

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT STUDY REPORT

FOR THE PROPOSED MUWARIZIKI SUGAR FACTORY ON PLOT
L.R NO. GEM/GENGA/1301 IN SANGO/RABANGO SUBLOCATION,
GENGA LOCATION, WEST GEM WARD, RANGWE SUB COUNTY,
HOMABAY COUNTY



GPS Coordinates:

0° 34' 23.0" S
34° 34' 33.1" E



EIA CONSULTANTS

BELEXA DEVELOPMENT CONSULTANTS
EIA/EA FIRM OF EXPERTS REG NO.12570
P.O BOX 14464-20100
NAKURU

Email: belexaconsultants@gmail.com

PROPONENT

MUWARIZIKI SUGAR MILLERS
LIMITED
P.O BOX 960-00621
NAIROBI, KENYA

CERTIFICATION

This Environmental and Social Impact Assessment Report (ESIA) for the Proposed Muwariziki Sugar Factory to be located on **Plot L.R No. Gem/Genga/1301 in Sango/Rabango sublocation, Genga location, West Gem ward, Rangwe Sub County, Homabay County** has been prepared in accordance with NEMA regulations under the guidance and supervision of a registered NEMA Lead Expert. It meets statutory provisions stipulated in EMCA 2015, the Legal Notice No. 32 and the Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019. We hereby certify that the details herein are correct and true to the best of our knowledge.

CONSULTANTS

Name: Mr. Benard O. Obara
Designation: EIA/EA Lead Expert Reg No. 2848



Signature:

Date: 27/12/2024

Name: Mr. Paul K. Muhia
Designation: EIA/EA Lead Expert Reg No. 10286



Signature:

Date: 27/12/2024

On behalf of: Belexa Development Consultants
EIA/EA Firm of Experts Reg No. 12570
P.O Box 14464-20100
Nakuru
Email: belexaconsultants@gmail.com

PROPONENT:

Muwariziki Sugar Millers Limited
P.O. Box 960-00621
Nairobi

Name: Alfred Ronny Muthomi
Designation: Director

Signature.....Date.....

PARTICIPATING EXPERTS

	Name	POSITION/SPECIALIZATION	ROLE
1.	Benard Obara	NEMA Lead Expert, Health and Safety Specialist Lead Expert Reg No. 2848 Belexa Development Consultants	Coordinated the overall EIA study activities, data collection, analysis, interpretation, and compilation of the final study results.
2.	Paul Muhia Karanja	Environment and Social Safeguards Expert Lead Expert Reg No. 10286 Belexa Development Consultants	Coordinated and guided in collection of baseline data and information, site visits, public participation and stakeholder consultation,
4.	Jermaine Omulami	Air Quality Expert CSI International Limited	Undertook required sampling and analysis of baseline data through NEMA accredited labs (Air quality, water quality etc)
5.	Kaguru Brian Otieno	Sociologist Associate Expert Reg No. 10286	As a sociologist to ensure the social aspects of the project were taken care of. Data collection, conducting public participation and report writing.
6	Moses K. Changwony	Director and Lead Consultant-MK Changwony & Associates	Produced and guided on information from feasibility studies, Designs and financial proposals conducted by his company. Convened, chaired and participated in all public and stakeholders' engagement forums. Also, in charge of GIS mapping for the project.

ACKNOWLEDGEMENT

Belexa Development Consultants wishes to thank proponents of the proposed Muwariziki Sugar Factory who commissioned this ESIA. We are highly indebted to the County Government of Homabay through the office of the Governor, the County Commissioner and the area chiefs who formed part of key Stakeholder's and even helped in stakeholders' mobilization. We also wish to thank all the stakeholders and other local leaders for their input. We highly express our gratitude to the general public and members of the community. Finally, we must appreciate the entire team at Belexa Development Consultants, MK Changwony & Associates, CSI International and all consultants who participated in conducting this ESIA Report by providing necessary assistance, information and relevant documentation including feasibility studies.

LIST OF ACRONYMS.

CCP	Captive Cogeneration Plant
CDM	Cleaner Development Mechanism
CITES	Convention on International Trade on Endangered Species
CPP	Captive Power Plant
EA	Environmental Audit
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act 1999
EMP	Environmental Management Plan
EMS	Environmental Management Systems
ESA	Ecologically Sensitive Areas
ETP	Effluent Treatment Plant
EU	European Union
FAO	Food and Agriculture Organization
HIV	Human Immune Virus
IRPTC	International Register for Potentially Toxic Chemicals
KLPD	Kiloliters Per Day
KP	Kenya Power
KWS	Kenya Wildlife Service
MOH	Medical Officer of Health
MSML	Muwariziki Sugar Millers Limited
MW	Mega Watt
NEAP	National Environmental Action Plan
NEC	National Environmental Council
NEMA	National Environmental Management Authority
NET	National Environment Tribunal
NETF	National Environment Trust Fund
PCC	Public Complaints Committee
PP&SC	Public Participation and Stakeholders Consultations
R.O	Reverse Osmosis
SEA	Sexual Exploitation and Abuse
SOP	Standard Operating Procedures
SPM	Suspended Particulate Matter
TCD	Tonnes of Cane per Day
TCH	Tonnes Crushed per Hour
TOR	Terms of Reference
UNEP	United National Environment Program
WRA	Water Resources Authority
MT	Metric Tones
VMGs	Vulnerable and Marginalized Groups

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EXECUTIVE SUMMARY

Background

Recent government efforts, including the Sugar Bill of 2019 and initiatives to strengthen the Sugar Sub sector resources, signal positive reforms for the industry. The revival of the Sugar Development Levy is expected to further support cane development and research, both of which are essential for the sustainable growth of the sugar sector. Kenya's domestic sugar production consistently falls short of meeting existing demand. As a result, expanding production capacity and establishing more sugar mills in regions with high agricultural potential is essential for the growth of the sugar industry. Homa Bay County, with its favorable climate and fertile soils, is well-suited for competitive sugar production.

Muwariziki Sugar Millers Limited has proposed to establish a sugar milling factory with a crushing capacity of 1250 TCD (expandable to 1500 TCD). The factory which is proposed to be called Muwariziki Sugar Factory will be located on **Plot L.R No. Gem/Genga/1301 in Sango/Rabango sublocation, Genga location, West Gem ward, Rangwe Sub County, Homabay County.**

In order to ensure that the proposed project is implemented in an environmentally and socially sustainable manner, the consultant has conducted an Environmental and Social Impact Assessment (ESIA) for the proposed project prior to its implementation. The study was therefore undertaken to ensure the proposed project meets the requirements stipulated by the National Environmental Management Authority (NEMA) under the Environmental Management and Coordination (amendment) Act (2015) that requires all proposed development projects listed under Schedule II of the EMCA, to undergo an Environmental Impact Assessment Study to determine the potential adverse impacts of a project and thereby devising appropriate mitigation measures.

The study assesses the impacts of the proposed development and proposes mitigation measures as well as an Environmental Management Plan (EMP). It was carried out through desk research, field visits, and consultations. The team conducted extensive literature review including information sourced from the internet, in relation to the proposed project. During field investigations, information on physical, ecological and socio-economic aspects of the project area and its environs were determined.

The Proponent is expected to engage in the activities of sugarcane procurement, milling of sugarcane, production of mill light brown sugar and marketing of the finished products.

Purpose of study

The purpose of this study is to ensure adequate identification of potentially positive and negative environmental and social impacts associated with the establishment of Muwariziki Sugar Millers Limited (MSML) sugar factory in the area. Secondly, to propose workable mitigation measures, and thirdly to formulate an Environmental and Social Management and Monitoring Plan articulating envisaged impacts and mitigations, and to obtain an Environmental Impact Assessment license prior to commencement of the project.

Methodology

Site visits were undertaken in December 2024 for purposes of 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 were ecological and socio-economic issues, landscape changes, land use character and water aspects. Data collection methods included literature review, observations during site visits and photography. Stakeholders and public consultations were conducted with the community neighboring the proposed project site, relevant stakeholders and the proponent in two major public participation forums held at Asumbi technical institute, Staridge hotel, Rabango Secondary School and Aoch Muga primary school in Sango/Rabango sublocation between **16th December 2024** and **20th December 2024** (*Copies of attendance lists and minutes are annexed*).

The Project proponent provided the proposed project design details including feasibility study, proposed designs, Bills of Quantities (BoQ), Land ownership, registration certificate among other documents. The data collection was carried out through structured questionnaires where 50 questionnaires were filled and returned.

Baseline environmental data was collected on ambient air and water quality in collaboration with Imara analytical laboratories and CSI International limited.

Involvement of Key stakeholders

Interviews were conducted on key informants including the area county heads of departments, the area chief, village elders and lead sugarcane farmers in the area. A meeting for the Key stakeholder's engagement was also organized at Staridge Hotel in Rangwe town on **17th Dec 2024**. Stakeholders engaged included heads of departments from the County Government of Homabay (Executive Office of the Governor, County Secretary, GACD, Agriculture, Livestock and Fisheries, Water, Irrigation, Environment, & Climate change, Trade & Industry), National Government (Ministry of interior, Ministry of Agriculture (MOA), Public Works, Roads & Transport, Social Services, Youth, Gender & Sports, NEMA) among other stakeholders. The meeting provided very key information and concerns that have been incorporated in this study report in Chapter 5.

Potential negative impacts and mitigation measures during construction, operation and decommissioning of the proposed Muwariziki Sugar Factory were taken into consideration during the study and public/stakeholders' engagement.

Current site status and land use

Partially, the proposed site is currently under sugarcane plantation and maize. The land will be converted into its intended use once necessary approvals have been acquired. There are however few homesteads scattered in the neighborhood but most are located far from the proposed project site.

ESIA Process, Approach and Methodology

The general steps followed during the assessment included: -

- Environment screening, during which the proposed sugar factory project was identified as among those listed and requiring to be subjected to the ESIA process as stipulated in EMCA 1999 (Revised 2015) and the Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019 as stipulated in the Legal Notice No. 31 and 32.
- Submission of TOR to NEMA Headquarters for Approval
- Environmental scoping that provided the key environmental issues to be considered,
- Desktop studies and documentary review of relevant reports, legal, institutional and policy frameworks,
- Physical inspection and assessment of the proposed factory site,
- Analysis of project alternative options,
- In-house consultative meetings with the proponent (Directors of Muwariziki Sugar Millers Limited),

- Comprehensive baseline field environmental assessment,
- Intensive stakeholder engagement and public consultations,
- Comprehensive project impact analysis,
- Impact mitigation planning,
- Environmental management planning and preparation of an ESMP,
- ESIA report writing.

Status of Land Ownership

The sugar factory, to be located **Plot L.R No. Gem/Genga/1301 in Sango/Rabango sublocation, Genga location, West Gem ward, Rangwe Sub County, Homabay County** owned by the proponent (*See title deed attached*). More land for the proposed sugar factory and associated facilities development has been acquired from the registered owners adjacent to the plot. More land acquisition is ongoing where most of the land owners neighboring the proposed site have agreed to sale the land to Muwariziki Sugar Company. The proponent currently has secured 30 acres and plans to acquire a total of approximately 50 acres in anticipation of future expansion.

Project Objectives

The project objectives include the installation of a 1250 TCD sugar mill (Expandable to 1500 TCD), Ethanol Distillery 20 Kiloliters per day (KLPD) and 3 MW Captive Power (Co-generation).

The operational phase of the project will involve the production of mill brown sugar and ethanol. Bagasse and molasses will be produced as by products. Other by-products will include filter mud and boiler ash. Main inputs will be sugarcane, water, bagasse and electricity.

The by-products generated from the sugar plant, such as bagasse will be utilized in the mill to run co-gen power plant and for ethanol distillery. Excess of it can eventually be used to make paper or chip boards (expansion into other industry).

The out growers targeted by the proposed sugar factory will be expected to fall mainly within 15 km radius of the factory area and will cover mainly Rangwe.

Capital Cost Estimate

Factory design is as provided by Saisidha Sugar Equipments & Engineering Company the selected EPC contractor and the cost estimate will be as specified below.

From the Bills of quantities, the estimated total cost of setting up the factory is **USD 11.52 Million** which translates to **Ksh. 1,514,880,000**. The statutory charge of 0.1% processing fee payable to NEMA is therefore **Ksh. 1,514,880 (One million, five hundred and fourteen thousand, eight hundred and eighty shillings)**. The payment is done on the e-citizen platform after receipt of an invoice from NEMA.

Baseline Environmental Status

The proposed project is situated within Homabay County in Rangwe Sub-County. However, the environmental details were collected from a radius of 15 Km of the project site. A financial and feasibility study has been carried out.

The baseline water sample was collected from Rangwe river and nearby spring. The water was analyzed as part of this study and indicated that most of the parameters are within the normal range for use but also indicated contamination by coliforms. The water will however be treated through reverse osmosis at the factory to meet all other standards for the parameters that were below the standards to render it safe for use. (*Source: Baseline water sampling and analysis report from River Rangwe-for the proposed Muwariziki Sugar Factory*).

Legislative and Environmental Setting

Various Laws and regulatory policies have been established by the relevant authorities for the control and regulations of sugar processing factories. These are considered and elaborated on the ESIA Study Report.

The proponent is advised to acquaint himself with the various Acts and regulations and adhere to them in the construction and operations phase of this project.

Prediction of Impacts

The assessment showed that the proposed sugar factory will have both positive and negative environmental and social impacts. The positive impacts are socio-economic in nature and include meeting the domestic demand for sugar in the Country, contribution of the project towards attainment of Vision 2030, provision of market for sugarcane and consequently income to local farmers, provision of employment opportunities, income to the proponent, market for local goods and services, source of raw materials for other industrial establishments (i.e molasses and bagasse), improved road network, corporate social responsibility (CSR), increased industrial development in Homabay County and revenue to the government.

The negative impacts including clearance of vegetation, sources of air pollution, water pollution and solid waste generation are identified and the impacts due to the above are superimposed on the existing baseline environment. Impacts such as fire hazards, increase in population and traffic, ambient noise, drainages and storm water management, air emissions, security, environmental health and safety and occupational health and considered and measures to reduce and mitigate them are provided for in the Study Report.

Key potential negative impacts and recommended mitigation strategies

The project will experience some level of negative throughout the project cycle i.e., construction, operational and decommissioning phases. At the construction phase, the negative impacts will include water demand and effluent generation, solid waste generation and management, environmental risks of obtaining raw materials, destruction of the physical environment, occupational safety and health risks, air pollution, noise pollution and increased energy demand.

Site preparatory and construction activities will generate significant quantities of solid waste in form of biomass, overburden, domestic waste such as plastic containers and construction materials such as wood, building blocks, metal cuttings and wrappings among others. The proponent will procure the services of a NEMA licensed waste handler to dispose off the solid waste and ensure compliance with the provisions of the Environmental Management and Coordination (Waste Management) Regulations, 2006.

Clearance of vegetation will happen to pave way for the project. The proponent should retain vegetation cover in areas that will not be excavated as far as practicable. Replant indigenous trees in the section of the property that will not be developed to compensate for loss at construction phase

Construction activities will involve excavations works and clearance of vegetation cover. The proponent will put in place mitigation measures including retaining vegetation cover in areas that will not be excavated as far as practicable, compact loose soil within the project sites, use the overburden generated during construction activity to backfill the adjacent eroded areas and replant indigenous trees in the sections of the project that will not be developed to compensate for loss at construction phase.

Increased water demand and effluent generation during construction phase will be mitigated by sensitizing workers on need to conserve available water, installing bio-digester in place of

soak pits and ensuring compliance with the provisions of Environmental Management and Coordination (Water Quality) Regulations, 2006

Environmental risks of obtaining raw materials will be mitigated by sourcing materials from licensed sites and ensuring procurement of materials is based on a Bill of Quantities prepared by a Quantity Surveyor to avoid potential oversupply of materials and wastage and maximize the re-use of construction waste materials.

The potential health and safety risks will be from the use of machinery, falling objects or even falls, air and noise pollution. These risks have a potential to cause disturbances, injuries, permanent disability or even death. The proponent should register the site as a workplace with the Directorate of Occupational Safety and Health Services (DOSHS), obtain insurance cover for 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, ensure moving parts of machines and sharp surfaces are securely protected with guards to avoid unnecessary contacts and injuries, provide first aid services and emergency vehicle at the site, regulate the entry of visitors to the construction site by deploying adequate security measures and comply with the provisions of the Occupational Safety and Health Act (OSHA), 2007.

Air pollution during the construction phase will be in form of dust and particulate matter generated during excavations, concrete mixing activities and exhaust fumes from machinery use and Heavy Commercial Vehicles (HCVs) delivering construction materials to the site. The proponent should mitigate this impact by ensuring dust screens are installed around the project site, water sprinkled to suppress dust, stock piles of construction materials covered, adequate dust masks provided and enforcing their use as well as monitoring fugitive emissions to ensure compliance with limits set under the First Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014.

The proposed mitigation measures against noise pollution will include delivery of raw materials, excavation and construction work be limited to day time hours only between 8am to 5pm, locate machinery that are likely to produce noise as far as practical from neighboring properties, procure, provide and enforce the use of earmuffs, sensitize truck drivers to avoid unnecessary hooting and running of vehicle engines and ensure compliance with provisions of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009

Operational phase impacts will include air and noise pollution, solid waste generation and management, increased water demand, effluent generation and management, occupational safety and health risks, community safety and health risks, fire risks and emergency, oil spills and increased energy demand.

Air pollution will mainly result in form of dusts and particulate matter emissions from stored bagasse during windy conditions, flue gases during combustion of bagasse in the boiler, juice treatment and evaporation process, exhaust fumes from machinery and vehicles accessing the facility and odor from the Effluent Treatment Plant (ETP). Mitigating the impacts of air pollution will involve planting fast growing trees along the boundary walls, installing dust screens around bagasse storage area, ensuring timely renewal of emissions license from NEMA, installing dust collectors and scrubbers within the plant and compliance with the provisions of Environmental Management and Coordination (Air Quality) Regulations, 2014.

Sources of noise pollution will include machineries during sugar production, vehicular movement in and out of the facility, loading and offloading activities and at the workshops. The excess noise levels may lead to hearing impairments to workers, visitors to the site and neighbors. The proponent should procure and provide adequate earmuffs to employees working at peak noise producing areas and enforce on their use, reduce the working hours for employees working at peak noise producing areas compared to those working in other areas, provide equipment that are properly fitted with noise reduction devices, service mechanical equipment regularly, undertake noise level monitoring through a NEMA designated laboratory and comply with provisions of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution (Control)) Regulations, 2009.

Solid waste generated during operation phase will include molasses, bagasse, fly ash and filter mud from the production process, paper, plastics, cartons, wrapping and organic wastes, used oil containers, and waste tyres and scrap metal from the workshops, and sludge from the ETP. Poor disposal of solid waste degrades environmental quality, may harbor disease causing pathogens and cause eye irritation. The proponent should therefore construct additional bagasse storage area to cater for the increased bagasse produced, amend the contractual agreement with the NEMA licensed solid waste handler to include disposal of the excess bagasse, sell of scrap metals and tyres to licensed recyclers and compliance with the provisions of the Environmental Management and Coordination (Waste Management) Regulations, 2006.

Waste water will be managed through constructing an Effluent Treatment Plant (ETP). The proponent will carry out regular inspection and maintenance of the ETPs, monitor quality of wastewater discharged from ETPs, ensure timely renewal of Effluent Discharge License and comply with the provisions of Environmental Management and Coordination (Water Quality) Regulations, 2006.

Water will be required for industrial and domestic purposes at various sections of the sugar mills. MSML will source its water from nearby river and will be supplemented by drilling a borehole. The management has undertaken water quality sampling and analysis from the nearby spring and river Rangwe. Valid water abstraction permits from Water Resources Authority (WRA) will be obtained for the water works and borehole drilling. Mitigation measures for water conservation will include installation of water saving systems, carrying out regular inspection and maintenance of water pipes and ensuring compliance with the provisions of Environmental Management and Coordination (Water Quality) Regulations, 2006 and the Water Act, 2016.

Safety and health risks shall be mitigated by ensuring provisions of appropriate Personal Protective Equipment (PPEs) to workers, putting in place an effective emergency response plan, displaying signage warning of potential hazards at various sections of the plant, obtaining insurance cover for the workers -Work Injury Benefits Act (WIBA), 2007 and compliance with provisions of Occupational Safety and Health (OSHA), 2007.

Energy to run the sugar mill will be sourced from the cogeneration plant, National Grid and standby generators.

To minimize energy usage, the proponent will procure modern plant machinery, adopt renewable sources of energy to power the lighting systems in areas such as offices, install compact fluorescent lights in high use areas within the facility, keep records of power consumption to inform substantial practical guidelines for opportunities in energy efficiency, create awareness on energy consumption and carry out annual energy audits.

Decommissioning of the project can happen in the event of end of project life, closure of the plant 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. Key environmental and social concerns at this phase will be economic decline, safety and health risks, waste generation and insecurity. To mitigate the

impacts, the proponent will prepare and submit a due diligence decommissioning audit report to NEMA for approval at least three (3) months in advance.

Environmental and Social Management Plan (ESMP)

Environmental and Social Management Plan includes the protection, mitigation and enhancement measures to be implemented to reduce the adverse impact on the environment as well as social impacts. The ESMP will be a baseline document that will be utilized in the management of the environment during the construction phase, the operational phase and the decommissioning phase. Its purpose is to ensure the sustainable use of the environment and it takes into consideration mitigation measures indicated in the above chapter and provides responsibilities and approximate costs. It is important that the proponent include this within his operating budgets from the outset in order to comply with the requirements of the Law.

Conclusion

The project will play an important role in the local, county and national economy. Constant monitoring of the said aspects (impacts and mitigation) through close follow-up and implementation of the recommended Environmental Management and Monitoring Plans will also ensure its longevity and avoid conflicts between the project and stakeholders or between it and the natural world. In relation to the proposed mitigation and environmental management and planning measures that will be incorporated during construction and operation phases; and the developments' input to the proponent and the general society, the proposed project is considered beneficial and important and the experts recommend it for approval. Major concerns should nevertheless be focused towards minimizing the occurrence of impacts that would degrade the general environment through follow up Environmental Audit which should be done annually just to cross check conformity and adherence to the regulations and recommendations made in this report.

CHAPTER ONE

INTRODUCTION

1.0 Project Overview

Muwariziki Sugar Factory has been proposed to be developed and located on **Plot L.R No. Gem/Genga/1301 in Sango/Rabango sublocation, Genga location, West Gem ward, Rangwe Sub County, Homabay County**. The company is a newly established enterprise backed by a consortium of local, European, and Asian investors (*CR12 annexed*).

The company has identified a gap in the crushing capacities of nearby sugar factories, the consequence of which has caused suffering among cane farmers in the region with most farmers claiming their sugarcane has been taking up to four years in the farm causing them unnecessary losses. In this view, with farmer targeted investment in mind, the directors of Muwariziki Sugar company have proposed to install a 1250 TCD plant for sugar milling with sufficient captive power.

1.1 Background and Rational of the ESIA Study Report

The proponent wishes to establish a sugar mill at the project site which hitherto has been agricultural. The company will encourage the community living in Rabango and the larger Rangwe to invest in sugar cane farming and will assist them with farming requirements. Once the factory is set up, the area will become an industrial growth center. This is an activity out of character with its surroundings at the proposed location and the land will have to go through change of user from agricultural land to industrial use. The project is included in the projects in Schedule 2 of the EMCA (Amendment 2015) that require an Environmental Impact Assessment. The proponent in compliance has therefore contracted EIA Experts to carry out this study report.

1.2 The Need for ESIA

The proposed project falls under the EIA mandatory activities and is among those listed and requiring to be subjected to the EIA process as stipulated in EMCA 1999 (Revised 2015) and the Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019 as stipulated in the Legal Notice No. 31 and 32. The project factory constitutes a major change in land use, and will establish an industrial estate, the project will also emit raw effluent that requires careful handling through proper ETP. Also anticipated is bagasse, a solid waste that is difficult to dispose off. The project will also result in air pollution which must be mitigated properly. All these have been addressed in this ESIA study report and proper mitigation measures to the impacts provided.

1.3 Objectives of the ESIA

The main objective in respect to the proposed Muwariziki Sugar factory is to guide environmentally sound decision-making. Such a decision will be on the basis of significant environmental impacts related to the project. Mitigation measures proposed will determine whether the decision to implement the project will be deferred or approved.

Specific broad objectives shall include:

- i. Identification; examination and analysis of all the significant environmental and socio-economic impacts related to the proposed Sugar Factory project.
- ii. Carrying out baseline surveys of the existing environmental, social and economic parameters in the project area upon which the ESIA Study is based.
- iii. Identifying, examining and analyzing existing policies and institutional arrangements for effective implementation of the proposed project.
- iv. Analyzing specific project alternatives in terms of site, technology, design, scale, size and extent.
- v. Formulating workable, acceptable and viable environmental mitigation measures to minimize identified negative impacts.
- vi. Developing an ESMP specifying specific actions, responsibilities, time schedule and costs.
- vii. Making appropriate conclusions and recommendations.
- viii. Ensuring adequate consultation and public participation throughout the ESIA process.

1.4 ESIA Process and Approach

The ESIA process identifies significant negative and positive environmental impacts and proposes mitigation measures to ameliorate negative impacts. The process also provides a mechanism for auditing and monitoring and implementation of mitigation measures contained in the Environmental and Social Management Plan (EMSP).

The key steps on EIA process include:

1.4.1 Screening

This project was screened and a decision was made in reference to the NEMA Public Notice on ESIA and Legal Notice No 31 and 32 of April 2019 that the report is high risk and thus requiring to undergo full study and submitted to NEMA headquarters.

1.4.2 Scoping

Site visits were made by the experts together with the representatives of MSML, the area chiefs and members of the public. This was done to ensure that critical issues pertaining to the ESIA were identified to enable the experts understand the area and collect baseline information in preparation for undertaking the task. Baseline samples were collected for analysis and analyzed in NEMA accredited laboratories.

1.4.3 Desk Review

A desk top review was done to collect secondary data especially from the Feasibility study for the proposed Muwariziki Sugar Factory conducted by MK Changwony and Associates and reference to other ESIA Study Reports on similar subject submitted to NEMA.

1.4.4 Field Data Collection

The study employed various tools and instruments for data collection. These included pre-determined checklists; camera for taking pictures of the site, questionnaires with both open-ended and closed format used to gather primary data and information from neighbors, notebooks for recording notable observations and site layout which included environmental screening and Physical environment that encompasses flora and fauna, geology and soil types, safety issues as well as noise pollution. FGD was used to get information from the Key informants who included the area chiefs, village elders and lead sugarcane farmers in the area. Other key stakeholder and departments were engaged among them heads of departments from the County Government of Homabay and national government.

Data from the general public was obtained using a closed and open-ended questionnaire circulated among the sampled respondents in the community.

The data gathered was evaluated, analyzed to determine the required level of environmental performance. Recommendation action plans were made with a view to ensure compliance with the National Environmental Management Authority requirements and/or guidelines relating to issues listed in Environmental Management and Coordination Act. Sampled questionnaires have been attached to the appendices of this report.

1.4.5 Reporting and documentation

The reporting and documentation followed the format provided by NEMA (through both EMCA, 1999 and the Environmental Impact Assessment and Audit Regulations-Legal Notice No.32 of 2019). The proponent was continually informed throughout the period of report preparation to ensure that they were

aware of the issues raised and the recommendations that were likely to be made regarding the best practices to mitigate environmental and social impacts.

1.5 Scope and Terms of Reference of the Study

1.5.1 Scope

A project proponent is required to undertake an Environmental Impact Assessment study before undertaking any project highlighted in Schedule 2 of the Environmental Management and Coordination (Amendment) Act, 2015. This study undertakes to fulfill this requirement. This report is necessary at the planning stages of the undertaking to ensure that significant impacts on the environment are taken into consideration during the design, construction, operation, and decommissioning of the facility.

The scope of the ESIA was to undertake the following key tasks:

- **Detailed desk-top review:** This involves review of all existing documentation especially the ESIA Study Report and then providing a concise description of the proposed sugar mill including its geographic, ecological, general layout of facilities including maps at appropriate scale where necessary information on size, capacity, facilities and services should also be provided.
- **Description of the baseline environment:** This involves collecting and documenting the baseline information on the environmental characteristics of the existing situation in the proposed factory site and neighborhood. This description will consider:
 - ✓ Physical environment which includes topography, soils, land cover, land use, climate, hydrology and drainage, and sound levels.
 - ✓ Biological environment comprising of flora and fauna types and diversity, endangered species, sensitive habitats.
 - ✓ Social and cultural environment present and projected population, land use, planned development activities, community social structure, social services, road networks, employment and labour market, sources and distribution of income, cultural/religious sites and properties, vulnerable groups and indigenous populations.
- **Occupational health and safety concerns:** The Consultants analyzed and have described all occupational health and safety concerns brought about by activities during all the phases of the project. The Consultants have also made recommendations on corrective and remedial measures to be implemented under the environmental management plan.
- **Determination of impacts of project facilities and activities:** From the detailed baseline environmental assessment, the Consultants have analyzed and described all significant changes

brought about by each project activity. These encompasses environmental, ecological and social impacts, both positive and negative, as a result of each facility/activity intervention that are likely to bring about changes in the baseline environmental and social conditions. The Consultant prioritized the concerns identified and differentiated between short, medium, long-term and cumulative impacts during construction, operation and decommissioning phases of the project. Both temporary and permanent impacts were also identified in this study.

- **Legislative and regulatory framework:** The experts identified and described the pertinent and relevant regulations and standards for the proposed sugar factory - both local and international, governing the environmental quality, health and safety, protection of sensitive areas, land use control at the national and local levels and ecological and socio-economic issues. The project activities that comply with the identified regulations were also be detailed.
- **Development of management plan to mitigate negative impacts:** The Consultants have developed a comprehensive environmental and social management plan. The plan recommends a set of mitigation, monitoring and institutional measures to eliminate, minimize or reduce to acceptable levels of adverse environmental impacts and/or maximize socio-economic benefits. The Consultants provided details on the institutional, time frame and responsibility for long term environmental management of the proposed Muwariziki Sugar factory.
- **Development of an environmental monitoring plan:** The Consultants have assigned a specific description, and technical details of environmental monitoring measures, including the parameters to be measured, methods to be used, monitoring locations, and frequency of monitoring.
- **Preparation of Environmental and Social Impact Assessment Study Report** which was done in accordance with the regulatory provisions.
- **The Consultant shall submit the Study Report for approval by NEMA.** The Consultant shall be responsible for making any modifications that the authorities may demand before approval of the report and issuance of an EIA License.

1.5.2 Terms of Reference (NEMA/TOR/5/2/839)

The following were the terms of reference:

- i) Prepared the TOR for submission to NEMA for consideration and approval. The approved TOR is NEMA Ref No. NEMA/TOR/5/2/839.
- ii) Hold meetings with the project proponent, and other stakeholders to establish the procedures, define requirements, responsibilities and a time frame.

- iii) Carry out a detailed systematic environmental assessment at the proposed project site and the surrounding area in line with established standards and laws.
- iv) Provide a description of the proposed activities throughout the entire implementation process of the project with a special focus on potential impacts to the surrounding environment and facilities.
- v) To provide a description of the location of the proposed development project
- vi) To provide a concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project.
- vii) To provide objectives of the proposed project.
- viii) To provide a description of the potentially affected environment.
- viii) To identify environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated.
- ix) To recommend a specific environmentally sound and affordable wastewater and solid waste management system.
- x) To provide alternative technologies and processes available and reasons for preferring the chosen technology and processes.
- xi) To analyze of alternatives including project site, design and technologies.
- xii) To prepare an Environmental Management/Monitoring Plan proposing the measures for eliminating, minimizing/mitigating adverse impacts on the environment, including the cost, timeframe and responsibility to implement the measures.
- xiii) To provide an action plan for the prevention and management of the foreseeable accidents and hazardous activities in the cause of carrying out development activities.
- xv) To propose measures to prevent health hazards and to ensure security in the working environment for the employees, residents and for the management in case of emergencies.
- xiv) Produce an Environmental & Social Impact Assessment study report that contain among other issues potential negative and positive impacts and recommendation of appropriate mitigation measures to minimize or prevent adverse impacts.
- xv) Such other matter as NEMA may require.

1.5.3 Details of Project Proponents

The proposed Muwariziki Sugar factory is a newly established enterprise owned by a consortium of local, European, and Asian investors (*CR12 annexed*).

CHAPTER TWO PROJECT LOCATION AND DESCRIPTION

2.1 Overview

The proposed Muwariziki Sugar Factory project is well conceived and conceptualized, with sound commercial viability. The expected financial returns are quite satisfactory. The project is being implemented by promoters who have the requisite background and experience and with plans to employ experienced and self-motivated professionals, experts and consultants. All perceived risks have adequate safeguards. The project is recommended for equity participation and lending by financial institutions. The ESIA experts have been brought on board to ensure the project meets the requirements of EMCA 1999 (Revised 2015) and the Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019 as stipulated in the Legal Notice No. 31 and 32.

2.1 Project Location

The proposed factory is located inside Land Parcel number Gem/Genga/1301 with the total acquired area measuring 30 acres. It is located **Sango/Rabango sublocation, Genga location, West Gem ward, Rangwe Sub County, Homabay County** and mapped by GPS Coordinates, Latitude: **0°34'23.0"S** and Longitude **34°34'33.1"E**.

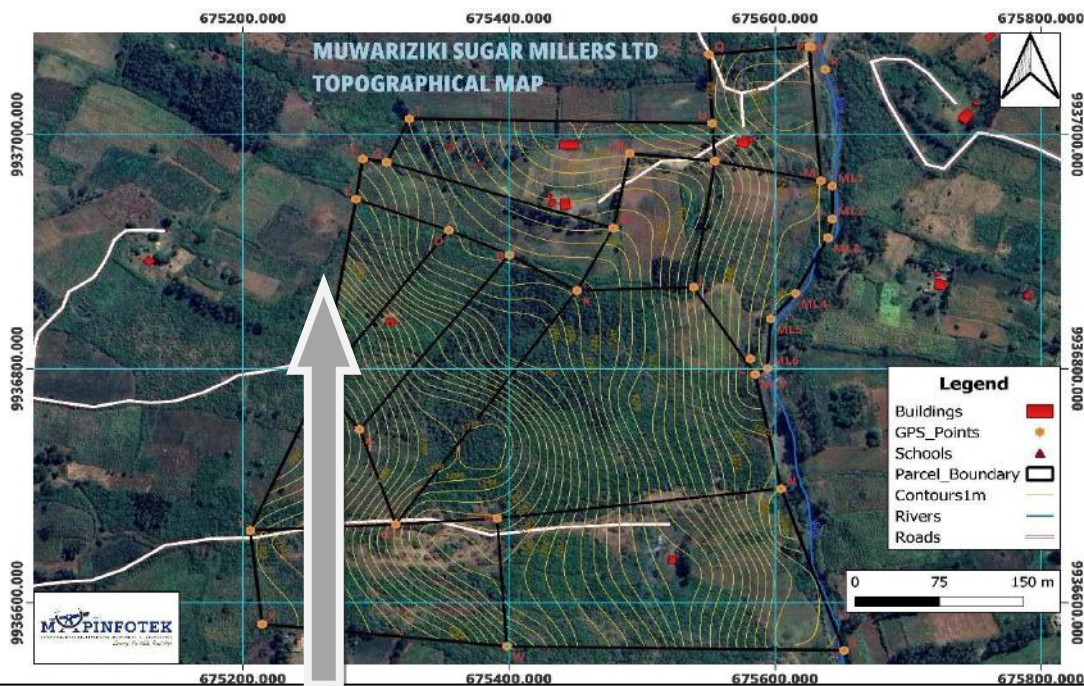


Figure 1 Topographical map showing the Proposed Project Site on Land Parcel number Gem/Genga/1301

Source: Site Topographical Maps by Mapinfotek

This location is central to the catchment of sugar cane growers. The circle provided in *figure 2* below covers a radius of 15 kilometers of an area mapped out as the most potential area for sugar cane growing

in Rangwe. The area covers over 10,000 acres of suitable land for sugar cane growing. The site is located 35 Km from the near sugar factory-(Ndhiwa).

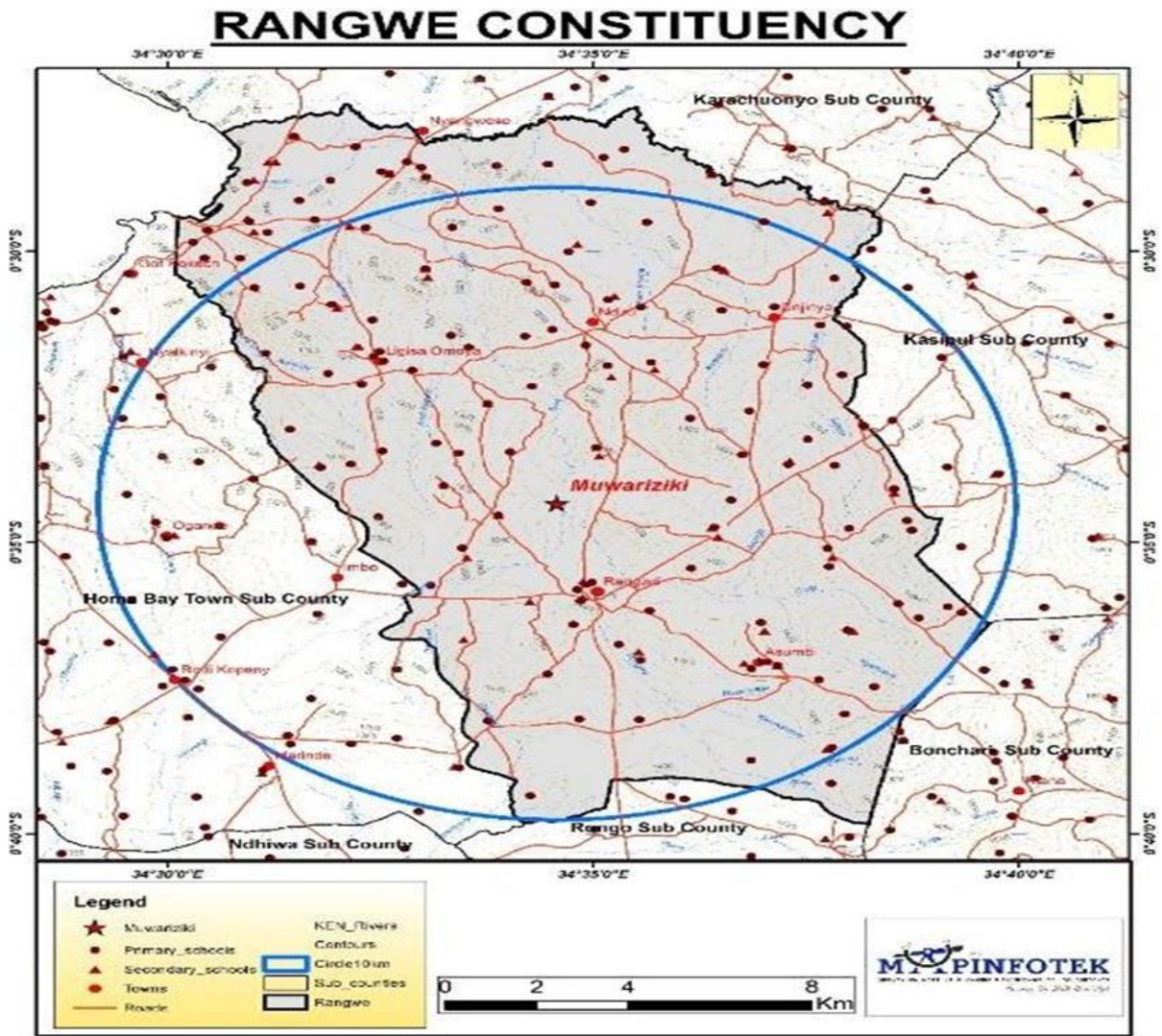


Figure 2: Circle showing catchment area for the proposed Muwariziki sugar factory

2.1 Goals of the Project

The goal of the project is to establish a 1250 TCD sugar factory expandable to 1500TCD. The project is expected to

- Utilize the excess sugar cane in the area and help alleviate the suffering of the sugarcane farmers who have decried sugarcane remaining unharvested for long periods.
- Assist Kenya to meet the existing sugar deficit of 280,000 tonnes per year (Domestic demand for sugar is currently estimated at 780,000 metric tons against an average production of 500,000 metric tons).

- Reverse the current trend of continuous importation of sugar into the country thereby draining the country's foreign exchange and job exportation.

Thus, the main purpose of the project is to increase sugar production in the country in order to meet domestic sugar demand.

2.2 Project Objectives

In order to achieve these goals, the objectives of the project are as follows: -

- Expand production of sugar cane in the nucleus farms and out growers' field
- Construct and establish a 1250 TCD sugar processing factory together with ethanol distillery (20KLPD) and 3MW captive power plant;
- Create employment to the residents of Genga, West Gem ward, Homabay County and Kenya at large as well as other staff for operating the sugar processing mill by engaging professionally qualified individuals;

2.3 Justification for the Project

Domestic sugar production in Kenya does not meet consumption demand. Existing consequently, expanded production and creation of more sugar mills within regions of high agricultural potential is necessary for expansion of the industry. Rangwe, has suitable Climate and soils for sugar production. Rangwe sub county produces a lot of sugarcane alongside other agricultural activities and livestock keeping. Currently, farmers in Sango/Rabango have suffered big losses due to the distance travelled by the existing sugar milling factories which are located far and situation made worse by poorly maintained roads in the area where they claim their sugarcane stays for several years unharvested lowering their output.

In case of technical breakdown in the nearest sugar factory, the farmers in the area have been incurring big losses with the sugarcane stranded with nowhere to take them. MSML has identified this gap and as a remedy, the directors have proposed to build a 1250 TCD Factory (Expandable to 1500 TCD) in Sango/Rabango. The proponents have extensively and diligently analyzed the present and future scenario of sugar industries. They have carefully reviewed surplus cane availability in the target project area, as well as future potential of additional cane availability.

The current policies in Kenya's Sugar Industry are supportive to such projects. The sugar market in Kenya is growing each year with demand growing faster than production.

2.4 Project Description

The project and company's operations will include the following: -

- i. Production of sugar cane in its nucleus estate and out-growers' fields;
- ii. Project construction activities with structures and amenities highlighted in 2.4.2.2.4 below
- iii. Commissioning the project and processing of mill white/mill brown sugar from harvested sugar cane
- iv. Generating 3 MW captive power for factory use in nucleus estates.
- v. Ethanol distillery.

The Out growers targeted by the proposed sugar factory will be expected to fall mainly within 15 km radius of the factory area and will cover mainly Genga and West Gem ward areas of Rangwe subcounty. Out of the mapped area, 60% of cane is established and the balance of 40% will be new crop establishment and will be planted in synchrony with factory crushing capacity.

2.4.1 Nature of the Project

The proposed project will involve a new vacuum pan plant consisting of a 1250 TCD (Expandable to 1500 TCD). The project also considers to have a cogeneration power plant of 3 MW and an ethanol distillery of 20 KLPD. The process involved at the mill will be as illustrated in the diagram below. (Figure 2.4.1).

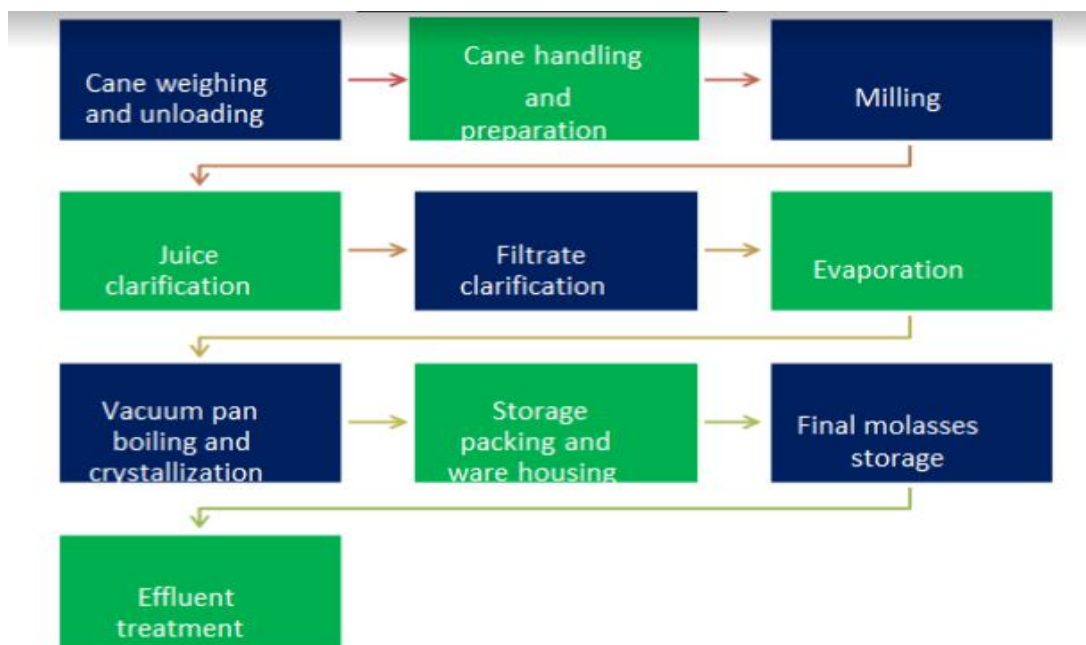


Figure 2.4.1: Simple illustration of the proposed sugar milling process

2.4.2 Project Components, Equipment and Specifications

2.4.2.1 Land Acquisition

Currently the proponent has secured land for factory construction and is in the process of acquiring approximately **30 acres** around his plot. The proposed Factory will be located inside Land Parcel number **Sango/Rabango sublocation, Genga location, West Gem ward, Rangwe Sub County, Homabay County** measuring 3.8 Ha (or 9.2 acres) on registry map sheet No. 5 registered under the company name Muwariziki Sugar Millers Limited (See title deed attached). The proponent has enough land and in total plans to acquire land area of approximately 50 acres in anticipation of future expansion. The map below shows the project site and adjacent plots under acquisition for purposes of the development.

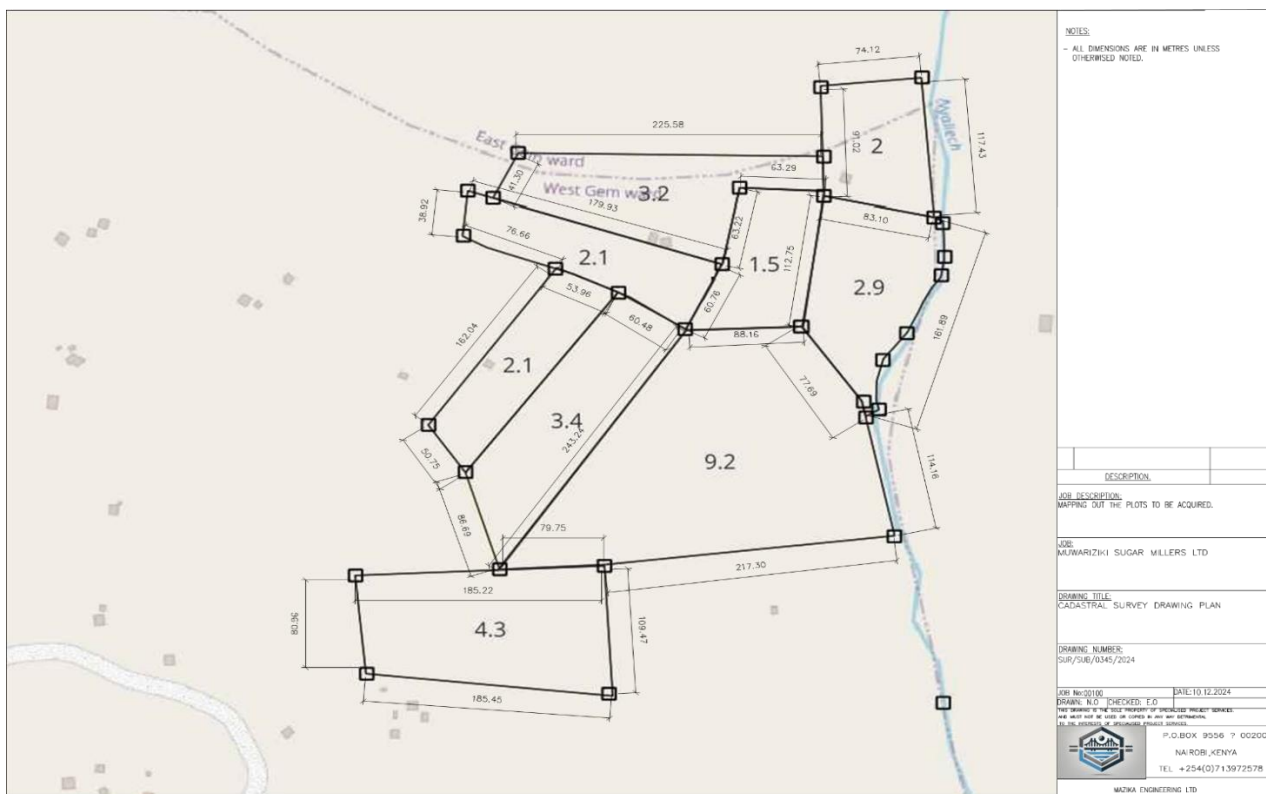


Figure 2.4.2.1: Topographical map showing size of land for the factory development

2.4.2.2 Factory Design and Project Specifications

The design and construction of the factory will be managed by Saisidha Engineering Company, a renowned Engineering, Procurement, and Construction (EPC) contractor. The plant layout and technology will incorporate the latest advancements in sugar processing to maximize efficiency and reduce operational costs.

2.4.2.2.1 Key features of the proposed factory Design

- **Advanced Milling Technology:** Employing modern crushing equipment to maximize sugar extraction rates.
- **Energy Efficiency:** Implementing energy-saving processes to reduce power consumption and enhance environmental sustainability.
- **Automation:** Integration of automated controls and monitoring systems to ensure consistent product quality and minimize human error.

2.4.2.2.2 Synchronization of Crop Establishment and Crushing Capacity

To optimize resource use and ensure a balanced production flow, new crop establishments will be synchronized with the factory's crushing capacity. This alignment will ensure that the factory operates at peak capacity throughout the year, reducing downtime and improving overall efficiency. The planned crop establishment will be as follows:

- **60% Established cane fields:** Currently available for harvesting and immediate supply.
- **40% New crop development:** To be planted progressively in line with factory capacity and market demand projections

Muwariziki Sugar Company's strategic design and operational plan are aimed at establishing a sustainable and profitable sugar production unit that meets the highest industry standards. By leveraging advanced technologies, developing a robust out-grower network, and creating an efficient distribution system, the company is poised to become a significant player in the local and national sugar markets.

2.4.2.2.3 Cane Quality Parameters

1	Pol % cane	Maximum 12%
2	Fiber % cane	Maximum 17%
3	Mixed Juice Purity	Not Less than 80 units
4	Extraneous Matter	Not More than 2%
5	Bagasse	Not more than 36%
6	Process Followed	Juice Defecation
7	Final Product	Brown Sugar, ICUMSA (less than 800)

2.4.2.2.4 Factory structures

The factory will be constructed using locally available materials including blocks, cement, ballast and timber, all obtained from nearby suppliers or from Homabay Town. According to the preliminary design provided by the supplier in India, the buildings to be constructed will mainly consist of the factory structures and the following: -

- a. Workshops,
- b. Administrative offices,
- c. Weighbridge,
- d. Cane yard,
- e. Pan and Mill House,
- f. Bagasse Handling area for boiler
- g. Boiler
- h. Power house,
- i. Ethanol Distillery
- j. Control Panel Room
- k. Chemist office and laboratory
- l. Sugar house,
- m. Effluent Treatment Plant,
- n. Molases storage tank
- o. Agriculture office
- p. Staff houses
- q. Warehouse and Go downs

2.4.2.3 Water and Electricity Supply to the factory site

Electricity and water are crucial for the operation of this plant. During construction, water will be easily available from the nearby Rangwe river bordering the lower area of the land and approximately 0.4Km away from where the factory is to be sited. The river is permanent throughout the year therefore will be sustainable to supply the community and the factory during operational phase of the project upon obtaining abstraction permits and approval from WRA.

The factory will be connected to the KPLC National grid to ensure that during construction, power will be available on site. A three-phase power line is connected to the site. During operation, the factory will supplement this by producing **3 MW** at the Cogen plant where bagasse will be used to drive boilers and generate steam to run turbines.

2.4.2.4 Sugar Milling Plant

The proposed sugar plant will be of 1250 TCD (Expandable to 1500 TCD). Necessary staging for all the machinery including supporting columns, integral floor structure, staircases, railings etc. shall be provided. Mills, mill drive, turbo generator, clarifier, filter, lime and boiler operating platform shall be on RCC staging. Other machinery except those on floor level shall have its own supporting steel staging. Pipelines, mill and powerhouse cranes, condensers, flash tanks, cyclones, separators can be supported on building columns. No weight of other machinery or platform shall be transmitted to building columns. All gangways, passages, staircases, working platform and railing shall be convenient.

A clear working platform of at least 1.5 m width should be provided in working front of pans and evaporator bodies. *(See more details of the mill on the feasibility study attached to this study report)*

2.4.2.4.1 Projected plant Operations activities

Table 1: projected plant operation

Plant Operations	Unit	Quantity/No or %
Crushing Capacity per day	[Tons per Day]	1,250
Plant Days Annual	[Days]	365
Mill Operating Days	[Days]	250
Working Hours	[Hours]	22
Maintenance Days	[Days]	115
Maintenance Start Month	[Month]	3
Mill Crushing Efficiency	[Percentage]	80%
Incremental Crushing Efficiency	[Percentage]	2%
Cane Required Annually	[Tons]	229,166.67
Cane Required per Month	[Tons]	19,097.22
Sugar Extraction	[Percentage]	10.00%
Molasses Extraction	[Percentage]	4.00%
Bagasse Produced	[Percentage]	30.00%
Filter Mud	[Percentage]	2.00%
Steam Produced from 1kg bagasse	[Kg]	2.10
Steam required to produce 1MW power	[Tons]	6.50

2.4.2.5 Power Generation Plant (Cogen Power Plant)

The plant targets to produce 3 MW as per the proposed design for own factory consumption. The proposed Factory is a 1250 TCD expandable to 1500. The Co-gen power project of 3 MW will mainly operate on mill bagasse during 250 season days the sugar plant will be milling and on saved bagasse for 27 offseason days. At designed levels, it will generate about 3 Megawatts and will utilize the surplus power to run other industries.

The proposed design of Co-Gen plant will initially run efficiently with steam powered turbines which although low in power generation efficiency will be cheaper compared with DC motors or hydraulic drives. The design specification should allow upgrade of the system to hydraulic system at the time of expansion of the plant to 1500 TCD.

The details of this power generation are as provided below:

2.4.2.6 The Boiler (One in Number)

One water tube boiler shall satisfy the following conditions:

1. MCR (Maximum continuous: 40 tons per hour rating) evaporation
2. Pressure at super heater outlet: 45 bar(a)
3. Temp. of super heater outlet: 440C \pm 50C at 60% to 100% of MCR
4. Feed water temperature at deaerator outlet: 1050C
5. Excess air % theoretical air: Not exceeding 35%
6. Temp. of gases at the outlet: 1700C
7. Efficiency: 70% on GCV (2270 kcal/kg) of bagasse having 50% moisture, ash % less than 1.5% with bagasse as fuel.

2.4.2.7 Steam turbine & its auxiliaries

2.4.2.7.1 Turbo Alternator Set

One Turbo alternator set of 3000 KW capacity. The steam turbine shall be designed for operation of the following ranges of steam parameters:

2.4.2.7.2 Inlet Steam Pressure

Table 2: Steam pressure and temperature

Inlet Steam Temperature	
Maximum	45 Kg/cm ² g
Normal	43 Kg/cm ² g
Minimum	38 Kg/cm ² g
Inlet Steam Temperature	
Maximum	440 °C
Normal	430 °C
Minimum	420 °C
Exhaust Steam Pressure	
Maximum	1.75 Kg/cm ² g
Normal	1.5 Kg/cm ² g
Minimum	1.0 Kg/cm ² g

The turbine should be so designed that it suffers no damage if exhaust pressure occasionally goes down to atmospheric pressure and/or live steam temperature goes up to 440 °C

The specific steam consumption at its rated speed and on normal steam operating parameters should not exceed 12 kg/KW/hour while delivering 3000 KW.

2.4.2.7.2 Safety Devices

The turbine shall be provided with following safety devices:

- i. Over speed trip with audio visual alarm
- ii. Low oil pressure trip with audio visual alarm
- iii. The turbine should trip when the alternator ACB trips due to differential protection
- iv. Manual Trip Nob/Handle
- v. High Back Pressure Trip
- vi. Axial movement trip
- vii. Remote operated manual trip with audio visual alarm

Special maintenance tool for turbine shall be supplied along with turbine.

The alternator shall be suitable for developing continuously 3750 KVA (3000 KW at 0.8 power factor) 3-phase, 50 cycles/sec at a normal voltage range of 415 V, and shall conform to IS – 4722 – 1968 specifications

2.4.2.6 Effluent Treatment Plant

During processing, the water effluent from the plant, mainly consisting of bagacillo and floor washings, which are rich in BOD, will be taken to modern effluent treatment plant with a designed capacity of **300 m³/day** capable of reducing the level of biological oxygen demand (B.O.D) to less than 30ppm and remove suspended matter. It shall perform as shown upon reaching steady state of its operation. The ETP shall have the following components:

Oil & Grease Trap, Collection Tank & Oil Grease Trap, Chemical Dosing Tank, Equalization Tank, Primary Clarifier, Aeration Tank, Filter Feed Tank, Pressure Sand Filter, Activated Carbon Filter, Treated Water Tank, Sludge Valve Tank, Sludge Drying Bed, Chemical Tank, Sludge Pump for Aeration, Tank, Primary Tank, Clarifier and Secondary Clarifier.

The ETP plant shall be designed for following parameters.

Table 3: ETP Design Parameters showing assumed and treated levels

Sr. No.	Parameter	Effluent (Assumed)	Treated Effluent
1	Flow (m ³ /Day)	250	250

2	pH	4-7	6.5-8.5
3	Oil/Grease (mg/l)	30	<10
4	BOD (mg/l)	1200	<30
5	COD (mg/l)	2500	<200
6	TSS (mg/l)	300	<100

2.4.6.2.1 Effluents from the Sugar Plant

To meet above standards, the sugar plant effluents will be treated in a separate Effluent Treatment Plant with final Reverse Osmosis. The discharges will be maintained as per the latest norms of NEMA as spelt out in Water Quality Regulations 2006 (Legal Notice No. 121). The liquid effluents from the sugar process will be mainly waste water from various process equipment in the milling and boiling house sections and the treated water will be used for gardening purposes.

2.4.6.2.2 Effluents from the Cogen Power Plant

The Cogen power plant effluents will also be treated in a separate effluent treatment plant and the discharges will be maintained as per the latest norms of NEMA. The liquid effluents generated from the Cogen power plant will be mainly from boiler blow down, cooling tower and water treatment plant blow downs, wash water and other sewage effluents.

2.4.2.7 Weighbridge

The installed weighbridge will be automatic with computerized weight recording, printing facility and capable of accounting and generating up to date crushing status report, analysis using relevant software for report generation, including identification of farmer, tractor number, cane variety among others.

2.4.2.8 Cane Handling and Feeding

The yard will consist of a weighbridge and overhead gantry. The cane preparation equipment will consist of a cane carrier, a cane kicker to regulate feed cane knives and a fibrizer. All operations will be electrically controlled from the operator's cabin. The overhead unloading crane will be capable of undertaking 20 lifts per hour while grabbing and lifting approximately 2-3 tonnes of cane per lift. The crane will be complete with its accessories, gantry columns, attendant platform along the length of the gantry on sides.

2.4.3 Sugar Milling Process

The sugar processing plant will be based on a milling capacity of 1250 TCD (Expandable to 2500 TCD). This is a simple three step process which will include Cane milling, Evaporation and Crystallization. The standard flow sheet as will be adopted can be given as;

2.4.3.1 Juice Extraction

The process of extraction of juice starts with the cane passing through a series of cuts into chips, then through a crusher, a succession of rollers mostly four to six stage rollers in a row. Modern design mill will be installed which will be fully equipped with turbine drive, special feeding devices, efficient compound imbibition system etc.

Bagasse will be the byproduct of this process as a residue. The bagasse generated will be approximately 30% of the total cane processed.

2.4.3.2 Clarification

Extracted juice is taken through a heating with temperatures between 65 to 75 degrees Celsius before being treated with phosphoric acid, sulphur dioxide & milk of lime to remove impurities. The treated juice, on boiling, is fed to continuous clarifier from which the clear juice is decanted while the settled impurities known as mud is sent to the field as fertilizer. The clear juice goes to the evaporators without further treatment

2.4.3.3 Evaporation

The clarified juice contains about 85 % water. About 75% of this water is evaporated in vacuum multiple effects consisting of a succession of four increasing vacuum boiling cells. The vapours from the final body go to condenser. The syrup leaves the last body continuously with about 60% solids & 40% water.

2.4.3.4 Crystallization

The syrup received from the evaporation process will be treated with sulphur dioxide after which it is sent to the pan station for crystallization of sugar. In this stage syrup is evaporated until saturated with sugar.

2.4.3.5 Centrifugation

The suspension of sugar crystals (massecuite) received from the crystallizer is deposited into revolving machines called centrifuges. The perforated lining retains the sugar crystals, which may be washed with water if desired. The molasses passes through the lining because of the centrifugal force exerted & after the sugar is „Purged“. It is cut down leaving the centrifuge ready for another charge of massecuite. Continuous centrifuges may purge low grades. molasses separated from commercial sugar is again sent to a pan for boiling and re-crystallization. Three stages of re-crystallization are adopted to ensure maximum

recovery of sugar in crystal form. The final molasses is sent out of the factory as a by-product used for animal feed etc.

2.5 Project Cost

Factory design and BQ is as provided by Saisidha Sugar Equipments & Engineering Company the selected EPC contractor and the cost estimate will be as specified below.

From the Bills of quantities, the estimated total cost of setting up the factory is **USD 11.52 Million** which translates to **Ksh. 1,514,880,000**. The statutory charge of 0.1% processing fee payable to NEMA is therefore **Ksh. 1,514,880 (One million, five hundred and fourteen thousand, eight hundred and eighty shillings)**.

The payment is done on the e-citizen platform after receipt of an invoice from NEMA.

CHAPTER 3

BASELINE ENVIRONMENTAL CONDITIONS

3.1 Background Information

This Chapter introduces the project site, its location in the County, its total area, the main physical features and its administrative units. The chapter also highlights the county's socio- economic characteristics in addition to its profile. The information here provides a general overview of the proposed site, Sango/Rabango location, Rangwe Subcounty and Homabay County.

Table 4: General site information at the proposed site

Proposed Plant Location	Sango/Rabango, Rangwe Sub County, Homa Bay County. Coordinates: 0°34'19"S 34°34'34"E
Ambient Temp °C	21-25 °C
Relative Humidity	65-85%
Plant Elevation (Above Mean Sea Level)	1,300m above MSL
Wind Velocity	1-4 m/s
Predominant Wind Direction	Influenced by lake breezes and monsoon patterns, often from the southeast during the rainy season
Seismic Condition	Low to moderate seismic risk
Area Classification	Safe & non-hazardous environment,
Annual high temperature	~35°C in warm months (January-March)
Annual low temperature	~15°C during cooler nights (June-August)
Average annual precip.	~1,200 mm
Wettest Month	April (146mm)
Driest Month	February (65mm)
Number of days with rainfall (≥ 1.0 mm)	~100-120 (32.88%)
Days with no rain	~245 days (67.12%)

Rangwe is one of the 290 constituencies in Kenya and one of the 8 constituencies in Homa Bay County. The constituency is situated 25km from Homa Bay Town center. The constituency covers an area of about 274.1 km². With four wards being East Gem, West Gem, Kagan and Kochia. Rangwe falls under Lower Midland (LM2) Agro ecological zone, this zone supports green grams, millet, sorghum, tobacco, sunflower, sugarcane, beans, pineapples, sisal, and groundnuts.

3.1.1 Region sugarcane growing and existing factories

In Homa Bay County, sugarcane farming is already established, with Sukari Industries operating a factory in Ndhiwa sub-county. Currently, this factory mills 1500 tons of sugarcane per day, supplied by 15,141 farmers cultivating approximately 14,311 hectares. The proposed project in Rangwe has favourable conditions, including suitable soil, reliable rainfall, and a pool of farmers, some of whom are already engaged in sugarcane cultivation.

Investors plan to open an additional 4,000 hectares of new sugarcane farms, focusing on early maturing and high-sucrose cultivars. This will bring the total sugarcane area in Rangwe to 18,311 hectares.

The GPS Coordinates for the site are **Latitude: 0° 34'23.0''S, Longitude: 34°34'33.1'' E.**

Distance between Muwariziki at Proposed Site and other Sugar Factories

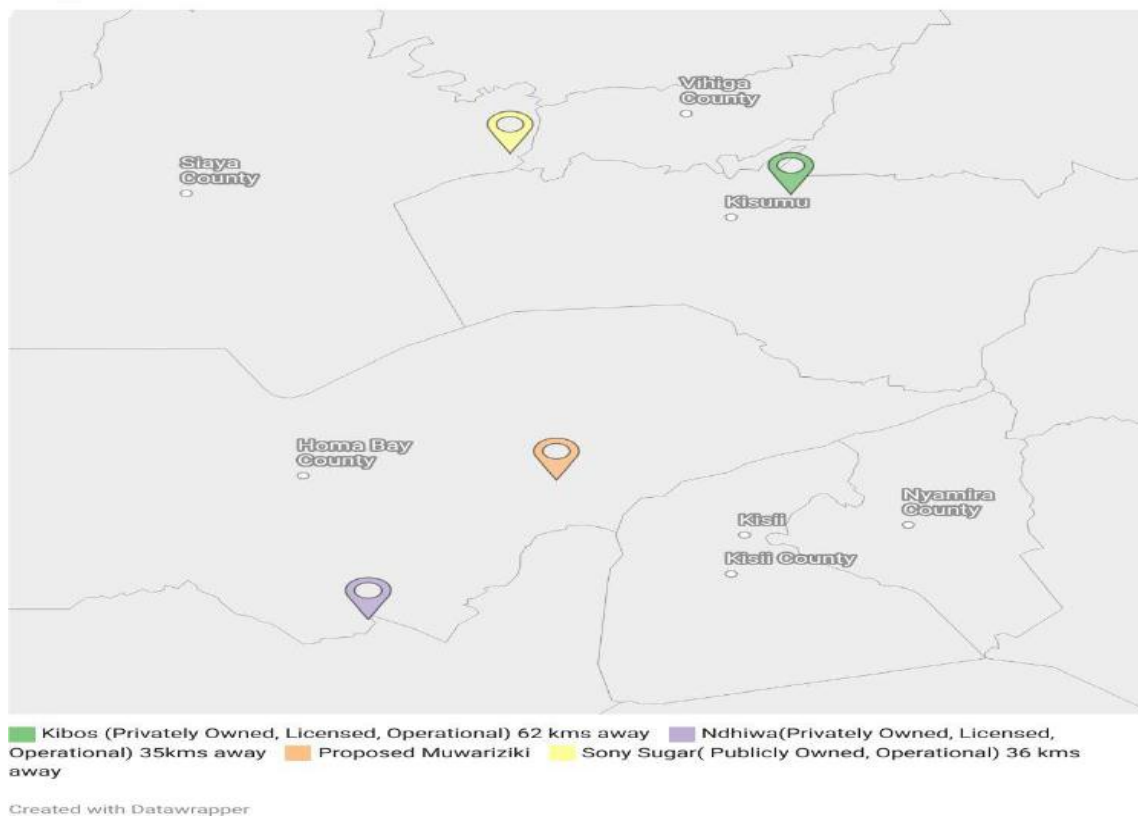


Figure 3.1.1: Distance showing proposed site in relation to other sugar factories

The environmental resources examined in baseline analysis include:

- (a) Physical resources (Climate, climate risk and vulnerability, topography and soils, ground water and surface water)

- (b) Ecological resources (aquatic biology e.g. fisheries, wildlife, forests and endangered vegetation species, protected coastal resources).
- (c) Economic development (infrastructural facilities such as water supply, sewerage, roads, land use, power sources, agricultural development).
- (d) Social and cultural resources (e.g. population numbers, locations, composition, employment, health facilities, socio-economic conditions e.g. social well-being, physical or cultural heritage, current use of lands and resources for traditional purposes by indigenous people, sites that are for historical, archaeological, paleontological or architectural significance).

3.2 Physical Resources

3.2.1 Topography and Soils

The study area lies within an area with good soils, well distributed rainfall and existing cane plantations. It has a huge potential for sugarcane growing, with the majority of the farmers being maize, beans and sugar cane growers with surplus cane in their fields.



Figure 3.2.1.1: View of the soils near the proposed project site.

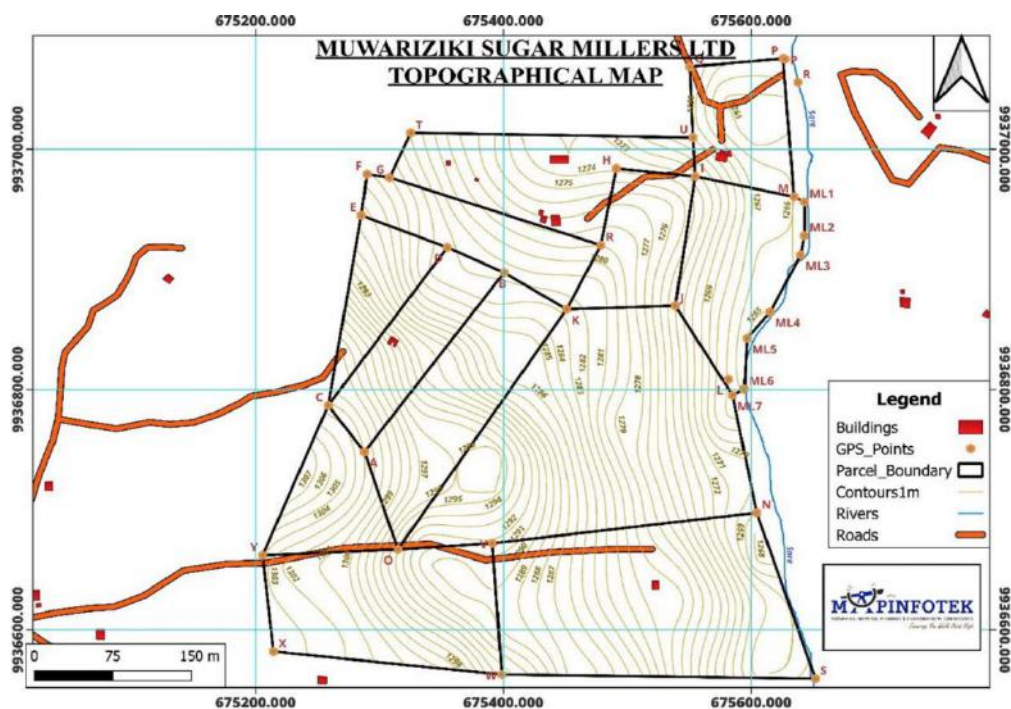


Figure 3.2.1.2: Topographical map showing parcel boundary, contours, rivers and roads at the proposed site

3.2.2 Geology

Geology depicts Rangwe covered with Nyanzian rocks composed almost entirely of rhyolites, andesites and basalts, with minor local developments of tuff and agglomerate.

3.2.3 Climate, Climate Change risks and Vulnerability

Climatic data reveals favorable maximum and minimum temperatures, as well as humidity levels, which support optimal sugarcane growth and high sucrose recovery. Cane yield projections for this area exceed 100 tonnes per hectare, attributed to suitable agro-climatic conditions.

Climate change is one of the major threats to the proposed project. Erratic weather patterns, droughts, and changing rainfall due to climate change pose a risk to sugarcane farming, as sugarcane is heavily reliant on specific climatic conditions.

3.2.3.1 Climate Change risks and Vulnerability Assessment

Conserving natural resources is a basic requirement for ensuring local populations is not vulnerable to climate change risks and impacts.

To identify climate vulnerabilities, the study has considered the extent to which people, ecosystems and species, economic, social and cultural assets, and services are sensitive to climate-related hazards (including extreme weather-related events and slow-onset climate changes) and have related adaptive capacities.

Climate change remains a major challenge in Rangwe and Homa Bay County whose main sources of livelihoods include fishing and fish trade, fish processing and agricultural production. In response, Homa Bay County in cognizance of the need to protect its people while allowing development projects, the county has proposed to develop resilient hubs, implement climate smart project and carbon trading and develop resilient hubs and develop community’s adaptation and mitigation plans.

In the recent past, the project area (Rangwe subcounty) has experienced climate change with climatic conditions recording as high as 36.27°C (Temperature) in the months of February and march against the daily mean of 22.53 °C. See below table 5:

Table 5: Showing record high, average, mean and record low weather recorded in Rangwe subcounty.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Nov	Oct	Dec	Year
Record high °C (°F)	35.21 (95.38)	36.27 (97.29)	36.27 (97.29)	35.21 (95.38)	30.94 (87.69)	27.74 (81.93)	29.87 (85.77)	30.94 (87.69)	34.14 (93.45)	33.07 (91.53)	32.01 (89.62)	32.01 (89.62)	36.27 (97.29)
Average high °C (°F)	27.54 (81.57)	29.39 (84.9)	28.53 (83.35)	26.22 (79.2)	25.21 (77.38)	24.49 (76.08)	25.04 (77.07)	26.48 (79.66)	27.52 (81.54)	27.65 (81.77)	26.53 (79.75)	26.17 (79.11)	26.73 (80.11)
Daily mean °C (°F)	23.12 (73.62)	24.28 (75.7)	23.79 (74.82)	22.38 (72.28)	21.7 (71.06)	21.12 (70.02)	21.19 (70.14)	21.98 (71.56)	22.78 (73.0)	23.12 (73.62)	22.56 (72.61)	22.32 (72.18)	22.53 (72.55)
Average low °C (°F)	17.33 (63.19)	17.97 (64.35)	17.68 (63.82)	17.01 (62.62)	16.4 (61.52)	15.67 (60.21)	15.25 (59.45)	15.68 (60.22)	15.89 (60.6)	16.42 (61.56)	17.05 (62.69)	16.79 (62.22)	16.59 (61.86)
Record low °C (°F)	13.87 (56.97)	13.87 (56.97)	13.87 (56.97)	13.87 (56.97)	13.87 (56.97)	11.74 (53.13)	11.74 (53.13)	12.8 (55.04)	12.8 (55.04)	13.87 (56.97)	13.87 (56.97)	13.87 (56.97)	11.74 (53.13)
Average precipitation mm (inches)	133.49 (5.26)	126.58 (4.98)	267.87 (10.55)	366.75 (14.44)	333.93 (13.15)	231.07 (9.1)	146.47 (5.77)	197.94 (7.79)	218.38 (8.6)	250.99 (9.88)	296.43 (11.67)	221.67 (8.73)	232.63 (9.16)
Average precipitation days (≥ 1.0 mm)	19.68	16.97	25.89	29.68	32.1	29.68	28.03	27.74	26.96	28.22	29.19	26.38	26.72
Average relative humidity (%)	72.35	67.83	75.68	87.78	91.53	89.92	83.66	78.87	77.57	78.4	83.83	81.45	80.73
Mean monthly sunshine hours	12.12	12.15	11.77	11.6	11.74	11.68	11.94	12.08	12.02	12.08	11.86	12.01	11.92

Source: The Global Historical Weather and Climate Data

The community of Rangwe highly depend on agriculture. Therefore, agriculture, forestry and hydrology are likely the most affected areas prone to climate change risk and variability because of its implication on livelihood.

Agricultural value chains in Rangwe subcounty are mainly growing of maize, sorghum, cow peas, ground nuts, beans, soya, sweet potatoes, sunflower, sesame, green grams, rice, sugarcane and vegetables (Source: Homabay county CIDP2023-2027).

Poultry and cow rearing is also practiced. Poultry will be greatly affected by climate change based on their response to extreme weather conditions.

Changes in temperature, rainfall, ultra violet (UV) radiation, and carbon dioxide (CO₂) levels also have a major impact on agricultural production. Other climatic effects on agriculture are the shifts in seasonal

climatic patterns and increase in frequency and intensity of weather extremes. It has also been noted that crop productivity can significantly be influenced by variability in rainfall and temperatures.

A greater risk likely to be facing the community and making them vulnerable to climate change risks is predominantly being on rural economies and low levels of agricultural diversification. Therefore, establishing the proposed sugar factory will help the community diversify and increase the number of value chains focusing on resilient value chain such as sugar cane as a way of building community resilience.

A large number of farmers amongst the community are small scale farmers adding to their vulnerability in scenarios of climate change. Current climatic trends, predictions and analysis studied using GIS technologies have shown that the most vulnerable groups to increased climate risks are small scale farmers in the tropical and subtropical areas (Change, 2007). This explains the reason why there has been decrease in production of main crops such as maize, sugarcane, wheat and rice while population continues to increase.

Because of these, there is likelihood to experience the risk of hunger, food insecurity in the region. Therefore, the target community has to be capacity built to be prepared and be able to mitigate on the risks of climate change risks by integrating this in the policies of the proposed sugar factory. Below are further recommended actions for adaptation and mitigation measures.

3.2.3.2 Recommended adaptation and mitigation measures against climate risks due to the proposed project

In view of above and the efforts already in place by the county government of Homabay to curb risk of climate change and vulnerability, the proponent of Mwariziki Sugar Millers Limited is advised to support the ongoing efforts by planting trees, developing early warning systems by setting aside resources focusing of mitigating climate risks and engage in agroforestry activities.

MSML to promote sustainable cane farming practices and environmental conservation. Key adaptation measures to include:

- **Soil Conservation:** Farmers cultivating steep slopes will receive training on soil conservation techniques, such as terracing and cover cropping, to prevent erosion and preserve soil health.
- **Tree Cover and Reforestation:** The Factory will monitor tree cover to ensure compliance with the national requirement of 10% tree cover for total land holdings. Farmers will be encouraged to adopt agroforestry practices, planting trees alongside sugarcane to maintain ecological

balance.

Water Resource Management: The Factory will map all existing streams within the cane catchment area and sponsor conservation efforts to protect these vital water resources. Initiatives will include tree planting along riparian zones and training farmers on sustainable water usage practices

3.2.4.1 Rainfall

There are two rainy seasons: the long rainy season from March to June and the short rainy season from August to November. The rainfall received in the long rainy season is 60 percent reliable and ranges from 250 – 1000 mm, while 500 –700 mm is received in the short rainy season. The County receives an average annual rainfall ranging from 700 to 800mm.

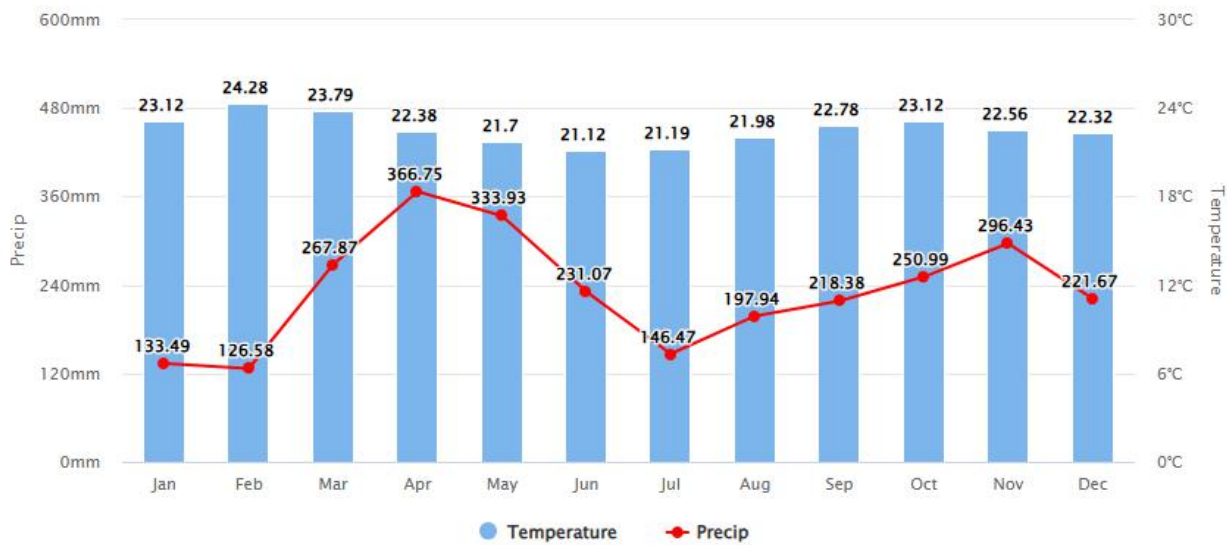


Figure 3.2.4.1: Rainfall and temperature pattern in Rangwe Subcounty

Source: World Weather Online, 2024

3.2.4.2 Temperature:

The climate is inland equatorial, with temperatures ranging from a mean annual minimum of 17.1°C to a mean maximum of 34.8°C

3.2.5 Hydrology and Ground water Potential

The proposed site is located approximately 400m from River Rangwe. The river is permanent throughout the year. The factory proposes to abstract water for factory use from the river upon obtaining approvals from WRA. The water will however require proper treatment through reverse osmosis at the factory to meet all other standards for the parameters that were below the standards to render it safe for use. (See analysis results on 3.5.1 table 4&5).



Figure 3.2.5.1: A section of River Rangwe which passess near the proposed site

3.3. Ecological resources

3.3.1 Flora and Fauna

The natural vegetation in the project area have substantially been disturbed by human activity. Most of the land in the project area is used for human habitation, farming especially sugar cane, maize cultivation, dairy farming, urban development and other land uses. The project site is currently covered with shrubs. The site is well conserved with few indigenous trees. The area does not have protected wildlife. Animals likely to be found includes hares, snakes, mice, birds among other small animals.

The predominant tree and plant species found within the project site are eucalyptus. The major grass types are common thatching grass (*Hyparrhenia hirta*) and *Cynodon dactylon* (Star grass). The proposed project site is currently under shrubs with some sections under beans and maize cultivation.

Most of these tree species grow naturally within the project site while few were planted. Some of these will be impacted during site clearance for construction purposes. The project shall however as much as possible avoid unnecessary clearance of vegetation. Revegetation program shall be done to compensate for any lost vegetation after the project.



Figure 3.3.1: Common vegetation currently dominating the proposed project site

3.4 Social and cultural resources

3.4.1 Population characteristics

The total population of Rangwe Subcounty is **117,732** with concentrations varying across administrative areas. According to the 2019 Kenya Population and Housing Census, the entire county population was 1,131,950 persons consisting of 539,560 males, 592,367 females, and 23 intersexes. Of the total population, 1,018,871 representing 90%, lived in rural areas within 262,036 households, while 113,079 representing about 10%, lived in urban areas within 32,024 households.

3.5 Economic profile

Poverty in Kenya remains a challenge requiring urgent attention. The bigger challenge is unemployment for the youth who some have graduated from universities but have no meaningful engagement. This has resulted in inadequacy of income and deprivation of basic needs and rights, and access to productive assets as well as to social infrastructure and markets.

3.5.1 Trade and Industry

Trade and industry is extensively done through the department of trade, industry, investment and enterprise development in Homa Bay County. The trade and industrial processes in the county are markets, industrial parks, major industries and varied businesses

3.5.2 Major Industries

Homa Bay County has a limited presence of industries being home only to two fish processing industries in Homa Bay Town and Mbita Point, one sugar processing industry in Ndhiwa, an ice plant in Mbita Point that processes and packages drinking water and, an integrated industry in Kwethumbe (Suba) that processes forest products. The cotton processing ginnery in Homa Bay had collapsed due to market and technological challenges and with the introduction of cheap synthetic alternatives to cotton in the world market that made cotton farming unattractive to most farmers in the county.

3.5.3 Markets

Homa Bay County currently has 103 active major markets generating revenue in the 8 sub counties. Some of the markets and trading Centre's lack vital services such as proper sheds, parking space, public space, water and sanitation facilities, and proper solid waste management among others. These markets generate a bigger portion of the local revenues thus there is need to develop them.

3.5.4. Agricultural Activities

The major agricultural activities conducted in Rangwe are maize, sugar cane, beans, sunflower and livestock production for both subsistence and commercial use. The area rises from 1200 m to 1600m above mean sea level.

Livestock keeping is practiced in all parts of the County. The main livestock breeds reared in Homa Bay county are: the east African zebu for meat, milk and draught power, meat and dairy goats, indigenous poultry, indigenous sheep and to some lesser extent dairy animals and few exotic poultry, donkeys, a few pigs, ducks and geese.

3.5.5. Mean Land Holding Size

In Homabay County, 11% of the land is used under cash crops. Most of the land is being used to produce subsistence food crops. The County has the potential to produce more than it can consume. The mean land holding size in Homa Bay County stands at 6 acres, meaning majority of farmers fall in the bracket of smallholders. On average, two acres of these are used for settlement and the balance is used for agricultural and rural development purpose.

3.5.6 Ranching

There exists no known form of ranching in Homa Bay County. Ranching is not viable in the county due to the land subdivision into small unsustainable units. Ranching requires large tracks of land which does not exist as single units in Homa Bay.

3.6 Physical infrastructure

3.6.1 Roads

Homa Bay County also has five airstrips, namely: Kabunde, Mfangano, Rusinga, Otange and Otaru airstrip but only Kabunde airstrip has been upgraded to 1.2Km of airport standards runway and is operational with nine flights per week. In terms of water transport, Homa Bay County has 2 water buses, 2 ferry services between Mbita and Lwanda Kotieno, and Mbita – Mfangano. Homa Bay County has 151 underdeveloped landing beaches and 6 jetties which includes Mbita (2), Kendubay (1), Mfangano (2), and Homa Bay (1). The 12 islands in the county water surface area are accessible with the majority only by motor boats. The harbors established by Kenya Railways in Homa Bay, Kendu -Bay and Kajimu need basic rehabilitation. The county has neither a railway system nor a pipeline.



Figure 3.6.1: Condition of the road network serving the proposed site

3.6.2 Sewer Line

In view of the rural setting, the area has no sewer lines. Most homes in the area use pit-latrines. We do not anticipate the development of a sewer system to cover the area in the near future. Other homes use septic tanks which are often exhausted. For now, it is sufficient. However, for the factory development, we shall recommend the use of bio-digester to treat human waste. Other factory effluent will utilize efficient ETPs with final Reverse Osmosis to be constructed. The proponent has set aside adequate land for this purpose.

3.6.3 Energy

Majority of Homa Bay county residents rely heavily on fuel wood (84%) and charcoal (13.4%) for cooking. Firewood is used more intensively in rural areas while charcoal in urban areas. As a result, Homa Bay is one of the counties with a negative biomass net balance represented by an annual deficit of 257,706 cubic meters. The county is not doing well in terms of efficient use of paraffin for lighting, with 94.6 per cent of households using it for lighting. This scenario is unsustainable and must be reversed by increasing access to alternative clean energy such as grid electricity, off-grid solar, biomass energy and solar lamps.

3.6.4 Water supply and Access to water supply

Other than lake, rivers and springs, the county of Homa Bay has several water facilities spread over 211 sub-locations. These facilities include boreholes, water pans and water wells/springs. Whereas development partners such as World Vision have made great sides in development and rehabilitation of water facilities, many areas still remain water-deficient particularly in Karachuonyo, Rangwe, Suba South and Homa Bay Town.

There is an estimated 1,684 water sources in the county among them dams, rivers, water pans, springs and boreholes which are community and private owned. In the whole county only an estimated 8.6 % of households were benefitting from piped water (Source CIDP-Homabay). In 2017, about 1,600 households were estimated to have roof catchments systems for harvesting rain water.

3.6.5 Water Resources

The major water resources in Homa Bay County includes rivers AwachKibwon, AwachTende, Maugo, Kuja, Rangwe, Riana, Sondu-Miriu and Lake Victoria. Other sources include 71 shallow wells, 43 protected springs, 78 unprotected springs, 383 water pans, 119 boreholes and rainwater catchment in 8,553 households.

The proposed project will rely on water from nearby river Rangwe, springs and boreholes. The analysis results from water sampled from River Rangwe indicated that the water will need to be treated in order to meet recommended standards. Summary of analysis results are presented in table 4:

3.7 Baseline Water Quality Sampling and Ambient Air quality Measurements from the site

3.7.1 Baseline Water Quality Sampling and Analysis

The sampling of the water was done according to the following procedures based on methods defined in the ISO 5667: Water sampling and analysis was done between 14th –21st December 2024; water sample was collected from a community water draw off point for spring water and

another sample from the nearby river. The samples were collected by use of a sampling bottles, preserved in cool boxes, and transported to the laboratory for analysis using standard approved methodologies. Sample analysis was done by Imara Analytical Laboratories and NEMA accredited laboratory. The results is as presented in Table 6 & 7 below.

Table 6: Baseline Water Quality Sampling and Analysis Results from River Rangwe

RESULTS:					
PARAMETER	UNIT	RESULT	TEST METHOD	STANDARD LIMITS	INTERPRETATION
PH	pH Values	7.94	Potentiometric	5.5 - 9.5	Normal
Conductivity	s/cm	102	Potentiometric	800 Max	Normal
Total Dissolve Solids	Mg/L	51	Potentiometric	2000 Max	Normal
Manganese (as Mn)	Mg/L	0.06	ICP -AES	1.5 Max	Normal
Chlorides (as Cl)	Mg/L	8.51	Titration	250 Max	Normal
Iron (as Fe)	Mg/L	13.20	ICP-AES	0.3 Max	>0.3
Sulphates (as SÖ4)	Mg/L	5.94	ICP-AES	400 Max	Normal
Nitrates (as N03)	Mg/L	3.36	Titrimetric	10 Max	Normal
Sodium (as Na)	Mg/L	9.54	ICP-AES	50 Max	Normal
Zinc (as Zn)	Mg/L	0.02	ICP-AES	5 Max	Normal
Calcium (as Ca)	Mg/L	5.29	ICP-AES	100 Max	Normal
Copper (as Cu)	Mg/L	0.09	ICP-AES	2 Max	Normal
Lead (as b)	Mg/L	0.01	ICP-AES	0.3 Max	Normal
Bicarbonates (CaC03)	Mg/L	36.60	Potentiometric	150 Max	Normal
Turbidity	NTU	231	Nephelometric	5 Max	>5
Total Coliform	Count	142	Total plate Count Per I00 Mls	<1	Present
E. Coli	Count	2	Total plate Count Per I00 Mls	<1	Present

Source: EIA study for Muwariziki Sugar Factory (Baseline Water Sampling and analysis Report)

Table 7: Baseline Water Quality Sampling and Analysis Results from the nearby Spring

RESULTS:					
PARAMETER	UNIT	RESULT	TEST METHOD	STANDARD LIMITS	INTERPRETATION
PH	pH Values	7.02	Potentiometric	6.5 - 8.5	Normal
Conductivity	µs/cm	120	Potentiometric	800 Max	Normal
Total Dissolve Solids	Mg/L	63	Potentiometric	2000 Max	Normal
Manganese (as Mn)	Mg/L	0.09	ICP -AES	1.5 Max	Normal
Chlorides (as Cl)	Mg/L	10.28	Titration	250 Max	Normal
Iron (as Fe)	Mg/L	27.10	ICP-AES	0.3 Max	>0.3
Sulphates (as SÖ4)	Mg/L	3.93	ICP-AES	400 Max	Normal
Nitrates (as N03)	Mg/L	0.56	Titrimetric	10 Max	Normal
Sodium (as Na)	Mg/L	20.0	ICP-AES	50 Max	Normal
Zinc (as Zn)	Mg/L	0.05	ICP-AES	5 Max	Normal
Calcium (as Ca)	Mg/L	2.29	ICP-AES	100 Max	Normal
Copper (as Cu)	Mg/L	0.20	ICP-AES	2 Max	Normal
Lead (as b)	Mg/L	ND	ICP-AES	0.3 Max	Normal
Bicarbonates (CaC03)	Mg/L	36.60	Potentiometric	150 Max	Normal
Turbidity	NTU	183	Nephelometric	5 Max	>5
Total Coliform	Count	40	Total plate Count Per I00 Mls	<1	Present
E. Coli	Count	4	Total plate Count Per I00 Mls	<1	Present

Source: EIA study for Muwariziki Sugar Factory (Baseline Water Sampling and analysis Report)

3.7.2 Discussion and conclusions

The results of analysis for spring water indicated that 4 parameters namely; iron, Turbidity and Total coliform and E-coli were higher beyond the recommended standards indicating that the water was polluted and needs treatment. Similarly, the same parameters were found to be higher in sampled water from River Rangwe. All other parameters tested were within the acceptable limits as stipulated in the EMCA (Water Quality Regulation), 2006 Legal Notice 120 of for Quality Standards for Sources of Domestic Water (First schedule).

3.7.3 Ambient Air quality Measurements

The measurements for ambient air quality were conducted at the proposed project site by CSI international, a NEMA accredited lab. The standards used to evaluate the measured values are derived from EMC (Air Quality) Regulations, 2014 for ambient air quality standards and The World Health Organization (WHO) Air Quality Guidelines (AQG) and Environmental, Health and Safety General Guidelines (IFC, 2007).

The specific parameters monitored included the baseline concentration of Particulate dust PM2.5, Particulate dust PM10, Sulphur dioxide (SO₂), Carbon monoxide (CO), Ozone (O₃), Hydrocarbons (C_xH_y), Nitrogen monoxide (NO), Nitrogen dioxide (NO₂) and Nitrogen Oxides (NO_x) was undertaken to establish ambient air gases at the proposed project boundaries adjacent to key receptors. Measurements was done using HAZ-SCANNER instrument. The HAZ-SCANNER instrument provides direct readings in real-time with data logging capabilities. Incorporating a dashboard, control panel, the instrument was powered on 20 minutes before collecting data.



Figure 3.7.3: Ongoing determination of the ambient air quality levels at the proposed Muwariziki Sugar factory site using HAZ-SCANNER instrument

The table below present the results from the air quality undertaken at the proposed site.

Table 8: Findings of the Ambient Air Quality Parameters at the proposed project site

MUWARIZIKI SUGAR MILLERS				
Average Pollutant	Average in Standard units		TWA OEL -RL	Remarks
Carbon Monoxide (CO)	0.10 ppm	0.109 mg/m ³	4 mg/m ³ **	Within Limit
Carbon Dioxide (CO ₂)	301.86 ppm	168.630 ppm	9000 ppm**	Within Limit
Hydrocarbons (C _x H _y)	0.00 ppm	0.000 ppb	NP	Not Provided
Nitrogen Monoxide (NO)	9.56 ppb	0.272 ppm	NP	Not Provided
Nitrogen Oxides (NO ₂)	2.31 ppb	0.183 ppm	0.2 ppm	Within Limit
Nitrogen Oxides (NO _x)	11.87 ppb	0.455 ppm	150 µg/m ³	Within Limit
Oxygen (O ₂)	20.96 %	20.955 %	NP	Not Provided
Ozone (O ₃)	0.50 ppb	0.119 ppm	0.12 ppm	Within Limit
Particulate Matter (PM ₁₀)	38.69 µg/m ³	15.889 µg/m ³	100 µg/m ³ **	Within Limit
Particulate Matter (PM _{2.5})	18.54 µg/m ³	18.543 µg/m ³	NP	Not Provided
Sulphur Dioxide (SO ₂)	24.10 ppb	25.452 µg/m ³	80 µg/m ³ **	Within Limit
Volatile Organic Compound (VOCs)	0.00 ppb	0.000 ppb	NP	Not Provided
Relative humidity (RH)	66.77 %			
Temperature	30.30 °C			
Wind direction	345.53 °			
Wind speed	8.00 kph			
KEY: µg/m ³ - microgram per cubic metre, mg/m ³ - milligram per cubic metre, ppm - parts per million, ppb - parts per billion, Values at Standard Temperature and Pressure (STP), * the 24-hour limit may not be exceeded more than three times in one year; ** 24-hour limit may not be exceeded Emission limits are as stipulated under EMCA 2014; CO ₂ limits are obtained from Occupational Safety and Health Act, of 2007				

Source: EIA study for Muwariziki Sugar Factory (Baseline air quality sampling and analysis Report)

3.7.3 Discussion of Findings

The baseline air quality assessment conducted revealed that the pollutants levels were within permissible limits stipulated under the EMCA, 2014. This suggests that the current air quality poses no significant risk to the environment or public health in the vicinity of the proposed Muwariziki Sugar factory site

CHAPTER FOUR

POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

4.1 Overview

Kenya has a policy, legal and administrative framework for environmental management. Under the framework, the National Environment Management Authority (NEMA) is responsible for ensuring that environmental impact assessments (EIAs) are carried out for new projects and environmental audits on existing facilities as per the Environmental Management and Co-ordination (Amendment) Act, 2015.

EIAs are carried out in order to identify potential positive and negative impacts associated with the proposed project with a view to taking advantage of the positive impacts and developing mitigation measures for the negative ones. The guidelines on EIAs are contained in Sections 58 to 67 of the Act. According to Section 68 of the Environmental Management and Coordination (Amendment) Act (EMCA) 2015, The Authority will be responsible for carrying out environmental assessments and audits on all activities that are likely to have a significant effect on the environment.

The government has established regulations to facilitate the process on EIAs and environmental audits. The regulations are contained in the Kenya Gazette Supplement No. 56, Legislative Supplement No. 31, and Legal Notice No. 101 of 13th June 2003.

In the past, the government has established a number of National policies and legal statutes to enhance environmental conservation and sustainable development.

The proponent will need to observe the provisions of the various statutes that are aimed at maintaining a clean, healthy and sustainable environment. Some of the policy and legal provisions are briefly presented in the following sub-Sections

4.1.1 The Constitution of Kenya

Promulgated on the 27th of August 2010, the constitution of Kenya in its preamble declares that the people of Kenya are respectful to the environment, which is their heritage and they are determined to sustain it for the benefit of future generations. The constitution which is based on the bill of rights as its backbone, states in article 42 that every person has a right to a clean and healthy environment and subsection 1 adds that this includes the right to protect environment for the benefit of present and future generations through legislative and other measures. Article 43 follows declaring economic and social rights of every Kenyan and they include in subsections: (a) the right to the highest attainable standard of

health, which includes the right to health care services, including reproductive health care and (d) the right to clean and safe water in adequate quantities. Section 2 of article 43 adds that no one shall be denied emergency medical care.

The constitution also endorses the national land policy and chapter 5 which deals with land and environment states principally in article 60 that land in Kenya will be held, used and managed in a manner that is equitable, efficient, productive and sustainable. The principles are outlined in subsections of article 60 and article 61 declares that all land in Kenya belongs to the people of Kenya collectively and subsection 2 classifies land to be as either public, community or private and thus it's important to establish in which of these the project lies. The national land commission is established in article 67 and its main function is to manage land on behalf of national and county governments.

Part 2 of chapter 5 deals with the environment and natural resources and article 69 section

- (1) subsection (a) states that the state will ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits. The following subsections give regulations in terms of forest cover, biodiversity, cultural resources, indigenous knowledge, systems for environmental impact assessment and prevention of activities that may harm the environment. Section 2 states that every person has a duty to cooperate with state organs and other persons, to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources. Article 70 deals with enforcement of environmental rights and everyone who feels their right to a clean and healthy environment has been denied has the obligation to go to court to seek redress. Article 71 and 72 deal with agreements relating to natural resources and legislation relating to the environment respectively, where parliament is given this authority.

Relevance

The proponent involved members of the public in the proposed development during public participation and shall involve during operation in ensuring the factory operates and at the same time safeguarding the environment.

4.1.2 The Environmental Management and Co-ordination (Amendment) Act, 2015

Environmental Management and Co-ordination Act No. 8 of 1999 has hitherto been providing a legal and institutional framework for the management of the environmental

related matters. It is the framework law on environment, which was enacted on the 14th of January 1999 and commenced in January 2002. The Act has since been amended and replaced by Environmental

Management and Co-ordination (Amendment) Act, 2015 which was enacted into a law on 3rd January, 2015.

Section 58 of the Second schedule of the Act require proponent of project to submit project reports to NEMA before financing, commencing, proceeding with, carrying out, executing or conducting projects. The Second Schedule to the Act specifies the projects for which an EIA and EA must be carried out. According to Section 68 of the Act, all projects listed in the Second Schedule of the Act must undertake an environmental audit, keep accurate records and make annual reports to NEMA or as NEMA may, in writing, require.

The main objectives of the Act are to:

- Provide guidelines for the establishment of an appropriate legal and institutional framework for the management of the environment in Kenya;
- Provide a framework legislation for over 70 statutes in Kenya that contain environmental provisions; and
- Provide guidelines for environmental impact assessment, environmental audit and monitoring, environmental quality standards and environmental protection orders.

In addition, the following regulations to the Act are also relevant to the proposed development.

Under EMCA Amendment, 2015, there are a number of regulations geared towards sustainable development.

Relevance

The proponent shall construct and operate the proposed Muwariziki Sugar Company in compliance with the provisions of this act.

The applicable regulations to the proposed Sugar Factory project are discussed below:

4.1.2.1 Environmental Management and Coordination (Environmental Impact Assessment and Audit) Regulations, 2003

Environmental Impact Assessment (EIA) is a critical examination of the effects of a project on the environment. The goal of an EIA is to ensure that decisions on proposed projects and activities are environmentally sustainable. An EIA is conducted in order to identify impacts of a project on the environment, predict likely changes on the environment as a result of the development, evaluate the impacts of the various alternatives on the project and propose mitigation measures for the significant negative impacts of the project on the environment. The Project proponent pays for the entire EIA process.

Environmental Audit (EA) is the systematic documentation, periodic and objective evaluation of activities and processes of an on-going project. The goal of EA is to establish if proponents are complying with environmental requirements and enforcing legislation. The purpose of EA is to determine the extent to which the activities and programs conform to the approved environmental management plan.

Relevance

This Report complies with the requirements of the Environmental Regulations in the coverage of environmental issues, project details, impacts, legislation, mitigation measures, management plans and procedures. The Proponent shall be required to commit to implementing the environmental management plan laid out in this report and any other conditions laid out by NEMA.

4.1.2.2 Environmental Management and Coordination (Water Quality Regulations of 2006)

Water Quality Regulations apply to water used for domestic, industrial, agricultural, and recreational purposes; water used for fisheries and wildlife purposes, and water used for any other purposes. Different standards apply to different modes of usage. These regulations provide for the protection of lakes, rivers, streams, springs, wells and other water sources. The objective of the regulations is to protect human health and the environment. The effective enforcement of the water quality regulations will lead to a marked reduction of water-borne diseases and hence a reduction in the health budget.

The regulations also provide guidelines and standards for the discharge of poisons, toxins, noxious, radioactive waste or other pollutants into the aquatic environment in line with the Third Schedule of the regulations. The regulations have standards for discharge of effluent into the sewer and aquatic environment. While it is the responsibility of the sewerage service providers to regulate discharges into sewer lines based on the given specifications, NEMA regulates discharge of all effluent into the aquatic environment. Everyone is required to refrain from any actions, which directly or indirectly cause water pollution, whether or not the water resource was polluted before the enactment of the Environmental Management and Coordination (Amendment) Act (EMCA) Gazetted in 2015. It is an offence to contravene the provisions of these regulations with a fine not exceeding five hundred thousand shillings.

Relevance

The proponent shall comply by ensuring all the effluent released during construction and operation of the factory are properly handled to prevent them from polluting the environment. In addition, the proponent shall construct effective ETP for handling and treatment of effluents from the sugar factory. Other compliance will involve applying for effluent discharge licence on annual basis and sampling and analysis of effluents of quarterly basis.

4.1.2.3 Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009

General prohibitions of the Act provide that no person shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others in the environment. Of importance in determining nuisance, the time of day, proximity to residential area, recurrence or intermittence of the noise, level and intensity of the noise and whether the noise can be controlled without much effort or expense to the person making the noise.

The regulations also provide that no person shall cause or cause to be made excessive vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others in the environment, or cause to be made excessive vibrations which exceed 0.5 centimetres per second beyond any source property or 30 meters from any moving source.

Vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others in the environment, or cause to be made excessive vibrations which exceed 0.5 centimetres per second beyond any source property or 30 meters from any moving source. Table 7 below indicates the maximum allowable noise levels for given zones.

Table 9: Permissible outdoor noise levels for residential and other areas

Zone	Sound level limit dB(A) Leq, 14h)		Noise Rating Level (NR) (leq, 14h)	
	Day	Night	Day	Night
Residential indoor	45	35	35	25
Residential outdoor	50	35	45	25
Places of worship	40	35	30	25
Silent zone	40	35	30	25
Commercial	60	35	55	25
Mixed residential (with some commercial and places of entertainment)	55	35	50	25

Day: 6:01 am – 8:00 pm; Night: 8:01 pm – 6:00 am

The regulations however exempt the emission of noise for the purpose of alerting persons to the existence of an emergency.

Relevance

Through the contractor and tenants to the proposed facility, the proponent shall ensure strict adherence to these regulations during the construction and operation phases respectively. Annual environmental audit of the facility will also be carried out to monitor observation of these regulations.

4.1.2.4 Environmental Management and Coordination (Air Quality Regulations), 2014

The objective is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. It provides for the establishment of emission standards for various sources, including as mobile sources (e.g. motor vehicles) and stationary sources (e.g. industries) as outlined in the Environmental Management and Coordination (Amendment) Act, 2015. It also covers any other air pollution source as may be determined by the Cabinet Secretary in consultation with the Authority. Emission limits for various areas and facilities have been set. The regulations provide the procedure for designating controlled areas, and the objectives of air quality management plans for these areas. The following operations (provided they are not used for disposal of refuse), are exempt from these regulations:

- Back-burning to control or suppress wildfires;
- Firefighting rehearsals or drills conducted by the Fire Service Agencies
- Traditional and cultural burning of savannah grasslands;
- Burning for purposes of public health protection;

Relevance

The proponent is committed to providing the environment against any nuisance related to air emissions. He has proposed to put air pollution control equipment in particular the ESP and to ensure that it meets both efficiency and good environmental performance. The chimney shall be in line with NEMA standards. In addition, the proponent will comply by conducting air quality sampling and analysis and applying for the Emission license from NEMA on annual basis.

4.1.2.5 Environmental Management and Coordination (Waste Management) Regulations, 2006

Part II, 4 (1) of the Regulations states that no person shall dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated receptacle. Regulation 4 (2) further states that a waste generator shall collect, segregate and dispose such waste in the manner provided for under these regulations. Regulation 5 (1) provides for cleaner production methods. It states that a waste generator shall minimize the waste generated by adopting the following cleaner production methods:

a) *Improvement of production process through:*

- Conserving raw materials and energy;

- Eliminating the use of toxic raw materials; and
 - Reducing toxic emissions and wastes.
- b) *Monitoring the product cycle from beginning to end by:***
- Identifying and eliminating potential negative impacts of the product; and
 - Enabling the recovery and re-use of the product where possible.
- c) *Incorporating environmental concerns in the design and disposal of a product.***

Relevance

The proponent shall adopt appropriate waste management system throughout the life cycle of the proposed project including hiring services of licensed waste collectors and transporters and disposal at licensed sites.

4.1.3 The Traffic Act, 2012

The Traffic Act, 2012 gives provisions and guidelines that govern the Kenya roads transport sector. These guidelines are essential to private, public and commercial service vehicles in ensuring safety and sanity on the roads hence ensuring the environment; the human being a component is safeguarded. In section 41 The Act demands for installation and certification of speed governors for the commercial vehicles ferrying goods adjusted to the loading condition of such vehicles to a limit of 80 KPH, registration and competence of drivers. Moreover, the owner of commercial vehicles or trailer shall ensure clear markings on their vehicles in English language on the right side of the vehicle showing ownership details, tare weight of vehicle and maximum authorized weight.

Section 26 and 27 of the same discourages engines that emit exhaust gases to the atmosphere without passing via a silencer or expansion chamber. In ensuring safety of all the persons in transit section 56 encourages that every public and commercial vehicle be fitted with inspected and first class first aid box and fire extinguisher.

Relevance

In ensuring compliance to this Act the contractor and developer shall ensure that all site drivers and all material suppliers to the site satisfy the provisions as stipulated in Act. The proponent shall enforce this act by ensuring all other vehicles of the company do not exceed speed limits and observe the rules at all times.

4.1.4 Public Health Act (Cap. 242)

Part IX, section 115, of the Act states that no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires that Local Authorities take all lawful,

necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable to be injurious or dangerous to human health. Such nuisance or conditions are defined under section 118 as waste pipes, sewers, drainers or refuse pits in such state, situated or constructed as in the opinion of the medical officer of health to be offensive or injurious to health.

Relevance

The Proponent undertakes to safeguard the environment ensuring that all solid waste or waste water effluent emanating from the proposed project is discharged appropriately so as not to cause pollution or nuisance or be injurious to the neighbours.

4.1.5 Water Act, 2016

The Water Act in section 3 vests every water resource in the state subject to any rights granted by or under the water Act or any other written law. The Act in Section 25 provides that a permit shall be required for any use of water from a water resource, especially where there is abstraction and use of water with the employment of works. Permits are also required for the drainage of any swamp or other land; and the discharge of a pollutant into any water resource. Section 26 of the act gives exclusions for which no permit is required like for the abstraction or use of water, without the employment of works, from or in any water resource for domestic purposes by any person having lawful access thereto. Section 7 of the Act establishes Water Resources Management Authority (WRMA) whose powers and functions as far as the administration of the Act is concerned, are stated in section 8.

The Water Act, 2016 also provides for establishment of 3 levels of institutions for the provision of services. These are:

- Water Services Regulatory Board (WSRB);
- Water Services Boards (WSB); and
- Water Service Providers (WSP).

Relevance

The proponent shall obtain all the permits for use of water from the Water Resources Authority prior to abstraction and use.

4.1.6 The Energy Act 2019

The Energy Act, amongst other issues, deals with all matters relating to all forms of energy including the generation, transmission, distribution, supply and use of electrical energy as well as the legal basis for establishing the systems associated with these purposes. The Energy Act, 2006 established the Energy

Regulatory Commission (ERC) now EPRA whose mandate is to regulate all functions and players in the Energy sector. One of the duties of the EPRA is to ensure compliance with Environmental, Health and Safety Standards in the Energy and Petroleum Sector, as empowered by the Energy Act.

Part IV (2) states that the Cabinet Secretary may in conjunction with relevant agencies perform such functions and exercise such powers as may be necessary under this Act to promote the development and use of renewable energy, including but not limited to—

- (g) promoting the utilization of renewable energy sources for either power generation or transportation;
- (i) promoting co-generation of electric power by sugar millers and sale of such electric power through the National Grid directly to the consumers

In this respect, the following environmental issues will be considered before approval is granted:

1. The need to protect and manage the environment, and conserve natural resources;
2. The ability to operate in a manner designated to protect the health and safety of the project employees; the local and other potentially affected communities.

PART VI section 117 provides that a person who wishes to carry out the generation, exportation, importation, transmission, distribution and retail supply of electricity must apply for a licence as the case may be to the Authority in accordance with the provisions of this Act. Provided that a person shall not require any authorization to generate electrical energy for own use of a capacity not exceeding one megawatt.

The act stipulates that the EPRA shall, before issuing a permit take into account all relevant factors including the relevant government policies and compliance with Environment Management and Coordination Act, 1999 and in particular EIA report as per Impact Assessment and Audit Regulations 2003, the Physical Planning Act, 1996 and the Local Government Act.

The Authority is responsible for the adoption and implementation of measures to conserve energy and improve efficiency in harnessing, processing, conversion, transportation, storage of energy, cogeneration, heat recovery and in the use of energy in all consumer sectors.

It is an offence to construct any facility defined in section 107 without obtaining a construction permit.

In addition, Part VI on electrical Energy Licensing section 118 states that a person who carries out any electricity undertaking without a licence commits an offence and shall, on conviction, be liable to a fine of not less than one million shillings or to a term of imprisonment not less than one year or to both such fine and imprisonment.

Relevance

The proponent shall follow this act to the latter and ensure Licensing and authorization to generate and/or transmit electrical power from the proposed Cogen power plant is done from EPRA, supported by an Environmental Impact Assessment Report (EIA) approved by NEMA.

4.1.7 The Land Act, 2012

This is an ACT of Parliament to give effect to Article 68 of the Constitution, to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land based resources, and for connected purposes. The Land Act of 2012 subsection (1) states that ‘any land may be converted from one category to another in accordance with the provisions of this Act or any other written law.’ it continues to state in subsection (2) that Without prejudice to the generality of subsection (1)

- a) Public land may be converted to private land by alienation
- b) Subject to public needs or in the interest of defence, public safety, public order, public morality, public health, or land use planning, public land may be converted to community land.
- c) private land may be converted to public land by
 - i. Compulsory acquisition;
 - ii. Reversion of leasehold interest to Government after the expiry of a lease; and
 - iii. Transfers; or
 - iv. Surrender.
- d) Community land may be converted to either private or public land in accordance with the law relating to community land enacted pursuant to Article 63(5) of the Constitution.

It is important to note that any substantial transaction involving the conversion of public land to private land shall require approval by the National Assembly or county assembly as the case may be.

Part I of the same Act states that title to land may be acquired through—

- a) allocation;
- b) land adjudication process;
- c) compulsory acquisition;

- d) prescription;
- e) settlement programs;
- f) transmissions;
- g) transfers;
- h) long term leases exceeding twenty-one years created out of private land; or
- i) any other manner prescribed in an Act of Parliament.

Part viii of this ACT provides procedures for compulsory acquisition of interests in land. Section 111 (1) States that if land is acquired compulsorily under this Act, just compensation shall be paid promptly in full to all persons whose interests in the land have been determined. The Act also provides for settlement programmes. Any dispute arising out of any matter provided for under this Act may be referred to the Land and Environment Court for determination.

Relevance

Land for the proposed project is privately owned by the developer and a and sale agreement is attached in this report. There will be further land acquisition for the proposed development as enough land is already available and set aside for this project. In case of such, proper procedure shall be followed.

4.1.8 The Registration Act, 2012

The Land Registration Act is place to revise, consolidate and rationalize the registration of titles to land, to give effect to the principles and objects of devolved government in land registration, and for connected purposes. This Act applies to Subject to section 4, this Act shall apply to:

Registration of interests in all public land as declared by Article 62 of the Constitution;

- Registration of interests in all private land as declared by Article 64 of the Constitution; and
- Registration and recording of community interests in land.

Section 24 states that: (a) the registration of a person as the proprietor of land shall vest in that person the absolute ownership of that land together with all rights and privileges belonging or appurtenant thereto; and (b) the registration of a person as the proprietor of a lease shall vest in that person the leasehold interest described in the lease, together with all implied and expressed rights and privileges belonging or appurtenant thereto and subject to all implied or expressed agreements, liabilities or incidents of the lease.

4.1.9 The Environment and Land Court Act, 2011

This Act is in place to give effect to Article 162(2) (b) of the Constitution; to establish a superior court to hear and determine disputes relating to the environment and the use and occupation of, and title to, land, and to make provision for its jurisdiction functions and powers, and for connected purposes.

This Act shall of great essence to the proponent, public, interested or affected party that may want to litigate against the development on settlement issues, location of project or even effects of the project to the public

4.1.10 The National Land Commission Act, 2012 (No. 5 of 2012)

Section 5 of the Act outlines the Functions of the Commission, pursuant to Article 67(2) of the Constitution as follows 5(1):-

- To manage public land on behalf of the national and county governments;
- To recommend a national land policy to the national government;
- To advise the national government on a comprehensive programme for the registration of title in land throughout Kenya;
- To conduct research related to land and the use of natural resources, and make recommendations to appropriate authorities;
- To initiate investigations, on its own initiative or on a complaint, into present or historical land injustices, and recommend appropriate redress;
- To encourage the application of traditional dispute resolution mechanisms in land conflicts;
- To assess tax on land and premiums on immovable property in any area designated by law; and
- To monitor and have oversight responsibilities over land use planning throughout the country.

Relevance: *The proponent commits to conduct all due diligence on matters of land ownership for the proposed development.*

4.1.11 The Building Code 2000

The building code under Septic and conservancy tanks, section 202 allows for installation of septic tanks where a sewer system has not been provided that the proponent abides with the provisions under the set table. The area where the project is to be located is not supported by a sewer line.

Relevance: *The proponent shall design an effluent treatment plant intended to serve the factory.*

4.1.12 Occupational Safety and Health Act (OSHA 2007)

This is an Act of Parliament to make provision for health, safety and welfare of persons employed in factories and other places, and for matters incidental thereto and connected therewith.

Building Operations and Works of Engineering Constructions

The provisions of the Factories and Other Places of Work Act relevant to engineering construction works are contained in the Abstract of the Act for Building Operations, and Works of Engineering Construction Rules. These are summarized in Table 8 below.

Table 10: Summary of Building Operations, and Works of Engineering Construction Rules

Legal Requirements	Description
General Requirements	
Give notice of particular operations or Works	Notice should be sent in writing to the Occupational Health and Safety Officer, not later than seven days after commencement of construction and building works except where the construction works will be complete in less than six weeks or notice had already been given to the Occupational Health and Safety Officer (Section 60 of the Act).
General Register	<p>A general register of every person undertaking building operations or construction works is kept in adherence to the prescribed form L.D.B.C.R.2. This register is kept at the site of operations or at the office of the person undertaking the operations or works.</p> <p>The register should contain:</p> <ul style="list-style-type: none"> • The certificate of registration of the workplace; • Every other certificate issued by the Chief Inspector under this Act; • The prescribed particulars as to the finishing (washing, white washing, colour washing, painting or varnishing) of the facility; • The prescribed particulars as to every accident and case of occupational disease occurring in the workplace of which a notice is required to be sent

	<p>to a labour officer under the provisions of any law for the time being in force;</p> <ul style="list-style-type: none"> • All reports and particulars required by any other provision of this Act to be entered in or attached to the general register; • Such other matters as may be prescribed (Section 62 of the Factories and Other Places of Work Act).
Special rules and welfare	Printed copies or prescribed abstracts of the Factories and Other Places of Work Act must be kept posted at the site of operations or works (Section 61 of the Factories and Other Places of Work Act).
Safety Requirements	
Air receivers	These should be of sound construction and be properly maintained. They should be thoroughly examined by a competent person at intervals of 24 months and the reports of such examinations attached to the General Register (Section 39 of the Factories and other Places of Work Act).
Cylinders for compressed, liquefied and dissolved gases	Such cylinders should be of good construction, sound material, and adequate strength and free from patent defect. The cylinders should conform to standards specified under the Standards Act or to a prescribed standard specification, approved in writing, by the Director, Kenya Bureau of Standards. They should be thoroughly examined by a competent person at regular intervals and a maintenance register kept (Section 39A of the amendment of the Factories and Other Places of Work Act).
Notification of accidents	<p>The particulars of an accident-causing death or disablement of a worker for more than three days from earning full wages at the work place where he was employed must be sent in the prescribed form (L.D.B.C.R)</p> <p>6) to the Occupational Health and Safety Officer and entered in the General Register. Certain dangerous occurrences must also be reported whether or not they cause disablement (Section 62 of the Factories and Other Places of Work Act).</p>

Health Requirements	
Sanitary accommodation	Sufficient and suitable sanitary conveniences must be available for persons employed. These must be kept clean and well lit (Sections 16 and 18 of the Factories and Other Places of Work Act).
Miscellaneous Requirements	
Prohibition of deduction from wages	The occupier must not make a deduction from wages in respect of anything he has to do or provide in pursuance of the Factories Act or permit any person in his employment to receive payment from other employees for such services (Section 66 of the Factories and Other Places of Work Act).
Duties of persons employed	An employee must not wilfully interfere with or misuse any means, appliance, convenience or other thing provided in pursuance of the Act for securing health, safety or welfare provided for his use under the Act. He must not wilfully and without reasonable cause do anything likely to endanger himself or others (Section 65 of the Factories and Other Places of Work Act).
Inspection	<p>The Occupational Health and Safety Officer has the power to inspect every part of the premises by day or by night. He may require the production of registers, certificates and other papers. May examine any person alone or in the presence of any other person as he thinks fit and may require him to sign a declaration of truth of the matters about which he is examined.</p> <p>Every person obstructing an Occupational Health and Safety Officer is liable to a penalty (Section 69 of the Factories and Other Places of Work Act).</p>

Medical Examination Rules

These are described in Legal Notice No. 24 of the Kenya Gazette Supplement No. 22 of April 2005. The Medical Examination Rules apply to all those employees in employment or who have been in employment in every workplace to which the provisions of the Factories and Other Places of Work Act (Cap 514) apply. The Rules describe the following:

- Occupations requiring medical examination;

- Duties of employer and employees with regard to medical examination;
- Reports on examination;
- Certificate of redeployment;
- Certificate of fitness;
- Notification of occupational diseases; and
- Offences and penalties.

Relevance: *The proponent shall register the proposed factory as a work place. In addition, the proponent will follow all the requirements including conducting trainings, OSH audits and other statutory requirements under DOSHS.*

4.1.13 Physical Planning Act (Cap 286)

An Act of Parliament to provide for the preparation and implementation of physical development plans and for connected purposes enacted by the Parliament of Kenya Under this Act, no person shall carry out development within the area of a local authority without a development permission granted by the local authority under section 33. The local authority concerned shall require the developer to restore the land on which such development has taken place to its original condition within a period of not more than ninety days. If on the expiry of the ninety days' notice given to the developer such restoration has not been effected the concerned local authority shall restore the site to its original condition and recover the cost incurred thereto from the developer.

Relevance: *The developer shall ensure the final drawings for the proposed development are approved by the relevant departments of County Government of Homabay.*

4.1.14 Employment Act No 11 of 2007

The Act is enacted to consolidate the law relating to trade unions and trade disputes, to provide for the registration, regulation, management and democratization of trade unions and employers organizations and federations. Its purpose is to promote sound labour relations through freedom of association, the encouragement of effective collective bargaining and promotion of orderly and expeditious dispute the protection and promotion of settlement conducive to social justice and economic development for connected purposes. This Act is important since it provides for employer – employee relationship that is important for the activities that would promote management of the environment within the housing sector. The developer, the contractor and the employees' relationship during the construction and later phases of this project shall be guided by this Act.

Relevance: *This ACT shall provide necessary guidance to the employer and the employees of the proposed project in all phases of the project.*

4.1.15 Penal Code Cap 63

Section 191 of the penal code states that if any person or institution that voluntarily corrupts or foils water from public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an offence. Section 192 of the same Act says a person who makes or vitiates the atmosphere in any place to make it noxious to health of persons /institution, dwelling or business premises in the neighbourhood or those passing along public way, commit an offence.

Relevance: *The proposed project shall protect the environment and shall engage in environmental protection activities and initiatives. The management shall create awareness to all its employees against causing any form of pollution to water sources.*

4.1.16 The Factory and Other Places of Work Act Cap 514 of 2005

This act governs noise prevention and control and in section 4 (1) it sets limits of how much noise a worker may be exposed to (a) as the continuous equivalent of ninety dB (A) in eight hours within any twenty-four hours duration; and (b) one hundred and forty dB (A) peak sound level at any given time. Section (3) adds that where noise is intermittent, noise exposure shall not exceed the sum of the partial noise exposure equivalent continuous sound level of ninety dB (A) in eight-hour duration within any twenty four hours duration. It also places the duty of ensuring an effective noise control and hearing conservation programme on occupiers in section 5, which the act states in subsection 5 (2) to include:

- a) Noise measurement;
- b) Education and training;
- c) Engineering noise control;
- d) Hearing protection.
- e) Posting of notices in noisy areas;
- f) Hearing tests; and
- g) Annual programme review.

The act places responsibility of recording noise levels at workplaces and reporting to the Director of Occupational Safety and Health on occupiers and in Section 10 (1) it states that machinery or plant in the workplace should be installed in such a way that the lowest possible noise is emitted when the machine is

in operation. In section 12 it states that where measures to segregate noisy areas (beyond 90 dB(A)) are not feasible then occupiers should provide workers with adequate PPEs.

Relevance: *The proponent shall comply by ensuring the law is followed and provide adequate PPEs to all his workers. All employees shall be protected against all potential harm while at work.*

4.1.17 The National Construction Authority Act, 2011

This act establishes the national construction authority, a state corporation under the Public Works Ministry. The authority is mandated to regulate and aid development of the construction industry through registration and accreditation of contractors, skilled construction workers and construction site supervisors and regulate their activities. It is also mandated to monitor the construction process as detailed in the Physical Planning Act.

Relevance: *Before construction commences, the proponent shall ensure that any hired contractors are registered by this authority. The project shall fully comply with the requirements of NCA during construction.*

4.1.18 County Governments Act, 2012

This Act vests responsibility upon the County Governments in planning of development projects within their areas of jurisdiction be it projects of importance to the local County government or those of national importance. Section 102 of the Act provides the principles of planning and development facilitation which include integration of national values in county planning, protect the right to self-fulfillment within the county communities and with responsibility to future generations, protection of rights of minorities and marginalized groups and communities, promotion of equity resource allocation, among others. Section 103 of the Act outlines the prime objective of county planning which aligned to the bill of rights and the constitution of Kenya.

Section 114 and 115 indicate and give guidelines in planning of projects of national significance and instill the aspect of public participation in every aspect of the planning process through that: clear strategic environmental assessments; clear environmental impact assessment reports; expected development outcomes; and development options and their cost implications. Each county assembly is tasked with the role to develop laws and regulations giving effect to the requirement for effective citizen participation in development planning and performance management within the county.

Relevance: *The project proponent has informed the respective county government officials through the stakeholders engagement and committed to initiate the process of compliance with relevant Homabay County Government departments through application of essential development approvals.*

4.1.19 Sexual Offences Act (No. 3 of 2006)

The Sexual Offences Act, No.3 2006 aims to make provision about sexual offences, their definition, prevention and the protection of all persons from harm from unlawful sexual acts, and for connected purposes.

Relevance: *The proponent shall put in place all mechanism to discourage unlawful sexual acts in the entire project life, these includes massive awareness.*

4.2 Policy Framework

4.2.1 Environmental policy framework

The Kenya Government's environmental policy is geared towards sound environmental management for sustainable development. This is envisaged in the principle of prudent use, which requires that the present day usage should not "compromise the needs of the future generations".

The policy emphasis is on environmental protection in order to ensure sufficient supplies for the present and future generations. The policy envisages the use of the "polluter pays principle", where one is expected to make good any damage made to the environment.

The Kenya Government's environmental policy aims at integrating environmental aspects into national development plans. The broad objectives of the national environmental policy include:

- Optimal use of natural land and water resources in improving the quality of human environment;
- Sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations;
- Integration of environmental conservation and economic activities into the process of sustainable development; and
- Meet national goals and international obligations by conserving bio-diversity, arresting desertification, mitigating effects of disasters, protecting the ozone layer and maintaining an ecological balance on earth.

4.2.2 Kenya's Vision 2030

Kenya Vision 2030 is the country's new development blueprint covering the period 2008- 2030. It aims to transform Kenya into a newly industrializing, "middle income country providing a high quality life to all its citizens by the year 2030". The vision was developed through an all inclusive and participatory stakeholder consultative process, involving Kenyans from all parts of the country

The Vision 2030 is based on 3 key pillars; Economic Pillar, Social Pillar, and Political Pillar. The economic, social and political pillars of Kenya Vision 2030 are anchored on the following foundations: macroeconomic stability; continuity in governance reforms; enhanced equity and wealth creation opportunities for the poor; infrastructure; energy; science, technology and innovation (STI); land reform; human resources development; security and public sector reforms.

The 2030 goal for equity and poverty elimination is to reduce the number of people living in absolute poverty to the tiniest proportion of the total population. The initiative aims to expand access across different social and political dimensions, including: widening coverage of "essential health care"; equitable distribution of water, sewerage and sanitation services; improvements in public transport; and attaining gender parity and fairness in the delivery of justice. Reducing social inequalities, in short, cuts across all the economic and social initiatives proposed by Vision 2030.

4.2.3 The Sugar Policy

The Sugar policy as established is in line with the national objectives of the national food policy, which are; self-sufficiency, food security, employment creation, income generation, foreign exchange earnings, stemming rural-urban migration, poverty alleviation and overall economic growth. Sugar plays a vital role in providing livelihoods, earning national revenues and incomes, and creating employment and foreign exchange savings. It is an industry valued at approximately Kshs. 15 billion, providing over 500,000 direct and indirect jobs and supporting the livelihoods of over 6 million people.

4.2.4 The National Land Policy

The National Land Policy adopted by the cabinet as Sessional Paper No. 3 of 2009, acknowledges environmental problems faced by Kenya. These include degradation of natural resources such as forests, wildlife, water, marine and coastal resources as well as soil erosion and the pollution of air, water and land. In its section 129 the policy provides for ecosystem protection, urban environment management, environmental assessment and audits to be undertaken to conserve and manage the environment.

Relevance: *The proponent shall protect the environment and shall be required to conduct annual environmental audits.*

4.3 Institutional and administrative framework

The environmental institutional and administrative frameworks have been established by EMCA 2015 Amendment and include the following.

4.3.1 National Environment Management Authority (NEMA)

The responsibility of the National Environment Management Authority (NEMA) is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Government in the implementation of all policies relating to the environment. In addition to NEMA, the Act provides for the establishment and enforcement of environmental quality standards to be set by the Cabinet Secretary in consultation with the Authority, which will govern the discharge, limits to the environment by the proposed project.

The proponent will acquire NEMA EIA license prior to commencing any development at the proposed site.

4.3.2 National Environmental Tribunal

The National Environment Tribunal (NET) is created under Section 125 of the Environmental Management and Coordination Act (EMCA) of 1999. Its functions are:

- To hear and determine appeals from NEMA's decisions and other actions relating to issuance, revocation or denial of Environmental Impact Assessment (EIA) licences or amount of money to be paid under the Act and imposition of restoration orders;
- To give direction to NEMA on any matter of complex nature referred to it by the Director General.

4.3.3 Land and Environment Court

This is established as a superior court to hear and determine disputes relating to the environment and the use and occupation of, and title to, land, and to make provision for its jurisdiction functions and powers, and for connected purposes. Section 13 (2) (b) of the Land and environment Court Act outlines that in exercise of its jurisdiction under Article 162 (2) (b) of the Constitution, the Court shall have power to hear and determine disputes relating to environment and land.

Relevance: *The proponent shall be guided accordingly in case of any land acquisition in the future and shall follow the set procedures.*

4.3.4 County Government of Homabay

It constitutes various developmental approvals departments such as the planning department. The project proponent presented the project drawings and plans to the department for approval prior to the project implementation. *The proponent will be required to circulate the plans to the designated approving departments prior to development.*

4.3.5 Ministry of Agriculture, Livestock and Fisheries

The overall function of the ministry is to enhance production of crops, livestock and fisheries, marketing and processing. The Ministry has also the mandate to provide development and extension services to smallholder farmers through its extension department.

The functions of the ministry are as follows:

- Formulate, implement and monitor legislations, regulations and policies;
- Provide extension services;
- Support research and promote technology delivery;
- Facilitate and represent agricultural state corporations in the government;
- Develop, implement and coordinate programmes in the agricultural sector;
- Regulation and quality control of inputs, produce and products from the agricultural sector;
- Management and control of pests and diseases;
- Promote management and conservation of the natural resource base for agriculture; and
- Collect, maintain and manage information on the agricultural sector.

Relevance: *The proponent shall work closely with this department to ensure extension services reach the sugarcane farmers.*

4.3.6 Kenya Sugar Board (Kenya Sugar Act (2024))

The Act provides for the development, regulation, and promotion of the sugar industry. It establishes the Kenya Sugar Board and the Kenya Sugar Research and Training Institute. The Kenya Sugar Board is now in charge of regulating and managing the sugar industry.

The KSB acts as a technical unit to advise the Ministry in promoting all aspects of producing, processing and marketing of sugar cane, sugar and molasses. The KSB also advises on pricing and necessary legislation for the industry. Kenya Sugar Board (KSB) is a public body set up by the Sugar Act of 2001 under the Ministry of Agriculture. It is mandated to:

- Regulate, develop and promote the sugar industry
- Co-ordinate the activities of individuals and organizations within the industry
- Facilitate equitable access to the benefits and resources of the industry by all interested parties

A sugar development levy of 7% of the market price is charged by the Kenya Government on all sugar sales. This levy is collected by the Kenya Revenue Authority and is managed by KSB. The levy comprises the following:

- Cane Development 2%
- Infrastructure 1%
- Factory Rehabilitation 3%
- Grants to Research 0.5%
- KSB Administration 0.5%

The setting up of a single regulatory body, the Kenya Sugar Board (KSB) ensures that investors get a single source of investment advice on the sector. The sugar companies operate under the umbrella of the Kenya Sugar Board, which is a public body charged with the responsibility of promoting and fostering the effective and efficient development of sugar cane for production of white sugar. KSB is also charged with the mandate of regulating the sector and ensuring the country is self-sufficient in white sugar production.

Relevance: *The proponent shall comply by applying and acquiring license from the Kenya sugar board before establishing the factory and adhere to conditions issued by the board.*

4.3.7 The Wildlife Conservation and Management Act, 2013

This Act became operational on 10 January 2014. One of its guiding principles is the devolution of conservation and management of wildlife to landowners and managers in areas where wildlife occurs, through in particular the recognition of wildlife conservation as a form of land-use, better access to benefits from wildlife conservation, and adherence to the principles of sustainable utilization. Section 25 of the act provides for compensation for injuries and damages caused by wildlife (species listed in its third schedule) to humans and their properties respectively. Such compensation claims are to be reviewed and awarded by County Wildlife Conservation and Compensation Committees at the ruling market rates: provided that no compensation shall be paid where the owner of the livestock, crops or other property failed to take reasonable measures to protect the properties from damage by wildlife or land use practices are incompatible with the ecosystem-based management plan for the area.

The act in its sixth schedule list various animal and tree species that are nationally considered as critically endangered, vulnerable, nearly threatened and protected. It also lists in its seventh schedule, national invasive species for which control is required.

Section 48 restricts activities involving the above listed species without a permit from KWS. KWS can make recommendations to the responsible cabinet secretary, to prohibit carrying out of any activity which: is of a nature that may negatively impact on the survival of species listed in sixth schedule; or is specified in the notice or prohibit the carrying out of such activity without a permit issued by KWS.

Part IX of the act deals with the management of human-wildlife conflicts. It provides for handling of problem animals by land owners/occupiers or their agents.

Relevance: *Any critically endangered, vulnerable, nearly threatened or protected species found within the project area will have to be managed in line with this Act. Further, management of any human-wildlife conflicts arising from the project implementation will also be guided by this act*

4.3.8 Agriculture, Fisheries and Food Authority Act, No. 13 of 2013

This is an Act of Parliament to repeal the agriculture Act, Cap 318 to align with the new constitution. The Act abolishes some of the institutions created under the repealed agriculture act like KEPHIS and PCPB. It has replaced them with Agriculture, Fisheries and Food Authority. The Authority shall, in consultation with the county governments, perform the following functions:

- 3.10.1.1 Administer the Crops Act, and the Fisheries Act in accordance with the provisions of these Acts;
 - 3.10.1.2 Promote best practices in, and regulate, the production, processing, marketing, grading, storage, collection, transportation and warehousing of agricultural and aquatic products excluding livestock products as may be provided for under the Crops Act, and the Fisheries Act.
 - 3.10.1.3 Collect and collate data, maintain a database on agricultural and aquatic products excluding livestock products, documents and monitor agriculture through registration of players as provided for in the Crops Act and the Fisheries Act;
- Be responsible for determining the research priorities in agriculture and aquaculture and to advise generally on research thereof;

- Advise the national government and the county governments on agricultural and aquatic levies for purposes of planning, enhancing harmony and equity in the sector; and
- Carry out such other functions as may be assigned to it by this Act, the Crops Act, the Fisheries Act and any written law while respecting the roles of the two levels of governments.

Relevance: *This piece of legislation is practical in this project since it will be subject to management and operational decisions made by the ministry of Agriculture, Livestock and Fisheries and the newly established Agriculture, Fisheries and Food Authority.*

4.3.9 Food Drugs and chemicals substances Act (Cap 254)

The Food, Drugs and Chemical Substances Act (CAP 254) whose purpose is to make provisions for the prevention of adulteration of food, drugs and chemical substances. This Act (which has been invoked for the consumption of genetically modified food), requires that food, drugs, cosmetics, devices and chemical substances should not be sold if they are unwholesome, poisonous, or adulterated. It further prohibits deceptive labelling. The statute also gives powers to authorized officers to inspect and examine any premises for evidence of contravention of the provisions of the law.

Relevance: *The sugar factory should be regularly inspected by the public health officer and issued with a Food Drugs and chemicals substances license.*

4.3.10 The Pest Control Products Act (Cap 346)

This is an Act of Parliament that regulates the importation, exportation, manufacture, distribution and use of products used for the control of pests and of the organic functions of plants and animals and for connected purposes. It also regulates against use of pest control products without due analysis from a certified analyst and inspection from an appointed inspector, in addition to granting due guidance on the licensing of use and storage of the said products.

Section 2 of the Act refers to “pest control product” as “ a product, device, organism, substance or thing that is manufactured, represented, sold or used as a means for directly or indirectly controlling, preventing, destroying, attracting or repelling any pest and includes-

- a) any compound or substance that enhances or modifies or is intended to enhance or modify the physical or chemical characteristics of a pest control product to which it is added; and
- b) any active ingredient used for the manufacture of a pest control product;”

Relevance: *Since the sugarcane farming will be aimed at improving the quality, quantity and variety of output from the project area, there are bound to be numerous sugarcane crop enhancement and protection activities by the proponent and farmers through use of pesticides and other soil-enriching chemicals. The relevant provisions in the Act will thus play an integral role in regulating the use of such products during operational phase of the project. It is therefore, vital that this legislation is granted requisite attention in the entire course of the project*

4.4 International Conventions

4.4.1 The 1985 Vienna Convention for the Protection of the Ozone Layer

Intergovernmental negotiations for an international agreement to phase out ozone depleting substances concluded in March 1985 with the adoption of the Vienna Convention for the Protection of the Ozone Layer. This Convention encourages intergovernmental cooperation on research, systematic observation of the ozone layer, monitoring of CFC production, and the exchange of information. The Montreal Protocol on Substances that Deplete the Ozone Layer was adopted in September 1987, and was intended to allow the revision of phase out schedules on the basis of periodic scientific and technological assessments. The Protocol was adjusted to accelerate the phase out schedules. It has since been amended to introduce other kinds of control measures and to add new controlled substances to the list.

4.4.2 The 1987 Montreal Protocol on Substances that Deplete the Ozone Layer

This Protocol was drawn to cut down on the production and consumption of ozone depleting substances in order to reduce their abundance in the atmosphere, and thereby protect the earth's fragile ozone Layer. The Parties to the Montreal Protocol have amended the Protocol to enable, among other things, the control of new chemicals and the creation of incentive measures to enable developing countries to comply. The project envisages use air conditioning equipment. Coolants used should be those of none ozone depleting components as required by NEMA

4.4.3 The 1992 United Nations Framework Convention on Climate Change (UNFCCC)

The primary purpose of the convention is to establish methods to minimize global warming and in particular the emission of the greenhouse gases. The UNFCCC was adopted on 9th May 1992 and came into force on 21st March 1994. The Convention has been ratified by 189 states. Kenya ratified the Convention on 30th August 1994. NEMA is the focal point for the Convention. The fuel used by the power back-up generator should be friendly to the environment and approved by the energy regulatory body, Energy and Petroleum Regulatory Authority (EPRA).

CHAPTER FIVE

PUBLIC PARTICIPATION AND STAKEHOLDERS' CONSULTATION

5.1 Overview.

Public participation and Stakeholders Consultation in ESIA is a systematic way of involving the public and stakeholders in the planning, development and decision-making process. Public participation aims at improving project design, environmental soundness and social acceptability. It provides opportunity for public involvement in scoping, ESIA review and monitoring.

5.2 Stakeholder's Identification/Mapping

The team engaged stakeholders in a forum held at Homabay town on **16th Dec 2024** and **17th Dec 2024**. The experts ensured that the stakeholders identified are multi-sectorial touching on agriculture, water, security, gender, health, sports, Safety, Environment, roads and human resource. These stakeholders were consulted by use of stakeholders meeting where presentations, interviews, questions and answers method were used. To ensure that no major player is left out, a desk top study/mapping was done to determine relevant stakeholders to the project.

First stakeholder's consultation meeting was organized at the Asumbi Technical Institute on **16th Dec 2024**. This provided the platform to brief local stakeholder's especially the area MCA, Security team (County Commissioner and ACCs), All chiefs and subchiefs of the proposed project.

The second and major key stakeholders' consultation meeting was convened at Staridge Hotel in Rangwe town on **17th Dec 2024**.

The stakeholders engagement served an integral part of environmental and social impact assessment by providing an avenue for a two-way flow of information and dialogue between project proponents and stakeholders, specifically it aimed at developing ideas that can help shape project design, resolve conflicts at an early stage assist in implementing solutions and monitor ongoing activities.

Table 11: List of Stakeholders, their roles and interests in the project

Department	Particulars	Roles and Responsibilities	Interest
Executive office of the Governor	Daniel Ogenga HGSDM & EU	Letter of No objection to the proposed project	Integration and harmonization of design

			with county government development plans
Office of County Secretary	Lilian Auma Orwa (Representing office of C.S)	Coordination (Investors and County Government Departments)	Responsible for establishing linkages with external stakeholders
National Government (Ministry of Interior and National Coordination)	Peter C Kaliman ACC-Rangwe Sammy L. Twala ACC-Rangwe Kennedy Okoko Senior Chief-Genga location	Security, mobilization and coordination of public meetings	Mobilization of the enumerators, Project affected persons during public meetings
Office of the MCA for West Gem	Emanuel Kenga Ward Manager (Representing MCA for West Gem)	Representing the interest of people of West Gem	Advocating for jobs and other benefits for the people of west gem
Governance, Administration, Communication and Devolution (GACD)	Maurice Kaundo Deputy Governor - spokesperson	Representing the executive office and to oversee matters of stakeholders' engagement, public participation, coordination of community involvement etc	Representing the office of the deputy Governor
GACD	Erick Teddy Oginga (Director Public Participation) Dominic Mboya (Deputy Director- Partnership) John Roche	Coordination of community mobilization, involvement and public communication, Partnership	Responsible for public participation issues on projects within the county, special projects, communication, partnership etc.

	(H.O.P)		
Agriculture, Livestock and Fisheries	Beryl A. Achila (Sub County Agriculture officer) Pacific Amoth (Agriculture Admin)	<ul style="list-style-type: none"> • County policies and plans • Extension services to farmers • Food security and agribusiness development. 	Promoting and developing agricultural practices for benefits of county's farmers and communities. Developing and disseminating appropriate technologies, capacity building, providing field extension services and advisory services.
Water, Sanitation, irrigation, Env & Climate Change	Oruko-Angeline- (Irrigation officer)	Developing water resources and implementing policies for conservation, control, and protection of water catchment areas, managing forests and water conservation	Enforce environmental regulations and standards; Promotion of compliance with the environmental laws, regulations and standards
Climate Change	Roy Odongo (Director)	Addressing issues of climate change, risks and adaptation	Coordination of the implementation of climate change policy, Act and Regulations
Public Works, Roads & Transport	Ewald Vinton Awiti- SCMO-Roads	Management of the county's transport system	Expansion of roads, feeder roads etc.
National Environment Management Authority	Mr. Nyandoro Josiah -CDE NEMA Homabay	Environmental Impact Assessment (EIA) is conducted and a license for project	Ensure all project impacts are successfully mitigated against.

		implementation is issued prior to construction	
Trade & Industry	Ellyas O. Okech (Chief Officer-Investments) Isaack Onyonyi (Director of Trade) Ruth Oteng (D. Director Industry) Dancun Obonyo (D. Director-Investments) Sam C. Owiyo (Principal trade officer) Robert Augo (Industry officer) Janet Ogolla (Economist)	Responsible for implementation of trade in the county. Promote fair trade practices	Promote investments, provide business development services, coordinate micro, small, and medium businesses engaged in trade, Promote consumer protection etc.
Cooperatives	Elijah Dede (Chief Officer)	Organization of farmers into cooperatives	Representing the interests of farmer cooperatives
National Value Chain Dev't Project (NAVCDP)	Livingstone Odongo (C.A.O)	Issues touching on sugarcane value chain	Advocating for farmers engaging in the sugarcane value chain
Social Services	Lucy Odwar Director Social Services	Advocating for social support, promoting and protecting rights of the 'would be' workers.	Advocating for social support
Youth, Gender & Sports	Silas Rabah Director-Youth Affairs Jared Okoth (Rev. officer)	Responsible for gender and social development, promotion of youth peace and social integration	Gender, Youth, Sports, GRM and other social impacts of the project to the community

5.3 Methodology of Public Participation and Stakeholders engagement

The stakeholders are categorized into two groups of primary stakeholders and secondary stakeholders. Primary stakeholders are the beneficiaries of a development intervention or those directly affected (positively or negatively) by the project. They included local populations (individuals and community-based organizations) in the project area.

Secondary stakeholders are those who influence development intervention or are indirectly affected by it. They include the proponent, national government and county line ministry or departments and implementing agencies. The consultation programme was developed and implemented taking into account the various areas of influence.





Figure 5.3: Ongoing Stakeholders consultation at St. Francis TTI Asumbi and Staridge hotel in Rangwe town (Standing is the Lead expert and the proponent's representative while giving the project brief and leading in consultations).

The members of the public were involved in this ESIA process. Views from the 'would be affected' people were sought from the community through two major Public Barazas held at Rabango Secondary School and another one at Aoch Muga Primary School on **19th and 20th December 2024** respectively. In attendance were 117 participants and 76 Participants in the two Barazas respectively. The Public Participation exercise was chaired by the area senior chief. The data collection was carried out through structured questionnaires where 50 questionnaires were administered, filled and returned. (*see attendance lists annexed*)

5.4 Consultation Process

The exercises were conducted by registered and licensed environmental experts. The objective of the consultation and public participation was to:-

- Disseminate and inform the stakeholders about the project with special reference to its key components and location
- Gather comments, suggestions and concerns of the interested and affected parties
- Propose solutions and mitigation measures to the various concerns
- Incorporate the information collected in the ESIA study

In addition, the Environmental Impact Assessment public consultation exercise enabled: -

- a) The establishment of a communication channel between the general public and the Lead Expert, the project proponents and the Government.

b) The concerns of the stakeholders to be known to the decision-making bodies at an early phase of project development

The purpose for such interviews was to identify the positive and negative impacts and subsequently promote and mitigate them respectively. It also helped in identifying any other miscellaneous issues which may bring conflicts in case project implementation proceeds as planned.

The Consultation and Public Participation (CPP) Process is a policy requirement by the Government of Kenya and a mandatory procedure as stipulated by EMCA 1999 section 58, on Environmental Impact Assessment for the purpose of achieving the fundamental principles of sustainable development.



Figure 5.4: Participants actively engaging in the consultations during public participation Barzcas held at Rabango Secondary School and Aoch Muga Primary School.

5.5 Summary of Issues raised by stakeholders and the community during Public Participation and the response

Table 12: Summary of Issues raised

Issues raised	Response
Sugarcane Spillage. How will the company ensure that its area of operation is free from this nuisance?	There will be harvesting supervisors. These will ensure that canes are tightly loaded to avoid spillage on transit. Dropped sugarcane will be collected through a designated vehicle that will be going round as well as through periodic cleanup activities of the area of operation.
The community wanted to know how bagasse will be managed.	Both the experts and the proponent representative replied that first, the excess bagasse which comprised a major form of solid waste from the process (120 Tonnes) will be stored and used in the Co-gen power plant to generate electricity (3 MW). Power generation will consume approximately 66% of the bagasse generated. The remaining 36% will not be a problem as a proposal is in place that it will be added to filter mud and used as fertilizer.
Is CSR incorporated in the company policies	Yes. CSR is a major component of the company policies. The projects to be identified and implemented as CSR will be community induced.
How long will the sugarcane stay in the farms to harvesting under the new factory?	The company will introduce the fast-growing seedlings typically 12-14 months as opposed to manywele (traditional ones) that goes upto 24 months and beyond.
Will the company drill boreholes for its own water or what plans are in place?	Water will be sourced from the nearby river Rangwe. A borehole will also be sunk. Abstraction permit will be acquired from Water Resource Authority (WRA)
How will the company ensure roads maintenance due to tractors?	The factory will ensure that all feeder roads within the catchment area are properly maintained, enabling smooth movement of transport tractors. Most of the cane fields are located within a 15-kilometre radius of

	the factory to minimize costs associated with delayed delivery
How will the company address conflicts that may arise between community and the factory	A grievance redress mechanism will be introduced to address issues that may arise.
On food security, how is the company prepared to ensure food crops is not affected due to shift in sugarcane farming	The company will integrate other value chains as part of the EDP. Encouraging the cultivation of maize, avocado, and sunflower alongside sugar cane. This will enable farmers to maintain food security while benefiting from diverse income streams. The planned long-term strategy is to incorporate a maize aggregation centre to support registered sugar cane farmers access markets for their maize and sunflower crop.
Sugar factories have been faced by challenges, how will this factory be different to stand the competition and maximize on profits?	Sugar factories can diversify into by-products like ethanol, electricity generation (from bagasse), and molasses, which can improve profitability and stabilize revenue streams
How will the safety of construction workers, neighbors and all employees be handled and what measures will the company put in place to ensure occupation, health and safety of its employees	<ul style="list-style-type: none"> • During construction and operation, the company will employ occupation, health and safety officers who will ensure that the EMP is implemented • Workers will be provided with adequate PPEs • Company will give health insurance to its employees

<p>How will the company address air pollution, water pollution, safety and general environment pollution.</p>	<ul style="list-style-type: none"> • The company will ensure that the roads used in collection / sourcing of materials are sprinkled with water to suppress dust. At the site the same will be done. • Bagasse will be utilized in the Co-gen to produce energy • An efficient Effluent treatment plant will be constructed • Sampling and analysis of wastewater will be done as per NEMA standards • Trees will be planted around the factory to absorb carbon dioxide • Electrostatic precipitator system will be applied to avoid air pollution • A SHE officer will be employed to ensure all EHS issues are addressed throughout the project cycle.
<p>Will the company completely address the current delay in sugarcane harvesting</p>	<ul style="list-style-type: none"> • Yes. The company will have a system to monitor cane development for all its registered farmers and therefore a farmer will be informed promptly on the due date of harvesting hence there will be no delay or cane overstaying on farm • The current delays is also due to distance travelled to collect the cane from farmers by existing factories. The factory is coming in this area to reduce to cover the radius within the affected farmers and therefore the issue will successfully be addressed

5.5 Conclusion from PP & SC exercise

From the analysis of public participation and stakeholders' engagement exercise conducted, it is concluded that the community, stakeholders and the general public had no objection to the project hence they welcomed it. It was obvious that the project is very welcome in Genga, Rangwe and the larger Homabay

County. This was on the condition that the issue raised be adequately addressed and they company keep to its word as they promised during PP& SC. The county Government was highly welcome to the project and issued the developer with the letter of No objection to the project. The community unanimously welcomes and supports the project without any single objection

CHAPTER SIX: ANALYSIS OF PROJECT ALTERNATIVES

6.1 The Proposed Alternatives

This Chapter analyses the proposed Sugar Factory Project alternatives in terms of site and technology. It describes the relocation alternative, no Project alternative and the proposed development alternative. It also analyses the alternative construction materials and technology

To be economically viable, the preselected sites must combine the following:

- i) Abundant resources, available all year long and the possibility of sustainable production;
- ii) Existing water supply all year long in acceptable quantity and quality;
- iii) Existing transportation facilities or possibilities to create them at a reasonable cost; and
- iv) Existing energy supply.

6.2 Project Alternatives

6.2.1 Alternative 1: No project alternative

The no project alternative in respect to the proposed Project implies that the status quo is maintained. Under the no project alternative, the existing land use and ecological system will not change. In addition, the proponent 's proposal would not receive the necessary approval from NEMA hence will not be constructed. The proposed sugar factory would not be constructed and the expectations attached to the Project would not be met. The no project construction alternative is the least preferred from the socio-economic perspective. This alternative would only be considered if the proposed project has adverse, irreversible and impacts that cannot be mitigated. Assessment of this project states that the impacts that are anticipated from this project can be mitigated. Therefore, it is apparent that the —no project alternative is not a viable alternative to the Proponent.

6.2.2 Alternative 2: Proposed construction alternative

Under the proposed construction alternative, the Proponent would be issued with an EIA License to implement the project. The site was determined by way of land availability, size, social surveys and compatibility of the site and the project. The project area is not within any critical ecological ecosystem and not under any dispute. Though it's not in character with its surrounding, project consultant has assessed the project and prepared this EIA study report that contains all possible economic, environmental and social impacts with their mitigation measures, hence the project will not affect the surrounding environment and community if all the mitigation measures proposed in this report are ensured. If NEMA is convinced that the site

is ecologically and socially ideal for the project and the resulting impacts will adequately be mitigated it will issue the license for implementation of the project. Due to NEMA approval for construction and operation of the proposed sugar factory, the proponent and the community will enjoy all the benefits associated with the project.

6.2.3 Alternative 3: Relocation alternative

Relocation alternative to a different site is an alternative available for the Project implementation. However, at present, the Proponent has already initiated and paid for the land that he deems the most suitable for such a project. The Proponent has also spent money on the proposed Project site during the planning and design phase. Relocation alternative would mean that the Proponent would have to identify another land and purchase as an alternative site. This will cost the Proponent a large sum of money. Whatever has been done and paid to date will be counted as a loss to the Proponent. The proposed Project is also in line with the industrialization and development agenda within the area. In consideration of the above concerns and assessment of the current proposed site, relocation of the proposed sugar factory project to a different site is not a viable alternative.

6.3 Analysis of Alternative Materials and Technology

The proposed sugar factory will be constructed using modern, locally available and internationally accepted materials and technology to achieve public health safety, security and environmental quality requirement. The structures will be made using locally sourced stones, cement, sand, metal bars and fittings that meet the Kenya Bureau of Standards requirements. Heavy use of timber during construction is discouraged. Equipment that saves energy and time will be given first priority

The sugar factory will connect to Kenya Power for energy apart from using its own by-product bagasse as fuel and production of co-gen power. Alternatives like utilizing diesel for generator or solar power for manufacturing are too expensive. Solar power can be utilized for the housing estate for the provision of hot water and security purposes.

It is also recommended that the factory harvest rain water from the roofs both in the factory and the residential estates for sugar processing and domestic use respectively. Other technologies include Resource Recovery and Waste minimization.

6.4 Waste Management Alternatives

6.4.1 Solid waste

A lot of Solid waste will be generated from the proposed project that will need proper management. Options to be considered in managing the waste:-

- i. Engaging county government to be collecting and disposing in their waste disposal site. However, it is noted that Homabay county government just like other county government faces huge challenge in waste management and therefore this option may not be ideal one if efficiency is to be achieved.
- ii. Contracting a NEMA licensed waste collector to be collecting wastes from the premise for safe disposal. However, the amount of waste generated by the company is a lot hence contracting may be expensive. Additionally, the contracted waste collectors are supposed to dispose the waste at a designated waste disposal site which is far therefore the number of trips needs to be minimized as much as possible.
- iii. The third option will be the company managing their own waste. This will be through an integrated solid waste management system that covers from generation, to final; disposal on site. This will include having own disposal site. An integrated solid waste management system is recommended for it ensures management of wastes generated in accordance with the Environmental Management and Coordination (Waste Management) Regulation of 2006.

6.4.2 Alternative Bagasse management

Bagasse is the residual material after extraction of juice from sugarcane. The proponent shall have a robust bagasse waste management infrastructure that comprises of briquette processing for the consumption by the local community in order to reduce chances of forming leachate especially during wet weather. Bagasse Leachate is a low pH liquid which normally forms when rain water percolates through bagasse and washes some of the bagasse organic components. The Proponent has considered each of several methods in the management of bagasse.

a. Transfer the bagasse heap to another location

The company has explored the possibilities of shifting the bagasse from the proposed factory grounds to another site to reduce the quantities of bagasse at the yard. However, this will only worsen the situation since the large quantities of bagasse will form leachate in the near future.

b. Reuse of bagasse in making of briquettes

Briquettes is another option that has been considered by the proponent once the mill commences operation. This will involve drying bagasse from 45% - 50% to the required 8% moisture content in order to make the briquettes.

c. Reuse of bagasse for making fertilizer

Bagasse could be a suitable soil conditioner if applied in thin layers and with pH adjustment, for example, using lime. MSML shall work with farmers on application of the bagasse on land

d. Use of bagasse in co-generation of power and steam

The Proponent will use fresh bagasse to produce power at its station. However, the power station will only be able to utilize a fraction of the fresh bagasse daily out of the quantities produced from crushing of cane per day.

The power plant specified by the company, is Waste Exchange Oriented Unit (WEOU). The design recommended for this project will address environmental concerns related to projects of this nature as is illustrated in the figure 6.4.2 below:

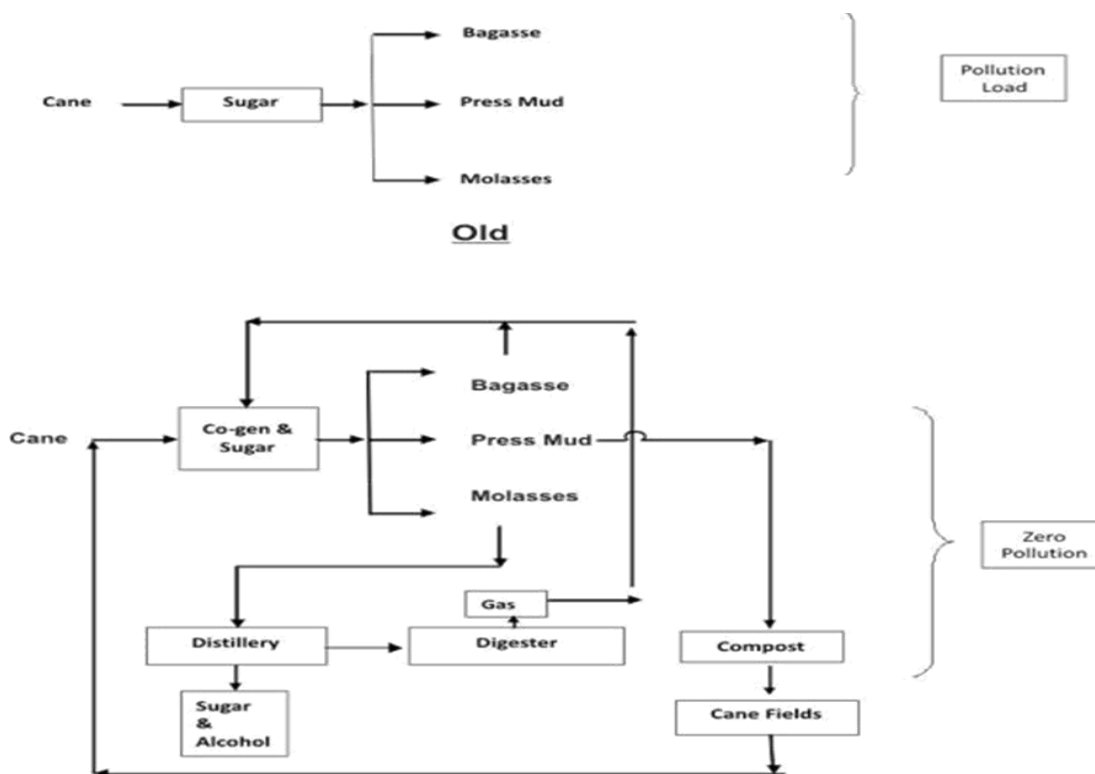


Figure 6.4.2: Illustration of the various waste management processes

6.4.3 Boiler Ash and Filter Mud Management

By-products, ash and filter mud will be used as composting materials and used as a **fertilizer on cane farms and gardens**. Boiler ash is washed from the mill chimneys and filter mud is the residue left after the sugar has been clarified. Press mud or filter mud contains all non-sucrose impurities along with CaCO₃ precipitate and sulphate. Press mud from double sulphitation process contains valuable nutrients like nitrogen, phosphorous, potassium, etc, and therefore highly recommended for use mainly as fertilizer.

Other option considered will include selling the ash to brick manufacturers. These methods have been benchmarked in similar projects and considered as good options to overcome the problems associated with the industrial wastes.

6.4.4 Management of Molasses

Molasses will be stored in RCC tanks or steel tanks above ground level. Otherwise, there is a possibility of ground water contamination due to the high BOD of molasses that may cause pollution problems due to mishandling. All the molasses produced at the factory will be sold to existing distilleries for ethanol manufacture/alcohol production, agrochemicals and animal feed manufacturing companies.

6.4.5 Treatment Alternatives

The sugar industries effluent is characterized by oil and grease, BOD, COD, suspended solids and pH requiring treatment. Unlike distilleries, the BOD level is not high. The factory can consider to use the activated sludge process, extended aeration, aerobic lagoon, anaerobic treatment alone e.g. Up flow or anaerobic sludge blanket (UASB) or diphasic anaerobic reactor or UASB followed by aerobic lagoon for the treatment of factory effluents. Having an effluent treatment plant will help reduce the effluent The ETP will see the BOD reduced from between **1000-1200 ppm to 80 ppm**, COD reduced from between **3000-3500 ppm to 250 ppm** while TSS is expected to reduce from between **500-600 ppm to 150 ppm**. Though this system is very effective in the treatment of wastewaters, require large tracts of land and release serious odors.

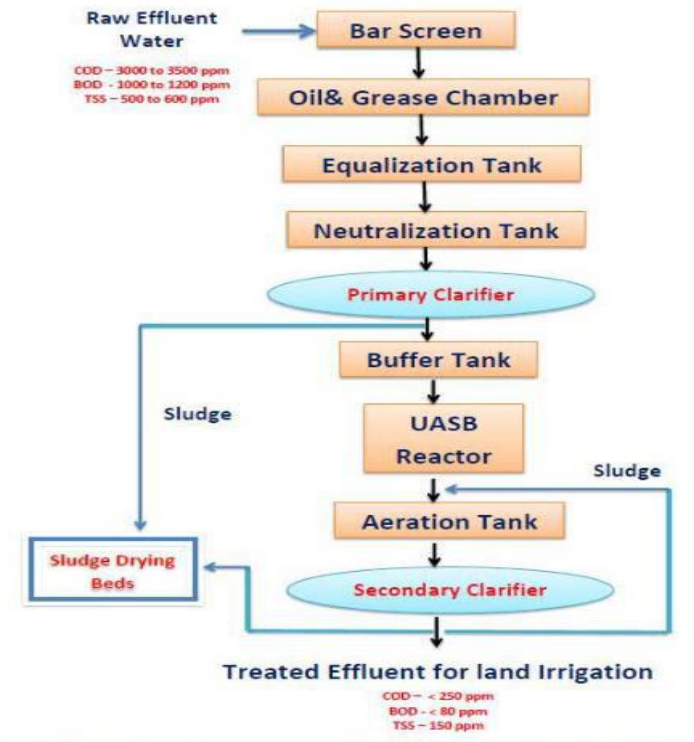


Figure 6.4.5: Typical ETP processes in a sugar plant

An alternative has been recommended for use by the directors of the proposed Muwariziki Sugar Factory is to install a modern Effluent Treatment Plant with a final Reverse Osmosis that will produce high quality of treated wastewaters and avoids serious odors. Reverse Osmosis and Microfiltration technologies for treatment of industrial raw water are better, both in terms of quality and quantity of treated water, when compared to the more conventional lagoon technologies.

To avert large quantities of wastewater generated, wastewater can be reused as a reduction measure and can involve the following:

Washing Water: Wash water may contain sugar and therefore requires treatment and should not be recycled. Periodic cleaning results in high BOD and it also contain caustic soda and weak acids.

Testing Water: This water is safe for returning it to the service water tank.

Oil and Grease: Providing suitable oil and grease traps can eliminate this.

Chemical Reuse: The stored and settled supernatant can be reused with a little addition of fresh caustic soda for next cleaning operation. Molasses Handling: It is necessary to store molasses in RCC tanks or steel tanks above ground level. Otherwise, there is a possibility of

ground water contamination. The high BOD of molasses may cause pollution problems due to mishandling.

6.5 Most preferred Options

For this project, there are limited alternatives for the project site because the proponent already has vast land away from the neighbors residence and has already invested a lot in preparation for the proposed project at the site including land acquisition. Therefore, emphasis is placed on the technological approaches that the proponent will adopt in constructing and managing environment, health and safety of the proposed sugar factory development at the proposed site.

CHAPTER SEVEN
**DESCRIPTION OF POTENTIAL ENVIRONMENTAL/SOCIAL-
ECONOMIC IMPACTS AND MITIGATION MEASURES**

7.1 Introduction

This Chapter identifies and discusses both positive and negative impacts associated with the construction and operation of the proposed sugar factory. On-site and off-site impacts can occur due to project location, and during construction, operation and decommissioning phases of the proposed Project. Identification and assessment of impacts depend on the nature and magnitude of the activity being undertaken and also on the type of pollution control measures that are envisaged as part of the Project proposal. The impacts are identified according to phases namely: Impacts during construction, operation and decommissioning phases.

7.2 Anticipated Positive Impacts and Enhancing Measures During Construction Phase

A number of positive impacts are associated with the proposed Sugar factory during construction phase. These will be positive impacts to the physical, social, economic and biological environment. The socio-economic benefits will be manifested to local communities by improving their living standards, the nation through improving the food security situation, the region and global community through export of agricultural produce or importing of farm inputs. However, it is upon all stakeholders to ensure the sustainability of the proposed project for long- term positive impacts to be realized. The following describes the positive impacts anticipated at construction phase;

7.2.1 Employment opportunities

The project will create direct employment to a number of people during construction and operation phase as skilled and non-skilled laborers. The living standards of a significant number of people will improve due to the availability of income from the construction of the project. Finally, during the construction phase, there will be a significant increase in the people working in the area and this will promote the economy of the county both directly and indirectly

7.2.1.1 Enhancement Measures

The local people need to be given first priority in employment opportunities particularly unskilled and skilled labour unless it cannot be found within the project area. The contractor should source materials locally from suppliers to employ more people. Project stakeholders

should also enforce the government policy of providing 30% of jobs or supplies of goods and services to Vulnerable and Marginalized groups within the project area

7.2.2 Increased income

The Project will require supply of large quantities of building materials most of which will be sourced locally in Homabay and in the surrounding areas. Producers and suppliers of materials such as building stones, timber, electrical cables, paint, sand, and cement will thus get market for their goods increasing their income.

7.2.2.1 Enhancement Measures

The contractor will be encouraged to source locally available materials as much as possible. This provides ready market for building material suppliers such as quarrying companies, hardware shops and individuals with such materials from among the community members.

7.2.3 Encouraging Business Opportunities

The construction work will attract other business opportunities for example food vendors in the area to supply food to the construction workers. The food vendors will therefore increase their sales and income as a result of selling food to the construction workers. In addition, the owners of the nearby business premises are also likely to benefit as a result of the construction workers purchasing some of the items from their shops. The influx of population will also require accommodation in the vicinity and encourage more housing in the area.

7.2.3.1 Enhancement Measures

For the income to be of significance to the local population, deliberate moves should be taken including; contracting a local food vendor to supply food to construction workers. The proponent should encourage the community to start building residential houses for new workers within the neighborhood.

7.2.4 Industrial development in Homabay County

The success of this project will offer other diverse benefits to Homabay County including the upgrading of its industrial sector as an important economic and employment sector in the country. This is also in line with the Vision 2030 economic development agenda of refurbishing and expanding the manufacturing industries in Kenya.

7.2.4.1 Enhancement Measures

The county government should encourage more development projects like the proposed sugar project. The proponent to liaise with relevant line ministries in expanding the area amenities are. This will encourage more development in the area and attract new investors in other sectors.

7.3 Anticipated Negative Impacts and Mitigation Measures During Construction Phase

The proposed development will equally have some negative environmental and social impacts. The impacts will emanate from physical construction of the whole project components. There is need therefore to identify the adverse impacts and mitigation measures to improve environmental and social sustainability of the project before implementation stage.

7.3.1 Loss of Vegetation

Clearance of vegetation will be experienced during excavation to develop the site, access roads and other infrastructure. Also, it will bring up more land under cultivation. Reliance on wood fuel and charcoal by the local people on the other hand will create more pressure on the existing vegetation a result of the factory construction. The project site is under sugarcane plantation. Some vegetation will however be cleared to pave way for the project associated structures. This will expose soil to agent of soil erosion and also reduce vegetation cover. Indigenous vegetation that are also used as herbal medicine will also be interfered with.

Mitigation

- The vegetation loss is set to be confined to the project location. The contractor will ensure that project area to be affected by the construction works is demarcated. This will be aimed at ensuring that any disturbance to flora and fauna is restricted to the actual project site and avoid spillover effects on the neighboring areas.
- Locate project components where there are less vegetation to minimize vegetation disturbance

7.3.2 Local increase of construction traffic

The construction of the proposed Project will make local increase of construction traffic inevitable. This is as a result of the movement of the construction vehicles and machines in and out of the construction site. However, there is unlikely to be significant increased traffic jam along the road as a result of the construction vehicles maneuverings to the proposed Project site.

Mitigation

- ✓ The proponent through the contractor will put measures in place to mitigate the local traffic jam that will occur in the project as a result of the construction vehicles turning to offload the raw materials to the site and after offloading the raw materials.
- ✓ To minimize the local construction traffic, construction vehicles will enter and leave the site at appropriate times.
- ✓ The contractor will also use signs and barriers to direct vehicles and pedestrian traffic as needed around the construction site.
- ✓ Some activities may also be scheduled in off-peak traffic times to minimize impacts.

7.3.3 Noise pollution and vibration

The construction works, delivery of materials by heavy trucks and the use of machinery/equipment including tractors, excavators, trucks, bulldozers, generators, grinders, mixers, blasting equipment, compactors and crushers together with drilling works will contribute to high levels of noise and vibration within the construction site and the surrounding area where ambient noise levels are low. This is anticipated to increase noise levels in the project area affecting particularly sensitive receptor areas such as immediate neighbors

Mitigation

- ✓ Limit pickup trucks and other small equipment to a minimum idling time and observe a common-sense approach to vehicle use, and encourage workers to shut off vehicle engines whenever possible.
- ✓ Avoiding unnecessary hooting,
- ✓ Insulate noisy machines;
- ✓ Workers working in noisy sections / areas to be provided with ear protection equipment,
- ✓ Workers using drilling equipment to be provided with specialized anti-vibrating gloves,
- ✓ Machines to be serviced to reduce generation of noise and vibrations;
- ✓ Prescribe noise reduction measures if appropriate e.g. restricted working hours, transport hours and noise buffering Use quiet equipment (i.e. equipment designed with noise control elements).
- ✓ The contractor will ensure that NEMA noise and Vibration standards are observed
- ✓ Construct mainly during the day. The time that most of the neighbors are out working.

7.3.4 Impact on air quality

Potential impacts on the air quality during construction phase will be due to exhaust and dust emissions generated in and around the construction site by the construction equipment. Motor

vehicles used to mobilize materials for construction and operating of construction vehicles and equipment would cause a potentially significant air quality impact by emitting pollutants through exhaust emissions.

The sources of air emission can be grouped into three categories namely:

- Point Source;
- Area Source; and
- Line Source.

A point source is a single source of emission with an identified location; an area source is when the sources of emission are many widely distributed point sources having relatively comparable significance; and a line source is when the sources of emission from a number of fixed or moving facilities have relatively comparable significance, such as roads.

Air emissions result from construction activities such as excavation, earthmoving and land filling, stone cutting and concrete processing as well as the loading and unloading of construction material and waste. Impacts include increased dust and airborne particulates caused by grading, filling, removals and other construction activities. After construction is complete, dust levels are expected to return to near non-existing conditions. Air quality impacts may also result from emissions from construction equipment and possibly from traffic stopped at the entrance of the building site to deliver materials.

During the period of maximum construction activity, the fuel consumption at the Project site is expected to rise significantly and the background concentrations of Suspended Particulate Matter (SPM), Respiratory Particulate Matter (RPM), Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂) and both Carbon Monoxide (CO) and Lead (pb) are also expected to rise.

These emissions can have significant cardio-pulmonary and respiratory effects on the local population; the health effects may range from subtle biochemical and physiological changes to difficulty in breathing, wheezing, coughing and aggravation of existing respiratory and cardiac condition. The impact of such emissions can be greater in areas where the materials are sourced and at construction site. Activities associated with site clearance, excavations, spreading of the top soil during construction, frequent vehicle turning and slow vehicle movement loading and off- loading areas can be implicated in this process.

Table 13: Summary of impacts of emissions on human health

Pollutant	Source	Primary effects
Sulphur Dioxide (SO ₂)	Combustion of sulphur containing fossil fuels for: <ul style="list-style-type: none"> ▪ Construction equipment ▪ Vehicle ▪ Diesel engine 	<ul style="list-style-type: none"> ▪ Plant injury ▪ Reduced visibility ▪ deterioration of metals, textiles, leather, finishes and coatings ▪ aggravation of respiratory diseases (asthma, emphysema) ▪ irritation
Nitrogen Oxides (NO _x)	Combustion of fossil fuel from: <ul style="list-style-type: none"> ▪ Construction equipment ▪ Vehicles ▪ Diesel generators 	<ul style="list-style-type: none"> ▪ Aggravation of respiratory illness ▪ Reduced visibility ▪ Reduced plant growth ▪ Formation of acid rain
SPM (Dust)	<ul style="list-style-type: none"> ▪ Construction activities ▪ Combustion of fossil fuels for construction equipment, vehicle and diesel generators. 	<ul style="list-style-type: none"> ▪ Soiling ▪ Reduced visibility ▪ Aggravation of the effects of gaseous pollutants ▪ Increased cough and chest discomfort ▪ Reduced lung function ▪ Aggravation of respiratory and cardio-respiratory diseases
Carbon Monoxide (CO)	Combustion of fossil fuels from <ul style="list-style-type: none"> ▪ Construction equipment ▪ Vehicles ▪ Diesel Generators 	<ul style="list-style-type: none"> ▪ Plant injury ▪ Reduced visibility ▪ Deterioration of metals, Textiles, Leather, finishes, coatings ▪ Irritation of eyes ▪ aggravation of respiratory diseases (asthma, emphysema)

Air quality impacts generated from exhaust emissions and dust emissions will be minimized as follows.

Mitigating Exhaust Emission

The following measures shall be implemented during construction to minimize the exhaust emission:

- The engine size of the construction equipment shall be the minimum practical size;
- The number of construction equipment operating simultaneously shall be minimized through efficient management practices;
- Vehicle idling time shall be minimized; and
- Equipment shall be properly tuned and maintained as per the manufacturer's specifications.

This will also be achieved through proper planning of transportation of materials to be used during construction of the proposed Project to ensure that vehicle fills are increased in order to reduce the number of trips done or the number of vehicles on the road.

Mitigating Dust Emission

Dust emissions from construction sites can also pose health risk to workers, and sensitive receptors surrounding the site, if not managed properly. It is the responsibility of the contractor to provide appropriate safety training, information equipment, signage, security and emergency response plans on site.

To mitigate the impact of SPM (dust), the following measures are recommended for implementation:

- Applying water to at least 80% of all inactive accessible disturbed surface areas on a daily basis when there is evidence of wind driven dust;
- Watering all roads used for any vehicular traffic at least twice per day of active operations or road used for any vehicular traffic once daily and restrict vehicle speed to 15 mph;
- The soil surface shall be kept humid through water spraying to control the level of dust during excavation works.
- Provide dust masks to construction staff working in dusty areas
- Construction materials must be properly stacked
- Dispose of debris from the construction site by licensed waste trucks to authorized dumping sites

- Down wash of trucks (especially tyres) prior to departure from site;
- Cover stockpiles of sand, soil and similar materials or surround them with wind breaks;
- Cover trucks hauling dirt and debris to reduce spillage on to paved roads surface or have adequate free board to prevent spillage;
- Trucks carrying construction waste shall be covered during their trip from the construction site to the final disposal location.
- Post signs that limit vehicle speeds onto unpaved roads and over disturbed soils; and
- Rapid onsite construction so as to reduce duration of traffic interference and therefore reduce emissions from traffic delays.

7.3.5 Disposal of solid waste

Construction activities create solid wastes that need to be disposed. Such wastes include: Timber, metals, nails, wires, glass, plastic piping, excavated soil and rocks, packaging materials and containers e.g. paint pails, cement bags, metallic straps, etc.

Soils will be excavated at the proposed Project site; the excavation works to level the site and to come up with the foundation will result in the generation of the excavated material.

These wastes may have a direct impact on the neighboring premises. Disposal of the same solid wastes off-site could also be a social inconvenience if done in wrong places. The offsite effects could be un-aesthetics view, pest breeding, unhygienic conditions, chocking of nearby drains and stream and pollution of physical environment. Proper waste management will however be taken into consideration and proper dumping done according to the requirements and directions of NEMA.

If not properly disposed, these wastes will result in the pollution of soil, ground water and air (paint). Materials consisting of chemicals e.g. paints, cement and thinners will alter the chemical composition of these regimes.

Mitigation Measures

- i) During the construction period an area will be specifically designated for solid wastes. These will be segregated and categorized into re-usable, those for re-sale

and those that cannot be used again. Reusable material will be recovered so as to reduce wastage and cost of raw materials.

- ii) The waste designated area will be well protected from the elements to ensure reduced chances of them being carried away by wind or rain.
- iii) Surplus material that cannot be reused in any way will be removed from site by licensed waste handlers.

7.3.6 Increased water demand

During the construction phase, the construction works will create additional demand for water in the area especially River Rangwe, in addition to the existing demand at the project area.

Water will mostly be used in the following activities:

- Concrete works including curing;
- Controlling dust on site;
- Washing of machinery and equipment;
- Preparing of mixtures, including water-based emulsion paints;
- Washing and drinking by construction workers;
- General cleaning; and
- Landscaping.

Increased water demand could result in increased Project costs, increased health risks, and increased soil erosion if not properly managed.

Mitigation

- 3 Drilling a borehole
- 4 Prompt reuse and recycling of water as much as possible where necessary
- 5 Install a discharge meter at water outlet to monitor and determine total water usage.
- 6 Monitor water consumption and utilization;
- 7 Sensitize construction workers on the importance of proper water management;
- 8 All wastewater should be drained into approved drainage facilities.
- 9 Promote awareness on water conservation and reducing water wastage;
- 10 Quick fixing of leaking pipes
- 11 Rain water harvesting should be taken into consideration to capture rain water and store.

7.3.7 Energy consumption

The proposed Project will consume fossil fuels to run transport vehicles and construction machinery. The machinery will include: construction vehicles and compactors. Fossil energy is non-renewable and its excessive use may have serious environmental implications on its availability, price and sustainability. Electricity will also be used during the construction of the proposed Project. The consumption of electricity is likely to be on the higher side. It should be noted also that manual labour as a source of energy will mainly be used during construction of the proposed Project. Efficient management of energy consumption is therefore required for optimal performance of the Project and to control Project costs.

Mitigation

- ✓ Sensitization of staff to conserve electricity by switching off electrical equipment or appliances when they are not being used.
- ✓ Proper planning of transportation of materials will ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts
- ✓ Complementary to these measures, the Contractor shall monitor energy use during construction and set targets for reduction of energy use
- ✓ The Contractor will also develop energy management plan.
- ✓ Construction machinery and vehicles should be maintained and used in accordance with manufacturer's specifications, to maximize efficiency and lower use of energy, e.g. drivers of construction vehicles should be instructed not to leave them idling for extended periods;

7.3.8 Increased storm water runoff from new impervious areas

Construction of the proposed Project and access driveway could result in additional runoff through creation of impervious areas. These areas generally have higher runoff coefficients than natural area, and increased flood peaks are a common occurrence in developed areas.

The storm water runoff is likely to increase the flooding along access roads.

Mitigation

- ✓ Leveling the Project site to reduce run-off velocity and increase infiltration of rain water into the soil.
- ✓ A storm water management plan that minimizes impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structures will be designed.

7.3.9 Extraction sites and impacts of use of building materials and procurement

Building materials such as hard core, ballast, cement, rough stone and sand required for the construction will be obtained from quarries, hardware shops and sand harvesters. This will have impacts including clearance of vegetation, destruction of landscape, dust and general disturbance during excavation. There is need to reinstate or landscape the gravel sites when the contractors have completed excavation works. Material sites if not reinstated and rehabilitated after project completion, will create a badlands type of landscape with water bodies, pools of water, scattered boulders and rubble of ballast on the soil surface. When left unfenced, quarries and borrow pits pose a risk to public especially children; livestock and wildlife due to drowning associated deaths, therefore should be fenced off when in use.

Mitigation

- ✓ The Proponent of the proposed Project shall ensure that all building materials such as sand ballast hard core are extracted from registered quarry and sand mining firms whose facilities have undergone satisfactory environmental impact assessment/audit and received NEMA approval. Since such firms are expected to apply acceptable environmental performance standards, the negative impacts of their activities at the extraction sites are presumably well mitigated.
- ✓ To reduce the negative impacts on availability and sustainability of the materials, the Proponent will only order for what will be required through accurate budgeting and estimation of actual construction requirements. This will ensure that materials are not extracted or purchased in excessive quantities.
- ✓ Moreover, the Proponent will ensure that wastage, damage or loss (through run-off, wind, etc) of materials at the construction site is kept minimal, as these would lead to additional demand for and extraction or purchase materials.
- ✓ In addition to the above measures, the Proponent shall consider reuse of building materials and use of recycled building materials. This will lead to reduction in the quantity of raw materials extracted from natural resources as well as reducing impacts at the extraction sites.

The following should also be taken into consideration:

- Contractor will be responsible for obtaining a current and valid blasting authorization from the Department of Mines and Geology prior to any blasting activity.

- A qualified and registered blaster by the shall supervise all blasting activities
- Contractor shall ensure that appropriate pre blast monitoring records are in place (i.e. photographic and inspection records of structures in close proximity to the blast area);
- The Contractor shall ensure that emergency services are notified, in writing, a minimum of 24 hours prior to any blasting activities commencing on Site;
- The Contractor shall take necessary precautions to prevent damage to special features and the general environment, which includes the removal of fly-rock. Environmental damage caused by blasting/drilling shall be repaired at the Contractor's expense to the satisfaction of the affected person / entity;
- Contractor shall ensure that adequate warning is provided to the local communities immediately prior to blasting. All signals shall also be clearly given;
- The Contractor shall use blast mats for cover material during blasting. Topsoil shall not be used as blast cover.

7.3.10 Oil spills

The machines to be used on site will have moving parts which will require continuous oiling to minimize the usual corrosion or wear and tear. Possibilities of such oils spilling and contaminating the soil on site are real. Likewise, moving vehicles on site may require oil change leading to oil spills. Irrespective of these possibilities, no significant adverse effects are expected as a result of oil spills given the scope, nature and duration of time to be taken on the construction of the proposed Project. Oil, fuel, grease and spillages, poor waste management that may lead to percolation of leachate into the soil and paint waste are occurrences that will lead to soil pollution. This is anticipated to change the chemical composition of the soils hence affecting the biochemical process.

Mitigation

- ✓ The Contractor shall control dangers of oil and fuel spills during construction by maintaining machinery in specific areas designated for this purpose.
- ✓ Ensure proper oil/fuel management as earlier on stated
- ✓ Ensure good waste management practice to prevent occurrence of leachate
- ✓ Prompt cleaning of oil and fuel spills, and proper disposal of clothing or rags contaminated with oil will also take place.

7.3.11 Risk of Water pollution.

Water pollution both for surface and ground water may be compromised due to the development in the area. Water pollution will affect the water parameters hindering normal chemical characteristics of the water and indirectly affecting all organisms that come in contact with the contaminated water

Activities that will be associated with water pollution will include; Wash down of debris generated from various construction activities, surface runoff from non-point and point sources pollution from various human-economic activities, poor disposal of solid wastes from construction camps, Poor management of oil and greases from contractor's service bays and spills from use of construction machines and equipment.

Mitigation

- ✓ Ensure proper handling of loose soils during construction to prevent it from getting into storm water drain;
- ✓ The contractor 's camps to have adequate sanitation facilities that can treat waste water before releasing into the environment;
- ✓ Ensure all repairs and maintenance work are done at the contractors 'yard to avoid spillages,
- ✓ Compact loose material/soils and;
- ✓ Ensure recommended water quality standards of effluents from the contractor's camp are adhered to as per the provisions of NEMA water quality regulation as shown in the baseline section on water quality.

7.3.12 Loss of aesthetic value

The project site has nice scenery in terms of vegetation and landscape. Clearance of vegetation, extraction of materials and construction of factory will change the landscape of the area. This with poor waste and waste water disposal may result to loss of aesthetic value of the project area during project construction.

Mitigation Measures

- ✓ Reinstating the site (borrow pits);
- ✓ Proper collection and disposal of waste
- ✓ Maintaining some vegetation and planting more

- ✓ Minimize on the excavations and ground disturbance

7.3.13 Occupational Health and Safety

During construction, project sites always present an element of danger. Construction workers are likely to encounter accidental injuries as a result of the intensive engineering and construction activities including erection and fastening of materials, metal grinding and cutting, concrete work, steel erection and welding among others. Such injuries can result from accidental falls from high elevations, injuries from hand tools and construction equipment cuts from sharp edges of metal sheets and collapse of building sections among others. Deaths have also been experienced as a result of poor construction activities leading to occupational health and safety concerns.

Workers are also likely to be exposed to diseases from building materials during the construction phase of the Project Occupational health and safety of the workforce will have to be monitored by the respective contractor's supervisors and foremen. As long as proper procedures are followed and personal protective equipment (PPE) provided and their use enforced, risks of accidents and incidents can be substantially reduced.

Mitigation

- ✓ Construction workers and everyone at the site will be provided with personal protective equipment (PPEs) which must be used at all time on site.
- ✓ Develop a site safety action plan detailing safety equipment to be used, emergency procedures, restriction on site, frequency and personnel responsible for safety inspections and controls.
- ✓ Recording of all injuries that occur on site in the incident register, corrective actions for their prevention are instigated as appropriate.
- ✓ Building materials will be inspected according to the occupational health and safety standards.
- ✓ Reducing vehicle speed on project area and site site;
- ✓ Close supervision of work,
- ✓ The contractor shall insure all his workers.
- ✓ Foreman shall instruct workers on safety and health issues to avoid occurrence of accident. The contractor must be committed to adherence to the occupational health and safety rules and regulations stipulated in Occupational Safety and Health Act, 2007;
- ✓ Ensure safety of the construction workers by putting first aid area and injury reporting mechanism

- ✓ Ensure safety of the community by providing safety signs at strategic places around the access roads.
- ✓ Ensure compliance to Occupational Safety and Health Act Cap. 514 and its Subsidiary Legislations.
- ✓ There should be adequate provision of the requisite sanitation facilities including toilets and bathrooms;
- ✓ The workers should receive the requisite training especially on the operation of the machinery and equipment

7.3.14 Labour influx and associated effects of population increase

This impact is triggered during Project Construction Phase due to the Project attracting various categories of workers from local and national or even international markets. This therefore can lead to new people coming to West Gem ward town area drawn from diverse social and cultural backgrounds often resulting to a number of issues as listed below;

- (i) Strain on various resources especially water resources
- (ii) Grievances from local community members over job opportunities
- (iii) Sexual Exploitation and Abuse
- (iv) Unwanted Pregnancies

Mitigation Measures

- i) The sugar mill will source almost all of its unskilled labour from the local communities in order to reduce an influx of population from outside the area;
- ii) Requirements by the facility will be made in an organized manner from the surrounding communities; thereby reducing occurrence of opportunistic hawking that could result in a myriad of vices such as drug use and peddling, petty crime, alcohol abuse and harboring of criminals.
- iii) During construction phase close monitoring of workers will be undertaken to ensure that unwanted characters are not absorbed.
- iv) In addition, activities will be undertaken in a closed environment and food and other requirements will be provided within to reduce traffic in and out of the building site.
- v) Security will be enhanced in and around the project site to reduce cases of material theft and any other uncalled-for occurrences.
- vi) Security agencies will be requested to beef up the current small police post in the area.

7.3.15 Sexual Exploitation and Abuse (SEA)

This impact refers to sexual exploitation and abuse committed by Project staff such as contractor or his employees against communities and represents a risk at all stages of the Project, especially when employees and community members are not clear about prohibitions against SEA in the Project.

Mitigation

- Management and Coordination: including integration of SEA in job descriptions, employments contracts, performance appraisal systems, etc.; development of contract policies related to SEA, including whistle blower protection and investigation and disciplinary procedures; training for all project management; management of coordination mechanism for case oversight, investigations and disciplinary procedures; supervision of dedicated PSEA focal points in the project and trained community liaison officers.
- Engagement with the community: including development of confidential community-based complaints mechanisms discrete from the standard GRM; mainstreaming of SEA awareness-raising in all community engagement activities; community-level IEC materials; regular community outreach to women and girls about social risks and their SEA-related rights;

7.3.16 Human Health Impact-Increase in incidences of HIV/AIDS and STIs

The project will attract new people to the project area and this can lead to several repercussions such as the spread of HIV virus. Influx of new people to the project area especially construction workers can affect the number of new cases of HIV & AID, because they often interfere with an otherwise stable situation but the contrary can also happen where the newcomers find themselves at higher risk.

Mitigation

There is always a concern of moral decay in the society that would arise from sexual relationships between residents and new workers leading to cases of increased transmission of HIV/AIDs and STDs. These will be achieved through

- Sensitization of the workers to adhere to work ethics and awareness creation at the community level on safe sex.
- Collaborating with other entities to put up a VCT centers near Muwariziki Sugar Factory

7.3.17 Gender Based violence and Sexual Harassment

This impact is triggered during Project Construction Phase when the Contractor fails to comply with the following provisions.

- (i) Gender inclusivity requirements in hiring of workers and entire Project Management as required by Gender Policy 2011 and 2/3 gender rule.
- (ii) Failure to protect human risk areas associated with, Disadvantaged groups, interfering with Participation Rights, and interfering with Labour Rights.

Mitigation

- Ensure clear human resources policy against sexual harassment that is aligned with national law.
- Integrate provisions related to sexual harassment in the employee code of conduct.
- Ensure appointment of human resources personnel to manage reports of sexual harassment according to policy
- The proponent to ensure that gender-based violence at the workplace is not triggered by the Project, including:
 - a) Effective and on-going engagement and consultation with female workers, particularly with women and also girls at the community.
 - b) Review of specific project components that are known to heighten GBV risk at the community level, e.g. compensation schemes; employment schemes for women; etc.

7.4 Operation Phase Impacts

(a) Positive Impacts

Just as in the construction phase, there are positive impacts associated with the construction of Muwariziki Sugar factory during operation phase. These positive impacts are discussed below:

7.4.1 Employment opportunities

Employment creation is one of the major impacts of the proposed Project during its operational phase. Technicians and operators will be employed in the project. Those contracted or employed will generate income as a result of being employed or contracted.

7.4.2 Optimal use of land

The proposed sugar factory project will enhance economy of land through intensification of land use in addition to provision of sugar and related by-products. This will be significant since the country is currently experiencing shortage of sugar and related by-products.

7.4.3 Increase in revenue to the national and County Government

The operation of the proposed Project will result in positive gains for numerous authorities. The local county government, Kenya Revenue Authority (KRA), Kenya Power and Lighting Company (KPLC), Kenya Sugar Board (KSB) through payment of relevant taxes, rates and fees to respective institutions.

7.4.4 Improved amenities

The operation of the proposed sugar factory is expected to improve amenities such as roads, water, health care and social facilities in the surrounding area in that the proposed Project will provide extension services, construct roads, a health center, water points and support the needy in the society as part of their CSR.

7.4.5 Increased market for sugar and related by-products

The farmers and the general consumer community are likely to benefit from the operation of the sugar factory since wholesalers who will purchase sugar and by-products products from the factory premises will improve their sales.

The proposed sugar factory is expected to reduce the monopolistic tendencies in the sector and allow farmers to choose where to sell their crop and thus provide them an improved platform to negotiate with respective factories as mutually interdependent partners. This will contribute to fair prices in sugar products

7.4.6 Improvement in the livelihoods of the sugar farmers

Farmers in Sango/Rabango anticipate they will gain from prompt payment of sugarcane produce as a result of introduction of the sugar factory in their area. Therefore, farmers will be able to pay for the education of their children, acquisition of additional property notably land and construction of descent family shelter.

7.4.7 Increased Participation of Women in Socio-economic Development

The prevailing socio-cultural norms influencing household division of labor will determine women income over the normal routines such as; looking after children, preparation of food and collecting water and firewood which are tasks for the women. By constructing of the sugar factory closer to the communities, the women will be able to spend their time in other productive activities thereby increasing their participation in socio- economic development. It is also expected that same will improve the economic and social status of women.

7.4.8 Boosting Industrial Development in the area

The proposed sugar factory project will not only enhance the economy but also contribute to industrial development in line with Vision 2030 economic development agenda of refurbishing and expanding the manufacturing industries in Kenya.

7.4.9 Reduced loss to farmers and Prompt Cane Harvesting

Due to the distance travelled to the milling factories, farmers were experiencing delays in harvesting their cane forcing cane overgrowing and overstaying on the farms. Therefore, locating this project in this area will ensure canes are harvested in good time and therefore the canes will not be left to overgrow / over stay on the farm.

7.5 Negative impacts and Mitigation Measures During Operation Phase

The following negative impacts are associated with the proposed sugar factory project during its operation phase.

7.5.1 Increased water use

The industrial activities during the operation phase of the Project will involve use of large quantity of water. This will increase the water demand in project area and increase pressure due to excess abstraction of water from river Reangwe.

Mitigation

- ✓ Immediately drill boreholes and additional dam as proposed
- ✓ Install water conserving taps;
- ✓ Promote recycling and reuse of water as much as possible;
- ✓ Promptly detect and repair of water pipes and tank leaks; and
- ✓ Install discharge meter to determine and monitor total water usage.
- ✓ Re-use the water for cooling purposes;
- ✓ Use closed loops for intensive solid generating washings, (e.g. cane and beet wash) and flue gas scrubbers.
- ✓ Sweep with a broom and pan where possible, rather than hose down external areas. The following water saving investments should be taken into consideration:
 - ✓ Reduce water delivery in taps, through the installation of low flow devices
 - ✓ A manually pressed button flush valve which stops on release of button; and
 - ✓ Water efficient plumbing fixtures to save water and energy.
 - ✓ Rain water harvesting should be taken into consideration to capture rain water and store.

7.5.2 Disposal of waste water/ Wastewater management

Since the disposal of waste water will be directed to the effluent treatment plant, if the plant is not efficient enough it may require alternative treatment, which may be costly. However, since the factory will utilize the effluent treatment plant as proposed, it is anticipated that the plant will work efficiently. The sources of wastewater in the factory will result from the following:

Mill house: Due to gland cooling and intermittent floor washing and contains high amounts of oils and grease and sugar from spills and leaks

Boiler Blow-down: Boiler blow-down is fairly clean water except that it contains high dissolved solids and phosphates.

Rotary filter: Filter cloth is periodically washed and constitutes a source of wastewater.

Condensates: The vapours from the last effect evaporator and pan boiling are separately cooled in barometric condensers and the condensate goes to the pond. A part of the cooled water from the pond is recycled into the sugar mill, but a large portion is discharged as wastewater. If the mill operates without overloading, the evaporator and vacuum pan condensate is quite clean and the entire quantity can be reused. But many a times, overloading and poor operating conditions can lead to significant sugar losses in the condensates through entrainment and thus polluting the water.

Occasional Spills and Leaks: Leaks from pumps and pipes in the evaporators and centrifuge house, along with periodical floor washings, constitute another source of wastewater. Although the flow is intermittent and volume discharged is not large, it represents the most polluting fraction of sugar mill wastewater.

Condensate Washings: Evaporators, juice heaters, pans, etc are cleaned once in 20 days for removal of deposited scales. Caustic soda, sodium bicarbonate and hydrochloric acid are used for scale removal. Normally the caustic soda washings are stored and reused for cleaning operations. After the equipment is boiled with caustic soda and rinsed with fresh water, it is cleaned with dilute hydrochloric acid using an inhibitor. The wastewater is discharged into the drains, as the recovery of the chemicals may not prove to be economical. It is seen that the wastewater has small organic load but inorganic content may be high to pose a shock-load to wastewater treatment facility (occasional discharge, once in fortnight). It is suggested to have a holding tank and mix this wastewater gradually to the final effluent to avoid shock loading on the treatment plant.

Sulphur and Lime Houses: The washings of sulphur and lime house would contain a considerable number of inorganic solids, which include carbonates and sulphates. The effluents from these two units when combined would give neutral pH value of waste. This wastewater does not contribute to organic pollution but can be characterized as inorganic wastewater.

Mitigation Measures:

- Waste water treatment plant will be constructed to handle waste water from the factory processing section.
- There will be aerobic and anaerobic treatment before the treated waters are passed through an artificial wetland to be put up. The artificial wetland will have various plants that have a high capacity to absorb nutrients such as alfalfa, papyrus,
- Ensure the effluent treatment plant is well operated and that proper monitoring takes place to make sure that the surrounding environment is not polluted.
- Provide grease trap to eliminate grease and oil before the waste water is drained into the treatment system.
- Store molasses in RCC tanks or steel tanks above ground level to prevent ground water contamination. The high BOD of molasses may cause pollution problems due to miss handling.
- Housekeeping measures such as monitoring oil spills, repair of leaking pumps, removing debris from canals to minimize content of pollutants in the waste water

(i) Management Sanitary Wastewater

within the factory, office / staff kitchenette and from residential [staff quarters] section), food service, and laundry facilities serving site employees. Miscellaneous wastewater from laboratories, medical infirmaries, water softening etc. may also be discharged to the sanitary wastewater treatment system.

Mitigation

- These waste water will be treated differently from the processing / factory waste water;
- Segregation of wastewater streams to ensure compatibility with selected treatment option (e.g. septic system and bio digester);
- Segregation and pretreatment of oil and grease containing effluents (e.g. use of a grease trap) prior to discharge into sewer systems;

- Sludge from sanitary wastewater treatment systems should be disposed of by a licensed NEMA Registered Waste disposal management entity.

(ii) Water quality monitoring

A wastewater and water quality monitoring program/section with adequate resources and management oversight should be developed and implemented to meet the objective(s) of the monitoring program. Management of industrial wastewater is regulated in the EMC (Waste Management) Regulations 2006. Through use of these guidelines and good practice techniques for wastewater management, facilities should meet the Guideline Values for wastewater discharge.

Mitigation

- Carry out regular inspection and maintenance of the ETP to ensure zero leaks and damages
- Install a water meter to measure the amount of waste water released from the factory on a daily basis
- Carry out an analysis of the composition of the effluent through a NEMA registered laboratory. Analysis should be conducted by entities permitted or certified/accredited for this purpose. Comply with EMC (Water quality) Regulations 2006 by:
 - ✚ Having appropriate liquid waste treatment facility,
 - ✚ Ensuring that the effluent discharged meet the set standards.
Continuously monitor the discharge as per the regulations
 - ✚ Apply for an effluent discharge license from NEMA on annual basis
- Have a department / section handling water quality monitoring
- There shall be personnel designated / employed to man and operate the waste management system. Sampling shall be conducted by or under the supervision of trained individuals
- Designate Effluent sampling point at strategic upstream points and discharge point.

7.5.3 Increased storm water flow

Upon completion, the building roofs and pavements of the project will lead to increased volume and velocity of storm water or run-off flowing across the area covered by the proposed Project. Rapid runoff causes erosion.

Storm water runoff contains suspended sediments, metals, petroleum hydrocarbons, coliform, which carried downstream hence resulting to degrading the quality of the receiving water.

Mitigation Measures:

In order to reduce the need for storm water treatment, the following principles should be applied:

- Oil water separators and grease traps should be installed and maintained as appropriate at refueling facilities, workshops, parking areas, fuel storage and containment areas.
- Good housekeeping to avoid contamination of storm water;
- Provision of slit traps in storm water drains
- Regular inspection and cleaning of storm drains.
- Where storm water treatment is deemed necessary to protect the quality of receiving water bodies, priority should be given to managing and treating the first flush of storm water runoff where the majority of potential contaminants tend to be present;
- Storm water should be separated from process and sanitary wastewater streams in order to reduce the volume of wastewater to be treated prior to discharge.
- Runoff from process and storage areas should be segregated from potentially less contaminated runoff.

7.5.4 Air Pollution

Potential sources of air emissions in sugar manufacturing are primarily related to particulate matter generated from:

- Exhaust emissions,
- Particulate Matter and Dust Emission
- Bagasse-fired steam boilers,
- Sugar drying or packing activities; and
- Inadequate cleaning of the raw material that result in fermented juice, which will also create a foul smell.

The bagasse, on burning, produces particulates, viz., unburnt fibres, carbon particles and gaseous pollutants like oxides of nitrogen, water vapour and other organic compounds. Of the particulate waste, the heavier particles slowly settle down in the surrounding area. Such dust fall leads to the problems of cleaning, reduction in property value, effect on vegetation, etc.

The main gaseous pollutants are CO, which is altogether not measured by any unit, and CO₂ is reported to be in the range of 12 – 14%.

Motor vehicles used to mobilize materials and equipment would cause a potentially significant air quality impact by emitting pollutants through exhaust emissions.

During the period of operation, the fuel consumption at the Project site is expected to rise significantly and the background concentrations of Suspended Particulate Matter (SPM), Respiratory Particulate Matter (RPM), Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂) and both Carbon Monoxide (CO) and Lead (pb) are also expected to rise.

These emissions can have significant cardio-pulmonary and respiratory effects on the workers; the health effects may range from subtle biochemical and physiological changes to difficulty in breathing, wheezing, coughing and aggravation of existing respiratory and cardiac condition.

Air emission specifications should be considered during all equipment selection and procurement.

Mitigating Exhaust Emission

- Vehicles and equipment will not be left idling when not in use.
- Ensuring a high standard of inspection, maintenance, and operational practices as it is an effective method of controlling excess emissions from vehicle and equipment use to an acceptable level.

Mitigating Stack Emissions

- The boiler to be designed to have particulate matter control (e.g. flue gas cyclones, fabric filters, or electrostatic precipitators, wet scrubbers and local recirculation systems) to capture the ash and recycle the water to prevent the emission of particulate;
- Use wet scrubbers to remove dust from drying and cooling of sugar;
- Regularly monitor stack emission. Explore the use of modern technology systems such as bio-filters and chemical scrubbers to control Ensure timely renewal of the air emission license from NEMA.
- Exhaust gas recirculation
- Selective non-catalytic/catalytic reduction
- Installation of wet scrubbers and thermal oxidizers. Use acceptable emission control technologies as per the Seventh Schedule of the Environmental Management and

Coordination (Air Quality) Regulations, 2014. The technology to mitigate particulate matter will be mechanical collectors (dust cyclones, multicyclones) and particulate scrubbers, sulphur oxide will be wet scrubbers and nitrogen oxide will be NOx scrubbers.

- Avoid overloading the bagasse for efficient burning
- Use the correct fuel to air ratio by proper adjustment of air and fuel ratios
- Avoid carbon build-up in the boiler and furnace tubes and maintain the boiler and furnace settings in good condition

Mitigating Fugitive Dust Emission

- Reduce fugitive dust from roads and areas within the factory by cleaning and maintaining a sufficient level of humidity;
- Install ventilation systems with filters on transport systems for dry sugar and on sugar packing equipment.
- Watering all roads used for any vehicular traffic at least twice per day of active operations or road used for any vehicular traffic once daily and restrict vehicle speed to 15 mph inside the compound;
- Post signs that limit vehicle speeds onto unpaved roads and over disturbed soils

Mitigating Dust Generated during Bagasse Handling, Storage and Disposal

Bagasse may create nuisance of dust contributing to pollution of the environment. The proponent proposes to use bagasse in the Co-gen power plant to generate power for use in the sugar mill. Mitigation measures includes:

- Ensure an enclosed bagasse shed to keep the dust enclosed.
- The company will develop a bagasse handling management plan to manage bagasse supply and demand to the boilers and to ensure bagasse quality is maintained during storage.
- Procure and install adequate dust screens around the bagasse storage area
- Immediately repair leakages in bagasse and bagacillo chutes to reduce dust releases.
- Provide Personal Protective Equipment and training to personnel working directly with bagasse.
- Plant fast growing trees such as casuarina along the boundary wall to act as dust screens and a buffer zone between the facility and the neighbors

- Develop and implement an air quality monitoring plan to ensure compliance with the limits set under the Third Schedule of the Environmental Management and Coordination (Air Quality) Regulations, 2014
- Comply with the provisions of the Environmental Management and Coordination (Air Quality) Regulations, 2014.

7.5.5 Generation of solid waste

Operation activities create solid wastes that need to be disposed. Activities of the project; factory and staff quarters will lead to the production of solid wastes such as used tires, worn out machinery and equipment parts (metal, electronic, plastic components), garage and workshop wastes, office wastes and general domestic wastes including garbage among others.

Such wastes include:

- Bagasse
- Press mud
- Paints, lubricants and petroleum wastes;
- Packaging materials;
- Metal, glass, plastic containers and other unwanted materials; and
- Food remains.

The effects of improperly waste management could be detrimental causing environmental pollution, nuisance to the local communities, and increased vermin among other undesirable effects.

Mitigation measures

- Ensure segregation of waste to promote reuse, recycling, reduction and appropriated disposal strategies
- Metal and plastic waste will be sold to scrap metal dealers for recycling; Scrap metal council guidelines shall be adhered to;
- Waste collection points; skips and bins, shall be positioned in area not susceptible to storm water so that they are not carried by storm water to nearby surface water bodies;
- Adequate litter collection facilities; dirt bins and skips, in all generation areas be provided, have own waste disposal site approved by NEMA,
- Chemical and hazardous wastes should not be burnt or dumped in open pits
- The company through their harvesting supervisors will ensure that canes are tightly loaded to avoid scatter or dropping (littering) when on transit.
- The company will also partner with county government department in charge of waste management to organize periodic cleanup activities to clean the wastes.

- All contracted waste management companies including those collecting waste for reuse/recycling i.e scrap metals, used tires e.t.c must be in compliance with waste management regulation of 2003 and county government laws. This will include having requisite permits, licenses and tracking documents.
- Partner with county government in waste management by providing waste bins and skips

Management option for Bagasse

It is estimated that bagasse contributes to 33.3% residue of the total cane crushed. It has a calorific value of about 1920 kcal/kg and is mainly used as fuel in boilers for steam generation. Excess can be converted into fertilizer upon mixing with press mud. It is also a raw material for production of briquette, paper, boards, animal feeds and ethanol.

Mitigation

- Bagasse will be stored in an area far from other factory activities; more so fire related activities Heaping section will be provided with lining to prevent leachate from percolating down the soil
- Heaping section will be provided with leachate drainage and containment/treatment lagoons / treatment system to ensure the leachate is pre-treated before discharge into the company main waste water treatment plant through pumping/connection via sewer line / exhausting.
- To minimize its amount, the company can sell it out to those reusing it for briquette making and other re-users/ recyclers.
- Bagasse could be a suitable soil conditioner if applied in thin layers and with pH adjustment.

Press Mud: It contains all non-sucrose impurities along with CaCO₃ precipitate and sulphate. Press mud from double sulphitation process contains valuable nutrients like nitrogen, phosphorous, potassium, etc, and therefore used as fertilizer.

Mitigation

- Set out a mechanism for collection and giving to the farmers for use as fertilizer
- Proper waste management will however be taken into consideration and proper dumping done according to the requirements and directions of NEMA.

7.5.6 Energy consumption

The proposed Project will consume fossil fuels to run and heat the machinery, lighting and other operations. Fossil energy is non-renewable and its excessive use may have serious environmental implications on its availability, price and sustainability. Electricity will also be used during the operation of the proposed Project. The consumption of electricity is likely to be on the higher side. Efficient management of energy consumption is therefore required for optimal performance of the Project and to control Project costs.

Mitigation

- Maximize the contribution of daylight to reduce use of artificial lighting in the buildings;
- Select the most efficient lighting system design and minimum lighting level appropriate for the required application;
- Install energy saving appliances;
- Select the most effective lighting controls for optimal operating efficiency and minimum energy wastage.
- Develop an energy management plan.
- Proponent will procure plant machinery and equipment that feature the latest technology to ensure power efficiency
- Supplement electrical supply from the national grid with renewable energy such as solar to power the lighting system in areas such as offices and walkways
- Install compact fluorescent lights in high use areas within the facility
- Create awareness among employees and visitors on energy conservation such as switching off lights when not in use
- Carry out energy audits.

7.5.7 Oil and fuel spills

The machinery to be used in the plant will have moving parts which will require continuous oiling to minimize the usual corrosion or wear and tear. Possibilities of such oils spilling and contaminating the soil on site are real. Likewise, combustion processes would require fuels, which may lead to fuel spills. Irrespective of these possibilities, no significant adverse effects are expected as a result of fuel and oil spills given the scope, nature and duration of time to be taken on the operation of the proposed Project.

Mitigation

- Provide oil spill response kit to aid speedy clean-up in case of spillage
- Train workers on containment and cleaning of oil spills
- Comply with the Used Oil Guidelines, 2017

7.5.8 Occupational health and safety risks

Workers are likely to encounter various occupational risks ranging from physical to biological and chemical hazards at the plant. Occupational health and safety hazards for sugar manufacturing facilities are similar to those of other industrial facilities and recommendations for the management of these issues can be found in the OSHA 2007. In addition, occupational health and safety issues that may be specifically associated with sugar manufacturing operations include the following: Physical hazards, Exposure to dust and biological hazards, Exposure to chemicals (including gases and vapors), Exposure to heat and cold and radiation, Exposure to noise and vibrations.

Mitigation

- Ensure timely renewal of the certificate of registration of a workplace
- Provide adequate and appropriate Personal Protective Equipment (PPEs) to workers and enforce on their use
- Put in place an effective emergency response plan
- Ensure the floor is kept clean and dry always to avoid accidental falls or slips
- Display signage warning of potential hazards at various sections of the plant
- Conduct first aid training among the workers and provide well-stocked first aid kits at different sections in the facility
- Provide and keep an accident/ incident register
- Obtain insurance cover for the workers as per Work Injury Benefits Act (WIBA)
- Comply with the provisions of the Occupational Safety and Health Act, 2007

Managing Exposure to Bagasse dust at Workplace

Exposure to bagasse dust is a potential concern in the bagasse handling area of sugar mills.

Recommended measures to prevent, minimize, and control dust include:

- i. Enclose and ventilate saws, shredders, dusters, and bagasse conveyors;
- ii. Consider enclosed chip storage;
- iii. Avoid use of compressed air to clear dust and waste paper;
- iv. Enclose and ventilate areas where dry, dusty additives are unloaded, weighed, and mixed, or use additives in liquid form;

- v. Regularly inspect and clean dusty areas to minimize dust explosion risk.

Managing accidents due to Confined Spaces

Operation and especially maintenance work may include confined space entry. Examples include: boilers, dryers, degreasers, digesters, blow pits, pipeline pits, process and reaction vessels, tanks, and vats.

Serious injury or fatality can result from inadequate preparation to enter a confined space or in attempting a rescue from a confined space.

Mitigation

- Engineering measures should be implemented to eliminate, to the degree feasible, the existence and adverse character of confined spaces.
- Permit-required confined spaces should be provided with permanent safety measures for venting, monitoring, and rescue operations, to the extent possible. The area adjoining an access to a confined space should provide ample room for emergency and rescue operation

7.5.9 Accidents, injuries and falls

The employees are likely to encounter accidental injuries as a result of the intensive engineering and plant operation activities. Such injuries can result from accidental falls from high elevations, injuries from hand tools and operation equipment cuts from sharp edges of metal sheets among others.

Mitigation

- Display signage warning of potential hazards at various sections of the plant
- Provide adequate and appropriate Personal Protective Equipment (PPEs) to workers and enforce on their use.
- Put in place an effective emergency response plan
- Obtain insurance cover for the workers as per Work Injury Benefits Act (WIBA), 2007
- Comply with the provisions of the Occupational Safety and Health Act, 2007

7.5.10 Increased Traffic

An increase in the number of vehicles within the area is anticipated which may lead to congestion and pose a threat to accidental occurrences.

Mitigation

- There shall be dedicated attendant employed to direct vehicles during peak periods.

- Locating associated facilities such as worker camps close to project sites and arranging worker bus transport to minimizing external traffic.
- Employing safe traffic control measures, including road signs to warn of dangerous conditions.

7.5.11 Noise pollution and vibration

Noise pollution and vibration is likely to occur due to leveling and casting process at the proposed site. Since the proposed Project site is within already constructed commercial and industrial premises, the proposed Project construction will be a potential source of disturbance to the neighbors both week days and weekends. However, since there are noise abatement measures, adverse impacts to the workers and neighboring premises will be controlled.

Mitigation

- Procure and provide adequate earmuffs to employees working at peak noise producing areas and enforce on their use
- Reduce the working hours for employees working at peak noise producing areas compared to those working in other areas
- Use equipment that are properly fitted with noise reduction devices such as mufflers
- Service mechanical equipment regularly to ensure that they are in good condition
- Apply for and obtain license to emit noise/vibrations in excess of permissible levels as per the Fourth Schedule of Noise Regulations, 2009
- Comply with the provisions of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009

7.5.12 Fire Risks and Emergencies

Potential sources include flammable materials, combustion of bagasse in the boiler, juice treatment, clarification process and sugar boiling which is carried out at high temperatures, oil spills, electrical faults or operational negligence among others. Fire occurrence may lead to death, financial losses and loss of livelihoods for the workers and neighbors.

Mitigation

- Develop, clearly display and implement a fire and emergency evacuation procedure
- Procure and provide adequate firefighting equipment such as fire extinguishers, fire hose reels, smoke detectors, fire alarms and fire hydrants and place them strategically within the facility

- Ensure firefighting equipment are serviced regularly by accredited fire service providers
- Train employees on the use of fire-fighting equipment
- Designate a fire assembly point and clearly display emergency exit points at strategic areas within the facility
- Display fire safety and warning signage at appropriate sections of the plant
- Ensure proper handling and storage of flammable materials
- Plant operations should be undertaken by authorized personnel only
- Ensure regular inspection and maintenance of electrical appliances
- Conduct annual fire safety audit and fire drills
- Access to the plant should be controlled to limit exposure to hazards
- Comply with the provisions of the Occupational Safety and Health Act, 2007

7.5.13 Ergonomic effects

The relationship between the working posture and the machinery would affect the workers muscles and joints.

Mitigation

- The machinery should be designed to minimize adverse effects of poor working posture among the workers in the plant.

7.5.14 Vector and rodents breeding grounds – Vulnerability to diseases

If the project does not have well-designed storm water drains, the rainwater may end up stagnating or intruding neighbouring facilities and hence creating conducive breeding areas for mosquitoes and other water-based vectors leading to human diseases like malaria. Poor solid waste management practices may also lead to breeding grounds for pests such as rats and other scavenging animals.

Mitigation

The design of the construction should ensure that no space for stagnant water will be retained.

- The proponent should put in place efficient storm water and waste management systems that will prevent the accumulation of rain water and uncontrolled waste, as well as an efficient collection system and off-site disposal.
- A well-maintained trash collection point should be set aside.

- Proper monitoring of the premise should be effected for maintenance of health and hygiene.

7.5.15 Gender Based violence, Sexual Exploitation and Sexual Harassment

This impact is triggered during Project when the proponent fails to comply with the following provisions.

- (iii) Gender inclusivity requirements in hiring of workers and entire Project Management as required by Gender Policy 2011 and 2/3 gender rule.
- (iv) Failure to protect human risk areas associated with, Disadvantaged groups, interfering with Participation Rights, and interfering with Labour Rights.

Mitigation

- Integrate provisions related to sexual harassment in the employee code of conduct.
- Ensure appointment of human resources personnel to manage reports of sexual harassment according to policy
- The proponent to ensure that gender-based violence at the workplace is not triggered by the Project, including:
 - Effective and on-going engagement and consultation with female workers, particularly with women and also girls at the community.
 - Review of specific project components that are known to heighten GBV risk at the community level, e.g. compensation schemes; employment schemes for women; etc.
 - Management and Coordination: including integration of SEA in job descriptions, employments contracts, performance appraisal systems, etc.; development of contract policies related to SEA, including whistle blower protection and investigation and disciplinary procedures; training for all project management; management of coordination mechanism for case oversight, investigations and disciplinary procedures; supervision of dedicated PSEA focal points in the project and trained community liaison officers.
 - Engagement with the community: including development of confidential community-based complaints mechanisms discrete from the standard GRM; mainstreaming of SEA awareness-raising in all community engagement activities; community-level IEC materials; regular community outreach to women and girls about social risks and their SEA-related rights;

7.5.16 Minimization of transmission of HIV/AIDs

There is always a concern of moral decay in the society that would arise from sexual relationships between residents and new workers leading to cases of increased transmission of HIV/AIDs and STDs. These will be achieved through

- Sensitization of the workers to adhere to work ethics and awareness creation at the community level on safe sex.
- Collaborating with other entities to put up a VCT centers near Muwariziki Sugar Factory

7.5.17 Security of the Premises

24 hours security should be provided within the premises and at the entrance to the facility by:

- i. Installation of an entrance and exit security check. This requires a proper gate and gate house, and security system to check those entering and exiting;
- ii. Procedures to leave items such as cigarettes, matchsticks, lighters, mobile phones, etc at the gate as a security measure to be put in place
- iii. Well trained security officers from a reputable company to patrol the grounds
- iv. The company should install an internal surveillance system that will monitor the plant at all times

7.6 Positive impacts during decommissioning phase

The following positive impacts are associated with the proposed Project during the decommissioning phase:

7.6.1 Rehabilitation

Upon decommissioning of the proposed Project, rehabilitation of the Project site will be carried out to restore the site to its original status or to a better state than it was originally. This will include replacement of topsoil and re-vegetation which will lead to improved visual quality of the area.

7.6.2 Employment opportunities

For demolition to take place properly and in good time, several people will be involved. As a result, several employment opportunities will be created for the demolition staff during the decommissioning phase of the proposed Project.

7.7 Negative impacts during decommissioning phase

The following three negative impacts discussed below, are associated with the proposed Project during its decommissioning phase.

7.7.1 Noise and vibration

The demolition works will lead to significant deterioration of the acoustic environment within the Project site and the surrounding areas. This will be as a result of the noise and vibration that will be experienced as a result of demolishing the proposed Project.

Mitigation measures

- Excessive noise and vibration can be reduced if the following will be observed;
- Switching of vehicles and machines when not in use;
- Avoiding unnecessary hooting, insulate noisy machines and activities during operation to minimize noise impact to neighboring communities;
- Workers to be provided with personal protection equipment, machines and equipment to be fitted with silencer devices where possible;
- Warnings to be issued to the locals in case of any unusual noise;
- The noisy activities should be restricted to daytime;
- The project proponent will ensure that NEMA noise and Vibration standards are observed in all project activities presented in baseline conditions

7.7.2 Solid waste generation

Demolition of the proposed Project and related infrastructure will result in large quantities of solid waste. The waste will contain the materials used in construction including concrete, metal, drywall, wood, glass, paints, adhesives, sealants and fasteners. Although demolition waste is generally considered as less harmful to the environment since they are composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment. In addition, even the generally non-toxic chemicals such as chloride, sodium, sulphate and ammonia which may be released as a result of leaching of demolition waste, are known to lead to degradation of groundwater quality.

Mitigation measures

- Proper disposal of wastes generated at decommissioning phase.
- Recycling and re-use of waste where possible.

7.7.3 Occupational health and safety impacts

During decommissioning phase, risks of accidents and ill health as a result of demolition activities are likely to take place. Demolition workers, neighboring premises are also likely to be affected by the dust generated and other fumes generated by the demolition machines.

Mitigation measures

- Ensure safety of the workers by putting first aid area and injury reporting mechanism
- Establish the appropriate safety measures in the O & M manual for the decommissioning phases.
- Ensure safety of residents by providing safety signs at strategic places around the access roads.
- Ensure compliance to Occupational Safety and Health Act Cap. 514 and its Subsidiary Legislations
- Provide personal protective equipment to workers
- There should be adequate provision of the requisite sanitation facilities for human waste disposal
- The workers should receive the requisite training especially on the operation of the machinery and equipment.
- Provide clean drinking water for the employees.
- Develop a site safety action plan detailing safety equipment to be used, emergency procedures, restriction on site, frequency and personnel responsible for safety inspections and controls.
- Recording of all injuries that occur on site in the incident register, corrective actions for their prevention are instigated as appropriate.
- Provision of prevention tools such as condoms at the health center and construction site availed to all

7.7.4 Impact on air quality

Potential impacts on the air quality during decommissioning phase will be due to exhaust and dust emissions generated in and around the construction site by the construction equipment. Motor vehicles used to carry demolished materials would cause a potentially significant air quality impact by emitting pollutants through exhaust emissions.

Mitigation;

- Watering of surfaces during decommissioning activities
- Ensuring that air quality standards highlighted in the baseline are adhered to

CHAPTER EIGHT

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

8.1 Significance of an ESMP

As a requirement in the Environmental Management and Coordination Act (EMCA), 1999 the report should provide for a detailed ESMP. This Chapter therefore complies with the requirements of EMCA, 1999 and Environmental (Impact Assessment and Audit) Regulations, 2003 and takes into consideration the applicable local and international standards and best practices.

It should be noted that there is no universally accepted standard format for ESMPs. However, the format needs to fit the circumstances in which the ESMP is being developed and the requirements which it is designed to meet. The ESMPs should contain the following which are in line with the NEMA requirements:

- **Summary of impacts:** The predicted negative environmental and social impacts for which mitigation is required should be summarized;
- **Description of mitigation measures:** The ESMP identifies feasible and cost-effective mitigation measures to reduce significant negative environmental impacts to acceptable and legal levels;
- **Description of monitoring programme:** Environmental performance monitoring should be designed to ensure that mitigation measures are implemented. The monitoring programme should clearly indicate the linkages between impacts, indicators to be measured, measurement methods and definition of thresholds that will signal the need for corrective actions;
- **Institutional arrangements:** Responsibilities for mitigation and monitoring actions should be clearly defined;
- **Legal enforceability:** The key legal considerations with respect to ESMPs are:
 - ❖ Legal framework for environmental protection; and
 - ❖ Legal basis for mitigation.
- **Implementation schedule and reporting procedures:** The timing, frequency, and duration of mitigation measures should be specified; and

- **Cost estimates:** Costs should be calculated for both the initial investment and recurring expenses for implementing the mitigation measures.

The benefits of including the ESMP as part of the ESIA are:

- Encouraging applicants to be more systematic and explicit in the design and development of mitigation measures and the intended means of implementation;
- Encouraging authorities to check the practicality and likelihood of implementation of mitigation and monitoring measures;
- Ensuring that the mitigation measures are properly incorporated into the project design and contract documentation after authorization is granted;
- Encouraging the project proponent to meet the requirements of the ESMP which now form the basis for the conditions attached to authorization of the project; and
- Forcing the project proponent to internalize environmental impacts that would otherwise become a social cost.

The EMPs presented in this Chapter therefore summarizes the key impact elements identified and the remedial measures, the actions to be taken by various parties and the monitoring activities. An indication of the time scale for implementation and cost involved is also provided. The ESMP tables can be further expanded with documented procedures and guidelines for work practices so as to be as responsive to the situations that various contract parties will encounter. The parties should formulate procedures and practices and maintain records as required by EMCA.

The implementation of the ESMP should be done within the provisions of the law and for the ultimate benefit of the stakeholders in the Project area. The effectiveness of the ESMP shall be monitored and assessed during spot checks, formal inspections and at the end of the Project when an overall audit of the works shall be carried out.

8.2 Types of environmental and social management plans

There are three broad categories of ESMPs in the project lifecycle: The construction ESMP, the operation ESMP and the decommissioning ESMP.

The objectives of these ESMPs are all the same, namely to:

- Identify the possible environmental impacts of the proposed activity; and

- Develop measures to minimize, mitigate and manage these impacts.

The difference between these ESMPs is related to the difference in mitigation actions required for the

A construction environmental and social management plan is a practical and different stages of the project cycle.

8.2.1 Construction Environmental and Social Management Plan

Achievable plan of management to ensure that any environmental impact during construction phase is minimized. Construction environmental management plan provides specific environmental guidance for the implementation and construction phase of a project. It is intended to enable the management and mitigation of construction activities so that environmental impacts are avoided or reduced. These impacts range from those incurred during start up to construction activities. Table 14 below shows the construction environmental management plan for the Muwariziki Sugar Factory.

Table 14: Environmental and Social management plan during construction phase

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
Minimize extraction site impacts and ensure efficient use of raw materials in construction					
Demand for raw material	<ul style="list-style-type: none"> Building materials such as sand ballast, hard core are extracted from registered quarry and sand mining firms whose facilities have undergone satisfactory environmental impact assessment/audit and received NEMA approval. 	Contractor	Inspection	Throughout construction period	100,000 for compliance Materials as per the market price and contractor BQ
	<ul style="list-style-type: none"> Source building materials from local suppliers who use environmentally friendly processes in their operations. 	Project Manager and Contractor	Inspection and Observation	Throughout construction period	No added cost
	<ul style="list-style-type: none"> Ensure accurate budgeting and estimation of actual construction material requirements to ensure that the least amount of material necessary is ordered. 	Project Manager and Contractor	Inspection and Calculation	Throughout construction period	No added cost
	<ul style="list-style-type: none"> Ensure that damage or loss of materials at the construction site is kept minimal through proper storage. 	Project Manager and Contractor	Observation	Throughout construction period	80,000

	<ul style="list-style-type: none"> Consider reuse of building materials and use of recycled building materials. 	Proponent	Observation	Throughout construction period	-
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Minimization of construction traffic

Minimization of local increase in construction traffic	<ul style="list-style-type: none"> Construction vehicles should enter and leave the site at appropriate times. 	Contractor	Observation and Inspection	Throughout construction period	50,000 (to label the site)
	<ul style="list-style-type: none"> Using signs and barriers the Contractor will direct vehicles and pedestrian traffic as needed around the construction site. 	Contractor	Observation and Inspection	Throughout construction period	100,000
	<ul style="list-style-type: none"> Some activities may be scheduled in off-peak traffic times to minimize impacts. 	Contractor	Inspection	Throughout construction period	-

Minimize solid waste generation and ensure efficient solid waste management during construction

Increased solid waste generation	Use of an integrated solid waste management system i.e. through a hierarchy of options: <ol style="list-style-type: none"> 1. Source reduction; 2. Recycling; 3. Reuse; and 4. Land filling. 	Project Manager and Contractor	Observation	Throughout construction period	500,000
	<ul style="list-style-type: none"> • Order materials in the sizes and quantities they will be needed, rather than cutting them to size, or having large quantities of residual materials. 	Project Manager and Contractor	Inspection and Observation	One-off	-

	<ul style="list-style-type: none"> • Damaged or wasted construction materials to be recovered for refurbishing and used in other projects. 	Project Manager and Contractor	Observation	One-off	No added cost
	<ul style="list-style-type: none"> • Use of durable, long-lasting materials to reduce the amount of construction waste generated over time. 	Project Manager and Contractor	Inspection	Throughout construction period	No added cost
	<ul style="list-style-type: none"> • Provide facilities for proper handling and storage of construction materials. 	Project Manager and Contractor	Inspection and Observation	One-off	50,000
	<ul style="list-style-type: none"> • Use building materials that have minimal or no packaging. 	Project Manager and Contractor	Inspection and Observation	Throughout construction period	No added cost

	<ul style="list-style-type: none"> Use construction materials containing recycled content where possible and in accordance with accepted standards. 	Project Manager and Contractor	Inspection	Throughout construction period	-
	<ul style="list-style-type: none"> Reuse packaging materials such as cartons, cement bags, empty metal and plastic containers. 	Project Manager, and Contractor	Observation	Throughout construction period	-
	<ul style="list-style-type: none"> Dispose waste more responsibly by dumping at designated dumping sites or landfills only. 	Project Manager, and Contractor	Inspection and Observation	Throughout construction period	20,000/month
	<ul style="list-style-type: none"> Waste collection bins to be provided at designated points on site. 	Project Manager, and Contractor	Observation	Throughout construction period	120,000

Minimize impacts on air quality					
Dust emission	<ul style="list-style-type: none"> Downwash of trucks (especially tyres) prior to departure from site. 	Contractor	Observation and Inspection	Throughout construction period	To be determined
	<ul style="list-style-type: none"> Cover stockpiles of sand, soil and similar materials or surround them with wind breaks. 	Contractor	Inspection and Observation	Throughout construction period	No added cost
	<ul style="list-style-type: none"> Cover trucks hauling dirt and debris to reduce spillage on to paved roads surface or have adequate free board to prevent spillage. 	Contractor	Inspection and Observation	Throughout construction period	No added cost

	<ul style="list-style-type: none"> Post signs that limit vehicles speed onto unpaved roads and over disturbed soils. 	Contractor	Inspection	One-off	5,000
	<ul style="list-style-type: none"> Rapid onsite construction so as to reduce duration of traffic interference and therefore reduce emissions from traffic delays. 	Contractor	Inspection	Throughout construction period	-
	<ul style="list-style-type: none"> Ensure strict enforcement of on-site speed limit regulations. 	Project Manager and Contractor	Observation	Construction period	No added cost
	<ul style="list-style-type: none"> Avoid excavation works in extremely dry weathers. 	Project Manager and Contractor	Inspection and Observation	Throughout construction period	-
	<ul style="list-style-type: none"> Sprinkle water on access routes when necessary to reduce dust generation by construction vehicles. 	Project Manager and Contractor	Inspection and Observation	Throughout construction period	60,000 per month

	<ul style="list-style-type: none"> Provide Personal protective equipment. PPEs to be worn. 	Contractor	Observation	Throughout construction period	130,000
Exhaust emission	<ul style="list-style-type: none"> The engine size of the construction equipment shall be the minimum practical size. 	Contractor	Inspection	One-off	-
	<ul style="list-style-type: none"> Construction equipment operating simultaneously to be minimized through efficient management practices. 	Contractor	Inspection and Observation	Throughout construction period	No added cost

	<ul style="list-style-type: none"> Construction equipment to be maintained properly tuned and maintained as per the manufacturer's specifications. 	Contractor	Inspection	One-off	To be determined
	<ul style="list-style-type: none"> Vehicle idling time shall be minimized. 	Project Manager and Contractor	Observation	Construction period	No added cost
	<ul style="list-style-type: none"> Alternatively fueled construction equipment shall be used where feasible equipment shall be properly tuned and maintained. 	Project Manager and Contractor	Inspection	Throughout construction period	300,000
	<ul style="list-style-type: none"> Sensitize truck drivers to avoid unnecessary racing of vehicle engines at loading/offloading points and parking areas, and to switch off or keep vehicle engines at these points. 	Project Manager and Contractor	Meeting	Throughout construction period	-
Minimization of noise and vibration					
Noise and vibration	<ul style="list-style-type: none"> Install portable barriers to shield compressors and other small stationery equipment where necessary. 	Contractor	Inspection	One-off	50,000
	<ul style="list-style-type: none"> Prescribe noise reduction measures if appropriate e.g. restricted working hours, transport hours and noise buffering. 	Contractor	Inspection and Observation	One-off	-
	<ul style="list-style-type: none"> Consult with the surrounding community on the permissible noise levels and best working hours. 	Contractor and Proponent	Meeting	One-off	50,000

	<ul style="list-style-type: none"> Use quiet equipment (i.e. equipment designed with noise control elements). 	Contractor	Inspection	Throughout construction period	100,000
	<ul style="list-style-type: none"> Provide workers with earmuffs and sensitize them on their use 	Contractor and Proponent	Meeting	One-off	150,000
	<ul style="list-style-type: none"> Sensitize construction vehicle drivers and machinery operators to switch off engines of vehicles or machinery not being used. 	Project Manager and Contractor	Meeting	Throughout construction period	-
	<ul style="list-style-type: none"> Sensitize construction drivers to avoid gunning of vehicle engines or hooting especially when passing through sensitive areas such as churches, offices, hospitals, residential houses and schools. 	Project Manager and Contractor	Meeting	Throughout construction period	-
	<ul style="list-style-type: none"> Ensure that construction machinery is kept in serviced and maintained in good condition to reduce noise generation. 	Project Manager and Contractor	Inspection	Throughout construction period	55,000
	<ul style="list-style-type: none"> The noisy construction works will be planned to be during the day only. 	Project Manager and all site foreman	Observation	Throughout construction period	No added cost

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
Minimization of energy consumption					

Increased energy consumption	<ul style="list-style-type: none"> Ensure electrical equipment and appliances are switched off when not being used. 	Contractor	Inspection and Observation	Throughout construction period	No added cost
	<ul style="list-style-type: none"> Install energy saving fluorescent tubes and bulbs at all lighting points instead of bulbs which consume higher electric energy. 	Contractor	Observation	Throughout construction period	35,000
	<ul style="list-style-type: none"> Ensure planning of transportation of materials to ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts. 	Contractor	Inspection and Observation	Throughout construction period	No added cost
	<ul style="list-style-type: none"> Development of energy management plan. 	Contractor	Inspection	One-off	To be determined
	<ul style="list-style-type: none"> Monitor energy use during construction and set targets for reduction of energy use. 	Contractor	Inspection	Throughout construction period	5,000
Minimize water consumption and ensure more efficient and safe water use					
Increased water demand	<ul style="list-style-type: none"> Harvest rainwater. 	Contractor	Observation	Throughout construction period	15,000
	<ul style="list-style-type: none"> Install water conserving taps. 	Contractor	Observation	One-off	120,000

	<ul style="list-style-type: none"> Promote recycling and reuse of water as much as possible. 	Contractor	Inspection	Throughout construction period	No added cost
	<ul style="list-style-type: none"> Install a discharge meter to determine and monitor total water usage. 	Project Manager and Contractor	Inspection	One-off	10,000
	<ul style="list-style-type: none"> Promptly detect and repair of water pipe and tank leaks. 	Contractor	Inspection and Observation	Throughout construction period	50,000
	<ul style="list-style-type: none"> Sensitize construction workers to conserve water. 	Contractor	Meeting	Throughout construction period	No added cost
Reduce storm-water from new impervious areas					
	<ul style="list-style-type: none"> Surface runoff and roof water shall be harvested and stored for reuse. 	Proponent	Inspection and Observation	During rainy season	-
	<ul style="list-style-type: none"> Apply soil erosion control measures such as levelling of the project site to reduce run-off velocity and increase infiltration of storm 	Proponent	Inspection	One-off	100,000
	<ul style="list-style-type: none"> Design a storm water management plan that minimizes impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structure. 	Contractor	Inspection	One-off	To be determined
Minimization of oil spills					

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
Oil Spills	<ul style="list-style-type: none"> • A designated garage section of the site fitted with oil trapping equipment to be planned for changes. 	Contractor	Inspection	Throughout construction period	To be determined
	<ul style="list-style-type: none"> • Prompt cleaning of oil and fuel spills. 	Contractor	Inspection and Observation	When there is oil spills	200,000
	<ul style="list-style-type: none"> • Proper disposal of clothing or rags contaminated with oil. 	Contractor	Inspection and Observation	Periodically	50,000
Minimize occupational health and safety risks					
Registration of the premises	<ul style="list-style-type: none"> • Registration of the Project as per Section 43 and 44 of the Occupational Safety and Health Act, 2007. 	Developer	Observation	One-off	To be determined
General register	<ul style="list-style-type: none"> • A general register should be kept within the facility as stipulated in Section 122 and 123 of the Occupational Safety and Health Act, 2007. 	Project Manager and Contractor	Inspection	One-off	2,000

Incidents, accidents and dangerous occurrences.	<ul style="list-style-type: none"> • Ensure that provisions for reporting incidents, accidents and dangerous occurrences during construction using prescribed forms obtainable from the local Occupational Health and Safety Office (OHSO) are in place. • Reporting should also be as stated in Section 21 of the Occupational Safety and Health Act, 2007. 	Contractor	Inspection	Throughout construction phase	-
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	<ul style="list-style-type: none"> • Enforcing safety procedures and preparing contingency plan for accident response in addition safety training shall be emphasized. 	Contractor	Meeting	Throughout construction period	50,000
Safety, health and environment (SHE) policy	<ul style="list-style-type: none"> • Develop, document and display prominently an appropriate SHE policy for construction works. 	Developer and Contractor	Observation	One-off	75,000
Health and safety committee	<ul style="list-style-type: none"> • Provisions must be put in place for the formation of a Health and Safety Committee, in which the employer and the workers are represented as per Section 9 of the • Occupational Safety and Health Act, 2007. 	Contractor and Developer	Inspection and Meeting	One-off	-
Sanitary conveniences	<ul style="list-style-type: none"> • Suitable, efficient, clean, well-lit and adequate sanitary conveniences should be provided for construction workers as per Section 52 of the • Occupational Safety and Health Act, 2007. 	Contractor	Inspection and Observation	One-off	40,000

Machinery/equipment safety	<ul style="list-style-type: none"> Ensure that machinery, equipment, personal protective equipment, appliances and hand tools comply with the prescribed safety and health standards and be appropriately installed maintained and safeguarded as indicated in Part VII of the Occupational Safety and Health Act, 2007. 	Contractor	Inspection and Observation	One-off	No added cost
	<ul style="list-style-type: none"> Ensure that equipment and work tasks are adapted to fit workers and their ability including protection against mental strain. 	Contractor	Inspection	Throughout construction period	120,000
	<ul style="list-style-type: none"> All machines and other moving parts of equipment must be enclosed or guarded to protect all workers from injury as stated in Section 56 of the Occupational Safety and Health Act, 2007. 	Contractor	Inspection and Observation	One-off	40,000
	<ul style="list-style-type: none"> Arrangements must be in place to train and supervise inexperienced workers regarding construction machinery use and other procedures/operations 	Contractor	Meeting	Throughout construction period.	40,000
	<ul style="list-style-type: none"> Equipment such as fire extinguishers must be examined by a government authorised person as indicated in Section 72 of the Occupational Safety and Health Act, 2007. The equipment may only be used if a certificate of examination has been issued. 	Contractor	Inspection and Observation	Once every 6 months	5,000 per examination

	<ul style="list-style-type: none"> • Reports of such examinations must be presented in prescribed forms, signed by the examiner and attached to the general register. 	Contractor	inspection	Throughout construction period	
Storage of materials	<ul style="list-style-type: none"> • Ensure that materials are stored or stacked in such manner as to ensure their stability and prevent any fall or collapse. 	Contractor	Inspection and Observation	Throughout construction period	-
	<ul style="list-style-type: none"> • Ensure that items are not stored/ stacked against weak walls and partitions. 	Contractor	Inspection and Observation	Throughout Construction period	-
Safe means of access and safe place of employment	<ul style="list-style-type: none"> • All floors, steps, stairs and passages of the rooms must be of sound construction and properly maintained. 	Contractor	Observation and Inspection	One-off	To be determined
	<ul style="list-style-type: none"> • Securely fence or cover all openings in floors. 	Contractor	Observation	One-off	To be determined
	<ul style="list-style-type: none"> • All ladders used in construction works must be of good construction and sound material of adequate strength and be properly maintained as indicated in Section 77 of the Occupational Safety and Health Act, 2007. 	Contractor	Inspection and Observation	One-off	-
Emergency preparedness and	<ul style="list-style-type: none"> • Design suitable documented emergency preparedness and evacuation procedures to be used during any emergency. 	Contractor	Inspection and Observation	One-off	-

evacuation procedures	<ul style="list-style-type: none"> Such procedures must be tested at regular intervals. 	Project Manager and Contractor	Inspection	Every 3 months	No added cost
	<ul style="list-style-type: none"> Ensure that adequate provisions are in place to immediately stop any operations where there is an emergency. 	Project Manager and Contractor	Inspection and Observation	One-off	-
	<ul style="list-style-type: none"> Provide measures to deal with emergencies and accidents including adequate first aid arrangements. 	Contractor	Meeting, Inspection and Observation	Throughout construction period	120,000
First Aid	<ul style="list-style-type: none"> Well stocked first aid box which is easily available and accessible should be provided within the premises as stated in Section 95 of the Occupational Safety and Health Act, 2007. 	Contractor	Inspection	One-off	15,000
	<ul style="list-style-type: none"> Provision must be made for persons to be trained in first aid, with a certificate issued by a recognized body. 	Contractor	Inspection and Observation	One-off	300,000
Fire protection	<ul style="list-style-type: none"> Firefighting equipment such as fire extinguishers and hydrant systems should be provided at strategic locations. 	Contractor	Inspection and Observation	One-off	To be determined
	<ul style="list-style-type: none"> Regular inspection and servicing of the equipment must be undertaken and records of such inspections maintained. 	Contractor	Inspection	Every 6 months	5,000

	<ul style="list-style-type: none"> • Signs such as “NO SMOKING” must be prominently displayed within the construction site. 	Contractor	Inspection and Observation	One-off	1,000
Ventilation	<ul style="list-style-type: none"> • Enough space must be provided within the premises to allow for adequate natural ventilation through circulation of fresh air. 	Project Manager and Contractor	Inspection and Observation	One-off	No added cost
Lighting	<ul style="list-style-type: none"> • There must be adequate provision for artificial or natural lighting in all parts of the rooms in which persons are working or passing. 	Project Manager and Contractor	Inspection and Observation	One-off	-
Electrical Safety	<ul style="list-style-type: none"> • Distribution board switches must be clearly marked to indicate respective circuits and pumps. 	Project Manager and Contractor	Inspection and Observation	One-off	-

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
	<ul style="list-style-type: none"> • There should be no live exposed connections. 	Project Manager and Contractor	Inspection and Observation	Throughout construction period	-
	<ul style="list-style-type: none"> • Electrical fittings near all potential sources of ignition should be flame proof. 	Project Manager and Contractor	Inspection and Observation	One-off	No added cost
	<ul style="list-style-type: none"> • All electrical equipment must be earthed 	Project Manager and Contractor	Inspection	One-off	No added cost

Chemical Safety	<ul style="list-style-type: none"> Collection, recycle and dispose chemical wastes, obsolete chemicals and empty chemical containers as per the Environmental Management and Coordination (Waste Management) Regulations, 2006. 	Contractor	Inspection and Observation	One-off	To be determined
	<ul style="list-style-type: none"> Ensure that all chemicals used in construction are appropriately labelled or marked and that material safety data sheets are available. 	Contractor	Inspection and Observation	One-off	-
	<ul style="list-style-type: none"> Keep a record of all hazardous chemicals used at the premises, cross-referenced to the appropriate chemical safety data sheets. 	Contractor	Inspection and Observation	Throughout construction period	-
	<ul style="list-style-type: none"> There should be no eating or drinking in areas where chemicals are stored or used. 	Contractor	Inspection and Observation	Throughout construction period	No added cost
	<ul style="list-style-type: none"> Provide workers in areas with elevated noise and vibration levels, with suitable ear protection equipment such as ear masks. 	Contractor	Inspection and Observation	One-off	To be determined

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
Supply of clean drinking water	<ul style="list-style-type: none"> Ensure that construction workers are provided with an adequate supply of wholesome drinking water. 	Contractor	Inspection and Observation	One-off	10,000/month

Washing facilities	<ul style="list-style-type: none"> • Ensure that conveniently accessible, clean, orderly, adequate and suitable washing facilities are provided and maintained within the site. 	Contractor	Inspection and Observation	One-off	90,000
Ergonomics	<ul style="list-style-type: none"> • Provision for repairing and maintaining of hand tools must be in place. 	Contractor	Inspection and Observation	One-off	85,000
	<ul style="list-style-type: none"> • Hand tools must be of appropriate size and shape for easy and safe use. 	Contractor	Inspection and Observation	One-off	-
	<ul style="list-style-type: none"> • Height of equipment, controls or work surfaces should be positioned to reduce bending posture for standing. 	Project Manager and Contractor	Inspection	One-off	-
Ensure the general safety and security of the proposed Project and surrounding areas					
Safety and security	<ul style="list-style-type: none"> • Ensure the general safety and security at all times by providing day and night security and adequate lighting within and around the construction site. 	Developer and Contractor	Observation	Throughout construction period	10,000/month
Labor risks including labor influx	<ul style="list-style-type: none"> • Local community members will be given priority in employment opportunities, in casual and unskilled labour. • Train the community on the project requirements and product. 	Contractor	Register of workers engaged in the project.	Throughout construction period	-

<p>Spread of COVID-19 amongst workers</p>	<ul style="list-style-type: none"> • The Contractor will develop a SOPs for managing the spread of Covid-19. The SOPs shall be in line with the Ministry of Health directives on COVID-19 prevention, and site-specific project conditions • Install handwashing facilities with adequate running water and soap, or sanitizing facilities at entrance to work sites including consultation venues and meetings and ensure they are used. 	<p>Developer and Contractor</p>	<p>Occurrence Registers</p>	<p>Throughout construction period</p>	<p>100,000</p>
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8.2.2 Operational phase ESMP

An operational environmental management plan provides specific guidance related to the operational activities associated with a particular project. It is focused on sound environmental management practices that will be undertaken to minimize adverse impacts on the environment through normal operation of a facility. The operational management plan further identifies what measures should be taken in the event of emergencies or incidents during the operation of the proposed Project. The roles and responsibilities for mitigation, monitoring and performance assessment for the operational life of the development are specified in the EMP. Table 15 below shows the operation phase of the proposed Muwariziki Sugar Factory.

Table 15: Environmental and Social management plan for the operational phase

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party		Monitoring Means	Time Frame	Cost (Ksh)
Minimization of solid waste generation and ensuring more efficient solid waste management						
Solid waste generation	Use of an integrated solid waste management system i.e. through a hierarchy of options: <ul style="list-style-type: none"> • Source reduction; • Recycling; • reuse; • Combustion; and • Sanitary land filling. 	Contracted Private Solid Waste Management Company		Inspection and Observation	Throughout operational phase	500,000
	<ul style="list-style-type: none"> • Provide solid handling waste facilities/cubicles. 	Proponent		Observation	One-off	250,000

	<ul style="list-style-type: none"> Ensure that solid wastes generated at the proposed Muwariziki Sugar factory are regularly disposed of appropriately at authorized dumping sites. 	Proponent/Contracted Private Solid Waste Management Company	Inspection	monthly	100,000
Discharge of solid wastes; bagasse, sediments from various tanks/plants and distillery effluent, boiler ash	<ul style="list-style-type: none"> Use of bagasse as fuel in boilers for steam and power production; making mechanical paper, drying of sediments for use as fertilizers 	Factory manager	Input and output of various materials in production process.	Through out	-
Minimize energy consumption					
High demand for energy	<ul style="list-style-type: none"> Select the most efficient lighting system design and minimum lighting level appropriate for the required application in various rooms. 	Proponent	Inspection	One-off	300,000
	<ul style="list-style-type: none"> Adopt the most effective lighting programmable time switches. 	Proponent	Inspection	One-off	No added cost
	<ul style="list-style-type: none"> Maximize the contribution of daylight to reduce the use of artificial lighting. 	operators	Observation and Inspection	Throughout operation period	No added cost
	<ul style="list-style-type: none"> Switch off electrical equipment, appliances and lights when not being used. 	operators	Inspection and Observation	Throughout operation phase	-

	<ul style="list-style-type: none"> Install occupation sensing lighting at various locations such as storage areas which are not in use all the time. 	Proponent	Observation	One-off	10-40 % higher than ordinary lighting
	<ul style="list-style-type: none"> Install energy saving fluorescent tubes and bulbs at all lighting points within the apartments instead of bulbs which consume higher electric energy. 	Proponent	Observation	One-off	200,000

	<ul style="list-style-type: none"> Monitor energy use during the operation of the Project and set targets for efficient energy use. 	operators	Observation	monthly	50,000
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Storm water management

Increased storm water flow	<ul style="list-style-type: none"> -Provision of slit traps in drains -Good housekeeping to avoid contamination of storm water. Regular inspection and cleaning of storm drains. 	Proponent	Inspection	One-off	200,000
		Operators/employees	Inspection	monthly	500,000
		operators	Inspection	monthly	50,000

Minimize water consumption and ensure more efficient and safe water use

High water demand	<ul style="list-style-type: none"> Reduce toilet cistern in single flash models. 	Proponent	Inspection	One-off	No added cost
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	<ul style="list-style-type: none"> Sweep with a broom and pan where possible, rather than hose down external areas. 	operators	Inspection	Throughout operation phase	No added cost
	<ul style="list-style-type: none"> Quick fixing of leaking pipes and toilet cistern. 	Proponent	Inspection and Observation	Once broken and monthly	50,000
	<ul style="list-style-type: none"> Reduce water delivery in taps, through the installation of low flow devices or aerators on taps. 	Proponent	Inspection and Observation	One-off	-

	<ul style="list-style-type: none"> Install a manually pressed button flush valve which stops on release of button. 	Proponent	Inspection	One-off	10-40% higher than ordinary taps
	<ul style="list-style-type: none"> Install a discharge meter at water outlets to determine and monitor total water usage. 	Proponent	Inspection and Observation	One-off	500,000
	<ul style="list-style-type: none"> Promote awareness on water conservation and reducing water wastage. 	Proponent	Meeting	Throughout operation phase	To be determined
	<ul style="list-style-type: none"> Consider water efficient plumbing fixtures to save water and energy. 	Proponent	Inspection	One-off	To be determined

Management of waste water and disposal

Sewage treatment and Effluent disposal	<ul style="list-style-type: none"> Monitor the efficiency of the effluent treatment plant to ensure that the sewage released from the facility do not pollute the environment and affect the general public during operation of the proposed Project. 	Proponent	Inspection and Observation	monthly	200,000
	<ul style="list-style-type: none"> Waste water treatment at Effluent Treatment Plant Ensure constant monitoring of the quality of the treated water to ensure it meets water quality standards of NEMA 				
	<ul style="list-style-type: none"> Conduct quarterly sampling and effluent analysis and apply for Effluent Discharge License from NEMA 	Proponent	Analysis results EDL Licence	Quarterly and annually	150,000
Discharge of waste oil	<ul style="list-style-type: none"> Minimization of oil spillage, burning of waste oil in boilers, installation of waste oil separator 	Factory manager	Receipts of waste oil separator, reports of waste oil collected	Monthly	100,000
Ensure the general safety and security of the proposed Project and surrounding areas					
Increased general safety and security impacts	<ul style="list-style-type: none"> Ensure the general safety and security at all times by providing day and night security and adequate lighting within and around the proposed Muwariziki Sugar Factory. 	Proponent	Inspection and Observation	Throughout operation phase	To be determined

Minimization of occupational health and safety impacts					
Increased occupational health and Safety Risks	<ul style="list-style-type: none"> • Ensure the general safety and security at all times 	Health and Safety Manager	Inspection, Meeting and Observation	Throughout operation phase	To be determined
	<ul style="list-style-type: none"> • Provide PPEs to all workers, establish and mark all emergency exits and provide a first aid kit. • Enforce use of PPE Adhere to Factory Act rules • Adhere to OSHA 2007 • Activate WIBA provisions • Ensure workers are trained in ESH 	Project manager	Observation Records of distributed equipment Accident records	monthly	200,000
Traffic Increase	<ul style="list-style-type: none"> • Ensuring clear roads without vegetation to obstruct view ahead • Install signs • Improve on the class of road • Regular maintenance and grading • Ensure the road is regularly watered to reduce dust 	Proponent and County Roads Engineer	Observation	Regularly	Tendered sum
Fire Safety	<ul style="list-style-type: none"> • Smoke detectors installed Install fire extinguishers at strategic points • Engage services of a safety officer 	Project Manager	Detectors Firefighting equipment installed	Monthly	100,000

			Safety officer on board		
Security	<ul style="list-style-type: none"> Fencing off the project site and limiting movement and attraction of unwanted characters. Ensure the sugar mill surrounding is fully lit during the night 	Site manager	Fence and restricted entry Strict monitoring on movement of personnel and materials to and from site	monthly	80,000
Minimization of air emissions impacts					
Increased air emissions	<ul style="list-style-type: none"> Use and monitor the efficiency of the equipment in trapping and neutralizing air emissions Use appropriate fuels in boilers 	Health and Safety Manager	Inspection, Meeting and Observation	Throughout operation phase	100,000 quarterly
	<ul style="list-style-type: none"> Monitor stack emissions by conducting routine air quality sampling for analysis to comply with the set standards. 	Health and Safety Manager	Analysis reports	Quarterly	200,000
	<ul style="list-style-type: none"> Install wet scrubbers 	Project manager	Monitoring reports	Once-off	Provided with equipment
Discharge of waste heat	<ul style="list-style-type: none"> Use spray ponds for increased ambient temperatures and increased river water temperatures 	Factory manager	Daily report of volumes pumped	400,000	

Air Discharge from flue duct/distillery	<ul style="list-style-type: none"> • Install wet scrubbers for flue duct and carbon dioxide scrubber for distillery 	Production manager/Chief chemists	Daily check for optimal performance	Once off then continuous monitoring	3000000
Risk of social conflict	<ul style="list-style-type: none"> • Develop and implement local hiring rules in consultation and partnership with the local community. 	<ul style="list-style-type: none"> • Human Resource manager 	<ul style="list-style-type: none"> • Minutes • Reports Attendance registers 	During Hiring	-
Increased risk of illicit behavior and crime	<ul style="list-style-type: none"> • Involve local administration and other social groups like the church in social mediation and moderation, • Establish a grievance redress mechanism where all conflicts related to the project are addressed 	<ul style="list-style-type: none"> • Human Resource manager • Village elders and local administration 	Incident Register GRMs policy	Throughout operation phase	-
Theft, vandalism and destruction of infrastructure	<ul style="list-style-type: none"> • Ensure the general safety and security of the facility at all times by providing day and night security guards • Ensure only authorized personnel get access to the site facility. • Install CCTV cameras 	<ul style="list-style-type: none"> • proponent 	Incident Register	Through ought	100,000 (monthly)
Spread of COVID-19	<ul style="list-style-type: none"> • Mandatory provision PPEs • Maintaining social distancing at least 2 meters. • All workers and visitors accessing facility every day shall be subjected to rapid Covid-19 screening which may include temperature check and other vital signs. 	<ul style="list-style-type: none"> • Proponent 	<ul style="list-style-type: none"> • SOPs, • Project assessment reports, • Purchase orders/receipts, • Photos 	Through ought	70,000 (monthly)

	<ul style="list-style-type: none">• Install hand washing facilities with adequate running water and soap.				
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8.2.3 Decommissioning phase EMP

Decommissioning refers to the formal process of removing something from the operational status. As the final phase in the project cycle, decommissioning may present positive environmental opportunities associated with the return of the land for alternative use and the cessation of impacts associated with operational activities. However, depending on the nature of the operational activity, the need to manage risks and potential residual impacts may remain well after operations have ceased. This ESMP should be treated as a guiding document that will be employed in the initial stages of the decommissioning. Detailed procedures will be developed with the cause of decommissioning in mind by competent persons and agencies. Table 15 below shows the ESMP of the decommissioning phase for the proposed project.

Table 15: Environmental management plan for the decommissioning phase

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
Demolition waste management					
Demolition waste	<ul style="list-style-type: none"> Use of an integrated solid waste management system i.e. through a hierarchy of options: Source reduction; Recycling; Reuse; Sanitary land filling. 	Project Manager and Contractor	Inspection and Observation	One-off	200,000
	<ul style="list-style-type: none"> All structures and partitions that will not be used for other purposes must be removed and recycled/reused as far as possible. 	Project Manager and Contractor	Inspection and Observation	One-off	200,000
	<ul style="list-style-type: none"> All foundations must be removed and recycled, reused or disposed of at a licensed disposal site. 	Project Manager and Contractor	Inspection and Observation	One-off	500,000
	<ul style="list-style-type: none"> Where recycling/reuse is not possible, the materials should be taken to a licensed waste disposal site. 	Project Manager and Contractor	Inspection and Observation	One-off	150,000

Rehabilitation of project site					
Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Monitoring Means	Time Frame	Cost (Ksh)
Vegetation disturbance	<ul style="list-style-type: none"> Implement an appropriate re-vegetation programme to restore the site to its original status. 	Project Manager and Contractor	Observation	One-off	300,000
	<ul style="list-style-type: none"> Consider use of indigenous plant species in re-vegetation. 	Project Manager and Contractor	Observation	One-off	-
Minimization of occupational health and safety impacts					
Increased occupational safety risks	Adherence to the Occupational Health and Safety Rules and Regulations stipulated in the Occupational Safety and Health Act, 2007.	Health and Safety Manager	Inspection, Meeting and Observation	Throughout decommissioning period	120,00
	Provision of appropriate personal protective equipment as well as ensuring a safe and healthy environment for demolition workers.	Proponent	Inspection and Observation	Throughout decommissioning period	-
	Mitigate demolition workers accidents by enforcing adherence to safety procedures and preparing contingency plan for accident response.	Health and Safety Manager	Meeting and Observation	Throughout decommissioning period	-

Minimization of demolition noise and vibration					
Noise and vibration	<ul style="list-style-type: none"> Sensitize demolition vehicle drivers and machinery operators to switch off engines of vehicles or machinery not being used. 	Project Manager and Contractor	Meeting	Throughout demolition period	No added cost
	<ul style="list-style-type: none"> Sensitize demolition drivers to avoid gunning of vehicle engines or hooting especially when passing through sensitive areas such as churches, offices, hospitals, residential houses and schools. 	Project Manager and Contractor	Meeting	Throughout demolition period	No added cost
	<ul style="list-style-type: none"> Ensure that demolition machinery is kept in good condition to reduce noise and vibration generation. 	Project Manager and Contractor	Inspection	Throughout demolition period	80,000
	<ul style="list-style-type: none"> Ensure that all generators and other equipment used are insulated or placed in enclosures. 	Project Manager and Contractor	Inspection	Throughout demolition period	To be determined
	<ul style="list-style-type: none"> The noisy construction works will be planned to be during the day. 	Project Manager and all site foreman	Observation	Throughout demolition period	No added cost
Water Pollution	<ul style="list-style-type: none"> Waste to be disposed off should be through a NEMA registered waste disposal company and in a designated site only. Exhaust the septic tank, and ETP fully through a licensed exhauster 	Contractor	<ul style="list-style-type: none"> Receipts, Reports, Copies of licenses, MoU, 	3 months	550,000

	<ul style="list-style-type: none">• Scoop and remediate the site from any oil spills immediately and seek advice from NEMA on how to dispose		<ul style="list-style-type: none">• Photos		
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CHAPTER NINE CONCLUSION AND RECOMMENDATIONS

9.1 Conclusion

From the study report, it is evident that the project is environmentally and socially acceptable with all the mitigation measures taken into consideration; Based on the positive side of the project, it will lead to job creation to locals improving their financial capability, improved sugarcane production, power generation and will create avenue for value addition projects

The proposed project will also have some negative impacts which in turn need to be minimized and mitigated during the construction and the operational phases. Based on the proposed mitigation measures, several of these negative impacts have lowered their rating to low and short-term thus, have minimal impacts.

With implementation of the ESMP, it is unlikely that the proposed Muwariziki Sugar Factory will have any significant adverse social and environmental impacts. Most of the impacts noted will be of a temporary nature especially during the construction phase. These impacts can be effectively managed to acceptable levels with implementation by implementation of the proposed mitigation measures. Accordingly, the overall benefits from the project far outweigh the possible adverse impacts.

The proponent to be committed to putting in place several measures to mitigate the negative environmental, safety, health and social impacts associated with the life cycle of the project.

9.2 Recommendations

Given that the proponent has committed to implementing the recommendations made and put mitigation to identified impacts, the Experts hereby recommends the project for consideration and licensing. It is recommended that the proponent shall focus on implementing the measures outlined in the ESMP as well as adhering to all relevant national and international environmental, health and safety standards, policies and regulations that govern establishment and operation of such projects. It is also recommended that the positive impacts that emanate from such activities shall

be maximized as much as possible. It is expected that these measures will go a long way in ensuring the best possible environmental compliance and performance standards.

Other specific recommendations that the proponent should implement include:

- Consult all relevant service providers and authorities (i.e. Homabay County Government, WRA, KPLC, EPRA, Homabay Water and Sewerage Company, Sugar Board of Kenya amongst others) so as to ensure compliance and harmonize the projects infrastructural and socio-economic developments with existing facilities.
- Adhere to all relevant construction, occupational, health and safety regulations and any other relevant law through ought the project.
- Ensure Water and Energy Management Systems are put in place as outlined within the report and incorporate rain water harvesting facilities.
- Ensure solid waste management during construction and operational phases of the project adhere to the Environmental Management and Coordination (Waste Management) Regulations, 2006.
- Ensure strict adherence to provisions of Environmental Management and Coordination (Noise and Excessive Vibrations Pollution) Regulations, 2009 during all phases of the project.
- Ensure waste water is disposed off as per standards set in the Environmental Management and Coordination (Water Quality) Regulations, 2006 and annually apply for EDL licence alongside conducting quarterly effluent analysis.
- Ensure strict adherence to Occupational Health and Safety Act, 2007
- Quarterly, conduct stack emissions sampling and analysis and submit the same to NEMA.

REFERENCES

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- 2 Guidelines for an Environmental Assessment of Energy and Industry Projects.
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- 4 US EPA. 1996. Bagasse Combustion in Sugar Mills. Publication AP-42, 5th Edition, Volume 1 Chapter 1.8.
- 5 Environmental Audits in Industrial projects;
- 6 Wastewater reuse (IFC guideline, 1998);
- 7 Hazardous Material management (IFC guideline, 2001);
- 8 Waste Management Facilities (IFC guideline, 1998);
- 9 Environment Management and Coordination Act, (Amendment 2015) – GoK
- 10 Export Processing Zones – Kenya Sugar Industry 2005
- 11 Environmental (Impact Assessment and Audit) Regulations, 2003
- 12 Feasibility Studies for Muwariziki Sugar Company by M.K Changwony & Associates
- 13 Occupational Health and Safety Act 2007 – GoK
- 14 Waste Management Regulations 2006 – GoK
- 15 Work Injury Benefits Act 2007 - GoK
- 16 Internet –Wikipedia, etc
- 17 Safety and Health Committee Rules (2004) – GoK
- 18 Pollution Prevention and Abatement Handbook, World Bank Group (Effective July 1998)
- 19 Kenya Sugar Sector Strategic Plan 5 – 10 Year Plan - December 2003
- 20 Intergovernmental Panel on Climate Change (IPCC). 1996.
- 21 Environmental Assessment Sourcebook Volume I: Policies, Procedure, and Cross-Sectoral Issues.

ANNEXES AND APPENDICES

Annexes

Annex 1: Public participation Questionnaires

Annex 2: Public Participation attendance Lists

Annex 3: Stakeholders' Participation attendance Lists

Annex 4: Minutes of Public Participation

Annex 5: Bills of Quantities (BoQ)

Annex 6: Proof of Land Ownership (Title Deed)

Annex 7: Company Registration Documents (CR12, KRA Pin, Cert of Reg)

Annex 8: Baseline water quality analysis Results

Annex 9: Topographical Map

Annex 10: Experts Practicing Licenses

Annex 11: Project Designs

Appendices

Appendix 1: Ambient air Quality Analysis Report

Appendix 2: Feasibility study for Muwariziki Sugar Company

Appendix 3: Geotechnical Survey of the proposed site