ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) STUDY REPORT

PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN LOLGORIAN WARD, TRANSMARA SOUTH SUB COUNTY, NAROK COUNTY

(Latitude -1.125749º and longitude 34.690654º)

Prepared for:

Bharat Patel & Umang Patel

P.0. B0X 19226 - 00501

NAIROBI.

Prepared by:

Gomake Consultancy Co. Ltd

Firm of Experts No. 8511

P.O. Box 5540-00100

Nairobi

E-mail: info@gomakeltd.co.ke

CERTIFICATION

Certification by Firm of Experts

This ESIA Study has been carried out in accordance with the Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019.

Due diligence has been observed in data collection, consultations and preparation of the report. The report was compiled without prejudice and is exclusively confidential. Apart from the NEMA and the Environmental Assessor, no other party shall have access to this report without the express permission of the proponent.

We certify that the particulars in this report are correct and righteous to the best of our knowledge.

Firm of Experts: **Gomake Consultancy Company Ltd**

NEMA expert certification of registration no: **8511**

Signature: _____ Date: 10/9/2024

Lead Expert: **Kennedy Kijana**

NEMA expert certification of registration no: **1254**

Signature: _____ Date: 10/9/2024

Certification by Proponent

Signed for and on behalf of: **Bharat Patel & Umang Patel**

Name: _____

Signature & Stamp: _____

Table of Contents

List of Tables

List of Plates

List of Figures

List of Annexure

Abbreviations

EA	Environmental Audit
EDL	Effluent Discharge License
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
EMP	Environmental Management Plan
EMS	Environmental Management System
ETP	Effluent Treatment Plant
LTP	Leachate Treatment Plant
Ha	Hectare
KES	Kenya Shillings
KPLC	Kenya Power & Lighting Company Limited
LR No	Land registration number
MDG's	Millennium Development Goals
NEAP	National Environment Action Plan
NEMA	National Environmental Management Authority
OSHA	Occupational Safety and Health Act
pH	Potential of Hydrogen
PPE	Personal Protective Equipment
UNCED	United Nations Conference on Environment and Development
UNFCCC	United Nations Framework Convention on Climate Change
WHO	World Health Organization
WRA	Water Resources Authority

Non-Technical Summary

Introduction

The proponent is determined to support Kenya in addressing the recurrent sugar production deficit in the country by establishing a new sugar in Enemasi Village, Moita Sub Location, Moita Location, Lolgorian Ward, Kereto Division, Transmara South Sub County, Narok County. The Sub County is endowed with suitable natural conditions for increased sugar cane production and expansion.

The development will definitely increase farm house hold incomes and promote sugarcane as the main cash crop. Moreover, if the income obtained from sugar cane cultivation can be partially invested in complementary agricultural or horticultural activities, then household food security and sustainable livelihoods could easily be attained.

To comply with the requirements of the Environmental Management and Co-ordination Act (EMCA) of 2015 and the Environmental Impact Assessment and Audit Regulations 2003, the project owner has commissioned Gomake Consultancy Company Limited to prepare a comprehensive Environmental and Social Impact Assessment (EIA) Project Report. The environmental study was commissioned in July, 2024. To initiate the public consultation process, standard public consultation forms/notices were issued to the immediate neighbours, clients and consultations were made with key lead agencies.

Terms of Reference

The Terms of Reference for this assessment are based on the Environmental Impact Assessment and Audit Regulations dated June 2003. The TOR was submitted to NEMA and given reference number TOR 771 which was reviewed and approved by NEMA on the 7th August 2024, copy of which is attached to this report.

Project location and scope

The proposed sugar factory-Narok development shall be located along Ogwedhi-Enemasi Road within Enemasi area, on Plot L.R. No. TRANSMARA/MOITA/761 in Enemasi Village, Moita Sub Location, Moita Location, Lolgorian Ward, Kereto Division, Transmara South Sub County, Narok County. The project shall comprise of the following components:

- Workshops;
- Administrative offices
- Weighbridge house;
- Cane yard;
- Mill House;
- Power house;
- Sugar house;
- Effluent treatment and recycling plant;
- Agricultural offices;
- Staff houses
- Stores;
- Access roads;

- Bagasse silos.
- Fuel station
- Water supply works (from a borehole)
- Electricity connection

The project shall also incorporate major land use change in the area involving sugarcane cultivation in partnership with the local farmers through leases. It is projected that an estimated 5,400 ha of sugarcane will be harvested each year when the project is in operation.

Legal and regulatory compliance

The proponent is committed to comply with all applicable legal provisions and regulations which have been reviewed in the report:

- The Constitution of Kenya (2010)
- Environmental Management & Coordination Act, 1999 (Amended 2015) and Subsidiary Regulations
- Environmental Management and Co-ordination (Waste Management) Regulations 2006
- Environmental (Impact Assessment and Audit) Regulations, 2003
- EMCA (Water Quality) Regulations, 2006
- EMCA (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009
- Environmental Management and Coordination (Air Quality) Regulations, 2014
- Land Act 2012
- The Public Health Act (Cap 242)
- The Occupational Safety and Health Act, 2007
- The Water Act, 2016 and The Water Resources Management Rules, 2007
- The County Governments Act 2012
- The Sustainable Waste Management Act 2022
- The Climate Change Act, 2016
- Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009
- Work Injury Benefits Act (WIBA), 2007
- The Energy Act 2019
- Penal code Cap 63(Section 191)
- The Traffic Act, 2012
- Physical Planning Act (Cap 286)
- Employment Act 2007
- Standards Act Chapter 496
- Kenya Sugar Act, 2001 (rev. 2012)
- Agriculture, Fisheries and Food Authority Act 2013
- Food Drugs and chemicals substances Act (Cap 254)
- Sustainable Development Goals (SDGs)

Public Participation

Legal Notice of 101 of June 2003 requires that all environmental and social assessment process in Kenya to incorporate Public Consultation.

Key stakeholder consultation was undertaken in the project area. The team identified stakeholder who are key to implementation of the proposed project as well as those who rely on such services. The stakeholders included County Government officials, National Government officials, and Non-governmental organization among others.

PCMs – The Consultant, in collaboration with the national government led by the local chiefs and assistant chiefs, carried out public participation in the proposed Sugar factory project in Narok. The meetings were held in five Sub Locations and locations: the Moita Location (the proposed mill site), the Oldanyati Sub Location, the Masurura Sub Location, the Kikat Sub Location, and the Naar-Olong Sub Location. The sixth meeting involving the county and national government officials was held in Narok Town on 28th August 2024. In their consultations, the community sensitization meetings generally targeted all community members within and neighbouring the project area.

Project Impacts:

Construction phase

Project impacts and their mitigation measures have been discussed in the report and they include:

- Procurement of construction materials:
- Employment opportunities
- Enhancement of local economy / More cash in circulation
- Occupational health and safety hazards
- Energy utilization:
- Water Utilization
- Waste production:
- Influx of construction workers into the area:
- Construction traffic:
- Archaeological findings:

Operation phase

- Increased pressure on infrastructure – Stressed up service provision
- Pollution – Environmental Degradation
- Drain blockages – Back flooding
- Vector and rodents breeding grounds – Vulnerability to diseases
- Electricity consumption – pressure on supply
- Foul smell from factory effluent
- Gaseous emissions into the atmosphere
- Reduction in biodiversity in the area due to altered habitats
- Destruction of wetlands
- Limitation of grazing land for animals
- Seepage of fertilizers into water sources
- Possible use of pesticides for crop pest control
- Reduced distance to cane milling factories for farmers
- Reduction of area of arable land for food crops
- Possible changes in soil quality / soil erosion
- Possibility of human disease outbreaks (e.g. cholera) due to poor effluent and sewage disposal

- Reduction of rampant theft due to better incomes for the youth
- Employment opportunities
- Occupational health and safety hazards
- Threat to livestock breeding/rearing among the Maasai community
- Improvement of infrastructure and social amenities through CSR activities
- Water supply and consumption
- Soil degradation
- Deforestation
- Waste generation i.e. filter cake and bagasse
- Revenue generation
- Value-added products
- Climate change contribution

Decommissioning phase Impacts

- Solid Waste Generation
- Dust
- Noise and Vibration
- Labour work
- Occupational Health and Safety Hazards
- Contaminated sites e.g. pesticides, industrial chemicals used in sugar processing
- Land restoration
- Water resource recovery
- Air pollution reduction
- Rural economic decline
- Loss of revenue
- Decline in investment
- Infrastructure degradation i.e disuse of transportation networks
- Redevelopment of projects
- Diversification
- Environmental rehabilitation

Project Alternatives

Project alternatives discussed in the report include:

- Site alternative
- Alternative Technologies
- Alternative Bagasse management
- Alternative Equipment
- "No Project" Alternatives

Project Cost

The total project budget is approximated to be One billion Shillings only (Kshs 1,000,000,000) as per the attached summary of the bill of quantities. The NEMA fees are payable at 0.1% of the project cost, with a minimum of 10,000.00, whichever is greater. Therefore, the total fee payable to NEMA is One Million Shillings (Ksh. 1,000,000.00).

Impact Matrix

The impact matrix below summarizes the positive and negative impacts by type and mitigation measures.

Environmental Impact	**Impact Type**								**Mitigation**	
	Positive		**Negative**							
	Significant	Not Significant	Significant	Not significant	Short term	Long term	irreversible	Cumulative	No mitigation	Mitigation Required
CONSTRUCTION AND INSTALLATION PHASE IMPACTS										
Employment opportunities	x				x				x	
Procurement opportunities	x				x				x	
More Cash in Circulation	x					x			x	
Occupational health and safety hazards			x		x	x				x
Energy utilization	x				x				x	
Water utilization	x			x	x					x
Waste production			x		x					x
Influx of construction workers	x			x	x					x
Increase in social vices e.g. prostitution, STDs, HIV-AIDS			x		x					x

Environmental Impact	**Impact Type**								**Mitigation**	
	Positive		**Negative**							
	Significant	Not Significant	Significant	Not significant	Short term	Long term	irreversible	Cumulative	No mitigation	Mitigation Required
Construction traffic			x		x					x
Archeological findings				x	x					x
OPERATION PHASE IMPACTS										
Employment opportunities	x					x		x	x	
Increased pressure on infrastructure				x		x		x		x
The bagasse menace				x				x		x
Land and water pollution – oil spills, effluent discharge			x					x		x
Air pollution / Emissions			x			x		x		x
Offensive smell from effluent			x			x				x
Electricity consumption	x					x				x
Noise and Vibration			x			x				x

Environmental Impact	**Impact Type**								**Mitigation**	
	Positive		**Negative**							
	Significant	Not Significant	Significant	Not significant	Short term	Long term	irreversible	Cumulative	No mitigation	Mitigation Required
Reduction in biodiversity				x		x		x		x
Destruction of wetlands				x		x	x	x		x
Vector and rodents breeding grounds			x			x		x		x
Limitation of grazing lands			x			x		x		x
Chemical pollution – fertilizer, pesticides and herbicides			x			x		x		x
Reduction of arable land for food crops				x		x		x		x
Reduced distance to milling factories	x					x		x	x	
Possibility of human disease outbreaks e.g. cholera			x			x				x
Possible changes in soil properties/quality				x		x		x		x

Environmental Impact	**Impact Type**								**Mitigation**	
	Positive		**Negative**							
	Significant	Not Significant	Significant	Not significant	Short term	Long term	irreversible	Cumulative	No mitigation	Mitigation Required
Reduction of theft by youth	x					x			x	
Employment opportunities	x					x		x	x	
Improved infrastructure and social amenities through CSR	x					x		x		x
Occupational health and safety hazards	x					x				x
Water supply and consumption	x		x			x				x
Land-use and landscape changes				x		x		x		x
Land degradation through soil erosion, soil compaction				x		x		x		x
Potential conflict with community of land ownership and succession issues, late payment			x		x	x	x	x		x
Increased accidents due to				x		x		x		x

Environmental Impact	**Impact Type**								**Mitigation**	
	Positive		**Negative**							
	Significant	Not Significant	Significant	Not significant	Short term	Long term	irreversible	Cumulative	No mitigation	Mitigation Required
agricultural machinery traffic										
Possibility of increased poverty due to late payment for cane			x			x		x		x
DECOMISSIONING PHASE IMPACTS										
Solid waste generation				x	x					x
Dust			x		x					x
Noise and vibration			x		x					x
Rehabilitation	x				x				x	
Employment		x			x				x	
Occupational Health and Safety hazards			x		x					x

Conclusion

This ESIA Study Report has been prepared to provide sufficient and relevant information on the proposed project to enable NEMA to establish whether activities of the project are likely to have significant adverse environmental impacts. Mitigation measures have been proposed for identified impacts in this report and an Environmental Management Plan (EMP) for the implementation of the proposed measures has been presented. The EMP presented in this report is a tool to be used by the Project Team during the construction, hand-over and operation periods.

1. INTRODUCTION AND SCOPE OF STUDY

1.1 Introduction

In Transmara South Sub County of Narok County, it is evident that only minimal agricultural and horticultural activities have been taking place in the recent past. Indeed, a good number of homes have been deserted by the able-bodied youth who have moved to towns and cities in search of jobs. The potential of the land is, however, clearly good enough for cash crop farming such as sugar cane or other high value horticultural crops. There is a real possibility that well-planned and managed cash crop farming could employ several people and increase household incomes in the area. It is in this context that the proponent has proposed to put up a sugarcane processing plant to support the production activities in Enemasi, Lolgorian Ward.

The proponent is determined to support Kenya in addressing its recurrent sugar production deficit by establishing a new sugar factory in Transmara South Sub County of Narok County. The Sub County is endowed with suitable natural conditions for increased sugar cane production and expansion.

The Transmara region has demonstrated the high suitability of climate and soil for supporting sugarcane productivities above 150 tonnes per hectare, yet the cane processing capacity in the three neighbouring Counties has not matched cane availability, resulting in high losses among growers.

Currently, farmers in Ndoinyo, Moita and surrounding Locations in Transmara West, Suna E, Uriri and Kuria West are suffering big losses due to the distance travelled by the existing sugar milling factories.

The development zone will definitely increase farm household incomes and promote sugarcane as the main cash crop. Moreover, if the income obtained from sugarcane cultivation can be partially invested in complementary agricultural or horticultural activities, then household food security and sustainable livelihoods could easily be attained.

1.2 Background and Rational of the EIA

To comply with the requirements of the Environmental Management and Co-ordination Act (EMCA) of 2015 and the Environmental Impact Assessment and Audit Regulations 2003, the project proponent has commissioned Gomake Company Consultancy Limited to prepare an Environmental and Social Impact Assessment (EIA) Project Report. The environmental study was commissioned in July, 2024. To initiate the public consultation process, standard public consultation forms were issued to the immediate neighbours, clients, staff of the proposed sites, and consultations were made with key lead agencies.

1.3 Scope

As a requirement by the Environmental Management and Coordination (Amendment) Act 2015, of Kenya, a project proponent is required to undertake an Environmental Impact Assessment study before undertaking any project highlighted in Schedule 2 of the Act. This study undertakes to fulfil this requirement. This study 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 project scope included literature review; detailed and updated description of the project design and proposed implementation schedule, costs, as well as suitable alternative options; an in-depth analysis of the environmental and social baseline conditions; an outline of policy, legal and institutional framework governing the sector with specific focus on agro-processing; inclusive public participation and meaningful stakeholder engagement; establishment of details of significant environmental and social impacts associated with the construction, operation, decommissioning or after-use plans and post-decommissioning of the project; recommend appropriate mitigation measures for all adverse environmental and social impacts and enhancement of the benefits; and develop an Environmental and Social Management Plan (ESMP) for all the project's phases giving specific actions, responsibilities, cost estimates, timeframes and monitorable indicators.

1.4 Terms of Reference

The Terms of Reference for this assessment are based on the Environmental Impact Assessment and Audit Regulations dated June 2003. The TOR was submitted to NEMA and given reference number TOR 771 which was reviewed and approved by NEMA on the 7th August 2024, a copy of which is attached to this report.

1.5 Methodology

After preliminary visits to the proposed site, the following were carried out in the preparation of this document:

i) Socio-economic survey;
ii) Qualitative and quantitative data;
iii) Observations, discussions with stakeholders and lead agencies;
iv) Documentary review of the nature of the proposed project;
v) Policy and legal frameworks, social and environmental setting of the area;
vi) Checklists were prepared to identify possible environmental and human safety issues, photography, etc;
vii) Review of the project designs and implementation plans and comprehensive discussions with the project proponent;
viii) Report writing

1.6 Team of Experts

All partners coming from different disciplines and experiences have spearheaded the implementation of innovative and appropriate approaches to development thinking, namely scientific and well researched outcomes, participatory approaches that enhance dialogue, forge partnerships and encourage conflict management and resolution. The team's diverse disciplines are consistent with the multi/inter/trans– disciplinary nature of the environmental management tools and the code of practice for the registered EIA/EA firm of experts.

Table 1: Key experts for the ESIA study

Name	Expertise
Kennedy Kijana McAbongo	Team Leader/ Environmental Lead Expert
Dr. Dickens Onyango Odeny	Biodiversity Expert/Ecologist
George Wandera	Sociologist
Fredrick Maseno	Safety and Health Advisor/ Fire Safety Expert
Jack Otieno	Environmental EIA/EA Associate Expert

2. PROJECT DESCRIPTION

2.1 Project Objectives

The primary objective of this Project is to construct a factory building, install equipment and machinery for sugar cane processing with a capacity of 1250 tonnes of cane per day (TCD) using state-of-the-art technology, that will;

- Reduce waste generation.
- Reduce energy consumption.
- Improve conversion efficiency.
- Produce better quality product
- Increase sustainability.
- Help the farming community to improve the economy
- Reduce transport cost to the nearest factory.
- Reduce carbon foot print
- Promote sustainable agricultural practices

2.2 Proposed Project Components

The proposed sugar factory development shall be located along Segere-Ambira Road within Enemasi village, on Plot L.R. No. Transmara/Moita/761 Moita Sub Location, Moita Location, Lolgorian Ward, Kereto Division, Transmara South Sub County, Narok County.

The project shall comprise of the following components:

- Workshops;
- Administrative offices
- Weighbridge house;
- Cane yard;
- Mill House;
- Powerhouse;
- Sugar house;
- Effluent treatment and recycling plant;
- Molasses tank
- Agricultural offices;
- Staff houses
- Stores;
- Access roads;
- Bagasse silos.
- Fuel station
- Water supply works
- Electricity connection

The project shall also incorporate major land use change in the area involving sugarcane cultivation in partnership with the local farmers through leases. It is projected that an estimated 5,400 ha of sugarcane will be harvested each year when the project is in operation.

2.3 Proposed infrastructure and processing activities

The proposed infrastructure and activities in the factory will include the following: -

2.3.1 Cane yard

The yard will consist of 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.

2.3.2 Milling

The extraction line will consist of roller milling tandem using a hydro-pneumatic pressure regulating system. The milling tandem will be driven by four AC electric motors with planetary type speed reducers. Auxiliary equipment will include a mill house crane. The mixed juice will be passed through a rotary juice screen before being pumped to the screened juice tank.

2.3.3 Clarification

The pumping of juice to clarification station will be done through automatic flow control to ensure uniform flow rate. Primary heating of juice will be done prior to liming and sulphitation. Before final heating, both liming and sulphitation will be done to the juice with proper control of pH. Control of liming will be automated. Finally, heated juice will be pumped through flask tank to clarifier for settling out mud and production of clear juice. The mud from the clarifier is de-sweetened in a rotary vacuum filter, with filtrate being returned to the screened juice tank, and mud removed and used as fertilizer on the fields.

2.3.4 Evaporation

The clear juice from the clarifier will be heated and then evaporated to form syrup. The evaporated set will consist of a quintuple effect. Exhaust steam from the turbine and boiler through pressure reducing station will be used as the heating medium for the first effect. Exhaust steam will be used in sequence so that the vapor leaving the first vessel will be used in the next vessel heat and so on; so that boiling will take place at reduced temperatures giving the advantage of minimizing destruction of sucrose, and for general steam company. Syrup, which consists of a concentrated clear juice will then be withdrawn from the last vessel and pumped to concentrated clear sugar juice will then be withdrawn from last vessel and pumped to Sulphitation Vessel to reduce color before pumping it to the Boiling House section of crystallization.

2.3.5 Boiling house (crystallization)

Batch vacuum pans will be used to boil syrup into A-massecuite while automatic continuous pans will be used to boil B- and C- massecuite. From the pans, A- & B- massecuite will flow under gravity to air cooled crystallizers. Vertical continuous crystallizer will be used for C-massecuite.

2.3.6 Crystal separation

A-sugar will be separated from A-molasses by Batch type Centrifugal machines. The centrifugal machines will be fully automated with a 1250kg/charge capacity, complete the accessories and drive. B&C sugars will be separated from B& C molasses with continuous centrifugal machines. The centrifugal will be of vertical type and have a total capacity to cure all the massecuites produced. The molasses produced will be pumped to the molasses storage tank.

2.3.7 Drying and bagging

Hot air will be blown into the sugar drier and the sugar will leave the batch centrifugal to dry it. Drying will occur in a multi-tray dryer with a hot air-blowing arrangement. Big sugar lumps will be separated in the last section of the tray. The sugar will then be cooled, sieved and conveyed to silos before packaging for sale.

2.3.8 Steam generating plant

The high-pressure steam needed will be generated in a 70 t/h (MCR) water tube boiler with heat recovery equipment (an economizer and air pre-heater). The steam at 44Bar and 415^0C will be generated using bagasse with 50% moisture. The flue gasses will be passed through mechanical grit collectors to meet the emission standards.

2.3.9 Spray ponds

Hot water from the condenser will be taken to the spraying pond where it will be cooled and re-used.

2.3.10 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 a modern effluent treatment plant to reduce the level of biological oxygen demand (B.O.D) to less than 30ppm and remove suspended matter.

2.3.11 Maintenance

The milling process will normally run for ten months per year, with monthly shutdowns of approximately 24 hours for servicing, cleaning/maintenance. These activities will include cleaning of heat exchangers, lubrication repairs and general cleaning.

During the two months off crop for replacement /rebuilding of wearing parts like mill rollers and general maintenance on all equipment and machinery will be done.

2.4 Cane Production Process

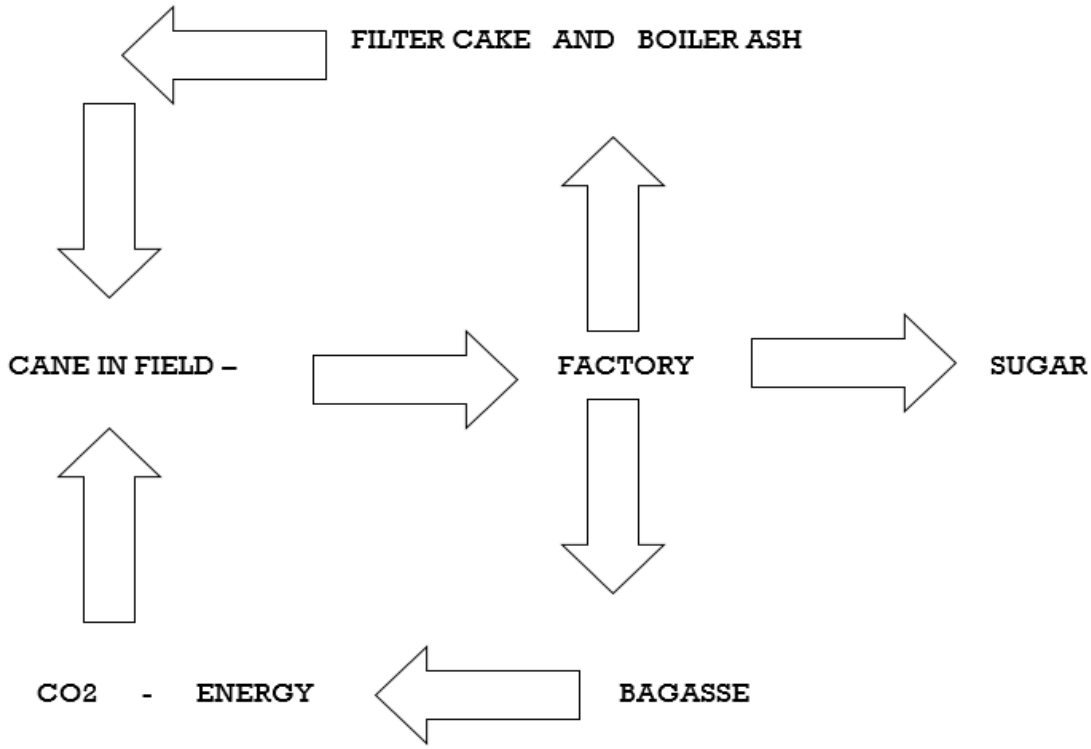


Figure 1: Summary of the sugar process

2.5 Project Implementation

The project will be implemented in four phases: design and construction, equipment installation, operation and decommissioning.

2.5.1 Design Phase

This phase is the concept of the planned development and the designing of a structure that was envisaged to be functional and to take care of every environmental concern such as liquid and solid wastes and security. This has already been completed.

2.5.2 The Equipment Installation Phase

This phase will be based on the building standards, code and all other relevant regulations applicable in Kenya. All the proposed works will follow standard environmental guidelines, health and safety measures.

a) Equipment installation Activities

i) Construction activities

This will have to be undertaken to provide support and shelter for the additional equipment to be installed. The construction of the building walls, foundation, floor pavement, and drainage system, among other component of the project will involve minimal masonry works and related activities. General masonry and related activities will include concrete mixing, plastering, slab construction, construction of foundation and curing of fresh concrete surfaces. These activities are known to be labour intensive hence may be supplemented by machinery such as concrete mixers.

ii) Roofing and sheet metal works

Roofing activities will include laying of iron sheets, and structural steel to the roof and fastening the roofing materials to the roof.

iii) Electrical Works

Electrical work during both construction and operation will involve installation of electrical gadgets and appliances including electrical cables, lighting apparatus, sockets etc.

2.6 Equipment to be installed

The proponent intents to achieve its objectives by installing the following equipment within the facility:

2.6.1 Shredder

The shredder is designed to achieve very fine preparation of sugar cane by separating the fibres and opening the cell wall efficiently. This allows the subsequent extraction process to maximize the removal of the sucrose bearing juice from the prepared cane. It shall ensure:

- Cane preparation for juice extraction
- Fibre and juice separation
- Increased sugar recovery
- Excellent fibre particle size distribution
- Improved final bagasse moisture
- Higher imbibition efficiencies at each stage
- Improved boiler performance/efficiency
- Consistently higher bagasse densities
- Lower bagasse pol loss

2.6.2 Cane carrier

Completely made from steel the cane carrier will have adequate column and support hence facilitating to feed the required cane capacity.

2.6.3 Pressure feeders

The new pressure feeders will have built-in overload protection, besides ensuring smooth and safe operation. They will have a compact, low-weight design that fits the available space without costly adjustments.

2.6.4 Boiler

As one kind of environmental protection industrial boiler, biomass fired boiler will be used in sugar factory, which can burn bagasse. With large quantity of sugar cane bagasse expected at the sugar factory, a lot of fuel cost will be saved.

2.6.5 FFE-Falling Film Evaporator

Falling film evaporator concentrates the juice coming from the purification station and sends the concentrated juice (syrup) to the crystallization station. The way an evaporator plant works has a crucial impact on the heat economy of sugar factories and refineries. Perfectly tailored to the overall process, it allows effective action to increase the energy efficiency of upstream or downstream process steps. Falling-film evaporators that will be installed will have a higher juice distributor dome, making them easier to inspect and clean. Whenever necessary, the juice distributor and heating tubes can be cleaned with a high-pressure water jet from the top tube plate, without opening the dome flange.

2.6.6 CVP-Continuous vacuum pan

The new CVP design produces high massecuite exhaustion, consistent crystal size and improves energy efficiency. The Continuous Vacuum Pan designs are suitable for A, B and C massecuites and are configured to optimise upstream and downstream plant capabilities. Importantly, the pan's vapour demand is surge-free and consistent with steady-state boiler operation and evaporator performance for extended periods.

2.6.7 Grader

Grader to be installed will provide vital grading functions that help in maintaining sugar cane quality and are known to improve the efficiency in grading processes. The grader shall be highly durable, corrosion resistance and will require low maintenance, thereby improving services and bringing greater efficiency in production.

2.6.8 Spray pond

The warm water from the condensers needs to be cooled to the lowest practical temperature before being re-used. The cooling process is carried out in spray ponds after which the water is pumped back to the condensers.

2.6.9 Molasses tank

Molasses tanks shall be installed. These will be specially designed to suit the storage of molasses. The tanks will come complete with an inspection lid / manway access, and good ventilation (to reduce condensation and bacterial growth).

2.6.10 Centrifugal machine

The centrifugal machine will provide real and sustained process advantages to the user as they are more efficient and reduce processing costs through lower electrical power consumption and improved recovery of crystals from the massecuite.

2.7 Decommissioning Phase

At the end of the operational life of the plant (factory), all the equipment and waste materials from the construction/equipment installation will be removed from the site. The materials that can be reused will be separated and used for other construction work and others disposed of appropriately. The areas not intended for parking of vehicles will be landscaped and planted with beautiful vegetation to improve the aesthetics of the surrounding.

2.8 Project Cost

The total project budget is approximated to be One billion Shillings only (Kshs 1,000,000,000) as per the attached summary of the bill of quantities. The NEMA fees are payable at 0.1% of the project cost, with a minimum of 10,000.00, whichever is greater. Therefore, the total fee payable to NEMA is One Million Shillings (Ksh. 1,000,000.00).

3. BASELINE INFORMATION

3.1 Location

The proposed site is located within Enemasi village on Plot L.R. No. Transmara/Moita/761 Moita Sub Location, Moita Sub Location, Lolgorian Ward, Kereto Division, Transmara South Sub County, Narok County. The proposed site for the sugar mill is 6.87 Ha but is projected to increase due to further land acquisition by the Proponent. The area is served by a good road network, including Ogwedhi-Enemasi Road and other access roads, which will ease the transportation of harvested sugarcane to the proposed sugar mill from different parts of the County. The proposed Kenya Sugar Factory site is approximately 5 km from Kilgoris

The site is located on coordinates: **Latitude -1.125749º and longitude 34.690654**

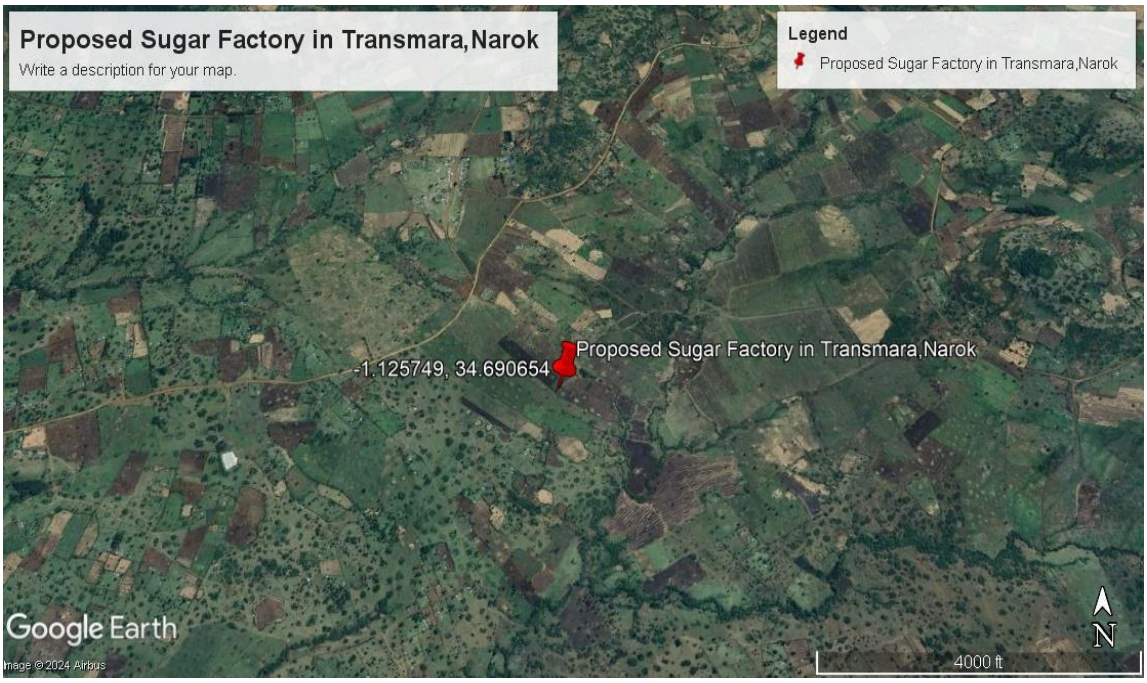


Figure 2: Google map showing the location of the facility

(*Source: Google Earth*)

3.2 Project's surrounding

The proposed project site is currently an open parcel of land with scattered homesteads in the neighbourhood. The entire land is covered by grass, herbs, and a few mature trees that will be cleared to allow for the construction.

Plate 1: Photo showing the proposed project site

Plate 2: Community water source within the Project area

3.3 Narok County Overview

3.3.1 Position and Size

The County Government of Narok lies between latitudes 0° 50′ and 1° 50′ South and longitude 35o 28′ and 36o 25′ East. It borders the Republic of Tanzania to the South, Kisii, Migori, Nyamira and Bomet counties to the West, Nakuru County to the North and Kajiado County to the East. The county headquarters is at Narok Town. The county covers an area of 17,933.1 Km2 representing 3.1 per cent of the total area in Kenya and therefore the eleventh largest in the country. Map 1 shows the location of the county in Kenya.

Figure 3: Map location Narok County

Source: Kenya National Bureau of Statistics, 2013)

3.3.2 Physiographic and Natural Conditions

a) ***Physical and Topographic Features***

The county lies within the Great Rift Valley, and is serviced by several rivers, flowing from highlands through arid and undulating landscapes. It is home to numerous volcanic landforms with areas of prominent geothermal activities. The highland areas of Mau escarpments, rising to an attitude of 3,100m above sea level provides fertile ground for farming and source to major

rivers like Mara and Ewaso Nyiro with Mara River being the single major river that passes through Maasai Mara Game Reserve and ultimately draining into Lake Victoria. Narok County is home to the world renowned Maasai Mara Game Reserve which is considered Kenya's jewel when it comes to wildlife. The reserve sitting on 1,510 km2 hosts 25% of Kenya's big cats and has one of the highest wildlife densities in Africa. It is characterized by Savannah plains and woody shrubs, which provide an ideal home for the 95 species of mammals, amphibians, and reptiles and over 400 bird species in the park and its environs. Over 300,000 tourists visit the park yearly, with the peak season coinciding with the Great Wildebeest Migration between July and September of every year.

In addition to high agricultural potential in the highlands and tourism economic activities in the lowlands, the county is endowed with numerous natural resources. Exploration of geothermal power in the Suswa area has shown positive prospects, and harnessing solar power in Talek is ongoing. Wind power pumps water from boreholes in the Mara area and adjacent areas. Other county resources include vast sand deposits in the Suswa and Naikarra Wards and pockets of gold deposits in the Transmara constituency.

The altitude for the proposed project area in Transmara ranges between 1750 m and 1948 m above sea level (Kimathi R, 2021 and Mirube J, 2022). Undulating hills and valleys cover most of the project area, with some stretches of flat land and isolated swampy spots.

b) ***Geology***

The project plot is situated in an area covered by a layer of grey/black cotton soil with quartzite grains and pebbles. Nyanzian units as discussed, consist of conglomerates, shale, greywacke, banded iron formations, pillow lavas and basalt, granites, tuffaceous, and slaty rocks. Kavirondian units consist of boulder conglomerates, shales, and sandstones. Bukoban units mainly consist of porphyritic and non-porphyritic basalts and are found in the project area north of Lolgorian. The principal igneous rock in the area is part of the Butende Granites, which makes contact with the Longaria Granite south of the area. Butende Granite is part of Bukoban rocks, which are volcanic in origin. The Butende Granite tends towards a more basic rock formation. ln favourable areas, a passage from the unaltered acid granite through to syenite and diorite may be observed. It is pale greenish. Quartz is fairly abundant in phenocrysts, while hornblende is less common. Biotite is fairly plentiful, scattered through the rock in crystals. Some of these granites to the North of Lolgorian Hill gradually transition from typical, medium-grained igneous rocks to chlorite-schist. It thus shows that metamorphism accompanied igneous intrusion.

c) ***Soils***

The soils at the foothills are sandy clay loam and moderately shallow with some loose stones. These soils of foothills are well drained but highly leached and erodible. The soils become dark brown toward the valleys, with loam to clay textures. Those are alluvial soils, fertile but occasionally water-logged in wet seasons. A mixture of soil types is found on flat lands, some deep and others shallow. Where soils are black, drainage is a prerequisite to draining off stagnant water. Fertilization would be required in all soil types to improve cane yields. During cane development, careful land selection will be made to leave out shallow soils with depths less than 30 cm because such soils will not sustain ratoons.

Physical and chemical baseline tests were carried out for the soil within the site and results are attached in the annex.

d) ***Climatic Conditions***

The altitude and physical features strongly influence the climatic conditions of Narok County. The county has four agro-climatic zones: humid, sub-humid, semi-humid to arid, and semi-arid. Two-thirds of the county is classified as semi-arid (Narok DEAP 2009-2013). Temperatures range from 20°C (January- March) to 10°C (June- September), averaging 18°C. Rainfall amounts are influenced by the passage of inter-tropical convergence zones, giving rise to bi-modal rainfall patterns. Long rains are experienced between the months of February and June, while short rains are experienced between August and November. Rainfall ranges from 2,500 mm in the wet season to 500 mm during the dry season. The March to June season receives high-intensity rainfalls that support the growth of vegetation, which is food for wild animals. This climatic characteristic has been influencing the migration of wildebeest into Kenya from Serengeti in June in search of vegetative food and return migration to Serengeti in November after the vegetation diminishes. The seasons are also important to farmers in planning for planting and harvesting

Rainfall records from Sony Sugar Central Meteorological Station and Transmara factory show similar patterns and quantities. Mean annual rainfall is 1780 mm ranging from 1200 mm in a dry year to 2000 mm. The rainfall pattern is bimodal. Long Rains occur from March to May, while the Short Rains season is from September to November. The driest months are July and February, when less than 100 mm are normally recorded. However, the rainfall distribution is good for agricultural activities. Temperature mean minimum of 24°C and maximum of 31°C is ambient. Humidity is high, and evaporation from open pan is 1800-2000 mm which is comparable to precipitation.

e) ***Ecological Conditions***

The county has a robust ecological system that residents depend on for agriculture, tourism, water, and many other benefits. The soil type, altitude, vegetation, rainfall pattern, and human activities influence the county's ecological conditions. The dominant vegetation in the county includes forest land in the Mau area and grasslands and shrubs in the lowland areas of Suswa, in Narok North, Osupuko and Loita divisions in Narok South, and the Mara sections in Transmara. These areas are suitable for livestock rearing and irrigation. A major threat to vegetation cover is the destruction caused by human activities, including grazing, charcoal burning, extraction of wood fuel, and cutting down trees without replacement, resulting in adverse ecological effects. The main drainage system includes Mara, Mogor, and Narok Enkare rivers that traverse the county from the Mau region to the border and into Tanzania. However, due to continuous deforestation over a couple of years, the volume of water in the rivers has been decreasing. To address this challenge, the county has introduced programs to construct water reservoirs, water pans, dams, shallow wells, and boreholes, especially in the lowlands and denser settlements of urban and market centers of Narok town, Kilgoris, Lolgorian, E/Enkare, and Ololulung‘a to continue providing water for domestic and livestock use.

Maasai Mara Game Reserve is a habitat for wildlife, making it a major tourist destination. The reserve is home to wildlife, including Wildebeests, Gazelles, Zebras, Warthogs, Hyenas, Giraffes, Elephants, Lions, Leopards, and Elands. With their increasing numbers and human encroachment on the reserve, cases of human-wildlife conflict have increased.

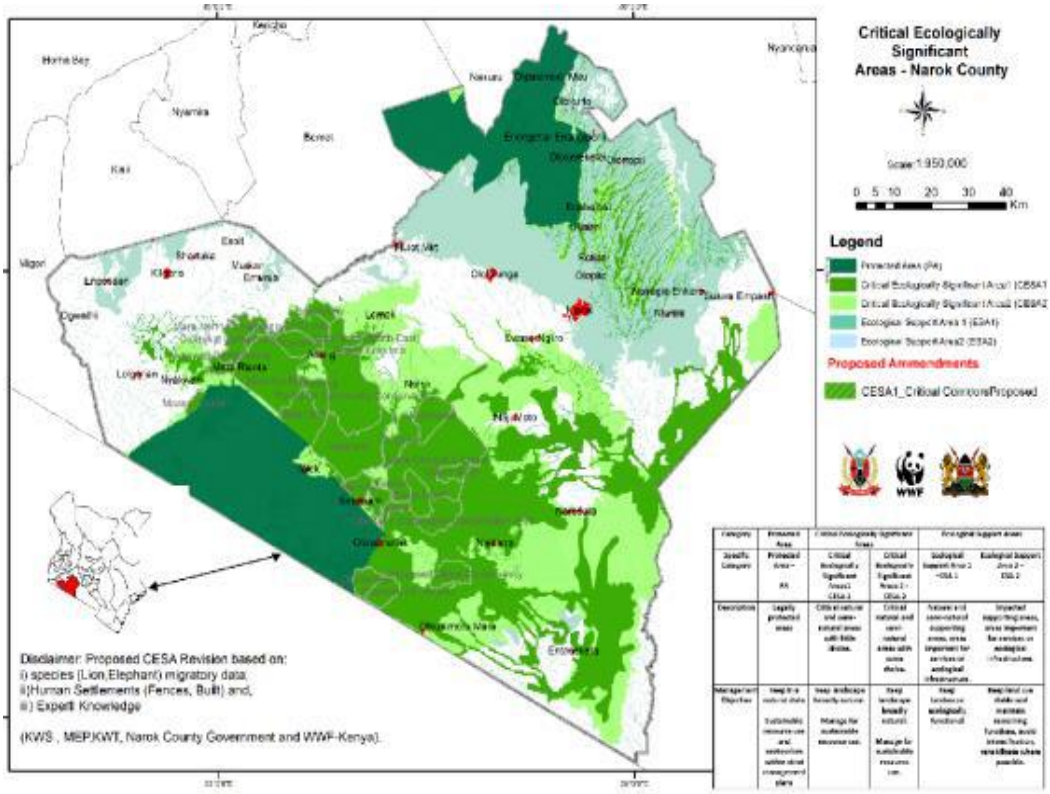


Figure 4: Narok County ecological map

f) ***Agro-ecological zones***

The proposed Kenya Sugar Factory site is about 5 km from Kilgoris Town. It is within sugar cane catchment area of suitable land for sugar cane growing, in Transmara, Suna East, Uriri and Kuria West.

The catchment area covers parts of Transmara West, Suna East Uriri and Kuria West. However, the total area of the Sub Counties is 3,124.4 km^2 and broken down as follows:

i. Transmara 2,580.4 km^2
ii. Suna East 206.5 km^2
iii. Kuria West 337.5 km^2

The proposed project will only require 8.5 km^2 (8500 ha) of good land for cane cultivation.

Organization of Growers

The outgrowers farmers of the proposed sugar factory will mainly be near the factory area and will cover Moita, Indonyo, Sikawa, Keiyan and Enemasi of Transmara Sub County, Ogwedhi, Sagegi, Kwa, Suna Rabuor, Osingo and God Jope of Suna East Sub County, Kakrao, Kanyamkago and Kawere of Uriri Sub County and Kombe and Masaba of Kuria West. The mapped area consists of 40% of already established cane, while the balance of 60% will be new crop establishment to match factory crushing capacity. The organization of out-growers shall be based on a cooperative society model that will facilitate bulk procurement of farm inputs and offer individual small growers collective bargaining power for accessing sugar market benefits.

g) ***Hydrology and Ground Water Potential***

According to the hydrogeological studies of the site, the Southwest Narok Area is in a hydrogeological complex environment, receiving water from direct precipitation and from stream flow or sub-surface flow around River Gori sub-catchment and Mara River Catchment and discharging groundwater to the south in perpendicular fractures to the main fault axis and axially along the main fault. The groundwater flow is intimately connected to the grid fault system within these porous host rocks.

Attempts to quantify groundwater flows can be looked in two dimensions Vis water balance and groundwater flow in a regional scale for the purpose of the project output conclusive recommendations.

A water supply borehole facility is to be constructed to a minimum depth of 120m at the recommended drill site. With an estimated discharge of 5.0m/hr, the facility is expected to supply a volume of 20m/day as per the attached hydrogeological survey report.

Laboratory water sampling and testing was done for the water collected from the nearby stream and the results showed that the water quality met the parameters for domestic water as shown in the attached results.

3.4 Administrative and Political Units

3.4.1 Administrative Sub Division

Administratively, Narok County had six sub-counties during the devolution era until after 2019, when two new sub-counties, Transmara South and Narok Central, were created. The initial sub-counties comprised Transmara West, Transmara East, Narok North, Narok South, Narok West, and Narok East. The proposed project will be located in the Transmara South Sub County, which covers an area of 224 km^2, which makes it the smallest while the largest one is Narok West.

Table 2: Area (Km^2) by Sub-County

Number

Sub-County	Divisions	Locations	Sub-Locations	Villages	Area (Km2)
Narok East	4	12	29	172	2123.45
Narok North	2	11	27	220	920.3
Narok Central	2	7	14	228	1239.1
Narok South	4	20	39	510	5378.7
Narok West	3	17	35	310	5452.79
Transmara East	2	6	13	430	311
Transmara West	3	18	40	305	2301
Transmara South	5	17	32	400	224
Total	**25**	**108**	**229**	**2,575**	**17,950.30**

(**Source: Narok CIDP 2023-2027**)

Table 3: Administrative Units in Narok County

Sub-County	No. of Wards	Name of County Administrative Wards
Transmara West	3	Kilgoris Central, Keyian, Shankoe,
Transmara South	3	Angata Barikoi, Kimintet, Lolgorian
Emurua Dikirr	4	Ilkerian, Ololmasani, Mogondo, Kapsasian
Narok Central	3	Narok Town, Nkareta, Olorropil,
Narok North	3	Olposimoru, Olokurto, Melili Ward
Narok East	4	Mosiro, Ildamat, Keekonyokie, Suswa
Narok South	6	Maji Moto, Ololulung'a, Melelo, Loita, Sogoo, Sagamian
Narok West	4	Ilmotiook, Mara, Siana, Naikarra
Total	**30**	

(Source: County Government of Narok CIDP, 2018-2022)

3.4.2 Political Units

Politically, the county has six political constituencies and 30 electoral Wards. The constituencies are Narok North, Narok South, Narok East, Narok West, Kilgoris, and Emurua Dikirr, as shown in Table 4.

Table 4: County's Electoral Wards by Constituency

Constituency	County Assembly Wards
Kilgoris	Kilgoris Central, Keyian, Angata Barikoi, Shankoe, Kimintet, Lolgorian
Emurua Dikirr	Ilkerian, Ololmasani, Mogondo, Kapsasian
Narok North	Olposimoru, Olokurto, Narok Town, Nkareta, Olorropil, Melili Ward
Narok East	Mosiro, Ildamat, Keekonyokie, Suswa
Narok South	Maji Moto, Ololulung'a, Melelo, Loita, Sogoo, Sagamian
Narok West	Ilmotiook, Mara, Siana, Naikarra

(**Source: IEBC**)

The proposed project is located in Lolgorian Ward, Kilgoris Constituency.

3.5 Infrastructure Development

3.5.1 Road, Rail Network, Airstrips and Jetties

Roads—as of 2018, Narok County has a road network of 4,602 km, out of which the national government is in charge of 1,348km and the county government takes 3,254 km. Approximately 185 km are tarmacked from the network, 1,510 km are gravelled, and 2,907 km are earth roads. The main challenge has been that some of the Murram roads are rendered impassable during the rainy season. This has hindered most highly agricultural areas from reaching their potential standard.

Airstrips. The County has four airstrips located at the Maasai Mara game reserve: Serena, Keekorok, Olkiombo, and Musiara. All of them are murram. The airstrips play a crucial role in the tourism sector by increasing the mobility of tourists visiting the Maasai Mara game reserve.

Rail Network – Phase 2B of the Standard Gauge Railway traversing Naivasha- Narok- Bomet-Nyamira - Kisumu (262 KM) is expected to ease pressure on the Mai- Mahiu Narok road. The standard gauge railway will be critical in increasing productivity in the county by enhancing access to markets and easing mobility.

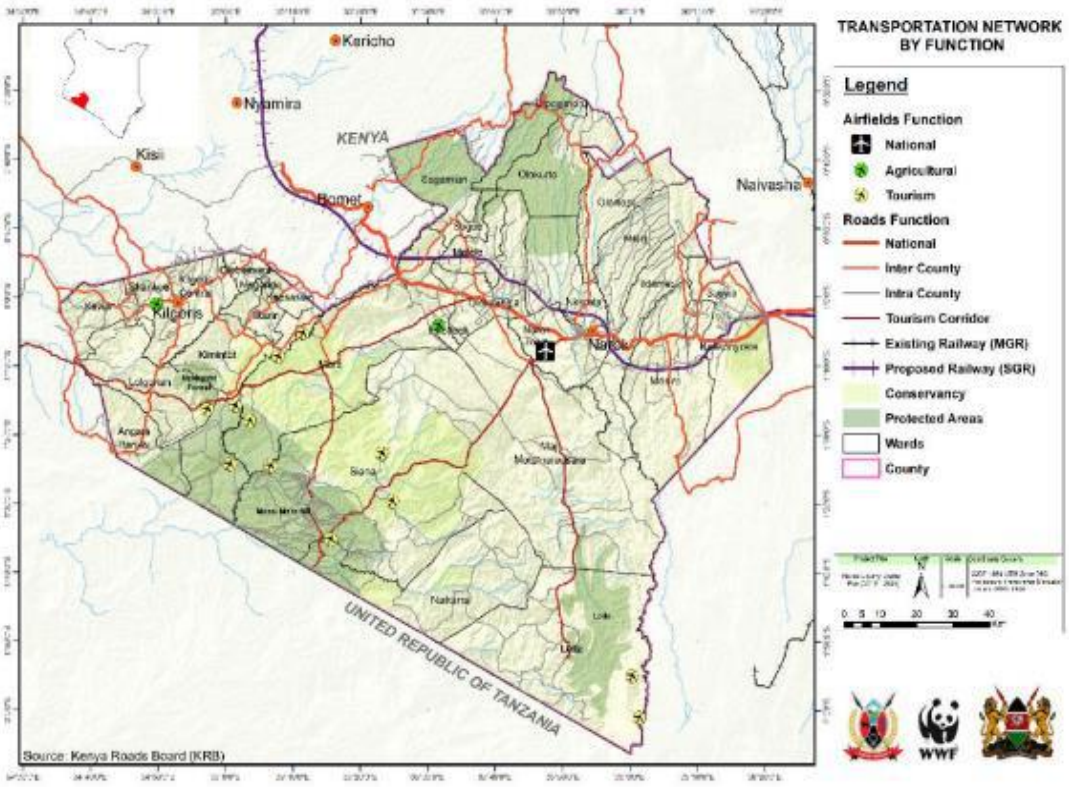


Figure 5: Narok County transportation and connection map

(Source: County Government of Narok CIDP, 2018-2022)

3.5.2 Energy Access

Electricity connectivity as of 2023 stood at 22.1% of households, increasing from 20% of household connections to the national grid as of 2018. Firewood and charcoal are, however, still the most common sources of energy, accounting for 80% of total energy used in the county. Approximately 51% of households are using lanterns for lighting despite the high cost of kerosene. Most of the bigger facilities in the rural areas including the hotels and lodges around the Mara continue to use generators to meet their energy needs. Just 1% of residents in Narok County use Liquefied Petroleum Gas (LPG), and 2% use paraffin. 80% use firewood and 17% use charcoal. A further 29% use lanterns, and 54% use tin lamps. 8% use fuel wood. Electricity use is mostly common in male headed households at 7% as compared with female headed households at 4%. Narok North constituency has the highest level of electricity use at 16%.

Respondents on Sources of Energy for Cooking

In the socio-economic baseline survey, the study examined the energy source for lighting and cooking within the surveyed households. The findings indicate that 12.3% (25 households) used electricity for lighting, while 87.2% (177 households) utilized solar energy. Only 0.5% (1 household) relied on kerosene lamps. Regarding cooking, 81.8% (166 households) used firewood, 10.3% (21 households) used charcoal, 3.9% (8 households) used electricity, 1.5% (3 households) utilized biogas, 2% (4 households) used cooking gas, and 0.5% (1 household) relied on other energy sources.

lighting energy	cooking energy							
	Other	Electrici	Biogas	Charcoal	Firewood	Cooking g	Kerosene	Total
Other	1	0	0	0	0	0	1	2
Electricity	0	0	1	0	1	1	0	3
Solar	0	1	0	3	197	4	0	205
Wind	0	0	0	0	1	0	0	1
Biogas	0	1	0	0	0	0	0	1
Kerosene lamp	0	0	0	0	12	0	0	12
Total	1	2	1	3	211	5	1	224

Figure 6: Sources of energy for cooking and lighting in the Project Area

(**Source: ESIA Study Socio-economic Survey, 2024**)

These findings have implications for the proposed sugar mill industry, necessitating investment in sustainable energy solutions to ensure a stable power supply, reduce environmental impact, and enhance socio-economic development within the community.

3.5.3 Housing

Housing types in the county are influenced mainly by culture. In the rural areas with higher incidences of poverty, the houses are mainly temporary structures made of mud and cow dung. According to the 2009 housing and population census, only less than 10 percent of residents have permanent houses (stone and bricks). Most brick and stone wall houses are found mainly in urban centers. This is because of the enforcement of the building code and other regulations that provide a framework for the type of houses that should be built within urban centres. Using floor as an indicator of housing type, 15% of residents have homes with cement floors, while 84% have earth floors. Less than 1% have tile, and 1% have wood floors. Narok North constituency has the highest share of cement floors at 27%. That is nine times Emurua Dikirr constituency, which has the lowest share of cement floors. Narok North constituency is 12 percentage points above the county average. Narok Town Ward has the highest share of cement floors at 70%. That is 35 times Mogondo Ward has the lowest share of cement floors.

Based on the socio-economic baseline survey, the housing structure in Moita Location exhibits varying characteristics. Of the 224 households surveyed, 31 had finished walls using cement, stones, and lime. Additionally, 27 households had uncovered adobe, plywood, or cardboard walls. In comparison, a significant majority of 166 households had natural walls made from materials such as cane, palm trunks, grass, or similar natural resources.

Regarding floor materials, 178 households had natural floors made of sand or dung, 32 had cement floors, and the remaining had materials like wood planks, ceramic tiles, or carpets. Regarding roofing, 214 households had iron sheet roofs, 9 had grass thatched roofs, and 1 had a roof made of mud or dung.

The housing structure analysis is relevant to implementing the proposed sugar mill industry at the Moita Sub Location. It provides crucial insights into the prevailing housing conditions and materials used, which can inform decisions related to infrastructure development, housing improvements, and environmental considerations. Understanding the housing structure enables industry planners to address housing-related needs, plan for workforce accommodation, and ensure sustainable development practices align with the existing housing landscape. See Figures 7 to 9 below.

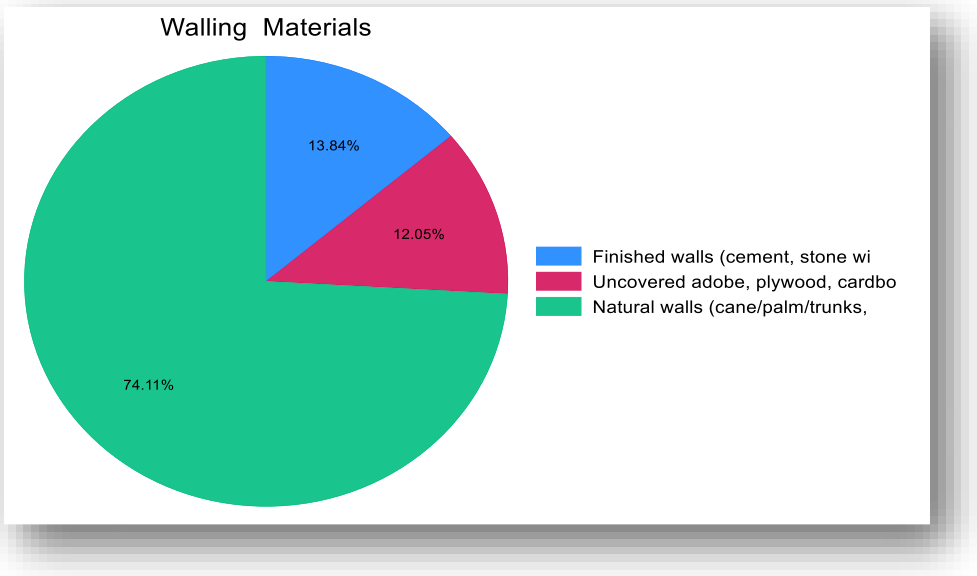


Figure 7: Walling material in the Project Area

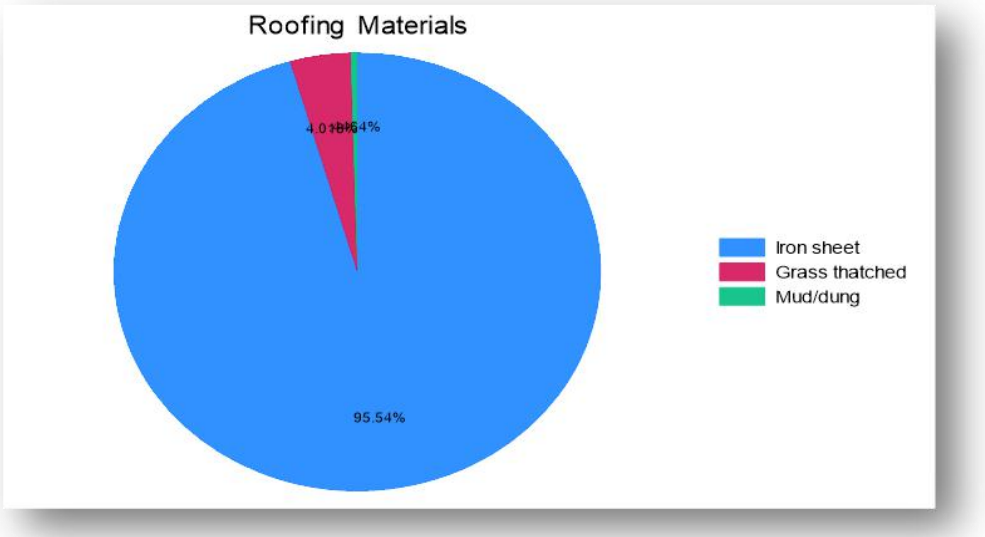


Figure 8: Roofing materials in the Project Area

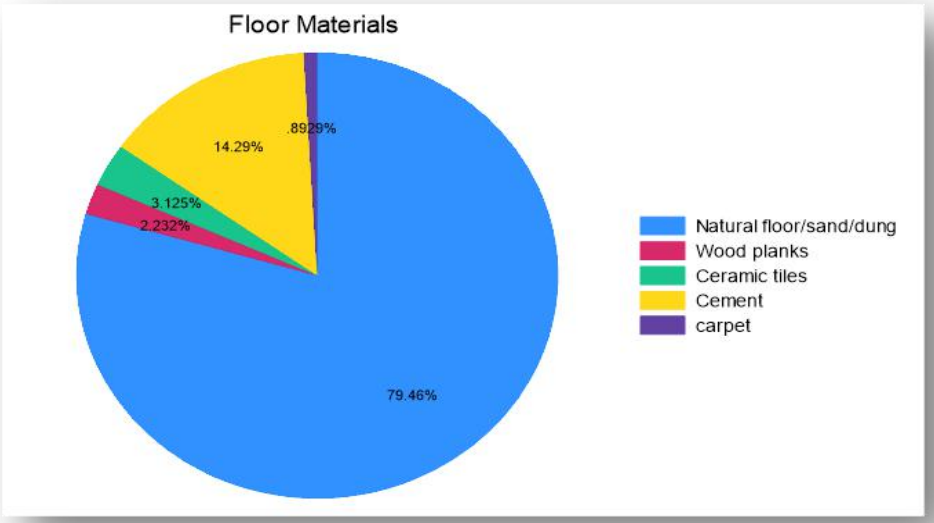


Figure 9: Types of floor materials in the Project Area

(Source: ESIA Study Socio-economic Survey, 2024)

3.6 Land and Land Use

3.6.1 Land Ownership Categories

Land ownership in Narok can be categorized into three main categories: community land, trust land, and private land. Figure 11 shows a map with different land categories in the county.

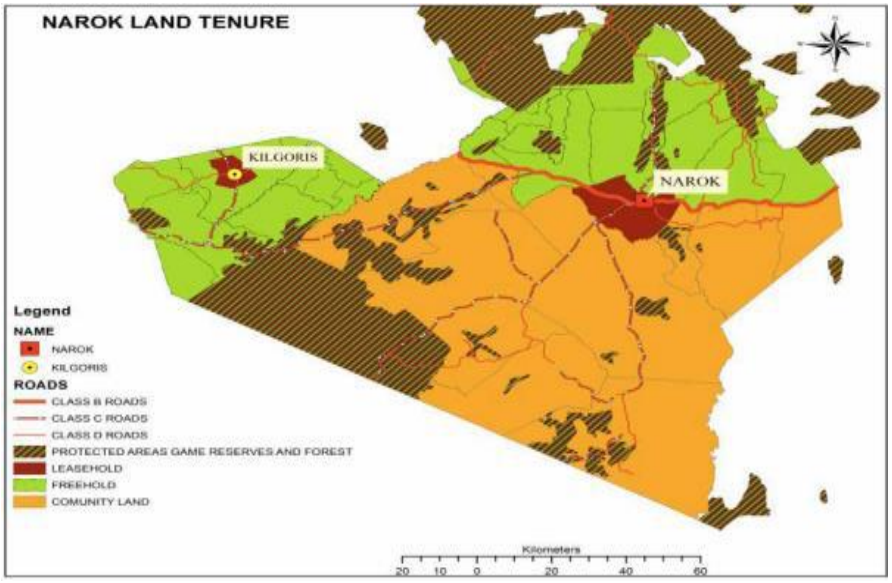


Figure 10: Map of land tenure in Narok

(Source: County Government of Narok CIDP, 2018-2022)

Community land refers to the proportion of land held communally and registered as a group ranch. Due to population growth, this type of land ownership is rapidly diminishing. Group

members are championing the subdivision of these group ranches into individual land ownership—freehold titles. The areas under communal land ownership are parts of Loita and Olokurto Wards.

Trust land is held by the county government on behalf of the people of Narok. This type of land is mainly in urban centres, forest reserve and in Maasai Mara game reserve.

Private land is emerging as a result of the disbandment of group ranches and community land. In urban centres, private ownership is in the form of leasehold titles, while in rural areas, people have freehold titles. Private land ownership has led to land owners leasing out their land to investors. This is mainly happening in the wheat-producing areas and within the Mara ecosystem.

3.6.2 Mean Holding Size

The average land holding size in the county is approximately 16 acres. However, this is not uniform throughout the county. Individuals who own thousands of acres, especially in the wheat-producing areas, own land within the conservancies. Land owned by members of the conservancies has bigger acreages. This is because these areas are conservation zones.

Based on the socio-economic baseline survey in Moita Community, the assessed land tenure revealed that 188 of 224 households own land. Among landowners, 48% cultivate 10 acres or less, 30% cultivate 11-30 acres, 14% cultivate 31-50 acres, and 8% own more than 50 acres. Notably, 12 households do not cultivate land.

Table 5: Land utility in Moita community (proposed project site)

	Of the acres of land that you have access to, how many acres have you cultivated					
What size of land is owned/have accessed by your household	10 acre or less	11-30 acres	31-50 acres	More than 50 acres	None	Total
10 acre or less	86	2	1	0	1	90
11-30 acres	42	7	2	0	6	57
31-50 acres	17	1	6	0	3	27
More than 50 acres	3	5	0	4	2	14
Total	148	15	9	4	12	188

3.6.3 Percentage of land with title deeds

The percentage of land with title deeds is greatly influenced by the subdivision of group ranches and adjudication sections. With the disbandment of the group ranches, the number of freehold titles has increased to about 80%.

3.6.4 Incidence of Landlessness

The county does not have any serious cases of landlessness. However, there are limited cases of people from outside the county who are mainly job seekers who end living in deplorable conditions in upcoming slum in Narok Town. The other landless people are those found encroaching into Mau forest.

3.6.5 Settlement patterns (Urban centers, informal settlements, etc.)

Settlement patterns in Narok are not evenly distributed. Human settlement pattern in the county is influenced by among other things; agricultural potential, development, land ownership tenure, and the ecosystem. This can be explained by the fact that some areas are densely populated while some others are not. The densely populated areas are the major towns (Narok, Kilgoris, Lolgorian, Ololulunga etc) and areas with high agricultural productivity including Mau and parts of Transmara East and West. Areas with high agricultural like the Mau and parts of Transmara have high concentrations of human settlements which are at times associated with informal settlements. Land ownership influences settlement patterns because each clan/family resides in a particular ancestral land. Generally, a bigger percentage of the County's population can be found in the rural areas.

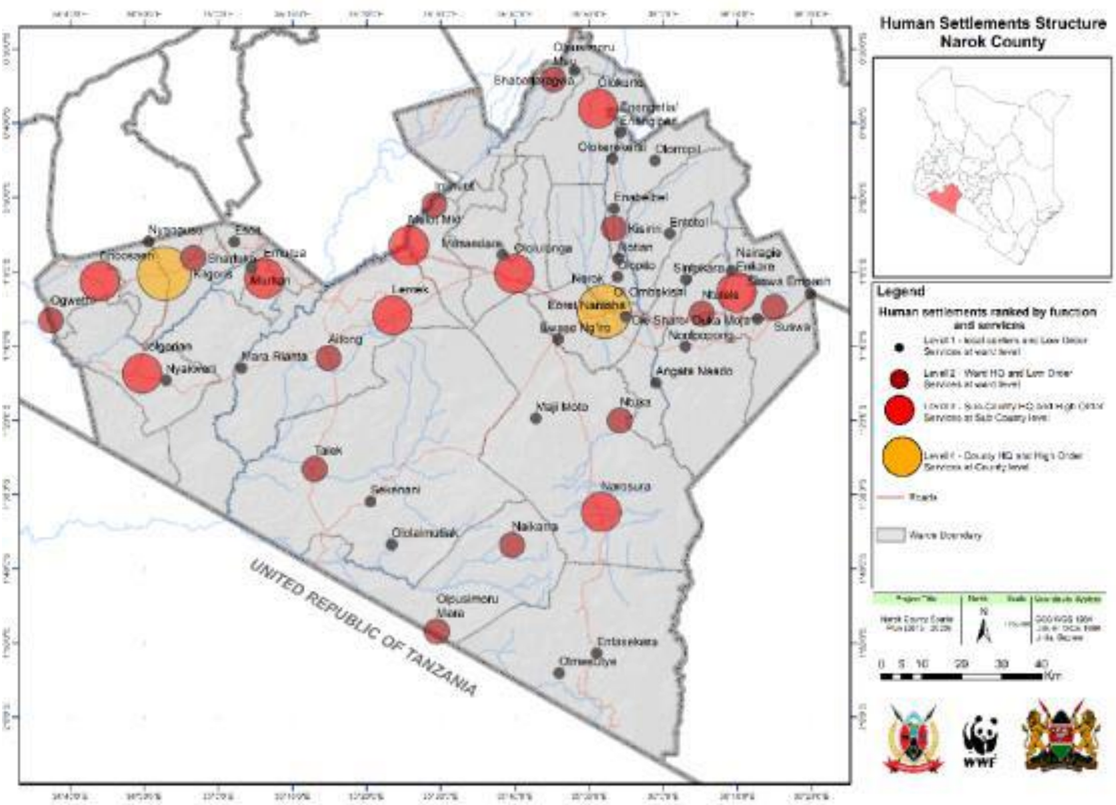


Figure 11: Human settlement map for Narok

Source: County Government of Narok CIDP, 2018-2022

3.7 *Employment*

3.7.1 Employment and Other Sources of Income

The main employment and income opportunities available in the county are agriculture (crop farming and livestock rearing), trade and tourism. The three sectors dominate the economy of the county and have created income and employment opportunities for the majority of youth in Narok. The main business activities include selling and buying livestock, the produce of main crops (maize, wheat and potatoes) and small retail businesses. Maasai Mara National Park and Maasai Cultural work of beadwork and attire are also employment and income opportunities for

the county residents. The main challenges faced in accessing these employment and income opportunities are a lack of capital and inadequate knowledge and skills to expand the sectors and sustain the economy.

Self Employed

Self-employment is the main form of employment in the county accounting for more than 60 percent of all forms of employment. One of the determining factors of employment in the county is education level: 8 per cent of the residents with no formal education, 10 per cent of those with a primary education and per cent of those with a secondary level of education or above are working for pay.

Unemployment Levels

Youth unemployment in the county poses a serious threat to the economy. According to the Analytical Report on Labour Force Dynamics (KNBS, 2012), Narok North (including Narok East), Narok South (including Narok West), and Trans Mara Sub-counties have unemployment rates of 3.8, 3.4, and 2.8 percent, respectively. The county government aims to reduce the unemployment rate by creating income and employment opportunities for the youth through the youth-targeted employment creation framework. The private and civil society sectors have also enhanced employment creation for young people and invested in their skills development.

The socio-economic baseline survey in Transmara West Sub County and Transmara South Sub County communities revealed that the main sources of income were dominated by livestock/poultry keeping (64.5%) and farming (15.8%). Other sources included cash transfers (7.9%), salaried employment (3.9%), daily/casual/common labor (3.4%), skilled labor (1%), and handicraft/artisan work (0.5%).

(See Table 6 below).

Table 6: Sources of Income in Project Area

Sources of Income	Freq.	Percent
Cash transfer	2	0.89
Daily /Casual/common labor	8	3.57
Farming	147	65.62
Fishing	3	1.34
Forestry, and hunting/foraging (such as	1	0.45
Livestock/poultry keeping (E.g. Cattle,	60	26.79
Retail/petty trade (including market ve	1	0.45
Salaried employment (such as medical, t	1	0.45
Skilled Labourer	1	0.45
Total	224	100.00

Source: ESIA Study Socio-economic Survey, 2024

Livestock farming emerged as the dominant economic activity (68.9%), followed by agro-pastoralists (13.3%), mining (8.9%), crop farming (7.4%), and small/large-scale businesses (see Figure 12 below).

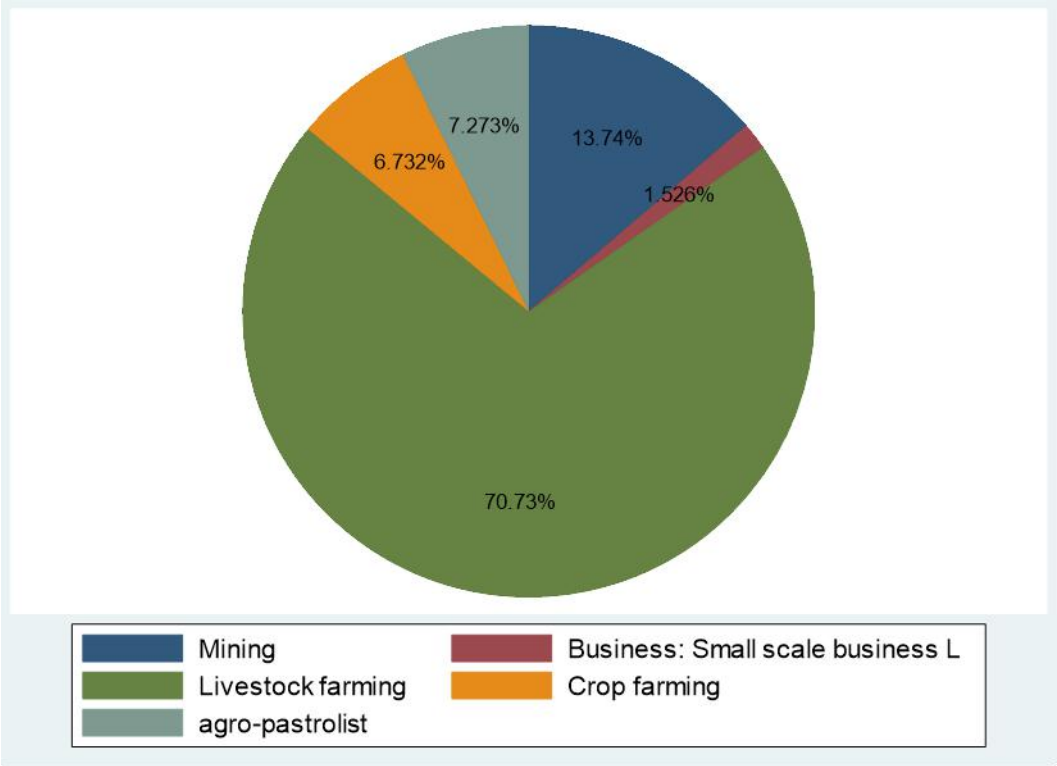


Figure 12: Economic Activities in the Project Area

(Source: ESIA Study Socio-economic Survey, 2024)

3.8 Irrigation Infrastructure and Schemes

3.8.1 Irrigation Potential

Narok County has a huge irrigation potential of 12,400 Ha, while only 3,160 Ha are currently under irrigation. Several permanent rivers flow through the County from the highlands to the low and dry areas. The rainfall ranges between 500mm – 1800mm, which is unreliable both in time and space. The predominant soils are sandy loam, with black cotton soils prevalent in Transmara East. Noteworthy is the large acreage of arable land totaling 164,730 km2, of which only 69,000 Ha is under cultivation. The irrigable land is distributed across the six sub-counties; Narok South/Narok West, 9,000 Ha, out of which 3,000 are irrigated; Narok North/East 400Ha, out of which 160 is irrigated; Transmara East 2,700Ha none is irrigated, Transmara West 300Ha, none is irrigated.

3.9 Crop, Livestock, Fish Production and Value Addition

3.9.1 Main Crops Produced

The main crops grown in the county are wheat, barley, maize, beans, sugarcane, and horticultural crops. The main horticultural crops include; tomatoes, potatoes, cabbage, French beans, onions, and indigenous vegetables. Maize, wheat, barley, tea, coffee, pyrethrum, and sugarcane are grown as cash crops. Maize and wheat are the highest income earning cash crops in the county. On average the county produces about 200,000MT of maize and 135,000 MT of wheat each year.

However, production of these crops has been fluctuating as a result of erratic rains and emergence of the devastating diseases such as Maize Lethal Necrosis Disease (MLND).

Other crops in the county that are increasingly being grown include sugarcane due to the construction of a new factory in Transmara West Sub County. Approximately, 200,000 hectares of land in high and medium potential areas is put under various crops annually. Others are beans, finger millets, pigeon peas, cowpeas, and small-scale production of cassava and sweet potatoes.

3.9.2 Acreage under Food and Cash Crops

Acreage under food crops represents approximately 252,880 Hectares whilst cash crops occupy an area of approximately 69,339 Hectares.

The area under maize also declined from 116,605 ha in 2012 to 110,079 ha in 2016. The total production fell from 462,981 tons, valued at 9.6 billion shillings, in 2013 to 271,158 tons, valued at 7.5 billion shillings, in 2015. Production of wheat declined in the last three years from 2.8 tons/ ha in 2014 to 1.9 tons/ha in 2016. Production declined from 226,662 tons, valued at 6.9 billion shillings, in 2013 to 195,489 tons, valued at 5.6 billion shillings, in 2014, 135,776 tons valued at 4.1 billion shillings, in 2015 and 132172 tons valued at 4.622 billion. The maize and wheat production has limited value addition which is limited to flour milling and cleaning and packaging for WFP.

3.9.3 Average Farm Size

The average farm size under small scale is 6.1 Hectares and that of large scale is 26.3 Hectares with barley, tea, sugarcane and wheat being grown as the major cash crops. There has been sub-division of land into uneconomic units in some parts of the county while some large scale farms remain unutilized.

3.9.4 Livestock production

Livestock rearing is one of the main economic activities supporting the majority of rural household livelihoods in food security, employment, and income generation. Livestock species reared comprise cattle, sheep and goats, poultry, bees, rabbits, donkeys, and other emerging livestock. The population of major livestock species is approximately 1. 4 million Cattle, 1.2 million sheep, and 0.8 million goats. Previously cattle comprised indigenous zebus for meat, milk, and other cultural purposes. However, owing to the increase in human population and competition from other agricultural enterprises (mainly crop farming) local communities have opted to diversify into keeping high-quality breeds. Thus Boran, Sahiwal, exotic dairy breeds, and their crosses are progressively becoming popular. The dairy value chain is growing faster under intensive and semi-intensive production systems.

3.9.5 Main livestock breeds and facilities

Indigenous breeds are the main livestock breed being reared in the county although. In recent times, farmers have agreed to improve those using exotic breeds which are better performing in growth rates and production. In the highlands, there is a high concentration of dairy cattle and merino sheep; while in the lowlands there are the indigenous breeds of cattle and red maasai sheep, among others. In the highlands, the main breeds are Friesian, Aryshire, and Guernsey for dailies, wool sheep, and small East African goats. In the lowlands, the cattle breeds include Zebu

and Boran, small East African goats, red Masaai, and local and exotic birds. To improve livestock breeds there has been adoption of the A. I or improved bulls to upgrade local breeds. To enhance the initiative, farmers are organized into dairy and beef cooperatives and linked to affordable credit and insurance service providers

3.9.6 Aquaculture

The total number of fish farmers in the county stands at 467 currently and the figure is expected to increase with the continued interest in fish farming and appreciation of fish as a healthy alternative source of protein. There are approximately 425 fish ponds in the county, out of which 366 are in Transmara West and East sub-counties. The aquaculture production trend has been steadily increasing for the past five years growing from 8,078 Kg in 2011 through 9,722 kg in 2012, 12,642kg in 2013, and 21,336 kg in 2014 to 31,352 kg in 2015. A total of 2,345,000 and 7,000 tilapia and catfish respectively were stocked in fish ponds. The total value of fish harvested was Ksh. 10,973,200

3.9.7 Ranching (number, ownerships and activities)

The county has 156 ranches, which are all classified as group ranches (NCDP, 2013). However, the number has been decreasing as a result of increased land demarcation and adjudication. There are also a few large-scale commercial farms keeping dual-purpose beef cattle, goat, and sheep, with milk, meat, hide and skin, wool, and mutton as the main products

3.9.8 Apiculture (beekeeping)

Promotion of beekeeping has successfully culminated in formalisation through the formation of a Bee products marketing hub in Narok County with a maximum capacity of 10 tonnes with a current operating capacity of 3.5 tonnes per month during harvesting season. There is a cooperative society (Maasai Mara beekeepers association) in collaboration with the Hive Limited- Christian Aid co –implementer to safeguard producers. There are 48,917 hives for honey production and its by-products (Bee wax used in industrial protection of fruits, Honey liquid for consumption, Queen Jelly, Combs, Bee venom, and Propolis) in the county.

3.10 Tourism and Wildlife

3.10.1 Main Tourist Attractions and Activities

The main tourist attractions scenes in the county include the Maasai Mara National Reserve and the rich Maasai culture. Maasai Mara Reserve is one of the most popular tourism destinations in Kenya, and indeed Africa. The wildlife in the reserve tends to be most concentrated on the reserve’s western escarpment. The Maasai Mara is regarded as the jewel of Kenya’s wildlife viewing areas. The annual wildebeest migration alone involves over 1.5 million animals arriving in July and departing in November. Maasai's rich culture is unique and a tourist attraction. Despite education, civilization, and Western cultural influences, the Maasai people have clung to their traditional way of life making them a symbol of Kenyan culture. Maasai's distinctive culture, dress style, and strategic territory along the game parks of Kenya and Tanzania have made them one of East Africa's most internationally famous tourist attractions.

Other tourism attraction activities include game drives, nature walks, and hot air balloons in the Mara Game Reserve. The activities provide a perfect opportunity to view a wide range of animals in the park. Balloon safaris help to see wild animals from the bird's eye view and when you add the ride itself, it is a double thrill. There are also Maasai village sites and Narok Museum which also attraction sites both for domestic and international visitors.

3.10.2 Main Wildlife

There are about 95 species of mammals, amphibians, and reptiles and over 420 bird species recorded on the reserve The main wild animals in the park are the big five (buffalo, elephant, leopard, lion, and rhino). Other games include wildebeests, hippopotamus, cheetah, impala, topi, coke's hartebeest, giraffe, roan antelope, zebras, spotted hyenas, waterbucks, Thompson's, and Grant's gazelles. The main birdlife includes the vulture, marabou stork, secretary bird, hornbill, crowned crane, ostrich, long-crested eagle, and pygmy falcon. Nowhere in Africa is wildlife more abundant than in the Maasai Mara Game Reserve.

3.10.3 Wildlife conservation areas

There are six registered wildlife conservancies in Narok: Ennonkishu, Mara Naboisho, Mara North, Olare Motoroki, Olkinyei, and Pardamat. The land under the conservancies is cumulatively more than 192,000 hectares. The conservancies are partnerships of different private landowners and communal land owners.

3.11 Industry and Trade

3.11.1 Markets

There are various markets and trading centers, with some having shades and other facilities. Continuous refurbishment of the markets is necessary to improve the levels and ease of doing business within the county. Some of the markets and trading centers include Kilgoris market, Olmeli market, Uhuru market (fenced), Rehabilitation of the Esoit market and cattle sale yard, Ogwedhi sale yard, Shartuk market and sale yard, Endonyo Onkopit market and sale yard and Duka Moja market and sale yard.

3.11.2 Industrial Parks (including Jua Kali sheds)

Narok Town does not have a designated industrial zone/park. However, Juakali sheds are spread across the County. There are seven Jua Kali associations and 3574 Jua Kali artisans involved in various income-generating activities. However, their output has remained low due to a lack of adequate capital arising from the unavailability of cheap credit facilities. With adequate support, they can indeed invest in the unexploited industrial potential, including factories for handling crops, livestock, and forest by-products and value addition which remains largely untapped. Handicrafts have a big untapped potential too.

3.11.3 Types and Number of Businesses

Trade in Narok County is predominantly based in Urban Centers. There are 2 Major Urban Centers:-Kilgoris and Narok Town. There are other Urban Centers that are growing fast, including Lolgorian in Transmara West and Nairagie Enkare in Narok North. There are 198 other smaller urban shopping centers and more than 25 markets in the county. These Towns, Urban

Centers, and Markets serve mainly as trading hubs for farm produce and supply-chain to trade with other parts of the country. The centers also serve as the county's retail and wholesale trading hubs. The county has 198 registered retail trades and 600 registered wholesale traders. In general, there are 198 shopping Centers, 6000 Registered Retail Traders, 198 Registered Wholesale, 1 Bakery, 497 Bars and Restaurants, 131 Unclassified Hotels, 39 Classified Hotels, 3574 Jua Kali artisans 3574, and 7 Jua Kali associations.

3.12 Micro, Small and Medium Enterprises (MSMEs)

The Micro and Small and Medium Enterprises are sub-divided into four areas namely: - retail trade, agri-business, services, and manufacturing. In Narok County, the sub-sector is grossly under-developed. There is inadequate infrastructure for use by entrepreneurs. There is limited financial support from the county and national government for small and micro-enterprises. The national government has put in place several intervention measures to assist the sub-sector to grow and create employment opportunities for the youth. These include training and capacity building, organizing exhibitions, and building Jua Kali sheds. These efforts are largely inadequate, and therefore, the County government needs to intervene and complement the programs. In terms of economic output, these enterprises contribute a big percentage to the County of Narok's output. They offer direct livelihood to an estimated 17,900 people and indirectly to over 100,000 people. If supported with well-targeted interventions such as funding, training, technology transfer, marketing and provision of infrastructure, the potential economic value of these enterprises is enormous.

3.13 Environment and Climate Change

3.13.1 Major Degraded Areas

Environmental degradation in the county is mainly as a result of unsuitable farming methods, effects of climate change, poor solid waste management, soil erosion, inadequate sanitary facilities, massive deforestation for charcoal, timber and firewood; land clearing for agricultural use; poor physical planning in urban areas; quarrying activities; pollution from agro-chemicals and alien and invasive species. Land degradation due to poor agricultural activities, overstocking and deforestation in Narok East, Narok West and parts of Narok South have resulted in the destruction of the upper catchment areas and the rangelands. Sand harvesting in the Suswa area and sections of the Greater Mara region has resulted in overexploitation; leaving the land bare and further exacerbating soil erosion, low water retention and incidences of flash floods. The forest reserves in the county especially Nyakweri Forest and the Maasai Mau are also degraded due to charcoal burning and illegal logging activities

3.13.2 Environmental threats

Drought and famine is one of the main environmental threats currently faced in Narok County. Over 30% of the population in the county resides in the semi-arid areas. Environmental shocks and stresses brought about by droughts compound poverty and affect the poor disproportionately because the poor are found in marginal and vulnerable areas. Loss of livestock and wildlife as well as displacement of communities in search of water and pasture further worsens the quality of life for the local communities. Adverse change in the weather pattern has resulted in reduced yields; which in turn have discouraged investors in the agricultural sector and would be adversely affected hindering the realization of Vision 2030 development goals. Narok County and Narok

Town in particular has experienced increased frequency of flooding in the past decade with flash floods being experienced every rainy season (twice a year) , unlike in the past when the frequency was every five years. The flooding events lead to loss of lives and destruction of property which affects the livelihoods of the business community especially in town. Other hazards include windstorms which are known to cause havoc in areas such as Olokurto, Mau and Ololunga divisions especially in open spaces. Fire hazards are frequent and normally occur during the dry spells (September – December and January – March). Areas prone to fire outbreaks include Masai Mara and Masai Mau forest where they are reported to cause serious ecological damage. Forest fires have been reported to cause serious deforestation in parts of Maasai Mara and parts of Masai Mau where they razed important ecosystems endemic to lions. Irreparable damage has also been caused to homesteads and other establishment as a result of fire outbreaks.

3.13.3 Solid Waste Management Facilities

Pollution of the environment and water sources because of improper waste management has had adverse effects on human, wildlife and livestock health. Improper solid waste management has led to clogging of drainage systems; death of livestock and wildlife from consuming plastics; and general poor ecosystem health. The use of agro-chemicals for farming coupled with inadequate water treatment has resulted in the contamination of ground and surface waters leading to disease outbreaks. The County is however in the process of constructing a sewer system to serve the residents of Narok Town. An integrated Waste Management Plan is crucial in determining the most appropriate collection, segregation, and transportation and treatment systems for both solid and liquid waste in the county and would be beneficial in providing a long term waste management strategy for the coming years.

3.13.4 Climate change – Projected temperature and rainfall changes in Narok County:

Pastoralist, agro-pastoralist and agriculturalists in Narok County will be amongst the most vulnerable due to the impacts of climate change. Increasing climate variability (changes duration, seasonality and increase in temperature) and extreme events (droughts and floods) will affect livestock and agriculture production, incomes, and food security of these communities in the County. It is projected that temperatures in the Africa are likely to increase more rapidly than the other parts of the world, which might surpass 2°C by midway of the 21st century and 4°C by the close of the 21st century (Niang et al., 2014; 2World Bank 2013). Recent national studies by 3Ogutu et al., (2016) indicate striking temperature rises in the ASALs of Kenya with annual average maximum temperature increases between 0.7 to 1.9 °C between 1960 and 2013. The mean annual minimum temperature rose from 0.6°C to 1.7°C between the same periods displaying a more country wide warming. In Narok the maximum average temperature increased by 1.75°C and minimum average temperature by 1.48°C between 1960 and 2013 (4Said et al., 2018).

March- April-May (MAM) and short rains October-November-December (OND) but with increasing dry spell for the months of June-July-August-September (JJAS). Agricultural and livestock production is likely to be affected in the near-term, as warming shifts the climatic conditions that are conducive to current agricultural production. The area of land suitable for agriculture, length of growing seasons and yield potential are expected to shrink-- particularly along the margins of semi-arid and arid areas. These changes in temperature and rainfall will have a huge impact in the planning for crop and livestock production in the county in the next 10 years and beyond.

3.13.5 Baseline Air Quality Survey

Baseline Atmospheric Environment Monitoring was conducted to characterize the existing environment before implementation (DO MINIMUM) of the proposed sugar factory. The conclusions below were drawn from the exercise conducted on the 02 August 2024.

Gaseous Parameters:

All gaseous parameters (carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone and total volatile organic compounds) were measured and quantified at all the four survey locations.

Before the project implementation of the proposed sugar factory, all measured gaseous parameters COMPLIED with the EMC (Air quality) regulations 2014 limits. The ambient air quality data (gaseous) measured around the monitoring locations are considered to be within a typical range of emissions for such neighborhood.

The findings of the gaseous monitoring program indicate that the air quality at the proposed sugar factory is generally good before commissioning of the project. All pollutants measured are at levels that doesn't pose Environmental, Sustainability, Health, Safety, Climate and compliance concerns.

Meteorological Parameters:

The monitoring locations in general provided standard atmospheric environment before project implementation due to the combination of good climate and ambient conditions. Weather and Climatic conditions at proposed sugar factory site provided good dispersion of air contaminants.

Particulate Matter (PM_{10} and $PM_{2.5}$):

Particulate parameters concentrations (PM10 and PM2.5) were measured and quantified across the survey stations. Before the project implementation of the proposed sugar factory, all measured particulate parameter concentration levels recorded were within the typical range of emissions for similar neighborhood. The findings of the monitoring program indicate that the particulate matter atmospheric environment is generally good before the proposed sugar factory implementation. Particulate pollutants measured are at levels that do not Environmental, Sustainability, Health, Safety, Climate and compliance concerns.

When the project related activities will begin, construction practices and factory operations must be put in place to control and manage gaseous pollutants to levels that do not surpass the regulated limits.

3.13.6 Baseline Noise Measurements

Noise measurements was initiated to obtain and quantify the prevailing and existing ambient acoustic levels before implementation of the proposed sugar factory. The obtained acoustic results were thereafter correlated against the Environmental Management Coordination (Excessive noise and vibration regulations) 2009 to ascertain compliance.

The highest diurnal noise emissions recorded at South Project Boundary 4 (SPB-4) extended to levels of 42.1 dBA while the lowest diurnal noise emission recorded at East Project Boundary 2

(EPB-1) extended to levels of 37.1 dBA. The average Leq noise levels in the proposed sugar factory averaged 45.1 dBA and at the sensitive receptor site averaged 39.68dBA. The average noise levels along all the survey locations complies with the EMC noise and vibrations regulations of 2009.

Determination of noise significance of results was done vide correlation against the EMC (Excessive noise and vibration regulations) 2009 to ensure compliance amongst other aspects. Diurnal noise Leq averages were rated as insignificant having scored <75 units based on parameters and score criteria; therefore, the proposed sugar factory site was characterized as noise insignificant area before its implementation. From the results of determination of significance, there is no threat to the noise receivers (residential homes, farmlands and surrounding school) of the noise emissions before construction and operations work begin.

Ambient conditions existed at the time of the diurnal survey. Environmental noise (Wind breeze), traffic noise emissions from motor vehicles / bikes and noise from human interactions were the main sources of noise emissions. The proposed project site was marked with no project related activities during the measurements. The levels of noise recorded from existing operations do not pose any Environmental, sustainability, Health, Safety and compliance concerns before implementation of the sugar factory project.

3.14 Water and Sanitation

3.14.1 Water Resources

Rivers, springs, groundwater, and surface runoff are the county's major water sources. The major rivers are Mara and Ewaso Nyiro. Ewaso Nyiro drains into Lake Natron, while Mara River, which passes through Maasai Mara Game Reserve, drains into Lake Victoria. Groundwater resource, which is developed into boreholes and shallow wells, provides water for domestic and livestock use. On the other hand, dams and water pans are used for livestock drinking. There is a scarcity of water in the lowlands, such as Suswa and Osupuko, which are semi-arid. Suswa area specifically has challenges as it has poor groundwater potential. The soils are also poor for water pans construction. Supply of water to Suswa Town and environs is expected to commence once the ongoing Suswa water supply project works with water from a borehole in Naivasha is complete. The work was expected to be completed in 2018/19. With regard to water quality in the county, water provided by the three water supplies (Narok w/s, Olololunga w/s, Kilgoris w/s) is quality assured as the water supplied is treated water. Spring Water drawn at the source (natural springs) is clean and can be used without treatment. Water from boreholes is considered free from contamination, except for dissolved minerals, which are considered safe for domestic use unless otherwise advised. However, water downstream is unsafe for raw consumption due to pollution, which is mainly from agricultural farm chemicals and human feces due to high levels of open defecation in the county.

3.14.2 Water Supply Schemes

The main water supply schemes in Narok County comprise of conventional water supplies from surface water and borehole water supplies from groundwater sources. Major water supply schemes include Narok water supply, Ololunga water supply, Kilgoris water supply, Mulot water supply, Enaibelbel water supply, Ilmashariani water supply, Lolgorian water supply, Mosiro water supply, Lemek water supply, Oletukat water supply and Rotian water supply. Groundwater

source is also a major contributor in water supply schemes, with the county having an estimated total number of boreholes at 207, both public and private, with an average yield of 6 M3 /hr. The water is supplied by Rift Valley Water Service Board through the local water service provider (Narok Water and Sewerage Company). Water tariffs by Narok Water Company are at Kshs 420 per 6,000 Litres (Minimum) as guided by WASREB through the Water Act 2002, mainly in urban areas, while in rural areas, a 20 Litres jerry can of water costs averages at Kshs 10.00. Government agencies, including Water Sector Trust Fund, Rift Valley Water Service Board, Lake Victoria South Water Service Board, National Water Conservation & Pipeline Corporation, National Draught Management, Ewasongiro South Development Authority, NGOs, and Donors, including World Bank, have greatly supported in water infrastructure development, especially in the areas of boreholes, water pans, and water supplies. Water tariffs by Narok Water Company are at Kshs 420 per 6,000 Litres (Minimum) as guided by WASREB through the Water Act 2002, mainly in urban areas, while in rural areas, a 20-litre jerry can of water costs averages at Kshs 5.00.

3.14.3 Water Access

There are an estimated 1,684 water sources in the county, among them dams, rivers, water pans, springs, and boreholes, which are community and privately owned. In the whole county, only an estimated 8.6 % of households benefitted from piped water (KNBS 2009).Based on the KNBS (2022) Kenya Demographic and Health Survey, it was discovered that only 48% of Nark county households have access to at least basic drinking water service. In 2017, about 1,600 households were estimated to have roof catchment systems for harvesting rainwater. The average distance people travel in search of water is approximately 2 km in wet seasons. The distance increases to 10 Km during the dry seasons. The areas with the longest distance to the water points are in rural areas where only 7,760 households accessed tap water, mainly from protected springs and boreholes. Low flows in rivers and springs have continued to be recorded in the county mainly due to water sources and catchment degradation.

When the study turned to the respondents' drinking water sources within the project area, most households (86 out of 224) rely on surface water, posing potential water quality and safety challenges. Moreover, 103 households depend on unprotected springs, indicating a significant risk of waterborne diseases. Addressing the safety and sustainability of these water sources is crucial for meeting the sugar mill industry's water requirements and ensuring the community's well-being. Additionally, a small number of households rely on other sources such as protected springs (19 households), tanker trucks (4 households), and boreholes (2 households), highlighting the varied but limited access to clean and reliable drinking water within the community.

Table 7: Sources of domestic water in the Project

Source of Drining Water	Freq.	Percent
Tubewell/borehole	2	0.89
Unprotected spring	103	45.98
Protected spring (has concrete lining)	19	8.48
Unprotected dug well	4	1.79
Protected dug well (has concrete lining	1	0.45
Rainwater	2	0.89
Tanker truck	4	1.79
Surface water (river, dam, lake, pond,	86	38.39
Piped water outside home, yard, or plot	3	1.34
Total	224	100.00

(Source: ESIA Study Socio-economic Survey, 2024)

3.14.4 Water Management

Water resources management and its use is managed by the different authorities as established under the Water Act 2016. The main water bodies that manage water resources are: Narok Water and Sewerage Company, Narok Water Resources Authorities, Water Resources Users Association, National Water Harvesting and Storage Authority, Water Services Regulation Board, Water Sector Trust Fund and Water Tribunals. Rift Valley Water Service Board and Lake Victoria Water Service Board are the licensed water service Board in the county. They have subsequently issued WSP licenses to Narok Water and Sewerage Company. Rural water schemes are managed by water management committees whose officials are elected from the water utilities. It is recognized that water is a limited resource subject to competing uses. An approach to managing water systems is crucial for maintaining normal stream flows in rivers and springs and groundwater recharge by water towers and catchment conservations.

Sustainability of water schemes entails professional management by the local water service provider, reduction of non-revenue water and upgrading of borehole schemes from generator powered to solar powered, hence reducing the costs of operations and maintenance and making water affordable. Conservation and protection of water catchment and riparian areas coordinated by the County water department in conjunction with partners is one of the many efforts applied towards water sustainability. The community manages the rural water schemes, thereby enhancing water schemes security against theft and vandalism.

3.14.5 Sanitation and sewerage

The lack of a properly developed sewerage system and good drainage system in urban centres such as Narok Town and Kilgoris is a major threat to good sanitation. The lack of these systems has exposed these towns to the risk of disease outbreaks, especially during the rainy season. Management of waste is not properly organised making the urban centres dirty and posing health challenges. Waste products of about 10 per cent of the households are collected by the local authority, 2 per cent by private firms while 30 per cent of the households use garbage pits. In 2017, approximately 97,010 of the households in the county used latrines (covered and uncovered) for waste disposal while about 65,360 households relieved themselves in the bush, resulting in outbreaks of waterborne diseases such as cholera and diarrhoea, especially during the

rainy seasons. Households in urban areas use pit latrines and septic tanks, which are emptied by Narok Water and Sewerage Company exhauster and privately owned exhausters. This has been necessitated by the lack of a sewer system, which is a major sanitation problem

When the study turned to the respondents' access to sanitation facilities within the project area, Out of the 224 households surveyed, 165 households reported having latrines, indicating a relatively high level of access to basic sanitation facilities. However, with 59 households lacking latrines, there remains a significant gap in sanitation coverage, which could contribute to hygiene and health challenges within the community. Promoting the construction and proper use of latrines is essential to prevent health hazards and enhance the overall health and well-being of the community. The emphasis should be placed on improving sanitation practices to ensure that all households have access to and make use of proper sanitation facilities.

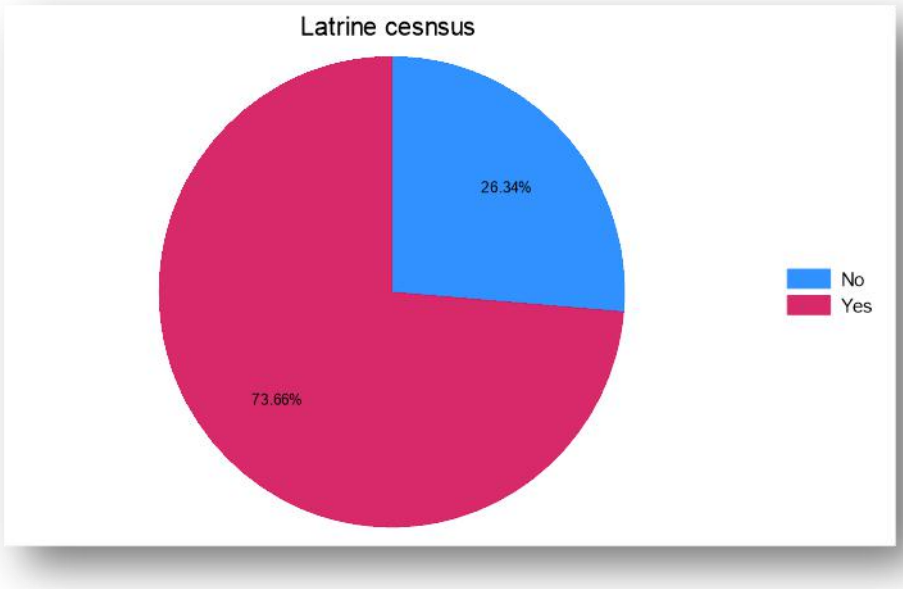


Figure 13: sanitation in the project area

Source: ESIA Study Socio-economic Survey, 2024

3.15 Health Access and Nutrition

3.15.1 Health Access

Health services are offered in three tiers namely :tier one which is composed of community, tier two composed of primary health care facilities i.e. dispensaries and health centres and tier three comprises of hospitals. In total, there is one county referral hospital, three sub county hospitals, 6 mission hospitals, 2 nursing homes, 36 health centres, 110 dispensaries and 47 clinics. The services offered are regulated by boards and councils such as Pharmacy and Poisons Board, Nursing Council, Clinical Officers' Council, Public Health Officers and Public Health Technicians Council, Nutrition and Dieticians Council, among others.

The total bed capacity in all health facilities in the county is 839, of which 300 t are provided by NGOs/missions, 110 by the private sector, and 429 are county health facilities. The average

distance to a health facility is fifteen kilometres (km). There are more than 788 technical health personnel, among them 36 medical doctors, 347 nurses, 105 clinical officers, and 10 dentists. The doctor/ population ratio is 1:40000, nurse/population ratio is 1:15000

The socio-economic survey identified four health facilities in the community. This suggests the need for adequate health infrastructure to cater to the population's health needs and support the well-being of the proposed sugar mill industry's workforce.

The socio-economic baseline survey assessed health facility attendance, and most households (180 out of 224) primarily attended government health facilities. This highlights the community's reliance on public health services and the importance of accessible and well-equipped government facilities. Some of the facilities visited as shown in the table below.

Facility Type	**Facility Name**
Dispensaries	Masurura Dispensary, Nkararo Dispensary, Naarolong Dispensary, Oldanyati Dispensary, Ilkarian Dispensary, Osagam Dispensary, Gem Dispensary, Naarolong Dispensary
Private Clinics	Oldanyati Private Clinic, Valley Gate Clinic, Moita Private Clinic, Jeffa Medical Clinic, Evens Medical Clinic, Kaben Medical Clinic, Enemasi Clinic, Nemasi Clinic
Health Centres	Ogwedhi Health Centre, Oldanyati Health Centre
Sub-County Hospitals	Kehancha Sub-County Hospital, Lolgorian Sub-County Hospital
Community Health Units	Naarolong Community Health Units (trained community health volunteers)

3.15.2 Morbidity

The five most common diseases, in order of prevalence, are upper respiratory tract infection (27 percent), skin diseases (13 percent), diarrhoea (10 percent), malaria (9.5 percent), and pneumonia (6 percent). These conditions could largely be caused by poor sanitation.

Based on the socio-economic study, it was discovered that within the last month, 100 households reported at least one member falling sick. Commonly diagnosed illnesses included malaria (30 cases), respiratory infections (20cases), gastrointestinal disorders (10cases), and other ailments (40 cases). The high incidence of malaria underscores the need for disease prevention and health interventions.

3.15.3 Nutritional status

The nutritional status of the children under 5 years in the county is as follows: Underweight 11.9% (National 11.0%), Stunting 32.9% (National26%), and Wasting 2.4% (National 4%) The county has serious health challenges resulting from malnutrition, especially in Transmara East, Narok South and some parts of Narok North. Therefore, strategies will need to be put in place to promote sustainable community-based activities. These strategies will aim to promote sustainable community-based activities in the areas of agriculture, nutrition, and health education to minimize malnutrition among children aged below 5 years. Adult malnutrition, especially in expectant mothers, is also on the rise, contributing to high incidences of low birth weight,

premature birth, and congenital abnormalities, among others, due to malnutrition during fetal development. This requires diet modification.

3.15.4 Immunization coverage

Immunization coverage in the county is relatively low with fully immunised children at 48%. There is a considerable drop from 58% in 2013. The drop-out rate between penta1 and 3 is relatively high as compared to an acceptable level of below 10%, while the dropout rate between Penta 1 and measles is also on the rise. The program's success largely depends on adequate funding and materials for the proposed interventions. The county is working with other sectors and partners in the following areas: Procurement and distribution of EPI logistics, conducting MLM and operational level training on EPI operations, ACSM activities on EPI, implementation of RED/REC strategy, conducting immunisation defaulter tracing, Provision of services too hard to reach areas including conducting regular preventive cold chain maintenance. Infant mortality rate stands at 39/1000 live births and the children under five mortality rate is 52/1000, which are national.

3.15.5 Maternal health care

Maternal health services are available in all the health facilities in the county. Mothers attending the first ANC clinic are 95% (National 95.5%), while the mothers attending the fourth ANC clinic are 22% (National 57.6%). The attrition between the first and Fourth ANC visits is attributed to the delay in attending the first ANC. To address the challenge of low ANC visits, the Department of Health and Sanitation is working with other partners to establish and strengthen mother-to-mother initiatives.

Teenage pregnancies in Narok County stand at 40%. This figure is quite high. The county is putting up strategies to address teenage pregnancies, which have impacted negatively on teenage health and education. These strategies include engagement with the stakeholders, including the community, in advocacy, establishment, and strengthening of youth-friendly services, reactivation and strengthening of the Department of Health and Department of Education ASRH-RWG, and carrying out integrated school health out-reach services (sexual health education, treatment of minor ailments and screening). Deliveries conducted by a skilled birth attendant are 32% (National level is 61.8%). This is far below the recommended, where all the deliveries are to be conducted by skilled birth attendants. This is being addressed through offering incentives to mothers who deliver in the health facilities under a skilled birth attendant, improving community-based referrals by the community health volunteers, improving skills of health workers to handle emergency maternal obstetric neonatal issues, holding maternity open days, incentivizing mother companions and re-orientation of traditional birth attendants. Several other initiatives have been implemented to enable mothers to access maternal health services. These are the Linda Mama Initiative through NHIF and the Beyond Zero Campaign. Hospital-based maternal mortality is 30/100,000 (National 362/100,000). To reduce maternal mortality, the department is establishing and strengthening maternal, perinatal, and neonatal death committees in all health facilities.

3.15.6 Access to family planning services

Family planning services are available in all hospitals, medical centres and most dispensaries. However, the proportion of the population using contraceptives is relatively low as compared to

the national (approximately 33% National 58.0%). Low uptake of FP services is attributed to low literacy levels, and negative cultural beliefs and practices. To address the shortfall in family planning uptake, the county through the department of health and sanitation in conjunction with the partners have initiated community based short term contraceptive distribution through the community health volunteers and improving skills on provision of long term contraceptive methods by the health workers.

3.15.7 HIV and AIDS prevalence rates and related services

The HIV prevalence in Narok County is at 3.1% compared to National level of 5.6%. HIV counseling and testing stands at 58% (National 76%), and PMTCT coverage is 77% (National 69%). A remarkable gap exists when the figures are compared with the national figures. To address these gaps, several programs have been initiated within the county on HIV and AIDS. The county government, National government through NACC, and other partners do these. Partners in health dealing with HIV and AIDS include PEPFAR (WALTEREED) and Aphia Plus. Major activities include care, treatment, counseling, testing, and advocacy (Source DHIS2 and KDHS).

3.16 Education, Skills, Literacy and Infrastructure

3.16.1 Transmara West Sub County and Transmara South Sub County Education Level

The socio-economic baseline survey examined respondents' levels of education, revealing the following distribution: 77 with no schooling, 61 with primary-level education, 48 with secondary-level education, 35 with tertiary/university/college education, and 3 with vocational training.

3.16.2 Pre- School Education (Early Childhood Development Education)

There are 695 ECDE centres distributed across sub-counties with an enrolment of 69,030 learners. Currently, there are 1,388 ECDE caregivers distributed across the county. The ECDE centers have registered a transition rate of 89% and a literacy rate of 67%. The teacher-pupil ratio currently stands at 1:50.

3.16.3 Primary Education

There are 664 public primary schools, including 19 special schools, with an enrolment of 239,948 across the County. The transition rate from primary to secondary schools currently stands at 11%. At this level of education, the teacher-pupil ratio stands at 1:53.

3.16.4 Non formal Education

There is only one non-formal education training centre in Narok County, Nakase Training Centre. It offers KCSE training to students unable to undergo the ordinary secondary school training programme. Non-formal education remains a new concept in the county and has not been embraced. This notwithstanding, it plays a critical role as it enables learners left out by the formal system to acquire basic certificates and pursue further education.

3.16.5 Youth polytechnics

Youth polytechnics are Technical Vocational Education and Training (TVET) institutions that offer training below diploma levels. In total there are nine youth polytechnics in the county; 2 in Narok north and south sub-counties, four in Transmara West and one in Transmara sub-county. The centres are manned by 99 instructors against an enrolment of 600 trainees giving an instructor: student ratio of 1:6.The philosophy of TVET training is "education for the workplace" and focuses on providing skills that meet the needs of the work place and self-employment. Youth Polytechnics have since been rebranded by the TVET Act of 2013 as vocational training centres (VTCs).

3.16.6 Secondary Education

There is a total of 138 secondary schools; 28 schools in the Narok North sub-county, 53 in Narok South, 31 in Transmara East, and 26 in the Transmara West sub-county. The gross enrolment enrolment stands at 31,252 against a teaching force of 775. The teacher: pupil ratio stands at 1:40. Transition rate from secondary school to university is very low at 7%. Despite the government's continued improvement of infrastructure and provision of bursary funds to needy children in secondary schools, performance in national examinations remains very low in the County. For instance in 2017, out of 6,459 candidates who sat KCSE examinations in the county, only 459 managed the minimum university entry grade of C+. Therefore, about 6000 secondary graduates can only continue with further education by pursuing diploma and certificate courses available majorly in TVET institutions.

3.16.7 Tertiary Education

Tertiary education in the county comprises middle-level colleges and universities. There is one public university and two tertiary colleges, namely Maasai Teachers and Ludebe Colleges, both situated in Narok town. The total enrolment in this college is 2,065, with approximately 56 tutors. 1.21.7. Adult and Continuing Education Adult and continuing education remains an important component of education in this county. There is a total of 111 centres: 28 in Narok North, 35 in Narok South, 34 in Transmara West, and 14 in Transmara East. The number of centres dropped from 117 in 2013 to 111 in 2018, which can be attributed to an improved level of literacy.

3.16.8 Technical, Vocational Education and Training

TVET institutes are middle-level colleges offering technical and vocational skills training up to the diploma level. There are currently four (4) well-developed TVET institutes in the county. The government policy has informed the establishment of these institutions of establishing a TVET institution in every constituency. Among the challenges facing the development of TVET include an inadequate number of qualified instructors, few TVET institutions, Limited teaching and learning materials, and inadequate research to support TVET training.

3.16.9 Museums, Heritage and Cultural sites

The county currently has museums and heritage sites, which play a crucial role in socioeconomic advancement.

3.16.10 Talent Academies

The County has not established youth talent Sports academies in all the Sub-Counties as anticipated but has been running a youth Sports Centre in Narok North as a pilot program. The projected plan is to build an all-purpose talent academy at Ntulele, which will have a secondary school and be multipurpose in its training programmes for young sportspeople.

3.16.11 Sports facilities

The County has only one stadium, namely Narok County Stadium which was funded by the Department of Urban Development upon request of the local authority. This was done in line with Vision 2030 and under the specific objective of enhancing and sustaining revenue collection for the County Government, thus creating opportunities for poverty reduction and improved of service delivery. The facility has a 5000-sitting capacity, with other amenities befitting a modern stadium facility. Currently, the stadium hosts Kenya's premier league matches and has been host to the Rift Valley trials of Safaricom's Chapa Dimba, a Presidential visit, among other high-profile events.

3.16.12 Libraries /information documentation centres/ Citizen Service centres

There is one library facility in the entire county, which is located in Narok town. To enhance literacy level and promote the Learning culture in the county, there is a need for the construction of more facilities across the county.

3.16.13 Registered traditional herbalists and medicine-men

There are 60 registered traditional herbalists and medicine men spread across the County.

3.16.14 Community Organizations/Non-State Actors

The county has a few Non-Governmental Organizations (NGOs) that support the area's development. The main NGOs in the county include World Vision, World Concern, and Action Aid, among others. The NGOs are mainly involved in water and sanitation, health, education, and social protection.

3.16.15 Cooperative Societies

There are 213 co-operative societies in the county, with a membership of 76,269 people. However, only 101 cooperative societies are active. The main objectives of these cooperative societies are to market members' farm produce and provide credit facilities and farm inputs to members. However, cooperative organizations are faced with serious challenges in management, low cooperative education absorption, and lack of adequate markets, among other issues.

3.16.16 Public Benefits Organizations (PBOs)

Among the active Public Benefits Organisations (PBOs) are the Centre for Rights, Education and Awareness (CREW), Safaricom, and KCB Foundation. The PBOs work closely with county departments and sectors by supporting numerous programmes and initiatives.

3.16.17 Development Partners

Many different development Partners are working with the Department of Education to offer support on various. Among the organisations in the county are UNESCO, WWF, World Bank, Africa Development Bank, Japan International Corporation Agency, DANIDA, United Nations Environment Programme, GTZ, and SNV, among others. However, despite various partners being working in the county, there is no common agreed framework, which has led to duplication of efforts and uneven development in the county.

3.16.18 Youth empowerment and social inclusion

There are four youth empowerment centres in the county distributed in four sub-counties. To enhance youth empowerment and social inclusion the county government in collaboration with other development have designed various programmes initiating income generating activities (IGAs) for the vulnerable populations. These include boda boda driving courses, jua kali and training on various technical courses among others. In employment in the county government youth and women have been mainstreamed. The county has also implemented Access to Government Procurement Opportunity (AGPO), which has seen youth get government contracts.

3.16.19 Education Level in Project Area

In the socio-economic baseline survey, the level of education among respondents was examined, revealing the following distribution: 77 with no schooling, 61 with primary level education, 48 with secondary level education, 35 with tertiary/university/college education, and 3 with vocational training (see table 8). The impact of these results is crucial as it sheds light on the educational landscape, highlighting potential challenges and opportunities for development. It allows stakeholders to identify educational gaps and design targeted interventions to improve literacy rates, enhance workforce skills, and foster economic growth, ensuring a more inclusive and prosperous future for the community.

Table 8: Education level in project area

Highest Level of Education	Freq.	Percent
No school	77	34.38
Primary school	61	27.23
Secondary school	48	21.43
Tertiary/University/college	35	15.62
Vocational School	3	1.34
Total	224	100.00

4. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

Environmental law is principally concerned with ensuring the sustainable utilization of natural resources according to a number of fundamental principles developed over the years. In an ideal setting, the utilization of land and land-based resources should adhere to these principles: sustainability, intergenerational equity, the principle of prevention, the precautionary principle, the polluter pays principle, and public participation.

The EMCA, 1999, was developed based on the principles highlighted in the preceding sections. Its basis was the fact that the public should be given effective access to judicial and administrative proceedings and that it should have access to the judicial review of environmental decision-making functions effectively.

4.1 Background to environmental management policies and laws

4.1.1 Sustainability

The principle of sustainability requires that natural resources should be utilized in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations. It strives for equity in allocating the benefits of development and decries short-term resource exploitation which does not consider the long-term costs of such exploitation.

4.1.2 Principle of intergenerational equity

The principle of sustainability should be examined together with that of intergenerational equity, which focuses on future generations as the rightful beneficiaries of environmental protection. Essentially, the principle of intergenerational equity advocates fairness so that present generations do not leave future generations worse off by the choices they make today regarding development. Its implementation requires the utilization of natural resources in a sustainable manner while avoiding irreversible environmental damage.

4.1.3 Principle of prevention

The principle of prevention states that protecting the environment is best achieved by preventing environmental harm in the first place rather than relying on remedies or compensation for such harm after it has occurred. This principle is based on the fact that prevention is less costly than allowing environmental damage to occur and then taking mitigation measures.

4.1.4 Precautionary principle

The precautionary principle recognizes the limitations of science, as it is not always able to accurately predict the likely environmental impacts of resource utilization. It calls for precaution in the making of environmental decisions where there is scientific uncertainty.

Accordingly, it is closely related to the principle of prevention and can be viewed as the application of the principle of prevention where the scientific understanding of a specific environmental threat is not complete. The precautionary principle thus requires that all reasonable measures must be taken to prevent the possible deleterious environmental consequences of development activities. Further, it demands that scientific uncertainty should not be used as a reason for not taking cost-effective measures to prevent environmental harm.

4.1.5 Polluter pays principle

The polluter pays principle requires that polluters of natural resources should bear the full environmental and social costs of their activities. It seeks to internalise environmental externalities by ensuring that the full environmental and social costs of resource utilization are reflected in the ultimate market price for the products of such utilization. Since environmentally harmful products will tend to cost more, this principle promotes efficient and sustainable resource allocation as consumers are likely to prefer the cheaper, less polluting substitutes of such products.

4.1.6 Principle of public participation

The principle of public participation seeks to ensure environmental democracy and requires that the public, especially local communities, participate in environmental and development decisions that affect their lives. It requires that the public have appropriate access to information concerning the environment held by public authorities and be given an opportunity to participate in decision-making processes.

4.2 Policy framework

4.2.1 Environmental policy

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

4.2.2 National Environmental Action Plan Framework, 2009-2013

The National Environment Action Plan Framework is the second national environmental policy after the 1994 National Environment Action Plan (NEAP). The development of NEAP is provided for by EMCA, 1999 which requires preparation of Environmental Action Plan at different levels; district, provincial, and national levels. The framework recognizes the intertwined linkages between economic growth and environment in Kenya. It highlights priority themes and activities for the country towards achieving sustainable environment.

The policy framework, among others, proposes integration of environmental concerns into regional and local development plans, promotion of appropriate land uses, and enforcement of EMCA, 1999 and its subsidiary and other relevant legislations. The policy framework also advocates for efficient water harvesting, storage, and usage. On human settlements and infrastructure, this policy framework recognizes the associated environmental issues. These include waste management, sanitation, diseases, land use changes in conservation areas, demand for water, energy, construction materials, pollution, land degradation, biodiversity loss, land and housing tenure, urban planning and design and electronic wastes. In managing the proposed sugar factory operations, consideration of the highlighted issues is vital for contributing to the national sustainable development goals.

4.2.3 The Sugar Policy

The Sugar policy, as established, is in line with the national objectives of national food policy, which are self-sufficiency, food security, employment creation, and income generation, foreign exchange earnings, stemming rural-urban migration, poverty alleviation, and overall economic growth. Sugar is vital in providing livelihoods, earning national revenues and incomes, 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.

The Sugar sub-sector is a major enterprise in the Western and Nyanza and potential exists in the Eastern and Coastal belts. Further improvement of this vital industry will help alleviate unemployment through backward and forward linkages.

4.2.4 The Occupational safety and Health Policy

This Policy lays emphasis on continual development and implementation of the Occupational Safety and Health systems and programs to reduce incidences of work related accidents and diseases. In addition, it seeks to offer equitable compensation to those who suffer physical injuries and contract occupational diseases. The Policy addresses the current challenges, gaps and future development of safety and health systems and programs in the country. It promotes basic principles of assessing occupational risks or hazards; combating occupational risks or hazards at source; and developing a national preventative safety and health culture that includes information, consultation, research and training. The policy also promotes continuous improvement of occupational safety and health by integrating Kenyan national laws and regulations with Regional Protocols, ILO Conventions, ISO standards and the best practices in the world. It sets up mechanisms for resource mobilization for occupational safety and health programs and activities and provides guidance to all stakeholders in the development and implementation of occupational safety and health systems and programs. The proponent is committed to put in place occupational safety and health systems and programs to be in tandem with the national policy.

4.2.5 The Kenya Vision 2030 and the "Big Four" Blueprint

The Kenya Vision 2030 is the national long-term development policy that aims to transform Kenya into a newly industrialized, middle-income country, providing a high quality of life to all its citizens by 2030 in a clean and secure environment.

The Big Four is an economic blueprint that was developed by the government to foster economic development and provide a solution to the various socio-economic problems facing Kenyans. The four items intended for delivery include Food Security and Nutrition, Universal Health Care, Affordable Housing, and enhancing the Local Manufacturing industry. The proponent will explicitly play a big role in the realization of two of the pillars, namely food security and local manufacture, as soon as it starts its operations in Narok County.

4.2.6 Sustainable Development Goals (SDGs)

MDGs are eight internationally agreed goals for socio-economic development that emphasize the following: elimination of extreme poverty and hunger; universal primary education; gender equality; reduction in child mortality; improvement in maternal health; lower HIV/AIDS and major disease incidence; environmental sustainability; and better partnerships with international development partners. The facility has an opportunity to contribute towards the local achievement of some of these goals via employment opportunities creation, corporate support to community initiatives, and contribution towards achieving environmental sustainability goals.

4.2.7 National Water Policy

The National Policy of Water, which was promulgated in April 1999 as Sessional Paper No. 1 of 1999, calls for the decentralization of operational activities from the central government to other sectors, including local authorities and the private sector, and increased involvement of communities in order to improve efficiency in service delivery. It also tackles issues pertaining to water supply and sanitation facilities development, institutional framework and financing of the sector. According to the policy, in order to enable sustainable water supply and sanitation services, there is a need to apply alternative management options that are participatory through enhanced involvement of others in the provision of these services, particularly the private sector.

The overall objective of the National Water Policy is to lay the foundation for the rational and efficient framework for meeting the water needs for national economic development, poverty alleviation, environmental protection, and social well-being of the people through sustainable water resource management.

4.3 Legal framework

4.3.1 NEMA

The National Environment Management Authority (NEMA) is the National body charged with coordinating matters of implementation of policy issues relating to the environment. This body was established under the Environmental Management and Coordination (amendment) Act (EMCA), 2015. Other departments that deal with environmental issues in the Sub County include Water Resources Authority (WRA), the Kenya Forestry Service, Kenya Wildlife Services (KWS), National Construction Authority (NCA), Agriculture and Food Authority (AFA), County Government of Narok, among others.

The proponent is committed to comply with all applicable legal provisions and regulations which have been reviewed in the table below.

Table 9: Relevant legal and regulatory requirements

Legislation/Regulation/ Standard	Provisions	Compliance/Non-compliance
The Constitution of Kenya (2010)	• Provides for the protection of the right to private property • Provides for the sound conservation and protection of ecologically sensitive areas • Supports the settlement of land disputes through recognized local community initiatives • Gives powers to the state to regulate the use of land	• The proponent will ensure sound protection of the environment and any other ecologically sensitive receptor by installing pollution prevention technologies such as effluent treatment and recycling plants. • The proponent involved members of the public in the proposed development during public participation and shall be involved during operation in ensuring the factory operates and, at the same time, safeguarding the environment
Environmental Management & Coordination Act, 1999 (Amended 2015) and Subsidiary Regulations	Ensure environmental protection during project implementation. • Environmental Impact Assessment EIA) • Environmental Audit and Monitoring, Environmental Quality standards, and issuance of environmental protection orders • Generation of sector related regulations • Environmental Management and Coordination (Environmental Impact Assessment and Audit) Regulations, 2003 - Waste Management Regulations - 2006 - Water Quality Regulations - 2006 - Wetlands, River Banks, Lake Shores, and Sea Shore Management Regulations - 2009 - Air Quality Regulations - 2014	• The proponent shall comply with EMCA and subsidiary regulations, including best international practices; • The proponent shall have an Environmental Policy in place and employ an environmental officer to oversee all environmental matters during the construction and operation of the sugar mill.
Environmental Management and Co-ordination (Waste Management) Regulations 2006	• Provides standards for handling, transportation, and disposal of various types of wastes, including hazardous wastes.	• The proponent shall utilize sugar process waste known as bagasse to produce power for its own consumption. • The proponent shall contract a NEMA registered waste disposal agent to dispose of appropriately its solid waste, including

Legislation/Regulation/ Standard	**Provisions**	**Compliance/Non-compliance**
		hazardous wastes such as used oil and oil filters from the workshop; • The proponent shall pave and install oil water interceptor in active operation area such as the workshops and parking areas.
Environmental (Impact Assessment and Audit) Regulations, 2003	• No proponent shall implement a project if it is likely to have a negative environmental impact; or for which an environmental impact assessment is required under the Act or these Regulations unless an environmental impact assessment has been concluded and approved in accordance with these regulations. • No licensing authority under any law in force in Kenya shall issue a license for any project for which an environmental impact assessment is required under the Act unless the applicant produces to the licensing authority a license of environmental impact assessment issued by the Authority under these Regulations	• The proponent is carrying out the ESIA for NEMA review and licensing and shall carry successive Environmental Audits at the facility to identify new potential environmental impacts associated with the future operations of the factory.
EMCA (Water Quality) Regulations, 2006	• Every person shall refrain from any act which directly or indirectly causes, or may cause immediate or subsequent water pollution, • No person shall throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution. • No person shall (a) Discharge, any effluent from sewage treatment works industry or other point sources without a valid effluent discharge license issued in accordance with the provisions of the Act; (b) Abstract ground water or carry out any activity near any lakes, rivers, streams, springs and wells that is likely to	• The proponent shall install an Effluent Treatment and recycling Plant (ETP) for pre-cleaning and recycling of effluent water from the factory. • The facility shall apply for a valid Effluent Discharge License from NEMA for its Effluent Treatment Plant once it is operational.

Legislation/Regulation/ Standard	**Provisions**	**Compliance/Non-compliance**
	have any adverse impact on the quantity and quality of the water, without an environmental impact assessment license issued in accordance with the provisions of the Act;	
EMCA (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009	A person shall not engage in any activity that may- • have an adverse impact on any ecosystem; • lead to the introduction of any exotic species; • lead to unsustainable use of natural resources, Without an Environmental Impact Assessment License issued by the Authority under the Act.	• The area lies on the boundary of the Mara River and Migori River catchments, and no effluent shall be released into the environment since the treated effluent water shall be re-used for other purposes within the factory.
Environmental Management and Coordination (Air Quality) Regulations, 2014	• Provides for ambient air quality tolerance limits. • Prohibits air pollution in a manner that exceeds specified levels. • Provides for installation of air pollution control systems where pollutants emitted exceed specified limits. • Provides for the control of fugitive emissions within the property boundary. • Provides for the control of vehicular emissions. • Provides for preventing dispersion of visible particulate matter or dust from any material being transported. • Provides for the acquisition of an emission license.	• The proponent shall install an appropriate Electrostatic precipitator (ESP) as an effective emissions control technology; • The proponent shall also sponsor tree planting exercises within and around the premises to counter air pollution as a result of the activities due to their operations.
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 a 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 proponent shall strictly adhere to these regulations during the construction and operation phases, respectively. • The proponent will ensure compliance with the site's set noise level limits during the construction and operation phases. • The contractor shall ensure that employees are not exposed to noise levels above 85 dB (A) and, in such cases, provide suitable personnel

Legislation/Regulation/ Standard	**Provisions**	**Compliance/Non-compliance**
	• The regulations also provide that no person shall cause or cause to be made excessive vibrations that annoy, disturb, injure, or endanger the comfort, repose, health, or safety of others in the environment, or cause to be made excessive vibrations that exceed 0.5 centimetres per second beyond any source property or 30 meters from any moving source. • Vibrations that annoy, disturb, injure, or endanger the comfort, repose, health, or safety of others in the environment or cause to be made excessive vibrations that exceed 0.5 centimeters per second beyond any source property or 30 meters from any moving source.	protection equipment (ear protective devices). • The proponent shall not engage in activities that will generate noise without a license from the relevant office. • Annual environmental audit of the facility will also be carried out to monitor observation of these regulations.
Land Act 2012	Promote Land Conservation including and need to prepare EMP: • Conservation of ecologically sensitive public land • Conservation of land based natural resources • Submit an EMP pursuant to existing law on the environment	• The proponent is the registered title holder and shall ensure that he complies with the current environmental laws in order to protect the land from any form of pollution.
The Energy Act 2019	• The Traffic Act, 2012 gives provisions and guidelines that govern the Kenya roads transport sector • 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	• The proponent shall follow this act to the latter and ensure Licensing and authorization to generate and/or transmit electrical power, supported by an Environmental Impact Assessment Report (EIA) approved by NEMA.

Legislation/Regulation/ Standard	**Provisions**	**Compliance/Non-compliance**
	development and use of renewable energy, including but not limited to— (i) promoting the utilization of renewable energy sources for either power generation or transportation; (ii) 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.	
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	• The developer shall ensure the final drawings for the proposed development are approved by the relevant departments of County Government of Narok
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	• 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.

Legislation/Regulation/ Standard	**Provisions**	**Compliance/Non-compliance**
	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	• 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.
The Public Health Act (Cap 242)	• No person shall cause a nuisance or shall suffer to exist on any land or premises owned or occupied by him or of which he is in charge any nuisance or other condition liable to be injurious or dangerous to health. • It shall be the duty of every health authority to take all lawful, necessary and reasonably practicable measures for preventing or causing to be prevented or remedied all conditions liable to be injurious or dangerous to health arising from the erection or occupation of unhealthy dwellings or premises	• Housekeeping within the site shall be well maintained in all the operation areas including compliance with the Ministry of Health Covid-19 Protocols by providing hand washing stations and notices to both the employees and visitors to keep social distances and put on face masks at all times within the facility. • Sanitary conveniences shall be provided to the employees during construction and operation of the factory; • The proponent will sensitize the community on the importance of environmental management and carry out HIV/AIDS awareness programs within the community
The Occupational Safety and Health Act, 2007	• Provides that every occupier shall ensure the safety, health and welfare at work of all persons working in his workplace	• The facility will carry out an occupational health and safety audit, fire safety audit, risk

Legislation/Regulation/ Standard	**Provisions**	**Compliance/Non-compliance**
	• Provides that the architectural plans of the factory be approved by the Directorate of Occupational Safety and Health Services before construction activities commence. In approving the plans Directorate of Occupational Safety and Health Services will among other requirements ensure that: - Prescribed dimensions with regards to the distance of floor to ceiling of every workroom are upheld - Space defining machine layout for intended use by operators will be within statutory limits - Emergency exits are provided for and are designed to open in accordance to statutory requirements - Sanitary conveniences are provided for with adequacy as to the number of intended employees and are designed to have separate approaches - First aid facilities like first aid room(s) are provided for, - There is provision for accommodation for clothes not worn during working hours - There is provision for adequate ventilation - There is provision for storage of a firefighting water storage tank with a capacity of at least 10,000 litres • Provides that before any person occupies or uses any premises as a workplace, he shall apply for the registration of the premises • Provides that the workplace shall be of sufficient size for work to be carried out with ease and shall further have the necessary free space and, having regard to the nature of the work, an adequate amount of air for each employee, the minimum permissible being ten cubic meters per person • Provides that an occupier shall ensure that effective and suitable provision is made for securing and maintaining, by the circulation of fresh air in each workroom, the adequate ventilation of the room	assessment and is in the process of implementing the recommendations. • The proponent shall ensure that firefighting equipment is present and strategically placed within the facility including a standby fire engine; • First Aid kits shall be made available in every department and training on first aid done; • Fire assembly points shall be marked where the visitors and employees can gather for briefing in case of a fire; • There shall be provided clear and demarcated emergency exits within the facility; • An ambulance shall be on standby in the eventuality of an emergency; • Provision of PPEs shall be made mandatory within the facility. • Application for site registration will be done as soon as construction commences and registration of the facility shall follow when the facility starts operations. • Safety and health committee shall be formed when the facility is operational • Safety signs shall be erected and posted as appropriate when the facility is operational.

Legislation/Regulation/ Standard	**Provisions**	**Compliance/Non-compliance**
	• Provides that an occupier shall ensure that effective provision is made for securing and maintaining sufficient and suitable lighting, whether natural or artificial, in every part of his workplace in which persons are working or passing • Provides that sufficient and suitable sanitary conveniences for the persons employed in the workplace shall be provided, maintained and kept clean, and effective provision shall be made for lighting the conveniences; and, where persons of both sexes are or are intended to be employed (except in the case of workplaces where the only persons employed are members of the same family dwelling there), such conveniences shall afford proper separate accommodation for persons of each sex • Provides that every steam boiler, lifting appliance, air receiver, refrigeration plant, steam receiver and all its fittings shall be thoroughly examined by an approved person, so far as the construction of the plant permits at prescribed intervals. • Provides that where work has to be done inside a confined space in which dangerous fumes are liable to be present, a permit to work has to be issued and the confined space shall be provided with adequate means of egress and ingress. • Provides that in every workplace or workroom, there shall be provided and maintained, and conspicuously displayed and free from any obstruction so as to be readily accessible, suitable means for extinguishing fire. • Provides every workplace there shall be provided and maintained safe plants and systems during its operational phase. • Provides for every workplace there shall be ensured absence/elimination of risks. • Provide for every workplace to ensure provision of information to employees to ensure safety and health. • Provides that every factory stops any hazardous activities and is maintained in a safe and healthy state.	

Legislation/Regulation/ Standard	**Provisions**	**Compliance/Non-compliance**
	• Provides that every workplace carries out workplace risk assessment and send a copy of the risk assessment to the Directorate of Occupational Safety and Health Services (DOSHS). • Provides for preparation of a safety & health policy and submission of a copy to the Directorate of Occupational Safety and Health Services • Provides for prevention of environmental pollution • Provides for notification of accident occurrence, cases of occupational diseases and dangerous occurrence to DOSHS • Provides that no employee is discriminated against by virtue of:- - Lodging a complaint about an unsafe condition at the workplace - Being an active member of a health safety committee. • Provides for establishment of a health and safety committee whose composition should be in accordance to the Factories (Health and Safety Committees) Rules L.N. 31of 2004. • Provides for carrying out workplace health and safety as well as fire safety audits on an annual basis.	
Safety & Health Committee Rules, 2004 Legal Notice No. 31	The Legal Notice provides for functions and duties of the health and safety committee, the purpose of meetings and recording minutes, and the roles of the office bearers. It further describes the duties of the occupier and those of the Health and Safety Adviser. Among other items, the rules provide that: • The occupier of every workplace shall establish a health and safety committee; • The committee shall consist of safety representatives from the management and the workers; • The factory occupiers shall appoint a competent person from the management staff to be responsible for safety, health and	• Safety and health committee shall be formed and trained when the facility is operational

Legislation/Regulation/ Standard	Provisions	Compliance/Non-compliance
	welfare in the factory or workplace; and the person appointed shall be the secretary to the committee. • Every member of the Health and Safety Committee shall undertake a prescribed basic training course in occupational health and safety within a period of six months from the date of appointment or election, and thereafter further training from time to time; • The occupier of every factory shall cause a health and safety audit of the workplace to be carried out at least once in every period of twelve months by a registered health and safety adviser.	
Fire Risk Reduction Rules, 2007 Legal Notice No. 59	The Rules provides that an employer/occupier having flammable substances must have fire resistant facility. The occupier to store highly flammable substances in fixed storage tanks, closed vessels, cupboards except for vehicles transporting the same. Flammable materials have to be kept in separate labelled stores. In go-downs, the employer has to maintain a distance of at least 80 cm wall gangway between the walls and stack of goods. Every employer is required to maintain good ventilation to allow exit of flammable fumes, maintain good housekeeping, maintain good electrical fittings, provide and maintain fire exits, form and train firefighting teams, conduct fire drills yearly, designate an assembly point, provide and maintain first aid facilities, post fire safety notices, install fire detectors, provide and maintain firefighting appliances, conduct an annual fire safety audit and formulate a fire safety policy.	• Fire assembly points shall be marked where the visitors and employees can gather for briefing in case of a fire; • There shall be provided clear and demarcated emergency exits within the facility; • The facility shall carry out fire safety audit, risk assessment and implement the recommendations.

Legislation/Regulation/ Standard	Provisions	Compliance/Non-compliance
Hazardous Substances Rules, 2007 Legal Notice No. 60	The rules provide that where hazardous substances are handled, washing facilities be provided, protective clothing be kept separate from personal clothing, separate clean and dirty changing rooms be maintained, proper maintenance and testing of engineering controls be done after every 2 years and a report submitted to DOSHS, protection against radioactive, carcinogenic, mutagenic or teratogenic be provided, Material Safety Data Sheets (MSDS) be availed in respect of chemicals handled, correct disposal of hazardous chemical substances be done, containers of hazardous substances be labelled, workers be trained on hazards associated to hazardous substances handled and air monitoring and measurements be done after every 12 months by an air quality monitor.	• The facility will carry out an occupational hygiene measurements and surveys which inform the process of implementing the recommended measures.
First Aid Rules, 1977 Legal Notice No. 160	These rules provide for first-aid box content with respect to size of a workplace and under whose charge the first-aid box should be placed.	• First Aid kits shall be made available in every department and training on first aid done; • An ambulance shall be on standby in the eventuality of an emergency;
Eye Protection Rules legal Notice No. 44 of 1978	The rules provide for eye safety in workplaces. Processes where eye protection is required include blasting, cleaning, chipping, metal cutting, arc welding, abrasive wheel use (grinding).	• Provision of PPEs shall be made mandatory within the facility. • Safe procedures and programmes will be provided to the workers
Electric Power(Special) Rules, 1979 Legal Notice No. 340	The rules provide for electrical safety with regards to electrical power installations, use and handling. These rules apply to generation, transformation, conversion, switching, controlling, regulating, distribution and use of electricity.	• Provision of PPEs shall be made mandatory within the facility. • Only qualified personnel will be allowed to handle activities that involve electric power.

Legislation/Regulation/ Standard	**Provisions**	**Compliance/Non-compliance**
Building Operations and Works of Engineering Construction Rules, 1984 Legal Notice No. 40	These rules provide for the safety, health and welfare of workers in construction sites relating to building operations and works of engineering construction undertaken by way of trade or business, or for the purpose of any industrial or commercial undertaking, and any line or siding which is used in connection therewith and for the purposes thereof. The rules apply whether the building operations and works of engineering construction undertaken by or on behalf of the Government or a public body or private developer.	During the construction phase, the contractor will be expected to ensure safety, health and welfare of workers and all persons lawfully present at the construction site
Medical Examination Rules, 2007 Legal Notice No. 24	The rules apply to workplaces of classified hazards. Every employer has to ensure medical examination of workers in the workplaces of classified hazards.	• During the construction phase, there will be noise emission, exposure to dusts and fumes (cement, soil, welding fumes etc) and exposure to musculoskeletal hazards. • During the operational phase, there will be noise emission, exposure to bagasse, dust and fumes, and exposure to musculoskeletal hazards. • Statutory medical examination of the workers exposed will be mandatory.
Noise Prevention and Control Rules, 2005. Legal Notice No. 25	The rules provide that 'No worker shall be exposed to noise level excess of the continuous equivalent of 90 dB(A) for more than 8 hours within any 24 hours duration'. They further protect from exposure to high noise levels.	• Provision of PPEs shall be made mandatory within the facility. • Medical examinations and surveillance will be implemented at the facility • Noise measurement and survey will be done at the facility
Work Injury Benefits Act, No. 17 of 2007	This law provides for compensation to employees for work-related injuries and diseases contracted in the course of employment and for connected purposes.	• The employer will have an insurance cover for the facility to cater for compensation for injuries sustained by employees while at work
The Water Act, 2016 and The Water Resources Management Rules, 2007	• Protection of surface and groundwater resources; • Protection of water catchments;	• The mill shall install a water treatment plant that abstracts water from the borehole

Legislation/Regulation/ Standard	**Provisions**	**Compliance/Non-compliance**
	• Empower the Water Resources Authority (WRA) to impose management controls on land use falling under riparian land; • 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.	• The proponent shall obtain a water abstraction permit from WRA to abstract water from a borehole. Other water sources include the proposed borehole, which will have a permit from WRA.
The County Governments Act 2012	• Enforcing the protection of trees and other vegetation in urban centers • Approval of development designs before construction can begin • Enforce orderly development in an urban setting	• The sugar mill shall liaise with the County Government to ensure compliance with land use requirements within the county and obtain the necessary licenses and permits.
Employment Act 2007	• The act stipulates that no person shall use or assist any other person in using forced labour. • No employer shall discriminate, directly or indirectly, against an employee or prospective employee or harass an employee or prospective employee on the following grounds: race, color, sex, language, religion, political or another opinion, nationality, ethnic or social origin, disability, pregnancy, mental status or HIV status. • An employer shall pay his employees equal remuneration for work of equal value.	• The sugar mill shall be a source of employment for many workers of both gender and diverse cultural backgrounds.
Standards Act Chapter 496	• Section 9 (2), states that where a Kenya Standard has been declared under subsection (1), the Cabinet Secretary, on the advice of the Council, shall, by order in the Gazette, prescribe a date after which no person shall manufacture or sell any commodity, method or procedure to which the relevant specification or code of practice relates unless it complies with that specification or code of practice. (3) Where, after the publication of an order under section 9. Section 10 (2), states that, any person intends to manufacture any commodity to which that order refers after the date specified therein he shall notify the Bureau in the prescribed form of his intention and the	• The proponent shall acquire a permit from KEBS to use the standardization mark as per this act to sell its sugar in the market

Legislation/Regulation/ Standard	**Provisions**	**Compliance/Non-compliance**
	Bureau, if it is satisfied that he is capable of manufacturing the commodity in accordance with the relevant Kenya Standard, shall issue him with a permit to use the standardization mark referred to in paragraph (a) of subsection (1).	
Kenya Sugar Act, 2001(rev.2012)	PART III – LICENSING AND REGISTRATION, 14. Requirement of license to operate mill states • that (1) No person shall operate a sugar mill or a jaggery mill unless he is a holder of a current license issued by the Authority for that purpose. • The Act is the primary legal framework governing the structure, operations and relationships of stakeholders in the sugar industry and provides for: - Establishment, powers and functions of the Kenya Sugar Board, which is the industry regulator; - Licensing and registration of sugar mills; - Financial provisions – the Sugar Development Levy; - Quality, health and safety; - Offences and penalties; - Sugar industry agreements; - Rights of growers; - Establishment and Constitution of the Sugar Arbitration Tribunal	• The proponent shall apply for a license from the Agriculture and Food Authority to operate the sugar mill
Food Drugs And Chemical 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	• The sugar mill shall be inspected by the public health officers from Narok County and issued with a Food Drugs and Chemicals Substances License for its sugar production

Legislation/Regulation/ Standard	**Provisions**	**Compliance/Non-compliance**
	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.	
Sustainable Development Goals (SDGs)	• Sustainable Development goals which were initiated by world leaders in 2015 as an advancement of the Millennium Development Goals (MDGs) provide concrete, numerical benchmarks for tackling extreme poverty in its many dimensions. The SDGs also provide a framework for the entire international community to work together towards a common end making sure that human development reaches everyone, everywhere. If these goals are achieved, world poverty will reduce by half, tens of millions of lives will be saved, and billions more people will have the opportunity to benefit from the global economy. • Goals 6, 7, 13 and 15 of the SDGs revolve around ensuring Environmental Sustainability. The goals highlight on; ✓ Ensuring availability of sustainable management of water and sanitation for all ; ✓ Ensuring a clean and more sustainable supply of water within related watersheds; ✓ Ensuring access to affordable, reliable, sustainable and modern energy for all; ✓ Combating climate change through the reforestation of degraded and degrading landscapes where by reforestation helps in strengthening community resilience to climate change ; ✓ Protecting, restoring and promoting sustainable use of terrestrial ecosystem, sustainably manage forests, and ✓ Combat desertification and halt and reverse land degradation, and halt biodiversity loss.	• The proposed project will contribute towards alleviating rural poverty by increasing means of livelihood and enhancing food security. The ESIA study will ensure that the proposed project reflects Environmental Sustainability especially during the time of construction and implementation.

Legislation/Regulation/ Standard	**Provisions**	**Compliance/Non-compliance**
The Sustainable West Management Act 2022	• This Act; • Promotes sustainable waste management; • Improve the health of all Kenyans by ensuring a clean and healthy environment • reduce air, land, fresh water and marine pollution • Promote and ensure the effective delivery of waste services • Create an enabling environment for employment in the green economy in waste management, recycling and recovery • Establish an environmentally sound infrastructure and system for sustainable waste management • Promote circular economy practices for green growth • Mainstream resource efficiency principles in sustainable consumption and production practices Inculcate responsible public behaviour on waste and environment	• The facility shall acquire relevant licenses required for waste management • The proponent shall dispose of the waste through only licensed waste service providers • The facility will install color coded segregation waste bins in strategic areas • The proponent will enforce staff to segregate waste when disposing them in the properly labeled and colour coded receptacles and bins that will be located around the facility
Penal Code, Cap. 63	• Section 191–Fouling Water • Section 192–Dwellings and Neighbourhood	• The management shall ensure that no foul water of any public spring or reservoir is rendered unfit for the purpose for which it was ordinarily used for by the community. • The operation phases of the project shall ensure that health of persons in general dwellings or carrying on business in the neighbourhood or passing along a public facility are protected.
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.	• The proponent shall observe the relevant provisions in the Act in regulating the use of pest control products during operational phase of the project when implementing sugarcane crop enhancement and protection activities by the facility's agriculture department and farmers

Legislation/Regulation/ Standard	**Provisions**	**Compliance/Non-compliance**
	• 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;"	through use of pesticides and other soil-enriching chemicals
The Wildlife Conservation and Management Act, 2013	• This Act 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 landuse, better access to benefits from wildlife conservation, and adherence to the principles of sustainable utilization. • 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	• 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

Legislation/Regulation/ Standard	**Provisions**	**Compliance/Non-compliance**
Work Injury Benefits Act (WIBA), 2007	• It is an act of Parliament (No. 13 of 2007) to provide for compensation to workers for injuries suffered in the course of their employment. It outlines the following: • Employer's liability for compensation for death or incapacity resulting from accident; • Compensation in fatal cases; • Compensation in case of permanent partial incapacity; • Compensation in case of temporary incapacity; • Persons entitled to compensation and methods of calculating the earnings; • No compensation shall be payable under this Act in respect of any incapacity or death resulting from a deliberate self-injury; and • Notice of an accident, causing injury to a workman, of such a nature as would entitle him for compensation shall be given in the prescribed form to the director.	• During construction period, the contractor will need to abide by all the provisions of WIBA. Similarly, the same will be required of the proponent during operation phase of the Sugar factory.
Public Roads and Road of Access Act (Cap 399)	• The Act provides for the following with regard to public roads: • Dedication of line of public travel; • Application to construct roads of access; • Notice to be served on land owners affected; • Granting of leave to construct road of access; • Notification of order to be registered; • Right of way over road of Access; • Power to cancel or alter road of access; and • Prohibition of classes of traffic	• The proponent will rehabilitate existing local roads and laying out of access roads.
The Kenya Roads Act of 2007	• The act stipulates the legal and institutional aspects of the road sub-sector policy. The Act provides for the establishment of three independent Road Authorities, namely: 1) Kenya National Highways Authority (KeNHA), responsible for the administration, control, development and maintenance of all class A, B and C roads in Kenya,	• The proponent will liaise with these institutions in the improvements existing and development of any new roads within the project area.

Legislation/Regulation/ Standard	**Provisions**	**Compliance/Non-compliance**
	2) Kenya Rural Roads Authority (KeRRA), responsible for rural and small town roads including class D, E roads and Special Purpose Roads; and 3) Kenya Urban Roads Authority (KURA) responsible for all City and Municipal Roads. The Authorities fall under the Ministry responsible for infrastructure and retains the role policy formulation and general oversight of public roads including regulatory aspects such as technical standards.	
The Agriculture, Fisheries and Food Authority Act, 2013	• This Act consolidated the activities of several agricultural parastatals in Kenya into one entity. The Agriculture and Food Authority operates under this entity as a directorate currently. The proponent has to acquaint himself with the provisions of this act especially in so far as licensing and permits are concerned	• The proposed project is expected to comply with the relevant provisions of this act.
Sexual Offences Act (No. 3 of 2006)	• This Act 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.	• The proponent shall put in place all mechanism to discourage unlawful sexual acts in the entire project life, these includes massive awareness

4.4 International Conventions and Treaties

A treaty is a binding agreement under International Law concluded by subjects of International Law, namely states and international organizations. Treaties can be called by many names including; International Agreements, Protocols, Covenants, Conventions, Exchanges of Letters, Exchanges of Notes, etc.

Treaties can be loosely compared to contracts; both are means of willing parties assuming obligations among themselves, and a party that fails to live up to their obligations can be held legally liable for that breach. The central principle of treaty law is expressed in the 'maximpactasuntservanda', translated as "pacts must be respected."

Kenya has ratified the following international conventions.

4.4.1 United Nations Framework Convention on Climate Change

The landmark United Nations Framework Convention on Climate Change (UNFCCC) was opened for signature at the 1992 United Nations Conference on Environment and Development (UNCED) conference in Rio de Janeiro (known by its popular title, the Earth Summit). On June 12th, 1992, 154 nations signed the UNFCCC, which, upon ratification, committed signatories' governments to a voluntary "non-binding aim" to reduce atmospheric concentrations of greenhouse gases with the goal of "preventing dangerous anthropogenic interference with Earth's climate system." These actions were aimed primarily at industrialized countries, with the intention of stabilizing their emissions of greenhouse gases at 1990 levels by the year 2000; and other responsibilities would be incumbent upon all UNFCCC parties. The parties agreed in general that they would recognize "common but differentiated responsibilities," with greater responsibility for reducing greenhouse gas emissions in the near term on the part of developed/industrialized countries, which were listed and identified in Annex I of the UNFCCC and thereafter referred to as "Annex I" countries.

4.4.2 Kyoto Protocol

According to a press release from the United Nations Environment Programme:
"The Kyoto Protocol is an agreement under which industrialized countries will reduce their collective emissions of greenhouse gases by 5.2% compared to the year 1990 (but note that, compared to the emissions levels that would be expected by 2010 without the Protocol, this target represents a 29% cut). The goal is to lower overall emissions of six greenhouse gases - carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, HFCs, and PFCs - calculated as an average over the five-year period of 2008-12. National targets range from 8% reductions for the European Union and some others to 7% for the US, 6% for Japan, 0% for Russia, and permitted increases of 8% for Australia and 10% for Iceland."

It is an agreement negotiated as an amendment to the UNFCCC, which was adopted at the Earth Summit in Rio de Janeiro in 1992. All parties to the UNFCCC can sign or ratify the Kyoto Protocol, while non-parties to the UNFCCC cannot. The Kyoto Protocol was adopted at the third session of the Conference of Parties (COP) to the UNFCCC in 1997 in Kyoto, Japan.

4.4.3 Convention on Biological Diversity

This global convention was held to foster conservation and sustainable use of biological resources, to preserve their diversity for posterity. Kenya is a signatory to this convention, having ratified it in 1994. The provisions of this Convention have since been integrated in the laws of Kenya, climaxed by the development of the Kenya National Biodiversity Strategy and Action Plan in 2000 by the Ministry of Environment and Natural Resources.

This project is in line with the spirit of the convention, there is need to integrate biodiversity in water resource planning as the environment has been considered a legitimate user of water thus the project shall consider the volume of water abstracted which leaves enough water for the existent ecosystems.

4.4.4 United Nations Convention to Combat Desertification (UNFCCC) of 1994

The convention requires parties to take climate change considerations into account in their relevant social, economic and environmental policies and actions.

The proponent has undertaken this ESIA with the aim of minimizing adverse effects of the project on the economy, on public health and on the quality of the environment.

5. PUBLIC CONSULTATION AND PARTICIPATION

5.1 Overview

The proposed project facilities will mainly serve the public and the local people. Therefore it is imperative that the beneficiaries are involved in the project feasibility, planning, implementation and operation stages. In view of these, the ESIA team adopted a participatory approach during the study noting that stakeholders' participation in Kenya is entrenched in the constitution, several legal instruments and international instruments to where Kenya is a party.

5.2 Legal Requirement for Public Participation

5.2.1 The Constitution of Kenya

Public participation is entrenched in several articles across the Kenya Constitution 2010. Article 6 provided for devolution and access to services. Responsibilities in major decision-making processes have been bestowed to the public (in the Bill of Rights, articles 118, 174, 196, and 201). The constitution further in Article 21 Section 3 requires safeguarding the rights and interests of marginalized groups for equity in public service provision. This can be effectively achieved through the active involvement of such groups in the decision-making process at all levels. Hence, there is a need to involve the local people in the project area in studies, design, and implementation of the proposed project facilities.

5.2.2 Environmental Management and Coordination Act, 1999

Section 17 of the Environmental (Impact Assessment and Audit) Regulations of 2003 requires that all ESIA studies incorporate public consultation throughout the study process. The aim of public consultation was to ensure that all stakeholders' issues and concerns about the proposed facilities were identified and their opinions considered during the project planning, design, implementation, operation, and decommissioning phases.

5.2.3 County Government Act 2012

Public participation is integral in Kenya's development process as set out in the decentralized system of governance. The County Government Act, which sets out the service delivery procedure of county governments, has recognized local people's involvement in decision-making as key to governance. The Act in part VIII stipulates the principles of citizen participation, and in part IX, it guarantees the citizen's‟ right to public communication as well as access to information. To ensure that there is optimal participation, the Act provides for civic education in part X to build the capacity of local people. Therefore, meaningful public consultation is significant during the planning, implementing, and operation of development projects, hence the need for such consultations for the proposed development of the sugar project in Narok County.

5.2.4 International Convention (Aarhus Convention 1998)

The Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters entered into force on October 2001. The Convention grants the public rights regarding access to information, public participation and access to justice, in public decision- making processes on matters concerning the local, national and trans-boundary environment. It focuses on interactions between the public and public authorities.

5.3 Objectives of Public Consultations

Public participation is not a one off event but a process throughout the project cycle that requires regular consultations. In regard to the preceding observation, the proposed project involved stakeholders' participation with the following objectives;

- Disseminate and inform the project stakeholders about the proposed project, its key components and activities, location and expected impacts with particular attention to potentially affected persons;
- Create awareness among the public and stakeholders on the need for the ESIA for the proposed project and its due process;
- To obtain information about the needs, concerns, comments, suggestions, and priorities of the local people as well as their general reactions to proposed project activities;
- To obtain the cooperation and participation of the key stakeholders, affected persons, and local communities in activities that were required to be undertaken for designing, implementing, and operating the proposed project or development of the project facilities;
- Create a sense of ownership, capacity build, and ensure transparency in all activities related to the project, including but not limited to designing, planning, implementing, environmental management, operation, monitoring, and evaluation of the project by all key stakeholders; and
- To establish a clear communication channel, easily accessible and effective grievance procedure between the public, consultant team, the project proponent and the County government of Narok.

5.4 Stakeholders' Identification/Mapping

The public participation was an inclusive exercise that required proper planning and arrangements.

- The team ensured that the stakeholders identified are multi-sectorial touching on agriculture, lands, water, health, environment, county and national government. These stakeholders were consulted by use of a key stakeholders' meeting. To ensure that no major player is left out, a desk top study/mapping was done to determine relevant stakeholders to the project;
- The stakeholders are categorised 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 it. They included local populations (individuals and community-based organizations) in the project area, in particular, poor and marginalized groups who have traditionally been excluded from participating in development efforts. Secondary stakeholders are those who influence development intervention or are indirectly affected by it. They include the proponent, government and county line ministries and departments, implementing agencies, civil society, NGOs, and

CBO. The consultation programme was developed and implemented considering the various areas of influence.

- Prior to the public meetings/barazas, the site was visited to identify all the stakeholders and appropriate meeting venues. This also presented a platform to consult with the area leaders and the residents, developing a good rapport. The ESIA team established contacts to enable proper planning and invitation of the public for the consultative meetings. The communication used to invite the public was verbally through the area chiefs/village elders and posters. In liaison with the local chiefs and assistant chiefs, the team settled on appropriate venues and dates for public meetings. The ESIA team documented minutes and ensured that the list of attendance was well documented.

5.5 Consultation Process

Legal Notice 101 of June 2003 requires that all environmental and social assessment processes in Kenya incorporate public consultation. This a requirement informed by an awareness that the development and implementation of projects can occasion diverse impacts on stakeholders, who should consequently be informed appropriately, following which they can make informed decisions on the proposed development. It is also important to ensure that all stakeholder interests are identified and incorporated in project development, implementation, and operation and, against such background, consultation was undertaken far and wide both within the project area and outside with the following objectives; -

i. To disclose the Study to both primary, secondary, and other stakeholders;
ii. To obtain the reaction/comments/concerns of all stakeholders so as to understand their perceived view of the proposed project and assess the extent to which their views need to be taken into account. This is important as it helps to ensure that important social issues are not overlooked and there is ownership from the communities in all the project areas;
iii. Improve project design by incorporating their views, thereby minimizing conflicts and delays in implementation;
iv. Increase long-term project sustainability and ownership of the project;
v. Identify local leaders with whom further dialogue can be continued in subsequent stages of the project.

Key stakeholder consultation was undertaken in the project area. The team identified stakeholders who are key to implementing the proposed project and those who rely on such services. The stakeholders included County Government officials, National Government officials, and Non-governmental organizations, among others.

5.6 Tools used in stakeholder and public consultations

5.6.1 Reconnaissance Visit

The ESIA study process commenced with a reconnaissance visit to the project area. On 24th July 2024, the consultants, along with the proponent's representatives, visited the proposed project site for a reconnaissance survey. The goal of the visit was to familiarize the team with the project site and assess the status of the construction site and the farms. The proponent explained the origin and justification of the project as well as the planning activities that had so far taken place in relation to the proposed project.

5.6.2 Feasibility study

A feasibility study of the project had already been done. The proponent also confirmed that they had already acquired a 6.87 hectares piece of land in Enemasi village, Moita Sub Location, Moita Location, Lolgorian Ward, Kereto Division, Transmara South Sub County, Narok County. Piloting of cane development had also taken place. It showed that the outgrowers farmers of the proposed sugar factory would mainly be near the factory area and will cover Moita, Indonyo, Sikawa, Keiyan, and Enemasi of Transmara Sub County, Ogwedhi, Sagegi, Kwa, Suna Rabuor, Osingo and God Jope of Suna East Sub County, Kakrao, Kanyamkago and Kawere of Uriri Sub County and Kombe and Masaba of Kuria West. The mapped area consists of 40% of already established cane, while the balance of 60% will be new crop establishment to match factory crushing capacity. The organization of out-growers shall be based on a cooperative society model that will facilitate bulk procurement of farm inputs and offer individual small growers collective bargaining power for accessing sugar market benefits.

The proposed milling plant will have a capacity of 1250 tonnes of cane per day (TCD). It was also confirmed that enough cane supply would support this capacity. The proponent had a full financial feasibility study for the project, which showed a positive Net Present Value (NPV) in terms of financial performance.

License

The consultant explained that a NEMA license, in addition to a sugar cane production and milling license from the Agricultural Food Authority through the Sugar Directorate, was required for such a venture. A comprehensive Environmental and Social Impact Assessment is necessary before a decision to issue a NEMA license can be made. The proponent authorized the consultant to prepare a Terms of Reference (TOR) for the consultancy assignment.

5.6.3 Socio-economic Survey

- Socio-economic Survey (Household questionnaires) — this was based on structured questionnaires programmed on Survey CTO, a digital data collection platform to gather information on socio-economic aspects of the communities in the study area. It was administered through face-to-face interviews at the household level. The survey was conducted on selected (sampled) households. The sampling was confined to communities living around identified project sites and the neighbours that will be affected by the project.

5.6.4 Key Stakeholder Meeting

- Key Stakeholders' meeting. –This meeting was held with technical representatives of the County's Environmental Committee to gather information and interrogate the technical and implementation schedule of the project with a view of identifying and tightening the gaps that might be a hindrance to the project.

5.6.5 Public Consultation Meetings

- PCMs – The Consultant, in collaboration with the national government led by the local chiefs and assistant chiefs, carried out public participation in the proposed Sugar factory project in Narok. The meetings were held in five Sub Locations and locations: the Moita Sub Location (the proposed mill site), the Oldanyati Sub Location, the Masurura Sub Location, the Kikat Sub Location, and the Naar-Olong Sub Location. The sixth meeting involving the county and national government officials was held in Narok town. In their

consultations, the community sensitization meetings generally targeted all community members within and neighbouring the project area.

- During the meetings, the proponent representative and the consultants explained the salient features of the project, including geographical scope, infrastructure, expected benefits that were cross-checked with the communities, and environmental aspects. The community members were given an opportunity to air their views and bring out the issues that were of concern to them. The meetings addressed the following topics: Overview of the project; cane development; the sugar milling factory, possibility of domestic water supply; socio-economic aspects including anticipated project benefits; community participation in the project; natural resources including water, land, and environmental and social issues including likely negative impacts and the proposed mitigation measures.

Table 10: Stakeholders engagement schedule

#	**Date and Time**	**Area/Location**	**Venue**
1.	12th August 2024; Morning	Moita	Moita Centre
2.	12th August 2024; Afternoon	Oldanyati	Oldanyati Centre
3.	13th August 2024; Morning	Masurura	Word of Faith Ebenezer Church, Masurura
4.	13th August 2024; Afternoon	Kikat	Indoinyo Primary School
5.	14th August 2024; Afternoon	Naar-Olong	Ndonyo Location Chief's Office
6.	28th August 2024; Morning	Institutional Stakeholders	Zebu Lodges and Luxury Hotels, Narok Town

Figure 14: Stakeholders consultation meetings

5.7 Views Expressed

The various stakeholders expressed their views freely and passionately during the sessions mentioned above. The views were largely expressed verbally. However, some questionnaires for the socio-economic survey were also filled out by respondents. The completed questionnaires capturing the respondents' views/opinions and suggestions are attached in the annex, while the summarised responses are tabulated in the table below.

Table 11: Summary of stakeholder responses and comments

No.	Name/Office	Positive Comments	Negative Comments /Other Comments	Recommendations
1	Edward Ole Tankoi, County Public Health	• Creation of local employment • Earnings from sugar • Road network development including other public utilities such as health facilities	• Noise and vibrations • Environmental including water pollution • Prostitution due to population influx • High open defecation (OD) • Insecurity	• Proper waste management to be put in place • Improve sanitation measures in the area • Implement health and safety measures
2.	Vincent Tamasis, Principal Administrator, Narok County Government	• Improved CSR to better farmers • Economic empowerment	• Social challenges such as immorality	• Involve leaders and stakeholders to tackle social challenges
3.	Bii Roy, Director, Trade & Industrialisation Narok County Government	• Road maintenance • Employment • Water provision • Improved livelihoods	• Prostitution • Family conflicts • Early marriages • Cane poaching	• Awareness campaingns • Proper waste management • Training of farmers
4.	Aunda Ordination, DOSHS, Narok	• Alternative food for livestock • Bio fuels • Community empowerment • Job creation	• Waste water • Sludge • Biodiversity kill	• Recycle the byproducts • Comply with Health and Safety Act ,2007
5.	Patrick Mpatiany, Director Cooperative NCG	• Employment • Revenue • Infrastructure development • Reduced carbon emission	• Air pollution	• Tree planting • Carry out CSR within the community
6	Francis Liaram Chief	• Creation of local employment • Eased transportation cost of farm produce	• Rise in insecurity	• The community to suggest name for the proposed project/company

No.	Name/Office	Positive Comments	Negative Comments /Other Comments	Recommendations
7.	Philip Gumba The ACC Kereto Division	• Reduction in delays in cane harvesting • Realization of the region's agricultural potential • Reduced cost of cane transportation to factory • Creation of employment opportunities for locals • Improved local road networks and maintenance	• Environmental pollution •	• Commit to specific CSR programs that would benefit the community directly • Emphasis on local employment • Abiding by environmental management regulations to reduce pollution
8	Charles Kinampu	• Enhanced services to farmers due to increased competition for raw materials • Creation of employment	• None	• Encouraged the proponent to set up beneficial CSR programs
9.	Elijah Kinasa	• Employment of local youths	• None	• Fostering a great relationship with the community • Hiring a community liaison officer to help build a stronger partnership between the community and the proposed facility • Proper advertisement of the of opportunities to enable the locals to apply
10.	Benson Koini	• Improved services to farmers • Improved local roads • Source of income for farmers • Increased competition for raw material which results in improved services to farmers	• Air pollution • Water pollution	• Installation of modern chimneys/furnaces to manage air pollution from boiler ash • Treatment of effluent before discharge • Collaboration between the proponent and the farmers to avail cane
11.	John Saipia	• Emphasized that there is a requirement for genuine public participation in	• Threat to livestock rearing	• Encouraging local farmers to practicing both crop farming and livestock rearing

No.	Name/Office	Positive Comments	Negative Comments /Other Comments	Recommendations
		development projects whether financed by the government or private sector entities. • Creation of employment for locals		• Carry out soil analysis to determine appropriate sugarcane varieties
12.	Wilson Saoyo	• Creation of local employment Complementary agricultural activities to be supported by the proponent	• Waste management	• Effective re-use and management of wastes e.g. making fertilizers from bagasse • Prioritization of locals when filling job vacancies
13.	Samwel Mooron	• Impressed by the project plan and public forum • Boost of sugarcane farming • Project offers an opportunity to create jobs	• Lack of cane seedling	• Provision of cane seedlings and fertilizer to farmers
14.	Jackson Talala	• Improved local roads • Creation of local employment	• Social conflicts due to unemployment	• Prioritization of employing locals • Requested the proponent to repair a local bridge in Oldanyati Sub Location
15.	Mr. Benard Nakurro Assistant Chief	• Improved local economy • Improved local roads • Infrastructural development • Creation of employment opportunities	• Risk of agriculture replacing livestock rearing • Occurrences of social conflicts • Deforestation due to increasing agricultural activities • Creation of CSR programs that promote community development	• Collaborating with Kenya Forest Services to practice re-afforestation • Installation of a police post or station to man security • Enhance livestock breeding approaches sand methodologies to meet modern needs • Provision of livestock feeds to cater for lack of grazing fields
16.	Olemuya Rumpas	• Welcomed the project • Creation of local employment	• None	• Prioritization of locals for employment opportunities
17.	William Tampul	• Infrastructure development • Supported the project	• Waste production and pollution	• Adoption of technology to achieve zero liquid discharge • Treatment of effluent prior to release

No.	Name/Office	Positive Comments	Negative Comments /Other Comments	Recommendations
				• Compensation framework for locals affected by the proposed project pollution
18.	Oloisiriri Naitipa	• Supported the project idea • Increased sugarcane farming	• None	• Proponent should conduct farmers sensitization farming • Adoption of cane development projects
19.	Mr. Moses Saiwa	• Improvement local roads • The new sugar factory will create increased competition in the area	• Threat to livestock breeding/rearing • Rise in insecurity • Pollution of neighboring stream	• Proper waste management
20.	Mr. Samuel Mukut-Senior Chief	• Reduction of farmers' transportation costs • Boost farmer customer services • Creation of local employment for youths	• Environmental pollution	• None
21.	Mr. Saitoti Ngeny	• Improvement of infrastructure in Ndonyo Sub Location • Local employment	• Conflict within the community	• Local employment will foster the relationship between the facility and the community.

6. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This chapter presents an assessment of environmental impacts from the planned project design and activities, and proposes mitigation and management measures to prevent and control these impacts.

The environmental impact assessment and analysis was done using a number of methods and tools. While identifying impacts, a checklist was used. This indicated all possible impacts that would accrue from implementation of this project.

6.1 Legal and regulatory compliance

The national laws and regulations relevant to the development and their relevance to the process project have been discussed.

6.2 Construction and Equipment installation

Key aspects to be considered during construction are:

- Procurement of construction materials;
- Installation of services and interiors of the buildings;
- Use of heavy and light machinery;
- Energy utilisation, major energy consuming activities include:
  - ✓ Lighting;
  - ✓ Excavation;
  - ✓ Transportation;
  - ✓ Hauling and hoisting of materials;
- Mixing raw materials;
- Waste handling trucking and disposal;
- Testing and commissioning of the development.
- Energy sources for these activities include grid electricity and diesel or petrol fuel for machinery/vehicles.
- Water utilisation, including use for the following activities:
  - ✓ Washing of machinery and equipment;
  - ✓ Preparing of mixtures, including water based emulsion paints;
  - ✓ Concrete works, including curing;
  - ✓ General cleaning;
  - ✓ Landscaping;
  - ✓ Controlling dust on site;
  - ✓ Domestic utilisation (sanitary facilities).
- Construction waste will include the following:
  - ✓ Timber from used formwork;
  - ✓ Paints, lubricants and petroleum wastes;
  - ✓ Containers, cement paper bags and other packaging materials;
  - ✓ Metal, glass, plastic containers and other unwanted materials.
- Socio-economic effects;
  - ✓ Labour;
  - ✓ Security;

- ✓ Transport.
- ✓ Archaeological findings and aesthetics.

Table 12: Summary of impacts and mitigation during construction and installation

Activity	Anticipated Impact	Recommended Mitigation Measures
Procurement of construction materials:	• Natural resource depletion if not rationally done through activities such as quarrying, mining, timber logging.	• The tender documents should specify required standards and certification for procurement of all materials and appliances; • All construction materials should be from approved sources; for example, hardstone for building should be obtained from bona fide commercial quarries; • As far as possible, environmentally friendly and sustainable materials should be used. • Materials not to be used for construction of the buildings include: ✓ High alumina cement; ✓ Wood wool slab in permanent formwork to concrete; ✓ Calcium silicate bricks or tiles; ✓ Asbestos in any form; ✓ Asbestos substitutes or any naturally occurring or man-made mineral fibers; ✓ Lead, lead paint or any other materials containing lead which may be inhaled, ingested or absorbed; Vermiculite, unless it is established as being fiber-free; ✓ Any products containing cadmium that are regarded as being injurious substances; ✓ Any other substances regarded as being deleterious building materials which are not in accordance with statutory requirements or with current accepted good building practice at the time of specification or construction. • The Project Manager should ensure that the Contractors are instructed in the use of all • materials that may have negative environmental (including health) effects; • If any material or substance is used that is at any point in the future deemed to be deleterious to health, then it must be replaced with an acceptable alternative.
Building works:	• Health and safety risk from accidents and incidents; Noise, vibrations and dust.	• Adhere to safety regulations outlined in the County Government Adoptive by-laws, Building Code and the Building Operations and Works of Engineering Construction • The Project Manager should ensure strict safety management through close attention to design, work procedures, materials and equipment; • Schedule noisy construction • Develop a site safety action plan detailing safety equipment to be used, emergency procedures, restrictions on site, frequency and personnel responsible for safety inspections and controls; • All workmen should be provided with personal protective equipment (e.g. dust masks, ear muffs, helmets, overalls, industrial boots, harnesses, etc);

Activity	Anticipated Impact	Recommended Mitigation Measures
		• There should be regular site reporting on health, safety and environment (HSE) issues by an appointed HSE representative, daily site inspections should be done to ensure safe work practices are adhered to; • All injuries that occur on site must be reported recorded in the accident registers and corrective actions for their prevention be instigated as appropriate; • Statistical records on accidents and incidents should be collated and analyzed on a monthly basis and forwarded to the Project Manager and / or displayed on the notice boards; • Site personnel should be encouraged to report "near-miss incidents" in order to avoid potential problems and increase safety awareness. • Safety signage should be erected and adhered to at the site
Energy utilization:	• Energy consumption.	• Develop an 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; • Construction workers should be sensitized on the importance of energy management.
Water Utilization	• Water consumption; Hygiene and sanitation challenges.	• Monitor water consumption and utilization; • Sensitize construction workers on the importance of proper water management; • All wastewater should be drained into approved drainage facilities.
Waste production:	• Littering, soil and surface water pollution potential.	• The tender documents should specify the proper disposal of waste during construction and should also ensure that the Contractor leaves the site in a clean and safe condition on completion of the Works; • The Contractor should be required to restore and landscape all areas to the satisfaction of the Project Manager; • All solid waste generated during construction should be collected, stored, and taken away for disposal; • There should be controlled use of raw materials; • Procedures for handling of special wastes, such as waste fuel oil, should be specified; • Comply with guidelines on solid waste disposal and Waste Management Regulations 2006.

Activity	Anticipated Impact	Recommended Mitigation Measures
Influx of construction workers into the area:	• Proliferation of informal kiosks in the area; • Increase in transport demand.	• Develop a catering program on site for construction staff; • Provide transportation for the workforce to and from the site.
Construction traffic:	• Disruption of local traffic; • Potential for accidents.	• The Contractor should plan itineraries for site traffic.
Archaeological findings:	• Destruction of natural heritage /loss of archaeological findings.	• In the event of an archaeological finding, the Contractor should secure the location 'as is' and immediately call the National Museums of Kenya's Archaeology Section.

6.3 Operation Stage

The key environmental issues during commissioning and operation are as follows:

- Water supply and consumption;
- Energy consumption and management;
- Effluent Management
- Solid waste, bagasse, filter cake and boiler ash management;
- Stack emissions
- Property management;
- Transport & security;
- Health and safety;
    - Noise.
    - Contamination of soil and water by agrochemicals
- Oil and fuel spillage on soils or highways

6.3.1 Operational Phase Negative Impacts

1. Increased pressure on infrastructure – Stressed up service provision

The additional facility will lead to increased pressure on existing infrastructure such as roads, water abstracted from the borehole, etc. due to the increased number of users. In turn, this may directly translate into increased use of facilities and services.

Recommended Mitigation Measures

a. Relevant authorities such as the Kenya Power and Lighting, WRA should be informed of the capacity of the facility;
b. The proponent will install water-conserving automatic taps and toilets, as well as energy saving electrical fittings to optimize use of public resources;
c. Water leaks through damaged pipes and faulty taps will be fixed promptly by qualified staff.
d. Occupants of the facility should be sensitized to use water efficiently.

2. Pollution – Environmental Degradation

Possible pollution may impact on alteration of soil structure by contaminations from introduced materials, bagasse, molasses, boiler ash, filter mud, waste water contamination, air pollution as well as noise levels from various sources within the premise.

a. Solid waste generation/by-products (bagasse, filter cake, boiler ash)

Once the proposed project is completed and operational, they are expected to generate a large amount of solid waste on a daily basis whose composition will be dominated by organic waste. These solid waste, if not disposed properly can cause the following impact on environment:

- Ground water contamination by bagasse leachate generated by non-scientific dumping;
- Surface water contamination by the run off from the bagasse dumping site;
- Bad odour, Pests, rodents and windblown litter in and around the collection site;
- Generation of inflammable gases (e.g. Methane).
- Risks of bagasse avalanche

b. Impacts may also result from improper sitting, inadequate design and poor operation of waste disposal facilities.

Recommended Mitigation Measures

a. Clearly designate and construct an appropriate waste collection facility or provide covered refuse skips;
b. Designate filter cake and boiler ash dumping and composting sites;
c. Use only NEMA licensed waste transport vehicles to transport waste materials;
d. Maintain a proper waste tracking document;
e. Utilise bagasse as a source of fuel in the boilers or mixing with boiler ash and filter mud for use by farmers as fertilizer and other reuse options such as cogeneration for electricity and quarry rehabilitation;
f. Construct bagasse holding shades to ensure remaining bagasse on site does not come in contact with rain to produce leachate; and
g. Ensure adequate fire warning, response and management systems are installed.

c. Wastewater management

There will be effluent release due to the cane crushing. The EMCA Water Quality Regulations of 2006 requires all facilities that discharge any effluent to the environment to obtain an Effluent Discharge license and to continuously monitor the discharge. The fourth schedule of the Water quality regulations gives a guide on the quality parameters which should be monitored for different types of effluents. The parameters which should be monitored for Sugar Industry effluent include the following: Biochemical Oxygen Demand (BOD), Total suspended solids (TSS), pH, Faecal Coliforms /Ecoli, Chemical Oxygen Demand (COD), Colour/Dye/Pigment, Organic Nitrogen as N, Flow, Copper, Zinc and Surfactants.

Recommendations

- Incorporate Effluent Treatment Plant (ETP) within the facility;
- Apply for effluent discharge license from NEMA on time;
- Install a water meter to measure the amount of water waste water released from the factory on daily basis;
- Carry out an analysis of the composition of the effluent through a NEMA registered laboratory;
- Continuously monitor the discharge as per the regulations.

d. Air pollution levels

Vehicular emissions from vehicles, stack emissions and fugitive emissions will be the major air pollution sources from the Project.

Recommended Mitigation Measures

- Regularly monitor stack emission and obtain Emission licence from NEMA;
- Invest in bagasse drying mechanism along the delivery line;
- Exhaust gas recirculation
- Selective non-catalytic/catalytic reduction
- Installation of Electrostatic Precipitators (ESP), wet scrubbers and thermal oxidizers
- Avoid overloading the bagasse for efficient burning

- Formulate the fugitive emissions Control Plan
- 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

3. Increased traffic flow – Unnecessary congestion

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

Recommended Mitigation Measures

- In case of heavy traffic, an attendant should be employed to direct vehicles during peak periods.

4. Drain blockages – Back flooding

Poor surface drain management or large amounts of effluents may lead to blockage of drains which in turn could result to flooding and unsanitary conditions within the neighbourhood. Blocked drains produce bad odour and are a threat to general health, hence are environmentally unfriendly.

Recommended Mitigation Measures

- The proponent should ensure that there are adequate means of handling the large quantities of sewage generated at the facility;
- It will also be important to ensure that septic pipes are not blocked or damaged since such occurrences can lead to release of the effluent, resulting in land and water contamination.
- Such blockages or damages will be fixed expeditiously

5. Vector and rodents breeding grounds – Vulnerability to diseases

If the project does not have well designed storm water drains, the rain water 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.

Recommended Mitigation Measures

- The design of the construction should ensure that no space for stagnant water will be retained;
- A well maintained trash collection point should be set aside;
- 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 recycling;
- Proper monitoring of the premise should be effected for maintenance of health and hygiene.

6. Electricity consumption – pressure on supply

The project shall consume large amount of electricity due to activities that will take place once the project is complete. The Sugar Mill will however generate its own electricity for internal use.

Recommended mitigation measures:

- 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.

7. Water supply and consumption

Water for the project shall be extracted from a proposed borehole to be drilled on site after obtaining abstraction permits from WRA.

Recommended mitigation measures:

- Monitor water consumption;
- Install internal water meters;
- Manage consumption rigorously.
- Installing plumbing fittings, appliances and devices to optimise water use efficiency;
- Recycling of wastewater to reduce water consumption.

8. Contamination from Agrochemicals

Agrochemicals such as pesticides, fertilizers and herbicides may be used on the farms and if not properly handled end up in water sources or the soil. There is also a danger that agrochemicals could be consumed by human beings deliberately or inadvertently Contamination of soil or water by agrochemicals can be minimized by;

- Training of farmers on Good Agricultural Practices for sugarcane production
- Storing the chemicals in properly designed stores
- Ensuring that farm workers are well-trained on handling and application of agro-chemicals
- Ensuring that human beings are warned about the danger of agro-chemical poising.

9. Oil and fuel Spillage

Oil and fuel spillage not only contribute to accidents but can also damage the soil or water bodies. People handing machinery like tractors must be trained on safe workshop practices and proper repair and maintenance to avoid such mishaps.

10. Safety and Health hazards

During operation, the use of machinery poses mechanical hazards such as accidental cuts and bruises. There will be storage of flammable liquids such as fuels and lubricants, and bagasse, which at some point will be stored at the workplace for use in vehicles, machines and firing of the boilers, respectively. Leakage, spillage or poor handling of such substances may result in fires that may cause considerable losses in terms of injury to persons and damage to property. Persons

exposed to bagasse will likely suffer from bagassosis. Noise levels from the occasioned by use of machinery may pose health hazards also. There are many other potential safety and health hazards commonly inherent in sugar factory.

Recommended mitigation measures:

- Regular maintenance and use of machinery safeguards i.e. machine fencing and guarding
- Statutory examination of plant and machinery
- Statutory medical examination and surveillance of workers exposed to classified hazards
- Statutory industrial hygiene surveys
- Statutory safety and health audits
- Use of appropriate Personal Protective Equipment (PPE)
- Safety and Health training for workers
- Provision of first aid facilities and personnel
- Execution of fire safety training and drills

6.4 Decommissioning

Decommissioning is the process of shutting down an operational facility in a manner that leaves the area in a safe and stable condition that is consistent with the surrounding physical and social environment. The Contractor will ensure that:

- The process of closure occurs in an orderly, cost effective and timely manner with the allocation of adequate resources;
- The anticipated cost of decommissioning is adequately provided for in the project costs.

The Contractor will be expected to:

- Carry out consultations with stakeholders;
- Develop the action plan for demolition including the assigning of roles for the demolition crew;
- Isolate power at the main switch and remove cables up to that point;
- Dismantle, remove and dispose of construction camp equipment and structures in an appropriate environmentally friendly manner;
- Request utility service providers to disconnect the power, water and telephones as may be appropriate;
- Reinstate the land to its natural condition by filling excavations and planting suitable saplings.

The Contractor must obtain a Certificate of Satisfactory Decommissioning from the relevant Authorities. In the unlikely event that the facilities is closed down decommissioning would comprise the reduction of all buildings and facilities to a safe condition and the restoration of the land to its original condition. The following will be done:

- Notification of intent to all relevant regulatory agencies;
- Liaise with project Consultants, including architects, engineers, and environmentalists, to ascertain guidelines, anticipated decommissioning impacts, and mitigation measures.

6.4.1 Decommissioning phase Negative Impacts

During the decommissioning phase, another comprehensive ESIA study based on the site's intended new use will be conducted. Decommissioning may involve one of the options: facing out operations and evacuating the premises without carrying out any other plans, changing the facility's use, or demolishing the property to restore it to its current or better status.

1. Solid Waste Generation

Demolition of the facilities 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 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 the 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 the leaching of demolition waste, are known to lead to the degradation of groundwater quality.

2. Dust

Large quantities of dust will be generated during demolition works. This will affect demolition staff as well as the neighbouring residents.

3. 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.

Table 13: Summary of major impacts and their proposed mitigation measures

Project stage	Potential Impact	Proposed Mitigation
Pre-construction/ equipment installation stage	▪ Introduction of improper seeds to the sugar farmers	▪ Use of short maturing sugar varieties, which will enable the farmers to be able to meet their financial needs through a short maturity period. The Proponent currently has FR and N14 sugar varieties, which take approximately 15 months to mature.
	▪ Improper land preparation	▪ The proponent, through their designated office, will sensitize the farmers on the standards of land preparation and methods of soil conservation to sustain the productivity of the soil over the long term.
	▪ Use of improper inputs	▪ The proponent, through their designated office, will sensitize farmers on the need to apply all the inputs they are given to get higher yields instead of diverting the farm inputs to other uses.
	▪ Conflicts with other sugar millers	▪ The proponent will carefully identify and contract their sugar farmers in collaboration with the local administration to avoid conflicts with other millers in the catchment area.
Construction/equipment installation stage	▪ Noise and vibration pollution	▪ Switching off machines while not in use ▪ Proper servicing of machines
	▪ Material and equipment Transport	▪ Restrict working hours to periods which are not associated to human disturbances, especially the recommended working hours 8.00 am – 5.00 pm ▪ Provide workers with ear masks. ▪ Regular servicing of working machines ▪ As far as possible, transport of construction materials should be scheduled for off-peak traffic hours. ▪ Appropriate traffic warning signs, informing road users of a construction site entrance ahead and instructing them to reduce speed, should be placed along the main road in the vicinity of the entrance to the site during the construction period. ▪ Flagmen should be employed to control traffic and assist construction vehicles as they enter and exit the project site. ▪ Issue notices/advisories of pending traffic inconveniences and solicit tolerance by local residents before the commencement of construction works. ▪ Assign traffic regulators to places during periods of chronic or potential traffic congestions. ▪ Set relatively low speed limit within the site. ▪ Encourage transport vehicle owner to insure their vehicles on regular basis.

Project stage	Potential Impact	Proposed Mitigation
		▪ Discourage parking near the entrance or exit routes.
	▪ Material and equipment stockpiling & storage	▪ The stockpiling of construction materials should be properly controlled and managed. Fine-grained materials (sand, marl, etc.) should be stockpiled away from any surface drainage channels and features. ▪ Low berms should be placed around the piles of sand and marl and/or tarpaulin used to cover open piles of these materials to prevent them from being washed away during rainfall. ▪ Safe storage areas should be identified and retaining structures put in place prior to the arrival and placement of material and equipment ▪ Materials and equipment to be delivered on site in installments.
	▪ Soil Erosion	▪ Stage site clearance works so as to minimize the area of exposed soil at any given time. ▪ Re-cover exposed soils with grass and other ground cover as soon as possible. ▪ Temporarily bund exposed soil and redirect flows from heavy runoff areas that threaten to erode or result in substantial turbid surface runoff to adjacent drainage waters. ▪ Monitor areas of exposed soil during periods of heavy rainfall throughout the construction phase of the project to ensure that any incidents of erosion are quickly controlled. ▪ Leveling of the project site to reduce run-off velocity and increase infiltration of storm water into the soil, therefore avoid compaction where possible.
	▪ Workers safety and health	▪ Provide workers with reflective garments. ▪ Regular maintenance and safeguarding of working machines. ▪ Train workers on manual handling techniques. ▪ Deploy an expert to lead first aid administration. ▪ Provision of adequate safety equipment and enforce on their usage. ▪ Discourage trespass. ▪ Erect signage on the ongoing activities ▪ Provide workers with personal protective equipment ▪ Provide implement safe systems and programs
	▪ Construction debris and other rejected construction materials.	▪ Reduce wastes from the point of generation by purchasing high standard and recommended materials. ▪ Instruct workers to avoid damage of working materials.

Project stage	Potential Impact	Proposed Mitigation
		▪ Contract NEMA registered garbage collector to collect waste on regular basis. ▪ Embrace the 3R's concept (Reduce, Reuse and Recycle).
	▪ Dust generation and aerosol emission	▪ Sprinkle water to harness dust level. ▪ Provide workers with dust masks.
	▪ Landscape and ecosystem change	▪ Once the project is completed, any bare land will be re-vegetated with indigenous grass, shrubs and trees ▪ Landscaping will be done to reduce any negative impacts ▪ Only specified areas of construction will have vegetation cleared ▪ protecting the existing individual trees as much as possible
	▪ Water supply	▪ Provide adequate water storage reservoirs on the construction site to meet project needs externally during periods of high demand and refill the tanks during periods of low demand (e.g. late at night). ▪ Engaging water supply tankers in case of total supply failure.
Operation Stage	▪ Cane fires	▪ The proponent will encourage green cane harvesting to avoid the negative ▪ Environmental impacts associated with can harvesting through burning
	▪ Land and succession conflicts	▪ The proponent should proactively approach this issue by considering appropriate lease agreements and using qualified lawyers to advise farmers about their land ownership status. It should also adhere to the Ministry of Agriculture, Land and Fisheries guidelines on sustainable sugarcane farming, including supporting complementary agricultural activities for food security and discouraging monoculture.
	▪ Cane spillage	▪ The proponent in partnership with Agriculture and Food Authority, Kenya Roads Board, KENHA, KURA, KERRA and the County Government of Narok will ensure the improvement of the road infrastructure within the cane growing area in order to reduce the level of cane spillage along the roads ▪ Sensitization of sugarcane loaders so as to allow for proper sugarcane loading avoiding protruding cane which inconvenience other road users ▪ The company should also institute measures of collecting all the spilled cane on the feeder roads

Project stage	Potential Impact	Proposed Mitigation
	Late Payment for Cane	▪ The proponent should ensure that their cane purchase agreements with farmers contain provisions for timely payment for can delivered and penalties for late payment.
	▪ Water use	▪ A Sustainable Water Management System Plan should be developed in collaboration with WRA to minimize impact to natural systems by managing water use, avoiding over-abstraction from the groundwater aquifers, and minimizing impacts to other water users. ▪ Factory water use should be carefully monitored through the use of flow meters and timely identification and control of nay leakages ▪ The factory will be operated at optimum capacity and with minimum stoppages because raw water consumption per ton of cane crushed increases when crushing lower than the optimum capacity and when hot water production is suspended during halts in operations (cleaning, restocking, and breakdowns).
	▪ Waste water	▪ Wherever possible, containment of water collected from areas with potential contaminants will be ensured. Such waste water should be reused; ▪ Oil interceptors and sediment traps should be installed and maintained to ensure any discharge to the environment carries a low sediment load. ▪ Storm water management canals and dams should be maintained and kept clean in order to ensure that the capacity of such systems is not compromised during the life of the operations ▪ Sensitization of the clients who buy molasses of the environmental effects of the product so as to prevent spillage of the same; ▪ Apply for effluent discharge license from NEMA on time; ▪ Install a water meter to measure the amount of water waste water released from the factory on daily basis; ▪ Carry out an analysis of the composition of the effluent through a NEMA registered laboratory; ▪ Continuously monitor the discharge as per the regulations; ▪ The company to construct drainages throughout the factory to direct storm waters to the river after lab testing and treatment if necessary.
	▪ Solid waste generation/by-products	▪ Clearly designate and construct an appropriate waste collection facility or provide covered refuse skips; (Designate Filter cake and boiler ash dumping and composting sites)

Project stage	Potential Impact	Proposed Mitigation
	(bagasse, filter cake, boiler ash)	▪ Provide NEMA licensed waste transport vehicles; ▪ Maintain a proper waste tracking document; ▪ Bagasse to be used as a source of fuel in the boilers in addition to being used to future plans of cogeneration; ▪ Ensure adequate fire warning, response and management systems are installed. ▪ Ensure prescribed regular medical examination of workers exposed to bagasse
	▪ Air pollution levels	▪ Monitor stack emissions regularly ▪ Have Fugitive Emissions Control Plan ▪ Install appropriate Electrostatic precipitator (ESP) as an effective emissions control technology. ▪ Ensure the emissions are within permissible limits in line with Air Quality Regulations 2014 ▪ Apply for Emission license and undertake quarterly analysis to ensure compliance with the emission standards. ▪ Do regular air quality monitoring (AQM) in the prescribed intervals
	▪ Drain blockages	▪ The proponent should ensure that there is adequate means of handling large quantities of sewage blockages as well as related emergency situations. ▪ Proper monitoring at waste generation points should be established. A site management plan should be put in place.
	▪ Increased pressure on infrastructure	▪ The proponent should maintain close operations with service providers such as the Kenya Power and Lighting Company, WRA etc. ▪ Principles of Cleaner Production should be applied to ensure optimal system performance.
	▪ Fire outbreak	▪ Install and regularly maintain firefighting equipment ▪ Clearly labeling fire exit routes. ▪ Constitute a firefighting team ▪ Staff to be made clearly aware of fire hazards
	▪ Vector breeding grounds	▪ Include an efficient storm water and waste management systems that will prevent the accumulation of rain water

Project stage	Potential Impact	Proposed Mitigation
		▪ All trenches and drains should be kept clear of all debris
Decommissioning stage	▪ Loss and damage of properties during demolition activities	▪ Removal of properties that are not intended to be destroyed before the actual demolition process. ▪ Proper supervision during demolition activities.
	▪ Loss of employment opportunities	▪ A good phase out programme for employees should be put in place from the onset of the project.
	▪ Accidents to the demolishing team.	▪ Issue the workers with reflective garments. ▪ Supervisors to ensure measures in place for the worker and ensure that no one is at risk by falling objects.
	▪ Loss of environmental aesthetics beauty.	▪ Ensure complete collection and disposal of wastes after demolition ▪ Landscaping the affected areas. ▪ Conduct a decommissioning audit.

7. PROJECT ALTERNATIVES

7.1 Site alternative

Alternatives for the siting of the project may be limited to land ownership and appropriateness of the area. The current location provides the most suitable place. The relocation option to a different site is an option available subject to negotiating afresh lease on other lands within the project area. More time shall be needed, and delays towards project implementation may be realized. Alternatives for siting of the project may be limited to land ownership and appropriateness of the area.

The proposed site is located on Plot L.R. No. Transmara/Moita/761 Moita Sub Location, Moita Sub Location, Lolgorian Ward, Kereto Division, Transmara south sub county, Narok County. The proposed site for the sugar mill is 6.87 Ha but is projected to increase due to further land acquisition by the Proponent. The area is served by a good road network, including Ogwedhi-Enemasi Road and other access roads, which will ease the transportation from the proposed sugar mill to other parts of the County. This alternative will have minimal impact on the physical environment and has considered the necessary measures to almost eliminate the identified issues.

Advantages:

- The property value appreciates.
- Investment made in the property will be productive. The proponent will have a potential source of income on a term basis.
- Government earns revenue from fees, taxes, rent, rates and licenses.
- Employment opportunities for the workforce at the facility.
- Optimal economic and spatial land use
- Visual amenities will be improved.

7.2 Alternative Technologies

The design of the ETP has taken into account measures that can be implemented to minimise wastewater production through recycling, treatment and reuse. No effluent discharge shall be made to the environment before satisfactory treatment. Sewage arising from the workforce at the plant will also be discharged into septic tanks. Equipment for the development were preferred with reference to available capital, and function. The facility's design was undertaken to provide the most suitable, modern and practical facilities for the expected users.

7.3 Alternative Bagasse management

Bagasse is the residual material after extraction of juice from sugarcane. This bagasse through the conveyor is sent to steam generation unit. However, the bagasse generated is so voluminous that managing it requires serious interventions. The proponent shall have a robust bagasse waste management infrastructure that comprises of using bagasse as soil conditioner to ensure excess bagasse that is not undergone complete combustion during boiler firing is turned into fertilizer 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.

7.3.1 Transfer the bagasse heap to another location

The proponent explored the possibilities of shifting the bagasse from the 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.

7.3.2 Use of bagasse in co-generation of power and steam

The proponent will use fresh bagasse to produce about 3 MW of power at its station. However, the power station will only be able to utilise a fraction of the fresh bagasse daily out of the quantities produced from crushing of cane per day.

7.3.3 Reuse of bagasse as soil conditioner

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

7.4 Alternative Equipment

Equipment for the development were preferred with reference to available capital, and function. The design of the facility was undertaken with a view to providing the most suitable, modern and practical facilities for the expected users.

7.5 "No Project" Alternatives

The No Project alternative would be a loss to the expected gap that would be filled by with the increase in sugar production at the sugar factory. The no project expansion alternative in respect to the proposed Project implies that the status quo is maintained. Under the no project expansion alternative, the proponent's proposal would not receive the necessary approval from NEMA. The proposed sugar factory complex Project 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.

7.6 Preferred option

For this project, there are limited alternatives for the project site because the proponent already acquired the land and has been carrying out cane development is the area for over two years. Therefore, emphasis is now placed on the technological approaches that the proponent will adopt in constructing and managing the proposed development.

8. ENVIRONMENTAL MANAGEMENT PLAN

8.1 Introduction

The Environmental Management Plan involves the protection, conservation and sustainable use of the various elements of the environment. The EMP for the proposed project provides all the de tails of its activities, impacts, mitigation measures and expected costs during implementation and decommissioning phases of the project. This project bears the potential of a number of negative impacts on the environment. With proper environmental management procedures in place and adhered to then there should be minimal negative impact of concern emanating from it. Key areas that require mitigation measures include wastewater, solid wastes, maintaining good air quality, safety, and storm water management.

The table below indicates measure for Environmental Management Plan

Table 14: Environmental Management Plan (EMP)

Environmental parameter	Impact	Mitigation measure	Responsible party	Costs (KES)
Construction/equipment installation phase				
Extraction of raw material	▪ Land-use and Landscape change ▪ Poor visual quality ▪ Water abstraction	▪ Obtain a change of User (Agricultural to industrial) as required. ▪ Source material from supplies that use environmentally friendly processes in their operation. ▪ Ensure accurate budgeting and estimation of actual construction material requirements to ensure that the least amount of material necessary is ordered. ▪ Ensure that damage or loss of material at the construction site is minimal through proper storage. ▪ Use at least 5%-10% recycled, refurbished, or salvaged materials to reduce the use of raw materials and divert material from landfills. ▪ Hydrological study to inform abstraction of water from the borehole and WRA permit to be obtained prior to abstraction. ▪ The tender documents should specify the required standards and certification for procurement of all materials and appliances; ▪ Steel scaffolding should be used in preference to timber and the Contractor should ensure that sufficient quantities of scaffolding are available for hire at the time of construction. ▪ All construction materials should be from approved sources; for example, hard stones for buildings should be obtained from NEMA-licensed sites and bona fide commercial quarries.	▪ Proponent and Contractor ▪ WRA, NEMA	▪ As per BQ and agreement with the Contractor
Removal/ clearing of vegetation	▪ Exposing ground to agents of soil erosion ▪ Loss of terrestrial habitat & biodiversity	▪ Proper demarcation and delineation of the project site to be affected by construction work ▪ Specify location for trucks and equipment, and areas of the site which should be kept free from traffic, equipment and storage. ▪ Designate access route within the site	▪ Proponent and contractor ▪ KFS	▪ 100,000 for landscaping

Environmental parameter	Impact	Mitigation measure	Responsible party	Costs (KES)
	▪ Permanent loss of vegetation ▪ Habitat fragmentation ▪ Interruption of ecological corridors and migration paths ▪ Erosion and stream sedimentation ▪ Draining of wetlands	▪ Design and implement an appropriate landscaping program to help in re- vegetation of part of the project site after construction ▪ Mapping out the conservation zones and ensure Protection of wetlands, rivers, springs and the existing vegetation as much as possible and in line with applicable rules, regulations and standards. ▪ Set a replanting and landscaping programme that focuses on increasing "green area"		
Sewage and effluent	▪ Pollution	▪ Provide adequate sanitary facilities for workers, ▪ Provide solid waste receptacles and storage containers, particularly for the disposal of plastic bags boxes, so as not to block drainage system and to prevent littering of the site.	▪ Proponent and contractor	▪ As per BQ and agreement with Contractor
Movement of vehicle at the site	▪ Compaction of soil ▪ Interference with soil structure leading to low water infiltration	▪ Apply soil erosion control measures such as levelling of the project site to reduce run-off velocity and Increase infiltration of storm water into the soil. ▪ Ensure that construction vehicles are restricted to existing graded roads to avoid soil compaction within the project site, ▪ Ensure that any compacted areas are ripped to reduce run-off. ▪ Storm water drainage lines be well constructed to reduce incidence of pounding and flooding	▪ Proponent and contractor	▪ As per BQ and agreement with Contractor
Utilization of construction materials	Generation of wastes leading to: ▪ Wastage of resources/ materials	▪ Through accurate estimation of quantities of materials required, order materials in the sizes and quantities they will be needed, rather than cutting them to size, or having large quantities of residual materials.	▪ Constructor and his workers	▪ As per BQ and agreement with Contractor

Environmental parameter	Impact	Mitigation measure	Responsible party	Costs (KES)
	▪ Health risk to the worker and environment ▪ Reduced aesthetic value of the site ▪ Blockage of drainage systems ▪ Chocking water bodies	▪ Ensure that construction materials left over at the end of construction will be used in other projects rather than being disposed off. ▪ Ensure that damaged or waste materials including cabinet, doors, plumbing, and lighting fixtures, marble and glasses will be recovered for refurbishing and use in other projects ▪ Reducing the amount of construction waste generated over time ▪ Provide facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements ▪ Purchase of perishable construction materials such as paints should be done incrementally to ensure reduced spoilage of unused materials ▪ Use building materials that have minimal or no packaging to avoid the generation of excessive packaging waste ▪ Maintain a proper waste tracking document ▪ Ensure adequate fire warning, response and management systems are installed. ▪ Hazardous wastes, such as waste oils and grease to be collected in secure storage facilities on-site to prevent accidental release that may result in contaminated run-off and leaching. ▪ Storage areas for hazardous material to be cemented to provide an impervious surface and to prevent uncontrolled discharges to groundwater. ▪ Contract a NEMA licensed waste handler to collect waste oil, waste tyres and general office and domestic wastes. ▪ Practice the 6Rs (Reuse, Recover, Refill, Return, Recycle) of waste Management.		

Environmental parameter	Impact	Mitigation measure	Responsible party	Costs (KES)
		▪ Training of workforce on matters health, safety and environment with regards to waste and its effects.		
Dust emission from movement of transportation vehicles at the site and on the road	▪ Air pollution ▪ Causing breathing problems to the workers and the neighbourhood ▪ Blockage of fauna stomata	▪ Sprinkle water on graded access routes each day to reduce dust generation by construction vehicles ▪ Controlling the speed of vehicles on the site ▪ Watering open soil or storage sites ▪ Selecting transportation routes ▪ Provide worker with dust masks ▪ Spiro metric examination on exposed workers at prescribed interval of time	▪ Constructor and his workers	▪ As per BQ and agreement with Contractor
Utilization of fossil fuel by fuel consuming machineries.	▪ Emission of carbon gas into the atmosphere leading to global warming ▪ Exhaustion of fossil fuel resource ▪ Air pollution ▪ Can Lead to breathing problems	▪ Ensure proper planning of transportation of materials to ensure that vehicle fills are increased in order to reduce the number of trips done per vehicle or the number of vehicles on the road. ▪ Sensitize truck drivers to avoid unnecessary racing of vehicle engines at adding/offloading points and parking areas, and to switch off or keep vehicle engines when not in use ▪ Prompt servicing of vehicles engines ▪ Use of unleaded and low sulphur fuel ▪ Monitor energy use during construction and set target for reduction of energy use.	▪ Contractor and Drivers	▪ As per need
Noise and vibration	▪ Noise generation ▪ Hearing problem	▪ Sensitize construction drivers to avoid gunning of vehicle engines or hooting especially when passing through sensitive areas such as churches, schools, residential areas and hospitals ▪ Sensitize construction vehicle drivers and machinery operators to switch of vehicle or machinery not being used.	▪ Constructor and Workers	▪ 50,000

Environmental parameter	Impact	Mitigation measure	Responsible party	Costs (KES)
		▪ Ensure that all heavy duty equipment are insulated or placed in enclosures to minimize ambient noise levels. ▪ Measure to ensure that noise levels does not exceed 75dB(A) ▪ Attenuation of any sound that may affect the inner ear by use of earplugs and earmuffs. ▪ Audio metrical examination of workers at prescribed intervals		
Water consumption	▪ Excessive use / misuse of water ▪ Generation of excess waste water ▪ Water pollution	▪ Prompt reuse and recycling of water as much as possible where necessary ▪ Install a discharge meter at water outlet to monitor and determine total water usage. ▪ Monitor water consumption and utilization; ▪ Sensitize construction workers on the importance of proper water management; ▪ All wastewater should be drained into approved drainage facilities.	▪ Contractor and his workers	▪ 150,000
Approval of building plan	▪ The development being in alignment with the County Integrated Development Plan (CIDP)	▪ Ensure that the Change of Use is effected and plans are approved by the County Government, Physical Planner and the local Occupational Health and Safety Office	▪ The proponent	▪ Gazetted fee
Incident, accidents, and dangerous occurrences	▪ To enable relevant authorities to monitor incidence occurrences and take necessary measure to minimize them.	▪ 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.	▪ Contractor and his workers	▪ Gazetted fee

Environmental parameter	Impact	Mitigation measure	Responsible party	Costs (KES)
Safety, health and environment (SHE) policy	▪ To give guidelines on how one is to protect himself within a given premises against any incident.	▪ Develop, document and display prominently an appropriate SHE policy for construction works	▪ Contractor	▪ 5,000
Personal protective gears	▪ To protect against any infection or injuries while at work.	▪ Suitable overalls, safety footwear, dust masks, gas masks, respirators, gloves, ear protection equipment etc. should be made available and construction personnel must be trained on their use.	▪ Contractor	▪ 100,000
Supply of clean water	▪ Ensure good health as dirty/untreated water leads to water borne diseases.	▪ Ensure that construction workers are provided with an adequate supply of wholesome drinking water which should be maintained at suitable and accessible points.	▪ Contractor	▪ 100,000
Storage of materials	▪ Can cause accident, material wastage and spoilage, and reduced aesthetic value.	▪ Ensure that materials are stored or stacked in such manner as to ensure their stability and prevent any fall or collapse	▪ Contractor	▪ 5000
First aid	▪ To ensure that when any injury occur it can be taken care of before main treatment at a hospital or a dispensary.	▪ Well stocked first aid box which is easily available and Accessible should be provided within the premises ▪ Provision must be made for persons to be trained in first aid, with a certificate issued by a recognized body.	▪ Contractor	▪ 40,000

Environmental parameter	Impact	Mitigation measure	Responsible party	Costs (KES)
Safety and security	▪ Destruction and stealing of materials on site.	▪ Ensure the general safety and security at all times by providing day and night security guards and adequate lighting within and around the construction site. ▪ The Contractor should ensure strict safety management through close attention to design, work procedures, materials and equipment; ▪ Develop a site safety action plan detailing safety equipment to be used, emergency procedures, restrictions on site, frequency and personnel responsible for safety inspections and controls; ▪ All workmen should be provided with personal protective equipment (e.g. nose masks, ear muffs, helmets, overalls, industrial boots, etc.); ▪ There should be regular site reporting on health, safety and environment (HSE) issues by an appointed HSE representative, daily site inspections should be done to ensure safe work practices are adhered to; ▪ All injuries that occur on site must be recorded in the accident registers and corrective actions for their prevention be instigated as appropriate (Section 62 of the Factories and Other Places of Work Act); ▪ Statistical records on accidents and incidents should be collated and analysed on a monthly basis and forwarded to the contractor and / or displayed on the notice boards; ▪ Site personnel should be encouraged to report "near-miss incidents" in order to avoid potential problems and increase safety awareness.	▪ Contractor	▪ 100,000
Fire Hazards	▪ Destruction of property and lives	▪ Provide adequate number of appropriate firefighting equipment as well as fire exit options. ▪ Ensure inspection and maintenance of fire equipment	▪ Contractor and proponent	▪ 200,000

Environmental parameter	Impact	Mitigation measure	Responsible party	Costs (KES)
		▪ A fire escape route and an emergency assembly point should be clearly indicated ▪ Form and train firefighting team ▪ Conduct regular fire drills		
Construction traffic:	▪ Disruption of local traffic; ▪ Potential for accidents.	▪ The Contractor should plan itineraries for site traffic. ▪ Issue notices/advisories of pending traffic inconveniences and solicit tolerance by commuters before the commencement of construction works. ▪ Assign traffic regulators to places during periods of chronic or potential traffic congestions. ▪ Prepare & provide appropriate signage & trained flag persons where the movement of heavy machinery and construction equipment may cross the main roads.	▪ Contractor	▪ 50,000
Influx of construction workers into the area:	▪ Proliferation of informal kiosks in the area; Increase in transport demand. ▪ Road side vending	▪ Develop a catering program on site for construction staff; ▪ Provide transportation for the workforce to and from the site; ▪ The contractor should identify, demarcate and fence a specific area within which specific number vendors will be allowed to operate. ▪ The vendors should be instructed to maintain the area in a tidy fashion and litter bins should be provided with arrangements in place to have the contents of these emptied on a regular basis and disposed of appropriately.	▪ Contractor	▪ 100,000
Energy utilization	▪ Energy consumption	▪ Develop an 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; ▪ Construction workers should be sensitized on the importance of energy management.	▪ Contractor	▪ 20,000

Environmental parameter	Impact	Mitigation measure	Responsible party	Costs (KES)
Ergonomic	▪ Bad posture may lead to body structural disorder.	▪ Provision for repairing and maintaining of hand tools must be in place ▪ Hand tools must be of appropriate size and shape for easy and safe use ▪ Height of equipment, controls or work surfaces should be positioned to reduce bending posture for standing workers	▪ Contractor	▪ 20,000
Operation phase				
Solid waste generation	▪ Generation of general Solid wastes leading to pollution of water bodies, air impairment when decomposing hence odours, and reduction in aesthetic value of the compound.	▪ Provision of dirt bins/skips at strategic points of the compound ▪ Disposal at the designated site, ▪ Awareness creation among workers ▪ Practice reuse and recycling methods as much as possible where applicable. ▪ Display portraits like “Don’t Litter”, “Keep Environment Clean”	▪ Proponent	▪ Waste collection as per rates
	▪ The Bagasse Menace	▪ Installation of a bagasse house as part of the project design. ▪ Use as a source of fuel in the boilers. ▪ Installation of a Co-generation unit ▪ Installation of a pelleting unit. ▪ Practicing of bagasse bailing to enhance transportation. ▪ Reuse together with the filter cake as soil enrichment to increase organic matter in the farm lands. ▪ Consider use of bagasse as a raw material in paper and chip-board manufacturing.	▪ Proponent	▪ As per need

Environmental parameter	**Impact**	**Mitigation measure**	**Responsible party**	**Costs (KES)**
Hazardous waste generation	▪ Pollution of surface or ground water due to oil spillage	▪ Hazardous wastes, such as waste oils and grease to be collected in secure storage facilities on-site to prevent accidental release that may result in contaminated run-off and leaching. ▪ Storage areas for hazardous material to be cemented to provide an impervious surface and to prevent uncontrolled discharges to groundwater	▪ Proponent	▪ Waste collection as per rates
Air pollution	▪ Unmonitored stack emissions	▪ Monitor stack emissions regularly ▪ Have Fugitive Emissions Control Plan ▪ Install appropriate Electrostatic precipitator (ESP) as an effective emissions control technology. ▪ Ensure the emissions are within permissible limits in line with Air Quality Regulations 2014 ▪ Apply for Emission license and undertake quarterly analysis to ensure compliance with the emission standards.	▪ Proponent	▪ 400,000
Accidents and injuries	▪ Machine safety (improper use and maintenance of machines)	▪ All plant, machinery and equipment should only be used for work which they are designed for and be operated by a competent person. ▪ Insist on regular servicing of electrical fittings and appliances by qualified personnel. ▪ Every machine intended to be driven by mechanical or any other type of power should be provided with safeguards and an efficient starting and stopping appliance, the control of which should be in such a position as to be readily and conveniently operated by the person operating the machine.	▪ Proponent	-
Occupational health and Safety	▪ Accidents and injuries	▪ The premise must be kept clean, daily removal of accumulated dust from floors, free from effluvia arising from any drain, sanitary convenience or nuisance	▪ Proponent	▪ 100,000

Environmental parameter	Impact	Mitigation measure	Responsible party	Costs (KES)
		▪ The premise must not be overcrowded, there must be in each room 10 metres of space for each employee, not counting space 14 feet from the floor and a 9 feet floor-roof height. ▪ The circulation of fresh air must secure adequate ventilation of workrooms. ▪ There must be sufficient and suitable lighting in every part of the premise in which persons are working or passing. ▪ There should also be sufficient and suitable sanitary conveniences separate for each sex, ▪ Management should ensure provision of suitable protective clothing and appliances including where necessary, suitable gloves, footwear, goggles, gas masks, and head covering, and maintained for the use of workers in any process involving expose to wet or to any injurious or offensive substances ▪ Management should ensure training and supervision of inexperienced workers ▪ An adequate supply of both quantity and quality of wholesome drinking water must be provided. ▪ Maintenance of suitable washing facilities, accommodation for clothing not worn during working hours must be provided. ▪ Provision of well-equipped First Aid kits and /or ready transport facilities to hospital.		
Use of sanitary room (toilets and urinal)	▪ Generation of sewage(liquid waste),Water pollution, Air pollution (odour) ▪ Reduced aesthetic value	▪ Incorporate grease traps ▪ Conduct regular inspections for sewerage pipe blockages or damages and fix appropriately ▪ Ensure regular monitoring of the sewage discharged ▪ Reuse, recycle waste water where necessary ▪ Ensure adequate water supply for flushing and to ensure the waste is carried to the sewerage system without causing blockage.	▪ Proponent ▪ NEMA	▪ 150,000

Environmental parameter	**Impact**	**Mitigation measure**	**Responsible party**	**Costs (KES)**
		▪ Ensure flashing toilet after use though Avoid unnecessary flushing ▪ Apply for effluent discharge license		
Water Consumption	▪ Overutilization of water	▪ Monitor water consumption ▪ Apply for water abstraction permits from WRA ▪ Install internal water meters. ▪ Installing plumbing fittings, appliances and devices to optimize water use efficiency; ▪ Recycling of wastewater to reduce water consumption.	▪ Proponent/ Contractor ▪ WRA	▪ As per BQ
Waste management	▪ Drain blockages	▪ The proponent should ensure that there is adequate means of handling large quantities of sewage blockages as well as related emergency situations. ▪ Proper monitoring at waste generation points should be established.	▪ Proponent/ Contractor	▪ As per BQ
Use of energy	▪ Overutilization of hydropower ▪ Overloading hydropower grid	▪ Switch off electrical equipment, appliances and lights when not being used ▪ Install energy saving fluorescent tubes at all lighting points within the facility instead of bulbs which consume higher electric energy ▪ Sensitize occupants of the facility to use energy efficiently ▪ Plant trees within the compound and along the fence.	▪ Proponent	▪ -
Electricity use	▪ Explosions/Fire outbreaks causing injuries and destruction of properties	▪ Regular maintenance of fire extinguishers ▪ Proper electric connections. ▪ Circuit must not be overloaded ▪ Distribution boards switches must be clearly marked to indicate respective circuits ▪ No live exposure connection	▪ Proponent/Contractor	▪ As per BQ and need

Environmental parameter	Impact	Mitigation measure	Responsible party	Costs (KES)
		▪ Electrical fittings near all potential sources of ignition should be flame proof		
Ventilation	▪ Suffocation and lack of clean air may lead to discomfort of the occupants in the facility.	▪ Enough space must be provided within the premises to allow for adequate natural ventilation through circulation of fresh air	▪ Proponent ▪ Contractor	▪ As per BQ
Vector/rodents breeding grounds	▪ Diseases and infections	▪ Ensure that there is no space for unplanned stagnant water retained in the fields. ▪ Recommended measures should be applied when dealing with rodents and food storage. ▪ A monitoring programme should be put in place for controlling relative cases observed.	▪ Proponent	▪ As per need
Lighting	▪ Lack of enough light in the facility may lead to eye straining hence eye problems	▪ There must be adequate provision for artificial and natural lighting in the facility.	▪ Proponent	▪ As per BQ
Decommissioning Phase				
Demolition activity	▪ Lead to accident from falling, and flying objects. ▪ Generation of construction waste ▪ Reduced aesthetic value of that place ▪ Destruction of soil structure	▪ Develop a decommissioning EIA	▪ Proponent and the contractor	▪ Develop BQ and project budget

Environmental parameter	Impact	Mitigation measure	Responsible party	Costs (KES)
	▪ Lead to soil erosion hence water pollution			

9. CONCLUSION AND RECOMMENDATIONS

This Study Report has been prepared to provide sufficient and relevant information on the proposed project to enable NEMA to establish whether activities of the project are likely to have significant adverse environmental impacts. Mitigation measures have been proposed for identified impacts in this report and an Environmental Management Plan (EMP) for the implementation of the proposed measures has been presented. The EMP presented in this report is a tool to be used by the Project Team during the construction, hand-over and operation periods.

To ensure implementation, mitigation measures should be reflected in the Conditions of Contract and Bills of Quantities. It is the responsibility of the Proponent to ensure these measures are incorporated into these two documents.

It is recommended that the available waste management systems must be monitored and upgraded (where necessary) to ensure that they adequately handle the anticipated increase in waste and by-products.

In this respect the project can proceed on condition that the concerns are addressed the proposed mitigation measures are implemented and an EIA license issued with the above conditions taken fully into account amongst any others.

REFERENCES

1. Agriculture, Fisheries and Food Authority Act, 2013
2. Kenya Gazette Supplement Acts Physical Planning Act, 1999. Government Printer, Nairobi.
3. Kenya Gazette Supplement Acts Public Health Act (Cap. 242). Government Printer, Nairobi.
4. Kenya Gazette Supplement Acts Water Act, 2016. Government Printer, Nairobi.
5. Kenya Gazette Supplement Acts. Environmental Management and Coordination (Water Quality) Regulations, 2006. Government Printer, Nairobi.
6. Kenya gazette supplement number 56. Environmental (Impact Assessment and Audit) Regulations, 2003. Government Printer, Nairobi.
7. Kenya Gazette Supplement Number 69. Environmental Management and Coordination (Waste Management) Regulations, 2006. Government Printer, Nairobi.
8. Kenya Sugar Act, 2001 (rev.2012)
9. Kilgoris Kimathi R. (2021) Hydrogeological/Geophysical survey report for Lolgorian Transmara
10. Kimathi Raymond (2021): Hydrogeological and geophysical survey report
11. KNBS. (2022). Kenya Demographic and Health Survey.
12. Mirobe J (2022). Hydrogeological/Geophysical investigation report for Winds of Grace Church in Moita.
13. Niang, I., Ruppel, O. C., Abdrabo, M. A., Essel, A., Lennard, C., Padgham, J., Urquhart, P., (2014) Africa. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros VR, Field CB, Dokken DJ and 13 others (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1199-1265
14. Occupational Safety and Health Act, 2007
15. Ogutu, J.O., Piepho, Hans-P, Said, M.Y., Ojwang, G.O., Njino, L.W., Kifugo, S.C., and Wargute, P.W. (2016) Extreme wildlife declines and concurrent increase in livestock numbers in Kenya: What are the causes? PLoSONE 11(9):e0163249.doi:10.1371/ journal.pone.0163249
16. Regulations, 2006. Government Printer, Nairobi. Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. Government Printer, Nairobi
17. Republic of Kenya (1998). Laws of Kenya: The Science and Technology Act, Cap 250. Government Printer, Nairobi.
18. Republic of Kenya (2003). Legislative Supplement No. 31, Legal Notice No. 101: The Environmental (Impact Assessment and Audit) Regulations, 2003. Government Printer, Nairobi

19. Republic of Kenya (2015). The Environmental Management and Co-ordination Act, No. 5 of 2015. Government Printer, Nairobi.
20. Republic of Kenya (2016). Laws of Kenya: The Water Act, Cap 372. Government Printer, Nairobi.
21. Said, M.Y., Muhwanga, J., Bedelian, C., Moiko, S., Ateino, F., and Abuya, R. (2018). Climate projections for Arid and Semi-arid lands of Kenya based on RCP 2.6, RCP 4.5 and RCP 8.5. PRISE Report.
22. Narok County Integrated Development Plan(CIDP)
23. West Ndungu S. (2022) Hydrogeological survey report at Isampin area, Kilgoris, Transmara West
24. WHO Covid-19 safety measures and regulations at workplace
25. World Bank (1991), Environmental Assessment sourcebook volume I: Policies, procedures and cross-sectoral issues. World Bank, Washington.
26. World Bank. (2013) Turn Down Heat. The Climate Extremes, Regional Impacts, and the Case for Resilience. Washington, DC.

ANNEXURE

Annex 1: NEMA Approved TOR

mazingira yetu | uhai wetu | wajibu wetu

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

Telcom Wireless: 020-2183718, 020-2101370
Mobile Line: 0724 253 398, 0723 363 010, 0735 013 046
Incident Line: 0786 101 100, 0741 101 100

P.O. Box 67839 - 00200
Popo Road, Nairobi, Kenya
Email: dgnema@nema.go.ke
Website: www.nema.go.ke

REF: NEMA/TOR/5/2/771 **DATE: 7th August, 2024**

The Proponent
Bharat Patel & Umang Patel
P.O. BOX 19226-00501
NAIROBI

RE: TERMS OF REFERENCE (TOR) FOR ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED SUGAR FACTORY ON PLOT L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY.

We acknowledge the receipt of your TOR for the above proposed project.

Pursuant to the Environmental Management and Coordination Act, 1999, the Environmental (Impact Assessment and Audit) Regulations 2003 and Legal notice 31 & 32 of 2013, your terms of reference for the Environmental Impact Assessment (EIA) for the **PROPOSED SUGAR FACTORY ON PLOT L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY** has been approved with the following conditions:

1. You shall undertake a detailed climate change risks and vulnerability assessment to inform the appropriate adaptation and mitigation measures to climate proof the project in line with provisions of Climate Change Act, 2016.
2. You shall undertake a comprehensive biodiversity assessment survey within the project site and the surrounding environment.

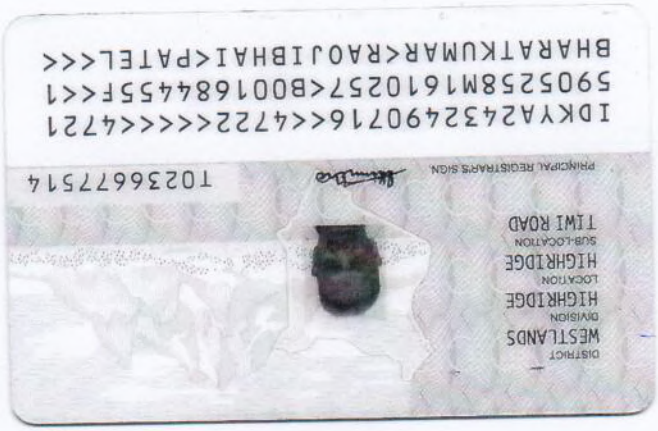
You shall submit ten (10) copies of the EIA study report accompanied by the above specialized assessment reports upon payment of the applicable EIA processing and monitoring fees being 0.1% of the total project cost, a soft copy of the summarised ESMP in **WORD** format for preparation of public notice and one electronic copy of the report prepared by the team of experts to the Authority.

You are advised to comply accordingly.

JOSEPH MAKAU
FOR: DIRECTOR GENERAL

Annex2: Proponent IDs and PIN


JAMHURI YA KENYA
REPUBLIC OF KENYA
SERIAL NUMBER 243249071
ID NUMBER 1684455
FULL NAMES
BHARATKUMAR RAOJIBHAI PATEL
DATE OF BIRTH
25. 05. 1959
SEX
MALE
DISTRICT OF BIRTH
INDIA
PLACE OF ISSUE
WESTLANDS
DATE OF ISSUE
25. 10. 2016
HOLDER'S SIGN
BHARATKUMAR RAOJIBHA


IDKYA2432490716<<4722<<<<<<4721
5905258M1610257<BOO16844 55F<<1
BHARATKUMAR<RAOJIBHAI<PATEL<<<
T023667751 4
PRINCIPAL REGISTRAR'S SIGN
DISTRICT
WESTLANDS
DIVISION
HIGHRIDGE
LOCATION
HIGHRIDGE
SUB-LOCATION
TIWI ROAD

KENYA REVENUE AUTHORITY

PIN Certificate

For General Tax Questions
Contact KRA Call Centre
Tel: +254 (020) 4999 999
Cell: +254(0711)099 999
Email: callcentre@kra.go.ke

www.kra.go.ke

Certificate Date : 29/06/2018

Personal Identification Number

A000123421R

This is to certify that taxpayer shown herein has been registered with Kenya Revenue Authority

Taxpayer Information

Taxpayer Name	BHARATKUMAR RAOJIBHAI PATEL
Email Address	BHARATPATELVEGPRO@GMAIL.COM

Registered Address

L.R. Number :	**Building :** VEGPRO BUILDING
Street/Road : KENYATTA HIGHWAY	**City/Town :** NAIROBI
County : Nairobi	**District :** Nairobi East District
Tax Area : Nairobi East	**Station :** East of Nairobi*
P. O. Box : 19226	**Postal Code :** 00501

Tax Obligation(s) Registration Details

Sr. No.	Tax Obligation(s)	Effective From Date	Effective Till Date	Status
1	Income Tax - Resident Individual	31/01/2009	N.A.	Active

The above PIN must appear on all your tax invoices and correspondences with Kenya Revenue Authority. Your accounting end date is 31st December as per the provisions stated in the Income Tax Act unless a change has been approved by the Commissioner-Domestic Taxes Department.The status of Tax Obligation(s) with 'Dormant' status will automatically change to 'Active' on date mentioned in "Effective Till Date" or any transaction done during the period. This certificate shall remain in force till further updated.

* The station is subject to change based on the verification done by Commissoner.

Disclaimer : This is a system generated certificate and does not require signature.

JAMHURI YA KENYA

REPUBLIC OF KENYA

SERIAL NUMBER 238527458

ID NUMBER 32771235

FULL NAMES
UMANG PATEL

DATE OF BIRTH
18. 03. 1973

SEX
MALE

DISTRICT OF BIRTH
LONDON

PLACE OF ISSUE
KARIOKOR

DATE OF ISSUE
07. 07. 2014

HOLDER'S SIGN.

DISTRICT
WESTLANDS

DIVISION
KILIMANI

LOCATION
KILIMANI

SUB-LOCATION
KILIMANI

PRINCIPAL REGISTRAR'S SIGN

T0171699673

IDKYA2385274580<<4723<<<<<4711
7303180M1407075<B032771235W<<7
UMANG<PATEL<<<<<<<<<<<<<<<<<<

KENYA REVENUE AUTHORITY

www.kra.go.ke

PIN Certificate

For General Tax Questions
Contact KRA Call Centre
Tel: +254 (020) 4999 999
Cell: +254(0711)099 999
Email: callcentre@kra.go.ke

Certificate Date : 12/08/2014

Personal Identification Number

A002568828H

This is to certify that taxpayer shown herein has been registered with Kenya Revenue Authority

Taxpayer Information

Taxpayer Name	Umang Patel
Email Address	ukp@vegpro-group.com

Registered Address

L.R. Number :	**Building :** VEGPRO BUILDING
Street/Road : NAIROBI	**City/Town :** NAIROBI CITY (NORTH)
County : Nairobi	**District :** Embakasi District
Tax Area : Embakasi	**Station :** South of Nairobi*
P. O. Box : 19226	**Postal Code :** 00501

Tax Obligation(s) Registration Details

Sr. No.	Tax Obligation(s)	Effective Date
1	Income Tax - Resident Individual	02/02/2009

The above PIN must appear on all your tax invoices and correspondences with Kenya Revenue Authority. Your accounting end date is 31st December as per the provisions stated in the Income Tax Act unless a change has been approved by the Commissioner-Domestic Taxes Department.The status of Tax Obligation(s) with 'Dormant' status will automatically change to 'Active' on date mentioned in "Effective Till Date" or any transaction done during the period. This certificate shall remain in force till further updated.

* The station is subject to change based on the verification done by Commissoner.

Disclaimer : This is a system generated certificate and does not require signature.

Annex 3: Land ownership document

REPUBLIC OF KENYA

THE LAND REGISTRATION ACT

(*No.* 3 *of* 2012. *section* 108)

THE REGISTERED LAND ACT

(*Chapter* 300) (REPEALED)

Title Deed

Title Number TRANSMARA/MOITA/761

Approximate Area (6.87 HA)

Registry Map Sheet No. 7

This is to certify that UMANG PATEL ID/32771235 AND BHARATKUMAR RAOJIBHAI PATEL ID/16884455

is (are) now registered as the absolute proprietor(s) of the land comprised in the above-mentioned title, subject to the entries in the register relating to the land and to such of the overriding interests set out in section 28 of the Land Registration Act (No. 3 of 2012) as may for the time being subsist and affect the land.

GIVEN under my hand and the seal of the TRANSMARA District Land Registry this 9TH day of JULY, 20 24

Land Registrar

J. M. Kobado 415

(To be completed only when the applicant has paid the fee of Sh. 125)

At the date stated on the front hereof, the following entries appeared in the register relating to the land:

EDITION: 1

OPENED: 5.5.2022

PART A—PROPERTY SECTION

REGISTRATION SECTION	EASEMENTS, ETC.	NATURE OF TITLE
TRANSMARA/MOTIA		
PARCEL NUMBER: 761		
APPROXIMATE AREA: 6.87 Ha.		ABSOLUTE
REGISTRY MAP SHEET No.: 7		

PART B—PROPRIETORSHIP SECTION

ENTRY NO.	DATE	NAME OF REGISTERED PROPRIETOR	ADDRESS AND DESCRIPTION OF REGISTERED PROPRIETOR	CONSIDERATION AND REMARKS	SIGNATURE OF REGISTRAR
4.	9.7.2024	UMANG PATEL			
		BHARATKUMAR RAOJIBHAI PATEL			
5.	9.7.2024	TITLE DEED		ISSUED	

PART C – ENCUMBRANCES SECTION

Entry No.	Date	Nature of Encumbrance	Further Particulars	Signature in Register

J. M. Kobado 415

REPUBLIC OF KENYA

THE LAND REGISTRATION ACT

(*No.* 3 *of* 2012. *section* 108)

THE REGISTERED LAND ACT

(*Chapter* 300) (REPEALED)

Title Deed

MLS/TD/02/A2/02

No. 4754459

GPK (L) 1078—200m—06/2023

Annex 4: Expert practicing licenses

EAE 2 3061837

FORM 7 (r.15(2))

nema
Mazingira Yetu | Uhai Wetu | Wajibu Wetu

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

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

License No : NEMA/EIA/ERPL/20775

Application Reference No: NEMA/EIA/EL/27670

M/S **Gomake Consultancy Company Ltd**
(individual or firm) of address
P.O. Box 5540 - 00100 Nairobi

is licensed to practice in the capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Firm of Experts** registration number **8511**

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

Issued Date: **2/8/2024** Expiry Date: **12/31/2024**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001 : 2015 Certified

EAE 23061833

FORM 7 (r.15(2))

nema
Mazingira Yetu | Uhai Wetu | Wajibu Wetu

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

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

License No : NEMA/EIA/ERPL/20776

Application Reference No: NEMA/EIA/EL/27671

M/S **Kennedy Kijana**
(individual or firm) of address
P.O. Box 254720964333 Nairobi

is licensed to practice in the capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert**

General

registration number **1254**

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

Issued Date: **2/8/2024** Expiry Date: **12/31/2024**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001 : 2015 Certified

Annex 5: PCMs (Notices, Minutes and Questionnaires)

Gomake Consultancy Company Ltd

Safety, Health and Environment Consultancies

Our Ref: Gomake/TSF/2024

19th August 2024

1. Office of the Governor,
   Narok County,
   P.O Box 545-20500,
   Narok

2. The County Commissioner,
   Narok County,
   Ministry of Interior & National Administration,
   Narok

3. The Deputy County Commissioner,
   Transmara West Sub County,
   Ministry of Interior & National Administration,
   Narok

4. The Deputy County Commissioner,
   Transmara South Sub County,
   Ministry of Interior & National Administration,
   Narok

5. The County Director of Environment
   NEMA Narok County,
   P.O Box 510-20500,
   Narok.

6. Agriculture and Food Authority
   Tea House; Naivasha Road, off Ngong Road
   P.O Box 37962 - 00100, Nairobi
   Cell Phone: +254-700638672/737454618
   E-Mail: info@afa.go.ke

7. County Occupational Safety & Health Officer
   DOSHS Narok
   Narok
   Email:doshsnarok@gmail.com

COUNTY COMMISSIONER'S OFFICE NAROK COUNTY
22 AUG 2024
RECEIVED
P. O. Box 4-20500, NAROK

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY-NEMA
COUNTY DIRECTOR OF ENVIRONMENT NEMA - NAROK
22 AUG 2024
RECEIVED
P. O. Box 510-20500 NAROK

County Occupational Health & Safety Officer Narok

K9, 1st Floor, Benisa Flat Opp. Seasons House||Seasons Road off Thika Road Kasarani.
P.O. Box 5540-00100||M: 0720964333||Nairobi.

8. Sub County Administrator,
   Transmara West Sub County,
   Narok
9. Sub County Administrator,
   Transmara South Sub County,
   Narok
10. Member of County Assembly,
    Keyian Ward,
    Narok County,
    Narok
11. Member of County Assembly,
    Lolgorian Ward,
    Narok County
    Narok.
12. Chief Officer, Agriculture
    Narok County,
    P.O Box 545-20500,
    Narok.
13. Director, Gender
    Narok County,
    P.O Box 545-20500,
    Narok
14. Director, Environment
    Narok County,
    P.O Box 545-20500,
    Narok
15. Director, Health
    Narok County,
    P.O Box 545-20500,
    Narok
16. Director, Trade & Investment
    Narok County,
    P.O Box 545-20500,
    Narok
17. Agriculture Team Lead,
    Nguzo Africa,
    Narok

NAROK COUNTY ASSEMBLY
22 AUG 2024
RECEIVED
P.O. Box 19-20500, NAROK, KENYA

COUNTY DIRECTOR OF AGRICULTURE
RECEIVED
22 AUG 2024
Sign:.....
P. O. Box 476 – 20500, NAROK
Email: narokcda@yahoo.com

COUNTY DIRECTOR OF HEALTH
RECEIVED
22 AUG 2024
P O Box 11-20500
NAROK
COUNTY GOVERNMENT

Dear Sir/Madam,

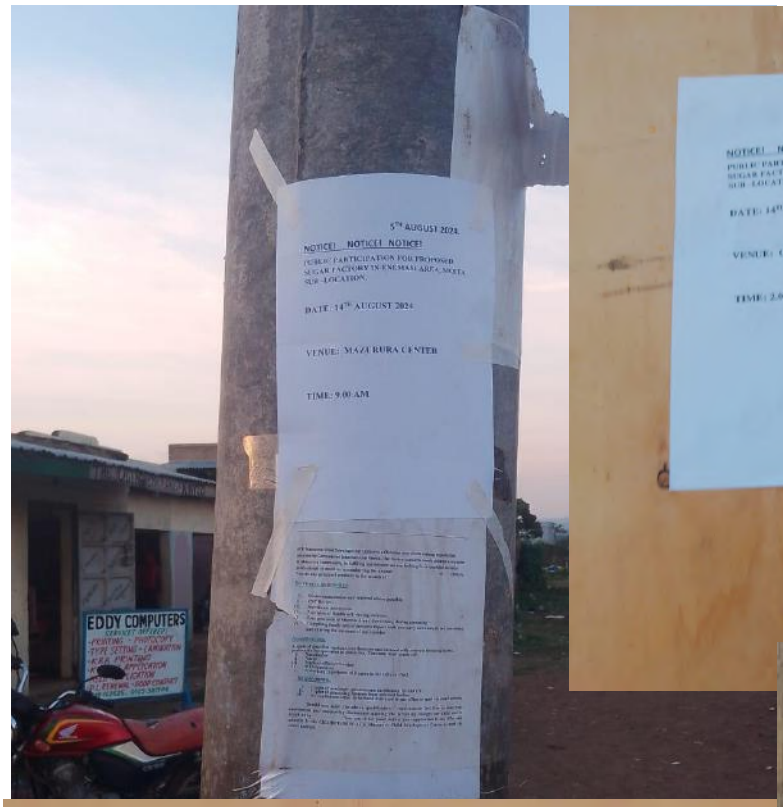
RE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY.

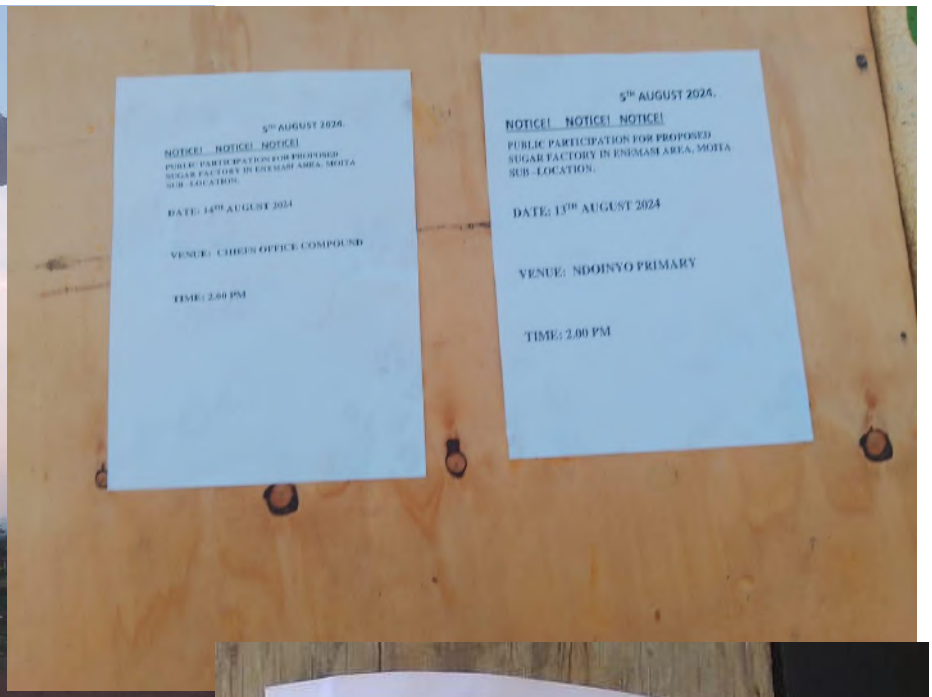
The Proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Area, Moita Sub Location, Moita Location, Lolgorian Ward, Kereto Division, Transmara South Sub County, Narok County. The Proponent is determined to support Kenya in addressing the recurrent sugar production deficit in the country by proposing to install the factory with a capacity to crush about 1,250TCD of sugarcane per day. The Proponent will rely on the neighbouring farmers for the cane. Pursuant to Section 58 of the Environmental Management and Coordination Act Cap 387 of the Laws of Kenya, the Proponent is carrying out Environmental and Social Impact Assessment (ESIA) Study for the Proposed Sugar Factory.

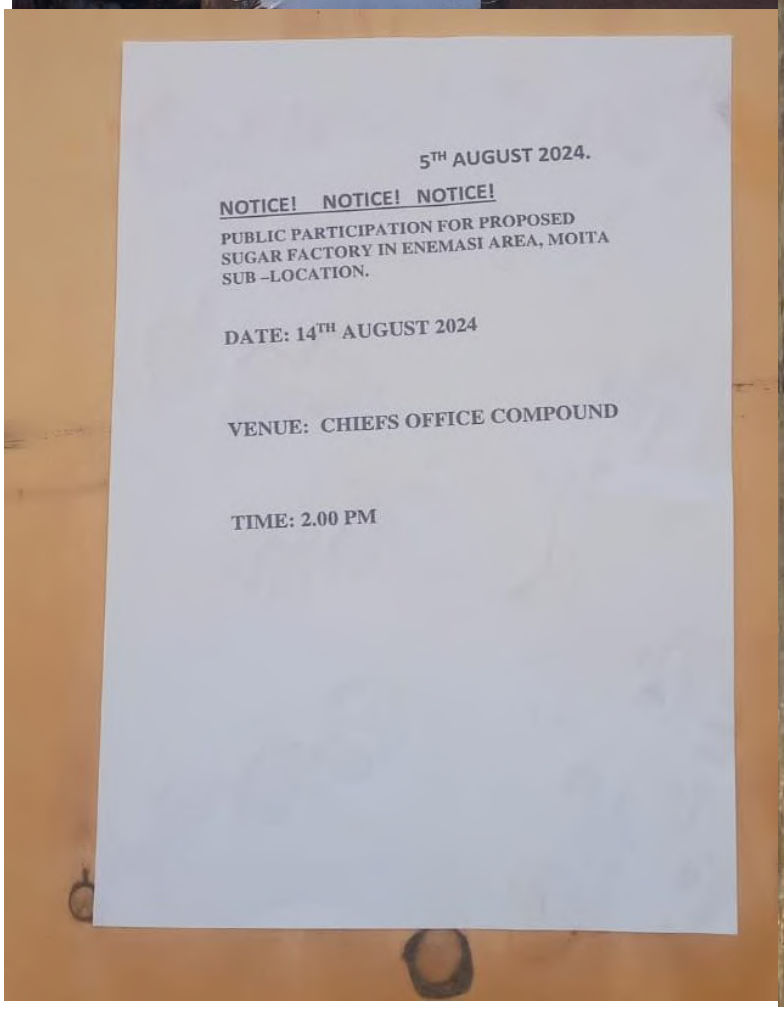
The ESIA Study process requires stakeholder involvement in providing views, comments and suggestions on the Proposed Sugar Factory works. In this regard, you are invited to stakeholder meeting on Wednesday, **28th August 2024 at 9.00 am** at **Zebu Lodges & Luxury Hotels** along Narok-Bomet Highway, Narok. The agenda of the meeting is to sensitize stakeholders on the project and obtain their comments on the Proposed Sugar Factory activities.

Yours Sincerely,

Kennedy Kijana,
CEO,
Gomake Consultancy Company Ltd


5TH AUGUST 2024.
NOTICE! NOTICE! NOTICE!
PUBLIC PARTICIPATION FOR PROPOSED SUGAR FACTORY IN ENEMASI AREA, MOITA SUB –LOCATION.
DATE: 14TH AUGUST 2024
VENUE: MAZI RURA CENTER
TIME: 9.00 AM
EDDY COMPUTERS


5TH AUGUST 2024.
NOTICE! NOTICE! NOTICE!
PUBLIC PARTICIPATION FOR PROPOSED SUGAR FACTORY IN ENEMASI AREA, MOITA SUB –LOCATION.
DATE: 14TH AUGUST 2024
VENUE: CHIEFS OFFICE COMPOUND
TIME: 2.00 PM
5TH AUGUST 2024.
NOTICE! NOTICE! NOTICE!
PUBLIC PARTICIPATION FOR PROPOSED SUGAR FACTORY IN ENEMASI AREA, MOITA SUB –LOCATION.
DATE: 13TH AUGUST 2024
VENUE: NDOINYO PRIMARY
TIME: 2.00 PM


5TH AUGUST 2024.
NOTICE! NOTICE! NOTICE!
PUBLIC PARTICIPATION FOR PROPOSED SUGAR FACTORY IN ENEMASI AREA, MOITA SUB –LOCATION.
DATE: 14TH AUGUST 2024
VENUE: CHIEFS OFFICE COMPOUND
TIME: 2.00 PM


5TH AUGUST 2024.
NOTICE! NOTICE! NOTICE!
PUBLIC PARTICIPATION FOR PROPOSED SUGAR FACTORY IN ENEMASI AREA, MOITA SUB –LOCATION.
DATE: 12TH AUGUST 2024
VENUE: OLDANYATI CENTER
TIME: 2.00 PM

MINUTES FOR THE FIRST STAKEHOLDER PARTICIPATION FOR THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY

VENUE: MOITA CENTRE-MOITA LOCATION

DATE: 12TH AUGUST, 2024

AGENDA

1. Preliminary
2. Opening Remarks
3. The Project Brief
4. Stakeholder Comments
5. Way Forward
6. Conclusion

Min 01/24 Preliminary

The meeting started at 11:23 am with a word of prayer from one of the participants and, after that, followed by introductions. Sixty one participants attended the meeting drawn from immediate neighbors, the consultant, and local administrators. The list of participants is attached.

Min 02/24 Opening Remarks

Acting Senior Chief Moita Location

Mr. Francis Liaram welcomed the proposed project and thanked the consultant for organizing the meeting. He noted that the proposed project would significantly benefit the local community. He also appreciated the proponent and environmental consultant's willingness to engage locals in the project. Then, he urged the participants to openly give their views about the proposed project since that would help improve its operations.

Min 03/24 Project Brief

The environmental consultant for the proposed project, informed the participants that the proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Area, Moita Sub Location, Moita Location, Lolgirian Ward, Kereto Division, Transmara South Sub County, Narok County. He clarified that the proponent has decided to set up the factory to help Kenya address the country's recurrent sugar production deficit. He noted that the plant will be able to crush 1250 tonnes of cane daily (1250TCD). Therefore, the plant will rely on the neighbouring farmers for the cane since it does not have a sugarcane nucleus. He also explained to the public that the mandate of the meeting was an ESIA study process consistent with the Environmental Management and Coordination Act Cap 387 of the Laws of Kenya and the Kenya Constitution of 2010, which both stipulates the need for the public to be consulted when any proposed development projects impact them environmentally, socially and economically. He reiterated that the public participation process would help capture the views and concerns of interested and affected parties regarding the impacts of the proposed sugar factory project. As a result, he encouraged the congregation to be open and willing to raise their views and comments regarding the proposed project. These concerns are inclusive of (environmental, social, and economic) impacts, which could either be positive or negative.

Min 04/24 Stakeholder Comments

The senior chief for the Moita location encouraged the attendants to provide their comments and views. They noted that they represent the community impacted by the proposed sugar factory project. The following are the views that were expressed:

- Daniel Tanpei: He welcomed the proposed project and thanked the proponent for considering investing in the Moita location. He urged the proponent to emphasize 70% local content when hiring employees once the plant is operational. In addition, he urged the company to work with the community since this would help foster relationships with the community and create goodwill with the farmers.
- Joseph Kubanj: He welcomed the proposed project and urged the proponent to prioritize locals when filling job vacancies at the company. He also wanted to know

how the company would manage bagasse and smoke/air pollution during operations. He also urged the company to develop or support CSR programs such as supporting health centers and established schools within the location.

Response: The proponent would prioritize 70% local content. However, he said that while the company will openly observe this, potential employees from the locality should have the requisite skills for the advertised jobs. Thus, if not, the company will have to outsource the workforce to fill such positions. Also, he revealed that the advertisements will be made in collaboration with the chief offices. In the case of CSR, he noted that through a liaison officer that the company would hire, the community would propose CSR programs that the company could support to improve the community's welfare. In the case of managing bagasse and smoke fumes from the boiler, he noted that the company would burn the bagasse to generate electricity and set up a briquette market station to manage the remaining bagasse. As for smoke, the consultant has recommended installing an electrostatic precipitator to collect dust produced by the boiler.

- Francis Nkailas: He inquired if the proponent would set up a committee to create a partnership with the community.

Response: The Company would hire a community liaison officer to help construct partnerships between the company and the community. As a result, the community can raise issues and suggestions for the company once operations start.

- John Sadala: He welcomed the proposed project and inquired if the neighboring farmers would be requested to provide sugarcane.

Response: The proponent is receptive to collaborating with local farmers to set up a framework that would encourage them to provide cane to the proposed facility. The proponent knows other sugar processing plants near the proposed project. However, the proponent is keen to establish this project and openly compete with other producers. Moreover, he noted that there is enough sugarcane and agricultural land to support the proposed project since, at the start, the project will only crash 1250 tonnes of cane per day.

- Elijah Kanasa: He welcomed the project and noted that the local youth are ready for employment. He also urged the proponent to build a close relationship with the community since this would encourage farmers to provide their cane to the proponent. Moreover, he wanted assurances that the proponent would meet the promises they made once they started operations.

Response: The proponent would hire a community liaison officer who would be tasked with establishing partnership relationships between the community and the company. In addition, several developmental projects, such as road construction and improvement in connection and their state, would happen since this would enhance the transportation of raw materials to the proposed facility. Regarding employment, local administrative representatives will be tasked with disseminating job advertisement announcements when the time comes.

- Charles Kinampu: Acknowledged the benefits the proposed project will bring to the community. He noted that the project will provide revenue to the county government and enhance services to farmers due to increased competition for raw materials. He also encouraged the proponent to support several community CSR programs, such as offering scholarships to vulnerable children and up-skilling opportunities for graduates.
- Francis Liadam: The senior chief for the Moita location welcomed the proposed project and thanked the proponent for their continuous inclusivity and progress in meeting the targets to set up the factory. He also pointed out that since the company has yet to make a decision on the name, the community should suggest it. Moreover, he stated that he is open to providing further assistance to the proponent when needed to ensure that the proposed project becomes operational.
- Mr. Philip Gumba: The ACC Kereto Division appreciated the proponent's willingness to invest in the Moita Location, Kereto Division. As a result, he encouraged the community to welcome the project since it would benefit them. He noted that in recent times, many farmers have been complaining about delays in cane harvesting. Therefore, establishing another factory nearby would help them harvest their cane on time while reducing the cost of transporting it to the factory. On the contrary, he stated

that for the proponent to realize the region's agricultural potential and establish a continuous availability of cane for the factory, the proponent has to invest in cane development by providing farmers with quality seed canes and fertilizer. In addition, he noted that the challenge for sugarcane poaching within the region will likely increase, given the addition of another sugar processing plant in the area. Moreover, he appreciated the proponent’s emphasis on employing locals. However, he urged them to hire locals at all levels, including high-skilled. He also urged the proponent to commit to specific CSR programs, such as providing electricity to locals, improving road networks and maintenance, providing cane seedlings to farmers, and educating them on the current and best agricultural practices of sugarcane farming.

Min 05/24 Way Forward

The consultant thanked the participants for their participation during the meeting and assured them that their feedback on the proposed sugar factory to be established in Enemasi will be incorporated in the ESIA study report, which will be submitted to NEMA. He also noted that other planned stakeholder meetings would incorporate locals from other sub-locations neighbouring the proposed project location, namely Kikat, Masurura, Naar-Olong, and Oldanyati.

Min 06/24 Conclusion

The Senior Chief for the Moita Location thanked the consultants for acknowledging the constitutional mandate of the community and providing views and comments about the proposed project. He noted that most members of the Moita Location, Kereto Division, openly support the proposed project and cannot wait for work to begin. He also informed the consultant and the proponents that his office is ready to provide any support in the future if called upon. Moreover, he thanked the participants for availing themselves and contributing to bettering the construction and operational phase of the proposed project. He urged them to convey the information they had heard from the meeting to other locals.

The meeting ended with a word of prayer from one of the participants at 12:45 p.m.

MINUTES CERTIFICATION PAGE

Signed by:

1. ADMINISTRATION REPRESENTATIVE:

FRANCIS LIARAM KIPKOSGEI

DATE: 12/8/2024

SIGNATURE and STAMP:

CHIEF : MOITA LOCATION
P.O. Box 1 KILGORIS
Date: 12/8/2024

2. CONSULTANT REPRESENTATIVE:

Jack Okiono

DATE: 12/08/2024

SIGNATURE and STAMP:

GOMAKE CONSULTANTS
12 AUG 2024
P. O. Box NAIROBI-KENYA
TEL: 0720 964 333
Email: Info@gomakeltd.co.ke

3. PROPONENT REPRESENTATIVE:

DATE: 12/8/2024

SIGNATURE and STAMP: Godwin Omuke

4. COMMUNITY REPRESENTATIVE:

James Saitoti

DATE: 12th Aug. 2024

SIGNATURE:

CHIEF : MOITA LOCATION
P.O. Box 1 KILGORIS
Date: 12/8/2024

Attendance Register

Project Name: *Environmental and Social Impact Assessment Study for the Proposed Sugar Factory in Transmara, Narok County*

Meeting Venue: Moita Centre.

Date: 12th August, 2024

No.	Name	Village/ Organization	Position	Mobile No.:	E-mail	Signature
1	PHILIP NGUMBA	Assistant county commissioner	Kereto Division	0717684370	ngumba philip@gmail.com	[signature]
2.	FRANCIS LIADAM	CHIEF	MOITA LOCATION	0723279863	Liaram francis	[signature]
3.	JACKSON TOBIKO	VL	MOITA	0799863136		[signature]
4.	DANIEL LATON	FARMER	MOITA	0729628981	F.	[signature]
5.	Joseph Kubany	Farmer	Moita	0743629992	JosephKubany@...	[signature]
6.	Daniel Taupei	Famer	Moita	0712324061		[signature]
7.	David Koisiala	Farmer	Moita	0729958689	Koisialadavy@gmail.com	[signature]
8.	Moses Sakara Koisiala	Farmer	Moita	0759459755	–	[signature]
9.	Samwel oserio	Farmer	Moita	0707918509	–	[signature]
10.	John Puja	Farmer	Moita	0706680076	–	[signature]
11.	Charles M. Kinampu	Farmer	Moita	0712609088	–	[signature]
12.	Joseph Maisra	Farmers	Moita	0725418317	–	[signature]
13.	SAMUEL TANI MANIIDO	Farmer	Moita	0712372082	–	[signature]
14	Pantom Ole	ntagia				
15	ERICKSON JOHN	Farm	MOITA	0726567686	–	[signature]

Attendance Register

CHIEF : MOITA LOCATION
P.O. Box 1 KILGORIS
Date: 12/08/2024

Project Name: *Environmental and Social Impact Assessment Study for the Proposed Sugar Factory in Transmara, Narok County*						
	Meeting Venue: Moita centre			**Date:** 12/08/2024		
No.	**Name**	**Village/ Organization**	**Position**	**Mobile No.:**	**E-mail**	**Signature**
16	Olekombo Ntaru	Farmer	Moita	—	—	
17	Samson Tuaelu	Farmer	Moita	07 —	—	
18	Elijah Kanasa	Farmer	Moita	—	—	
19	Konchella Benard	farmer	moita	0718354605	Konchellabenard01@gmail.com	
20	OLTERITOT OREMARE	FARMER	MOITA	0720224946		
21	Karau Dokoi	Farmer	Moita	07268218		
22	Nicholus Cekajie	Farmer	Moita	0717301006	Nogong.com	
23	Peter Merumu	Farmer	Moita	0717837176	—	
24	JOHN SADALA	Farmer	Moita	0727057144	—	
25.	Samuel Ntegu.	farmer	moita	0717111285	—	
26.	Emanuel Shankati	Surveyor	Moita	0723981014	@gmail.com	
27.	Robert Kiauko	Farmer	Moita	07043770	—	
28.	SR Teresa Mapila	Farmer	Moita	0718803230	SKTeresa@yahoo.com	
29.	Joel Nyakangi	Farmer	Moita	0757451342	—	
30	Goodwin Ngwono	Farmer	Moita	0757633359	Ngwonogodwin@gmail.com	

Attendance Register

CHIEF : MOITA LOCATION
P.O. Box 1 KILGORIS
Date: 12/8/2024

Project Name: *Environmental and Social Impact Assessment Study for the Proposed Sugar Factory in Transmara, Narok County*

Meeting Venue: Moita centre **Date:** 10/08/2024

No.	Name	Village/ Organization	Position	Mobile No.:	E-mail	Signature
31	James Lekumo	Moita	Farmer	0706985681		
32	JOHN OLTEFICH	MOITA	FARMER	0715290293		
33	Alex Kiutia	moita	Farmer	0726273999		
34	John Saeliba	Nkararo	Farmer	0704004968		
35	JOHN OLKIYIEKUIKASIO	NKARARO	Farmer	0703419123		
36	MOSES KATEI	MOITA	FARMER	0799889368	KUSHINGUA@GMAIL.COM	
37	DAVID IETEIPA	MOITA	FARMER	0110711534		
38	DANIEL KATEI	MOITA	FARMER	0708120207		
39	JOHN PESI	MOITA	FARMER	0717528204		
40	SARUNI LITTON	MOITA	FARMER			
41	Collins Lekishon	MOITA	FARMER	0704096052	Collo@gmail	
42	John Sikiar	MOITA	FARMER	0715350241		
43	JULIUS	MOITA	FARMER	0114442046		
44	DAVID NTANDIKA	MOITA	FARMER	0111895905		
45	Francis Nkalas	Moita	Farmer	0728[illegible]858		
46	KIPKOECH ALBERT RONO	Moita	FARMER	0708257204		

Attendance Register

CHIEF : MOITA LOCATION
P.O. Box 1 KILGORIS
Date: 12/8/2024

Project Name: *Environmental and Social Impact Assessment Study for the Proposed Sugar Factory in Transmara, Narok County*

Meeting Venue: Moita Centre **Date:** 12/08/2024.

No.	Name	Village/ Organization	Position	Mobile No.:	E-mail	Signature
47	SARIKO TIMOTY	MOITA	FARMER	/	/	
48	KENNEDY SUKANJA	MOITA	FAMER	0720069783		
49	Samwel Mwalia	Moita	Farmer	/	/	
50	Olesenet Kipeno	Moita	Farmer	/	/	
51	Kiyayo Kisalei	Moita	Farmer	0703663227	/	
52	Ole-rago Kipeno	Moita	Farmer	0710152223	/	
53	WILFRED MOKAYA			0713858440	/	
54	JAMES TOMO	MOITA	FARMER	0729348971		
55	JOSPHAT OTIENO	//	//	0728903099	/	
56	Jackson Kisalei	Moita	Farmer	0748192826	/	
57	Moses Kisolei	//	Farmer	0713030534	/	
58	Jacob Tubula	//	Farmer	0711565305	/	
59	Daniel Kisiko	MOITA	farmer	0726021200	Kisikodan@gmail	
60	Jack Otieno	Glomake Consulting	EIA Expert	0711385745	Jackseam die.	
61.	FLORA AKINYI	Glomake consultancy		0701393729	floramitchell994@gmail.com	
62.	Kennedy Kijana	"	EIA Expert	0729961333		

CHIEF : MOITA LOCATION
P.O. Box 1 KILGORIS
Date: 12/8/2024

MINUTES FOR THE SECOND STAKEHOLDER PARTICIPATION FOR THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY

VENUE: OLDANYATI CENTRE-OLDANYATI SUB LOCATION

DATE: 12TH AUGUST, 2024

AGENDA

1. Preliminary
2. Opening Remarks
3. The Project Brief
4. Stakeholder Comments
5. Way Forward
6. Conclusion

Min 01/24 Preliminary

The meeting started at 2:39 pm with a word of prayer from one of the participants and, after that, followed by introductions. Thirty-three participants attended the meeting drawn from immediate neighbors, the consultant, and local administrators. The list of participants is attached.

Min 02/24 Opening Remarks

Assistant Chief Oldanyati Sub Location

Mr. Benson Koini welcomed the proposed project and thanked the consultant for organizing the meeting. He noted that the project would significantly benefit the local community, particularly farmers. He appreciated the proponent and environmental consultant's willingness to engage locals on the project. Then, he urged the participants to openly give their views about the proposed project since that would help improve its operations.

Min 03/24 Project Brief

The environmental consultant for the proposed project, informed the participants that the proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Area, Moita Sub Location, Moita Location, Lolgirian Ward, Kereto Division, Transmara South Sub County, Narok County. He clarified that the proponent has decided to set up the factory to help Kenya address the country's recurrent sugar production deficit. He noted that the plant will be able to crush 1250 tonnes of cane daily (1250TCD). Therefore, the plant will rely on the neighbouring farmers for the cane since it does not have a sugarcane nucleus. He also explained to the public that the mandate of the meeting was an ESIA study process consistent with the Environmental Management and Coordination Act Cap 387 of the Laws of Kenya and the Kenya Constitution of 2010, which both stipulates the need for the public to be consulted when any proposed development projects impact them environmentally, socially and economically. He reiterated that the public participation process would help capture the views and concerns of interested and affected parties regarding the impacts of the proposed sugar factory project. As a result, he encouraged the congregation to be open and willing to raise their views and comments regarding the proposed project. These concerns are inclusive of (environmental, social, and economic) impacts, which could either be positive or negative.

Min 04/24 Stakeholder Comments

The Assistant Chief for the Oldanyati Sub Location encouraged the attendants to provide their comments and views. They noted that they represent the community impacted by the proposed sugar factory project. The following are the views that were expressed:

- Mr. Benson Koini: The Assistant Chief for the Oldanyati Sub Location sought clarity on the appropriate distance between sugar factories since the Transmara region has other established sugar factories, such as Angata and Trans Mara. Will the given proximity hinder the government's establishment of the proposed project?

Response: AFA recommends minimum distances between sugar processing plants. AFA would provide further directives on the concern since one of its mandates involves

promoting best practices and regulating the production, processing, and marketing of agricultural produce, in this case, sugarcane.

- Mr. John Sopia: He thanked the proponent and consultant for organizing the meeting and welcomed the proposed project. However, he noted that establishing a new sugar factor in the area threatens livestock production, which has been a cultural practice among the Maasai people. Also, he enquired about the proponent's preparation for the proposed facility, particularly regarding the provision of sugarcane.

Response: The proponent has prepared enough as the required regulative process permits. He explained that feasibility, baseline, soil analysis, and ESIA studies are all part of the preparations. As a result, based on the information collected so far, it was established that the region has enough agricultural land to support sugarcane farming and provide the raw material for the proposed facility. Besides, the facility will start by crushing 1250 tonnes of cane per day (TCD), which will undoubtedly meet the available raw material within the area. Moreover, sugar processing plants are allowed to source sugarcane from other regions. In the case of honoring culture, he responded that it would be up to the farmers to be educated and encouraged to practice both farming and livestock production.

- Mr. Wilson Saoyo: He acknowledged the role of public participation and pointed out that the proposed project will significantly benefit the community. He urged the proponent to prioritize locals when filling vacancies once the company becomes operational. He also requested that the proponent build roads, hospitals, and schools to support the local community.
- Mr. Samwel Mooron: He enquired if the proposed sugar factory has its nucleus. If No, he urged the proponent to provide local farmers with cane seedlings to support them with sugarcane.

Response: The proposed sugar factory will rely on private farmers to supply sugarcane. However, the company will be responsible for cane development programs and supporting farmers to enhance production.

- Mr. Mantankori Saoyo: He sought clarity on why the proponent is considering setting up a sugar processing plant in Trans Mara when there are other established ones in the vicinity.

Response: The proponent has done enough preparations as the required regulative process permits. He explained that feasibility, baseline, soil analysis, and ESIA studies are all part of the preparations. As a result, based on the information collected so far, it was established that the region has enough agricultural land to support sugarcane farming and provide the raw material for the proposed facility. Besides, the facility will start by crushing 1250 tonnes of cane per day (TCD), which will undoubtedly meet the available raw material within the area.

- Mr. Benson Koini: The Assistant Chief for the Oldanyati Sub Location stated that the proposed project would benefit the community, so he welcomed it. He noted that establishing the project would create competition that would boost the quality of services offered to farmers to enhance their produce and, as a result, boost their primary source of income. He wanted to know if the proponent had analyzed soil and decided which sugarcane varieties local farmers should plant to maximize yields.

Response: Soil analysis has been done, and once the process is complete, local farmers will be educated.

- Jackson Talala: He thanked the proponent for the proposed investment and welcomed the project as an Oldanyati resident and farmer. He urged the proponent to improve local roads and give priority to locals when hiring. Further, he noted that there is a broken bridge within the locality that the proponent should consider repairing.
- Samson Samboti: He welcomed the proposed project and assured the proponent that local farmers are willing to produce raw materials to help the proposed facility operate. However, to grow such support, the proponent should offer more support services to farmers.
- Samuel Samoei: He wanted to know when the proposed facility will start operating.

Response: The facility will start work once all the regulatory bodies involved issue the requisite licenses.

Min 05/24 Way Forward

The consultant thanked the participants for their participation during the meeting and assured them that their feedback on the proposed sugar factory to be established in Enemasi will be incorporated in the ESIA study report, which will be submitted to NEMA. He also noted that a preceding meeting was held in the Moita Location. Other planned stakeholder meetings will incorporate locals from other Sub Locations neighbouring the proposed project, namely Kikat, Masurura, and Naar-Olong.

Min 06/24 Conclusion

Mr. Benson Koini, the Assistant Chief for the Oldanyati Sub Location, thanked the consultants for acknowledging the constitutional mandate of the community in providing views and comments about the proposed project. He noted that most members of his Sub-location openly support the proposed project. He also assured the proponent and consultant of his office's support in the future if called upon. Moreover, he thanked the participants for availing themselves and contributing to bettering the construction and operational phase of the proposed project. He urged them to convey the information they had heard from the meeting to other locals.

The meeting ended with a word of prayer from one of the participants at 3:48 p.m.

MINUTES CERTIFICATION PAGE

Signed by:

1. ADMINISTRATION REPRESENTATIVE:

BENSON KOINI

DATE: 12/8/2024

SIGNATURE and STAMP:

ASSISTANT CHIEF
OLDANYATI SUB-LOCATION
P.O. BOX 143 - 20720 KILGORIS
DATE: 12/8/2024 SIGN:

2. CONSULTANT REPRESENTATIVE:

Jack Otieno

DATE: 12/8/2024

SIGNATURE and STAMP:

GOMAKE CONSULTANCY
CO... LTD.
12 AUG 2024
P. O. Box ... NAIROBI-KENYA
TEL: 0720 964 333
Email: Info@gomakeltd.co.ke

3. PROPONENT REPRESENTATIVE:

DATE: 12/8/2024

SIGNATURE and STAMP: Godwin Omolo

4. COMMUNITY REPRESENTATIVE:

SAMUEL LETEIPA KIMOOKO

DATE: 12/08/2024

SIGNATURE:

Attendance Register

ASSISTANT CHIEF OLDANYATI SUB-LOCATION P.O. BOX 409 - 20110 KILGORIS DATE: 12/8/2024 SIGN.

Project Name: Environmental and Social Impact Assessment Study for the Proposed Sugar Factory in Transmara, Narok County						
	Meeting Venue: Oldanyoti Centre on ~~Oldanyati~~ Sublocation			**Date:** 12/08/2024.		
No.	**Name**	**Village/ Organization**	**Position**	**Mobile No.:**	**E-mail**	**Signature**
1	BENSON KOINI	Oldanyati ~~ASS. CHIEF~~	chief	0704941588		
2	Julius Sawoyo	Oldanyati		0727077312		
3	MOSES Napaju	Enchurai		0757861316		
4	Samuel Kimooke	Enchurai	Samuel Kimooke	0708744116		
5	Wilson Saoyo	Oldanyati		0716392481		
6	MOSES MUIYA	Oldanyati		0729647848		
7	Michiel manduku	Enchurai		0757296935		
8	John Talala	Enchurai		0725222160		
9	OLekambala Kortom	Oldanyati		0729626612		
10	WILLIAM KOINI	ENCHURAI		0790728932		
11	MOSES KENTORE	ENCHURAI		0714477746		
12	mpsheke ntoiza	enchekepe		0707745911		
13	Peter tawuo	Enchurai		0706453172		
14	Emmanuel Sanduku	Oldanyati		0718510257		
15	Meeke Kottom	Olenkijape		0729290736		

Attendance Register

Project Name: *Environmental and Social Impact Assessment Study for the Proposed Sugar Factory in Transmara, Narok County*						
	Meeting Venue: Oldanyati centre - Oldanyati Sublocation			**Date:** 12/08/2024		
No.	**Name**	**Village/ Organization**	**Position**	**Mobile No.:**	**E-mail**	**Signature**
16	CIASA SAWOY	Oldanyati 368		0701218447		
17	John sopia	oldanyati		0759330285		
18	LEPAPA LENKUME	Oldanyati		0716475158		
19	Stephine Kimoigo	Oldanyati		0742054752		
20	Emmanuel L Ntirankeu	oldanyati		0710257826		
21	PAUL NTOMESAWOYO	oldanyati		0723847329		
22	OLPKISUA SAOYO	Oldanyati		0718275611		
23	Jackson talala	Oldanyati		0729459361		
24	moses kantai	Enchurai		0723219257		
25	matankori saoyo	oldanyati		0712272511		
26	Samwel moroon	Enchurai		0725436892		
27	YIAMPOI KIPKEMEI SAWOYO	OLDANYATI		0791789279		
28	KIMELI WILSON KOMU	OLDANYATI,		0115452974		
29	Samson Sambati	OLDANYATI		0729300131		
30	samwel saoyo			0720392816		

Attendance Register

Project Name: *Environmental and Social Impact Assessment Study for the Proposed Sugar Factory in Transmara, Narok County*						
	Meeting Venue: Oldanyati Centre			**Date:** 12/08/24		
No.	**Name**	**Village/ Organization**	**Position**	**Mobile No.:**	**E-mail**	**Signature**
31.	Edward Tawno	Enchurai		0729959752	Lotoiptedward@gmail.com	
32.	Jack Okiomo	Gtomako Co. Ltd		0711385457	Jacksamota@gmail.com	
33	Kennedy Kijana	Gomako Co. Co. Ltd	EIA Lead Expert	0720964333	kijanakennedy@gmail.com	
34	Godwin Otindi	Mmatta	Manager	0720863220	godwin@gmako tea.co.ke	

MINUTES FOR THE THIRD STAKEHOLDER PARTICIPATION FOR THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY

VENUE: WORD OF FAITH EBENEZER CHURCH-MASURURA SUB LOCATION

DATE: 13TH AUGUST, 2024

AGENDA

1. Preliminary
2. Opening Remarks
3. The Project Brief
4. Stakeholder Comments
5. Way Forward
6. Conclusion

Min 01/24 Preliminary

The meeting started at 10:38 am with a word of prayer from one of the participants and, after that, followed by introductions. Thirty nine participants attended the meeting drawn from immediate neighbors, the consultant, and local administrators. The list of participants is attached.

Min 02/24 Opening Remarks

Assistant Chief Masurura Sub Location

Mr. Benard Nakurro, the area Assistant Chief for the Masurura Sub Location, thanked the participants for attending the meeting and encouraged them to raise their views. She noted that the proposed project is a great initiative by the proponent, given its potential impacts on his Sub Location. He added that the region is rich in agricultural potential and thanked the consultant for their cooperation, particularly in organizing the meeting.

Min 03/24 Project Brief

The environmental consultant for the proposed project, informed the participants that the proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing

factory within Enemasi Area, Moita Sub Location, Moita Location, Lolgirian Ward, Kereto Division, Transmara South Sub County, Narok County. He clarified that the proponent has decided to set up the factory to help Kenya address the country's recurrent sugar production deficit. He noted that the plant will be able to crush 1250 tonnes of cane daily (1250TCD). Therefore, the plant will rely on the neighbouring farmers for the cane since it does not have a sugarcane nucleus. He also explained to the public that the mandate of the meeting was an ESIA study process consistent with the Environmental Management and Coordination Act Cap 387 of the Laws of Kenya and the Kenya Constitution of 2010, which both stipulates the need for the public to be consulted when any proposed development projects impact them environmentally, socially and economically. He reiterated that the public participation process would help capture the views and concerns of interested and affected parties regarding the impacts of the proposed sugar factory project. As a result, he encouraged the congregation to be open and willing to raise their views and comments regarding the proposed project. These concerns are inclusive of (environmental, social, and economic) impacts, which could either be positive or negative.

Min 04/24 Stakeholder Comments

The area Assistant Chief for the Masurura Sub Location encouraged the attendants to provide their comments and views. They noted that they represent the community impacted by the proposed sugar factory project. The following are the views that were expressed:

- Peter Marau wanted to know when the proposed facility will start operating.

Response: The facility would start work once all the regulatory bodies involved issue the requisite licenses.

- Julius Meitoi: He enquired if farmers can start growing sugarcane in anticipation of the proposed project’s establishment.

Response: Farmers can start growing cane since it is a vital raw material. However, there is yet to be a definitive timeline for when the company will start work since the proponent is in the process of meeting all the regulatory frameworks to be issued with the required

licenses. As a result, with such a timeline, farmers can start growing sugarcane since by the time it is ready for harvest, the proponent might have been given the green light to start work.

- Joshua Tierakat: He enquired if the proposed project is owned by the government or a private entity

Response: The project's proponent is a private entity.

- Oloisiriri Naitipa noted that local farmers are open to increasing sugarcane farming to provide the raw material for the proposed facility. However, he asked if they should begin the process.

Response: Farmers can grow different varieties of sugarcane in anticipation of the proposed project. The proponent will conduct farmers' sensitization meetings once the proposed project is issued with all the requisite licensees.

- Olemuya Rumpas: He enquired about whether the proposed project will provide local employment and which hiring protocol will be adopted.

Response: The proposed project would offer local employment during the construction and operational phases. These jobs will cover low- and high-skilled positions. The applicants will be subjected to interviews, and those with the requisite skills will be hired.

- Daniel Mairau: He noted that the proponent would have to hire agricultural officers to recruit local farmers to provide raw materials for the proposed project

Response: Once all licenses are issued, agricultural officers will be hired and tasked with recruiting and sensitizing farmers.

- Julius Meitoi: He wanted to know about the way forward

Response: The project has contracted an environmental consultant to conduct an ESIA study, whose report will be submitted to NEMA. Based on the evaluation of the report by NEMA, the proponent will be issued or denied a license. If issued, there are other regulatory licenses that the proponent would have to secure before work begins. The proponent is committed to following all the regulatory frameworks in place to ensure that

they have secured all the necessary licenses to allow the project to begin and operate effectively.

- William Tampul: He welcomed the project. However, he pointed out his concern is the potential negative impact the company will have on the environment, notably water pollution, since the Maasai community are livestock breeders and rely on available water resources to feed their livestock. He also wanted to know if the locals would be compensated if they were affected by the factory's pollution once it was operational.

Response: The proponent does not plan to release wastewater into the environment. On the contrary, the proposed project will subject the wastewater to an effluent treatment plant and re-circulate it for production process, such as cooling. The current ESIA study will incorporate an evaluation of the proposed project area's baseline environmental and social conditions. Based on the collected baseline information, the proponent would set up a monitoring and evaluation framework to monitor the state of water and air conditions in regard to pollution. Besides, the purpose of such an approach is to ensure that the proponent does oblige to several regulatory frameworks that provide guidelines for wastewater handling and disposal, including EMCA 1999, Water Act 2016, The Environmental (Waste Management) Regulations 2006, and Public Health Cap 242, among others. NEMA is a government agency that is responsible for enforcing such regulations. Therefore, the community has appropriate avenues that they can use to seek answers to ensure that the mitigation measures in place to help conserve the environment are adopted by the proponent. In the case of compensation, there are frameworks through the community liaison officer and NEMA that locals can utilize after a thorough investigation has been conducted.

Min 05/24 Way Forward

The consultant thanked the participants for their participation during the meeting and assured them that their feedback on the proposed sugar factory to be established in Enemasi would be incorporated in the ESIA study report, which will be submitted to NEMA. He also noted that the preceding meetings were held at the Moita location and Oldanyati Sub Location. Other planned stakeholder meetings will incorporate locals from other Sub Locations neighbouring the proposed project, namely Kikat and Naar-Olong.

Min 06/24 Conclusion

Mr. Benard Nakurro, the area Assistant Chief for the Masurura Sub Location, thanked the consultants for acknowledging the constitutional mandate of the community in providing views and comments about the proposed project. He noted that most members of his Sub Location openly support the proposed project. He also assured the proponent and consultant of his office's support in the future if called upon. Moreover, he thanked the participants for availing themselves and contributing to bettering the construction and operational phase of the proposed project. He urged them to convey the information they had heard from the meeting to other locals.

The meeting ended with a word of prayer from one of the participants at 11:33 a.m.

MINUTES CERTIFICATION PAGE

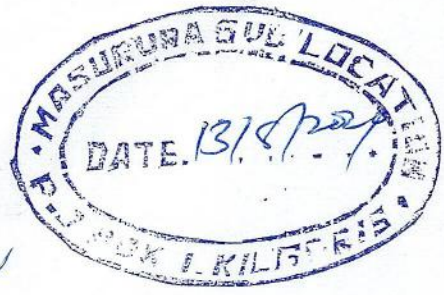
Signed by:

1. ADMINISTRATION REPRESENTATIVE:

BENARD NAZURETO

DATE: 13/8/2024

SIGNATURE and STAMP:



2. CONSULTANT REPRESENTATIVE:

Jack Otieno

DATE: 13/08/24

SIGNATURE and STAMP:

3. PROPONENT REPRESENTATIVE:

DATE: 13/8/2024

SIGNATURE and STAMP: Godwin Omuli

4. COMMUNITY REPRESENTATIVE:

BENSON NYAKERI

DATE: 13-8-2024

SIGNATURE:

Attendance Register

MASURURA SUB LOCATION
DATE. 13/8/2024

Project Name: *Environmental and Social Impact Assessment Study for the Proposed Sugar Factory in Transmara, Narok County*						
	Meeting Venue: Word of Faith Ebenezer Church - Masururu			**Date:** 13/08/2024		
No.	**Name**	**Village/ Organization**	**Position**	**Mobile No.:**	**E-mail**	**Signature**
1.	Benard Ngikuna	Oloresho	Chief Masurura	0724439578		
2.	BENSON NAKERI	OLOMAYIANA	FARMER	0716683526	bensonnakeri@gmail.com	
3.	EZEKIEL NAILENYA	OLORESHO	FARMER	0712415508		
4.	STEPHEN NAPOE	ILMISIGIYIO	FARMER	0793520535		
5.	DANIEL TIPIS	OLORESHO	FARMER	0748980706		
6.	IBRAHIM LEKAKENY	OLORRESHO	Teacher & farmer	0748462583	lekakenyibra@gmail.com	
7.	DAVID LENKAI OLENGIATO	Village elder Enchoyongiro	Village elder	0728626478		
8.	Joseph Lataya Kosiji	oloresho	Farmer	0713411519	0	
9.	Peter Lataya	oloresho	Farmer	0701238651		
10.	Lekoiseyie Sunkuli	Ilmisigiyio Village elder	village elder	0714181833		
11.	SAMWEL KOSISI	Inkoiti Kosha	Vilage elder	0714643270		
12.	Oksantian Kalema	Olchurai	village elder	0795115819		
13.	Joshua Tierikat	olomayiana	farmer	0713416668		
14.	Julius Kosisi	oloresho	farmer	0797278758		
15.	James Teleu	Olepolosi	farmer	0707490961		

Attendance Register

MASURURA SUB-LOCATION DATE 13/8/2024

Project Name: Environmental and Social Impact Assessment Study for the Proposed Sugar Factory in Transmara, Narok County

No.	Name	Village/ Organization	Position	Mobile No.:	E-mail	Signature
	Meeting Venue: Word of Faith Ebenezer church - Masurura			**Date:** 13/08/24		
31	William Tampul	Olomayiana	Farmer	0713890142		
32.	Japhason Rumpas	Entumukaana	Farmer	0725970469		
33	Moses sere	Endonyorg'iro	Farmer	0723006448		
34.	Emmanuel Lekishon	Ilmisigiyio	Farmer	0717149051		
35.	Joseph Naigeyo	Kinyibol	Village elder	0112203644		
36.	Daniel Sinti	Kinyibol	Farmer	0725557968		
37.	John Olepurkel	Kinyibol	Farmer	0724479876		
38.	Jack Otieno	Gamake Ltd	EIA Expert	0711385457		
39.	Kennedy Kijana	Gamake Ltd	EIA Lead Exp	0720964353	kijanakennedy@gmail	
40	Godwin Osindi	Masurura	Munyapi church	0712863770	Godwin@...yahoo.com	

MASURURA SUB-LOCATION DATE 13/8/2024 P.O. BOX KILGORIS

MINUTES FOR THE FOURTH STAKEHOLDER PARTICIPATION FOR THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY

VENUE: INDOINYO PRIMARY SCHOOL-KIKAT SUB LOCATION

DATE: 13TH AUGUST, 2024

AGENDA

1. Preliminary
2. Opening Remarks
3. The Project Brief
4. Stakeholder Comments
5. Way Forward
6. Conclusion

Min 01/24 Preliminary

The meeting started at 12:55 pm with a word of prayer from one of the participants and, after that, followed by introductions. Sixty five participants attended the meeting drawn from immediate neighbors, the consultant, and local administrators. The list of participants is attached.

Min CH02/24 Opening Remarks

Senior Chief Ndonyo Location

Mr. Samuel Mukut, the area Senior Chief for the Ndonyo Location, thanked the participants for attending the meeting and encouraged them to raise their views. He noted that the proposed project does neighbor his location. He stated that the proposed project is a great initiative by the proponent, given its potential impact on his location. He added that the region is rich in agricultural potential and thanked the consultant for their cooperation, particularly in organizing the meeting.

Proponent Representative

Mr. Godwin Osinde noted that the proponent identified the location for the proposed project as the ideal location for setting up the investment. As a result, he urged the locals from the given location and those nearby to welcome and support it. He noted that the proposed project would benefit the community and its surroundings, particularly the farmers. Some of these benefits he outlined include improving the local road network, which is a necessary supportive infrastructure for the proposed facility, creating local employment, and boosting agriculture activities and skills development among the local workforce. However, he added that several drawbacks will be associated with the project. As a result, he assured the participants that the proponent would adopt effective mitigation measures, especially in managing negative environmental impacts, as well as collaborating with the community to resolve such issues.

Min 03/24 Project Brief

The environmental consultant for the proposed project, informed the participants that the proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Area, Moita Sub Location, Moita Location, Lolgirian Ward, Kereto Division, Transmara South Sub County, Narok County. He clarified that the proponent has decided to set up the factory to help Kenya address the country's recurrent sugar production deficit. He noted that the plant will be able to crush 1250 tonnes of cane daily (1250TCD). Therefore, the plant will rely on the neighbouring farmers for the cane since it does not have a sugarcane nucleus. He also explained to the public that the mandate of the meeting was an ESIA study process consistent with the Environmental Management and Coordination Act Cap 387 of the Laws of Kenya and the Kenya Constitution of 2010, which both stipulates the need for the public to be consulted when any proposed development projects impact them environmentally, socially and economically. He reiterated that the public participation process would help capture the views and concerns of interested and affected parties regarding the impacts of the proposed sugar factory project. As a result, he encouraged the congregation to be open and willing to raise their views and comments regarding the proposed project. These

concerns are inclusive of (environmental, social, and economic) impacts, which could either be positive or negative.

Min 04/24 Stakeholder Comments

The area Senior Chief for the Ndonyo Location encouraged the attendants to provide their comments and views. They noted that they represent the community impacted by the proposed sugar factory project. The following are the views that were expressed:

- Mr. Samuel Mukut: The area Senior Chief for the Ndonyo Location wanted to know if the proposed facility has been issued with a permit to start operations

Response: The proposed facility has not been issued a permit yet, and operations will start to work once all the regulatory bodies involved issue the requisite licenses. At the moment, the proponent is in the process of securing a NEMA permit based on the ongoing ESIA study.

- Rev. David Shahi: He sought clarification on whether the proponent is the same organization that did an earlier survey in the region

Response: It is the same party that conducted several meetings and surveys earlier. He noted that, at the time, the party was conducting a feasibility study for the proposed project, and based on that exercise, it was decided that the next step would be to conduct the ESIA study to get a license from NEMA. Thereafter, other processes will be followed as guided by the existing regulatory frameworks.

- David Mosaiko: He inquired if the proposed facility will produce sugar

Response: The proposed project will produce sugar.

- Mr. Moses Saiwa: He welcomed the proposed project and thanked the proponent for considering investing in the area. He noted that the project would create employment for locals and boost skill development among the local population. He noted that there are already four sugar processing plants in the area, which will increase competition among them. However, he added that some of the drawbacks that could arise from the establishment of the proposed project include the threat of hindering livestock

breeding/herding among the Maasai community, a rise in insecurity, and negative environmental impacts, specifically after the pollution of the neighboring stream.

Response: The proponent does not plan to release wastewater into the environment. On the contrary, the proposed project will subject the wastewater to an effluent treatment plant and re-circulate it for production, such as cooling. The current ESIA study will evaluate the proposed project area's baseline environmental and social conditions. Based on the collected baseline information, the proponent would set up a monitoring and evaluation framework to monitor the state of water and air conditions concerning pollution. Besides, he reiterated that the purpose of such an approach is to ensure that the proponent does oblige to several regulatory frameworks that provide guidelines for wastewater handling and disposal, including EMCA 1999, Water Act 2016, The Environmental (Waste Management) Regulations 2006, and Public Health Cap 242, among others. NEMA is a government agency that enforces such regulations. In the case of insecurity, the proponent will consult government security agencies through the area deputy county commissioner to request the establishment of a police station or post within the locality. The proponent plans to observe the Department for Labor and Social Services recommendation, which recommends that investors consider upholding 70% local content. Those who meet the requisite skills will be employed during the proposed project's construction and operational phases.

- Samuel Kiu: He wanted to know if the proponent would compensate farmers who experience field fires. He also inquired if the proponent had conducted soil analysis and discovered if the local area supported sugarcane as a crop.

Response: The issue will be resolved, and communication will be provided once the facility starts operating. Based on the survey already carried out, it was determined that the region does support the growth of different varieties of sugarcane.

- Mr. Samuel Mukut: The area Senior Chief for the Ndonyo Location welcomed the proposed project and encouraged the local farms to start preparing their farms and invest in sugarcane farming in anticipation of the proposed projects. Additionally, he inquired about the proposed project's water source and timeline.

Response: The source of water would be a drilled borehole, and the amount drawn from it would be based on the guidance of the hydrological survey conducted at the location and the volume permitted by WRA. Regarding the timeline, he noted that it will be determined by the speed at which requisite licenses are issued.

- David Masako: He noted that there are instances where companies employ locals but later fire them. As a result, what guarantees will the proponent provide locals on job security?

Response: The employees' job security will be guided by their professional contracts and performances. As a result, firing and hiring will be guided by those contracts' terms and conditions.

- Samuel Saiwa: He inquired about the proponent's plans to improve local roads and if they will be tarmacked.

Response: Tarmacked roads are only contracted by the national government. However, the proponent will commit to improving local roads since they are a vital resource that guarantees easy transportation of produce from the farm to the processing plant.

- Mr. Samuel Mukut: The area Senior Chief for the Ndonyo location sought clarity on the appropriate distance between sugar factories since the Transmara region has other established sugar factories, such as Ang'ata and Trans Mara. Will the given proximity hinder the government's establishment of the proposed project?

Response: AFA recommends a minimum distance between sugar processing plants. AFA would provide further directives on the concern since one of its mandates involves promoting best practices and regulating the production, processing, and marketing of agricultural produce, in this case, sugarcane.

Min 05/24 Way Forward

The consultant thanked the participants for their participation during the meeting and assured them that their feedback on the proposed sugar factory to be established in Enemasi would be incorporated in the ESIA study report, which will be submitted to NEMA. He also noted that preceding meetings were held in the Moita location, Oldanyati

sub-location, and Masurura sub-location. He informed them about another planned stakeholder meeting in the Naar-Olong sub-location, which is another neighboring sub-location of the proposed project.

Min 06/24 Conclusion

Mr. John Songor, former retired Senior Chief for the Ndonyo Location, thanked the consultants for acknowledging the community's constitutional mandate in providing views and comments about the proposed project. He noted that the locals openly support the proposed project. Moreover, he thanked the participants for availing themselves and contributing to bettering the construction and operational phase of the proposed project. He urged them to convey the information they had heard from the meeting to other locals.

The meeting ended with a word of prayer from one of the participants at 1:55 p.m.

MINUTES CERTIFICATION PAGE

Signed by:

1. ADMINISTRATION REPRESENTATIVE:

SAMUEL O. MUKUT

DATE: 13/08/2024

SIGNATURE and STAMP:

S/M. CHIEF: NDONYO LOCATION
DATE 13/08/...
SIGN.....
P.O. BOX 1 - 40700 KILGORIS

2. CONSULTANT REPRESENTATIVE:

Jack Otieno

DATE: 13/08/2024

SIGNATURE and STAMP:

GOMAKE CONSULTANCY
CO... LTD.
13 AUG 2024
P. O. Box ... -KENYA
TEL: 0720 964 333
Email: Info@gomakeltd.co.ke

3. PROPONENT REPRESENTATIVE:

DATE: 13/8/2024

SIGNATURE and STAMP: Kipchirchir Osinde

4. COMMUNITY REPRESENTATIVE:

SAMWEL SAIYUA

DATE:
13/08/2024

SIGNATURE:

Attendance Register

Project Name: Environmental and Social Impact Assessment Study for the Proposed Sugar Factory in Transmara, Narok County

Meeting Venue: Ndoinyo Primary school - Ndoinyo location **Date:** 13/08/2024

No.	Name	Village/ Organization	Position	Mobile No.:	E-mail	Signature
1.	SAMUEL O. MUKUI	INTERIOR & NATIONAL ADMINISTRA	SNR CHIEF	0710 114430		
2.	DANIEL MAROO	Kiikat	farmer	0729269951		
3.	SAMWEL SAIYUA	Kiikat	farmer	0711300298		
4.	DANIEL RIKEI	Kiikat	farmer	0715185500		
5.	MOSES SAKIPOR	Kiikat	farmer	0728780274		
6.	JOSEPH OLE MAROO	Kiikat	farmer			
7.	OLE KITAANA	Kiikat	farmer	0745325676		
8.	EDWARD KAITA	Kiikat	Pastor	0727995702		
9.	WILSON KIPAKI	Kiikat	farmer	0741474243		
10.	JOHN KITINGOS	Kiikat	farmer	0720314997		
11.	JAMES SHAAI	Kiikat	Pastor/Bishop	0700742641		
12.	JULIUS LESHAN	Kiikat	farmer	0759445210		
13.	JOSHUA SANTIAN	Kiikat	farmer	0748817288		
14.	MOSES SIRE	Kiikat	farmer	0713597358		
15.	DANIEL KITINGOS	Kikat	farmer	0712022[illegible]		

Attendance Register

SNR. CHIEF: NDONYO LOCATION DATE 13/08/29 SIGN 13/08/29 P.O. BOX 1 40700 KILGORIS

Project Name: Environmental and Social Impact Assessment Study for the Proposed Sugar Factory in Transmara, Narok County

Meeting Venue: Indoinyo Primary School **Date:** 13/08/29

No.	Name	Village/ Organization	Position	Mobile No.:	E-mail	Signature
16	PETER SHAAI	Kiikat	farmer	0768571599		
17	MOSES SAITUA	KIIKAT	Farmer	0729302352		
18	PETER KITIYIA	KIKAT	FARMER	0742605784		
19	JONATHAN SHAAI	kiikat	farmer	0710698604		
20	JOSHUA DION	kiikat	farmer	0705158049		
21	PAUL KITINGOS	kiikat	farmer	0740703254		
22	EMMANUEL RIKEI	kiikat	farmer	0799411010		
23	PAUL SARTAWUA	Kiikat	farmer	0796670939		
24	JULIUS KIINGOS	Kiikat	Farmer	0706321606		
25	WILLIAM KITINGOS	kiikat	farmer	0797755239		
26	JOSEPH KIU	Kiikat	farmer	0706602319		
27	CHRISTOPHER NKENCHAN	Kikat	farme	0707861149		
28	JOSHP KiSerema	KIIKAT	Farmer	0705260573		
29	RIKEI WILLIAM	KIIKAT	Farmer	0796 56991		
30	SAMIEL SHAAP	KIIKAT	Farmer	0742302723		

Attendance Register

Project Name: Environmental and Social Impact Assessment Study for the Proposed Sugar Factory in Transmara, Narok County

Meeting Venue: Indoinyo Primary School - Kikat Sublocation **Date:** 13/08/19

No.	Name	Village/ Organization	Position	Mobile No.:	E-mail	Signature
31.	FREDRICK MOSOINE	KIIKAT	FARMER	0768003456		
32	Julius Leparan	Kiikat	Farmer	0748212359		
33	DANIEL NGEEM	KIIKAT	FARMER	0742588606		
34	Joseph Ntialel	Kiikat	Farmer	0113603353		
35	WILLIAM KITIJIA	KIIKAT	FARMER	0728870442		
36	SAMWEL KITINGOS	Kiikat	Farmer	-		
37	JOHN KITIANA	Kiikat	Farmer	0721514854		
38	JOSEPH NGEEM	Kiikat	Farmer	0711684882		
39	JOLIAS LEINA	Kiikat	Farmer	0729308405		
40	DANIEL KITIJIA	Kiikat	Farmer	0728736909		
41	James masoiko	Kikat	Farmer	0758328916		
42	Michael Saiyua	Kikat	Farmer	0792549444		
43	Stephen Sunkuli	Kikat	Farmer	0742301831		
44	Ezekiel NTielel	Kikat	farmer	0703956991		
45	Jackson Masoiko	Kiikat	Fasmer	0729579974		
46	MoRombi ole kitaana	kiikat	Famer	0727342433		

Attendance Register

Project Name: *Environmental and Social Impact Assessment Study for the Proposed Sugar Factory in Transmara, Narok County*

Meeting Venue: Ndonyo Primary School - Kikat Sublocation **Date:** 13/08/24

No.	Name	Village/ Organization	Position	Mobile No.:	E-mail	Signature
47	Moses Ngeera	Kiikat	farmer	0726600918		
48	Francis Ntiaki	Kiikat	farmer	0723417552		
49	Samuel ngeera	Kiikat	farmer	0726403681		
50	JOSEPH KITAANA	Kiikat	farmer	0728994802		
51	DOLMAS SIRE	KIKAT	FARMER	0727520957		
52	SAMWEL KIU	Kiikat	Farmer	07		
53	JOEL KANKO	Kiikat	Farmer	0725901625		
54	David Mosioko	Kiikat	Famer	0729719041		
55	ROBERT NKEPON	KIKAT	FARMER	0713660530		
56	RIKEI MUKENI JULIUS	KIKAT	Farmer	0748811997		
57	Joseph Shaai	Kiikat	Farmer	0714325077		
58	REV DAVID SHAAI	Kikat	FARMER	0713279061		
59	GODWIN OLE NE	MAMATEA	EMPLOYEE	0720863270		
60	Kennedy Kitaana	Gomako Consult	EIA Expert	0720964333		
61.	Jack Otieno	Gomako Ltd	EIA Expert	0711385467		
62.	Esther Kitaana	Kiikat	Farmer			
63.	Jackline Shaai	Kikat	Farmer	0702816857		
64.	Naomy Kitaana	Kikat	Farmer			
65.	Janet Shaai	Kikat	Farmer	0748074689172		

SNR. CHIEF: NDONYO LOCATION DATE SIGN P.O. BOX 1 - 40700 KILGORIS

SNR. CHIEF: NDONYO LOCATION DATE 13/08/24 SIGN P.O. BOX 1 - 40700 KILGORIS

MINUTES FOR THE FIFTH STAKEHOLDER PARTICIPATION FOR THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY

VENUE: NAAR-OLONG CHIEF'S OFFICE/CENTRE/CHURCH'S COMPOUND IN NAAR-OLONG SUB LOCATION

DATE: 14TH AUGUST, 2024

AGENDA

1. Preliminary
2. Opening Remarks
3. The Project Brief
4. Stakeholder Comments
5. Way Forward
6. Conclusion

Min 01/24 Preliminary

The meeting started at 2:08 pm with a word of prayer from one of the participants and, after that, followed by introductions. Forty seven participants attended the meeting drawn from immediate neighbors, the consultant, and local administrators. The list of participants is attached.

Min 02/24 Opening Remarks

Senior Chief Ndonyo Location

Mr. Samuel Mukut, the area Senior Chief for the Ndonyo Location, thanked the participants for attending the meeting and encouraged them to raise their views. He noted that the meeting mobilization was conducted at different venues, and the locals knew about the meeting and the proposed project. He said that most of the participants at the current meeting are farmers who are highly likely to be impacted by the proposed project. He stated that the proposed project is an excellent initiative by the proponent, given its potential impact on his location. He added that the region is rich in agricultural potential.

Min 03/24 Project Brief

The environmental consultant for the proposed project, informed the participants that the proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Area, Moita Sub Location, Moita Location, Lolgirian Ward, Kereto Division, Transmara South Sub County, Narok County. He clarified that the proponent has decided to set up the factory to help Kenya address the country's recurrent sugar production deficit. He noted that the plant will be able to crush 1250 tonnes of cane daily (1250TCD). Therefore, the plant will rely on the neighbouring farmers for the cane since it does not have a sugarcane nucleus. He also explained to the public that the mandate of the meeting was an ESIA study process consistent with the Environmental Management and Coordination Act Cap 387 of the Laws of Kenya and the Kenya Constitution of 2010, which both stipulates the need for the public to be consulted when any proposed development projects impact them environmentally, socially and economically. He reiterated that the public participation process would help capture the views and concerns of interested and affected parties regarding the impacts of the proposed sugar factory project. As a result, he encouraged the congregation to be open and willing to raise their views and comments regarding the proposed project. These concerns are inclusive of (environmental, social, and economic) impacts, which could either be positive or negative.

Min 04/24 Stakeholder Comments

The area Senior Chief for the Ndonyo location encouraged the attendants to provide their comments and views. They noted that they represent the community impacted by the proposed sugar factory project. The following are the views that were expressed:

- Daniel Siparo: He welcomed the proposed project and urged the proponent to prioritize local employment by implementing the recommended 70% content policy.

Response: The proponent plans to observe the recommendation by the Department for Labor and Social Services, which recommends that investors consider upholding 70% local content. Those who meet the requisite skills will be employed during the proposed project's construction and operational phases.

- Mr. Saitoti Ngeny: He welcomed the proposed project. He pointed out that the Ndonyo location has lagged behind in infrastructure development and acknowledged the impact the proposed project would have on improving this. However, he urged the proponent to ensure that locals are employed since this will help foster the relationship between the facility and the community.

Response: The proponent would be committed to improving local roads, given that they help ease the transportation of raw materials from the farms to the factory.

- Mike Siparo: He noted that over the years, prejudices against the Maasai community have existed, portraying them as lazy, illiterate, and dangerous. However, he informed the proponent that that was not the case. As a result, the proponent should not be swayed from hiring locals.

Response: Socio-economic survey is one of the components of the ESIA study. Based on the results, the above prejudices would be disapproved of.

- Daniel Adama: He stated that, as a farmer and resident of the Naar-Olong Sub Location, he welcomes the proposed project, given its benefits to the community. However, he urged the proponent to prioritize local employment.
- Mr. Samuel Mukut: The area Senior Chief for the Ndonyo location welcomed the proposed project. He noted that it would reduce farmers' transportation costs, boost farmer customer services, and create local employment for youths. On the other hand, he appreciated the consultant and proponent's efforts in involving him and the community in setting up the proposed project. The approach has made the community feel like a part of the company, and they cannot wait for the project to be established.
- Fredrick Mukut: He welcomed the proposed project and noted that it will benefit the community. However, he added that there are other negative impacts linked to the project, such as insecurity and cases of poaching due to stiff competition in the sector, given the existence of different regional sugar processing companies. As a result, he inquired about mitigation measures the proponent will adopt to address the above. Moreover, he wanted to know the sugarcane varieties the farmers are advised to grow based on the soil analysis of the area conducted.

Response: The proponent would consult government security agencies through the area deputy county commissioner to request the establishment of a police station or post within the locality. Based on the survey already carried out, it was determined that the region does support the growth of different sugarcane varieties. Regarding poaching, no company would sanction the harvesting of cane without an okay from the farmer.

- Samson Nchamusi: He thanked the proponent for investing in the region and welcomed the proposed project. He inquired about the recommended ideal distance between sugar factories and if the existence of similar factories in the area would impede the establishment of the proposed project in the Moita Location.

Response: AFA recommends a minimum distance between sugar processing plants. AFA would provide further directives on the concern since one of its mandates involves promoting best practices and regulating the production, processing, and marketing of agricultural produce, in this case, sugarcane. Moreover, the facility will start by crushing 1250 tonnes of cane per day (TCD), which will undoubtedly meet the available raw material within the area. Sugar processing plants are allowed to source sugarcane from other regions. In the case of honoring culture, it would be up to the farmers to be educated and encouraged to practice both farming and livestock production.

Min 05/24 Way Forward

The consultant thanked the participants for their participation during the meeting and assured them that their feedback on the proposed sugar factory to be established in Enemasi would be incorporated in the ESIA study report, which will be submitted to NEMA. He also noted that preceding meetings were held in the Moita Location, Oldanyati Sub Location, Kikat Sub Location, and Masurura Sub Location. He informed them about another planned stakeholder meeting in Narok Town that will incorporate County and national government officials from different departments and government agencies in governance, security, water, environment, and heath.

Min 06/24 Conclusion

Mr. Samuel Mukut, the area Senior Chief for the Ndonyo Location, thanked the consultants for acknowledging the constitutional mandate of the community in providing views and comments about the proposed project. He noted that most members of the Naar-Olong Sub location openly support the proposed project. He also assured the proponent and consultant of his office's support in the future if called upon. Moreover, he thanked the participants for availing themselves and contributing to bettering the construction and operational phase of the proposed project. He urged them to convey the information they had heard from the meeting to other locals.

The meeting ended with a word of prayer from one of the participants at 3:06 p.m.

Naroloms Sublocation.

MINUTES CERTIFICATION PAGE

Signed by:

1. ADMINISTRATION REPRESENTATIVE:

SAMUEL O. MUBUT

DATE: 14/08/24

SNR. CHIEF: NDONYO LOCATION
DATE.....
SIGN.....
P.O. BOX 1 - 40700 KILGORIS

SIGNATURE and STAMP:

2. CONSULTANT REPRESENTATIVE:

Jack Otieno

DATE: 14/08/2024

SIGNATURE and STAMP:

GOMAKE CONSULTANCY COMPANY LTD.
14 AUG 2024
P. O. Box 5540-00100, NAIROBI-KENYA
TEL: 0720 964 333
Email: Info@gomakeltd.co.ke

3. PROPONENT REPRESENTATIVE:

DATE: 14/8/2024

SIGNATURE and STAMP: Godwin Otieno

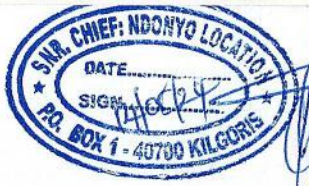
4. COMMUNITY REPRESENTATIVE:

Sampati Lenkai

DATE: 14/08/2024

SIGNATURE:

Attendance Register

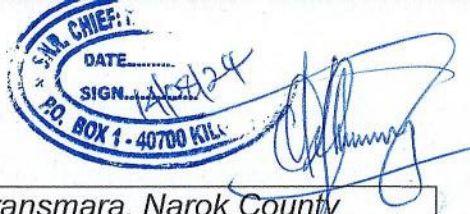


Project Name: Environmental and Social Impact Assessment Study for the Proposed Sugar Factory in Transmara, Narok County

Meeting Venue: Naar-olong chief office/centre **Date:** 14/08/24

No.	Name	Village/ Organization	Position	Mobile No.:	E-mail	Signature
1.	SAMUEL O. MUKUT	MINISTRY OF INTERIOR	SNR CHIEF	0710114430		
2.	Kennedy Kijana	Gomake Ltd	EIA Lead Expert	0720964333	kijanakennedy@gmail	
3.	Jack Otieno	Gomake Ltd	EIA - A. Expert	0711385417	Jacksamoti@gmail.com	
4.	Saitoti Ngeety	TSC	Teacher	0721214930	ngeetysaitoti@gmail.	
5.	Ezra Kaftom	Osegam	Farmer	0721268097	ezrakaftom@gmail.com	
6.	Paul Ntome	TSC	Teacher	0712347339	Lekakengaa@gmail.com	
7.	Felix Kaftom	Osegam	Farmer	0797825809	Kortomfelix@gmail.com	
8.	Stephen Naimija	Olenkampi	farmer	0719634321	Stevenaimya@gmail.	
9.	LIMPASO DANIEL LESAMA	ORMEEYU	SURVEYOR	0769757620	Limpasolelesama@gmail	
10.	Mike Siparo	Go Mau	Enumerator	0705036023	mikesiparo@gmail.com	
11.	Sampeti Zakayo	Inkerikong'i	Farmer	0716136289	sampetiankai@gmail.com	
12.	Daniel Siparo	Ilbuko	farmer	0705347107	danielsiparo@gmail.com	
13.	Peter Yiampoi	Ilbuko	farmer	0710765924	YiampoiPeter@gmail.com	
14	Dalmas Ntamo	Naar-Olong'	farmer	0711546883	dalmasntamo@gmail.com	
15	~~Joseph Ilbuya~~ Joseph	~~Ilbuko~~ Olong'	~~Farmer~~ farmer	0~~723445~~5914	dalmsntme.gmail	

Attendance Register



Project Name: *Environmental and Social Impact Assessment Study for the Proposed Sugar Factory in Transmara, Narok County*

Meeting Venue: Naar - Olong Chief's Office/centre **Date:** 14/08/24.

No.	Name	Village/ Organization	Position	Mobile No.:	E-mail	Signature
16	Jackson Ibuya	naarolong	farmer	0700250335	daimsatmo	
17.	Patrick Lemayian Papiani	Naar-olong	Farmer.	0708063647	Patrick lemayian Papiani	
18	Kinglasenye Koi	Naar-olong	Farmer	0792219811		
19.	Fredrick Mukut	Naar-olong	Farmer	0724842479	fredmuk@23.coke.	
20	Joshua GiPaso	Naar-olong	Farmer	0799710345	Joshua	
21	Samwel. R. Nkamusi	Naa- olong	Farmer	0720139429	Samuel	
22	Daniel Kasaee	Naar olong	farmer	0721944374	Kasaedan@gmail.com	
23	JOSEPH MPUKA	Naar olong	Farmer	0719100335	MPUKA	
24	SAMUEL O. MUKUT	NAAROLONG	FARMER	0710114430		
25	Paulo Nanpoki'e	Naar-olong	Farmer			
26	Moses Mukut	Naar-olong	Farmer	0711130067		
27	Julius Ngeeti	Naar-olong	farmer	0712801107		
28	Simion Sankei	Naar-olong	farmer	0704346889	ssankeisimion@yahoo.com	
29	David Siampoi	Naar-olong	Farmer	0790402481		
30	JOHN SUKUTA	Naar-olong	Farmer	0726050439	jmsuk...@gmail.com	

Attendance Register

SNR. CHIEF: NDONYO LOCATION
DATE
SIGN 14/08/24
P.O. BOX 1 - 40700 KILGORIS

Project Name: Environmental and Social Impact Assessment Study for the Proposed Sugar Factory in Transmara, Narok County

Meeting Venue: Naarolong Chief's Office - Church Compound **Date:** 14/08/24.

No.	Name	Village/ Organization	Position	Mobile No.:	E-mail	Signature
31	Moses Salaton.	Ilbuko	Farmer	0722353670	Mosessalato.mail	
32	DANIEL SANKEI	OLMAKAU	Farmer	0729595505	SANKEYDANIEL23@GMAIL.COM	
33	Narikunkara Sipara	Ilbuko	farmer	0712362169	"	
34	Samwel Sopia	Olmaka	farmer	0114113416	Sakopamc230	
35	Joseph Abura	Olmakau	framer	0723999594	mosesadt mail	
36	Samuel saloon	Olmakau	framer	0715979098	mosesadt mail.	
37	Edward Kala	Enaiborsoit	farmer	0708953056		
38	KENNEDY OMONDI	Naroiong	farmer	0794298393		
39	Samson Nchamusi	Ilbuko	farmer	0748235769		
40	Benjamen Sopia	Ilbuko	farmer	0727225641		
41	Joshua NChamusi	Ilbuko	Farmer	0729712767	sulaijoshua3@gmail.com	
42	PAULO SANKEI	ENAIBORESOIT	FARMER	0710513050		
43	OLEMERIAN NGEETI	ENAIBORESOIT	FARMER	0724621961		
44	JOHN KALASINGA	ENAIBORESOIT	FARMER	0726614308		
45	JULIUS KIBULU	OLMAKAU	FARMER	0716527060		
46	MOSES SANKEI	ENAIBORESOIT	FARMER	0718172058		

Attendance Register

Project Name: *Environmental and Social Impact Assessment Study for the Proposed Sugar Factory in Transmara, Narok County*

Meeting Venue: Naarolong Chief's office Compound. **Date:** 14/08/24

No.	Name	Village/ Organization	Position	Mobile No.:	E-mail	Signature
47	LETUATI TUMAI	KINAIBORSOIT	Farmer	0725135038		[signature]
48	Gollwin Osinde	Muru Tea	Manager -[illegible]	0720863220		[signature]

SNR. CHIEF: NDONYO LOCATION
DATE 14/08/24
SIGN
P.O. BOX 1 - 40700 KILGORIS

SNR. CHIEF: NDONYO LOCATION
DATE 14/08/24
SIGN
P.O. BOX 1 - 40700 KILGORIS

MINUTES FOR THE FIRST STAKEHOLDER PARTICIPATION FOR THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY

VENUE: ZEBU LODGES AND LUXURY HOTELS, NAROK

DATE: 28TH AUGUST, 2024

AGENDA

1. Preliminary
2. Opening Remarks
3. The Project Brief
4. Stakeholder Comments
5. Way Forward
6. Conclusion

Min 01/24 Preliminary

The meeting started at 10:15 am with a word of prayer from one of the participants and, after that, followed by introductions. Twelve participants attended the meeting drawn from Narok County Government, National Government Officers, the consultant, Client and local community representative. The list of participants is attached.

Min 02/24 Opening Remarks

Client Representative

Godwin Osinde provided an insightful overview of the client's operations, highlighting:

- The involvement of the Client in the region and current ownership of existing investment in the tea industry within the same region.
- The urge to adhere to sugar industry regulations and integration within the current legislative framework.
- A well-structured timeline for the implementation and construction of the 1,250 TCD sugar factory.

- A call for government support in ensuring a smooth and efficient process.
- The potential for the project to alleviate local unemployment, mitigate tribal conflicts, and improve road infrastructure.
- Plans to prioritize local employment, with the factory expected to generate 1,500-2,000 jobs.
- Corporate Social Responsibility (CSR) initiatives aimed at improving local health facilities, the nearby police station, and electricity access.

Min 03/24 Project Brief

The environmental consultant for the proposed project, informed the participants that the proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Area, Moita Sub Location, Moita Location, Lolgirian Ward, Kereto Division, Transmara South Sub County, Narok County. He clarified that the proponent has decided to set up the factory to help Kenya address the country's recurrent sugar production deficit. He noted that the plant will be able to crush 1250 tonnes of cane daily (1250TCD). Therefore, the plant will rely on the neighbouring farmers for the cane since it does not have a sugarcane nucleus. He also explained to the public that the mandate of the meeting was an ESIA study process consistent with the Environmental Management and Coordination Act Cap 387 of the Laws of Kenya and the Kenya Constitution of 2010, which both stipulates the need for the public to be consulted when any proposed development projects impact them environmentally, socially and economically. He reiterated that the public participation process would help capture the views and concerns of interested and affected parties regarding the impacts of the proposed sugar factory project. As a result, he encouraged the congregation to be open and willing to raise their views and comments regarding the proposed project. These concerns are inclusive of (environmental, social, and economic) impacts, which could either be positive or negative.

Min 04/24 Stakeholder Comments

- Joseph Ole Naigisa – Farmer from Keiyan Division: He expressed concerns regarding the current state of waste of sugarcane within the area due to inadequate and timely harvesting due to location of available sugar industries within the area. This he said will be alleviated by the entrance of the proposed factory in the market. He also stressed the importance of the proposed factory working with local authorities to mitigate tribal clashes and expedite processes to introduce alternative crops such as sugarcane that could help reduce cattle rustling in the region.
- Edward Ole Tankoi – County Health Officer. He requested for a site visit to advice on waste management solutions. He also expressed concerns regarding waste disposal strategies, sanitation needs of cane cutters, particularly the issue of open defecation in sugarcane plantations and a call for CSR initiatives to strengthen the health of the community.
- Roy Bii – Director, Trade and Industrialization, Narok County. He emphasized the importance of giving priority to local communities in job opportunities, adhering to government regulations and mitigating the negative impacts of urbanization, particularly the strain on local resources.
- Esther Malaso – County Government Gender Department. She stressed the importance of ensuring that all employees are 18 years and above, with proof of identification to prevent child labor and establishment of CSR programs focusing on community empowerment, education, the fight against Female Genital Mutilation (FGM), provision of sanitary pads to girls, and improving water access.
- Ordination Aunda – Department of Occupational Safety and Health Services (DOSHS). He encouraged collaboration with his department to promote health and safety standards and urged the project team to register the site with DOSHS. He also emphasized the need for a site visit to offer professional advice on several aspects, including project scope.
- Vincent Tanyasis – Ministry of Trade and Industrialization. He highlighted the critical importance of obtaining all relevant documentation and licenses before project commencement. He also echoed the need for a site visit to assess the project's impact.

- Brian Ochieng' – National Environment Management Authority (NEMA). He requested the Consultant to complete and submit the ESIA report to NEMA, after which it would be shared with all stakeholders for review prior to the site visit.
- Patrick Mpatiany – Director, Cooperatives Department, Narok County Government. He encouraged the management of the proposed sugar factory to advocate for the formation of cooperative societies among farmers and employees, which would help empower the community financially.

Min 05/24 Way Forward

The consultant thanked the participants for their participation during the meeting and assured them that their feedback on the proposed sugar factory to be established in Enemasi will be incorporated in the ESIA study report, which will be submitted to NEMA.

Min 06/24 Conclusion

The meeting ended with a word of prayer from one of the participants at 12:15 p.m.

MINUTES CERTIFICATION PAGE

Signed by:

1. ADMINISTRATION REPRESENTATIVE:

PATRICK-D. MPATIKANY

DATE: 28/8/24

SIGNATURE and STAMP:

2. CONSULTANT REPRESENTATIVE:

KENNEDY KIJANA

DATE: 28/8/2024

SIGNATURE and STAMP:

3. PROPONENT REPRESENTATIVE:

DATE: 28/8/2024

SIGNATURE and STAMP: Godwin Olinde

4. COMMUNITY REPRESENTATIVE:

DATE: 28/8/2024

SIGNATURE: JOSEPH N. NIAIESSA

Attendance Register

Project Name: *Environmental and Social Impact Assessment Study for the Proposed Sugar Factory in Transmara, Narok County*						
	Meeting Venue: ZEBU LODGES & LUXURY HOTELS (NAROK)		**Date:** 28/08/2024.			
No.	**Name**	**Village/ Organization**	**Position**	**Mobile No.:**	**E-mail**	**Signature**
1.	Bll Roy	TRADE	DIRECTOR	0720535643	Bironybg@gmail	
2.	ESTHER MARASO	GENDER NGC	DIRECTOR	0724238854	malasoem23@gmail.com	
3	BRIAN OCHIENG	NEMA	RO	0725587166	bnyanjoe yahoo	
4	Godwin Osinde	GOMAKE	GOMAKE	0720 863270	godwin@munteyjoe	
5	JOSEPH NYAGISA	GO MAKE	CLIENT	0720863270	"	NCG
6	Anderson Legosna	GO Make	Environmentalist	0707535550	lego2201@gmail.	
7.	ORDINATION ANDA	DOSHS	SOSHO	0707376648	ordains87@gmail.com	
8.	EDWARD OLE TANKOI	NCG-HEALTH	CPHO	0725367131	oledaretankoi@yahoo.com	
9.	Kennedy Kijana	Gomake	Environmentalist	0720 914333	kijanakennedy@gmail.com	
10.	George Wandera	GOMAKE	Sociologist	0729632854	wanderabink@hotmail.com	
11.	VINCENT TANYASIS	NCG-TRADE	ADMINISTRATOR	0720598535	vincenttanyasis@gmail.com	
12.	PATRICK P. MPATIANY	NCG COOP	DIRECTOR	0722331500	Mpatienypatrick@gmail.com	

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY

STAKEHOLDERS OPINION

The Proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Village, Moita Sub Location, Moita Location, Lolgorian Ward, Kereito Division, Transmara South Sub County, Narok County. The Proponent is determined to support Kenya in addressing the recurrent sugar production deficit in the country by proposing to install the factory with a capacity to crush about 1,250TCD of sugarcane per day. The Proponent will rely on the neighbouring farmers for the cane. Pursuant to Section 58 of the Environmental Management and Coordination Act Cap 387 of the Laws of Kenya, the Proponent is carrying out Environmental and Social Impact Assessment (ESIA) Study for the Proposed Sugar Factory.

The ESIA Study process requires stakeholder involvement in providing views, comments and suggestions on the Proposed Sugar Factory works.

It is in this regard, that your views are sought regarding potential environmental and socio-economic impacts that may arise from implementing the above project activities. Your views will be incorporated into the ESIA Report.

1. In your opinion, who stands to gain the most from the implementation of the proposed project? Please explain why.

The community around including the youth and technical educated people around. The county and National government because of the development.

2. What are some of the impacts (social, economic and/or environmental) that you anticipate from the execution of this project? Please list them.

a) Positive impacts

- People will be employed
- Earnings from sugar
- Road network development
- Other public utilities such as Health facilities

b) Negative impacts

- Noise and vibration nuisance.
- Environmental including water source pollution.
- Prostitution due to population influx.

- High open defecation (OD) for the canes cutters or harvesters.
- Potential hideouts for criminals.

3. Are there any of the impact(s) identified in *question 2 above* that you think will affect you directly or affect your institution directly? If YES, please explain how you will be affected.

- Environmental pollution - diseases
- Health hazards of accidents within the factory if not mitigated.
- Sanitation related diseases

4. What mitigation measures would you recommend for the negative impacts you listed above?

- Proper mitigation on the factory waste product to relevant disposal ground.
- Sanitation challenge - liaise with the community on provision of designated toilets at strategic places.
- Health and safety measures including periodical personnel sensitization and training.

5. Are there any specific safety or operational considerations that you wish to be met before the project is implemented?

- Site visit is important to ensure that all siting consideration have been made
- Design approval by various entities

6. What are your additional comments on the proposed project?

None.

NAME: EDWARD OLE TANKOI TELEPHONE NO. 0725367131

DATE: 28/8/2024 SIGNATURE

INSTITUTION (If any): HEALTH POSITION (If any): County Public Health Officer (CPHO)

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY

STAKEHOLDERS OPINION

The Proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Village, Moita Sub Location, Moita Location, Lolgorian Ward, Kereito Division, Transmara South Sub County, Narok County. The Proponent is determined to support Kenya in addressing the recurrent sugar production deficit in the country by proposing to install the factory with a capacity to crush about 1,250TCD of sugarcane per day. The Proponent will rely on the neighbouring farmers for the cane. Pursuant to Section 58 of the Environmental Management and Coordination Act Cap 387 of the Laws of Kenya, the Proponent is carrying out Environmental and Social Impact Assessment (ESIA) Study for the Proposed Sugar Factory.

The ESIA Study process requires stakeholder involvement in providing views, comments and suggestions on the Proposed Sugar Factory works.

It is in this regard, that your views are sought regarding potential environmental and socio-economic impacts that may arise from implementing the above project activities. Your views will be incorporated into the ESIA Report.

1. In your opinion, who stands to gain the most from the implementation of the proposed project? Please explain why.

1. Farmers — Through trade.
2. Mamanchi — Through Development of ag Roads

2. What are some of the impacts (social, economic and/or environmental) that you anticipate from the execution of this project? Please list them.

a) Positive impacts

Social — Mitigations on social issues to better farmers lives through CSR.
Economic — Income to Farmers and indirect business communities.
Environmental improve on waste management mitigations

b) Negative impacts

— Immorality brought by Instant huge payouts to farmers and prostitution.

3. Are there any of the impact(s) identified in *question 2 above* that you think will affect you directly or affect your institution directly? If YES, please explain how you will be affected.

Yes, late licensing issues by paying of Single Business permits

4. What mitigation measures would you recommend for the negative impacts you listed above?

Involve leaders and all stake holders to assist sensitize on good morals and spirituality

5. Are there any specific safety or operational considerations that you wish to be met before the project is implemented?

Yes, adhere to safety and occupational safe ty and regulations

6. What are your additional comments on the proposed project?

If all Requirements are met we recommend it starts as soon as to aid assist implement our County and National Governments agendas.

NAME: VINCENT TARASIS TELEPHONE NO. 0720598535

DATE: 28/8/2024 SIGNATURE

INSTITUTION (If any): NCG POSITION (If any): PRINCIPAL ADMINISTRATOR

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY

STAKEHOLDERS OPINION

The Proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Village, Moita Sub Location, Moita Location, Lolgorian Ward, Kereito Division, Transmara South Sub County, Narok County. The Proponent is determined to support Kenya in addressing the recurrent sugar production deficit in the country by proposing to install the factory with a capacity to crush about 1,250TCD of sugarcane per day. The Proponent will rely on the neighbouring farmers for the cane. Pursuant to Section 58 of the Environmental Management and Coordination Act Cap 387 of the Laws of Kenya, the Proponent is carrying out Environmental and Social Impact Assessment (ESIA) Study for the Proposed Sugar Factory.

The ESIA Study process requires stakeholder involvement in providing views, comments and suggestions on the Proposed Sugar Factory works.

It is in this regard, that your views are sought regarding potential environmental and socio-economic impacts that may arise from implementing the above project activities. Your views will be incorporated into the ESIA Report.

1. In your opinion, who stands to gain the most from the implementation of the proposed project? Please explain why.

Farmers, families and community living
Income generation obtain from sugar
farmer.
Youth - gain employment

2. What are some of the impacts (social, economic and/or environmental) that you anticipate from the execution of this project? Please list them.

a) Positive impacts

- Road Maintance
- employment opportunities
- Urban sprawl -
- Water pollution
- Improved livelihoods

b) Negative impacts

- Pollution
- Family conflict
- Early pregnancies
- Land poaching

- Pollution
- waste from sugar
- deforestation
- illicit trade on bhang and changa at Coast and good

3. Are there any of the impact(s) identified in *question 2 above* that you think will affect you directly or affect your institution directly? If YES, please explain how you will be affected.

Cross border trade need to be handle to avoid potential influx over the same raw materials and issues of contraband goods finding their way

4. What mitigation measures would you recommend for the negative impacts you listed above?

- utilize waste from sugar to be manure such use for reclamation
- Awareness for farmers training
- Law for mechanism to reduce deforestation
- Public awareness campaigns

5. Are there any specific safety or operational considerations that you wish to be met before the project is implemented?

Liase with Public health and Safety Occupation Officer and Engage all Stake holders

6. What are your additional comments on the proposed project?

Site visit nice report is out for the team to interrogate well

NAME: Bill Roy TELEPHONE NO. 0720535643

DATE: 28/8/24 SIGNATURE

INSTITUTION (If any): NCA POSITION (If any): Director Trade & Industrialization.

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY

STAKEHOLDERS OPINION

The Proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Village, Moita Sub Location, Moita Location, Lolgorian Ward, Kereito Division, Transmara South Sub County, Narok County. The Proponent is determined to support Kenya in addressing the recurrent sugar production deficit in the country by proposing to install the factory with a capacity to crush about 1,250TCD of sugarcane per day. The Proponent will rely on the neighbouring farmers for the cane. Pursuant to Section 58 of the Environmental Management and Coordination Act Cap 387 of the Laws of Kenya, the Proponent is carrying out Environmental and Social Impact Assessment (ESIA) Study for the Proposed Sugar Factory.

The ESIA Study process requires stakeholder involvement in providing views, comments and suggestions on the Proposed Sugar Factory works.

It is in this regard, that your views are sought regarding potential environmental and socio-economic impacts that may arise from implementing the above project activities. Your views will be incorporated into the ESIA Report.

1. In your opinion, who stands to gain the most from the implementation of the proposed project? Please explain why.

✓ The Government for Compact - Joblessness
✓ Community - Job creations and combating border crashes.
✓ Government and Counties for revenue generations.

2. What are some of the impacts (social, economic and/or environmental) that you anticipate from the execution of this project? Please list them.

a) Positive impacts

- Alternate food for livestock
- Bio fuels
- Co-Generation of electricity (Cane Bagasse)
- Job Creation
- Community Empowerment -

b) Negative impacts

- Waste water
- Sludge
- Massive HSR Kills

3. Are there any of the impact(s) identified in *question 2 above* that you think will affect you directly or affect your institution directly? If YES, please explain how you will be affected.

✓ None -

4. What mitigation measures would you recommend for the negative impacts you listed above?

✓ Recycling of By-products

5. Are there any specific safety or operational considerations that you wish to be met before the project is implemented?

- Approval of structural Plans by DOSHS
- Site registration with DOSHS
- Presence of WIBA insurance for compensation
- Employees training on construction Safety.
- Presence of approved site officer approved by DOSHS
- EHS policies to include evacuation Plans.

6. What are your additional comments on the proposed project?

NAME: AUNDA ORDINATION TELEPHONE NO. 0707376648

DATE: 27/8/2024 SIGNATURE

INSTITUTION (If any): DOSHS POSITION (If any): COUNTY OCCUPATIONAL SAFETY OFFICER

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY

STAKEHOLDERS OPINION

The Proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Village, Moita Sub Location, Moita Location, Lolgorian Ward, Kereito Division, Transmara South Sub County, Narok County. The Proponent is determined to support Kenya in addressing the recurrent sugar production deficit in the country by proposing to install the factory with a capacity to crush about 1,250TCD of sugarcane per day. The Proponent will rely on the neighbouring farmers for the cane. Pursuant to Section 58 of the Environmental Management and Coordination Act Cap 387 of the Laws of Kenya, the Proponent is carrying out Environmental and Social Impact Assessment (ESIA) Study for the Proposed Sugar Factory.

The ESIA Study process requires stakeholder involvement in providing views, comments and suggestions on the Proposed Sugar Factory works.

It is in this regard, that your views are sought regarding potential environmental and socio-economic impacts that may arise from implementing the above project activities. Your views will be incorporated into the ESIA Report.

1. In your opinion, who stands to gain the most from the implementation of the proposed project? Please explain why.

The community and the goverment
1) They will benefit from employment
2) They will get the market for the produce
3) The Goverment will get Revenue both the County & the National Goverment.

2. What are some of the impacts (social, economic and/or environmental) that you anticipate from the execution of this project? Please list them.

a) Positive impacts

Employment
Market
Revenue generation
Infrastructure Developed
Reduce carbon

b) Negative impacts

- Degradation to the Environment.
- Smokes

3. Are there any of the impact(s) identified in *question 2 above* that you think will affect you directly or affect your institution directly? If YES, please explain how you will be affected.

Smoke

4. What mitigation measures would you recommend for the negative impacts you listed above?

Plant trees in the sugar farms

5. Are there any specific safety or operational considerations that you wish to be met before the project is implemented?

- Construction of Development of infrastructure
- Build of Health centre
- Establishing a school in the area.
- Sensatization to the community

6. What are your additional comments on the proposed project?

Good work to the community
Provide them with water & Health centre.

NAME: PATRICK MPATIANY TELEPHONE NO. 0722331500

DATE: 28/8/24 SIGNATURE

INSTITUTION (If any): COOPERATIVE POSITION (If any): DIRECTOR COOPERATIVE

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY

STAKEHOLDERS OPINION

The Proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Village, Moita Sub Location, Moita Location, Lolgorian Ward, Kereito Division, Transmara South Sub County, Narok County. The Proponent is determined to support Kenya in addressing the recurrent sugar production deficit in the country by proposing to install the factory with a capacity to crush about 1,250TCD of sugarcane per day. The Proponent will rely on the neighbouring farmers for the cane. Pursuant to Section 58 of the Environmental Management and Coordination Act Cap 387 of the Laws of Kenya, the Proponent is carrying out Environmental and Social Impact Assessment (ESIA) Study for the Proposed Sugar Factory.

The ESIA Study process requires stakeholder involvement in providing views, comments and suggestions on the Proposed Sugar Factory works.

It is in this regard, that your views are sought regarding potential environmental and socio-economic impacts that may arise from implementing the above project activities. Your views will be incorporated into the ESIA Report.

1. In your opinion, who stands to gain the most from the implementation of the proposed project? Please explain why.

Community because of improved/upgraded roads, & local employment

2. What are some of the impacts (social, economic and/or environmental) that you anticipate from the execution of this project? Please list them.

a) Positive impacts

- local employment
- Improved roads.
- Source of income to farmers.

b) Negative impacts

- Air pollution.
- Water pollution - of streams.

3. Are there any of the impact(s) identified in *question 2 above* that you think will affect you directly or affect your institution directly? If YES, please explain how you will be affected.

- Yes, you reside close to the facility.

4. What mitigation measures would you recommend for the negative impacts you listed above?

- Installation of modern furnaces.
- Treatment of effluent before discharge.

5. Are there any specific safety or operational considerations that you wish to be met before the project is implemented?

- Improve roads.
- Collaboration with farmers to avail cane.

6. What are your additional comments on the proposed project?

N/A

NAME: BENSON KOINI TELEPHONE NO. 0704941588

DATE: 12/8/2024 SIGNATURE

ASSOCIATE DIRECTOR CHIEF
OLDANYATI SUB-LOCATION
P.O. BOX 345 KILGORIS
DATE: 12/8/2024 SIGN.

INSTITUTION (If any): Nil POSITION (If any): Ass. Chief

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY

STAKEHOLDERS OPINION

The Proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Village, Moita Sub Location, Moita Location, Lolgorian Ward, Kereito Division, Transmara South Sub County, Narok County. The Proponent is determined to support Kenya in addressing the recurrent sugar production deficit in the country by proposing to install the factory with a capacity to crush about 1,250TCD of sugarcane per day. The Proponent will rely on the neighbouring farmers for the cane. Pursuant to Section 58 of the Environmental Management and Coordination Act Cap 387 of the Laws of Kenya, the Proponent is carrying out Environmental and Social Impact Assessment (ESIA) Study for the Proposed Sugar Factory.

The ESIA Study process requires stakeholder involvement in providing views, comments and suggestions on the Proposed Sugar Factory works.

It is in this regard, that your views are sought regarding potential environmental and socio-economic impacts that may arise from implementing the above project activities. Your views will be incorporated into the ESIA Report.

1. In your opinion, who stands to gain the most from the implementation of the proposed project? Please explain why.

THE SURROUNDING COMMUNITY

2. What are some of the impacts (social, economic and/or environmental) that you anticipate from the execution of this project? Please list them.

a) Positive impacts

→ Employment

→ Roads

→

b) Negative impacts

AIR POLLUTION

SNR. CHIEF: NDONYO LOCATION
DATE
SIGN 13/08/24
P.O. BOX 1 - 40700 KILGORIS

3. Are there any of the impact(s) identified in *question 2 above* that you think will affect you directly or affect your institution directly? If YES, please explain how you will be affected.

4. What mitigation measures would you recommend for the negative impacts you listed above?

THE COMPANY TO ENCOURAGE TREE PLANTING

5. Are there any specific safety or operational considerations that you wish to be met before the project is implemented?

CARE DEVELOPMENT

6. What are your additional comments on the proposed project?

THE COMPANY IS WELL RECEIVED BY THE COMMUNITY. WISH THEM WELL IN FACILITATION

NAME: SAMUEL O. MUKUI TELEPHONE NO. 0710114430

DATE: 13/08/2024 SIGNATURE

INSTITUTION (If any): INTERIOR POSITION (If any): SNR CHIEF NDONYO LOCATION

SNR. CHIEF: NDONYO LOCATION
DATE
SIGN. 12/08/24
P.O. BOX 1 - 40700 KILGORIS

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY

STAKEHOLDERS OPINION

The Proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Village, Moita Sub Location, Moita Location, Lolgorian Ward, Kerito Division, Transmara South Sub County, Narok County. The Proponent is determined to support Kenya in addressing the recurrent sugar production deficit in the country by proposing to install the factory with a capacity to crush about 1,250TCD of sugarcane per day. The Proponent will rely on the neighbouring farmers for the cane. Pursuant to Section 58 of the Environmental Management and Coordination Act Cap 387 of the Laws of Kenya, the Proponent is carrying out Environmental and Social Impact Assessment (ESIA) Study for the Proponent is carrying out Environmental and Social Impact Assessment (ESIA) Study for the Proposed Sugar Factory.

The ESIA Study process requires stakeholder involvement in providing views, comments and suggestions on the Proposed Sugar Factory works.

It is in this regard, that your views are sought regarding potential environmental and socio-economic impacts that may arise from implementing the above project activities. Your views will be incorporated into the ESIA Report.

1. In your opinion, who stands to gain the most from the implementation of the proposed project? Please explain why.

- The farmers and the entire community who live around.

2. What are some of the impacts (social, economic and/or environmental) that you anticipate from the execution of this project? Please list them.

a) Positive impacts

- Employement of our youth.

b) Negative impacts

- Air pollution

CHIEF : MOITA LOCATION
P.O. Box 1 KILGORIS
Date: 12/8/2024

3. Are there any of the impact(s) identified in *question 2 above* that you think will affect you directly or affect your institution directly? If YES, please explain how you will be affected.

No.

4. What mitigation measures would you recommend for the negative impacts you listed above?

- Installation of Electrostatic precipitated
- Contact Quarry air Quality measurement.

5. Are there any specific safety or operational considerations that you wish to be met before the project is implemented?

- To make sure Covers fire extinguisher
- Collaborate with government security agencies

6. What are your additional comments on the proposed project?

- The priority to local employment.
- Proactive CSR programs.

NAME: Francis Waiyaki TELEPHONE NO. 0723279863

DATE: 12/08/2024 SIGNATURE

INSTITUTION (If any): Investor POSITION (If any): CHIEF

CHIEF : MOITA LOCATION
P.O. Box 1 KILGORIS
Date: 12/8/24

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY

STAKEHOLDERS OPINION

The Proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Village, Moita Sub Location, Moita Location, Lolgorian Ward, Kereito Division, Transmara South Sub County, Narok County. The Proponent is determined to support Kenya in addressing the recurrent sugar production deficit in the country by proposing to install the factory with a capacity to crush about 1,250TCD of sugarcane per day. The Proponent will rely on the neighbouring farmers for the cane. Pursuant to Section 58 of the Environmental Management and Coordination Act Cap 387 of the Laws of Kenya, the Proponent is carrying out Environmental and Social Impact Assessment (ESIA) Study for the Proposed Sugar Factory.

The ESIA Study process requires stakeholder involvement in providing views, comments and suggestions on the Proposed Sugar Factory works.

It is in this regard, that your views are sought regarding potential environmental and socio-economic impacts that may arise from implementing the above project activities. Your views will be incorporated into the ESIA Report.

1. In your opinion, who stands to gain the most from the implementation of the proposed project? Please explain why.

Residents of Kereto Division & Transmara South in extension. Locals have been neglected by others companies & a Local project will bridge the gap.

2. What are some of the impacts (social, economic and/or environmental) that you anticipate from the execution of this project? Please list them.

a) Positive impacts

1. provision employment to locals
2. Ready market for cane
3. Growth of local centers i.e Enemasi and moita

b) Negative impacts

1. Environmental impact
2. Border security challanges

3. Are there any of the impact(s) identified in *question 2 above* that you think will affect you directly or affect your institution directly? If YES, please explain how you will be affected.

1. Border security challanges - The position of the proposed project will be near to Sota - Uganda/Kenya border which has past challanges. The project directors must be in constant communication with local security agencies to ensure no issues arise on the boundary.

4. What mitigation measures would you recommend for the negative impacts you listed above?

1. Proper disposal of bagasse i.e provision of alternative methods of utilizing bagasse
2. Regular consultation with security agencies in handling emerging security challanges
3. Use of modern electrostatic precipitate to ensure clean air is emmitted

5. Are there any specific safety or operational considerations that you wish to be met before the project is implemented?

1. Provision of security lights in the area
2. Establish a fire fighting department
3. Regular consultation with local administration on arising issues

6. What are your additional comments on the proposed project?

1. Priority to locals for employment positions
2. Productive CSR programmes
3. Provision of seed cane and fertilizer to farmers
4. Provision of school fees advance to farmers

NAME: PHILIP NGUMBA TELEPHONE NO. 0717 684370

DATE: 12/08/2024 SIGNATURE

INSTITUTION (If any): INTERIOR POSITION (If any): ACC KERETO DIVISION

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY

STAKEHOLDERS OPINION

The Proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Village, Moita Sub Location, Moita Location, Lolgorian Ward, Kereito Division, Transmara South Sub County, Narok County. The Proponent is determined to support Kenya in addressing the recurrent sugar production deficit in the country by proposing to install the factory with a capacity to crush about 1,250TCD of sugarcane per day. The Proponent will rely on the neighbouring farmers for the cane. Pursuant to Section 58 of the Environmental Management and Coordination Act Cap 387 of the Laws of Kenya, the Proponent is carrying out Environmental and Social Impact Assessment (ESIA) Study for the Proposed Sugar Factory.

The ESIA Study process requires stakeholder involvement in providing views, comments and suggestions on the Proposed Sugar Factory works.

It is in this regard, that your views are sought regarding potential environmental and socio-economic impacts that may arise from implementing the above project activities. Your views will be incorporated into the ESIA Report.

1. In your opinion, who stands to gain the most from the implementation of the proposed project? Please explain why.

Farmers, provision of sugarcane

2. What are some of the impacts (social, economic and/or environmental) that you anticipate from the execution of this project? Please list them.

a) Positive impacts

- Improved local economy
- Local roads improvement
- Infrastructural development
- Employment opportunities

b) Negative impacts

- Agriculture will replace livestock breeding as main economic & cultural activity
- Social conflicts & deterioration of cultural values,

- Deforestation ~~due~~ due to agricultural activities.
- lack of grazing fields.

3. Are there any of the impact(s) identified in *question 2 above* that you think will affect you directly or affect your institution directly? If YES, please explain how you will be affected.

Greatly; destruction of forests will result lack of firewood, herbal medicine.

4. What mitigation measures would you recommend for the negative impacts you listed above?

- Partnering with ~~KeFS~~ KEFRI for re-afforestation exercises.
- Enhance livestock breeding approaches & methodology to meet modern needs.
- Improve on growing/farming livestock feeds.

5. Are there any specific safety or operational considerations that you wish to be met before the project is implemented?

- Installation of a patrol post/police post to enhance security.

6. What are your additional comments on the proposed project?

- Develop CSR programs that focuses on promoting education.
- Provision of clean water to the community.
- Provision of health services to employees & community.

NAME: Benard Nasuuna TELEPHONE NO. 0776639568

DATE: 13/08/2024 SIGNATURE

INSTITUTION (If any): Interior POSITION (If any): Chief Masuuna

MASURURA SUB LOCATION
DATE. 13/08/24
P.O. BOX 1 KILIBERIA

Annex 6: Baseline Environmental Measurements

AMBIENT ATMOSPHERIC QUALITY MONITORING REPORT

ENVIRONMENTAL BASELINE STUDY REPORT FOR AMBIENT ATMOSPHERIC QUALITY MONITORING OF THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY.

PROJECT INFORMATION:

PREPARED FOR:
BHARAT PATEL AND UMANG PATEL,
P.O BOX 19226 - 00501,
NAIROBI, KENYA.

CLIENT ADDRESS:

PREPARED BY:
LAHVENS LIMITED
P.O BOX 34153, 80118.
DESIGNATION LAB REF. NO. NEMA/21/2/LAB77/LLL
EMAIL: lahvens@lahvens.com

TESTING CONSULTANTS:

DOCUMENT ID: 50124-0070A.
TEST DATES: AUGUST 02ND 2024.
(FINAL) REPORT ISSUED: AUGUST 18TH, 2024

DOCUMENT INFORMATION:

DOCUMENT REVIEW PAGE

This Technical report titled ENVIRONMENTAL BASELINE STUDY REPORT FOR AMBIENT ATMOSPHERIC QUALITY MONITORING OF THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY was authored by Lahvens Limited in accordance to the EMC (Air Quality) Regulation 2014, Legal Notice 34.

REVISION HISTORY

03	18-08-2024	Issuance of Final Report
02	09-08-2024	Re-submission to close the given comments and approvals
01	01-08-2024	1st draft issue of the soft copy submitted for review
REV	**DATE**	DESCRIPTION

Accepted by			
Reviewed & Approved by	LOVANS ROBERT SPOO (LABORATORY DIRECTOR) N.E.R. NO.: 7165		18.08.2024
Prepared by	VINCENT AGIN – FIELD ATTENDANT		18.08.2024
	VALENTINE AGUTU - FIELD ATTENDANT		18.08.2024
PROJECT	Name	Signature	Date

DOCUMENT & PROJECT PARTICULARS

DOCUMENT REF: 50124-0070A	CLASSIFICATION: A – UNCLASSIFIED (OPEN REPORT)	CONTRACT NO. AS PER KKJ TOR.	REVISION: 00 FINAL

TEST FIRM CONTACT PERSON: LOVANS SPOO: (254 – 728716948)	PROJECT: THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY	NUMBER OF PAGES: 39

AUTHOR(S): VINCENT OKUMU, VALENTINE AGUTU	QUALITY CONTROLLER: LOVANS ROBERT SPOO

ABSTRACT (ENGLISH TITTLE):
The client Bharat Patel and Umang Patel through the firm of experts Gomake Consultancy Company Limited contracted Lahvens Limited to form part of the Project's Environmental Team (ET). LAHVENS Limited was commissioned to provide consulting services of environmental baseline atmospheric quality concentrations assessment before implementation of the proposed sugar processing factory within Enemasi Area, Moita Sub Location, Moita Location, Lolgorian Ward, Kereto Division, Transmara South Sub County, Narok County.

KEY WORDS:
EBS Air Quality Monitoring and Consultant Reporting.

ABSTRACT (in ENGLISH)	PUBLICATION TYPE: Digital document (pdf)

REVIEW AND CERTIFICATION FROM THE TESTING CONSULTANTS

All work, calculations, other activities, and tasks performed and documented in this report were carried out under my direction and supervision. This test project conforms to the requirements of Lahvens Limited's quality manual and **EMC (Air Quality) Regulation 2014, Legal Notice 34.**

Team Leader: VALENTINE ODUOR

Signature:

Date: 18.08.2024

I have reviewed all testing details, calculations, results, conclusions and other appropriate written material contained herein, and hereby certify that the presented material is authentic and accurate.

Reviewer: LOVANS ROBERT SPOO

Title: LABORATORY DIRECTOR

Signature:

Date: 18.08.2024

LAHVENS LIMITED 20 AUG 2024 P.O. Box 34153 - 80118, MOMBASA Email:lahvens@lahvens.com

CERTIFICATION FROM THE LEGAL ENTITY OF THE TESTING FACILITY:

I have reviewed the information being submitted in its entirety. Based on the information and belief formed after reasonable inquiry, I certify that the statements and information contained in this submittal are true, accurate and complete.

_____ _____

Signature Date

_____ _____

Name Printed Tittle

_____ _____

Company Name Company stamp

LAHVENS LIMITED 20 AUG 2024 P.O. Box 34153 - 80118, MOMBASA Email:lahvens@lahvens.com

EXECUTIVE SUMMARY

Lahvens Limited, a NEMA designated laboratory, carried out the baseline ambient atmospheric environment survey of the proposed sugar processing factory on plot L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY on the 2nd August 2024. Atmospheric Environment survey was conducted to determine the EXISTING (Do minimum) air pollution around the proposed project for Environmental, Sustainability, Health, Safety and compliance purposes. Air quality remains a valued component in this environmental assessment because of their fundamental significance to the well-being of humans, wildlife and vegetation.

Sugarcane is the main crop cultivated worldwide for sugar production. Therefore, sugarcane is considered the primary tool for economic development and growth. It is a strategic commodity for the most producing countries. Sugarcane is a critical economic crop manufacturing and contributes approximately 80% of the global sugar output (Wang et al., 2020). About 60% to 80% of globally produced sugar is from sugarcane, and the rest comes from sugar beet (Kaab et al. 2019a; Wang et al., 2020; Oliveira et al. 2021).

The sugar industry holds a significant position in Kenya's economic landscape, providing employment opportunities and contributing to the nation's growth. However, like many industrial sectors, sugar production is not immune to environmental challenges. Industrial Air / Atmospheric pollution is generated from anthropogenic activities and originates from raw materials and manufacturing processes. One of the most pressing concerns is air pollution, caused mainly by the combustion of fossil fuels during sugar milling processes. During its operations, air / atmospheric pollution resulting from sugar industry activities not only deteriorates the air quality around sugar mills but also contributes to global environmental issues, such as climate change and acid rain. Moreover, prolonged exposure to air pollution poses severe health risks to nearby communities and the workforce.
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.
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 hence the need for baseline air quality monitoring and factory operational monitoring.

The objectives of environmental atmospheric baseline monitoring therefore will be as follows;

- To monitor the existing state of atmospheric air quality environment at predetermined survey locations of the proposed site before any construction and implementation of related works.
- The results of these tests shall be used to demonstrate compliance with a set of emission concentration limit values for prescribed pollutants as specified in the EMC (Air quality) regulations 2014 during licensing and continuous assessments.
- Report the qualitative and quantitative findings of the survey in a report that will also be used as part of a Comprehensive Baseline Study (CBS) of the proposed Project

Clean air is essential to human health and ecosystems. Breathing clean air can lessen the possibility of disease from stroke, heart disease, lung cancer as well as chronic and acute respiratory illnesses such as asthma. Lower levels of air pollution are better for heart and respiratory health both long and short-term. Ensuring clean air is achieved throughout the project life cycle begins with the monitoring and documentation of existing atmospheric environment.

The Proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Area, Moita Sub Location, Moita Location, Lolgorian Ward, Kereto Division, Transmara South Sub County, Narok County, on GPS coordinates of latitude 1°7'30.9324" S and longitude 34°41'29.88024" E. The Proponent is determined to support Kenya in addressing the recurrent sugar production deficit in the country by proposing to install the factory with a capacity to crush about 1,250TCD of sugarcane per day.

This Environmental Baseline Study is designed to characterize the atmospheric resources at the proposed site prior to establishment of the proposed sugar factory. EBS will provide a benchmark and reference against which to compare the environmental conditions influenced by the construction, operation and closure phases of the sugar factory. The information will be used to assess the effectiveness of any proposed mitigation measures and to implement adaptive management, if need be.

The environmental baseline study will collect, assess, and interpret enough chemical atmospheric information to: support the characterization of the atmospheric resource; enable determination of possible impacts; help predict the significance of impacts and the effectiveness of any proposed mitigation; establish thresholds for indicators of ecosystem health; and facilitate the design of monitoring programs.

Well-developed EBS often alleviate heightened perceived concerns within the community during the initial phases of any proposed development, before issues become a serious risk to the project. EBS also creates reassurance in the minds of the public and jurisdictional decision makers that key environmental issues have been identified and will be monitored and mitigated, during and after the project is approved. EBS monitoring can be looked at as an early warning system of impacts that could potentially affect the environment during the project operation phase and long after the project is decommissioned.

Atmospheric environment has been selected as a valued component because of their fundamental significance to the well-being of human health, flora and fauna health. Environmental Baseline Study is a significant component of monitoring programs for some successful development activities. This Baseline Report forms part of a Comprehensive Baseline Study (CBS) of the proposed Project. The CBS is being prepared as part of an environmental Social Impact assessment (ESIA) and approval process.

It is important to accurately determine prevailing air quality conditions against which predicted effects can be gauged and assessed for any environmental effects' assessment.
Ambient air quality survey for this study consists of **four** representative monitoring locations. Information for the report is presented based on air monitoring completed for 8-hour weighted average per locale. For the purpose of the baseline investigation, monitoring of air pollutants was achieved on the 02nd day of August 2024 and thereafter the results were compared against the guidelines and standards while attention given to relevant referencing sites of similar nature.
Ambient air quality data were obtained from a validated and approved air quality monitoring program.

Ambient air quality data were obtained from a validated and approved air quality monitoring program. Mobile and active monitoring was done by use of real time equipment AQM-09 which integrates the main ambient gases and meteorological parameters and particulate counter meter. Temperature is measured by way of a highly accurate Air Chip 3000 while humidity is measured using a capacitive humidity sensor (accuracy < 0.8 % / 0.1 K). The gas detector and particulate matter meters were mounted at about 1 – 2 M above the ground surface. The duration information was used to calculate the gas / pm concentrations.

FIELD NOTES AND OBSERVATIONS:

Ambient air quality measurements were taken for short term exposure levels. It should however be noted that this exercise is only applicable to the time period when sampling took place and does not take into account seasonal and other local various that might occur during other months and times. However, it is still a good general overview of the existing air quality environment.

Sensitive receptors:

The proposed site is surrounded by sugarcane farmlands to the South, West and East and neighbors' Enemasi primary school, Enemesi market centre, residential establishments and Kenye Menolight church all within 2km to the North of the proposed sugar factory.

Potential Pollution causes;

From the site visits and background site description, the following sources have been identified as potential pollution causes at the proposed site;

Exhaust gases:

The survey location is accessible to sugarcane trucks, motor vehicles and motor cycles that utilize diesel and petrol. Vehicle and motorcycle exhausts contain a number of pollutants including carbon dioxide (CO_2), carbon monoxide (CO), hydrocarbons, oxides of nitrogen (NO_x), sulphur and PM_{10}. The quantity of each pollutant emitted depends upon the type and quantity of fuel used, engine size, speed of the vehicle and abatement equipment fitted. Once emitted, the pollutants are diluted and dispersed in the ambient air.

Vehicular movement;

Re-suspension of roadside dust from movement of vehicles resulted in generation of relatively higher fraction of finer dust ($PM_{2.5}$). Some fugitive atmospheric dust arose from the mechanical disturbance of granular soils materials exposed to the air from motor vehicle / cycle movement. Pulverization and abrasion of surface materials by application of vehicular mechanical forces generate substantial amount of dust.

Air Quality Survey Conclusions:

Baseline Atmospheric Environment Monitoring was conducted to characterize the existing environment before implementation (DO MINIMUM) of the proposed sugar factory. The conclusions below were drawn from the exercise conducted on the 02nd August 2024.

Gaseous Parameters:

All gaseous parameters (carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone and total volatile organic compounds) were measured and quantified at all the four survey locations.

Before the project implementation of the proposed sugar factory, all measured gaseous parameters COMPLIED with the EMC (Air quality) regulations 2014 limits.

The ambient air quality data (gaseous) measured around the monitoring locations are considered to be within a typical range of emissions for such neighborhood.

The findings of the gaseous monitoring program indicate that the air quality at the proposed sugar factory is generally good before commissioning of the project. All pollutants measured are at levels that doesn't pose Environmental, Sustainability, Health, Safety, Climate and compliance concerns.

When the project related activities will begin, construction practices and factory operations must be put in place to control and manage gaseous pollutants to levels that do not surpass the regulated limits.

Meteorological Parameters:

The monitoring locations in general provided standard atmospheric environment before project implementation due to the combination of good climate and ambient conditions. Weather and Climatic conditions at proposed sugar factory site provided good dispersion of air contaminants.

Particulate Matter (PM_{10} and $PM_{2.5}$):

Particulate parameters concentrations (PM_{10} and $PM_{2.5}$) were measured and quantified across the survey stations.

Before the project implementation of the proposed sugar factory, all measured particulate parameter concentration levels recorded were within the typical range of emissions for similar neighborhood.

The findings of the monitoring program indicate that the particulate matter atmospheric environment is generally good before the proposed sugar factory implementation. Particulate pollutants measured are at levels that do not Environmental, Sustainability, Health, Safety, Climate and compliance concerns.

When the project related activities will begin, construction practices and factory operations must be put in place to control and manage gaseous pollutants to levels that do not surpass the regulated limits.

Recommendations:

When operations / commissioning take effect, greenhouse gas measurements and sampling should be frequently done in order to build up a robust dust and gaseous management plan.

TABLE OF CONTENTS

LIST OF TABLES

TABLE OF FIGURES

DEFINITIONS.

Table 1: List of acronyms

µg/m^3	Microgram per cubic meter
AAQTL	Ambient Air Quality Threshold Limits
AQG	Air Quality Guidelines
CBS	Comprehensive Baseline Study
CO	Carbon monoxide
CO_2	Carbon dioxide
EA	Environmental Audits
EIA	Environmental Impact Assessment
EMC	Environmental Management and Coordination
EPA	Environmental Protection Authority
GPS	Geographic Positioning System
hpa	Hectopascal
Km/hr	Kilometer per hour
mg/m3	Milligram per cubic meter
NEMA	National Environment Management Authority
NO_x	Oxides of Nitrogen
NO_2	Nitrogen dioxide
PM_{10}	Particulate matter (<10 microns)
$PM_{2.5}$	Particulate matter (<2.5 microns)
SO_2	Sulfur dioxide
QAQC	Quality Assurance / Quality Control
TVOC	Total volatile Organic compounds
TWA	Time Weighted Average
WB	World bank
WHO	World Health Organization
µg/m^3	Micro gram per cubic meter
VOCs	Volatile organic compounds

1. INTRODUCTION

1.1. Project Summary and Objectives

Lahvens Limited, a NEMA designated laboratory, carried out the baseline ambient atmospheric environment survey of the proposed sugar processing factory on plot L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY on the 2nd August 2024. Atmospheric Environment survey was conducted to determine the EXISTING (Do minimum) air pollution around the proposed project for Environmental, Sustainability, Health, Safety, climate and compliance purposes. Air quality remains a valued component in this environmental assessment because of their fundamental significance to the well-being of humans, wildlife and vegetation.

Sugarcane is the main crop cultivated worldwide for sugar production. Therefore, sugarcane is considered the primary tool for economic development and growth. It is a strategic commodity for the most producing countries. Sugarcane is a critical economic crop manufacturing and contributes approximately 80% of the global sugar output (Wang et al., 2020). About 60% to 80% of globally produced sugar is from sugarcane, and the rest comes from sugar beet (Kaab et al. 2019a; Wang et al., 2020; Oliveira et al. 2021).

The sugar industry holds a significant position in Kenya's economic landscape, providing employment opportunities and contributing to the nation's growth. However, like many industrial sectors, sugar production is not immune to environmental challenges. Industrial Air / Atmospheric pollution is generated from anthropogenic activities and originates from raw materials and manufacturing processes. One of the most pressing concerns is air pollution, caused mainly by the combustion of fossil fuels during sugar milling processes. During its operations, air / atmospheric pollution resulting from sugar industry activities not only deteriorates the air quality around sugar mills but also contributes to global environmental issues, such as climate change and acid rain. Moreover, prolonged exposure to air pollution poses severe health risks to nearby communities and the workforce.
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.
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 hence the need for baseline air quality monitoring and factory operational monitoring.

The objectives of environmental atmospheric baseline monitoring therefore will be as follows;

- To monitor the existing state of atmospheric air quality environment at predetermined survey locations of the proposed site before any construction and implementation of related works.
- The results of these tests shall be used to demonstrate compliance with a set of emission concentration limit values for prescribed pollutants as specified in the EMC (Air quality) regulations 2014 during licensing and continuous assessments.
- Report the qualitative and quantitative findings of the survey in a report that will also be used as part of a Comprehensive Baseline Study (CBS) of the proposed Project

Clean air is essential to human health and ecosystems. Breathing clean air can lessen the possibility of disease from stroke, heart disease, lung cancer as well as chronic and acute respiratory illnesses such as asthma. Lower levels of air pollution are better for heart and respiratory health both long and short-term. Ensuring clean air is achieved throughout the project life cycle begins with the monitoring and documentation of existing atmospheric environment.

1.2. Project Description;

The Proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Area, Moita Sub Location, Moita Location, Lolgorian Ward, Kereto Division, Transmara South Sub County, Narok County, on GPS coordinates of latitude 1°7'30.9324" S and longitude 34°41'29.88024" E. The Proponent is determined to support Kenya in addressing the recurrent sugar production deficit in the country by proposing to install the factory with a capacity to crush about 1,250TCD of sugarcane per day.

1.3. Appraisal Framework Requirements

Under the Second Schedule of the Environmental Management and Coordination Act (EMCA), Cap 387 of the Laws of Kenya, the project is categorized as a High Risk and thus should undergo Environmental and Social Impact Assessment (ESIA) Study process.

Air quality monitoring is enshrined in the environmental Management Coordination (Air quality) regulations 2014 framework legal notice 34. According to EMC (Air quality) regulations 2014 framework legal notice 34 under preliminary, the interpretation of *"monitoring" means any periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements or pollutant levels in various media or in humans, animal, and other living things*.

The Constitution of Kenya provides that *"every person has a right to a clean and healthy environment and this includes the right to have the environment protected for the benefit of present and future generations."* The prevention of atmospheric pollution is recognized as a component of a clean and healthy environment. All development therefore that are proposed to be established should comply with this provisions when their operational phase commences. It is essential therefore to take note through measurement the current / existing air quality conditions before implementation of the proposed project to justify during operations that the environmental media / parameter was not deteriorated as a consequence of the project implementation. Once the baseline values are determined, the industries are then allowed to operate in a manner that does not cause pollution, that might not lead to injury of the body and disruption of peace and comfort enjoyed by the employees and workers in the industrial areas. It is for this reason that there is a need to regulate the levels of air emissions. These regulations are set out by the National Environmental Management Authority (NEMA) to protect people from air pollution and odor.

Environmental Management Coordination (Air quality) regulations 2014 framework legal notice 34, PART XIII-MISCELLANEOUS – section 75 states that *"The Authority may in consultation with the relevant lead agencies establish **baseline levels of priority air pollutants set out in the Second Schedule***.

In addition, Environmental Audit is required for all existing projects in compliance with Section 54 (A)(2) of the Environmental Impact Assessment (EIA) regulations, 2014 (as amended), promulgated under the National Environmental Management Act, 1998 (act No. 107 of 1998; NEMA). Air quality monitoring is captured as an environmental aspect that needs to be monitored under the Environmental Monitoring and Management plan (EMMP).

According to the EMC (IMPACT ASSESSMENT AND AUDIT) regulations 2003 framework legal notice 101 PART IV, THE ENVIRONMENTAL IMPACT ASSESSMENT STUDY REPORT section 18 which states that *(1) A proponent shall submit to the Authority, an environmental contents of impact assessment study report incorporating but not limited to the environmental following information; – (b) a concise description of the national environmental legislative and regulatory framework, **baseline information.*** PART VI -

MISCELLANEOUS PROVISIONS section 43 (2) states that *the proposed policy, programme or plan specified in this regulation shall state – (d) an environmental analysis covering: (i**) baseline information focusing on areas potentially affected***.

The client in adhering to the above extracts and as part of this authorization process contracted a lead expert, Gomake Consultancy Company Limited to carry out the ESIA study in August 2024. The lead expert of the consultancy firm commissioned LAHVENS Ltd to form the Project's Environmental Team (ET). Lahvens Limited were responsible to provide consulting services of existing atmospheric concentrations / environment before implementation of the proposed project.

1.4. Scope of Baseline Air Quality Assessment;

The baseline air quality report includes the National and local assessments. At the National scale the assessment considers the total mass emission of general pollutants associated with construction and operational activities. These are sulfur dioxide (SO_2), Nitrogen oxide (NO_x), Ozone (O_3), Particulate Matter (PM_{10} and $PM_{2.5}$) – particles with aerodynamic diameters of less than 10 and 2.5 microns respectively. Background information on these pollutants and why they are of concern is summarized in section 2 'CONTEXT OF THE AIR QUALITY & MONITORING NETWORK'. The current concentrations of these pollutants are at risk of exceeding their respective Air Quality Limit Values during construction, commissioning and decommissioning phases. The estimates of the existing concentrations will be measured and compared to any relevant existing information and when the project commences, will be used as the background data. Relevant available information related to the pre-development ambient air concentration in the environment was looked into while identifying the major existing air emission sources in the environment and the existing sensitive pollution areas in the environment.

1.5. Terms of Reference

As part of the Terms of Reference (ToR), ambient air quality measurements were undertaken in compliance with the EMC (Air quality) regulations 2014 framework legal notice 34.
The following forms the TOR of the air quality survey:

- Review of the legal context relating to air pollutants;
- Evaluation of site meteorology;
- Monitoring of background air quality:

  Particulate Matter (PM) - particulate matter with aerodynamic diameter less than 10 microns and 2.5 microns (PM_{10} and $PM_{2.5}$).

  Gases - sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and carbon dioxide (CO_2) Total Volatile Organic Compounds (TVOC) and Ozone (O_3).

1.6. Justification of EBS

This Environmental Baseline Study is designed to characterize the atmospheric resources at the proposed site prior to establishment of the proposed sugar factory. EBS will provide a benchmark and reference against which to compare the environmental conditions influenced by the construction, operation and closure phases of the sugar factory. The information will be used to assess the effectiveness of any proposed mitigation measures and to implement adaptive management, if need be.

The environmental baseline study will collect, assess, and interpret enough chemical atmospheric information to:

a. support the characterization of the atmospheric resource;
b. enable determination of possible impacts;
c. help predict the significance of impacts and the effectiveness of any proposed mitigation;
d. establish thresholds for indicators of ecosystem health; and
e. facilitate the design of monitoring programs.

Well-developed EBS often alleviate heightened perceived concerns within the community during the initial phases of any proposed development, before issues become a serious risk to the project. EBS also creates reassurance in the minds of the public and jurisdictional decision makers that key environmental issues have been identified and will be monitored and mitigated, during and after the project is approved. EBS monitoring can be looked at as an early warning system of impacts that could potentially affect the environment during the project operation phase and long after the project is decommissioned. Atmospheric environment has been selected as a valued component because of their fundamental significance to the well-being of human health, flora and fauna health. Environmental Baseline Study is a significant component of monitoring programs for some successful development activities. This Baseline Report forms part of a Comprehensive Baseline Study (CBS) of the proposed Project. The CBS is being prepared as part of an environmental Social Impact assessment (ESIA) and approval process.

2. CONTEXT OF THE AIR QUALITY & MONITORING NETWORKS

Clean air is essential to human health and ecosystems. Five categories of general pollutants were measured at the monitoring networks at the proposed site in Transmara, Narok county. The monitored categories of pollutants were sulphur dioxide (SO_2); oxides of nitrogen (NO_x) (which includes nitric oxide (NO) and nitrogen dioxide (NO_2)); carbon monoxide (CO); Total Volatile Organic Compounds (TVOC); ozone (O_3); particulate matter (PM) (which includes particles less or equal to than 2.5 microns ($PM_{2.5}$), particles less than or equal to 10 microns (PM_{10}). The EB study includes monitoring over a 4-hour period for the above pollutants.

Sugar factory Construction, demolition and operational works deteriorate air quality in three main ways: **Dust nuisance**. The circulation of machinery, demolition operations or the loading and unloading of materials release suspended particles (PM10, PM2.5 and PM1) that can cause health risks when inhaled, especially among the most vulnerable groups of people; **Atmospheric emissions** from machinery and the incineration equipment; Machinery on a construction site generates noise, dust and gases such as NOx or CO**. Transport of construction materials** - the handling of construction materials also contributes to higher pollution levels, especially in the case of particulate matter.

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 from a sugar factory can be grouped into three categories namely:

- Point Source - boilers;
- 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. Dust emission is likely to occur during demolition of any existing structures and site clearance, excavation and spreading of top soil during construction of the proposed sugar factory especially if the activities are taking place during dry seasons. However, there will be very small possibility of particulate matter (PM) suspended and settleable particles affecting the site workers and even neighbors health, since construction method of minimum excavation and nil cart away of soil will be applied and only residual material and debris carted away.

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 hence the need for baseline air quality monitoring and factory operational monitoring. Air pollution from construction is a real challenge due to the various sources and emanation of different pollutants. In this respect, particulate matter is one of the most harmful emissions. Their hazardous nature derives from their size, for example, particles ranging from 10 microns (PM_{10}) to 1 micron (PM_1). In addition to this characteristic, sometimes the nature of the

particle must also be taken into account, since, in the case of asbestos, silica or wood, it can represent an added risk factor. However, detailed analyses are necessary to ascertain this.

The environmental impact of sugar construction site and sugar factory operations are wide-ranging. In this sense, air quality may be relegated to the background. It is, after all, a temporary condition, generally limited to the period during which the works are being carried out. But this is no excuse for not adopting measures to help reconcile environmental protection and construction or demolition activities. Thus, it should be noted that the environmental impact of construction on the atmosphere can manifest itself in different ways:

- Ecological impacts: pollutants from construction activities can alter the quality of water resources. But they can also affect the vegetation and animal species that make up ecosystems and upset the ecological balance.
- Impact on public health: the emissions mentioned in the previous section may have a significant impact on local communities and inhabited areas in the vicinity of the construction site.
- Climate connection: the soot or black carbon which is part of fine particulate matter (PM2.5) absorbs sunlight, thus contributing to global warming.

Air in its purest state is best suited for the essential task sustaining life. Air pollution is a major environmental risk to health. Air pollution can trigger heart attacks or strokes. In fact, one in three persons who have heart disease can be potentially worsened by air pollution. Breathing clean air can lessen the possibility of disease from stroke, heart disease, lung cancer as well as chronic and acute respiratory illnesses such as asthma. Lower levels of air pollution are better for heart and respiratory health both long- and short-term.

2.1. Oxides of Nitrogen (NOx)

In a combustion process, NOx is produced through three mechanisms, namely thermal NOx, fuel NOx and prompt NOx. Thermal NOx is the primary source of NOx and is formed as a high temperature dissociation and subsequent reaction of nitrogen (N2) and oxygen (O2). It is produced in the hottest part of the flame and its formation increases exponentially with the flame temperature. The control of thermal NOx is generally achieved through reducing the flame temperature, reducing the residence time, or by operating under fuel rich conditions. Fuel NOx is formed by the reaction of nitrogen compounds chemically bound in liquid or solid fuels with oxygen in the combustion air. In the combustion of such fuels, fuel NOx can account for up to 50% of the total NOx emissions. Prompt NOx is formed from the rapid reaction of atmospheric nitrogen with hydrocarbon radicals, and typically under partially fuel-rich conditions. It can be reduced through combustion staging or by operating under highly oxidizing combustion conditions. NO2 is the primary component of concern in NOx emissions. Generally, up to 10% of the NOx emitted from the combustion of fuel is emitted as NO2. The remainder is emitted as NO, which is subsequently converted to NO2 in reactions with various oxidants and ozone as the plume is transported downwind from the source. The rate of NO2 formation varies with time of day, season, temperature, wind speed, solar radiation and the availability of oxidants to help drive the chemical reactions.

NO2 is a reddish-brown gas with a pungent odour, which upon reaction with other atmospheric compounds, becomes a major contributor to smog, acid rain, inhalable particulates and reduced visibility. At significant levels and exposure, inhalation may result in irritation and burning to the skin and eyes, nose and throat. Prolonged exposure may result in permanent lung damage.

2.2. Carbon Monoxide (CO)

Carbon monoxide is a colorless and odorless gas which reduces the delivery of oxygen to the body's organs. For those with heart disease, exposure to low doses can result in chest pain. For healthier people, exposure to higher levels affects the central nervous system.

Incomplete oxidation of fuel results in the formation of CO. In simplified terms, the generic stoichiometric combustion equation for complete combustion is:

$$HC + O2 \rightarrow CO2 + H2O$$

However, if sufficient oxygen (O2) is not present to complete the combustion of the hydrocarbon fuel (HC), then the oxidation to carbon dioxide (CO2) and water (H2O) is not completed and hence CO is emitted.

2.3. Sulphur Dioxide (SO2)

Levels of sulphur dioxide (SO_2) in ambient air are typically directly related to the concentration of sulphur in fuel and the quantity of fuel being combusted. Upon combustion, approximately 98% of the sulphur in the fuel will oxidize to form SO_2, with the remaining 2% producing sulphur trioxide (SO_3). The emitted SO2 can also further oxidize to SO_3 and react with water to produce acid rain in the form of sulphuric acid (H_2SO_4). Short-term exposures to SO_2 have shown adverse respiratory effects including bronchoconstriction and increased asthma symptoms.

2.4. Ozone (O_3)

Ground-level ozone is not directly emitted into the air, but rather is formed by chemical reactions between NOx and volatile organic compounds (VOCs) in the presence of ultraviolet (UV) radiation. Ozone is a primary component of smog.

Breathing ozone can trigger a variety of health problems including chest pain, coughing, throat irritation, and congestion. It can also worsen bronchitis, emphysema, and asthma as well as reduce lung function and inflame the linings of the lungs, permanently scarring lung tissue under repeated exposure.

2.5. Particulate Matter (PM)

Particulate matter is the term for particles and aerosols found in the air, including dust, dirt, soot, smoke, and liquid droplets, and can be large and dark enough to be seen with the naked eye or so small that they can only be detected with an electron microscope. Particulate matter is one of the most harmful emissions. Their hazardous nature derives from their size, for example, particles ranging from 10 microns (PM_{10}) to 1 micron (PM_1). In addition to this characteristic, sometimes the nature of the particle must also be taken into account, since, in the case of asbestos, silica or wood, it can represent an added risk factor. However, many manmade and natural sources emit particulate matter directly while others emit gaseous pollutants that react in the atmosphere to form particulate matter. The size of the particulate has important health considerations. Particulate matter less than or equal to 10 microns in diameter (PM_{10}) poses a health concern because it can be inhaled into and accumulate in the respiratory system. Particulate matter less than or equal to 2.5 microns in diameter (PM2.5) is believed to pose the greatest health risks as it can lodge deeply into the lungs; a $PM_{2.5}$ particles is approximately $1/30^{th}$ the average width of a human hair. Typically, these smaller particles are suspended in the air for long periods of time. Total Particulate Matter (TPM) is the term applied to any particle suspended in the atmosphere, but depending on the monitoring method, is typically limited to particulate matter less than 44 microns. Particulate larger than 10 microns is typically associated with a nuisance issue rather than a health issue.

Table 2: Summary of impacts of emissions on public health, Ecological impacts and Climate connection:

Pollutant	Source	Primary effects
Sulphur Dioxide (SO_2)	Combustion of sulphur containing fossil fuels for: ▪ Construction equipment ▪ Vehicle ▪ Diesel engine	▪ Plant injury ▪ Reduced visibility ▪ deterioration of metals, textiles, leather, finishes and coatings ▪ aggravation of respiratory diseases(asthma, emphysema) ▪ irritation
Nitrogen Oxides (NOX)	Combustion of fossil fuel from: ▪ Construction equipment ▪ Vehicles ▪ Diesel generators	▪ Aggravation of respiratory illness ▪ Reduced visibility ▪ Reduced plant growth ▪ Formation of acid rain
SPM (Dust)	▪ Construction activities ▪ Combustion of fossil fuels for construction equipment, vehicle and diesel generators.	▪ 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 ▪ Construction equipment ▪ Vehicles ▪ Diesel Generators	▪ Plant injury ▪ Reduced visibility ▪ Deterioration of metals, Textiles, Leather, finishes, coatings ▪ Irritation of eyes ▪ aggravation of respiratory diseases(asthma, emphysema)

Even then, dust and exhaust gas emissions from construction machineries will be small and temporary. Therefore, no adverse impacts, except for those close to the construction site, are likely to be affected. On completion of construction, the adverse impacts of SPM, RPM and engine emissions on ambient air close to the construction site will be eliminated.

3. LEGISLATIVE AND ENVIRONMENTAL POLICY FRAMEWORK

3.1. Environmental Management Coordination (Air Quality) regulations 2014

The Kenya Air Quality Regulations 2014 impose limit values as detailed in the SPECIAL ISSUE Kenya Gazette Supplement No.41, Legislative Supplement No.15, Legal Notice No. 34, compliance with the objectives (prevention, control and abatement of air pollution to ensure clean and healthy ambient air) is a legal requirement in Kenya.

Part 65 and 66 details the requirements on monitoring and assessment of ambient air quality, part 85 shows the need for establishment of baseline levels of priority air pollutants listed in the first schedule of the guideline and included PM_{10}, $PM_{2.5}$, SO_2, NO_2, 0_3 and CO. Statutory requirements relevant to this study FIRST SCHEDULE are detailed in Table 2 below:

Table 3: Ambient Air Quality Tolerance Limits

	Pollutant	Time weighted Average	Industrial area	Residential, Rural & Other area	Controlled areas***
1.	Respirable particulate matter (<10 µg/m^3) (RPM)	24 hours**	150µg/Nm^3	100µg/Nm^3	75µg/Nm^3
2.	$PM_{2.5}$	24 hours	75 µg/m^3	-	-
3.	Sulphur dioxide	Instant Peak		500 µg/m^3	-
4.		Instant peak (10min)		0.191 ppm	-
5.	Non-methane hydrocarbons	instant Peak	700ppb	-	-
6.	Total VOC	24 hours**	600 µg/m^3	-	-
7.	Oxides of Nitrogen	24 hours	100 µg/m^3	0.1 PPM	-
8.		Instant peak		0.5 PPM	-
9.	Nitrogen dioxide	One hour		0.2 ppm	-
		Instant peak		0.5 ppm	-
10.	Carbon monoxide / carbon dioxide	One Hour	10 mg/m^3	4.0 mg/m^3	10 mg/m^3
11.	Ozone	24-hour	200 µg/m3	0.12 PPM	-

Extract from the Ambient EMC Air Quality regulations, 2014 (Tolerance Limits)

4. MONITORING METHODOLOGY

It is important to accurately determine prevailing air quality conditions against which predicted effects can be gauged and assessed for any environmental effects' assessment.
Ambient air quality survey for this study consists of **four** representative monitoring locations. Information for the report is presented based on air monitoring completed for 4-hour weighted average per locale. For the purpose of the baseline investigation, monitoring of air pollutants was achieved on the 02nd day of August 2024 and thereafter the results were compared against the guidelines and standards while attention given to relevant referencing sites of similar nature.
Ambient air quality data were obtained from a validated and approved air quality monitoring program.

4.1. Baseline Study Area;

4.1.1. Sensitive Receptors

The geographical scope of the baseline assessment is currently defined as the proposed Sugar factory in Moita, Transmara, Narok county boundaries and environs, including potentially high risk zones along the routes of any existing surface access. High risk zones include locations with the potential for exceedance of regulatory standards for the protection of human health and / or **sensitive habitats**, in the initial and / or mature operations years.

The issue of pollutants is particularly pertinent in areas sensitive to change, often referred to as **'sensitive receptors'.** Locations for the protection of human health are areas of long term exposure which are more susceptible and shall be considered to include residential properties, hospitals and schools; whereas locations for the protection of sensitive habitats / ecosystems shall be considered to include statutory designated sites (such as sites of special scientific interest (SSSIs), special areas of conservation (SACs) and special protection areas (SPAs) which contain habitat types that are also sensitive to atmospheric quality changes.

The proposed site is surrounded by sugarcane farmlands to the South, West and East and neighbors' Enemasi primary school, Enemesi market centre, residential establishments and Kenye Menolight church all within 2km to the North of the proposed sugar factory.

Close proximity of the emission source to the 'sensitive receptor' causes poor air quality because there is less opportunity for dispersion of emissions between the source and receptor resulting in greater concentrations of pollutants. Air quality is evaluated by comparing concentrations of pollutants against the EMC (Air Quality) regulations 2014 Legal Notice 34 first schedule of the Ambient Air Quality Tolerance Limits set at locations where exposure harm to human health and ecosystems is thought to occur.

4.1.2. Existing Atmospheric Environment

The topography of the project site is generally flat to gently undulating, with slight slopes that facilitate natural drainage. The predominant land use in the area is sugarcane farming, with both crop and livestock farming being common. The project site is frequented by sugarcane tractors and motorbikes. The main source of existing air pollution is diffuse and fugitive emissions of dust particles and gaseous emissions from the mobile sources. The anthropogenic emission sources directly associated with the proposed project will be the main concern of the appraisal framework and will be emitted from various sources including; mobile sources (personal and commercial vehicles, trucks that will be accessing the site to offload materials during construction, source emissions (generator), other related fugitive and diffuse sources. However, exposure locations will also be influenced by non-related sources including domestic heating around the residential facility.

The emissions concentrations reported herein, will be a combination of the total emissions from the sources and the distance to the receptor which influences the concentrations of pollutants in the air and impacts air quality. As such, the most common ambient atmospheric emission source causing poor air

quality within close proximity to sensitive receptors and the site in general will be diffuse and fugitive emissions as the dominant emission sources.

4.1.3. Monitoring Locations

Baseline atmospheric quality monitoring locations were selected based on the existing facility that could or have the potential to influence the proposed project atmospheric environment. The monitoring locations at the proposed project site were determined at the four project boundaries to the East (PB-1), West (PB-2), North (PB-3) and South (PB-4).

Table 4: Description of the measurement locations

Measurement Sites	Description of monitoring Locations	Dates of sampling
East Project Boundary 1 (EPB-1)	The proposed site is surrounded by sugarcane farmlands to the South, West and East and neighbors' Enemasi primary school, Enemesi market centre, residential establishments and Kenye Menolight church all within 2km to the North of the proposed sugar factory. The topography of the project site is generally flat to gently undulating, with slight slopes that facilitate natural drainage. The predominant land use in the area is sugarcane farming, with both crop and livestock farming being common. The project site is frequented by sugarcane tractors and motorbikes. The main source of existing air pollution is diffuse and fugitive emissions of dust particles and gaseous emissions from the mobile sources. The exposure locations will also be influenced by non-related sources including domestic heating around the residential facility	02ND AUGUST 2024.
West Project Boundary 2 (WPB-2)		02ND AUGUST 2024.
North Project Boundary 3 (NPB-3)		02ND AUGUST 2024.
South Project Boundary 4 (SPB-4)		02ND AUGUST 2024.

4.2. Baseline Air Quality Assessment process

The National and Local baseline assessments have been undertaken following the processes shown in Figure 1 and Figure 2 below.

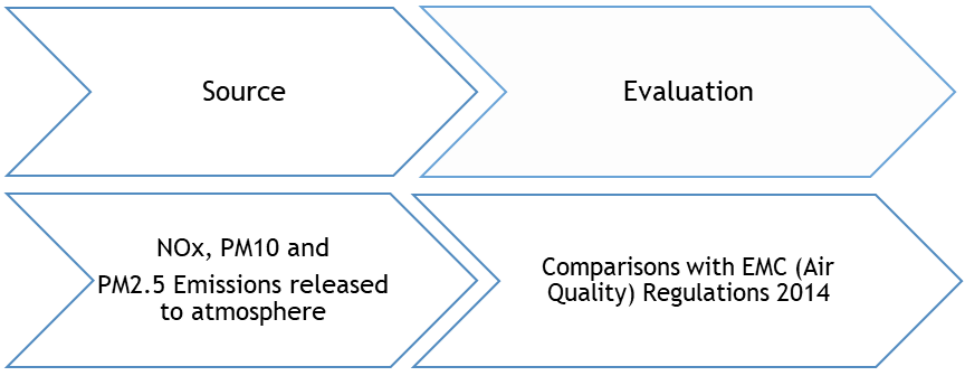


Figure 1: National Baseline Assessment Process

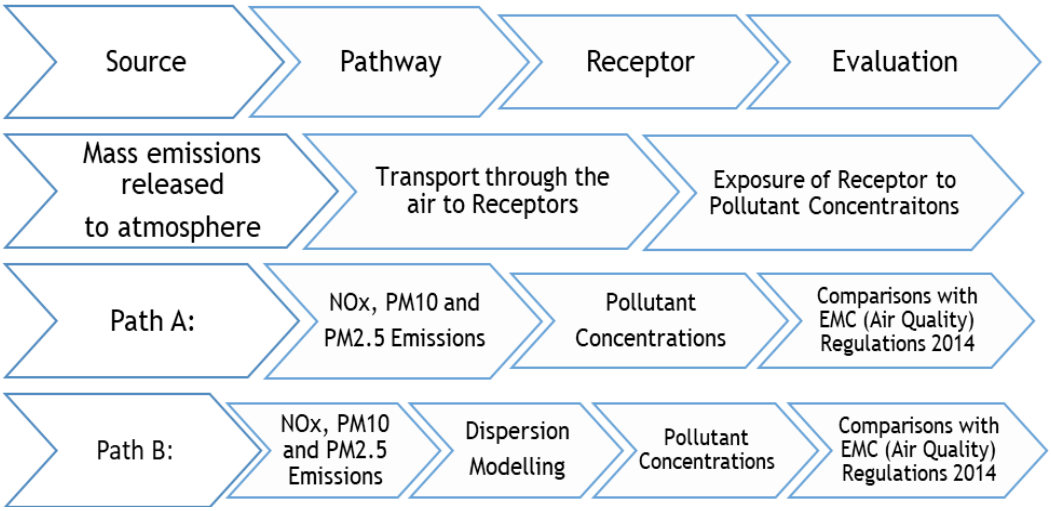


Figure 2: Local / Site Specific Baseline Assessment Process

The local baseline assessment has been undertaken following Process Path A for the first stage assessment.

4.3. Assessment Criteria for gaseous and particulate parameters

Sampling of gases was done using a 24-hour AQM-09 is a device which can monitor the air quality via the value of O_3, SO_2, NO_2, CO, $PM_{2.5}$, PM_{10}, etc. The target value is converted into voltage signal by operational amplifier circuit, and then filtered through high-precision AD data acquisition system. Finally, the gas concentration is calculated by CPU. Particulates mainly use laser scattering method to produce different scattering light according to different particle diameters under laser scattering conditions. The scattered light intensity is collected by a response device, and the particle 4 concentration is obtained after amplification, filtering and AD acquisition. The obtained gas concentration and particulate matter concentration can be displayed on LCD screen in real time, and can also be transmitted to cloud platform or environmental protection platform through GPRS, 4G LTE and other network signals, so as to realize the monitoring of regional environmental quality. The gas meters were mounted at about 1 – 2 M above the ground surface. The results and sampling duration information were used to calculate the gaseous concentrations.

Ongoing atmospheric assessment

4.3.1. Carbon monoxide (CO)

CO monitoring instruments were predominantly gas filter correlation infrared (GFC-IR) absorption analyzers and the electrochemical sensor systems.

Ambient air was continuously sampled using a pump unit and the CO concentration in the sample air was measured by the absorption of infrared radiation at 4.5 to 4.9 nanometers (nm) wavelength. A reference detection system was used to alternately measure absorption due to CO in the ambient air stream and absorption by interfering species. An infrared detector and amplification system produced output voltages proportional to the CO concentration. The concentration was derived from the Beer-Lambert relation:

$$I1 = I0\ e\text{-}alc$$

where the sample was passed through a cell tube of length 'l'. The analyzer alternately measured the absorption I_0 of the air path with no CO present and the absorption I_1 of the ambient sample, with 'a' being the absorption coefficient, to provide the CO concentration, 'c'.

4.3.2. Nitrogen dioxide (NO2)

Nitric oxide (NO) in the sample air stream was reacted with ozone (O_3) in an evacuated chamber to produce activated NO_2:

$$NO + O_3 \rightarrow NO_2 + O_2 \rightarrow NO_2 + O_2 + hv$$

The intensity of the chemiluminescent radiation (hv) produced is measured using a photomultiplier tube (PMT) or photodiode detector. The detector output voltage is proportional to the NO concentration. The ambient air sample is divided into two streams; in one, ambient NO_2 is reduced to NO using a molybdenum catalyst before reaction. The molybdenum converter should be at least 95 per cent efficient at converting NO_2 to NO. This gas stream gives total NOx. The second stream measures NO directly by not passing through the molybdenum converter.

Separate measurements are made of total oxides of nitrogen NOx (= NO + NO_2) and NO. The ambient NO_2 concentration is calculated from the difference (NO_2= NOx – NO). This is an important point to remember because the contaminant of interest (NO_2), is actually measured by inference rather than directly, and the efficiency of the molybdenum converter should be checked on a regular basis.

In a chemiluminescent analyzer, ambient air is drawn through the system via a pump and permapure drier unit. NOx analyzers are equipped with either a single or a double reaction chamber and PMT system. A solenoid valve is used to alternately switch between NO and NOx measurements, typically at 15-second intervals.

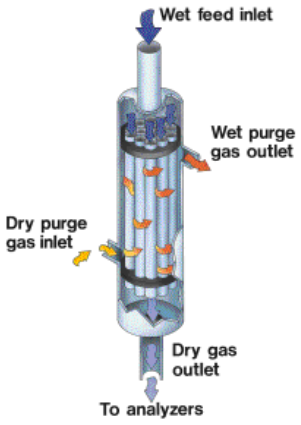


Figure 3: Permapure drier unit

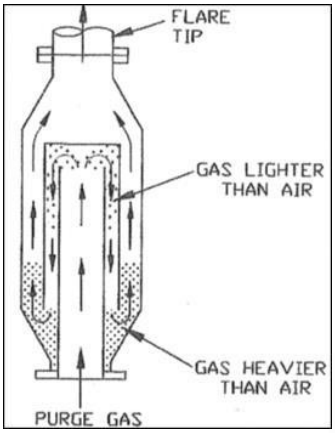


Figure 4: Air purge gas

4.3.3. Sulphur dioxide (SO2)

SO_2 monitoring instruments are predominantly molecular UV fluorescence analyzers. This is the recommended SO_2 monitoring method. UV fluorescence systems operate on the principle that an ambient air sample stream exposed to UV light excites SO_2 molecules in the sample to higher, but unstable, excited states. These excited states decay, giving rise to the emission of secondary (fluorescent) radiation:

$$SO_2 + hv \rightarrow SO_2 \rightarrow SO_2 + hv \text{ (fluorescence)}.$$

The fluorescent radiation is detected by a PMT, causing an output voltage proportional to the SO_2 concentration. A permeable membrane 'kicker' is used to remove interfering hydrocarbons (aromatic hydrocarbons also fluoresce) before reaction. Ambient air is drawn through the system via a pump unit, and the analyzer continuously displays current SO_2 concentrations.

4.3.4. Ozone (O_3)

Ozone was measured using a direct reading using the flame-ionisation detector (FID). In the FID, an organic compound is burned in a hydrogen flame giving rise to ions which are attracted to a collector electrode. The resulting electric current is amplified and recorded. The intensity of the signal depends primarily on the number of carbon atoms of the molecule, but to some extent it is also influenced by the character or structure of the chemical. Therefore, the same number of molecules of two different ozone with the same number of carbon atoms can give rise to two different signals. The FID is very stable.

4.3.5. Total Volatile Organic Compounds (TVOC)

Optical gas detection using absorption spectroscopy is based on the Lambert–Beer law (1,2):

$$I(\lambda)=I_0(\lambda)\exp[-a(\lambda C)\cdot L] \qquad a[\text{cm}^{-1}]$$

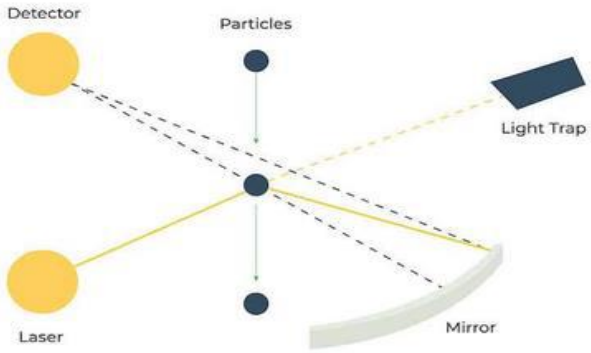
$$I(\lambda)=I_0(\lambda)\exp[-\alpha(\lambda)\cdot C\cdot L] \qquad \alpha[\text{ppm}\cdot\text{cm}^{-1}]$$

where: I—light intensity transmitted by the medium with the gas, I_0—intensity of light incident on the medium, C—concentration, a, α—absorption coefficients, and L—optical path length, gas concentration.

The optical methods for volatile organic compounds detection use its absorption characteristics in the infrared range. The strongest bands occur in the area of deformation vibrations and then valence; they are weaker in the range of overtones.

4.3.6. Total Suspended Particulate matter (TSP, $PM_{2.5}$ & PM_{10}):

AQM 09 is an online particulate monitoring system that measures the concentration of various particulate sizes ranging from 2.5 micron to TSP such as $PM_{2.5}$, PM_{10}, and TSP in the ambient air. The PM sensor works on the principle of laser scattering hence, the active sampling-powered sensor-based air quality monitor. The PM monitor based on the physical principle of light scattering, also known as optical particle counter (OPC), measures dust particles illuminated by laser light at a 90° angle. Whereas, the light scattered from each particle is collected at approximately 90° by a mirror and detected by a photo-diode. This signal is then fed into a multi-channel size classifier where a pulse height analyzer is used to classify each pulse that is proportional to the particle size. As a result, the counts in the channel corresponding to PM2.5 convert to the concentration of $PM_{2.5}$ and same applies to other fractions.



4.4. Tools Equipment and materials used

Below is the equipment used during air monitoring survey:

- Air quality multiparameter meter.
- Geographic Positioning System (GPS)
- Digital camera
- Calibration certificates
- Standard Reference materials & Standard operating procedures
- Equipment manuals.
- Terms of Reference & Maps of the project area

4.5. Monitoring Frequency

Monitoring of air quality test parameters was done for 4 - hours in the study location. Once operations are underway, monitoring of air quality parameters should be tested at 3 months' interval.

4.6. Assumptions

The 8-hour exposure levels of data collection for PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO_2, O_3 and TVOC data collected is considered sufficient to understand the state of atmospheric air quality environment before implementation of the proposed sugar factory.

4.7. Data Validity and Acceptability

All data monitored in the study was taken through data replications and quality assurance procedure to ensure that any anomalous readings or questionable data is not incorporated in the final results.

Elements of this procedure account for:

- Routine calibration and auditing of the analyzers
- Statistical rendering of outliers

5. PRESENTATION, DISCUSSION & CONCLUSION OF THE AIR QUALITY SURVEY RESULTS

5.1. Presentation of Results

5.1.1. Summary of singular Air quality measurements

Table 5: Summary results for air quality and environmental measurements

Monitoring Locations	$PM_{2.5}$ µg/m³	PM_{10} µg/m³	CO mg/m³	SO_2 ppm	NO_2 ppm	NO ppm	O_3 ppm	TVOC µg/m³	HUMIDITY %	TEMPS ^0C
East Project Boundary 1 (EPB-1)	11	20	<0.001	0.015	0.005	0.015	0.012	<0.01	79	29
West Project Boundary 2 (WPB-2)	13	21	<0.001	0.014	0.004	0.015	0.015	<0.01	79	29
North Project Boundary 3 (NPB-3)	10	18	<0.001	0.016	0.003	0.016	0.013	<0.01	79	30
South Project Boundary 4 (SPB-4)	14	21	<0.001	0.018	0.007	0.013	0.011	<0.01	77	31

(Source: Site monitoring in June 2024).

5.1.2. Gaseous parameters

Table 6: Average results for gaseous parameters

Monitoring Locations	*NO_X*		*SO_2*		*CO*		*Ozone*		*TVOC*		*REMARKS*
	Conc. (ppm)	EMC AQR guide 2014 (ppm)	Conc. (ppm)	EMC AQR guide 2014 (ppm)	Conc. (mg/m³)	EMC AQR guide 2014 (mg/m³)	Conc. (ppm)	EMC AQR guide 2014 (ppm)	Conc. (µg/m³)	EMC AQR guide 2014 (µg/m³)	
EPB-1	0.020	0.8	0.015	0.191	<0.001	4.0	0.012	0.12	<0.01	-	Complies
WPB-2	0.019	0.8	0.014	0.191	<0.001	4.0	0.015	0.12	<0.01	-	Complies
NPB-3	0.019	0.8	0.016	0.191	<0.001	4.0	0.013	0.12	<0.01	-	Complies
SPB-4	0.020	0.8	0.018	0.191	<0.001	4.0	0.011	0.12	<0.01	-	Complies

5.1.3. Particulate matter (PM_{10})

Table 7: Results for Particulate matter (<10 microns)

Monitoring Locations	*PARTICULATE MATTER ≤10 (PM_{10})*			
	Sampling time	Concentration ($\mu g/m^3$)	Guideline ($\mu g/m^3$)	Remarks
EPB-1	1 hour	20	-	No 1-Hr guideline for residential, rural and other areas
WPB-2	1 hour	21	-	No 1-Hr guideline for residential, rural and other areas
NPB-3	1 hour	18	-	No 1-Hr guideline for residential, rural and other areas
SPB-4	1 hour	21	-	No 1-Hr guideline for residential, rural and other areas

5.1.4. Particulate matter ($PM_{2.5}$)

Table 8: Results for Particulate matter (<2.5 microns)

Monitoring Locations	*PARTICULATE MATTER ≤2.5 ($PM_{2.5}$)*			
	Sampling time	Concentration ($\mu g/m^3$)	Guideline ($\mu g/m^3$)	Remarks
EPB-1	1 hour	11	-	No 1-Hr guideline for residential, rural and other areas
WPB-2	1 hour	13	-	No 1-Hr guideline for residential, rural and other areas
NPB-3	1 hour	10	-	No 1-Hr guideline for residential, rural and other areas
SPB-4	1 hour	14	-	No 1-Hr guideline for residential, rural and other areas

5.1.5. Environmental parameters

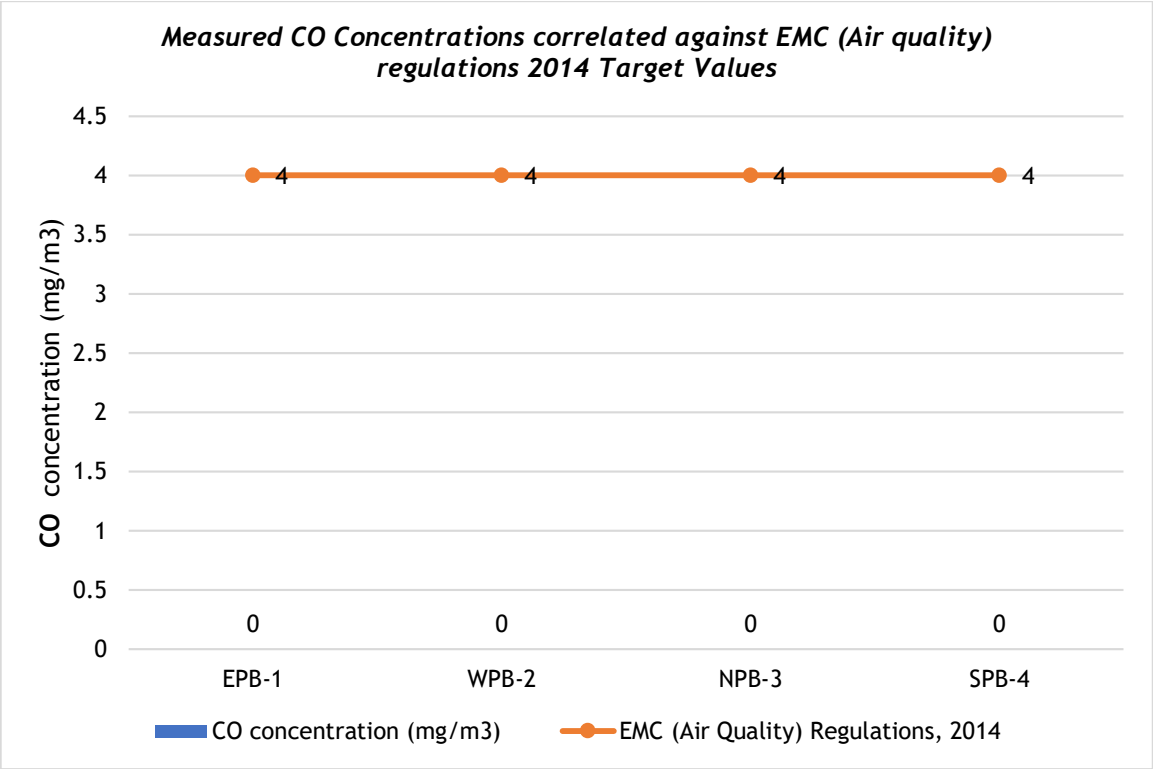
Table 9: Results for Environmental parameters

Monitoring Locations	Environmental parameters				*Remarks*
	Air temps °C	Pressure hPa	Humidity %	Wind Speed km/hr	
EPB-1	29	1001	79	8 km/hr South East wind	Ambient conditions present
WPB-2	29	1001	79	8 km/hr South East wind	Ambient conditions present
NPB-3	30	1001	79	8 km/hr North East wind	Ambient conditions present
MPS	31	1001	77	8 km/hr South East wind	Ambient conditions present
AVERAGES	29.75	1010.0	78.5	8.0 km/hr South East wind	Ambient conditions present

5.2. Discussions of air quality survey results

Air quality survey was completed for 1-hr exposure levels per point as the preferred time weighted averages in order to measure and quantify the air pollutant levels so as to determine the current existing conditions. Results of the gaseous concentrations and particulate parameters were thereafter correlated against the Environmental Management Coordination (Air quality) regulations of 2014 as follows:

5.2.1. Carbon Monoxide



The above combined graph was drawn from statistical analysis for 1-hr monitoring per location of atmospheric Carbon monoxide environment as per the requirement of TOR.

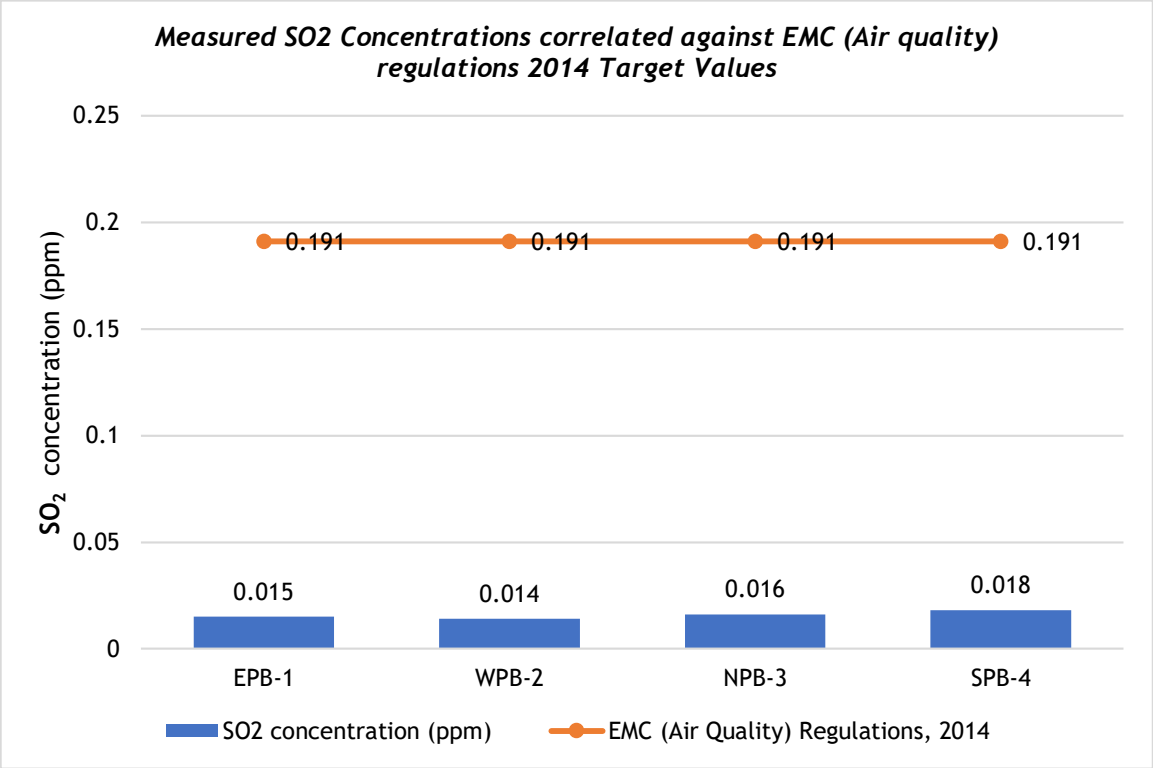
CO average concentration across the monitoring locations for the TWA of 8-hour were below the detection limit (0.001 mg/m^3) of the testing equipment. There was no 1-hour peak exceedance of the AAQTL of 4.0 mg/m^3 thus the frequency of exceedance was zero.

All CO concentrations recorded in the sites BEFORE IMPLEMENTATION OF THE PROPOSED SUGAR FACTORY COMPLIED with the EMC (Air quality) regulations 2014 of 4.0 mg/m^3.

The low carbon monoxide concentration levels do not pose a health concern. Carbon monoxide is a gas formed by the incomplete combustion of fuels containing carbon. The main outdoor source of carbon monoxide is currently motor vehicles, in particular petrol-engine vehicles. The carbon monoxide produced around areas surrounding the sites are quickly converted to carbon dioxide gas.

From the above combined graph results, the levels of CO emitted from the proposed site existing operations does not pose Environment, sustainability, health, safety, climate and compliance concerns to the recipients / receivers around the proposed project site.

5.2.2. Sulfur dioxide



The above combined graph was drawn from statistical analysis for 1-hr monitoring per location of atmospheric sulfur dioxide environment as per the requirement of TOR.

From the above graph, the maximum 1-hour SO_2 average concentration extended to levels 0.018 ppm at South Project Boundary (SPB-4) while the minimum 1-hour SO_2 average concentration extended to levels of 0.014 ppm at West Project Boundary 2 (WPB-2). The average SO_2 concentration at the study area extended to levels of 0.0158 ppm. There was no peak exceedance of the AAQTL of 0.191 ppm thus the frequency of exceedance was zero.

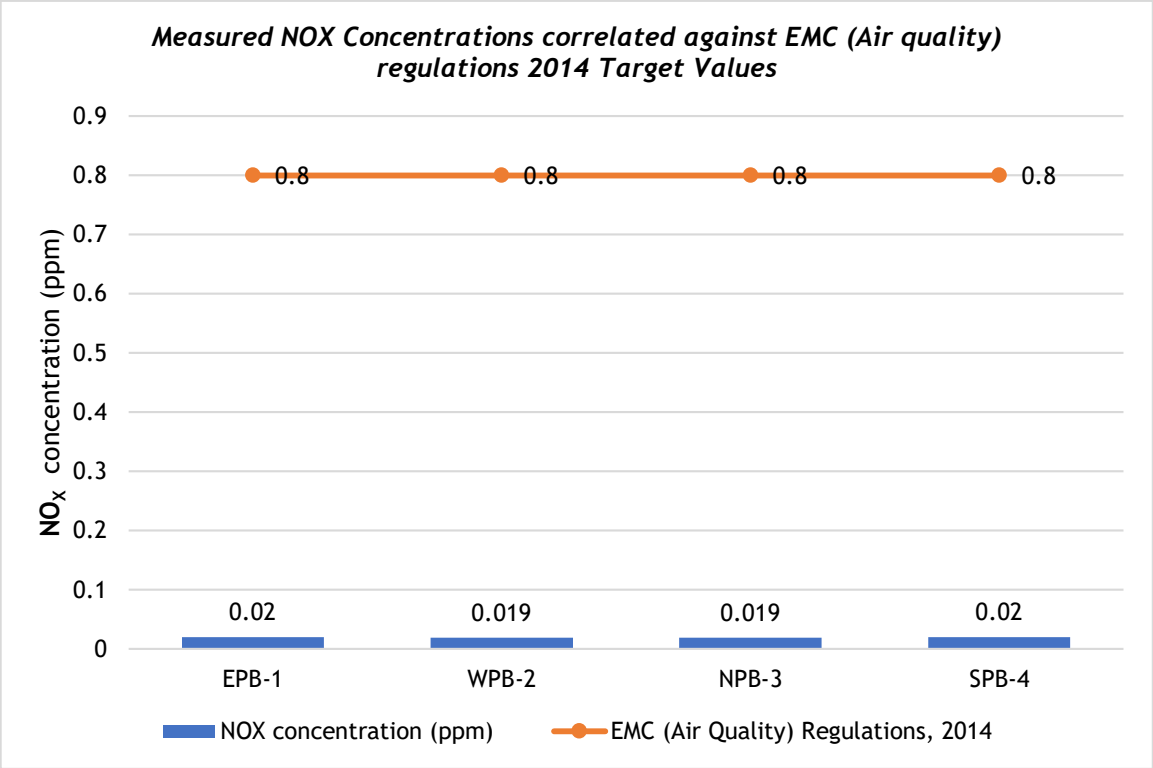
The sulfur dioxide concentrations recorded across all survey locations had concentrations levels within the ambient sulfur dioxide levels of 0.02ppm.

The resultant sulfur dioxide concentrations were correlated with the limit value EMC (Air quality) regulations 2014 maximum limits) for short term exposures. Results showed 100% compliance with the limit values.

Low concentration levels of sulfur dioxide recorded before implementation of the proposed sugar factory does not pose Environment, sustainability, health, safety, climate and compliance concerns.

Fugitive and diffuse sources i.e. sugarcane trucks / motor vehicles / cycles fuel combustion around the project area contribute about 90% of sulfur dioxide at the proposed site.

5.2.3. Nitrogen oxides



The above combined graph was drawn from statistical analysis for 1-hr monitoring per location of atmospheric nitrogen oxides (NO2+NO) environment as per the requirement of TOR.

From the above graph, the maximum 1-hour NO_X concentration extended to levels of 0.020 ppm at East Project Boundary (EPB-1) and South Project Boundary (SPB-4) while the minimum 1-hour NO_X concentration extended to levels of 0.019 ppm West Project Boundary (WPB-2) and North Project Boundary (NPB-3). The average NO_X concentration at the study area extended to levels of 0.0195 ppm. There was no peak exceedance of the AAQTL of 0.8 ppm thus the frequency of exceedance was zero.

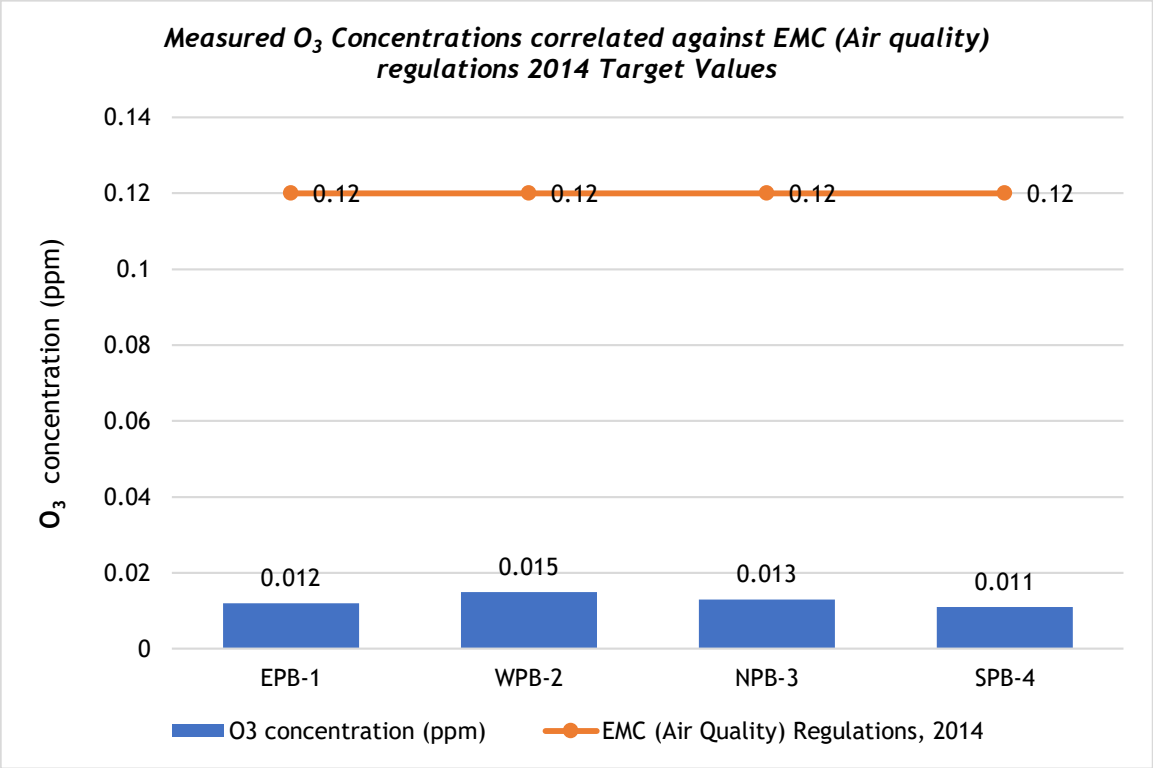
The concentration levels of all recorded nitrogen oxide gas within the 4-hour survey were all below the ambient levels (0.05ppm).

The results for the nitrogen oxide (NO_X) concentrations measured below the air quality guidelines limits. The concentration of NOx at the survey locations were 100.00% in compliance of the EMC (Air quality) regulations 2014 maximum limits.

The low NO_x concentration recorded before implementation of the proposed sugar factory does not pose Environment, sustainability, health, safety, climate and compliance concerns.

NO_X is generated due to the oxidation of N2 in the atmosphere at high temperature and due to oxidation of nitrogen compounds in used fuel or due to the reaction of nitrogen radical with hydrocarbons. 90% of the NOx at the proposed project site is attributed to fugitive and diffuse emissions from the sugarcane trucks / motor vehicles fuel combustion.

5.2.4. Ozone



The statistical analysis for 4-hr monitoring of ozone as outlined in the TOR was completed at four boundary monitoring locations.

From the above graph, the maximum 1-hour ozone concentration extended to levels of 0.015 ppm at West Project Boundary (WPB-2) while the minimum 1-hour ozone concentration extended to levels of 0.011 ppm at South Project Boundary (SPB-4). The average O_3 concentration at the study area extended to levels of 0.0128 ppm. There was no exceedance of the 1-hour AAQTL of 0.12 ppm thus the frequency of exceedance was zero.

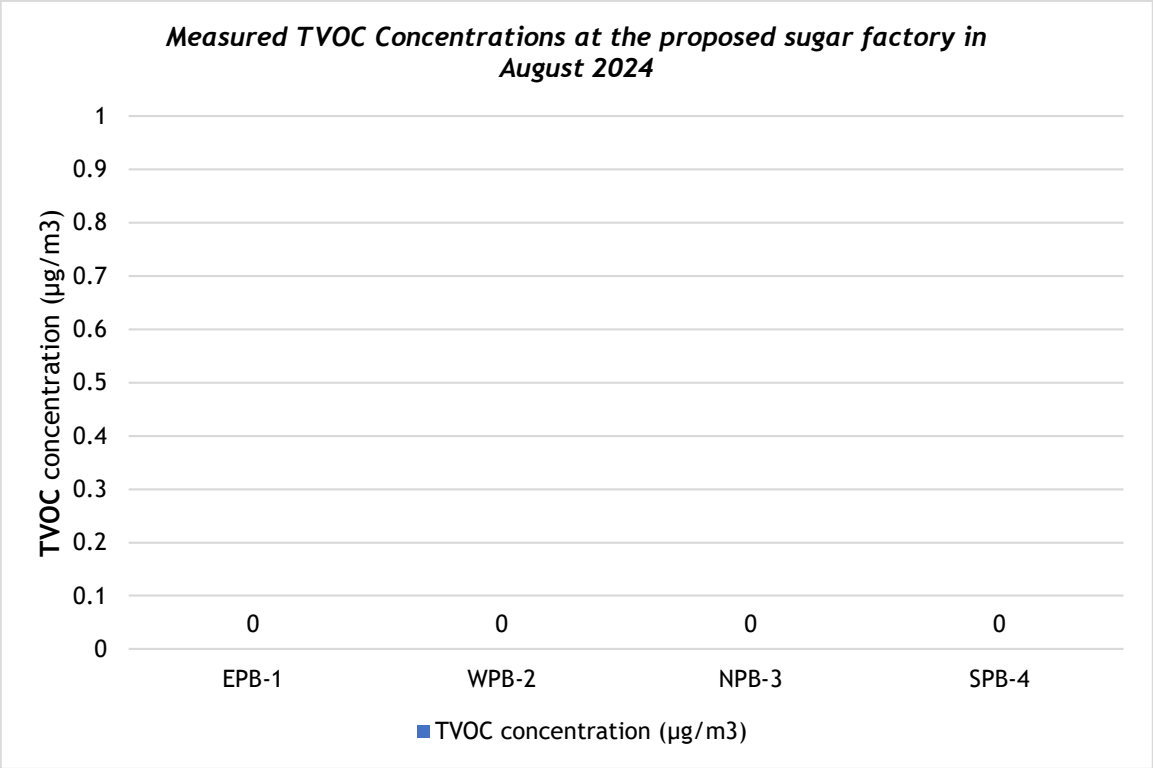
All ozone concentrations recorded in the project sites complied with the EMC (Air quality) regulations.

The primary natural source of surface O_3 is the subsidence of stratospheric O_3 from the upper atmosphere. In contrast, the primary anthropogenic source of surface O_3 is photochemical reactions involving the atmospheric pollutant carbon monoxide (CO). Ozone at ground level is primarily formed by a complicated series of chemical reactions initiated by sunlight. NO_X and volatile organic compounds (VOCs), derived mainly from man-made sources, react to form ozone. These substances are produced by combustion, industrial processes and activities such as solvent use and petrol distribution and handling. NO_X and VOCs are the most important precursors of elevated levels of O_3.

Motor vehicles account for 40% of the ground level ozone at site. These chemical reactions do not take place instantaneously, but over several hours or even days depending on the VOCs, and once ozone has been produced it may persist for several days. Ozone measured at a particular location may therefore have arisen from VOC and NOx emissions many kilometres away, and may then travel further. Maximum concentrations, therefore, generally occur downwind of the source areas of the precursor pollutant emissions.

Low concentration levels of Ozone recorded before implementation of the proposed sugar factory does not pose Environment, sustainability, health, safety, climate and compliance concerns..

5.2.5. Total Volatile Organic Compounds (CH_4)



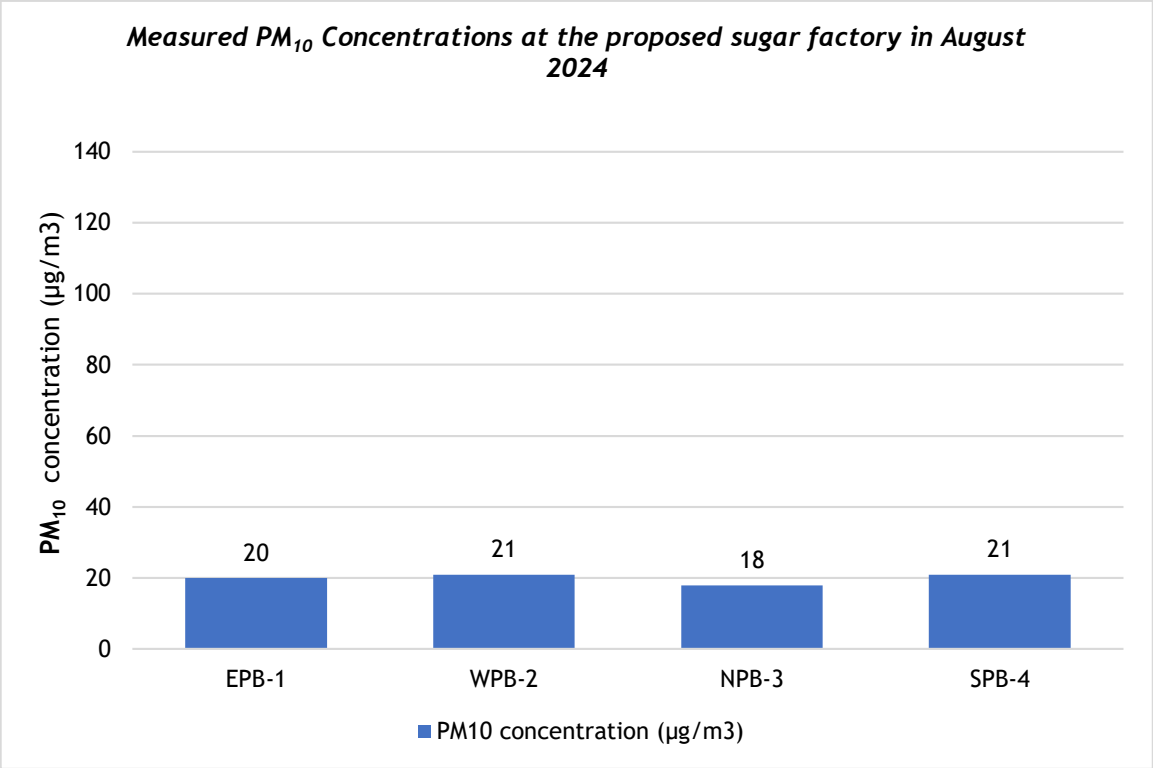
The statistical analysis for 1-hr monitoring of TVOC as outlined in the TOR was completed at each of the four monitoring locations.

The average TVOC concentration across the monitoring locations for the TWA of 4-hour were below the detection limit (0.001 µg/m^3) of the testing equipment.

There are No 1-Hour TVOC guideline for residential, rural and other areas given under the EMC (Air quality) regulations 2014 for comparison of results. No comparisons were made against the regulation. However, all the TVOC concentrations recorded across the four boundary locations seems to be within the typical range of emissions for such neighborhood.

The very low TVOC concentration levels recorded before implementation of the proposed sugar factory does not pose Environment, sustainability, health, safety, climate and compliance concerns.

5.2.6. Particulate matter (PM_{10})



The statistical analysis for the combined 1-hr monitoring of Particulate matter <10 ug/m^3 per location as outlined in the TOR was completed.

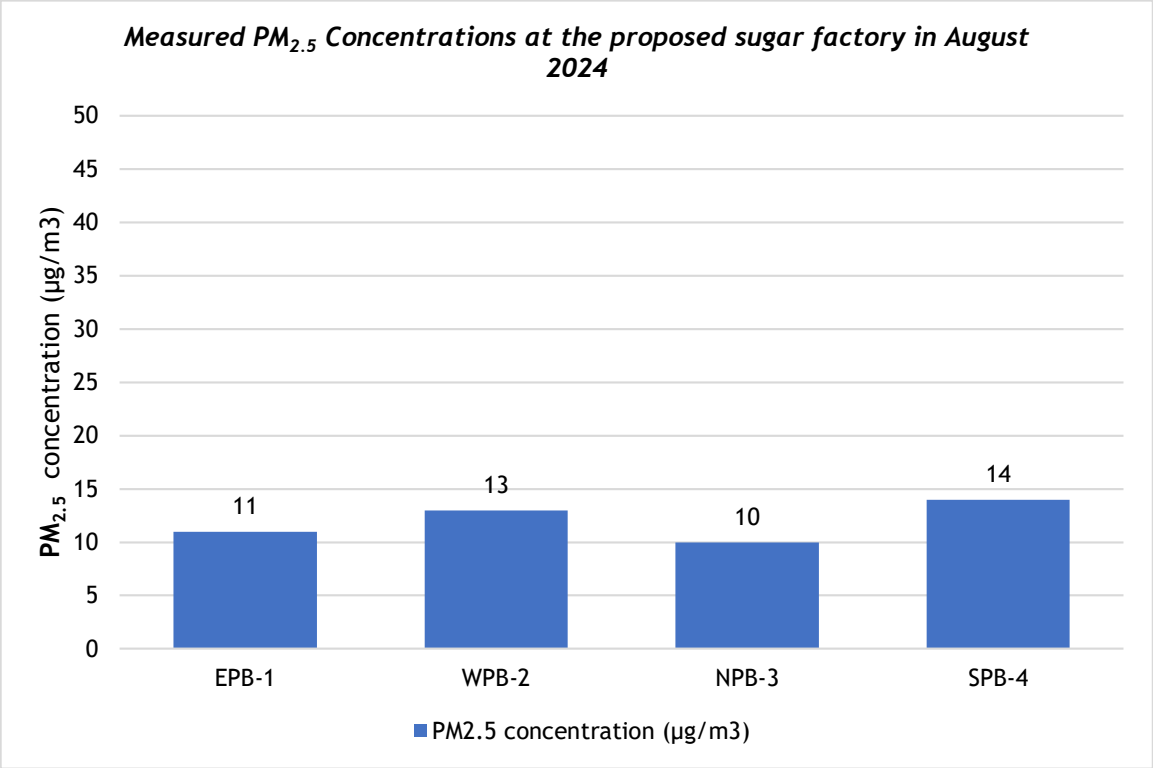
From the above graph, the maximum 1-hour PM_{10} concentration across West Project Boundary (WPB-2) and South Project Boundary (SPB-4) extended to levels of 21.0 ug/m^3 while the minimum 1-hour PM_{10} concentration along the North Project Boundary (NPB-3) extended to levels of 18.0 ug/m^3. The overall average PM_{10} concentrations of the project area over the 4-hour assessment extended to levels of 20.0 ug/m^3.

There are No 1-Hour guideline for residential, rural and other areas given under the EMC (Air quality) regulations 2014 for comparison of results. No comparisons were made against the regulation. However, the concentration values of PM_{10} recorded seems to be within the typical range of emissions for such neighborhood.

Unlike the individual gaseous pollutants, which are single, well-defined substances, particles (PM_{10}) in the atmosphere are composed of a wide range of materials arising from a variety of sources. Concentrations of PM_{10} comprise: primary particles, arising from combustion sources (mainly motor vehicles emissions, which in the proposed site contribute -70%); secondary particles, mainly sulphate and nitrate formed by chemical reactions in the atmosphere; and coarse particles, suspended soils and dusts, biological particles and particles from construction work and marram roads. The relative contribution of each source type varies from day to day, depending on meteorological conditions and quantities of emissions from mobile and static sources.

From the above combined graph results, the levels of PM_{10} released through existing proposed site operations before implementation of the proposed sugar factory does not pose Environment, sustainability, health, safety, climate and compliance concerns.

5.2.7. Particulate matter ($PM_{2.5}$)



The statistical analysis for the 1-hr monitoring of particulate matter $PM_{2.5}$ as outlined in the TOR was completed at four survey locations.

From the above graph, the peak 1-hour $PM_{2.5}$ concentration extended to levels of 14 µg/Nm^3 at the South Project Boundary (SPB-4). Similarly, the minimum 1-hour $PM_{2.5}$ concentration extended to levels of 10 µg/Nm^3 at the North Project Boundary (NPB-4).

There are No 1-Hour guideline for residential, rural and other areas given under the EMC (Air quality) regulations 2014 for comparison of results. No comparisons were made against the regulation. However, the concentration values of $PM_{2.5}$ recorded seems to be within the typical range of emissions for such neighborhood.

The main sources of atmospheric particulate matter were primarily the burning of fuel during automobile movements and pulverization of dust as a result of speeding of vehicles and bikes.

The fine particle fraction ($PM_{2.5}$) is composed predominantly of primary and secondary particles. Particles in the range from $PM_{2.5}$ - PM_{10} generally consist of coarse particles.

From the above combined graph results, the levels of $PM_{2.5}$ released through existing proposed site operations before implementation of the proposed sugar factory does not pose Environment, sustainability, health, safety, climate and compliance concerns.

5.3. FIELD NOTES AND OBSERVATIONS:

Ambient air quality measurements were taken for short term exposure levels. It should however be noted that this exercise is only applicable to the time period when sampling took place and does not take into account seasonal and other local various that might occur during other months and times. However, it is still a good general overview of the existing air quality environment.

5.3.1. Sensitive receptors

The proposed site is surrounded by sugarcane farmlands to the South, West and East and neighbors' Enemasi primary school, Enemesi market centre, residential establishments and Kenye Menolight church all within 2km to the North of the proposed sugar factory

5.3.2. Potential Pollution causes;

From the site visits and background site description, the following sources have been identified as potential pollution causes at the proposed site;

Exhaust gases:

The survey location is accessible to sugarcane trucks, motor vehicles and motor cycles that utilize diesel and petrol. Vehicle and motorcycle exhausts contain a number of pollutants including carbon dioxide (CO_2), carbon monoxide (CO), hydrocarbons, oxides of nitrogen (NO_x), sulphur and PM_{10}. The quantity of each pollutant emitted depends upon the type and quantity of fuel used, engine size, speed of the vehicle and abatement equipment fitted. Once emitted, the pollutants are diluted and dispersed in the ambient air.

Vehicular movement;

Re-suspension of roadside dust from movement of vehicles resulted in generation of relatively higher fraction of finer dust ($PM_{2.5}$). Some fugitive atmospheric dust arose from the mechanical disturbance of granular soils materials exposed to the air from motor vehicle / cycle movement. Pulverization and abrasion of surface materials by application of vehicular mechanical forces generate substantial amount of dust.

5.4. Air Quality Survey Conclusions

Baseline Atmospheric Environment Monitoring was conducted to characterize the existing environment before implementation (DO MINIMUM) of the proposed sugar factory. The conclusions below were drawn from the exercise conducted on the 02nd August 2024.

Gaseous Parameters:

All gaseous parameters (carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone and total volatile organic compounds) were measured and quantified at all the four survey locations.

Before the project implementation of the proposed sugar factory, all measured gaseous parameters COMPLIED with the EMC (Air quality) regulations 2014 limits.

The ambient air quality data (gaseous) measured around the monitoring locations are considered to be within a typical range of emissions for such neighborhood.

The findings of the gaseous monitoring program indicate that the air quality at the proposed sugar factory is generally good before commissioning of the project. All pollutants measured are at levels that doesn't pose Environmental, Sustainability, Health, Safety, Climate and compliance concerns.

When the project related activities will begin, construction practices and factory operations must be put in place to control and manage gaseous pollutants to levels that do not surpass the regulated limits.

Meteorological Parameters:

The monitoring locations in general provided standard atmospheric environment before project implementation due to the combination of good climate and ambient conditions. Weather

and Climatic conditions at proposed sugar factory site provided good dispersion of air contaminants.

Particulate Matter (PM_{10} and $PM_{2.5}$):

Particulate parameters concentrations (PM_{10} and $PM_{2.5}$) were measured and quantified across the survey stations.

Before the project implementation of the proposed sugar factory, all measured particulate parameter concentration levels recorded were within the typical range of emissions for similar neighborhood.

The findings of the monitoring program indicate that the particulate matter atmospheric environment is generally good before the proposed sugar factory implementation. Particulate pollutants measured are at levels that do not Environmental, Sustainability, Health, Safety, Climate and compliance concerns.

When the project related activities will begin, construction practices and factory operations must be put in place to control and manage gaseous pollutants to levels that do not surpass the regulated limits.

5.5. Recommendations

When operations / commissioning take effect, greenhouse gas measurements and sampling should be frequently done in order to build up a robust dust and gaseous management plan.

6. REFERENCES

1) Environmental Management and Coordination Act (EMCA) 1999 (amended 2015).
2) Environmental Management Coordination (Air Quality) Regulations 2014 (Legal Notice No.34).
3) Environmental Protection Agency. (1976) Quality Assurance Handbook for Air Pollution Measurement Systems – Volume 1 Principles. EPA-600/9-76-005, Research Triangle Park, NC.
4) Quality Assurance and Quality Control (QA/QC) Procedures for UK Air Quality Monitoring under 2008/50/EC and 2004/107/EC
5) U.S. Environmental Protection Agency (2000) Guidance for Data Quality Assessment – Practical Methods for Data Analysis, EPA Report QA G-9 QA00 Update, Washington DC, July 2000. This document can be downloaded from website: http://www.epa.gov/quality/qs-docs/g9-final.pdf
6) U.S. Environmental Protection Agency. (1998) EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, Report EPA/600/R-98/018, EPA Project Boundary 2 (PB-2) or Research and Development, Washington DC. This document can be downloaded from website: http://www.epa.gov/swerust1/cat/epaqag5.pdf.

APPENDIX A:
EQUIPMENT CALIBRATION CERTIFICATES

Calibrate report

Product	Air Quality Monitor System	Model	AQM-09
Quantity	1pcs	Cali date	October, 19, 2023
Product No.	OC202205074030080		
Appearance	☑Clean ☑Non corrosive ☑No damage		
Gas type	NO2: ppb SO2:ppb TVOC:ppm O3:ppb H2S:ppm PM2.5:ug/m³ PM10:ug/m³ TSP:ug/m³ Wind veloci: m/s Wind direct: Atmospheric : hpa Noise:dB Temperature and humidity: ℃/%RH		
Accuracy	±3%F.S		
resolution	0.1ppm 1ppb 1ug/m³		
Response time	≤30S		
Survey range	NO2:0-2000ppb SO2:0-2000ppb H2S:0-100ppm O3:0-2000ppb TVOC:0-50ppm PM2.5:0-1000ug/m³ PM10:0-1000ug/m³ TSP:0-1000ug/m³ Windveloci:0-60m/s Winddirect:0-360 Atmospheric :600-1100 hpa Temperature: -20-50℃ Humidity:0%-100%RH Noise:30-130dB		
Signal output mode	4G LTE		
Power supply voltage	AC 240V/50Hz		
Power dissipation	≤ 30W		
Working temperature and humidity range	-20℃-50℃ / 0%RH-100%RH		
Testing condition Indoor	Temperature: 25℃ Humidity: 60%RH		
Calibration gas	SO2 O3 NO2 TVOC H2S		
Cali gas test	1.H2S: Cali gas concentration: 50 ppm Inspect concentration: 41.8 ppm 2.SO2: Cali gas concentration: 1000 ppb Inspect concentration: 1000 ppb 3.O3: Cali gas concentration: 1000 ppb Inspect concentration: 998 ppb 4:NO2: Cali gas concentration: 1000ppb Inspect concentration: 999 ppb 5.TVOC: Cali gas concentration: 50 ppm Inspect concentration: 49.7 ppm 6.PM2.5:Measured value: 19 ug/m³ PM10:Measured value: 26 ug/m³ 7.TSP:Measured value 31 ug/m³ Atmospheric:Measured value: 1003 hpa 8.Wind veloci:Measured value: 1.3 m/s Wind direct:Measured value : 217 9:Noise::Measured value: 74 dB 10.Temperature: Measured value: 26.3℃ Humidity:Measured value: 53 %RH		
Test result	Qualified		
Remark			

Check: QC PASS 01 Approval: QC PASS 02 Tester: QC PASS

Company: Henan Oceanus Import & Export Co., Ltd.

Date: October, 19, 2023

LAHVENS LIMITED 20 AUG 2024 P.O. Box 34153 - 80118, MOMBASA Email:lahvens@lahvens.com

APPENDIX B:
LABORATORY DESIGNATION CERTIFICATES

nema

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

Mobile Lines: 0724-253 398, 0723-363 010, 0735-013 046
Telkom Wireless: 020-2101370, 020-2183718
Incident Lines: 0786-101100, 0741-101100

P.O. Box 67839, 00200
Popo Road, Nairobi, Kenya
E-mail: dgnema@nema.go.ke
Website: www.nema.go.ke

NEMA/21/2/LAB 77/LLL **20th April, 2023**

Lahvens Limited Laboratory
Lahvens House,
P.O. Box 34153-80118
MOMBASA.

RE: LABORATORY DESIGNATION BY NEMA.

Pursuant to your application for designation, your laboratory was inspected and evaluated based on ISO 17025 for laboratory competence to carry out tests and samplings.

The Lahvens Limited Laboratory qualified and has in principle been designated to undertake **Air Quality Analysis (Stack Emission and Ambient Air) and Noise Level Measurements** subject to the attached terms and conditions.

However, pursuant to section 119 of EMCA 1999 the Gazettement will take effect once the Authority places a notice in the Kenya Gazette.

DAVID ONGARE
For: DIRECTOR GENERAL

Our Environment, Our Life, Our Responsibility

ISO 9001:2015 Certified

LAHVENS LIMITED P.O. Box 34153 - 80118, MOMBASA 28 AUG 2024 Email:lahvens@lahvens.com

AMBIENT ACOUSTIC LEVELS TEST REPORT.

ENVIRONMENTAL BASELINE STUDY REPORT FOR AMBIENT ACOUSTIC EMISSIONS LEVELS MONITORING OF THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY.

PROJECT INFORMATION:

PREPARED FOR:
BHARAT PATEL AND UMANG PATEL,
P.O BOX 19226 - 00501,
NAIROBI, KENYA.

CLIENT ADDRESS:

PREPARED BY:
LAHVENS LIMITED
P.O BOX 34153, 80118.
DESIGNATION LAB REF. NO. NEMA/21/2/LAB77/LLL
EMAIL: lahvens@lahvens.com

TESTING CONSULTANTS:

DOCUMENT ID: 50124-0070B.
TEST DATES: AUGUST 02ND 2024.
(FINAL) REPORT ISSUED: AUGUST 23RD, 2024.

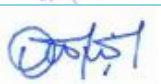
DOCUMENT INFORMATION:

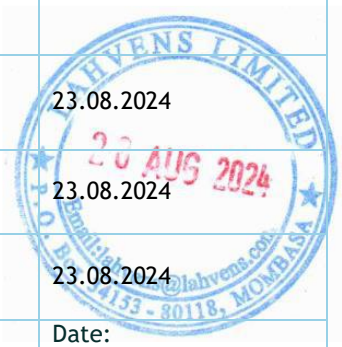
DOCUMENT REVIEW PAGE

This Technical report titled ENVIRONMENTAL BASELINE STUDY REPORT FOR AMBIENT ACOUSTIC EMISSIONS LEVELS MONITORING OF THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY, was authored by Lahvens Limited in accordance to the EMC (Excessive Noise and Vibration Regulations) (control) 2009, Legal Notice 61.

REVISION HISTORY

03	18-08-2024	Issuance of Final Report
02	09-08-2024	Re-submission to close the given comments and approvals
01	01-08-2024	1st draft issue of the soft copy submitted for review
REV	**DATE**	DESCRIPTION

Accepted by			
Reviewed & Approved by	LOVANS ROBERT SPOO – LABORATORY DIRECTOR. N.E.R. NO.: 7165		23.08.2024
Prepared by	VINCENT AGIN – FIELD ATTENDANT		23.08.2024
	VALENTINE AGUTU - FIELD ATTENDANT		23.08.2024
PROJECT:	Name:		Date:



DOCUMENT & PROJECT PARTICULARS

DOCUMENT REF: 50124-0070 B	CLASSIFICATION: A – UNCLASSIFIED (OPEN REPORT)	CONTRACT NO. AS PER EECL TOR.	REVISION: 00 FINAL

TEST FIRM CONTACT PERSON: LOVANS SPOO: (254 – 728716948)	PROJECT: THE PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY.	NUMBER OF PAGES: 30

AUTHOR(S): VINCENT OKUMU, VALENTINE AGUTU	QUALITY CONTROLLER: LOVANS ROBERT SPOO

ABSTRACT (ENGLISH TITTLE):
The client Bharat Patel and Umang Patel through the firm of experts Gomake Consultancy Company Limited contracted Lahvens Limited to form part of the Project's Environmental Team (ET). LAHVENS Limited was commissioned to provide consulting services of environmental baseline Acoustic emissions level assessment before implementation of the of the proposed sugar factory on L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY.

KEY WORDS:
EBS Acoustic Emissions Level Monitoring and Consultant Reporting.

ABSTRACT (in ENGLISH)	PUBLICATION TYPE: Digital document (pdf)

REVIEW AND CERTIFICATION FROM THE TESTING CONSULTANTS:

All work, calculations, other activities, and tasks performed and documented in this report were carried out under my direction and supervision. This test project conforms to the requirements of Lahvens Limited's quality manual and **EMC (Excessive Noise and Vibration Regulations) (control) 2009, Legal Notice 61.**

Team Leader: VALENTINE ODUOR

Signature:

Date: 23.08.2024

I have reviewed all testing details, calculations, results, conclusions and other appropriate written material contained herein, and hereby certify that the presented material is authentic and accurate.

Reviewer: LOVANS ROBERT SPOO

Title: LABORATORY DIRECTOR

Signature:

Date: 23.08.2024

LAHVENS LIMITED 23 AUG 2024 P.O. Box 34153 - 80118, MOMBASA Email:lahvens@lahvens.com

CERTIFICATION FROM THE LEGAL ENTITY OF THE TESTING FACILITY:

I have reviewed the information being submitted in its entirety. Based on the information and belief formed after reasonable inquiry, I certify that the statements and information contained in this submittal are true, accurate and complete.

_____ _____

Signature Date

_____ _____

Name Printed Tittle

_____ _____

Company Name Company stamp

LAHVENS LIMITED 23 AUG 2024 P.O. Box 34153 - 80118, MOMBASA Email:lahvens@lahvens.com

EXECUTIVE SUMMARY

Lahvens Limited, a NEMA designated laboratory, carried out the baseline ambient Acoustic environment survey at the proposed sugar factory on plot L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY on the 2nd August 2024. Acoustic Environment survey was conducted to determine the EXISTING (Do minimum) noise pollution around the proposed project for Environmental, Sustainability, Health, Safety and compliance purposes.

Sugarcane is the main crop cultivated worldwide for sugar production. Therefore, sugarcane is considered the primary tool for economic development and growth. It is a strategic commodity for the most producing countries. Sugarcane is a critical economic crop manufacturing and contributes approximately 80% of the global sugar output (Wang et al., 2020). About 60% to 80% of globally produced sugar is from sugarcane, and the rest comes from sugar beet (Kaab et al. 2019a; Wang et al., 2020; Oliveira et al. 2021).

The sugar industry holds a significant position in Kenya's economic landscape, providing employment opportunities and contributing to the nation's growth. However, like many industrial sectors, sugar production is not immune to environmental challenges. Environmental pollution is one of the major and serious threats now-a-days and often defined as “the contamination of physical and biological components of the earth to such an extent that normal environmental processes are adversely affected.” The contamination of the earth creates the serious environmental problem. All is due to human beings’ avarices as well as the lifestyles and gradually has created and destroyed life on earth.

Noise is a major outcome of industrialization and modern civilization. It is undesirable sound usually caused by industries, vehicles, aeroplane etc at a wrong time and place. The unit of noise measurement is decibel (dB). Human ear can tolerate noise up to 120 dBA. The repeated sound of high intensity often causes hearing loss and may also cause permanent loss of hearing ie damaging of the ear drum. It also affects the functioning of various systems of the body. It may result in hypertension, insomnia (sleeplessness), gastro-intestinal and digestive disorders, peptic ulcers, blood pressure changes, behavioural changes and emotional changes etc.

During construction of the sugar factory, noise pollution and vibration is likely to occur due to leveling and casting process at the proposed site. Since the proposed Project site is not 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.

Sugar factories are also a source of noise, due to the various operations and heavy machinery used during the production process. During its operations, two types of noise are associated with its sugar factories i.e industrial noise and traffic noise. Industrial noise is one of the most important source of noise pollution. The major sources of industrial noise may include electrochemical machines (motors and generators), impact machines, combustion processes, fluid machines (compressors and fans), unbalanced or improperly fitted mechanical parts (shafts and gears). Traffic noise will be contributed mainly by highway vehicles including trucks accessing the sugar factory and will depend upon the volume and frequency of the visits to the sites.

Acoustic Environment Monitoring was conducted to determine the extent of pollution around the proposed sugar factory with regards to Environmental, Sustainability, Health, Safety and compliance purposes before its implementation. The results will thereafter be used to assess compliance through comparisons against the Environmental Management Coordination (excessive noise and vibration controls) regulations 2009. A report on the findings will then be prepared and published.

Noise environment remains a valued component in this environmental assessment because of their fundamental significance to the well-being of humans and wildlife.

The baseline acoustic emissions report considers the total emission of key acoustic parameters associated with construction and operations of the sugar factory activities. These are Noise equivalent levels (LAeq), maximum noise levels recorded (Lmax) and minimum noise recorded (Lmin). The current concentrations of these pollutants are at risk of exceeding their respective Limit Values when the project commissions. The estimates of the existing concentrations will be measured and compared to any relevant existing information and when the project commences, will be used as the background data. Relevant available information related to the pre-development ambient acoustic emissions level in the environment was looked into while identifying the major existing acoustic emission sources in the environment and the existing sensitive pollution areas in the environment.

Acoustic Environmental Baseline Study is a significant component of monitoring programs for successful development activities. This Environmental Baseline Study is designed to characterize the acoustic environment at the proposed project site prior to commencement of construction of the proposed sugar factory. EBS will provide a benchmark and reference against which to compare the acoustic conditions influenced by the construction and operation of the proposed sugar factory. The information will be used to assess the effectiveness of any proposed mitigation measures and to implement adaptive management, if needed.

Well-developed EBS often alleviate heightened perceived concerns within the community during the initial phases of any proposed development, before issues become a serious risk to the project. EBS also creates reassurance in the minds of the public and jurisdictional decision makers that key environmental issues have been identified and will be monitored and mitigated, during and after the project is approved. EBS monitoring can be looked at as an early warning system of impacts that could potentially affect the environment during the project operation phase and long after the project is decommissioned.

A baseline noise survey consisting of an operator attended noise measurements (OANM) was performed on the proposed site within Enemasi Area, Moita Sub Location, Moita Location, Lolgorian Ward, Kereto Division, Transmara South Sub County, Narok County. Lahvens Limited operated four mobile stations along the project boundary walls as part of its noise levels monitoring networks on the 02nd August 2024.

Acoustic / Noise emission survey was achieved via initial examination of existing noise sources of significance. Noise levels was evaluated using a Sound Level Meter Model UT – 351, C150107874 class 2. SLM was mounted on at 2.0m above ground level and at least 3.5m away from any sound reflecting surfaces at a boundary position and measurements taken at timed intervals of 15 minutes every one-hour period and stored in SLM's memory. The sound level meter was placed on the microphone to reduce any wind interference during measurements. The sound level meters, were within their calibration period, at the time of monitoring. In addition, the equivalent noise level (Leq), the maximum sound pressure level (Lmax) and the minimum sound pressure level (Lmin) during that measurement period were recorded.

Factors such as time, duration and predictability of the noise emission, amplitude and frequency of the noise emission, nature of the source, location of noise sensitive receptors, ambient and background noise level, nature and character of the locality, presence of special acoustic characteristics and the incongruity or familiarity of the noise during noise survey and site placement were put into consideration.

Field Observations:

Sensitive Receptors;

The proposed site is surrounded by sugarcane farmlands to the South, West and East and neighbors' Enemasi primary school, Enemesi market centre, residential establishments and Kenye Menolight church all within 2km to the North of the proposed sugar factory.

Existing Acoustic Environment;

The project site is frequented by sugarcane tractors and motorbikes. The main source of existing noise pollution is fugitive noise from the traffic (mobile sources) such as transport noise emissions (sugar cane tractors, motor vehicles & motorcycle emissions) and environmental noise. The acoustic emission sources directly associated with the proposed project will be the main concern of the appraisal framework and will be emitted from various sources including; construction equipment, mobile sources (cars and heavy goods vehicles that will be accessing the site to offload materials during construction, source emissions (generators) and environmental noise.

RESULTS AND CONCLUSIONS:

Noise measurements was initiated to obtain and quantify the prevailing and existing ambient acoustic levels before implementation of the proposed sugar factory. The obtained acoustic results were thereafter correlated against the Environmental Management Coordination (Excessive noise and vibration regulations) 2009 to ascertain compliance.

The highest diurnal noise emissions recorded at South Project Boundary 4 (SPB-4) extended to levels of 42.1 dBA while the lowest diurnal noise emission recorded at East Project Boundary 2 (EPB-1) extended to levels of 37.1 dBA. The average Leq noise levels in the proposed sugar factory averaged 45.1 dBA and at the sensitive receptor site averaged 39.68dBA. The average noise levels along all the survey locations complies with the EMC noise and vibrations regulations of 2009.

Determination of noise significance of results was done vide correlation against the EMC (Excessive noise and vibration regulations) 2009 to ensure compliance amongst other aspects. Diurnal noise Leq averages were rated as insignificant having scored <75 units based on parameters and score criteria; therefore, the proposed sugar factory site was characterized as noise insignificant area before its implementation. From the results of determination of significance, there is no threat to the noise receivers (residential homes, farmlands and surrounding school) of the noise emissions before construction and operations work begin.

Ambient conditions existed at the time of the diurnal survey.

Environmental noise (Wind breeze), traffic noise emissions from motor vehicles / bikes and noise from human interactions were the main sources of noise emissions.

The proposed project site was marked with no project related activities during the measurements.

The levels of noise recorded from existing operations do not pose any Environmental, sustainability, Health, Safety and compliance concerns before implementation of the sugar factory project.

TABLE OF CONTENTS

LIST OF TABLES

DEFINITIONS.

Table 1: List of acronyms

dBA	Decibels (A) weighted
CBS	Comprehensive Baseline Study
EMC	Environmental Management and Coordination
EBS	Environmental Baseline Study
GPS	Geographic Positioning System
hpa	Hectopascal
km/hr	Kilometer per hour
Leq	Noise equivalent noise
Lmax	Maximum Sound Level
Lmin	Minimum Sound Level
NEMA	National Environment Management Authority
OSHA	Occupational Safety and Health Administration's
SLM	Sound Level Meter
TWA	Time Weighted Average
WB	World bank
WHO	World Health Organization

1. INTRODUCTION

1.1. Project Summary and objectives:

Lahvens Limited, a NEMA designated laboratory, carried out the baseline ambient Acoustic environment survey at the proposed sugar factory on plot L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY on the 2nd August 2024. Acoustic Environment survey was conducted to determine the EXISTING (Do minimum) noise pollution around the proposed project for Environmental, Sustainability, Health, Safety and compliance purposes.

Sugarcane is the main crop cultivated worldwide for sugar production. Therefore, sugarcane is considered the primary tool for economic development and growth. It is a strategic commodity for the most producing countries. Sugarcane is a critical economic crop manufacturing and contributes approximately 80% of the global sugar output (Wang et al., 2020). About 60% to 80% of globally produced sugar is from sugarcane, and the rest comes from sugar beet (Kaab et al. 2019a; Wang et al., 2020; Oliveira et al. 2021).

The sugar industry holds a significant position in Kenya's economic landscape, providing employment opportunities and contributing to the nation's growth. However, like many industrial sectors, sugar production is not immune to environmental challenges. Environmental pollution is one of the major and serious threats now-a-days and often defined as “the contamination of physical and biological components of the earth to such an extent that normal environmental processes are adversely affected.” The contamination of the earth creates the serious environmental problem. All is due to human beings’ avarices as well as the lifestyles and gradually has created and destroyed life on earth.

Noise is a major outcome of industrialization and modern civilization. It is undesirable sound usually caused by industries, vehicles, aeroplane etc at a wrong time and place. The unit of noise measurement is decibel (dB). Human ear can tolerate noise up to 120 dBA. The repeated sound of high intensity often causes hearing loss and may also cause permanent loss of hearing ie damaging of the ear drum. It also affects the functioning of various systems of the body. It may result in hypertension, insomnia (sleeplessness), gastro-intestinal and digestive disorders, peptic ulcers, blood pressure changes, behavioural changes and emotional changes etc.

During construction of the sugar factory, noise pollution and vibration is likely to occur due to leveling and casting process at the proposed site. Since the proposed Project site is not 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.

Sugar factories are also a source of noise, due to the various operations and heavy machinery used during the production process. During its operations, two types of noise are associated with its sugar factories i.e industrial noise and traffic noise. Industrial noise is one of the most important source of noise pollution. The major sources of industrial noise may include electrochemical machines (motors and generators), impact machines, combustion processes, fluid machines (compressors and fans), unbalanced or improperly fitted mechanical parts (shafts and gears). Traffic noise will be contributed mainly by highway vehicles including trucks accessing the sugar factory and will depend upon the volume and frequency of the visits to the sites.

Acoustic Environment Monitoring was conducted to determine the extent of pollution around the proposed sugar factory with regards to Environmental, Sustainability, Health, Safety and compliance purposes before its implementation. The results will thereafter be used to assess compliance through comparisons against the Environmental Management Coordination (excessive noise and vibration controls) regulations 2009. A report on the findings will then be prepared and published.

Noise environment remains a valued component in this environmental assessment because of their fundamental significance to the well-being of humans and wildlife.

1.2. Project Description

The Proponent (Bharat Patel and Umang Patel) is proposing to establish a sugar processing factory within Enemasi Area, Moita Sub Location, Moita Location, Lolgorian Ward, Kereto Division, Transmara South Sub County, Narok County, on GPS coordinates of latitude 1°7'30.9324" S and longitude 34°41'29.88024" E. The Proponent is determined to support Kenya in addressing the recurrent sugar production deficit in the country by proposing to install the factory with a capacity to crush about 1,250TCD of sugarcane per day.

1.3. Purpose of this report

This report identifies baseline information relating to acoustic emissions levels environment within study area in Narok county on Plot L.R. No. TRANSMARA/MOITA/761 in Transmara. The baseline provides the 'do minimum' (without the proposed sugar factory) scenario taking account of the proposed changes to the land use.

1.4. Appraisal Framework Requirements

Under the Second Schedule of the Environmental Management and Coordination Act (EMCA), Cap 387 of the Laws of Kenya, the project is categorized as a High Risk and thus should undergo Environmental and Social Impact Assessment (ESIA) Study process.

According to the EMC (IMPACT ASSESSMENT AND AUDIT) regulations 2003 framework legal notice 101 PART IV, THE ENVIRONMENTAL IMPACT ASSESSMENT STUDY REPORT section 18 which states that *(1) A proponent shall submit to the Authority, an environmental contents of impact assessment study report incorporating but not limited to the environmental following information; - (b) a concise description of the national environmental legislative and regulatory framework,* ***baseline information.*** PART VI - MISCELLANEOUS PROVISIONS section 43 (2) states that *the proposed policy, programme or plan specified in this regulation shall state - (d) an environmental analysis covering: (i)* ***baseline information focusing on areas potentially affected***. Noise / Acoustic emissions levels was earmarked as one of the baseline parameter to be assessed and monitored.

Section 3 of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009, General Prohibitions states as follows;
(1) Except as otherwise provided in these Regulations, 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 and the environment.
(2). In determining whether noise is loud, unreasonable, unnecessary or unusual, the following factors may be considered; (a) time of the day; (b) proximity to residential area; (c) whether the noise is recurrent, intermittent or constant; (d) the level and intensity of the noise; (e) whether the noise has been enhanced in level or range by any type of electronic or mechanical means; and,
(f) whether the noise can be controlled without much effort or expense to the person making the noise.

(3). Any person who contravenes the provisions of this Regulation commits an offence.

Section 5 of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009, on Permissible noise levels states as follows;
"No person shall make, continue or cause to be made or continued any noise in excess of the noise levels set in the First Schedule to these Regulations, unless such noise is reasonably necessary to the preservation of life, health, safety or property.

In order to comply with the above extracts, Lahvens Limited was commissioned by the client through the lead expert Mr. Kennedy Kijana representing Gomake consultancy company Limited to form the Project's Environmental Team (ET) to monitor a field baseline study of acoustic emissions prior to the proposed sugar factory implementation, to gain insight into construction-related emissions (of Lmax, Lmin and LAeq), the existing acoustic emissions impacts that result from current ongoing activities, and opportunities to mitigate potential impacts. The findings from this assessment will also support public and stakeholder communication. It will also determine the baseline acoustic environment before implementation of the proposed project.

This Baseline Report forms part of a Comprehensive Baseline Study (CBS) of the proposed Project. The CBS is being prepared as part of an environmental Social Impact assessment (ESIA) and approval process.

1.5. Scope of work

The baseline acoustic emissions report considers the total emission of key acoustic parameters associated with construction and operations of the sugar factory activities. These are Noise equivalent levels (LAeq), maximum noise levels recorded (Lmax) and minimum noise recorded (Lmin). The current concentrations of these pollutants are at risk of exceeding their respective Limit Values when the project commissions. The estimates of the existing concentrations will be measured and compared to any relevant existing information and when the project commences, will be used as the background data. Relevant available information related to the pre-development ambient acoustic emissions level in the environment was looked into while identifying the major existing acoustic emission sources in the environment and the existing sensitive pollution areas in the environment.

1.6. Terms of Reference

Reference is made to the EMCA Legal Notice 61 First Schedule Extract, Acoustics — Determination of noise exposure and estimation of noise-induced hearing impairment recognizing the fact that any person emitting noise in excess of noise emission standards commits an offence therefore legalizing the process of compliance with the set emission goals, permissible standards, control strategies and technologies for noise emission as mandatory.
The scope of work was outlined as follows:

- Review of the legal context as it relates to noise emissions;
- Evaluation of site meteorology;
- Monitoring of background noise including the noise equivalent levels Leq.

1.7. EBS Justification

Acoustic Environmental Baseline Study is a significant component of monitoring programs for successful development activities. This Environmental Baseline Study is designed to characterize the acoustic environment at the proposed project site prior to commencement of construction of the proposed sugar

factory. EBS will provide a benchmark and reference against which to compare the acoustic conditions influenced by the construction and operation of the proposed sugar factory. The information will be used to assess the effectiveness of any proposed mitigation measures and to implement adaptive management, if needed.

Well-developed EBS often alleviate heightened perceived concerns within the community during the initial phases of any proposed development, before issues become a serious risk to the project. EBS also creates reassurance in the minds of the public and jurisdictional decision makers that key environmental issues have been identified and will be monitored and mitigated, during and after the project is approved. EBS monitoring can be looked at as an early warning system of impacts that could potentially affect the environment during the project operation phase and long after the project is decommissioned.

2. ACOUSTIC EMISSIONS OVERVIEW AND NETWORKS

According to the National Environment Management Authority (NEMA), "construction" includes erection, alteration, repair, dismantling, demolition, structural maintenance, painting, mowing, land-clearing, earth-moving, landscaping, grading, excavating, laying of pipes and conduits whether above or below ground level, road, railway and highway building, concreting, installation and alteration of equipment, and the structural installation of construction components and materials in any form or for any purpose that includes any work in connection with the construction". The proposed project falls under the construction sector.

As per Oxford Definition, noise is a sound, especially one that is loud or unpleasant or that causes disturbance. Noise is generally considered as undesirable sound and sound can be considered undesirable due to amplitude or volume of loudness, category of noise, occurrence time of the day and resonance created. Noise is regarded as a pollutant under the EMC (Excessive Noise and Vibration Regulations) (control) 2009.

It is therefore fundamental to note that ambient noise levels are essential to human health and ecosystems. The repercussions of construction noise are extensive and encompass both the workers and the surrounding environment. Construction noise can disrupt the peace of residential neighborhoods, affecting the quality of life for residents. This disruption can lead to complaints and strained relationships between the construction project and the community.

Construction site generates noise with activities like demolition, excavation, building works, machinery involved, material unloading etc. The noise generated from such activities is found loud and irritant at times. Such activities generate noise exceeding the Occupational Safety and Health Administration's (OSHA) limit given of 90dB. Continuous exposure to such loud noise can cause various physical, psychological, and mental illnesses. This hassle can affect the workers, as well as the residences, commercial complexes or school colleges surrounding the ongoing construction sites.

Construction Related Noise Generators could include the following: -

a. Various Machineries / Equipment are involved at various stages of construction. Right from the Excavation until Finishes, various machineries are involved which help to carry out the work with lesser labors and at a faster speed by also achieving the required quality.
b. Labors Talks / yelling: - Some of the activities like Plastering, curtain wall installation, fixing trusses at sites involve laborers working at different heights. In such cases, the talk happens by yelling, shouting for the instructions.

Noise Pollution due to Construction Machineries is a major hazard observed on Modern Construction sites where extensive machineries are used for the Speed and Quality. Noise generated from the heavy machineries and the power tools varies between 80dB to 120dB. OSHA states permissible noise exposure limit is 90 dBA (29 CFR 1926.52), whereas the American Conference of Industrial Hygienists has a noise threshold limit value of 85 dBA. NEMA through the EMC (Excessive Noise and Vibration Regulations) (control) 2009 states the permissible levels to be 55dBA.

The level of ambient sound usually varies continuously with time. A human's subjective response to varying sounds is primarily governed by the total sound energy received. The total sound energy is the average level of the fluctuating sound, occurring over a period of time, multiplied by the total time

period. In order to compare the effects of different fluctuating sounds, one compares the average sound level over the time period with the constant level of a steady, non-varying sound that will produce the same energy during the same time period. The average of the fluctuating noise levels over the time period is termed Leq, and it represents the constant noise level that would produce the same sound energy over the time period as the fluctuating noise level.

In order to compare the effects of different fluctuating sounds, one compares the average sound level over the time period with the constant level of a steady, non-varying sound that will produce the same energy during the same time period. The average of the fluctuating noise levels over the time period is termed Leq, and it represents the constant noise level that would produce the same sound energy over the time period as the fluctuating noise level.

The atmospheric conditions, interference from other objects and ground effects also play an important role in the resulting noise levels. For example, “hard” ground, such as asphalt or cement transmits sound differently than “soft” ground, such as grass. The first ground type promotes transmission of sound, thus producing louder sound levels farther from the source. In general terms, the above effects increase with distance, and the magnitude of the effect depends upon the frequency of the sound. The effects tend to be greater at high frequencies and less at low frequencies. For example, “hard” ground, such as asphalt or cement transmits sound differently than “soft” ground, such as grass. The first ground type promotes transmission of sound, thus producing louder sound levels farther from the source. In general terms, the above effects increase with distance, and the magnitude of the effect depends upon the frequency of the sound. The effects tend to be greater at high frequencies and less at low frequencies

Section 3 of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations requires determination as to whether the noise is recurrent, intermittent or constant.

Continuous noise in construction persists for an extended period of time. Unlike impulsive noise which comes in bursts, continuous noise is steady and unvarying, similar to a drone or a hum that stays constant over time. Machinery or processes that operate without interruption often produce this noise. Some examples of continuous noise in construction include the humming of generators, the constant whir of an operating excavator, the steady drone of ventilation systems, or the ongoing rumble of cement mixers. This persistent background noise exposure can be harmful to workers over a long period of time.

Impulsive noise, on the other hand, is characterized by sudden, loud bursts of sound that are often of high intensity but short duration. These noises are typically more jarring and noticeable than continuous noise due to their abrupt and disruptive nature. Impulsive noise adds to the overall noise level at a construction site, and its spread can significantly impact people at varying distances.

In construction settings, impulsive noise can come from a variety of sources. The loud bang of a pile driver pounding into the ground, the explosive bursts from powder-actuated tools, or the pounding of jackhammers are all examples of impulsive noise.

It is assumed that the measurement location represents other dwellings in the area (similar environment and sensitive receptors). Some numerous factors that could impact on ambient sound levels at the time of monitoring could include; the distance to closest trees, number and type of trees as well as the height of trees; available habitat and food for birds and other animals; distance to residential dwelling,

locomotive sources (motorbikes, trucks & personal vehicles) and type of equipment used at dwelling (compressors, aircons, generators) was considered.

Noise is often measured by use of equivalent noise levels (Leq).
Leq is the preferred method to describe sound levels that vary over time, resulting in a single decibel value, which considers the total sound energy over the period of time of interest.
Leq noise levels often fluctuate over a wide range with time. For example, in the middle of the night the level might go down as low as 30 dB (A) with occasional passing vehicles of 70dB (A) or more. Later comes the dawn chorus followed by the general noises of the day before relative peace returns in the late evening. Alternatively, it may be an activity with different noise emissions throughout the day or week, with deliveries, intermittent compressors, and lots of varying noisy processes on top of the routine production noise levels. This is where the Leq noise or equivalent continuous noise level meter comes in. The meter follows all the fluctuations, stores them in its memory and at the end of the measurement calculates an 'average energy' or Leq value. When we say average, this is not a simple arithmetic average because we are measuring in decibels which are logarithmic values. The SLM converts the dB values to sound pressure levels, adds them all up then divides by the number of samples and finally converts this equivalent level back to decibels – dBs.

LAeq – It is common practice to measure noise levels using the A-weighting setting built into all sound level meters. In which case the term is properly known as LAeq and the results should say so – for example LAeq = 73 dB or Leq = 73 dB.
Leq noise levels are logarithmic (dB) values and cannot be added directly. A doubling of sound level results in a measured increase of 3 dB, four identical sources in a room would increase the noise level by 6 dB and so on. This works both ways, say 10 similar machines in a room produce 100 dBA then removing one machine completely will only reduce the overall noise level to 0.5 dBA, you would need to silence or remove 50% of the machines to achieve a 3 dB reduction.

Other Parameters

- Lmax: Maximum Sound Level: level during a measurement period or a noise event and is not necessarily peak.
- Lmin: Minimum Sound Level: during a measurement period or a noise event.

3. ACOUSTIC LEGISLATIVE AND POLICY FRAMEWORK

3.1. EMC (Excessive Noise and Vibration Regulations) (control) 2009

The legislative controls relevant to noise emissions associated with any development is outlined in the EMCA Legal Notice 61 First Schedule Extract, Acoustics — Determination of occupational noise exposure and estimation of noise-induced hearing impairment. The standard recognizes that any person emitting noise in excess of noise emission standards commits an offence. It legalizes the process of Environmental Impact Assessment and compliance with the set emission goals, permissible standards, and control strategies and technologies for noise emission as mandatory. With establishment of noise emission standards, it will be a requirement to obtain temporary permits from the National Environmental Management Authorities allowing for emissions of noise in excess of established standards for a period not exceeding three months.

Noise Exposure Standards (First Schedule)

Table 2: EMC (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

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

Source: EMC (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 Legal Notice 61

The survey location falls under Zone D; mixed residential with some commercial and places of entertainment.

4. ACOUSTIC SURVEY METHODOLOGY

A baseline noise survey consisting of an operator attended noise measurements (OANM) was performed on the proposed site within Enemasi Area, Moita Sub Location, Moita Location, Lolgorian Ward, Kereto Division, Transmara South Sub County, Narok County. Lahvens Limited operated four mobile stations along the project boundary walls as part of its noise levels monitoring networks on the 02nd August 2024.

4.1. Baseline Study Area;

4.1.1. Sensitive Receptors

The geographical scope of the baseline assessment is currently defined as the proposed Sugar factory in Moita, Transmara, Narok county boundaries and environs, including potentially high risk zones along the routes of any existing surface access. High risk zones include locations with the potential for exceedance of regulatory standards for the protection of human health and/or **sensitive habitats**, in the initial and / or mature operations years. The issue of noise / acoustic pollution is particularly pertinent in areas sensitive to change, often referred to as **'sensitive receptors'.** Locations for the protection of human health are areas of long term exposure which are more susceptible and shall be considered to include residential properties, hospitals and schools; whereas locations for the protection of sensitive habitats / ecosystems shall be considered to include statutory designated sites (such as sites of special scientific interest (SSSIs), special areas of conservation (SACs) and special protection areas (SPAs) which contain habitat types that are also sensitive to acoustic changes.

The proposed site is surrounded by sugarcane farmlands to the South, West and East and neighbors' Enemasi primary school, Enemesi market centre, residential establishments and Kenye Menolight church all within 2km to the North of the proposed sugar factory.

Close proximity of the emission source to the 'sensitive receptor' causes acoustic pollution because there is less opportunity for dispersion of emissions between the source and receptor resulting in greater noise emissions. Noise / Acoustic levels is evaluated by comparing emissions against the EMC (Excessive Noise and Vibration Regulations) (control) 2009 Legal Notice 61, first schedule of the Noise Exposure Standards Limit values set at locations where exposure harm to human health and ecosystems is thought to occur.

4.1.2. Existing Acoustic Environment

The topography of the project site is generally flat to gently undulating, with slight slopes that facilitate natural drainage. The predominant land use in the area is sugarcane farming, with both crop and livestock farming being common. The project site is frequented by sugarcane tractors and motorbikes. The main source of existing noise pollution is fugitive noise from the traffic (mobile sources) such as transport noise emissions (sugar cane tractors, motor vehicles & motorcycle emissions) and environmental noise. The acoustic emission sources directly associated with the proposed project will be the main concern of the appraisal framework and will be emitted from various sources including; construction equipment, mobile sources (cars and heavy goods vehicles that will be accessing the site to offload materials during construction, source emissions (generators) and environmental noise.

The emissions concentrations reported herein, will be a combination of the emissions from the sources and the distance to the receptors which influence the levels of noise emissions and quality of life.

4.1.3. Monitoring Locations

Baseline acoustic emissions were selected based on the existing facility that could or have the potential to influence the proposed project acoustic environment. The monitoring locations at the proposed project site were determined at the four project boundaries to the East (PB-1), West (PB-2), North (PB-3) and South (SP-4).

Table 3: Description of the measurement locations

Measurement Sites	Description of monitoring Locations	Dates of sampling
East Project Boundary 1 (EPB-1)	The proposed site is surrounded by sugarcane farmlands to the South, West and East and neighbors' Enemasi primary school, Enemesi market centre, residential establishments and Kenye Menolight church all within 2km to the North of the proposed sugar factory. The topography of the project site is generally flat to gently undulating, with slight slopes that facilitate natural drainage. The predominant land use in the area is sugarcane farming, with both crop and livestock farming being common. The project site is frequented by sugarcane tractors and motorbikes. The main source of existing air pollution is diffuse and fugitive emissions of dust particles and gaseous emissions from the mobile sources. The exposure locations will also be influenced by non-related sources including domestic heating around the residential facility.	02ND AUGUST 2024.
West Project Boundary 2 (WPB-2)		02ND AUGUST 2024.
North Project Boundary 3 (NPB-3)		02ND AUGUST 2024.
South Project Boundary 4 (SPB-4)		02ND AUGUST 2024.

4.2. Equipment Placement

Acoustic / Noise emission survey was achieved via initial examination of existing noise sources of significance. Noise levels was evaluated using a Sound Level Meter Model UT – 351, C150107874 class 2. SLM was mounted on at 2.0m above ground level and at least 3.5m away from any sound reflecting surfaces at a boundary position and measurements taken at timed intervals of 15 minutes every one-hour period and stored in SLM's memory. The sound level meter was placed on the microphone to reduce any wind interference during measurements. The sound level meters, were within their calibration period, at the time of monitoring. In addition, the equivalent noise level (Leq), the maximum sound pressure level (Lmax) and the minimum sound pressure level (Lmin) during that measurement period were recorded.

Factors such as time, duration and predictability of the noise emission, amplitude and frequency of the noise emission, nature of the source, location of noise sensitive receptors, ambient and background noise level, nature and character of the locality, presence of special acoustic characteristics and the incongruity or familiarity of the noise during noise survey and site placement were put into consideration.

Furthermore, as each individual measurement was being taken, the nature of the noise climate in the area was assessed and recorded. This comprised an auditory observation by the surveyor, as well as identifying those noise incidents which influenced the sound level meter readings during the measurement period.

Ongoing diurnal acoustic level measurements at the proposed boundaries (source: Fieldwork August, 2024)

4.3. Acoustic analysis

4.3.1. Parameters and score criteria

After finding various activities, aspects and impacts, identification of the significant aspects was done. It entirely depended on the management of the system or industry to give a scaling factor. The table 4 below shows six factors naming as A to F (top row) and column 1 to 6 shows rating scheme with minimum as 1 and maximum marks as 10 depending upon their severity.

4.3.2. Procedure of significance evaluation

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

Table *4*: Parameters and score criteria

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

4.4. Tools and Equipment

- Sound Level Meter Model meter UT-351 IEC 61672 – 1:2013 class 2
- Geographic Positioning System (GPS)
- Digital camera

4.5. Assumptions

The short term (1-hr per site) noise emissions survey and data collection for L_{eq}, L_{max} and L_{min} is considered sufficient to understand background acoustic conditions at each location.

4.6. Data Validity and Acceptability

All data recorded in the study was taken through data replications and quality assurance procedure to ensure that any anomalous readings or questionable data is not incorporated in the final results.
Elements of this procedure account for:

- Routine calibration and auditing of the analyzers and Statistical rendering of outliers.

4.7. Monitoring Frequency

Monitoring of acoustic emissions levels was done for 1-hr / survey location. Once sugar processing operations will be underway, monitoring of acoustic emissions parameters should be done at quarterly intervals.

5. RESULTS PRESENTATION, DISCUSSIONS AND CONCLUSION.

5.1. PRESENTATION OF RESULTS

5.1.1. Summary of singular noise measurements

Table 5: Results for Diurnal singular noise measurements

Measured Sound Pressure Level (Noise) (dBA)				**EMC Noise Regulation 2009**	**Site Notes / Remarks**
02nd August 2024.				**Day time**	
Locations	**Leq**	**Lmax**	**Lmin**	**Leq**	
East Project Boundary 1 (EPB-1)	37.1	70.6	30.3	55	The prevailing weather was sunny at the time of acoustic survey. Wind speed averaged about 8 km/hr South East wind. Measurements are taken to quantify prevailing ambient acoustic levels. **Leq** noise levels complied with the EMC 2009 noise permissible levels. No site related activities were ongoing during measurements. Environmental noise including wind breeze were the likely sources of noise emissions. Ambient conditions were extant at the time of the survey.
West Project Boundary 2 (WPB-2)	39.6	68.4	30.8	55	The prevailing weather was sunny at the time of acoustic survey. Wind speed averaged about 8 km/hr South East wind. Measurements are taken to quantify prevailing ambient acoustic levels. **Leq** noise levels complied with the EMC 2009 noise permissible levels. No site related activities were ongoing during measurements. Environmental noise including wind breeze were the likely sources of noise emissions. Ambient conditions were extant at the time of the survey.
North Project Boundary 3 (NPB-3)	39.9	70.4	31.1	55	The prevailing weather was sunny at the time of acoustic survey. Wind speed averaged about 8 km/hr South East wind. Measurements are taken to quantify prevailing ambient acoustic levels. **Leq** noise levels complied with the EMC 2009 noise permissible levels. No site related activities were ongoing during measurements. Environmental noise including wind breeze were the likely sources of noise emissions. Ambient conditions were extant at the time of the survey.
South Project Boundary 4 (SPB-4)	42.1	75.3	35.7	55	The prevailing weather was sunny at the time of acoustic survey. Wind speed averaged about 8 km/hr South East wind. Measurements are taken to quantify prevailing ambient acoustic levels. **Leq** noise levels complied with the EMC 2009 noise permissible levels. No site related activities were ongoing during measurements. Environmental noise including wind breeze and noise from human interactions were the likely sources of noise emissions. Ambient conditions were extant at the time of the survey.

5.2. Summary of average diurnal noise equivalents (Leq)

5.2.1. Tabular presentation of test of L_{eq} noise equivalents.

Table 6: Summary results for diurnal noise equivalents

Monitoring locations	Diurnal LAeq average results	Maximum noise level permitted (Leq) in dB (A) Day (0601-2000) hrs	Comments
EPB-1	37.1	**55**	Complies
WPB-2	39.6	**55**	Complies
NPB-3	39.9	**55**	Complies
SPB-4	42.1	**55**	Complies

5.2.2. Tabular presentation of test of significance

Table 7:Determination of diurnal noise significance of results

MEASUREMENT SITE	ASPECT	CONDITION/A	IMPACT	QUANTITY A	OCCURRENCE	IMPACTS	DETECTION	CONTROL	LEGISLATION	TOTAL A*B*C*D	REMARKS SIG / INSIG
EPB-1	NOISE	N/A	Hearing impairment	3	6	1	1	3	1	54	INSIG
WPB-2	NOISE	N/A	Hearing impairment	3	6	1	1	3	1	54	INSIG
NPB-3	NOISE	N/A	Hearing impairment	3	6	1	1	3	1	54	INSIG
SPB-4	NOISE	N/A	Hearing impairment	3	6	1	1	3	1	54	INSIG

5.3. DISCUSSIONS OF RESULTS

Noise measurements was initiated to obtain and quantify the prevailing and existing ambient acoustic levels before implementation of the proposed sugar factory. The obtained acoustic results were thereafter correlated against the Environmental Management Coordination (Excessive noise and vibration regulations) 2009 to ascertain compliance.

5.3.1. Presentation of singular noise results

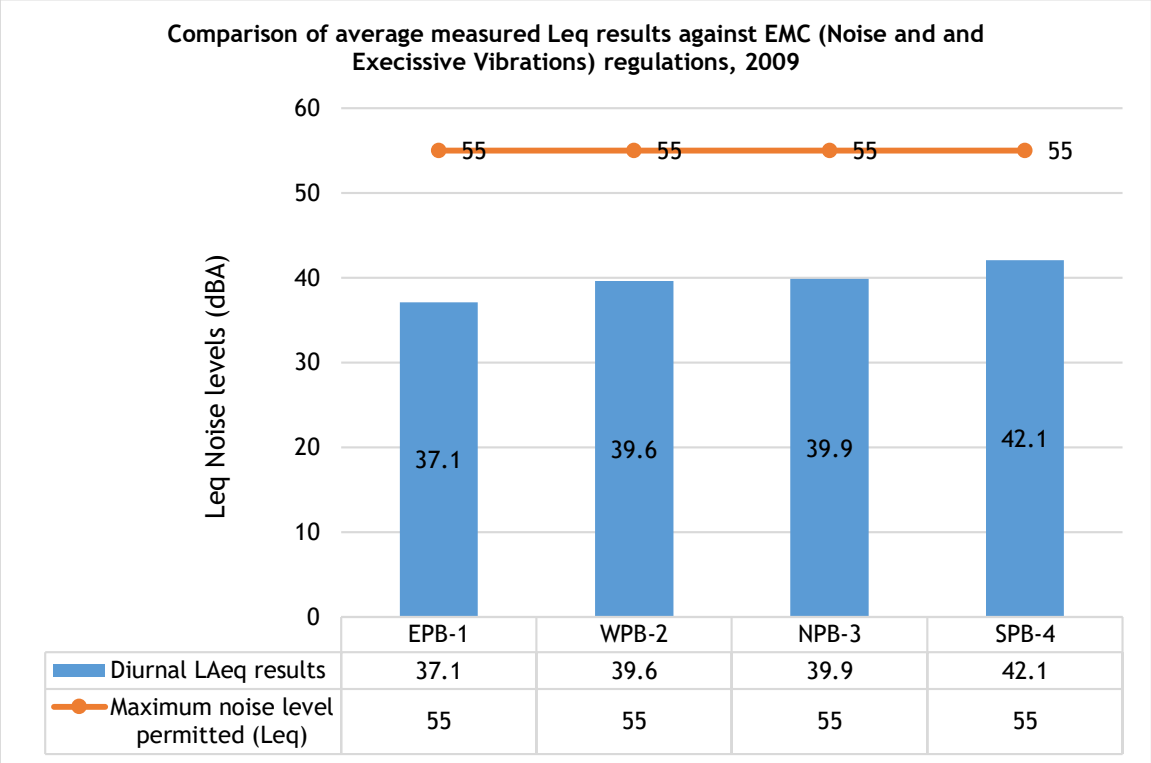
Diurnal noise results

The highest diurnal noise emissions recorded at South Project Boundary 4 (SPB-4) extended to levels of 42.1 dBA while the lowest diurnal noise emission recorded at East Project Boundary 2 (EPB-1) extended to levels of 37.1 dBA. The average Leq noise levels in the proposed sugar factory averaged 45.1 dBA and at the sensitive receptor site averaged 39.68dBA. The average noise levels along all the survey locations complies with the EMC noise and vibrations regulations of 2009.

5.3.2. Correlation of average noise monitoring results against the noise regulations

Correlation of results against the Environmental Management Coordination (Excessive noise and vibration control regulations) 2009 to ensure compliance was done and presentation of the combined charts are as follows:

a. Diurnal noise results



- The average diurnal noise equivalent levels (Leq) recorded across all the four survey locations complied with the EMC noise and vibration regulations 2009 before commencement of the construction of the proposed facility.

5.3.3. Determination of significance

Determination of noise significance of results was done vide correlation against the EMC (Excessive noise and vibration regulations) 2009 to ensure compliance amongst other aspects.

- Diurnal noise Leq averages were rated as insignificant having scored <75 units based on parameters and score criteria; therefore, the proposed sugar factory site was characterized as noise insignificant area before commencement of construction works.
- From the results of determination of significance, there is no threat to the noise receivers (residential homes, farmlands and surrounding school) of the noise emissions before construction and operations work begin.

5.4. CONCLUSION.

This ambient noise measurement report documented the current noise levels and meteorological conditions for the proposed sugar factory as follows:

- The quantity of noise measured and recorded along the project boundaries complied with the EMC noise and vibration regulations 2009 maximum Noise Level Permitted (Leq) during the day before implementation of the proposed sugar factory project.
- Baseline results obtained along the project boundaries show that the survey location was a noise insignificant area hence the levels do not pose threat to the sensitive receptors before implementation of the proposed sugar factory project.
- Ambient conditions existed at the time of the diurnal survey.
- Environmental noise (Wind breeze), traffic noise emissions from motor vehicles / bikes and noise from human interactions were the main sources of noise emissions.
- The proposed project site was marked with no project related activities during the measurements.
- The levels of noise recorded from existing operations do not pose any Environmental, sustainability, Health, Safety and compliance concerns before implementation of the sugar factory project.

6. REFERENCES

1) Environmental Management and Coordination Act (EMCA) 1999 (amended 2015).
2) Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009 (Legal Notice No.61).

LIST OF APPENDICES:

APPENDIX A:
EQUIPMENT CALIBRATION CERTIFICATES

APPENDIX B:
LABORATORY DESIGNATION CERTIFICATES

APPENDIX A: EQUIPMENT CALIBRATION CERTIFICATES

SONIC QUALITY INSPECTORS LTD

P.O BOX 6063-00200,Nairobi-Kenya,Tel:+254-20-6007509/+254 722-732142
E-Mail:sonicinspections@yahoo.com or mail@sonicinspections.com
website:www.sonicinspections.com

CALIBRATION CERTIFICATE (CENTRE NO. KENAS/CL/002)

Page 1 of 2 pages

REQUESTED BY	**: LAHVENS LIMITED.**
ADDRESS	**: P.O. BOX 34153 - 80118 MOMBASA, KENYA.**
EQUIPMENT	**: SOUND LEVEL METER**
TYPE/MODEL	**: UT351**
SERIAL No.	**: 00000627**
STICKER No.	**: 10909**
MANUFACTURER	**: UNI-T**
DATE CALIBRATED	**: 06-01-2024**
CERTIFICATE No.	**: SQI/LAHVENS/24/001**

1.0 REFERENCE STANDARD AND EQUIPMENT USED

The sound level meter was calibrated according to Kenya Standard KS OIML 58: 1998 Fluke SM-70 sound level meter standard s/no. **S4564D4** was used in the calibration of the Sound Level Meter.

2.0 CALIBRATION PROCEDURE

Procedure number SQI/TCP/023 (measurement procedure for the calibration of Sound Level Meters) was followed in the calibration of the Sound Level Meter.

3.0 TRACEABILITY

This calibration certificate documents traceability of calibration standards used which are traceable to the National Standard Institute KEBS, to realize units of measurement according to the International System of Units (SI).

4.0 This certificate is valid until **6th January, 2025.**

Calibrated by: **J.Kilo** *Date:* **06-01-2024**

Checked by: *Date:* 6/1/2024

Signed: *Date:* 6/1/2024

TECHNICAL MANAGER

Calibration certificate without signature and official SQI stamp is invalid. This certificate has been issued without any alteration. This Certificate is only valid for the instrument calibrated/tested and for the period indicated there in.

BRITISH SAFETY COUNCIL MEMBERSHIP NO.50432711-00200

KENAS

ilac-MRA

20 AUG 2024

CERTIFICATE No: SQI/LAHVENS/24/001
Page 2 of 2 pages

5.0 CALIBRATION RESULTS

STANDARD VALUE IN dB	UUT READING IN dB	CORRECTION IN dB
30-80dB		
35.5	35.2	0.3
45.8	45.4	0.4
56.4	55.9	0.5
71.0	70.3	0.7
79.3	79.5	-0.2
50-100 dB		
51.1	51.3	-0.2
60.4	60.8	-0.4
70.2	70.6	-0.4
80.2	80.9	-0.7
91.1	91.4	-0.3
95.6	96.6	-1.0
80-130 dB		
81.5	81.4	0.1
91.2	90.3	0.9
102.2	101.2	1.0
113.2	112.3	0.9
126.5	125.6	0.9

Comments: The absolute tolerance and uncertainty combined satisfied the MPE of the instrument under calibration

5.1 UNCERTAINTIES

The Uncertainty of the calibration results for the given range of sound level measurements is ± 1.5%dB.

The reported expanded uncertainty is stated as expanded uncertainty of measurement multiplied by coverage factor K= 2, providing a confidence level of approximately 95%.

----------o--0--o----------

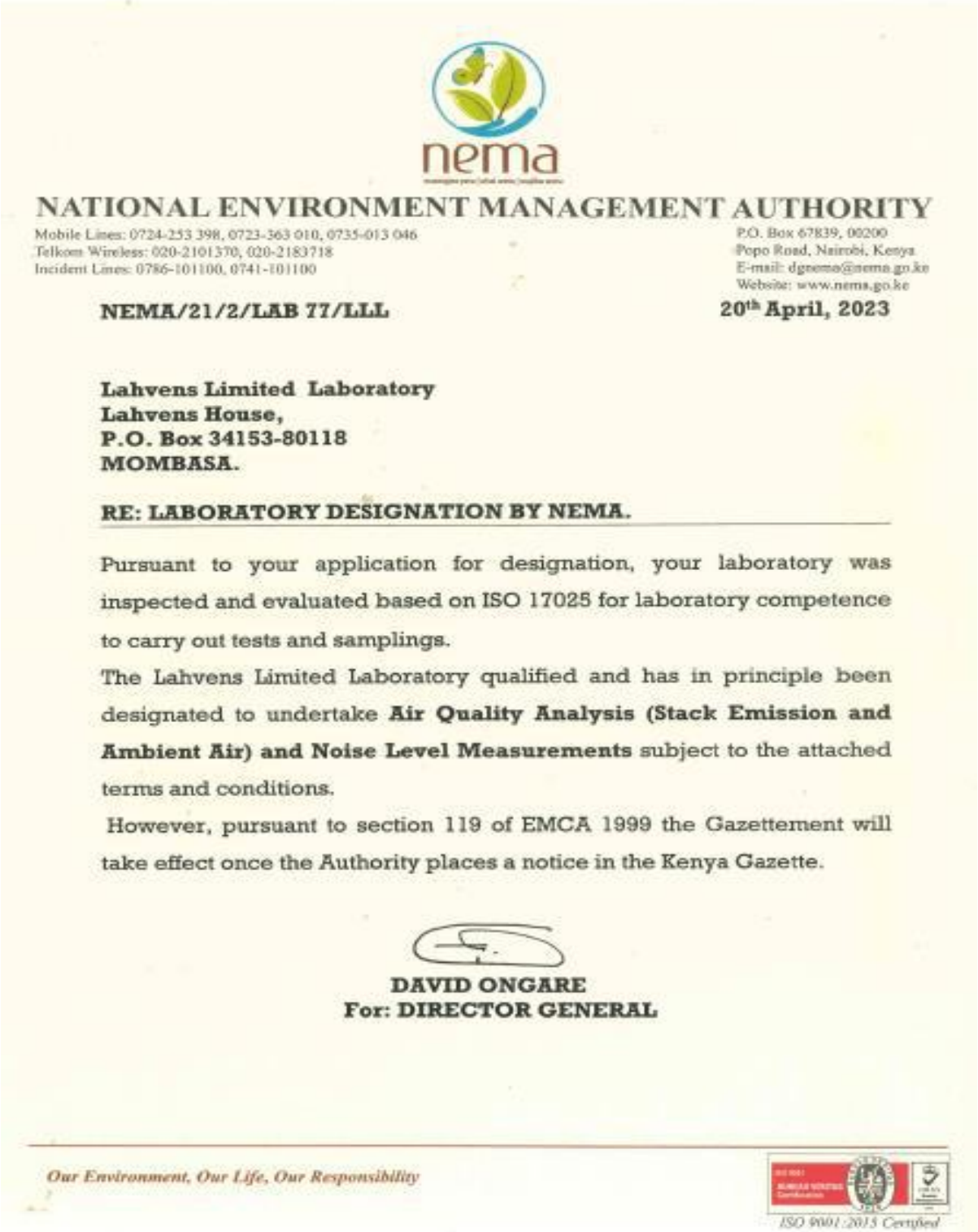
BRITISH SAFETY COUNCIL
MEMBERSHIP NO.50432711-00200

KENAS

ilac-MRA

20 AUG 2024

APPENDIX B: LABORATORY DESIGNATION CERTIFICATES



NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

Mobile Lines: 0724-253 398, 0723-363 010, 0735-013 046
Telkom Wireless: 020-2101370, 020-2183718
Incident Lines: 0786-101100, 0741-101100

P.O. Box 67839, 00200
Popo Road, Nairobi, Kenya
E-mail: dgnema@nema.go.ke
Website: www.nema.go.ke

NEMA/21/2/LAB 77/LLL

20th April, 2023

Lahvens Limited Laboratory
Lahvens House,
P.O. Box 34153-80118
MOMBASA.

RE: LABORATORY DESIGNATION BY NEMA.

Pursuant to your application for designation, your laboratory was inspected and evaluated based on ISO 17025 for laboratory competence to carry out tests and samplings.

The Lahvens Limited Laboratory qualified and has in principle been designated to undertake **Air Quality Analysis (Stack Emission and Ambient Air) and Noise Level Measurements** subject to the attached terms and conditions.

However, pursuant to section 119 of EMCA 1999 the Gazettement will take effect once the Authority places a notice in the Kenya Gazette.

DAVID ONGARE
For: DIRECTOR GENERAL

Our Environment, Our Life, Our Responsibility

ISO 9001:2015 Certified

20 AUG 2024

GEOPHYSICAL AND HYDROGEOLOGICAL SURVEY REPORT

FOR

BHARAT PATEL & UMANG PATEL
P.O. BOX 19226 – 00501
NAIROBI

FOR A PROPOSED BOREHOLE ON
LR. No. TRANSMARA / MOITA/ 761
IN
MOITA AREA OF LOLGORIAN IN KILGORIS SUB-COUNTY
NAROK COUNTY

GEOL. KENYATTA OTIENO
M.GSK/Reg. Hydrogeologist
Under License No WD/WRP 231

P.O. Box 12624 – 00100
NAIROBI

Tel: 0721 596173
Email: otienokenyatta@gmail.com

GEOL. KENYATTA OTIENO
13 MAY 2024
M. GSK / REG. HYDROGEOLOGIST
P.O. Box 12624-00100 NAIROBI

GEOPHYSICAL AND HYDROGEOLOGICAL SURVEY REPORT

FOR

BHARAT PATEL & UMANG PATEL
P.O. BOX 19226 – 00501
NAIROBI

FOR A PROPOSED BOREHOLE ON
LR. No. TRANSMARA / MOITA/ 761
IN
MOITA AREA OF LOLGORIAN IN KILGORIS SUB-COUNTY
NAROK COUNTY

.

GEOL. KENYATTA OTIENO
M.GSK/Reg. Hydrogeologist
Under License No WD/WRP 231

P.O. Box 12624 – 00100
NAIROBI

Tel: 0721 596173
Email: otienokenyatta@gmail.com

EXECUTIVE SUMMARY

The report here-in describes the results of a hydrogeological survey for proposed borehole belonging to **BHARAT PATEL AND UMANG PATEL** in Moita Area of Lolgorian in Kilgoris Division of Narok County. The study was geared towards site identification for the optimal selection of a drilling site proposed for production borehole development.

The proposed borehole is intended for the provision of a sustainable water source for the client. The water demand for domestic use is estimated to be about **5 m^3/hr** and about **20m^3/day.**

Lolgorian lies in a Tropical- Savannah climate zone with semi-highland tendencies with average temperatures of 24°C and a rainfall of about 1,700 mm per annum which falls between March and June as long rains and October-January as short rains. The major formations expected in this area are Igneous rocks of the Butende System. They overlie metamorphic rocks that form part of the oldest rock system in East Africa. These rocks consist of granites, tuffs, pillow lavas and sandstones as well as rocks of different metamorphic aureoles. They weather into thick loam to sandy soils. Generally, the ground water potential in the Area can be rated at between medium and low potential. The hydrogeology in the area is mainly controlled by secondary porosity due to external action on the rocks as igneous rocks tend to lack primary porosity. This means that water is held in cracks, joints and faults

Waters from a nearby spring, existing borehole at Enemasi Market and rainwater harvesting are the only sources of water for area residents. Rainfall has become erratic which makes rainwater unreliable. This makes an alternative water sources a necessity. Surface water is also constrained by lack of permanent water body. The groundwater occurrence is thus considered the more reliable option as a primary water supply for the client. A borehole is therefore required to enable the client set up a sugar mill.

The type formations that are likely to be encountered during drilling at the project site referenced from the basal sequence: -

- Recent Deposits
- Undifferentiated Nyanzian Rocks.
- Undifferentiated Kavirondian Rocks.

In order to arrive at reliable conclusions on the viability of the groundwater resource supply, the Consultants were commissioned to:-

a) Identifying suitable and the most favorable targets for a detailed groundwater investigation.
b) Optimize through the survey procedure the most ideal location for the project site; inclusive the confirmation of the depth range pre-requisite to drilling works.

c) To come up with the most effective borehole siting and drilling techniques as well as borehole designs that would make groundwater development in this region feasible in an optimal and most economical way.

d) Locating alternate and potential drilling sites based on the field geological mapping and/or most promising geophysical anomaly.
e) Evaluating the groundwater resources and formulating recommendations on their exploitation.

In general terms, the Southwest Narok Area is in a hydrogeological complex environment, receiving water from direct precipitation and from stream flow or sub-surface flow around River Gori sub-catchment and Mara River Catchment– and discharging groundwater to the south in perpendicular fractures to the main fault axis and axially along the main fault.

The groundwater flow is intimately connected to the grid fault system within these porous host rocks. Attempts to quantify groundwater flows can be looked in two dimensions *Vis* water balance and groundwater flow in a regional scale for the purpose of the project output conclusive recommendations.

A water supply borehole facility is to be constructed to a minimum depth of 120m at the recommended drill site detailed in the table below. With an estimated discharge of 5.0m^3/hr, the facility is expected to supply a volume of 20m^3/day.

Table 1; specific borehole construction parameters

VES No. & ranking in Yield Potential	Recommended depth in meters	Anticipated Yields	Site coordinates	Construction Details.
VES 01	**Min 120m Max 160m**	**5.0m^3/hr**	**37M 0687909 E UTM 9875765 N Elev: 1,535m**	**254mm/203mm**

ABBREVIATIONS

(All S.I Units unless indicated otherwise)

Agl	above ground level
Amsl	above mean sea level
Bgl	below ground level
E	East
EC	electrical conductivity (µS/cm)
Hr	hour
M	metre
N	North
PWL	pumped water level
Q	discharge (m^3/hr)
s	drawdown (m)
S	South
SWL	static water level
T	Transmissivity (m^2/day)
VES	Vertical Electrical Sounding
W	West
WAB	Water Apportionment Board
WRA	Water Resources Authority
WSL	water struck level
µS/cm	micro-Siemens per centimeter: Unit for electrical conductivity
°C	degrees Celsius: Unit for temperature
"	Inch

GLOSSARY OF TERMS

Alluvium General Term for detrital material deposited by flowing water

Aquifer A geological formation or structure, which stores and transmits water and which is able to supply water to wells, boreholes or springs.

Colluvium General Term for detrital material deposited by hill slope gravitational processes, with or without water as an agent, usually of mixed texture

Confined aquifer A formation in which the groundwater is isolated from the atmosphere by impermeable geologic formations. Confined water is generally at greater pressure than atmospheric, and will therefore rise above the struck level in a borehole.

Development In borehole engineering, this is the general term for procedures applied to repair the damage done to the formation during drilling. Often the borehole walls are partially clogged by an impermeable "wall cake", consisting of fine debris crushed during drilling, and clays from the penetrated formations. Well development removes these clayey cakes, and increases the porosity and permeability of the materials around the intake portion of the well. As a result, a higher sustainable yield can be achieved.

Fault A larger fracture surface along which appreciable displacement has taken place.

Gradient The rate of change in total head per unit of distance, which causes flow in the direction of the lowest >head

Grit Coarse sandstone of angular grain

Hydraulic head Energy contained in a water mass, produced by elevation, pressure or velocity.

Hydrogeological Those factors that deal with subsurface waters and related geological aspects of surface waters.

Infiltration Process of water entering the soil through the ground surface.

Joint Fractures along which no significant displacement has taken place

Lava sheet Lava flow, in parts very thick, covering a large area.

Percolation Process of water seeping through the unsaturated zone, generally from a surface source to the saturated zone.

Permeability The capacity of a porous medium for transmitting fluid

Phenocrysts Large, conspicuous crystals in porphyritic rocks (i.e. rocks with visible mineral crystals in a generally fine groundmass)

Phonolite Compact and fine textured volcanic rock, belonging to the trachyte-group (together with *trachyte ss.* and *latite*). Defined by a high portion of feldspar (40-90%) and feldspatoidic minerals (10-60%: analcite, nepheline, leucite, etc.), and very low to negligible quartz content (0-2%). Incorporated dark coloured minerals (0-40%) most commonly include hornblende, olivine, melanite and acmite. The structure is porphyritic with common phenocrysts of sanidine (orthoclase, or Potassium-feldspar) and nepheline.

Piezometric level An imaginary water table, representing the total head in a confined aquifer: it is defined by the level to which water would rise in a well.

Pyroclastic rocks Group of rocks consisting of volcanic dust, ashes, lapilli and coarse lumps of lava, explosively thrown up in molten condition, and deposited by gravity. Hardened masses of dust, ashes and lapilli are known as *tuff*, while coarse, consolidated pyroclastic debris is referred to as *agglomerate.*

Porosity The portion of bulk volume in a rock or sediment that is occupied by openings, whether isolated or connected.

Pumping test A test that is conducted to determine aquifer and/or well characteristics.

Recharge General term applied to the passage of water from surface or subsurface sources (e.g. rivers, rainfall, and lateral groundwater flow) to the aquifer zones.

Static water level The level of water in a well that is not being affected by pumping (a.k.a. "rest water level")

Transmissivity A measure for the capacity of an aquifer to conduct water through its saturated thickness (m^2/day)

Tuff Here: hardened volcanic ash.

Unconfined Referring to an aquifer situation whereby the water table is exposed to the atmosphere through openings in the overlying materials (as opposed to >confined conditions).

Yield Volume of water discharged from a well.

TABLE OF CONTENTS

1.0 BACKGROUND INFORMATION

1.1 Location

The site is situated within Enemasi Village of Moita Location in Lolgroian Ward in Kilgoris Sub-County. The site is off Awendo – Kehancha road about 38 kilometres from Awendo, on the Kisii – Migori Road. It is also 32 kilometres from Migori town and 30 kilometres from Kilgoris town. The site is 11 kilometres to Ogwedhi Maasai market. It lies within the Survey of Kenya topographic map sheet for **KIHANCHA 144/1** and its defining coordinates are **37M 0687909 E UTM 9875765 N** at an altitude of 1,535 metres above sea level.

1.2 Climate

The climate of this part is of the Tropical Savannah with with lower highland type. The average annual rainfall figure for the area is approximately 1,700 mm, the area is warm and wet. There is relatively low vegetation cover due to human incursion unless along river valleys. The rainfall pattern exhibits a bi-modal distribution, with main wet seasons in March - June and October-January (corresponding to the "long" and "short" rains, respectively). Between 70 and 85% of precipitation, falls during these rainy seasons. Temperatures are highest in the months of February at 24°C before the rain season and lowest in the months of July at 17°C. Annual mean temperatures 20.5°C.

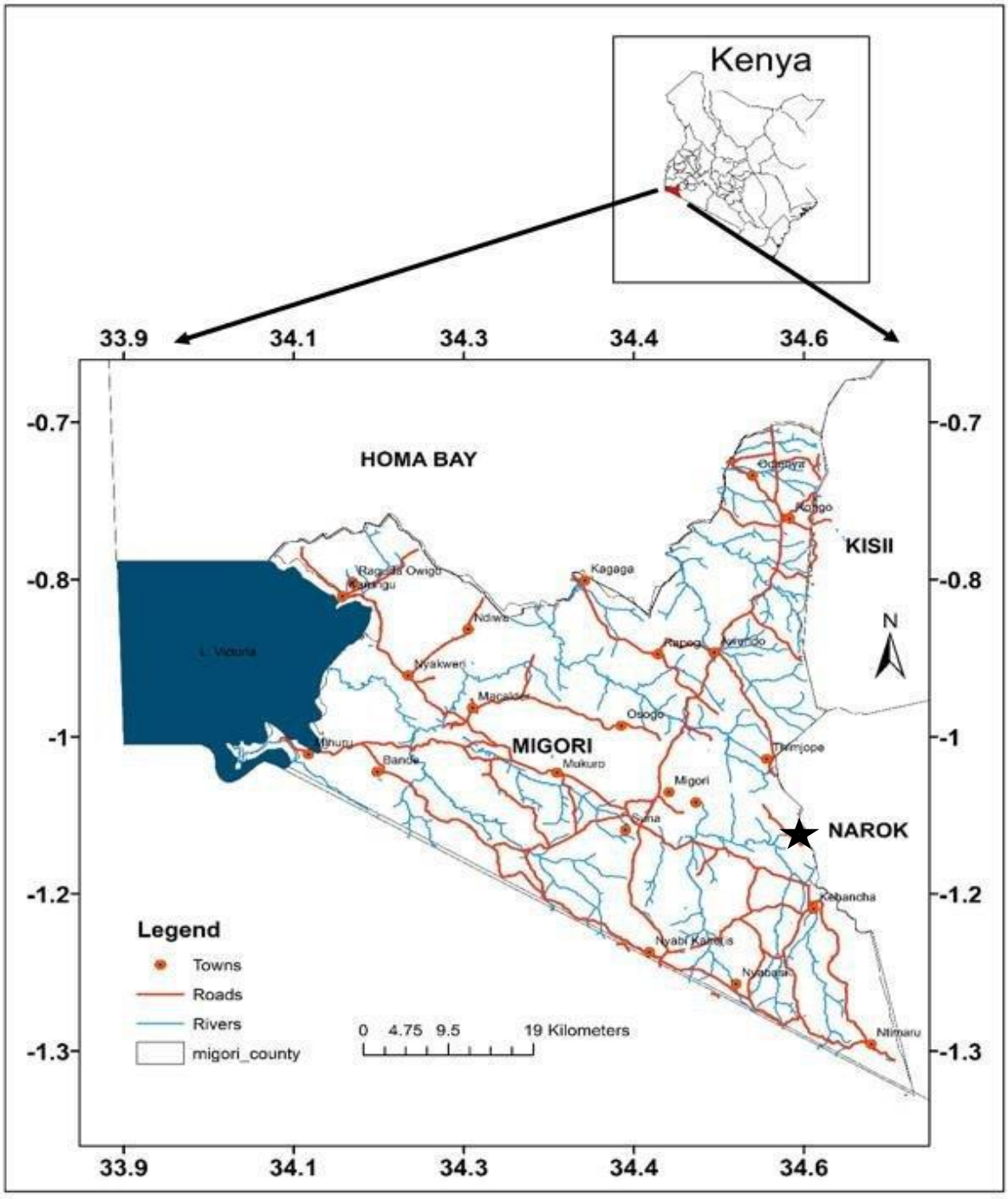
1.3 Physiographic

The site lies at an altitude of about 1,537 **m amsl** on a flat terrain surrounded by hills on all sides except to the north. The hills on the Southern side are Elerai to the West, Enemasi and Keikat which is to the Southeast. Three physiographic units defined either by predominant rock types or the results of tectonic Movement can be recognized in the area.

They are-:

a) Kisii highlands to the North and
b) Migori Hills to the West
c) Low peneplain in East

The area lies on the boundary of Mara River and Migori River catchments. The major drainage areas can be recognized, that feed the internal drainage; tributaries rising from the Kisii Highlands and Migori Hills. The area has a drainage patterns running in dendritic pattern from the orientation in area rivers. They all flow northeastwards as tributaries which drains into Gucha – Migori Basin. River Mogor/Migori is the major drainage river of the area. It joins River Gucha before flowing into Lake Victoria.



Sketch Map of Area Drainage Patterns

2.0 TERMS OF REFERENCE.

The clients commissioned us to carry out a detailed exploration on their project site, - in the Moita Location of Lolgorian Division of Narok County. The site lies to the Northwest of Lolgorian Town and East of Migori Town.

The consultants were thus commissioned by the client to carry out the detailed exploration program at the project site and subsequently present a detailed report under the specifics*:*

i) Carry out a reconnaissance survey at the project site and generate the baseline data for the subsequent borehole site investigations. As a pre-site assessment element, the area lies to the south of River Oyani.

ii) In order to optimize borehole locations with an inherently higher potential yield; the survey program should be geared towards identification of optimally permeable section of the grid structures.

iii) Generate baseline data on the basis of actualized aquifer performance from functional existing facilities located within the farm and in the neighbourhood. The quantifiable parameters would serve as a guide to the ultimate site identification and thus justify the conclusive recommendations for the other site.

iv) Integrate reconnaissance baseline survey data with the geophysical borehole data obtained in the conduct of the surveys and assimilate the borehole data to define the recharge/discharge boundaries for the project site. I.e. calibrate the exploration data against known geological settings.

v) Combine the baseline data with the mapping data – to include hydro-geological, geological, geophysical and hydrological data for the project site with a view to optimize the drilling conditions; dully recommended as part of the investigations.

vi) Analyze all the above data in order to fully quantify the groundwater potential; and subsequently provide a comprehensive report on the groundwater exploration program.

vii) Define the parameters of drilling depth; potential aquifer strike depths and provide indicative elements of the likely aquifer performance in terms of discharge from the proposed drilled intakes.

viii) Analyse all data collected during all the surveys to determine the best drilling site.

3.0 GEOLOGY

3.1 Regional Geology

The area is situated in the Nyanzian, Kavirondian and Bukoban System of rocks. The Nyanzian greenstone belt which is an extension of Archean Greenstone Belt located in the neighbouring Tanzania. This belt is generally composed of continuous volcano-sedimentary successions and granitic intrusions. It is divided into the Southern and Northern terrains by the Winam gulf. They are considered to be of sedimentary origin in an old ocean. The composition and texture of most of its component is gneisses with wavy textures typical of sedimentary origin.

After the consolidation into metamorphic rocks, alkali metasomatism took place that gave rise to microline rich rocks. These are biotite gneiss and migmatites. In other areas there was complete reconstitution of these rocks due to fluid action that led to change from biotite gneiss to granitoid gneiss. There was a quiet moment of millions of years which led to erosion of weak formations into a plain. After the formation of a peneplain Tertiary Volcanic activities took place. Mt. Kilimambogo was the main vent nearby but some phonolites came to the area from the eastern Rift Valley flanks.

3.2 Geology of the Project Area

The project plot is situated in an area covered by a layer of grey/black cotton soil with quartzite grains and pebbles. Nyanzian units as already discussed consist of conglomerates, shale, greywacke, banded iron formations, pillow lavas and basalt, granites, tuffaceous and slaty rocks. Kavirondian units consist of boulder conglomerates, shales and sandstones. Bukoban units mainly consist of porphyritic and non-porphyritic basalts and are found on the project area which is to the north of Lolgorian.

The principal igneous rock in the area is part of the Butende Granites which makes contact with the Longaria Granite south of the area. Butende Granite is part of Bukoban rocks, which are volcanic in origin. The Bntende Granite tends towards a more basic rock formation. ln favourable areas, a passage from the unaltered acid granite through to syenite and diorite may be observed. It is pale greenish in colour. Quartz is fairly abundant in phenoerysts while hornblende is less common. Biotite is fairly plentiful, scattered through the rock in crystals.

Some of these granites to the North of Lolgorien Hill, show a gradual transition from typical, medium grained igneous rocks to chlorite-schist. It thus shows that there was metamorphism that accompanied igneous intrusion.

3.2 Structural Geology

The crystalline rocks of the Nyanzian and Kavirondian belt were intensively folded along regional trends, possibly during Precambrian times. There formation was a result of folding so most of them have synclines and anticlines that run in a northwest-southeast orientation. They have since been filled up with sediments and volcanic materials.

Faulting and structural adjustments happened later. The major fault in the area is the Northeast –Southwest Oldonyo Lolgarian Fault. Other faults trend in this direction. This was partly engineered by volcanicity around Eastern Rift Valley which is to the East of the area.

4.0 HYDROGEOLOGY

4.1 Background

The hydro-geology of an area is determined by the nature of the parent rock, structural features, weathering processes and precipitation patterns. Within volcanic rocks, groundwater primarily occurs within fissure zones, fractures, sedimentary beds, lithological contacts and Old Land Surfaces (OLS) which characterize periods of erosion between volcanic eruptions and subsequent lava flows are potential aquifers. These OLS's comprise soils, weathered rocks and water-lain erosional material of volcanic origin. Magma Intrusions rarely possess significant pore space; instead, their porosity is largely determined by secondary features, such as cracks. However, deposits and especially sediments do have a primary porosity: the cavities between the mineral grains or clasts are usually open and interconnected. Consequently, they can contain and transmit water.

4.2 Hydrogeology of the Project Area

Within the area, the numerous the major formations have low porosities. The inter-crystalline voids that make up the porosity are minute and many are not interconnected. Because of the small pore size and low degree of pore interconnectivity, the primary permeability of these rocks is extremely small. Groundwater in igneous and metamorphic zones is thus limited to fractured areas and erosional surfaces within the succession. The groundwater potential of the area is further inhibited by the shallow depth nature of secondary porosity. Consequently, both the geology and hydrogeology are relatively complicated. Possible aquifers within such a terrain are:

- Sedimentary intercalations within the igneous rocks,
- Old land surfaces (OLS) above the rocks,
- Faults and fissures within the rocks.
- Lacustrine or alluvial sediments laid down after the end of the major faulting episodes.

4.3 Existing boreholes

As per WRMA standards and now incorporated within the Kenyan Law (Water Act), that borehole spacing in a particular aquifer will be determined on the basis of the potential of that aquifer/s or through the application of a special allocation plan(WAP) developed for different aquifers.

The conception is that a permit to drill will be issued on the basis of the nature of the aquifer and/or any other special condition, and this aspect may override the radial distance requirement. There are very few boreholes within the area and those within the vicinity of the project site are as tabulated here under.

There is no borehole close by to analyze for purpose of this report. However, the three boreholes captured in the table below show shallow drilling depths and medium to low yields.

BH No. C-	Owner	Location (X km dir)	Depth (m bgl)	WSL (m bgl)	WRL (m bgl)	Q (m3/hr)	PWL (m)
Ref.	**Client's Site**						
5825		15 NW	90	19	15	0.9	86
6016		17 NW	52	49	3	2	43.4
8708	Kehancha Mission	5.3 SSW	60	18, 42	5	4.98	43
Range			**52 - 90**	**18 - 49**	**3 - 15**	**0.9 – 4.98**	**43 - 86**

4.3.1 Recharge

The recharge mechanisms (and the rate of replenishment) of the local aquifers has not been fully established. The two major processes are probably direct recharge at surface (not necessarily local) and indirect recharge via faults and/or other aquifers.

Direct recharge is obtained through downward percolation of rainfall or river water into aquifer. If the infiltration rate is low due to the presence of an aquiclude (such as clay), the recharge to the aquifer is low. Percolation will depend on the soil structure, vegetation cover and the state of erosion of the parent rock. Rocks weathering to clayey soils naturally inhibit infiltration and downward percolation. Aquifers may also be recharged laterally if the rock is permeable over a wide area.

In the study area, the principal recharge zones are the southern slopes of Kisii Highlands and the hills along the Southern belt of the project area. These areas receive good levels of rainfall which compromises recharge. The slopes are also not steep and the project area is generally flat and surrounded by hills. As a result, the aquifers identified are indirectly recharged by underground drainage of water falling some distance from their present locations.

Several forms of recharge are believed to occur in the general study area:

a) Direct recharge from infiltration of rainfall through permeable formations and faulted areas to the groundwater storage zones.
b) Indirect, lateral recharge from neighboring aquifers, as probably occurs from aquifers directly recharged in the peripheral escarpment areas and led under gravity towards the Valley floor
c) Indirect recharge from the river systems that drain into River Migori through alluvial sediments to the sediment aquifers.

4.3.2 Mean Annual Recharge

The three recharge mechanisms replenishing the aquifers underlying the study area cannot be separated from one another. Instead they act as integrated parts in a highly-complex and very variable hydrological environment. As a result, the precise location of the mixing zones of the three recharge mechanisms is not possible to pin-point, although it will in any case take the form of transition zones, rather than absolute cut-off zones.

However, recharge amount is probably an underestimation due to the possibility of influent recharge from the lake at greater depth.

4.4 Discharge

Discharge from aquifers is either through natural processes as base-flow to streams and springs, or artificial discharge through human activities. However, considering the few number of boreholes in the area this form of discharge is not much pronounced.

The total effective discharge from the aquifers via either of the above means is not known. The main form of discharge is through flow along formations and faults/ interconnected fractures.

5.0 GEOPHYSICAL INVESTIGATION METHODS

A variety of geophysical methods are available to assist in the assessment of geological subsurface conditions. In the present survey resistivity (also known as the geo-electrical method) has been used. Fieldwork was done on July 31, 2024.

5.1 Resistivity Method

Vertical electrical soundings (VES) were carried out to probe the condition of the sub-surface and to confirm the existence of deep groundwater. The VES investigates the resistivity layering below the site of measurement. This technique is described below.

5.2 Basic Principles

The electrical properties of rocks in the upper part of the earth's crust are dependent upon the lithology, porosity, and the degree of pore space saturation and the salinity of the pore water. Saturated rocks have lower resistivities than unsaturated and dry rocks. The higher the porosity of the saturated rock the lower its resistivity, and the higher the salinity of the saturating fluids, the lower the resistivity. The presence of clays and conductive minerals also reduces the resistivity of the rock.

The resistivity of earth materials can be studied by measuring the electrical potential distribution produced at the earth's surface by an electric current that is passed through the earth.

The resistance R of a certain material is directly proportional to its length L and cross sectional area A, expressed as:

$$R = Rs * L/A \quad \text{(Ohm)} \tag{1}$$

WhereRs is known as the specific resistivity, characteristic of the material and independent of its shape or size, With Ohm's Law,

$$R = dV/I \quad \text{(Ohm)} \tag{2}$$

WheredV is the potential difference across the resistor and I is the electric current through the resistor, the specific resistivity may be determined by:

$$Rs = (A/L) * (dV/I) \quad \text{(Ohm.m)} \tag{3}$$

5.3 Vertical Electrical Soundings (VES)

When carrying out a resistivity sounding, current is led into the ground by means of two electrodes. With two other electrodes, situated near the centre of the array, the potential field generated by the current is measured. From the observations of the current strength and the

potential difference, and taking into account the electrode separations, the ground resistivity can be determined.

While carrying out the resistivity sounding the separation between the electrodes is step-wise increased (in what is known as a Schlumberger Array), thus causing the flow of current to penetrate greater depths. When plotting the observed resistivity values against depth on double logarithmic paper, a resistivity graph is formed, which depicts the variation of resistivity with depth.

This graph can be interpreted with the aid of a computer, and the actual resistivity layering of the subsoil is obtained. The depths and resistivity values provide the hydro-geologist with information on the geological layering and thus the occurrence of groundwater.

5.4 The Prospecting Methods

5.4.1 The Concept Basis of the Resistivity Methods

The electrical properties of rocks in the upper part of the earth's crust are dependent upon the lithology, porosity, and the degree of pore space saturation and the salinity of the pore water. Saturated rocks have lower Resistivity than unsaturated and dry rocks.

The higher the porosity of the saturated rock, the lower is its resistivity, and the higher the salinity of the saturating fluids, the lower the resistivity. The presence of clays and conductive minerals also reduces the resistivity of the rock. The resistivity of the earth materials can be studied by measuring the electrical potential distribution produced at the earth's surface by an electric current that is passed through the earth.

The resistance R of a certain material is directly proportional to its length L and cross-sectional area A, expressed as:

$$R = \rho * L.A \quad (1)$$

Where ρ is known as the specific Resistivity; characteristic of the material and independent of its shape or size. With Ohm's Law;

$$R = \Delta V / I \quad (2)$$

Where 8V is the potential difference across the resistor and I is the electric current through the resistor, the specific resistivity may be determined by:

$$\rho = (A/L)\ \Delta\ V/I) \quad (3)$$

5.4.2 Resistivity Sounding Method

When carrying out a resistivity sounding, also called vertical electrical sounding (VES), an electric current (I) is passed into the ground through two metal pegs, the current electrodes.

Subsurface variations in electrical conductivity determine the pattern of current flow in the ground and thus the distribution of electrical potential.

A measure of this is obtained in terms of the voltage drop (ΔV) between a second pair of metal pegs and the potential electrodes placed near the center of the array. The ratio (V/I) provides a direct measurement of the ground resistance and from this and the electrode spacing, the apparent resistivity (ρ) of the ground is calculated.

A series of measurements made with an expanding array of current electrodes (Schlumberger Array), allows the flow of current to penetrate greater depths, providing information on the vertical variation in resistivity. The calculated apparent resistivity is plotted against current electrode half separation on a bi-logarithmic graph paper to constitute the so-called sounding curve. The curve depicts a layered earth model composed of individual layers of specific thickness and resistivity.

Interpretation of the sounding curves is based upon the convolution method of Ghosh (1971) a mathematical curve-fitting procedure. Without additional data for correlation it can easily lead to a fitting solution that does not quite correspond to reality.

5.4.3 The Combined Wenner/VES Method

The combined Wenner/VES method locates suitable groundwater zones by making use of the resistivity contrast, which exists between fresh unproductive rocks and water bearing zones. The resistivity of fresh basement exceeds 1880 Ω-m, whereas that of water-bearing zones is lower, being dependent upon the degree of weathering and the groundwater quality. The method exploits the different operating characteristics of two methodologies.

First HEP configuration is used to carry out a conductivity traverse across the area of interest. In most cases, two parallel profiles are run, in order to assess the significance and the direction of the observed anomalies. Vertical Electrical Soundings are then carried out at the most promising VES on the Wenner profiles, using an **PQWT GT300A Terrameter**. The survey assessed the nature of the feature, because a variety of sub-surface conditions can give rise to similar profiling data. In addition, the VES is used to predict the thickness of different layers and depth to the aquifer.

By combining VES, and the resistivity profiling, a ground resistivity model can be obtained which best fits both sets of data. The joint computer interpretation helps to reduce the ambiguity caused by equivalence.

5.4.4 Fieldwork

The soundings were conducted on the project site and further analysis and modeling of the data enabled the optimization of the drilling depth for specific construction requirements. The maximum electrode spacing used for the Sounding was 2metres over a distance of 40 metres. The VES sounding data is as represented in the table below with a brief interpretation of the underlying lithology and the curves are provided in the appendix.

5.4.5 Data Interpretations and Analysis

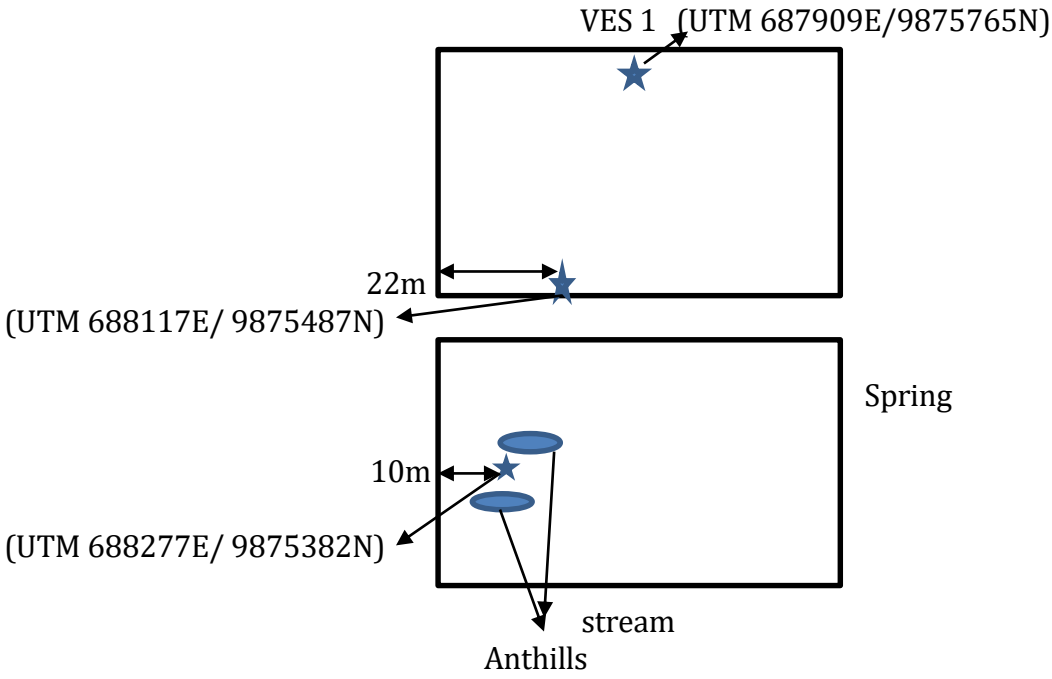
Interpretation of the sounding curves is based upon the convolution method of a mathematical curve-fitting procedure. Without additional data for correlation it can easily lead to a fitting solution that does not quite correspond to reality.

The three Schlumberger sounding curves were prepared and modeled using a software, which uses interpretation techniques based on the Barnes Layer Model. The generated resistivity models were subsequently interpreted, using known geological conditions and educated guess to help establish/predict potential aquifer depths. Refer to the appendices section for VES data, curves, models, and their interpretations.

The layered earth model is actually very much a simplification of the many different layers, which may be present in a given hydrographic environment. The various equivalent solutions which can be generated through a single resistively sounding should never be interpreted in isolation as this leads to a meaningless result.

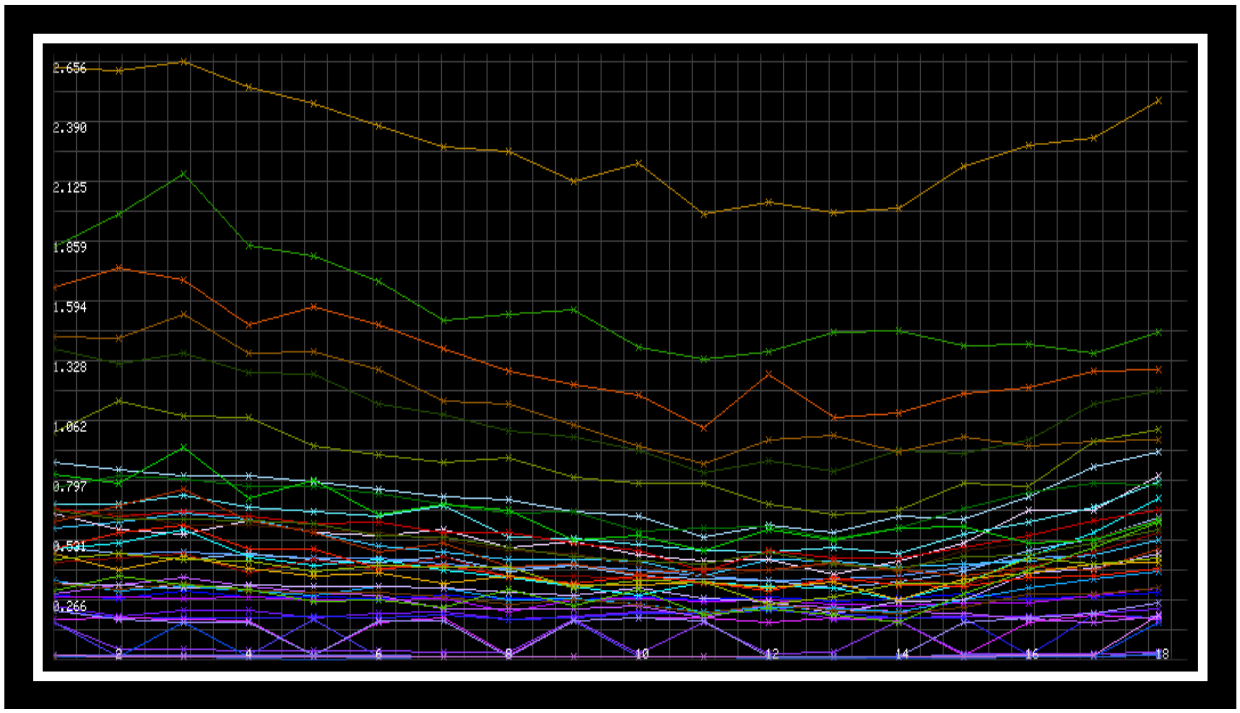
5.5 FIELDWORK AND RESULTS

The project area is on a low lying plain with hills around it. This raises the groundwater potential of the area as the slow speed of flow leads to higher infiltration. We tracked a line of weakness perpendicular to the seasonal rivers. We used water dowsing to get a line of weakness parallel to the general orientation of the seasonal rivers (faulting and folding) in the area.



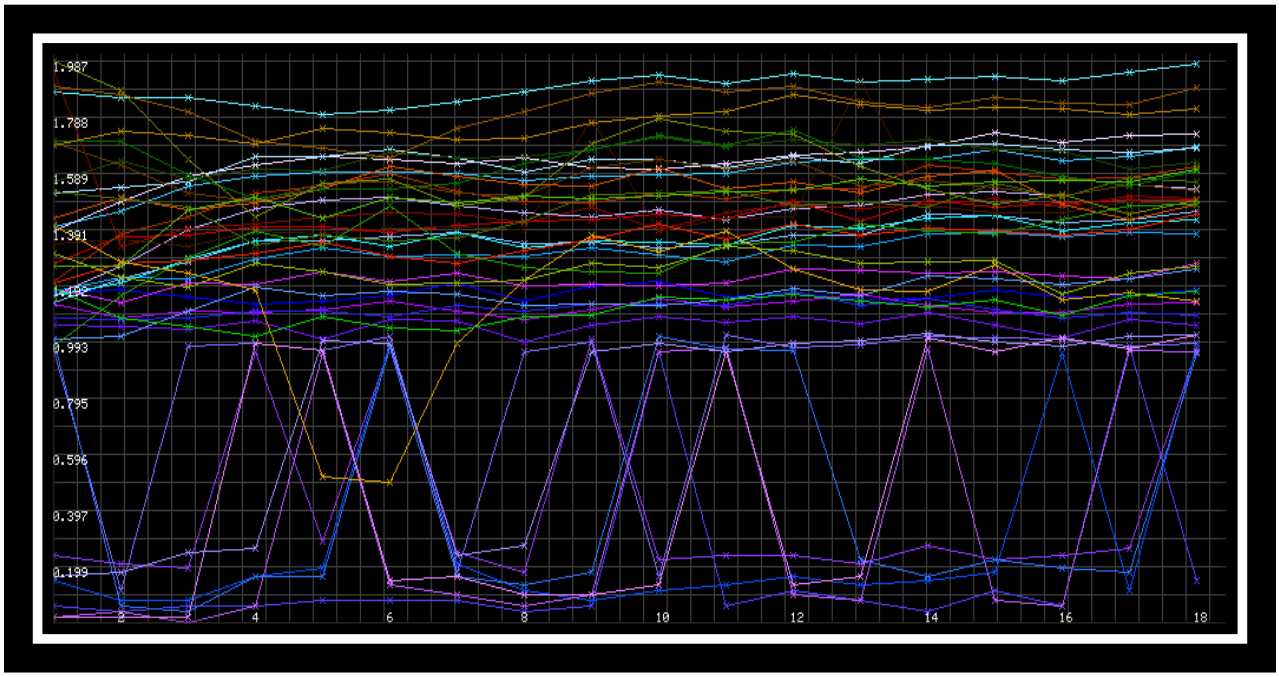
5.6 VES ONE

Water dowsing was carried out and a point was identified to the Western fence of the plot. The lines of weakness run in a east-west orientation. VES ONE was carried out in a north – south orientation. The weathered and fractured zone goes down to about 120 metres. I recommend point 11.



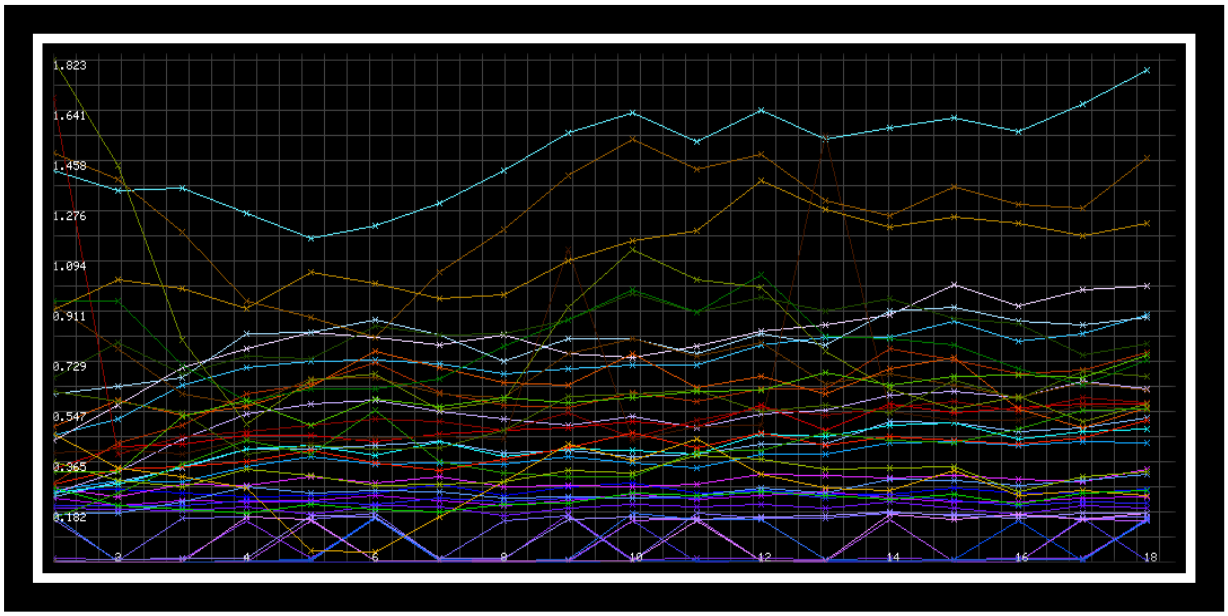
5.7 VES TWO

This was a sounding carried out in a North – South orientation to a distance of 40 metres to the Northwest of the plot near the fig tree. The resistivities look a little better than VES ONE but it is very close to the spring.



5.8 VES THREE

This was a sounding carried to the Northwest of the plot between two anthills. It was carried in a North – South orientation to a distance of 40 metres. The resistivities look good but due to its position near the lowest point on the farm, VES ONE is still preferred.



6.0 GROUNDWATER QUALITY AND NATIONAL STANDARDS

Practically all types of water; runoff water, groundwater and even rainwater, contain some dissolved salts and impurities. If certain elements are present in high concentrations, the application of the water for domestic and or irrigation uses may be restricted.

The waters in the Southwest Narok County – where a reliance on borehole water source is not quite prevalent - comprise un-modified waters and especially where groundwater recharge is low. Un-modified waters comprise types whose chemical composition is derived from normal water-rock interaction at moderate temperatures.

Other properties of waters such as PH, and Eh (oxidation potential) indicate that the waters are relatively un-modified. PH is similar for most of these waters, with a very few exceptions of 8.0 PH units, which is typical of dilute bicarbonate waters. They attest to rainfall followed by good water rock interaction. The main impediment to water quality in the area is low mineralization of host rock.

NB. WHO Water Quality Standard chat is attached as an appendix

6.1 Factors Affecting Degree of Salinity in Groundwater

Evaporation and Transpiration.
Direct evaporation due to the sun and preferential uptake of certain mineral ions by plants relative to low rainfall leads to high salinity levels. This is possible in the area as the average temperatures are higher during dry season and the area has poor vegetation cover.

Dissolution of Evaporites.
The process of evapotranspiration described above is common in arid conditions, this lead to the precipitation of salts in the top soil. These salts may then be carried down to the groundwater store during the next rainy season, thus leading to high ion concentrations in space and time. This process is not high as there is no wide range in weather patterns especially temperature and rainfall in the area. This factor comes into play in the area mainly due to high temperatures and high populations which increase human waste. Agricultural waste can lead to dissolution of evaporates which is a factor in the farm.

Dissolution of Host Rock.
Given relatively short residence times, erratic seasons of recharge and fairly high ambient temperatures in groundwater systems, progressive salinity of groundwater can be expected in the host rock. This will vary according to local geology, local structures which may increase the rate of passage of water through an aquifer through faults and joints etc, hence limiting retention time. The quality of groundwater in the project area is not expected to be affected much by this factor even though the level of mineralization is high in rocks.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The summarized conclusions and recommendations from the hydro geological investigations undertaken within the Moita area are described in the following sections.

Localized Hydrogeology of Investigated Area

The area is situated in a zone with medium groundwater potential: recharge is obtained through a concentration of groundwater drainage from seasonal streams. In addition, the transmissivity of the aquifer system is known to be moderate. The study concludes that based on geological evidence, groundwater prospects for medium-scale abstractions are good.

Proposed Borehole Drilling

It is proposed that the borehole is drilled at the point marked **VES 1**, known to client's contact person. This is also good as it is far from the spring which might be affected by groundwater abstraction. Sustainable water supply can only be guaranteed if water is tapped mainly from the fractures characterizing the area rocks. The recommended maximum depth of the proposed borehole is ***160 metres*** to fully penetrate the weathered formation. Given the moderate water demand for domestic use, the borehole should be drilled to a minimum diameter of 8", in order to allow for the installation of 6" casings and screens.

Additional Recommendations and Legal Requirements

A dipper line and a water meter should be installed to monitor static and pumped water levels, in combination with the applied groundwater abstraction.

The hydraulic properties of the borehole and the surrounding aquifer should be determined during a step-drawdown test, followed by 24-hour constant discharge test. After stopping the pump, recovery of water lever should be measured for 12 hours, or alternatively, a 95% return to the static level. Using test-pumping results, the sustainable yield can be calculated. The maximum discharge is restricted to 60% of the rate applied during the constant discharge tests.

Samples taken during test pumping to a recognized laboratory for chemical analysis.

It is strongly recommended to engage the services of an experienced hydro geologist during the drilling, installation, and testing of the borehole.

This borehole should be drilled conventionally and within the standard document policy, laid down by WRA. The borehole is to be drilled at a nominal diameter of 203mm drilling diameter with a nominal casing diameter of -153mm –6''. A comprehensive borehole design is presented as figure 8a. Apart from inspecting the quality of material and verifying the quantities of items billed by the contractor, the main tasks of the supervisor are to ensure that the borehole is completed according to the technical specifications, and to provide sound professional judgment on design aspects, required drilling depth, sustainable yield and selection of the permanent pumping plant.

The drilling should ideally be carried out with a Rotary drilling plant rotary in order to attain the recommended minimum drilling depth of ***150.0m*** below ground level. Screens should only be installed at the deeper aquifers as from 30- 100m. We emphasize the use of plasma slotted pipes with enhanced density of slots to improve the lifespan of the bore.

The borehole should be test pumped to within British standards BS 6316 (1992). An industrial standard that stipulates of a 10hours of the step test at – 2-hour interval followed by a CRT test for 30 hours is recommended. Recovery must be carried out to the Static Water Levels or 98%.

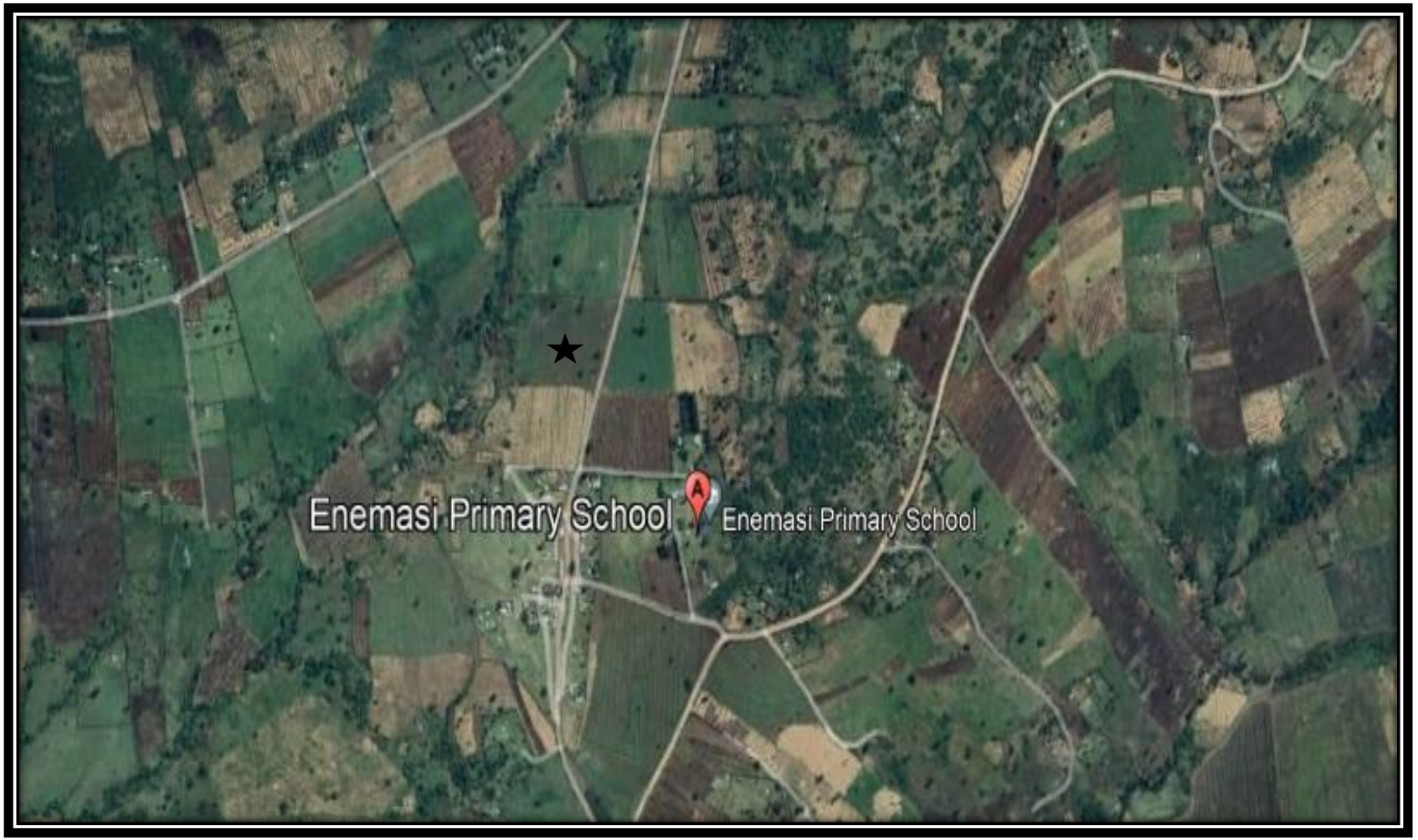
The borehole should be developed until the water is clear and free of sediments. This is for the purpose of both well and aquifer efficiencies.

The pump chamber should never be installed within the screens to avoid encrustation and for an increased borehole lifespan. Well development must be compressive and aggressive; and it should comprise chemical development with SHMP – trade name Calgon. SHMP acts as a clay disaggregate and is highly recommended for all water supply bores as a way to enhance yield.

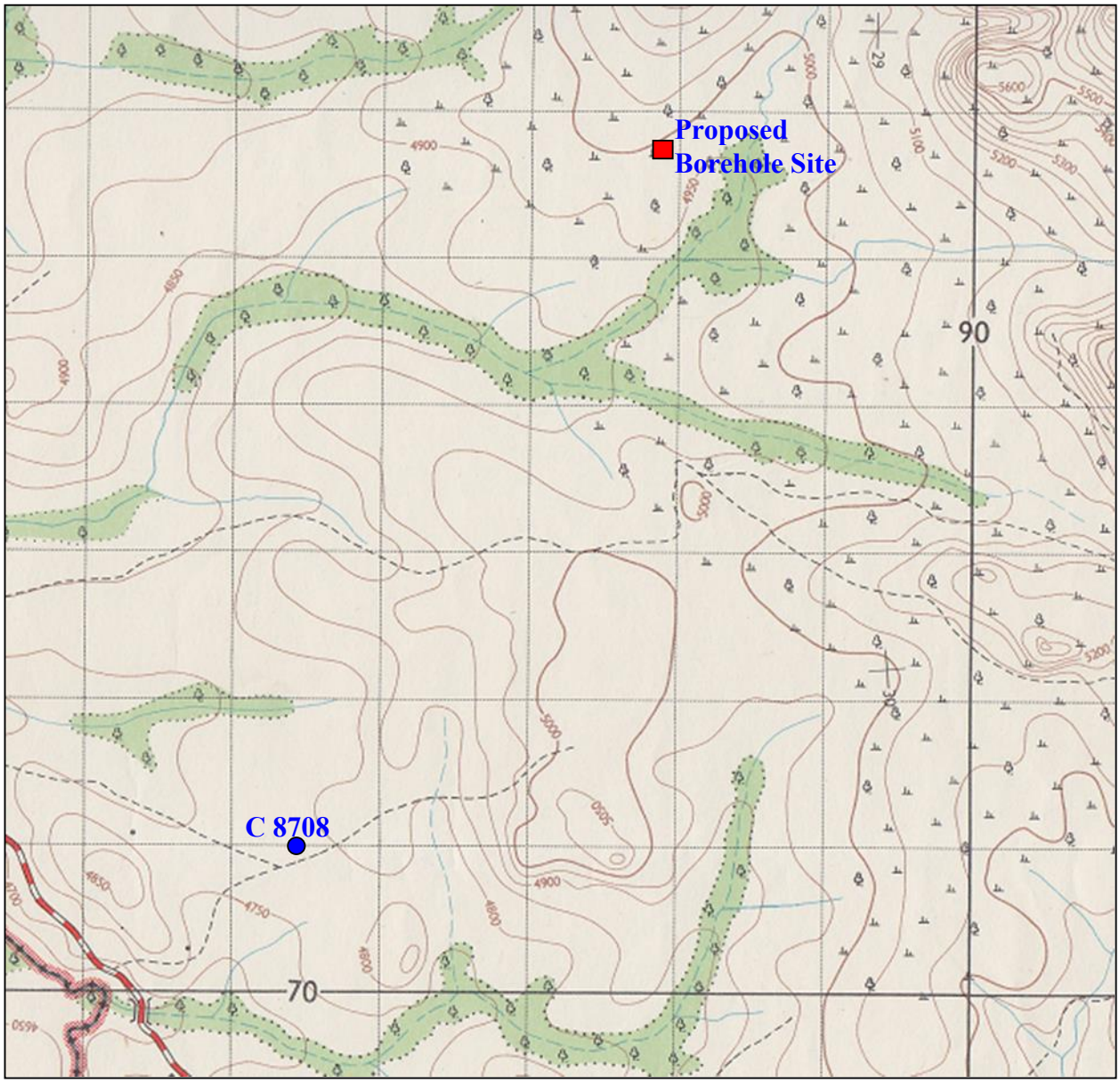
The associated waters from the aquifer calibrated against geological data and the hydro-chemical data attest to high quality groundwater supplies; devoid of abnormal pH; low level of carbonates and TDS. The borehole water is thus suitable for the proposed usage.

It is thus recommended that: The borehole is to be drilled to a **maximum depth of 160 metres** at the selected site.
The point is known to Samuel Moniko of phone number 0712 372002, an area resident.

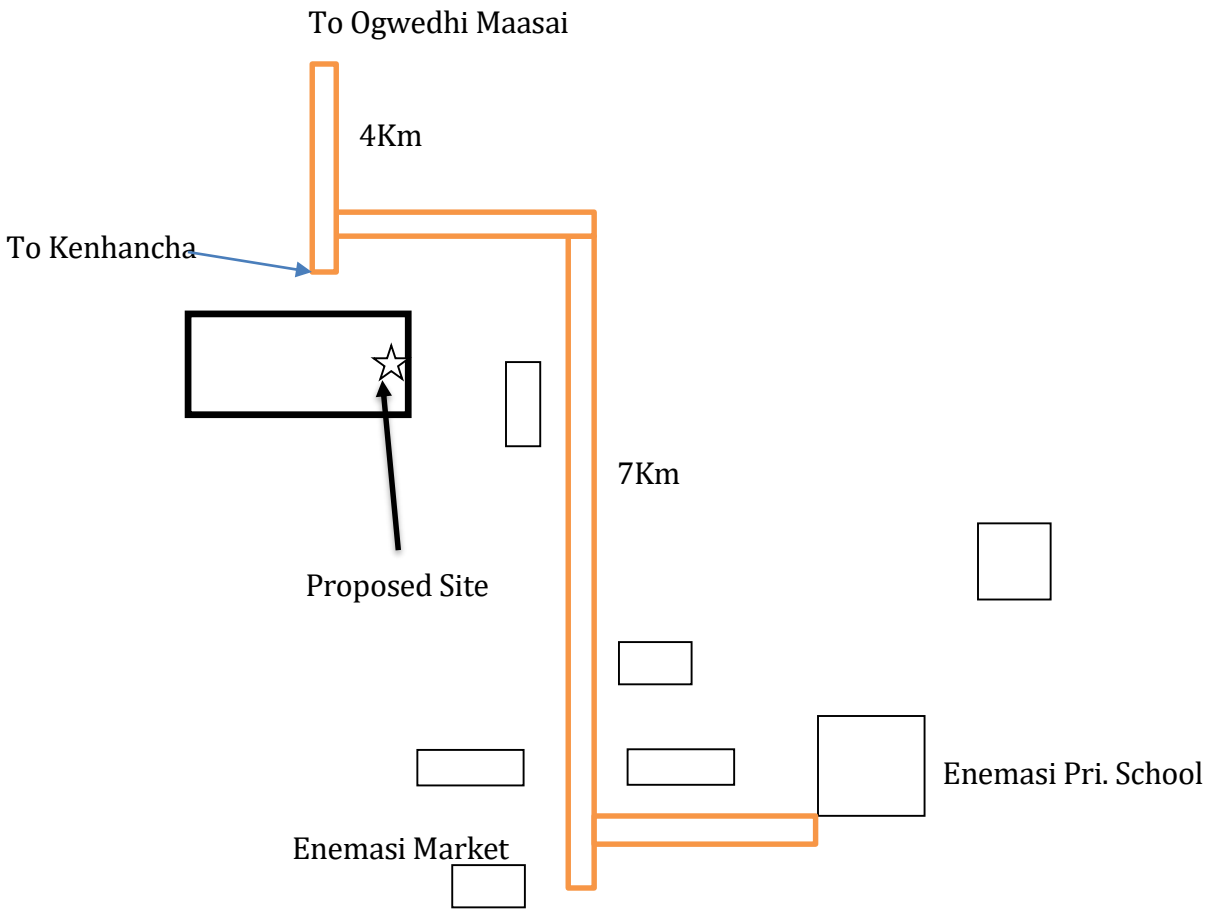
APPENDIX 1: GOOGLE IMAGERY OF THE PROJECT AREA



APPENDIX 2: EXTRACT FROM TOPOGRAPHIC MAP – KIHANCHA 144/1



APPENDIX 3: SKETCH MAP OF PROJECT AREA



APPENDIX 4: ACCEPTABLE IONIC CONCENTRATION

		World Health Organization: 1983 Guidelines;	1971 Int. Standards;	European Community: EC Directive 1980 relating to the quality of water intended for human consumption:	
Substance or Characteristic	Value	Guideline (GV)	Upper limit (HL), (tentative)	Guide Level (GL)	Max. Admissible Concentration MAC)
Inorganic Constituents of health significance;					
Antimony	Sb				0.01
Arsenic	As	0.05	0.05	0.05	
Cadmium	Cd	0.005	0.01		0.005
Chromium	Cr	0.05	0.05		
Cyanide	CN	0.10	0.05		0.05
Fluoride	F	1.5	1.7		1.5
Lead	Pb	0.05	0.10		0.05
Mercury	Hg	0.001	0.001		0.001
Nickel	Ni				0.05
Nitrates		10 (as N)	45 (as N03)	25 (as NO3)	50 (as NO3)
Selenium	Se	0.01			

Other Substances		GV:	Highest Desirable Level:	Maximum Permissible Level:		GV:		MAC:	
Aluminum	Al		0.20				0.05		0.20
Ammonium	NH4						0.05		0.50
Barium	Ba					0.10			
Boron	B						1.0		
Calcium	Ca			75	50		100		
Chloride	Cl		250	200	600		25		
Copper	Cu			0.05		0.10			
Hydrogen Sulphide	H2S						ND		
Iron	Fe		0.30	0.10	1.0		0.05		0.20
Magnesium	Mg		0.10	30	150		30		50
Manganese	Mn		0.10	0.05	0.50		0.02		0.05
Nitrite	NO2								0.10
Potassium	K						10		12
Silver	Ag								0.01
Sodium	Na	200				20		175	
Sulphate	SO4		400	200	400		25		250
Zinc	Zn			5.0	15		0.10		
Total Dissolved Solids		1000		500	1500			1500	
Total Hardness as CaCO3				500	100	500			
Colour	ºHazen	15		5	50	1		20	
Odour		Inoffensive		Unobjectionable			2 or 3 TON		
Taste		Inoffensive		Unobjectionable				2 or 3 TON	
Turbidity	(JTU)		5	5	25		0.4		4
pH		6.5 - 8.5	7.0 - 8.5	6.5 - 9.2	6.5 - 8.5		9.5 (max)		
Temperature	ºC						12		25
EC	uS/cm						400		

Notes: ND - Not Detectable; IO - Inoffensive; GL - Guide Level; UO - Unobjectionable

(Based on Table 6.1, in Twort, Law & Crowley, 1985 - Water Supply, Edward Arnold, London)

APPENDIX 5: DRILLING TECHNIQUES

Drilling should be carried out with an appropriate tool. A percussion or rotary drilling machine will be suitable, though the latter is considerably faster. Geological rock samples should be collected at 2 metres intervals. Water struck and water rest levels and if possible estimates of the yield of individual aquifers encountered, should also be noted.

1. Well Design

The design of well should ensure that screens are placed against the optimum aquifer zones. The final design should be made by an experienced Hydro-geologist.

2. Casing and Screens

The well should be screened with good quality screens considering the depth of the borehole; it is recommended that stainless steel casing and screens of 6" diameter be used. Slots should be of maximum 2mm in size.

We strongly advice against the use of torch-lit steel castings for screens,in general its use will reduce well efficiency (which leads to lower yields) increase pumping costs through greater draw down, increased maintenance's cost, and eventually reduction of the potential effective life of the well.

3. Gravel pack

The use of gravel pack is recommended within the aquifer zone, because the aquifer could contain sands or silts which are finer than the screen slot size. An 81/2 diameter borehole screened at 6", which should be sufficient. Should the slot size chosen be too large, the well will pump sand, thus damaging the plant and leading to gradual siltation of the well. The grain size of the gravel pack should be an average 2-4mm.

4. Well Construction

Once the design has been agreed, construction can be preceded. In installing screen and casing, centralizers at 6 metre intervals should be used to ensure centrality within the borehole. This is particularly important to insert the artificial gravel pack all around the screen. If installed gravel packed sections should be sealed off, top and bottom with clay(2m), the remaining annular space should be backfilled with an inert material and the top five metres grouted with cement to ensure that no surface water at the well head can enter the well and thus prevent contamination.

5. Well Development

Once screen, pack, seals and backfill have been installed, the well should be developed. Development aims at repairing the damage done to the aquifer during the course of drilling by removing clays and other addictives from borehole wall. Secondly, it alters the physical characteristics of the aquifer around the screen and removes fine particles.

We do not advocate the use of over pumping as a means of development since it only increases permeability in zones, which are already permeable. Instead, we would recommend the use of air or water jetting or the use of the mechanical plunger, which physically agitates the gravel pack and adjacent aquifer material. This is an extremely efficient method of development and cleaning wells.

Wells development is an expensive element in the completion of a well, but is usually justified in longer well-life, greater efficiencies, lower operational and maintenance costs and a more constant yield.

6. Well Testing

After development and preliminary tests, a long duration well test should be carried out. Well tests have to be carried out on all newly-completed wells because not only does this give an indication of the success of the drilling, design and development, but it also yields information on aquifer parameters which are vital to a hydro geologist.

A well test consists of pumping a well from measured start (SWL) at a known or measured yield and recording the rate and pattern by which the water level within the well changes. Once as dynamic water level (DWL) is reached, rate of inflow to the well equals the rate of pumping.

The duration of the test should be 24 hours with a further 24 hours for a recovery test or less depending on the rate of recovery during which the rate discovery to SWL is recorded. The results of the test will enable a hydro geologist to calculate the test recorded. The results of the test pumping rate, the installation depth and the drawdown for a given discharge rate.

It is nowadays-common practice to carry out a so-called step draw down test, in which the yield during testing increases stepwise. Each step is continued until hydraulic equilibrium is reached after which the yield is increased wit 50 to 100% towards the end of the test a water sample of 2 litres should be collected for chemical analysis.

Bureau Veritas Kenya Limited
North Belgravia Place, Zanzibar Rd, Shimanzi,
P.O. Box 41622-80100,
Mombasa.
Tel: 254 41 2220866/67,
Fax: 254 41 2226015,
Email:laboratory.mombasa@bureauveritas.com

KENYA LIMITED

TEST REPORT

REPORT NO. : M-24-0984

CLIENT: **BHARAT PATEL & UMANG PATEL,**
P.O BOX 19226-00501,
NAIROBI.

Designated Product	Soil	**Sampled By**	Client
Date Received	03-08-2024	**Sampling date**	02-08-2024
Container Type	In a Plastic container	**Sampling Location**	Moita Narok County
Date of Analysis	05-08-2024	**Sample Markings**	S 1°7'32.531.88' E 34°41'27.636'
Date Reported	12-08-2024	**No.of pages**	1

Test	**Units**	**Method**	**Results**
Physical & Chemical Tests Analysis			
Ph	-	KS ISO 3071	6.38
% Organic Matter	%	ISO 19822	3.0
Exchangeable Phosphorous	mg dm-3	APA 3050 B	1.42
Extractable Potassium	mg dm-3	APA 3050 B	79.56
Bulk density	Mg m^{-3}	Gravimetric	1.19
Particle density	Mg m^{-3}	Gravimetric	2.28
Water Holding Capacity	%	ICARDA 4.4	71.66
Soil Textural class		ICARDA 4.4	Clay
Heavy Metal Tests Analysis			
Cadmium	mg/kg	EPA 3050 B	0.09
Chromium	mg/kg	EPA 3050 B	0.06
Nickel	mg/kg	EPA 3050 B	1.90
Zinc	mg/kg	EPA 3050 B	1.04
Lead	mg/kg	EPA 3050 B	0.25

Remarks: ***The parameters tested performed as stated above.***

Reported By

Alice NGARI
Laboratory Analyst.

RESULTS REPORTED RELATED ONLY TO ITEMS TESTED

Nairobi Office:
Delta Corner, Tower A, 5th Floor
Along Waiyaki Way, Westlands
P. O. Box 34378-00100, Nairobi – Kenya
Tel: +254 (20) 4450560 – 64
Fax: +254 (20) 4450565
Email: fin.nairobi@bureauveritas.com

Mombasa Laboratory:
1st Floor, North Belgravia Place,
Zanzibar Road Shimanzi, Mombasa
P. O. Box 41622 - 80100 Mombasa – Kenya
Tel: +254 (41) 2220866/67
Fax: +254 (41) 2226015
Email: laboratory.mombasa@bureauveritas.com

Bureau Veritas Kenya Limited
North Belgravia Place, Zanzibar Rd, Shimanzi,
P.O. Box 41622-80100,
Mombasa.
Tel: 254 41 2220866/67,
Fax: 254 41 2226015,
Email:laboratory.mombasa@bureauveritas.com

KENYA LIMITED

TEST REPORT

REPORT NO. : M-24-0975

CLIENT: **BHARAT PATEL & UMANG PATEL**
P.O BOX 19226-00501
NAIROBI.

Designated Product	Stream water	**Sampled By**	Client
Date Received	03-08-2024	**Sampling date**	02-08-2024
Container Type	In a Plastic container	**Sampling Location**	Moita Narok County
Date of Analysis	05-08-2024	**Sample Markings**	
Date Reported	12-08-2024	**No.of pages**	2

Test	Units	Method	Results	SPECIFICATION KS EAS 12:2018
PH content	-	ISO 10523	8.01	6.5-8.5
Temperature	°C	Thermometer	25	-
Color	TCU	ISO 7887	5	15 Max
Turbidity	NTU	ISO 7027	0.60	-
Conductivity	uS/cm	ISO 7890	248	1500 Max
Suspended solids	mg/L	ISO 11923	Nil	30 Max
Total Dissolved Solids	mg/L	ISO 3025-10	121	1200 Max
Oxidation Reduction Potential	mV	ASTM D1498	+68.7	-
Dissolved Oxygen	mg/L	ISO 17289	7.37	-
Salinity	mg/L	ISO 9963	0.08	-
Total Alkalinity	mg/L	ISO 9963	61	<500 Max
Total hardness as $CaCO_3$	mg/L	ISO 6059	102	300 Max
Nitrate-NO_3	mg/L	ISO 7980	3.9	10 Max
Nitrite –NO_2	mg/L	ISO 6777	0.41	3 Max
Ammonia –NH_3	mg/L	ISO 11732	0.12	0.5 Max
Chlorides as Cl	mg/L	ISO 9297	15.8	250 Max
Fluoride	mg/L	ISO 10359	<1.0	1.5 Max
Phenols	mg/L	ISO 8165	Nil	Nil
Bicarbonates	mg/L	ISO 9963	20.4	-
Carbonates	mg/L	ISO 9963	<0.01	-

RESULTS REPORTED RELATED ONLY TO ITEMS TESTED

Nairobi Office:
Delta Corner, Tower A, 5th Floor
Along Waiyaki Way, Westlands
P. O. Box 34378-00100, Nairobi – Kenya
Tel: +254 (20) 4450560 – 64
Fax: +254 (20) 4450565
Email: fin.nairobi@bureauveritas.com

Mombasa Laboratory:
1st Floor, North Belgravia Place,
Zanzibar Road Shimanzi, Mombasa
P. O. Box 41622 - 80100 Mombasa – Kenya
Tel: +254 (41) 2220866/67
Fax: +254 (41) 2226015
Email: laboratory.mombasa@bureauveritas.com

Bureau Veritas Kenya Limited
North Belgravia Place, Zanzibar Rd, Shimanzi,
P.O. Box 41622-80100,
Mombasa.
Tel: 254 41 2220866/67,
Fax: 254 41 2226015,
Email:laboratory.mombasa@bureauveritas.com

KENYA LIMITED

TEST REPORT

REPORT NO. : M-24-0975

Sulphates SO_4^{2-}	mg/L	ISO 22743	10.55	400 Max
Residual Free Chlorine	mg/L	ISO 7393	<0.1	0.2 Max
Chemical Oxygen Demand	mg/L	AOAC 973.46	15.24	-
Biochemical Oxygen Demand	mg/L	AOAC 973.46	8.69	-
Lead	mg/L	APHA 3120B	<0.01	0.05 Max
Copper	mg/L	APHA 3120B	<0.01	0.05 Max
Zinc	mg/L	APHA 3120B	0.27	1.5 Max
Selenium	mg/L	APHA 3120B	<0.01	0.01 Max
Arsenic	mg/L	APHA 3120B	<0.01	0.01 Max
Cadmium as cd	mg/L	APHA 3120B	<0.01	0.01 Max
Magnesium as Mg^{2+}	mg/L	APHA 3120B	10.9	100 Max
Calcium as Ca^{2+}	mg/L	APHA 3120B	8.8	150 Max
Potassium	mg/L	APHA 3120B	6.11	-
Sodium as Na+	mg/L	APHA 3120B	4.80	200 Max
E.coli Count	cfu/100ml	ISO 9308-1	Not detected	Not detected

Remarks: ***The test results are as reported above.***

Reported By

Alice NGARI
Laboratory Analyst.

RESULTS REPORTED RELATED ONLY TO ITEMS TESTED
This certificate cannot be reproduced without the written consent of Bureau Veritas Mombasa Laboratory.

Nairobi Office:
Delta Corner, Tower A, 5th Floor
Along Waiyaki Way, Westlands
P. O. Box 34378-00100, Nairobi – Kenya
Tel: +254 (20) 4450560 – 64
Fax: +254 (20) 4450565
Email: fin.nairobi@bureauveritas.com

Mombasa Laboratory:
1st Floor, North Belgravia Place,
Zanzibar Road Shimanzi, Mombasa
P. O. Box 41622 - 80100 Mombasa – Kenya
Tel: +254 (41) 2220866/67
Fax: +254 (41) 2226015
Email: laboratory.mombasa@bureauveritas.com

Annex 7: Project Design Layout

PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY

GRAND SUMMARY

FULL CONTRACT

SECTION NO.	SECTION NAME	PAGE NO.	AMOUNT (KSHS)
1	MILLING SECTION		1,000,000,000.00
2	PROCESS HOUSE		
3	BOILER HOUSE & POWER HOUSE		
TOTAL AMOUNT			**1,000,000,000.00**

SIGNED

CLIENT'S NAME .....

ADDRESS .....

CONTACT .....

SIGN .....

FRANCIS MBURU MBUGUA
REGISTERED
QUANTITY SURVEYOR
REG. NO. Q1163
10 SEP 2024
P. O. BOX 75773 – 00200 NAIROBI

SIGNED

CONTRACTOR'S NAME .....

STAMP

ADDRESS .....

CONTACT .....

SIGN .....

PROPOSED SUGAR FACTORY ON L.R. NO. TRANSMARA/MOITA/761 IN TRANSMARA, NAROK COUNTY

Bill of Quantities

1. MILLING SECTION

Sr. No.	Description			Qty
1.	**CANE WEIGHBRIDGE**			1 No
	Capacity		1x 60 T (PF size 3m x 16 m length)	
	Type of weighbridge		Pit less, load cell type	
	No of Deck		3 or 4	
	No of load cells		8 nos. Load cells to be hermetically sealed, compression type, helium leak tested	
	Display		Digital indicator with backlight for display (with date, time, weight) 1 no Jumbo display suitable for 5 digit display, 50 mm character height in Bright red LED shall be provided outside the security cabin.	
	The weighbridge shall be complete with • Online ticket printer, UPS (1kVA) and computer system. • Platform to steel construction with anti-skid strips avoiding skidding of vehicles. • RS-32 port for hook up to Central Computer System. • Inbuilt microprocessor for memory retention of tuck weighment			
2.	**CANE UNLOADING & FEEDING**			
2.1.	**CANE UNLOADER CRANE**			1 No.
	Installation		On horizontal portion of carrier	
	Type		Two motion, Electrically operated overhead travelling crane Hydraulic de-hooking arrangement Operations with remote	
	No. of bridge and trolleys		1 no. bridge with 1 no. trolley having sling bar attachment. Bridge and structure suitable for 20 T SWL.	
	Capacity		10 T SWL	
	Lifts per hour		8-10	
	Height of Lift		15 m	
	Crane bridge		Box type construction	
	Design code		IS 3177 and 807, Class IV (M8)	
	Span		16 m with 5.5 m cantilever on both sides	
	Un-loader gantry structure		Provided	
2.2.	**FEEDER TABLE**			1 No.
	Installation		Perpendicular to cane carrier with top rising towards cane carrier (angle ~5 deg. With horizontal)	

Sr. No.	Description			Qty
	Width		7m	
	Inclined length		7m	
	Chain			
	No. of stands		8	
	Pitch		150 mm	
	Type		Heavy duty drag type	
	Min. breaking load		40000 kg.	
	Drive		AC VFD with planetary gearbox	
	Motor		11 kW, 1440RPM, TEFC SQ cage	
	Gearbox		Planetary foot mounted, SF 2.0	
	Linear speed		1 – 6 m/min	
3.	**CANE CONVEYING**			
3.1.	**Cane carrier**			1 No.
	Installation		Conventional installation of horizontal portion below ground and inclined portion above ground.	
	Width		1220 mm	
	Length		~14 m horizontal loading length; (approx. 23 m total horizontal sprocket length)	
	Angle of inclination		Horizontal for cane chopper; not more than 6 Deg. Before Fibrizer	
	Slat Thickness / Length		6 mm / 1205 mm	
	Chain			
	Type		Roller	
	No. of strands		2	
	Pitch		150 mm	
	Breaking load		40000 Kg	
	Drive		AC VFD with Planetary Gear Box	
	Motor		15 kW, 1440 rpm, TEFC sq. Cage	
	Gear Box Linear speed		Planetary, foot mounted (SF 2.0) 3 – 10 m/ min.	
3.2.	**Rake Elevator**			1 No.
	Installation		After Fibrizer and Inline to milling tandem	
	Application		It shall receive prepared cane from Fibrizer and deliver it to first mill Donnelley chute	
	Width		Suitable for 1220 mm rake width	
	Rakes		Rakes shall be fabricated out of MS double angles. Rollers shall be provided at both ends of rake shafts.	
	Total Length		Suitable for (approx.) 13 m horizontal length between sprockets.	
	Angle of inclination		Not more than 45^{o}with respect to horizontal	
	Chain			
	Type		Block forge type	
	No. of strands		2	

Sr. No.	Description			Qty
	Pitch		150 mm	
	Breaking load		40 T	
	Drive		AC VFD and foot mounted Planetary gear box.	
	Motor		15 kW, 1440 rpm, TEFC sq. Cage motor with VFD	
	Gear Box		Planetary gearbox (SF 2.0) Gearbox input coupling shall be flexible gear type and output coupling shall be gear type.	
	Linear speed		10 – 25 m/ min.	
3.3.	**Prepared cane belt conveyor**			1 No.
	Installation		After rake elevator and Inline to milling tandem	
	Application		It shall receive prepared cane from rake elevator and deliver it to Donnelly chute for 1st mill	
	Type		Flat bottom, troughed belt conveyor	
	Size		1600 mm belt width, ~ 20 m length	
			between pulleys,	
	Belting			
	Width		1600 mm	
	Material		Nylon / Nylon	
	No. of ply		Min. 3	
	Cover pattern		Carcass	
	Grade		M 24	
	Drive		AC motor and foot mounted helical	
	Motor		7.5 kW, 1440 rpm, TEFC sq. Cage motor	
	Linear speed		7 m/min to 70 m/ min.	
	Belt conveyor shall be complete with		• Blade type primary and secondary scrappers. • V-type internal scrapper. • Deck plate and sealing plate. • Screw take up arrangement. • Pull cord and belt sway switch. • Zero speed switch.	
3.3.1.	**Cane equalizer**			1 No.
	Dia. over tips		1000 mm	
	MOC		Mild steel fabricated	
	Drive		AC motor and shaft mounted Planetary/helical gear box with flange mounted motors.	
	Motor		5 kW, 1440 rpm, TEFC sq. Cage motor	
	Gear Box		Foot mounted Planetary gearbox (SF 2.0) with tyre type input coupling and geared output coupling.	

Sr. No.	Description			Qty
	Linear speed		50 RPM	
3.3.2.	**Magnetic separator on prepared belt conveyor.**			1 No.
	Cross belt suspended electromagnetic separator capable of picking up iron pieces of 25 Kg within 250 mm of cane bed depth. Chute to collect captured tramp iron pieces shall be provided.			
4.	**CANE PREPARATION**			
4.1.	**Cane Chopper**			1 No.
	Installation		On horizontal portion of main cane carrier	
	Type		Fixed knives type	
	Size		1400 mm dia. over knife tips x 1220 mm	
	Knives		24 nos.	
	Dia. at centre x dia.		180 mm at centre and 150 mm at bearings	
	Bearing		Antifriction, double row spherical row	
	Material of			
	Shaft material		45 C8, IS:1570	
	Bearing housing		Cast steel, IS: 1030, Gr. 280 - 520 W	
	Hubs		IS: 1030, Gr. 280-520 W	
	Knives		IS: 8461	
	Drive		AC motor	
	Motor		90 kW, 1440 rpm, SPDP slip ring	
	Gearbox		Foot mounted helical gearbox (SF2.0)	
	Final speed		~288 RPM	
4.2.	**Cane Fibrizer**			1 No.
	Installation		At head end of Cane carrier.	
	Type		Swing hammer type	
	No. of hammers		68 Nos.; arranged in 8 rows. (Tip size shall be 90 x 90).	
	Tip diameter/swing dia.		1830 mm	
	Weight of each hammer		~20 kg.	
	Anvil wrap angle		160 Deg.	
	Anvil base plate thickness		25 mm	
	Anvil hardness		500 BHN	
	Drive		CACA slip ring motor	
	Motor		1 Nos. 600 kW, 1000 RPM, 415 V	
	Gear box		Not required	
	Speed		1000 RPM	
	Coupling		Resilient type coupling provided	
5.	**Automatic cane feeding Devices** PLC BASED AUTO CANE FEED SYSTEM SHALL BE PROVIDED. REDUNDANCY SHALL BE PROVIDED FOR			1 Lot.
6.	**CANE MILLING PLANT**			

Sr. No.	Description			Qty
6.1.	**Mill assembly**			4 Nos.
	3 – ROLLER MILL (26”x 48”) with Under Feed Roller (3 nos. main			
	Brief technical specifications			
	Mill centre distance		6.5 m	
	Head stock centre distance		1900 mm	
	Roller size (Nominal dia. x Length)		650 mm x 1220 mm	
	Journal size (Dia. x Length)		330 mm x 430 mm	
	Shaft Material of construction		45C8	
	Shaft drive end cross section and size		Square end, 250 x 250 mm	
	Crown Pinion face width		350 mm	
	Hydraulic ram dia.		280 mm	
	Juice tray		5 mm thick SS 409 bolted to headstock	
	NOTE: - **FEED ROLLERS OF ALL MILLS SHALL BE PERFORATED TYPE. (4 NOS)** - **DISCHARGE ROLLERS OF ALL MILLS (EXCEPT LAST MILL) SHALL BE**			
6.2.	**Grooved Under Feed Roller (GUFR)**			4 Nos.
	Roller size (Nominal Dia. x Length)		650 mm x 1220 mm	
	Type of Roller		Grooved roller hot shrunk fitted on shaft.	
	Journal size		150 mm x 200 mmm length	
	Bearing		CS IS:1030 Gr. 280-520 W housing with GM liner as per IS:318-1981 Gr. LTB 2	
	Drive		GUFR shall be driven by mill Top roller through set of crown pinions to provide surface speed 10% higher than mill roller speed.	
6.3.	**SCRAPPER ASSEMBLY**			4 Nos.
	Top roller		Floating type, MOC- Cast iron	
	Feed roller		Messchaert type, MOC- Spring Steel	
	Discharge roller		Fixed, Adjustable, MOC- Cast iron	
6.4.	**Lubrication System**			1 Lot
	Type		Common centralized dual line, total loss type	

Sr. No.	Description			Qty
	Lubricant		Oil/ Grease	
	Pumping units		2 units (1W + 1S)	
	Piping		Seamless carbon steel	
6.5.	**Hydraulic system**			1 Lot
	Design pressure		280 kg/cm2	
	No. of accumulators		9 nos. (One no. for each mill top roller bearing and one extra as spare)	
	Capacity		20 litres	
	Top roller lift indicator		Electronic	
	Accessories		Necessary gauges, necessary interconnecting piping shall be provided.	
	Pumping unit		Suitable pumping unit shall be provided	
	NOTE: NECESSARY GAUGES, NECESSARY INTERCONNECTING			
6.6.	**Donnelly chute**			4 Nos.
	Quick mill bypass system		QMBS Shall be provided for all Donnelley chutes.	
6.7.	**Mill by– pass chute (Portable)**			1 No.
	MOC		MS	
	Thickness		6 mm	
6.8.	**Rake type intermediate carrier**			3 Nos
	Installation		Between cane mills	
	Width		To suit 1220 mm rake width	
	Rakes		Rakes shall be fabricated out of MS double angles. Rollers shall be provided at both ends of rake shafts.	
	Angle of inclination		Not more than 45 Deg with horizontal	
	Mill to Mill centre		6500 mm	
	MOC of trough bottom plate		6 mm Thick SS 409 M with Stiffeners	
	Chain			
	Type		Block forged	
	No. of strands		2	
	Pitch		150 mm	
	Breaking load		40 T	
	Drive			
	Motor		11 kW, 1440 rpm, TEFC sq. Cage	
	Gear Box		Planetary gearbox (SF 2.0) Gearbox input and output coupling shall be flexible geared type.	
	Linear speed		25 m/min. constant speed.	
6.9.	**Mill gangway**			1 Lot.

Sr. No.	Description			Qty
	Width		750 mm	
	MOC		Carbon steel	
	No. of staircase		4 nos.	
	NOTE: - THE MILL GANGWAY SHALL BE PROVIDED WITH GRATING, HAND RAILING TOE GUARDS ETC.			
	MOC		SS 409	
	Thickness		5 mm	
	Height		~ 2.5 m	
	Inclination		Not less than 80 deg	
7.	**Mill drive arrangement** Each mill drive arrangement shall consist of: • AC motor with Variable Frequency Drive panel. • Foot mounted planetary gearbox • Rope coupling			4 Sets
7.1.	**AC Mill motors** as per the following specifications:–			
	Quantity		1 no. for each mill	
	Description		3 Phase AC Induction motor	
	Duty		Continuous (S1)	
	Rating (Continuous)		150 kW at 1000 RPM (with Class IV overload duty)	
	Voltage		50 Hz, 415 V	
	Cooling Arrangement		TEFC/CACA	
	Class of protection		IP– 55	
	Insulation Class		F	
	Direction of Rotation		Bi– directional	
	Temperature rise		Limited to class B	
7.2.	**Variable Frequency Drive**			
	Quantity		1 no. for each mill	
	Rating (Continuous)		Suitable for above motor rating	
	Voltage		50 Hz, 415 V	
	Class of protection		IP– 41	
	VFD		6 Pulse	
7.3.	**Mill drive Gear**			
	Quantity		1 no. for each mill	
	Installation		Foot mounted	
	Type		Planetary gear unit with Solid Circular Input and Solid Square output shaft.	
	Nominal Ratio		167:1	
	Safety Factor (Minimum)		2.0 on Mechanical Power	
	Mechanical Power		120 kW	
	Input Speed		1000 RPM	
	Output Speed		6.0 RPM	

Sr. No.	Description			Qty
	Input Coupling		Geared type	
	Output coupling		Rope coupling	
8.	**Imbibitions Equipment & Juice Pumps**			
8.1.	**Rotary juice screen**			1 No.
	Screen size		10 x 24	
	Aperture size		0.35 mm	
	Juice handling capacity of screen		~105 m3/hr	
	MOC of drum		SS 304	
8.2.	**Mixed Juice tanks and pumps** –			
	Juice and Water Tanks			
	for 3RD mill			1 No.
	Size		800 mm dia. and 1700 mm height	
	Whirler tank MOC		SS 409, 4 mm thick	
	for 4TH mill			1 No
	Size		800 mm dia. and 1700 mm height	
	Whirler tank MOC		SS 409, 4 mm thick	
	for 1ST & 2ND mill			1 No.
	Size		1000 mm dia. and 1700 mm height	
	Whirler tank MOC		SS 409, 4 mm thick	
	Screened juice tank			1 No.
	Size		70HL cap.	
	Screened juice tank MOC		SS 409, 5 mm thick	
	Imbibitions water tank			1 No.
	Size		3 m3	
	Whirler tank MOC		MS, 8 mm thick	
	Juice and water pumps			
	for 3rd and 4th mill			2 Nos.
	Fluid		Imbibitions juice	
	Capacity		25 m3/hr, 10 m H; 960 rpm	
	MOC		SS Body / SS Impeller / SS 410 Shaft	
	for 2nd and 1st mill			2 Nos. (1W +1S)
	Fluid		Unstrained juice	
	Capacity		65 m3/hr, 12 mH; 960 rpm	
	MOC		SS Body / SS Impeller / SS 410 Shaft	

Sr. No.	Description					Qty
	for strained juice pump					2 Nos. (1W +1S)
	Fluid		Strained / Raw juice			
	Capacity		65 m3/hr, 60 mH; 1440 rpm with VFD			
	MOC		SS Body / SS Impeller / SS 410 Shaft			
	imbibitions water pumps					2 Nos. (1W +1S)
	Fluid		Hot water			
	Capacity		25 m3/hr, 60 mH; 1440 rpm			
	MOC		CI Body / SS Impeller / SS 410 Shaft			
8.3.	**Imbibitions water measurement**					1 No.
	Type		Magnetic flow meter, SS 304 construction			
	Capacity		0 – 30 m3/hr			
	Temperature		90 deg C			
9.	**Mill House Crane**					1 No.
	Type		Three motion electrically operated overhead travelling			
	Capacity (SWL)		10 T EOT with 2 T aux. hand operated hoist.			
	Type of construction		Double girder box type conforming to Class II as per IS: 3177(1977) & IS: 807 or equivalent			
			Hoisting	**Long travel**	**Cross travel**	
	Motor type		Slip ring	Slip ring	Sq. cage	
	Motor power		Suitable	Suitable	Suitable	
	Motor speed		Suitable	Suitable	Suitable	
	Gearbox type		Helical type			
	Service factor		2.0			
	Coupling type		Flexible gear/ centrifugal			
	Brakes		Electro hydraulic thrusters			
	Crane gantry					
	Span		16 m Column to column centre			
	Length		48 m, to cover mills and fibrizor			
	Height of lift		10 m			
	NOTE: ONLY GANTRY WITH RAILS SHALL BE PROVIDED. GANTRY SUPPORTING STRUCTURE / BRACKETS AND COLUMNS SHALL BE IN					

2. PROCESS HOUSE

VAPOR BLEEDING ARRANGEMENT

1.	RJ 1st heating 30^{0} to 45^{0}C.	:	4th Vapour – VLJH
2.	RJ2nd heating 45 to 70^{0}C	:	3rd Vapors
3.	DJ 1st heating 68^{0} to 85^{0}C.	:	3rd Vapors
4.	DJ 2nd heating 85^{0} to 102^{0}C.	:	2nd Vapors
5.	CLJ1 heating 96^{0} to 102^{0}C.	:	2nd Vapors
6.	CLJ2 heating 102^{0} to 113^{0}C.	:	1st Vapors - DCH
7.	All pans boiling	:	2nd Vapors
8.	Molasses conditioners	:	Exhaust/1st Vapors
9.	For sugar melter	:	1st Vapors
10.	Pan washing	:	Exhaust/1st Vapors
11.	Sugar drying	:	1st Vapors

LIST OF EQUIPMENTS:

Sr.	Equipments	Capacity/Size	MOC	Qty
2.1	Juice measurement , mass flow meter, stabilizing and pumping station (2 pumps of 40 Mts head one as Stand by)	suitable for 70 M3 /hr		1 no
2.2	Vapor line juice Heater	200 M2	M.S	1no
	Vapor line juice Heater condensate receiving tank	Suitable	M.S	1 no
	Vapor line juice heater condensate pump	8 M3/hr,30 M head	CI/SS	2 no
	Direct contact heaters for Raw juice 2nd stage Defecated juice 1st and 2nd stage Clear juice 1st and 2nd stage	70 M3 /hr flow rate	S.S.304	5 no
2.3	MOL station as suitable comprising lime mixing mond, collecting tanks with stirrers, 2 nos pumps (1 as stand by)		M.S.	1 LOT
2.4	Defecator for cane juice with lime proportioning tank, PH control etc. Stirring arrangement with drive if applicable, receiving tank with 2 nos. pumps of 70 M3 / hr capacity at 40 mts head	8.5M3 suitable for 70 M3 /hr flow rate	M.S.	1 no

Sr.	Equipments	Capacity/Size	MOC	Qty
2.5	One no. short retention clarifier with mud receiving tank, clear juice column, pumps (70 m3 /hr capacity at 40 mts head – 1 as stand by), and flocculent tank with 2 nos. dosing pumps	Suitable for flow rate of 70 M3 /hr and 50 M^3 holding capacity	M.S.	1 set
	Rotary vacuum filter with all accessories	8' X 16'	MS/SS	1 set
2.6	**Evaporator Station (Quadruple)**			
	Evaporator station comprising 4 nos. vessels I body of Semikestner type Set will be complete with condensate flash recovery system, pumps, transfer pump, final brix monitoring , Vapours bleeding arrangement to pans and juice heaters, flash tank,& single jet condenser , Syrup receiving tank and 2 nos pumps (one as stand by) are included	First body-900M2 Second body-1000M2 Third body-500M2 Fourth body-300M2	MS	1 lot
	SS Tubes for Semi Kestner	42 mm OD x 1.6 mm thk x 4000 mm long	SS 304	1 lot
	SS Tubes for Robert bodies	42 mm OD x 1.2 mm thk x 2000 mm long	SS 304	1 lot
2.7	**Pan supply tanks**			
	For syrup	50 m3	MS	1 no
	For raw AH	50 m3	MS	1 no
	For raw AL	35 m3	MS	1 no
	For BH	35 m3	MS	1 no
	For CL	17 m3	MS	1 no
	Molasses conditioner with auto brix and temperature control			
	For AH	06 M3	MS	1 no
	For BH	04 M3	MS	1 no
	For CL	02 M3	MS	1 no
	Auto brix/temp control - A l l tanks with level indicators and required fittings. Pans condensate system shall be connected to flash heat recovery unit			

Sr.	Equipments	Capacity/Size	MOC	Qty
2.8	**Vacuum Pans** Batch type vacuum pans having S/V ratio 6.6:1 having 102 mm OD SS tubes of 900 mm length.			
	For A massecuite	35 Ton	MS	2 no
	For B massecuite	35 Ton	MS	1 no
	For C massecuite	35 Ton	MS	1 no
	Pan station complete with automation, all pipes, valves, control valves, discharge valves connections as required, massecuite gutters etc.			
2.9	**COOLING & CONDENSING SYSTEM with auto control system**			
	Single entry condensers for evaporator and pans with automation	Suitable	SS 304	5 no
	Injection water pumps	1500 m3/hr, 22M head	CI/SS	2 no
	Spray pond (app 260 involutes nozzles)	1500 m3/hr		1 no
	Spray water pump	1500 m3/hr, 16M head	CI/SS	1 no
2.10	**CRYSTALLIZERS**			
	Receiving crystallizers for A massecuite	40 Tons	MS	2 no
	Water cooled crystallizers for B massecuite	40 Ton	MS	2 no
	Water cooled crystallizers for C massecuite	40 Ton	MS	2 no
	Vacuum Crystallizers for A,B & C massecuite	25 Ton	MS	3 no
	Dry seed crystallizer	25 Ton	MS	1 no
	B seed crystallizer	25 Ton	MS	1 no
2.11	**CENTRIFUGALS**			
	Continuous centrifugal machines			
	For ‘B’ massecuite	1100 mm dia.	MS/SS	1 no
	For ‘C’ massecuite	1100 mm dia.	MS/SS	2 no
	For ‘CAW’ magma	1100 mm dia.	MS/SS	1 no
	Spare	1100 mm dia.	MS/SS	1 no
	Batch centrifugal machine fully auto for ‘A’ massecuite with ACVFD drive	1250 kg/charge	MS/SS	2 no
	All machines with pug mills, magma mixers , molasses runoff tanks & pumps etc.			

Sr.	Equipments	Capacity/Size	MOC	Qty
	Sugar Melter B & CA sugar with auto control – 10 T/H – 1 no. Run off tanks pumps 2 each of required capacity (1 as stand by), Complete with Pipe lines connections, accessories etc.			
2.12	**SUGAR HOUSE**			
	Grass Hopper – Plain Tray.	1.2m width x 10 m length	MS	1 no
	Grass Hopper –Multi Tray with hot air & cold air blowing arrangement.	1.2m width x 10 m length	MS	2 no
	Sugar elevator	10 T/HR		1 no
	Sugar sizer	10 T/HR		1 no
	Sugar bins.	100 Ton	MS	2 no
	Sugar Weighing Machine			2 no
	Sugar Bag Stitching Machine with slat conveyor			2 no
	Sugar conveying system.			1 set
2.13	**HOT & COLD WATER STORAGE &**			
	Over head cold water storage tank	80 m3	MS	1 no
	Overh ead hot water storage tank	50 m3	MS	1 no
	Cold water service water pumps from cold water UFR to service tank	80 m3/hr	CI/SS	2 no
	Hot water service pumps from water UFR to service tank	50 m3/hr	CI/SS	2 no
	All hot lines shall be equipped with flow meters for recording consumption of water at pans, centrifugals, sugar melters, magmas, etc.			1 lot
	Closed loop water cooling system with individual localized cooling towers to conserve water consumption for power turbine& alternator, mills, vertical crystallizers etc.	Suitable		1 set
2.14	**Final molasses storage**			
	Final molasses flow meter	0-4 m3/hr		1 no
	Final molasses storage tank	800 m3	MS	1 no
	Loading/recirculation pumps	15 m3/hr, 25M head	CI/SS	2 no
	Cold water spray system	Suitable	MS	1 set

3. BOILER HOUSE & POWER HOUSE

Sr.	Equipments	Capacity/Size	Qty
3.1	**Boiler** complete with automation all accessories, mountings, deaerator, high pressure water heater, feed water storage tank, ESP & Ash handling, steam pipes headers, control panels etc., HP heaters, electrical etc.	35 T/HR, 45 Kg/Cm^2 / 415+/-5 deg C outlet temperature	1 no
	De-superheating station for exhaust steam	From 150^0C to 125^0Cof 24	1 set
	One PRDS from 45 kg/cm2 /415 deg C to 1.5 kg/cm2/125 deg C shall also be provided.	10 T/H	1 set
	Turbine: LT turbine		
3.2	Back Pressure TG set complete with accessories and pipe lines/DB. etc. POWER HOUSE GANTARY & EOT CRANE-10	3.0 MW /415 V/3 phase.	1 set
3.3	Complete Electrical distribution and controls, for above from Power house to equipment & Plant lighting, earthing is included.		Lot
3.4	DG sets with distribution panels	450 KVA	1
	TOTAL ESTIMATED CONSTRUCTION	**1,000,000,000**	

PRACTISING CERTIFICATE FOR QUANTITY SURVEYORS

Pursuant to the Architects & Quantity Surveyors Act Cap 525

QS. FRANCIS MBURU MBUGUA (Q1163)

is duly qualified as a Quantity Surveyor and is entitled to practise as such Quantity Surveyor

From **1st July 2024** *to* **30th June 2025**

Registrar *Date* **1st July 2024**

serial no. PCQS/13/24-25

FRANCIS MBURU MBUGUA
REGISTERED
QUANTITY SURVEYOR
REG. NO. Q1163
10 SEP 2024
P.O. BOX 75773 - 00200 NAIROBI

W.T.P. PLANT

BAGGASE YARD

SURPLUS BAGASSE BELT CONVEYOR

RETURN BAGASSE CARRIER

60000

90000

ASH SILO

ASH HANDLING

ASH BELT CONVEYOR

CHIMNEY

D.M. PLANT

D.M.WATER STORAGE TANK

FEED WATER STORAGE TANK

TRANSFORMER SUB STATION

POWER DISTRIBUTION STATION

D.G.SET

POWER HOUSE @+5.00M LEVEL

FUTURE POWER HOUSE

MILL HOUSE

FUTURE MILL

60000 HORIZONTAL SPROCKET CRS

C.L OF M.B.C.

CANE CARRIER

CANE INTER CARRIER

CANE LEVELLER

CANE ELEVATOR

CANE TRASH

SCREENED JUICE TANK

ROTARY SCREEN

SURGE TANK

LIME BAG STORAGE CONTAINER

BOILING HOUSE

EVAPORATORS

PAN STATION

SUGAR HOUSE

SPRAY SPOND

SECTION WATER PLANT

SERVICE WATER (TREATED WATER) SUMP

GENERAL STORE

LAB & ENGG. OFFICE

SUGAR GODOWN

RS

MOLASSES STORAGE TANK

E.T.P. PLANT

ROAD 9.0 M WIDE

16000

32000

5000

8000

17800

22000

16500

49500

30000

93500

15000

75000

40000

43200

25000

7330

7340

5500

11000

22000

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

A B C D E F G H J K L M N O

A A' B B' C C' D D' E E' F F' G

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21