measures and fencing where appropriate
6. Provide and enforce appropriate PPE among workers and visitors to the site
7. Retain existing vegetation in areas which are not earmarked for quarrying to act as dust screens and a buffer zone between the quarry areas and the settlements
8. Ensure that quarrying activity is not undertaken to the water table level (below 13m)
9. Stabilize the quarry pits walls to prevent erosion and risk of loose boulders falling
10. Reuse overburden for backfilling the decommissioned quarry pits
11. Secure the site with an impermeable boundary wall to contain mining tailings and overburden are contained within the site
12. Rehabilitate the decommissioned quarry pits by planting of indigenous plant species which create a stable final landform with acceptable post-mining land use capability
13. Monitor fugitive emissions
14. Prior to decommissioning, the proponent should prepare and submit a due diligence decommissioning audit report to NEMA for approval at least three (3) months in advance.
15. Comply with all pieces of regulations as documented in this study report.

On the basis of a commitment by the proponent to implement the proposed mitigation measures and the Environmental and Social Management Plans, we recommend the issuance of an EIA License as per the Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya and Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003.

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    - National Environment Policy, 2013
    - National Forest Policy, 2014
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    - National Water Services Strategy, 2004
    - Shoreline Management Strategy for Kenya, 2010
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    - Environmental Management and Coordination (Impact Assessment and Audit) Regulations, 2003
    - Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulation, 2009
    - Environmental Management and Coordination (Waste Management) Regulations, 2006
    - Environmental Management and Coordination (Water Quality), 2016 - Environmental Management and Coordination (Wetlands, River banks, Lake shores and Sea shore Management) Regulations, 2009
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- The Constitution of Kenya, 2010
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- The Fisheries Management and Development Act, 2016
- The Forest Conservation and Management Act, 2016
- The Forest Conservation and Management Act, 2016
- The Kwale County Quarrying Act, 2016
- The Mining Act, 2016
- The Occupational Safety and Health Act, 2007
- The Occupiers Liability Act, 2012
- The Physical and Land Use Planning Act, 2019
- The Public Health Act, 2012
- The Water Act, 2016
- The Wildlife Conservation and Management Act, 2013

10 LIST OF ANNEXTURES

1. Copy of certificate of change of name for Mzuri Mining Limited
2. Copy of the PIN certificate for Mzuri Mining Limited
3. Copy of the survey plan for the project site
4. Copy of approval of the scoping report and Terms of Reference for the ESIA study
5. Copy of the geological survey report conducted in August 2012 to establish the mineral potential of Pongwe Kidimu area
6. Copies of reports of baseline environmental monitoring results (Air quality, noise level measurements and water quality results)
7. Letters of invitation and evidence of receipt by the stakeholders and community for the Consultative Meetings
8. Copy of the community consultative meeting programme
9. Proceedings of the community consultative meetings held in Shimoni (26th July 2021), Kibuyuni (26th July 2021), Fikirini (27th July 2021) and Mkuyuni/Mwambao (26th July 2021)
10. Letters of invitation and evidence of receipt by the stakeholders to review and validate the draft ESIA study report
11. Copy of the stakeholders' consultative meeting programme
12. Proceedings of the stakeholders' meeting to review and validate the draft ESIA study report held at Kibuyuni centre on 14th August 2021
13. Copies of the public consultation questionnaires
14. Copy of NEMA practicing license for the firm, Envasses Environmental Consultants Limited
15. Copies of NEMA practicing licenses for the key Lead Experts, Mr. Simon Nzuki and Ms. Jane Gitau