Environmental and Social Impact Assessment Study Report – MUMIAS TOWN

Feasibility Study, Detailed Design and Preparation of Tender Documents for Mumias - Kimilili Sewerage Project

Contract No.: RVWSB/LVN/KTSWSSP/C/MUMIAS – KIMILILI/2018 - 2019
Prepared for Central Rift Valley Water Works Development Agency
9 April 2021

SMEC INTERNAL REF 7083018

DECLARATION

I, **Charles Lwanga Muyembe** on behalf of SMEC, submit this **Environmental and Social Impact Assessment (ESIA) Study of the Feasibility Study, Detailed Design and Preparation of Tender Documents for Mumias Sewerage Project** The ESIA report has been prepared in accordance with the Client Guidelines, Environmental Management and Coordination Act, Cap 387, and the Environmental (Impact Assessment and Audit) Regulations, 2003 (and the amendment Regulations of 2016).

Signed at NAIROBI on this …**9th**……day of……**April**….2021

Signature: ……

Designation: ESIA/AUDIT LEAD EXPERT REG. NO.1283

I, …….. on behalf of Central Rift Valley Water Works Development Agency, submit this **Environmental and Social Impact Assessment (ESIA) Study of the Feasibility Study, Detailed Design, and Preparation of Tender Documents for Mumias Sewerage Project**. The ESIA has been prepared in accordance with the Client Guidelines, Environmental Management and Coordination Act, Cap 387, and the Environmental (Impact Assessment and Audit) Regulations, 2003 (and the amendment Regulations of 2016).

Signed at …….. on this …… Day of …….. 2021

Signature…….

Designation: ……

CONTACT DETAILS: ……

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A. EXECUTIVE SUMMARY

1. Project Background

The Government of Kenya has received financing from the Africa Development Fund (AfDF or "or Fund") to support the Kenya Sustainable Towns Water Supply and Sanitation Programme. The programme aims at contributing to the quality health of life and reducing poverty levels of the population of Kenya through provision of water and sanitation services on a suitable basis.

The main objective of the program is to improve the access, availability and sustainability of water supply and wastewater management services in multiple towns with a view to catalysing commercial activities, driving economic growth, improving quality of life of people and building resilience against climate variability and change.

To achieve this objective, the Rift Valley WWDA has on behalf of Lake Victoria North WWDA, has prioritized the design of the Mumias - Kimilili Sewerage Project.

2. Purpose of the ESIA

Environmental and Social Impact Assessment (ESIA) is designed to establish a triangular relationship between the proposed Project, natural ecosystems, social setting and co-existence. The study, therefore, will relate the project and key environmental, social and economic areas and related linkages for ease of integration in the implementation of the project right from the planning stage through construction, commissioning and eventually long term use.

The overall study objective of the assignment is to develop the most cost-effective system to address collection, treatment and disposal with design output that is focused on the following:

- Capable of performing the intended functions throughout the design life;
- Environmentally acceptable, both during construction and in the long term;
- Economical in terms of both capital and recurrent costs.

The Central Rift Valley Water Works Development Agency (hereafter referred to as the Client) has engaged SMEC Kenya in association with SMEC International (hereafter referred to as the Consultant) to conduct the Consultancy Services for the Feasibility Study, Detailed Design, and Preparation of Tender Documents for Mumias-Kimilili Sewerage Project (hereafter referred to as the Project).

3. Study Methodology

The Environmental and Social Impact Assessment followed the following procedure; screening, scoping, site assessment, baseline studies, impact analysis and provision of mitigation measures, project alternatives, Environmental and Social Management Plan and the Environmental Monitoring Plan.

4. Baseline

The proposed project location is within Mumias town and its environs, Kakamega County. The specific project areas include:

- Town Centre (Mumias CBD)/Camcon Estate;
- St. Mary's Hospital;
- Lumino area;
- Ekero Market;
- Mayoni Market;
- Shibale area;
- Ekama area;
- Matawa area.

5. Project Description

The proposed Mumias Sewerage System project scope as outlined in SMECs' Detailed Engineering design is as shown in the table below:

Table A-1: Proposed Mumias Sewerage Project Scope

Phase I	Phase II
• Matawa WWTP – Capacity **2,700m^3/day** comprising anaerobic ponds, facultative ponds, maturation ponds and sludge drying beds; site entrance gate, security fencing, inlet Works, office building, staff houses and laboratory; • Sewer length - **47,790m** • Provision of onsite facilities at Mayoni Market (Ablution Block and Septic Tank) and Shibale (Septic Tank); • Supply of sanitation equipment including Suction truck 10m^3 and Truck (7.5 tonne) with hydraulic host; • 500 Nr. Consumer connections.	• Expansion of the Matawa WWTP capacity to **4,000m^3/day** by addition of **2Nr. Trickling Filters**.

6. Policy, Legal and Regulatory Framework

Some the Policies reviewed include the Kenya Vision 2030, Sessional Paper No. 10 of 2014 on the National Environment Policy, National Water Policy, 2012, the public health policy of 2014, Kenya National Policy on Gender and Development, 2000 and the draft National Land Use Policy, 2016.

Institutional framework reviewed includes; Ministry of Water and Irrigation, Ministry of Environment and Forestry, EMCA, CAP 387 Administrative Framework, National Environment Action Plan Committee, County Environment Committees and the National Environment Restoration Fund.

Legal framework reviewed include; Environmental Management and Coordination Act CAP 397, the Environment and Land Court Act, 2011, the Water Act, 2016, The land Act, 2012, The Agriculture, Fisheries and Food Authority Act, 2013, the Energy Act 2006, Penal Code Act CAP 63, County Government Act 2012, Occupational Health and Safety Act 2007, Public Health Act CAP 242, and the Physical Planning Act 1996.

AfDB safeguards triggered by the project include: Environmental Assessment OP 4.01, and Involuntary Resettlement (OP 4.12).

International conventions and treaties were also reviewed.

7. Potential Impacts and Mitigation Measures

The main objective of this assessment was to identify significant potential impacts anticipated from the proposed development of Mumias Town Sewerage System to the environment and social aspects with a view to establishing appropriate recommendations on ensuring that the proposed project takes into consideration appropriate measures to mitigate any adverse effects to the environment.

The following is summary of the anticipated environmental impacts.

Some of the positive impacts identified are as the summary below, they are discussed broadly in Chapter 7 of this report:

- Employment opportunities;
- Stimulation of local economy;
- Improved sanitation;
- Improved living standards of Mumias residents;
- Reduced exposure to health risks;
- Improved food security and nutrition;
- Sustainability of Kakamega County Water and Sanitation Company.

Some of the negative impacts identified are below, mitigation measures for the same are outlined in Chapter Seven:

- Land take;
- Accidental sewer bursts;
- Risk of contamination;

- Risk of illegal connections;
- Loss of structures/vegetation;
- Occupational Health and Safety Risks.

8. Environmental and Social Management Plan

Environmental and Social Management Plan (ESMP) for developing projects is given to provide a logical framework within which identified negative environmental impacts can be mitigated and monitored. In addition, the ESMP assigns responsibilities of actions to various actors and provides a timeframe within which mitigation measures and monitoring can be done and their budgetary element.

9. Conclusions and Recommendations

The ESIA study has established that the proposed Sewer system in Mumias town by Central Rift Valley Water Works Development Agency is a worthy investment by the proponent and without a doubt will contribute significantly to the economic development of the country.

However, the ESIA study has established that the proposed project will also have some negative impacts. The proponent shall be committed to putting in place several measures to mitigate the negative environmental, safety, health and social impacts associated with the life cycle of the project. It is recommended that in addition to this commitment, the proponent shall focus on implementing the measures outlined in the Environmental Management Plan as well as adhering to all relevant national and international environmental, health and safety standards, policies and regulations that govern establishment and operation of such projects in Kenya. It is expected that the positive impacts that emanate from such project shall be maximized as much as possible as exhaustively outlined within the report.

Considering the positive socio-economic and environmental benefits which will accrue because of the proposed development and the ESIA project having found no major impacts to arise from the development, it is our recommendation that the project be allowed to proceed on the understanding that the proponent will adhere to the mitigation measures recommended herein and will further still implement the proposed Environmental Management Plan to the latter. Mumias town has an insignificant sewerage system, therefore, the proposed expansion of the Mumias sewer system will go a long way in solving part of the existing challenges experienced by the water and sanitation sector and sector and the residents.

B. ABBREVIATIONS AND ACRONYMS

Table B-1: Abbreviations and Acronyms

ABBREVIATION/ ACRONYM	DESCRIPTION
AfDB	African Development Bank
amsl	Above Mean Sea Level
BOD	Biochemical Oxygen Demand
BS	British Standards
BS EN	British adoption of a European (EN) standard
CBOs	Community Based Organizations
CEC	County Executive Committee Member
COD	Chemical Oxygen Demand
CRVWWDA	Central Rift Valley Water Works Development Agency
CSR	Corporate Social Responsibility
DWC	Double Wall Corrugated
EHS	Environmental Health and Safety
EMCA	Environmental Management and Co-ordination Act
EMP	Environmental Management/Monitoring Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
FGDs	Focused Group Discussions
GHGs	Greenhouse Gases
GoK	Government of Kenya
HC	House Connections
HRM	Human Resource Management
KACWASCO	Kakamega County Water and Sanitation Company
KTSWSSP	Kenya Towns Sustainable Water Supply and Sanitation Programme
LVNWWDA	Lake Victoria North Water Works Development Agency
MWIPMSS	Ministry of Water and Irrigation Practice Manual for Water Supply Services in Kenya
NEMA	National Environment Management Authority
NGOs	Non-Governmental Organizations
NHC	National Housing Corporation
NRW	Non-Revenue Water
OSHA	Occupational Safety and Health Act
PAP	Project Affected Person
PPE	Personal Protective Equipment
RAP	Resettlement Action Plan
SMEC	Snowy Mountains Engineering Corporation
SWM	Solid Waste Management
TDS	Total Dissolved Solids
ToR	Terms of Reference
TSS	Total Suspended Solids
UfW	Unaccounted for Water
UNCHS	(UN-Habitat) The United Nations Human Settlements Programme
uPVC	Un-Plasticised Polyvinyl Chloride
WASREB	Water Services Regulatory Board

ABBREVIATION/ ACRONYM	DESCRIPTION
WHO	World Health Organisation
WIBA	Work Injury Benefit Act
WRA	Water Resources Authority
WSP	Water Service Provider
WSS	Water Supply and Sanitation
WWTP/W	Wastewater Treatment Plant/Works

1 INTRODUCTION

1.1 Project Background

The Government of Kenya has received financing from the Africa Development Fund to support the Kenya Sustainable Towns Water Supply and Sanitation Programme. The programme aims at contributing to the quality health of life and reducing poverty levels of the population of Kenya through provision of water and sanitation services on a sustainable basis.

The main objective of the program is to improve the access, availability and sustainability of water supply and wastewater management services in multiple towns with a view to catalysing commercial activities, driving economic growth, improving quality of life of people and building resilience against climate variability and change.

To achieve this objective, the Lake Victoria North Water Works Development Agency (LVNWWDA), through the Central Rift Valley Water Works Development Agency (CRVWWDA) has prioritized the design of the Mumias - Kimilili Sewerage Project.

The Central Rift Valley Water Works Development Agency (hereafter referred to as the Client) has engaged SMEC Kenya in association with SMEC International (hereafter referred to as the Consultant) to conduct the Consultancy Services for the Feasibility Study, Detailed Design, and Preparation of Tender Documents for Mumias-Kimilili Sewerage Project (hereafter referred to as the Project)

This ESIA project report covers the studies of the project areas for sewer expansion in Mumias Town. The report is prepared following the Client guidelines, the applicable Kenyan regulations as well as the AfDB policy guidelines on Environment.

1.2 Objectives of Environmental Impact Assessment

The objective of the ESIA study is to predict, assess, and analyse the possible positive and negative environmental and social impacts that are anticipated during the construction, operation and decommissioning phases of the project. This will be done with the aim of proposing the possible mitigation measures for the negative impacts. This is in line with ensuring that the development does not impact negatively on the environment within which it is implemented.

1.3 Legal and Regulatory Framework in Kenya

The ESIA Report preparation was guided by relevant policies, legislation and institutional frameworks that are available Nationally and reference made to acceptable International guidelines. These instruments include:

- The National Environment Policy (NEP);
- HIV and AIDs Policy 2009, HIV Prevention and Control Act of 2006;
- Gender Policy 2011, Water Act 2016, Environmental Management and Coordination Act, Cap 387;
- The Environmental (Impact Assessment and Audit) Regulations, 2003 (and the amendment Regulations of 2016);
- County Government Act no 17 of 2012;
- Physical Planning Act 1996 (286);
- Occupational Health and Safety Act (OSHA 2007);
- Public Health Act (Cap.242) and the Eviction Way-leave and Rehabilitation Bill (2014).

1.4 Justification of the Project

The project aims at contributing to the quality health of life and reducing poverty levels of the population of Kenya through provision of water and sanitation services on a suitable basis.

The main objective of the program is to improve the access, availability and sustainability of water supply and wastewater management services in Mumias Town with a view to catalysing commercial activities, driving economic growth, improving quality of life of people and building resilience against climate variability and change.

The specific areas for Sewer connection in Mumias town are:

- Town Centre (Mumias CBD)/Camcon Estate;
- St. Mary's Hospital;
- Lumino area;

- Ekero Market;
- Mayoni Market;
- Shibale area;
- Ekama area;
- Matawa area.

1.5 Scope of Works

The proposed Mumias Sewer system as outlined in SMECs' Detailed Engineering Design Report has three main trunk sewers namely M_1, M_2 and M_3.

Table 1-1: Proposed Sewers

Sewer	Description
M_1 Trunk Sewer	The proposed trunk sewer originates from Ekero Market and traverses to the East of Kakamega – Mumias Road (C40) and will cross Mumias – Bungoma road (C33) near Finito Sports Pub as it discharges to the proposed M_3 Trunk. The line will serve the areas of Ekero Market and Ekama and towards areas to the East of Ekero Market and Ekama. The M_1 Trunk will receive wastewater flows from secondary sewers M_1.1, M_1.2, M_1.3, M_1.4, M_1.5, M_1.6, M_1.7, M_1.8, M_1.9, M_1.10, M_1.11, M_1.12, M_1.13, M_1.14 and M_1.15. The drainage areas to be served include Ekero Market, Ekero Mosque, Oasis of Grace Church, Westgate Hotel, Total Mumias Service Station, Number Seventy Guest House, Finito Sports Pub, St. Mary's Mumias Secondary School, St Annes Girls Primary School, St Mary's Hospital, St. Mary's Girls Secondary School, Field of Life Education Centre Primary School, Ichinga Muslim Primary School, Ekama Guest House, Ekama Village Mumias, Mwitoti Primary School among others.
M_2 Trunk Sewer	The proposed trunk sewer originates from Mumias CBD and collects along the catchment to discharge at the proposed M_1 Trunk. The trunk will also collect the wastewater from Camcon Estate. A lateral sewer M_2.4 has been proposed to collect wastewater flows along Mumias - Bungoma Road (C33) and will eventual discharge into trunk sewer M_2 before it discharging into the proposed WWTP. The lateral sewers feeding trunk M_2 are M_2.1, M_2.2, M_2.3, M_2.4 and M_2.5. The secondary sewer M_2.4 has lateral sewers M_2.4.1 and M_2.4.2 discharging into it. All the proposed sewers are gravity sewers. The drainage areas to be served include Mumias Shopping Mall, Matungu Level 4 Hospital, Several Banks (KCB, Equity, Family, KWFT, Post Bank), Mumias Municipal Market, NHIF Offices, Mumias Township Primary School, Mumias Town Hall, Mama Watoto supermarket, Mumias Police Station, Tumaini Enterprises among others.
M_3 Trunk Sewer	The proposed trunk sewer traverses along Nzoia River, to the West of Mumias – Bungoma Road (C33) and it finally discharges to the proposed septic tank in Shibale. The trunk serves the areas within Shibale. The trunk has five secondary sewers discharging into it namely M_3.1, M_3.2, M_3.3, M_3.4, M_3.5, M_3.6. The secondary sewer M_3.6 has two lateral sewers M_3.6.1 and M_3.6.2 discharging into it. All the proposed sewers are gravity sewers. The sewers serve the drainage areas, among others, Shibale Primary School, Club the Pride, Shibale Shopping Centre, P.A.G Shibale, Shibale SDA Church, Friends Church Mumias, Kivulini Enterprises, Mumias ACK Church, Lureko Secondary School, Matawa Secondary School, Matawa Primary School.
Mayoni Sewer	Mayoni area is separated from the rest of the proposed sewer network by River Nzoia. In addition, the topography within the area supports gravity flow only up to a certain location where it will be necessary to pump or support the proposed sewer on an aerial crossing. Therefore, the Consultant has proposed provision of onsite sanitation facilities (Septic tanks and Ablution Block)

The proposed wastewater treatment plant, located at Matawa, comprises a hybrid system of wastewater stabilization ponds and trickling filters. Further, ablution block and septic tanks have been proposed for Mayoni Market and parts of Shibale area.

1.6 Justification of the ESIA

The implementation of the proposed project will have both socio-economic and environmental impacts on the project area. In order to alleviate any detrimental effects of the project, there is need to assess possible impacts of the development on the environment and the socio-economic attributes of the project area. At first, the proposed project will be evaluated against the framework provided by the Mumias Physical Development plan to ensure proper alignment. Then an Environmental Impact Assessment is conducted in accordance with the Client Guidelines, Environmental Management and Co-ordination Act (EMCA), Act, Cap 387, and the Environmental (Impact Assessment and Audit) Regulations, 2003 (and the amendment Regulations of 2016).

Due to the likely socio-economic impacts of the project, our Environmental Specialist and Socio-Economic Specialist have also collected socio-economic data to support the Environmental Impact Assessment and also to be used for Economic Evaluation of the Project. They were assisted by Field Assistants and a group of Enumerators especially in the process of acquiring the primary data in the field.

The execution of the assignment was carried out during the preliminary design of the Project to ensure that the designs produced comply with environmental requirements and take into account socio-economic status in the areas. The outcome of the Environmental Impact Assessment will be used to moderate the Engineers' Designs to ensure that they are in harmony with the environmental and socio-economic attributes of the project area. This approach will enhance the protection of the environment and the local community from negative effects of development.

1.7 Methodology

This section outlines the Methodology of Environmental and Social Impact Assessment in line with the Environmental Management and Coordination Act CAP 387 of 1999 and (Amendment 2015). Various stages were undertaken to realize this report. The stages are as detailed below:

1.7.1 Environmental Screening and Scoping

Owing to the nature of the project and the provisions of EMCA CAP 387, Second Schedule, Part 3 (a), this project is required to undergo an ESIA study to ascertain the impacts of the Project in the area.

At the screening stage, we determined the potential magnitude of impacts and hence the depth of study required. This is the first stage in incorporating environmental considerations into a Water Supply and Sanitation project. Scoping is a process used for defining what can and what cannot be accomplished during a particular environmental study. This process included the following:

- Defining the geographic boundary of the study in relation to possible impacts;
- Identifying the time constraints and time horizons of the study (i.e. project time limits and how far into the future one should predict project effects); and,
- Identifying the skills and human resources needed to undertake the project.
- Identify, materialize harmony with the affected / interested stakeholders and inform them of the Project and the ESIA process;
- Provide stakeholders with the opportunity to identify any issues and concerns associated with the Project;
- Identify areas of likely impact and environmental issues that may require further investigation in an ESIA; and
- Determine the need for specialist baseline and impact assessment studies in response to initial stakeholder input.

1.7.2 Desktop Study

A desktop study was conducted in order to review available published (like policies and legislations) and unpublished reports, County Integrated development plans and maps and information gathered from reconnaissance in order to compile relevant baseline biophysical and socio-economic information about the study area.

The biophysical information was also compiled on environmental aspects such as flora, fauna, conservation, topography, drainage, soils, geology, hydrogeology, climate and vegetation, while the socio-economic environment study compiled information on aspects such as population, land use and land tenure. This is outlined under the Baseline Information Chapter.

1.7.3 Site Assessment

Site assessment (physical inspection) was carried out between 17 -30 July 2019.The assessment entailed observation on biophysical and socio-economic environment. From this, details of the positive and negative effects of the

development of the project on the environment were identified and appropriate recommendations outlined to minimize any undesirable effects resulting from proposed project.

1.7.4 Public Participation

Public participation was done by conducting interviews, discussions and public meetings with key stakeholders including members of the community in the project area to obtain their views on the impacts of the project and possible mitigation measures. This is as per the Kenyan Constitution and EMCA Cap 387. The public consultation and participation was conducted through:

- Household socio-economic survey;
- Key stakeholder interviews;
- Key stakeholder Meeting (KACWASCO Mumias Office);
- Public Meetings held at Mumias Town, Lumino and Mayoni.

1.7.5 Key Stakeholder Meeting

Key Stakeholder Interview/ meeting was conducted on 13 June 2019 during the reconnaissance site visit at KACWASCO Mumias Water Office. The key stakeholder engagements were conducted to follow protocol on publicize the public barazas via Deputy County Commissioners, foster better mutual understanding of public concerns as well as incorporate key stakeholders' opinions regarding the proposed project.

1.7.6 Public Meetings

In Mumias Town two (2) public participation meetings were conducted at the proposed sites and a total of 65 people participated in the meetings. The local Chief, Sub-chiefs, Members of County Assemblies was used to mobilize the public to attend the meetings. The announcements for the meetings were made by phone calls, announcement at centers and settlements, in places of worship and chiefs barazas.

1.7.7 Socio-economic/Household survey in Mumias Town

A total of 420 Household Socio-economic survey questionnaires were administered within the proposed project areas to assess the socio-economic status of the project area.

1.7.7.1 Data Collection Tools

The socio-economic survey used both the quantitative and qualitative tools. Three quantitative tools namely; household survey questionnaire, education institutions questionnaire and health institution survey questionnaire were used. Qualitative tools included; Waste handlers guide and Industries guide. Samples of both quantitative and qualitative tools are appended in this report.

1.7.7.2 Digitization of Data Collection Tools

An Open Data Kit (ODK) collect server subscription was secured until data collection was completed and beyond. The household survey questionnaire, education and health survey questionnaires developed in word format were coded in to digital format using the (ODK) coding language. The coded survey forms were pre-tested and improved further before deployment for field data collection.

The figure below explains how digital data collection works. The process is designed to allow feedback loops. The starting point is the design/coding of the questionnaire. In ODK this can be done using the online inter-phase or through spreadsheets. The later was used for this exercise. The forms were then sent to the server ready for download to the mobile data collection devices.

1.7.7.3 Mobile Data Collection Process

Data collection used android-based devices from version 7.0 and above. The ODK collector application/inter-phase was installed in the gadgets. The gadgets were configured with the correct credentials for data collection. This enabled the enumerators to access the server and download the forms and upload/submit the completed interviews in real time. The submitted data was used to communicate data quality issues to field teams and also improve any technical data collection issues identified in the forms.

1.7.7.4 Data analysis, reporting and documentation

Upon data analysis, potential environmental impacts (both positive and adverse) were predicted based mainly on concerns raised by the public, stakeholders and expert observations on the ground and available tools. The magnitude,

significance, and acceptability of predicted impacts were evaluated with a view to determining whether observed adverse impacts are significant enough to warrant mitigation. Impacts were further screened for occurrence and significance of residual (those which cannot be mitigated satisfactorily) and cumulative impacts with a view to providing a basis of making recommendations on the way forward for the project.

1.8 Terms of Reference

The following broad terms of reference applies to the project:

- Description of the proposed location of the project;
- A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project;
- The objectives of the project;
- The technology, procedures and processes to be used, in the implementation of the Project;
- The materials to be used in the construction and implementation of the project;
- The products, by-products and waste generated by the project;
- A description of the potentially affected environment;
- The environmental effects of the Project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated;
- Alternative technologies and processes available and reasons for preferring the chosen technology and processes;
- Analysis of alternatives including project site, design and technologies and reasons for preferring the proposed site, design and technologies;
- An environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, time frame and responsibility to implement the measures;
- Provision of an action plan for the prevention and management of foreseeable accidents and hazardous activities in the course of carrying out activities or major industrial and other development projects;
- The measures to prevent health hazards and to ensure security in the working environment for the construction workers in case of emergencies;
- An identification of gaps in knowledge and uncertainties which were encountered in compiling the information;
- An economic and social analysis of the project;
- An indication of whether the environment of any other state is likely to be affected and the available alternatives and mitigating measures; and
- Such other matters as the Authority may require.

1.9 The Environmental Impact Assessment Team

The table below presents the Environmental Impact Assessment team for the project:

Table 1-2: ESIA Project Team

Name	NEMA Reg. No.	Responsibilities
Charles Lwanga Muyembe	Lead Expert Reg. No 1283	Team Leader, Policy review, Flora, Fauna and Community sensitization
Julius Musyoka Musili	Lead Expert Reg. 3074	Project review, liaisons, quality assurance, and Community sensitization.
Jason Opanda	NEMA Associate Expert No. 8304	Site survey, data collection and report writing
Florence Muthui	NEMA Expert Reg. 8703	Social economic analysis, data collection , report writing
Evelyn Mbithi	Sociologist	Social economic analysis, data collection , report writing

2 PROJECT DESCRIPTION

2.1 Project Background

The most common method of existing wastewater disposal in Mumias Town and its environs is by use of on-site sanitation technologies such as individual septic tanks and pit latrines. Mumias Town has a waterborne sanitation serving only one estate i.e. Camcon Estate built by National Housing Finance Co-operation (NHFC) with a coverage area of about 0.08km2 and serves about 1% of the current municipal population. An outfall sewer delivers the wastewater from the Housing Estate to the simply constructed sewerage treatment plant comprising of 3Nr ponds that have deteriorated over a period of time and are now completely non- functional. The uncontrolled effluent is discharged to a seasonal stream (Eshimiche), draining to the Shibale River which flows into Nzoia River.

A separate sewerage system and sewage works exists for Mumias Sugar Factory and their housing complex for staff. Treated wastewater is discharged to River Nzoia.

The peripheral region around the waste stabilization ponds is densely populated and is connected to the water distribution network but not covered by a sewerage collection system, thereby creating a need for provision of wastewater management infrastructure. Ideally, a capacity needs assessment for Mumias sewerage facility is necessary due to the rapid growth of the town. A central sewerage system for Mumias town, which is long overdue. This will be prudent so that most of the town residents shall be connected.

The County has a strategic plan for Mumias Town to attain Municipality status therefore rapid intervention such as connectivity works are essential.

The Proposed development of Mumias sewerage system will involve establishment of new sewer lines; the extent of the proposed project is within Mumias town and its environs.

2.2 Sewer Network Layout

The main catchments within Mumias Town were generated using GIS-based hydrological analysis techniques, giving an indication of the overall drainage regime of the area as per the figure below:

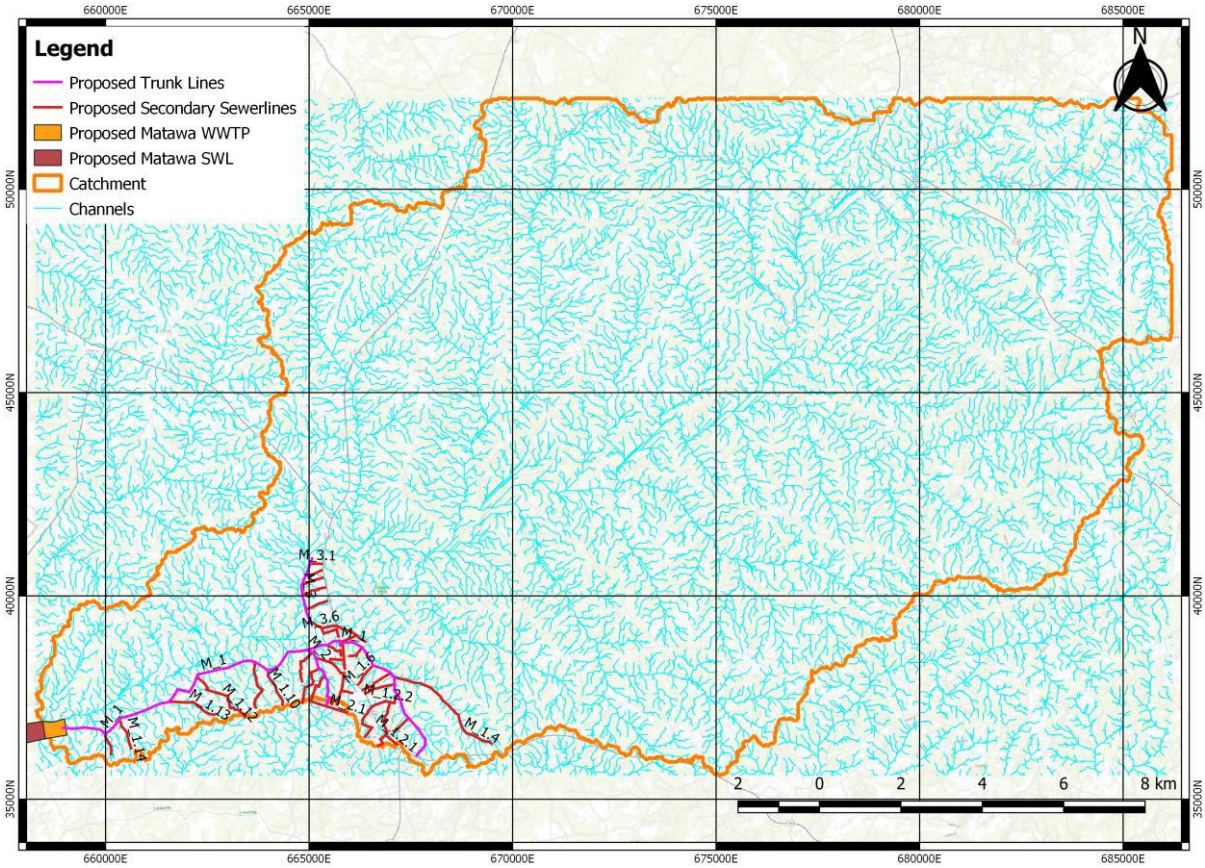


Figure 2-1: Proposed Sewerage Drainage areas within the Mumias Town catchment area

The figure below presents the proposed sewer network for Mumias Town area:

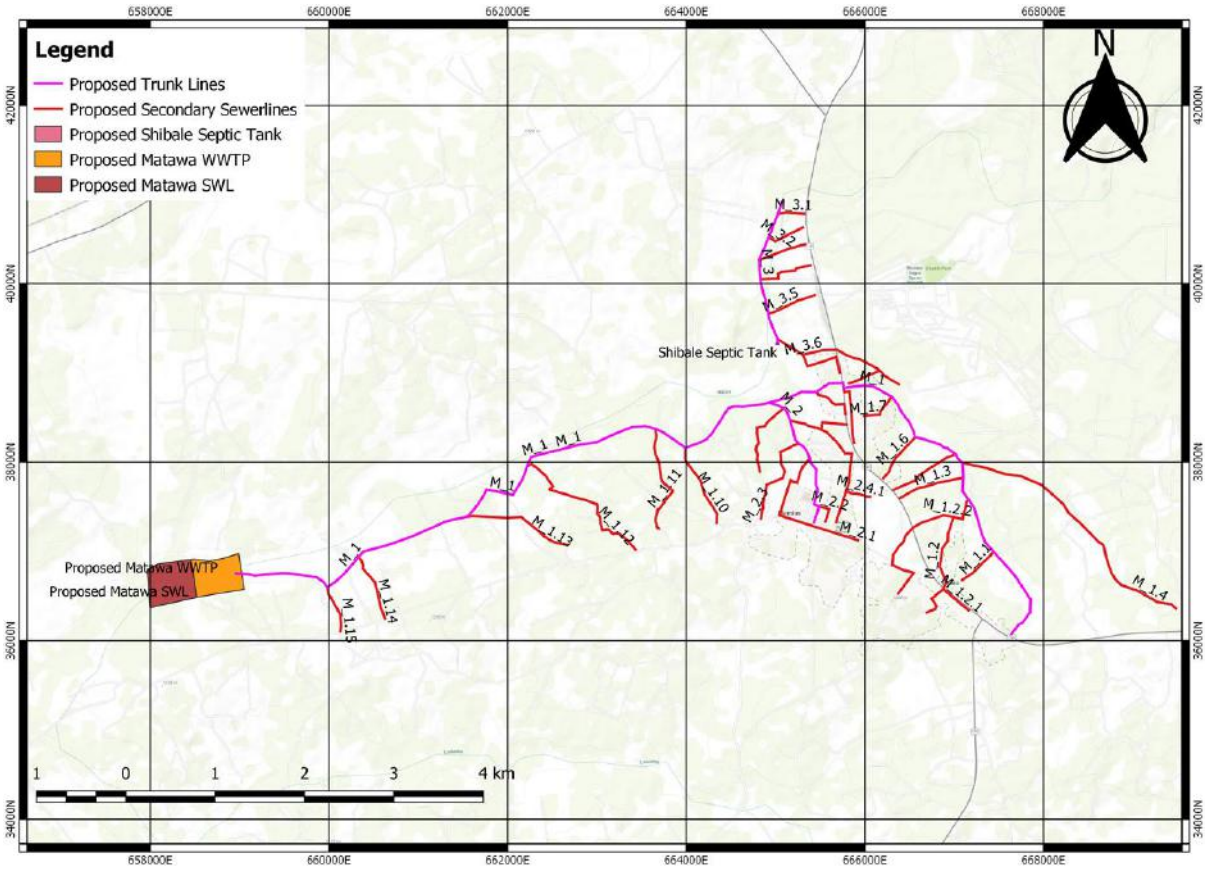


Figure 2-2: Proposed sewer network layout for Mumias Town and environs

2.3 Proposed Sewers

The proposed Mumias Town Sewerage project has three main trunk sewers namely M_1, M_2 and M_3 as shown in *Error! Reference source not found.* above. The description of the trunk sewers is as follows:

2.3.1.1 M_1 Trunk Sewer

The proposed trunk sewer originates from Ekero Market and traverses to the East of Kakamega – Mumias Road (C40) and will cross Mumias – Bungoma road (C33) near Finito Sports Pub as it discharges to the proposed M_3 Trunk. The line will serve the areas of Ekero Market and Ekama and towards areas to the East of Ekero Market and Ekama.

The M_1 Trunk will receive wastewater flows from secondary sewers M_1.1, M_1.2, M_1.3, M_1.4, M_1.5, M_1.6, M_1.7, M_1.8, M_1.9, M_1.10, M_1.11, M_1.12, M_1.13, M_1.14 and M_1.15.

The drainage areas to be served include Ekero Market, Ekero Mosque, Oasis of Grace Church, Westgate Hotel, Total Mumias Service Station, Number Seventy Guest House, Finito Sports Pub, St. Mary's Mumias Secondary School, St Annes Girls Primary School, St Mary's Hospital, St. Mary's Girls Secondary School, Field of Life Education Centre Primary School, Ichinga Muslim Primary School, Ekama Guest House, Ekama Village Mumias, Mwitoti Primary School among others.

The table below shows the summary of the proposed sewers within the proposed trunk sewer M_1.

Table 2-1: Summary of the proposed sewers to serve the proposed trunk sewer M_1

Proposed Sewer	Category of Sewer
M_1	Trunk
M_1.1	Secondary
M_1.2	Secondary
M_1.2.1	Lateral
M_1.2.2	Lateral
M_1.3	Secondary

Proposed Sewer	Category of Sewer
M_1.4	Secondary
M_1.5	Secondary
M_1.6	Secondary
M_1.7	Secondary
M_1.8	Secondary
M_1.9	Secondary
M_1.10	Secondary
M_1.11	Secondary
M_1.12	Secondary
M_1.13	Secondary
M_1.14	Secondary
M_1.15	Secondary

2.3.1.2 M_2 Trunk Sewer

The proposed trunk sewer originates from Mumias CBD and collects along the catchment to discharge at the proposed M_1 Trunk. The trunk will also collect the wastewater from Camcon Estate. A lateral sewer M_2.4 has been proposed to collect wastewater flows along Mumias - Bungoma Road (C33) and will eventual discharge into trunk sewer M_2 before it discharging into the proposed WWTP.

The lateral sewers feeding trunk M_2 are M_2.1, M_2.2, M_2.3, M_2.4 and M_2.5. The secondary sewer M_2.4 has lateral sewers M_2.4.1 and M_2.4.2 discharging into it. All the proposed sewers are gravity sewers.

The drainage areas to be served include Mumias Shopping Mall, Matungu Level 4 Hospital, Several Banks (KCB, Equity, Family, KWFT, Post Bank), Mumias Municipal Market, NHIF Offices, Mumias Township Primary School, Mumias Town Hall, Mama Watoto supermarket, Mumias Police Station, Tumaini Enterprises among others.

Table 2-2: Summary of the proposed sewers to serve the proposed trunk sewer M_2

Proposed Sewer	Category of Sewer
M_2	Trunk
M_2.1	Secondary
M_2.2	Secondary
M_2.3	Secondary
M_2.4	Secondary
M_2.4.1	Lateral
M_2.4.2	Lateral
M_2.5	Secondary

2.3.1.3 M_3 Trunk Sewer

The proposed trunk sewer traverses along Nzoia River, to the West of Mumias – Bungoma Road (C33) and it finally discharges to the proposed septic tank in Shibale.

The trunk serves the areas within Shibale. The trunk has five secondary sewers discharging into it namely M_3.1, M_3.2, M_3.3, M_3.4, M_3.5, M_3.6. The secondary sewer M_3.6 has two lateral sewers M_3.6.1 and M_3.6.2 discharging into it. All the proposed sewers are gravity sewers.

The sewers serve the drainage areas, among others, Shibale Primary School, Club the Pride, Shibale Shopping Centre, P.A.G Shibale, Shibale SDA Church, Friends Church Mumias, Kivulini Enterprises, Mumias ACK Church, Lureko Secondary School, Matawa Secondary School, Matawa Primary School.

The table below shows the summary of the proposed sewers within the proposed trunk sewer M_3.

Table 2-3: Summary of the proposed sewers to serve the proposed trunk sewer M_3

Proposed Sewer	Category of Sewer
M_3	Trunk
M_3.1	Secondary
M_3.2	Secondary
M_3.3	Secondary

Proposed Sewer	Category of Sewer
M_3.4	Secondary
M_3.5	Secondary
M_3.6	Secondary
M_3.6.1	Lateral
M_3.6.2	Lateral

2.3.1.4 Mayoni Secondary Sewer

Mayoni area is separated from the rest of the proposed sewer network by River Nzoia. In addition, the topography within the area supports gravity flow only up to a certain location where it will be necessary to pump or support the proposed sewer on an aerial crossing. Therefore, the Consultant has proposed provision of onsite sanitation facilities.

Onsite sanitation facilities such as Septic tanks and Ablution Block would be provided to suit the needs of the population in Mayoni, including Mayoni Market. The sewer could be constructed to convey wastewater flows from households and proposed ablution block at the market centre to a septic tank which will be desludged regularly by KACWASCO.

The table below presents the detailed design details of the proposed sewers:

Table 2-4: Hydraulic Design of proposed sewers for Mumias Town

Proposed Sewer	Length (m)	Pipe Diameter (mm)	Pipe Material
M_1	11,852	300 – 375 – 450 – 525 - 600	PCC/Steel
M_1.1	473	200	DWC/Steel
M_1.2	1,598	200	DWC
M_1.2.1	370	200	DWC
M_1.2.2	1,521	200	DWC
M_1.3	756	200	DWC
M_1.4	3,073	200	DWC/Steel
M_1.5	813	200	DWC
M_1.6	586	200	DWC
M_1.7	425	200	DWC
M_1.8	682	200	DWC
M_1.9	473	200	DWC
M_1.10	943	200	DWC/Steel
M_1.11	1,254	200	DWC
M_1.12	1,758	200	DWC
M_1.13	1,222	200	DWC
M_1.14	770	200	DWC
M_1.15	526	200	DWC
M_2	1,627	300	PCC/Steel
M_2.1	1,730	200	DWC
M_2.2	259	200	DWC
M_2.3	1,115	200	DWC/Steel
M_2.4	1,619	200	DWC/Steel
M_2.4.1	280	200	DWC/Steel
M_2.4.2	352	200	DWC
M_2.5	884	200	DWC
M_3	1,665	200	PCC
M_3.1	292	200	DWC
M_3.2	432	200	DWC
M_3.3	544	200	DWC
M_3.4	636	200	DWC
M_3.5	564	200	DWC
M_3.6	1,520	200	PCC
M_3.6.1	432	200	DWC
M_3.6.2	659	200	DWC
Total Length	**43,705.00**		

2.4 Proposed Wastewater Treatment Plant

2.4.1 Overview

From the analysis undertaken during Feasibility Study and Preliminary Design phases, a hybrid system of wastewater stabilization ponds and trickling filters was found to be the most suitable wastewater treatment option for Mumias Town.

Wastewater stabilization ponds are large, shallow ponds in parallel or series that allow for the wastewater to be treated in a natural manner through processes involving bacteria and algae, and solar UV radiation. The processes are most efficient at higher temperatures; hence they are a very preferred treatment method in tropical countries.

From literature, it can also be confirmed that in case land availability is not a concern and climate is sufficiently warm, waste stabilization ponds are often the most preferred and suitable method of wastewater treatment. They require relatively large areas of land to provide the necessary long retention periods needed to stabilize the organic material in the wastewater, but on the other hand, they operate without mechanical equipment (if gravity flow can be assured) and with limited supervision. Furthermore, the systems maintenance requirements are minimal.

Waste stabilization ponds are without doubt the most important method of wastewater treatment in developing countries where sufficient land is normally available and where the temperature is most favourable for their operation.

There are three principal types of WSP: anaerobic, facultative and maturation ponds. Anaerobic ponds and facultative ponds are designed for BOD (biochemical oxygen demand) removal, and maturation ponds are designed for faecal bacterial removal.

The different WSP types are arranged in a series – first an anaerobic pond, then a facultative pond, and finally (and if needed to achieve the required effluent quality) one or more maturation ponds. At any one site there may be more than one series of WSP, each usually receiving an equal proportion of the wastewater flow.

It is commonly observed that the effluent from a series of ponds is of better quality than that from a single pond of the same size. This is because, even if the hydraulic flow regime in individual ponds is closer to complete mixing than it is to plug flow, the overall performance of a series of ponds.

Trickling filters are a valuable alternative for natural wastewater treatment in case land availability is limited and operator capacity is sufficiently high to operate the slightly more complex system in an efficient way.

A trickling filter is a three-phase system with fixed biofilm carriers. Wastewater enters the bioreactor through a distribution system, trickles downward over the biofilm surface, and air moves upward or downward in the third phase. Trickling filter components typically include a distribution system, containment structure, rock or plastic media, underdrain, and ventilation system.

Just as waste stabilization ponds systems, trickling filters (TFs) are used to remove organic matter (BOD) from wastewater. The TF is a system that functions under (mostly) aerobic conditions and utilizes microorganisms attached to a medium (rocks or plastic) to remove organic matter from wastewater. These systems are known as attached-growth processes. In contrast, systems in which microorganisms are sustained in a liquid are known as suspended-growth processes (EPA, SWMM).

Table 2-5: Brief factsheet of trickling filters (SWMM)

Working Principle	Wastewater trickles vertically through a porous media (e.g. a stone bed) with high specific surface. The biofilm growing on the media removes organic matter under aerobic conditions.
Capacity/Adequacy	Semi-centralised to centralised. The system is usually applied in urban areas for treatment of domestic wastewater. It can be applied for bigger and smaller communities.
Performance	BOD: 65 to 90 %. Low TSS removal. Total Coliforms: 1 to 2 log units N: 0 to 35%. P: 10 to 15 %.
Costs	Medium; investment costs depend on type of filter materials and feeder pumps used; operational costs determined by electricity consumption of feeder pumps.
Self-help Compatibility	Low. Design, planning and implementation by expert consultants; no community labour contribution possible; feeder pumps required; permanent staff required for operation.
O&M	Civil engineer needed for construction, professional service providers required
Reliability	Resistant to shock loadings but the systems do not work during power failures in case reliant on feeder pumps.

Main strength	High treatment efficiency with lower area requirement compared to wetlands or ponds; resistant to shock loading.
Main weakness	Requires expert skills, pumps and continuous electrical power, as well as ample and continuous wastewater flow required

Since development of the proposed wastewater treatment plant will be phased, the recommendation was to construct the waste stabilization ponds in Phase 1, then expand the WWTP by adding trickling filters during Phase 2. This will have the following advantages:

- It will reduce the land requirements since trickling filters do not require large areas of land compared to waste stabilization ponds;
- It will allow for time for operational capacity building within the water service provider's team;
- It will allow for additional buffer in case the trickling filter experiences some technical problems – the facultative ponds from the Phase I works will be there to still offer a reasonable (not perfect) level of treatment.

2.4.2 Location of the Proposed Wastewater Treatment Plant and Septic Tank

The Consultant identified the land allocated for sewerage works under the Mumias Town Physical Development Plan (PDP)/Mumias Town Land Use Zoning Map. The approximate size of the land allocated is 214,240 m^2 (approx. 21.4Ha).

The site/location for the proposed wastewater treatment plant was analysed, mainly based on the following conditions:

- Availability of land;
- Topography that should allow for gravitational flow of the sewer collection system as much as possible.

In addition to those two main conditions, there are a number of other important issues that were considered in choosing the location of the proposed Wastewater Treatment Plant:

- The available area, topography, and soil conditions of the site should be suitable for the construction of the type of plant proposed;
- The chosen location should not be susceptible to flooding;
- The chosen location should not be too far from the main contributing areas;
- The chosen location should be close to the final point of effluent disposal;
- The location should preferably be close to water supply, electricity services and access roads.

It should be noted that it is very rare to find a wastewater treatment location that fulfils all the requirements of an ideal treatment site and, often compromises need to be made. With pond systems, in particular, it is sometimes difficult to find a suitable site that has a large enough land area.

The central developed area of the Town is the origin of about half of the anticipated wastewater flows and this area can be mostly drained to the site through a system of gravity sewers. Most of Mumias Town, Ekero and Ekama areas drain to the site by gravity flow to the proposed Matawa Wastewater Treatment Plant. Shibale area drain to the proposed Shibale Septic Tank by gravity flow. Only pumping may be required from the north of the town, across the river (Mayoni area). These flows are small compared with the main gravity flows from the central parts of the Town. On site sanitation was proposed for Mayoni.

The Consultant concluded geotechnical investigations and testing to ascertain the parameters of the soils in the area. The soils were found to be inadequate and lining of the waste stabilization ponds was recommended and Concrete and HDPE liners were proposed.

The table below shows the assessment undertaken for the proposed wastewater treatment plant site:

Table 2-6: Analysis of the proposed WWTP location in Mumias Town

Criteria	Matawa WWTP
At least 200m (preferably 500m) downwind from the community	No – away from the more densely populated areas, but still quite a number of houses and farms within the 200 m radius. The wind blows lightly from eastern direction.
Drainage	Good drainage location – most of Mumias Town, Ekero, Ekama and Shibale areas can drain to the site by gravity flow. It is located at the lowest point of the Mumias town catchment.

Criteria	Matawa WWTP
Away from any likely area of future expansion	Yes – located in peri-urban area dominated by households and farmland. Further, the location has been designated for wastewater treatment plant facilities by the County Government of Kakamega.
Vehicle access available	Yes – murram and tarmac road connectivity.
Site should be flat or gently sloping	Yes – the area is gently sloping towards River Nzoia as confirmed on site during topographic survey.
Soils must be suitable (NOT organic / plastic / medium-to-course sand)	Soils were confirmed to be inadequate and unsuitable after concluding geotechnical investigations and testing. Thus Concrete and HDPE liners proposed.
Not located within 2 km of airports	Yes – far from airstrip at Mumias Sugar Factory.
Groundwater table	Slightly above alluvial grounds - therefore, lining of the ponds was recommended to avoid inflow.
Proximity to a receiving water body (stream, river, lake, ocean).	Yes – adjacent to River Nzoia.

Estimation of Peak Flood Discharge for a desired return period is a pre-requisite for planning, design and management of wastewater treatment plants. As mentioned above, the proposed site of the WWTP should not be susceptible to flooding. The system must be protected from general flooding, for ponds, inlet and outlet devices, and other features can be damaged or destroyed by floodwaters and accompanying debris. Floodwaters containing large amounts of sediments may, through deposition and erosion, completely destroy inadequately protected waste stabilization ponds.

Therefore, flood analysis of the proposed site was undertaken to establish the level of flood resilience of the proposed infrastructure. The analysis was undertaken using HEC-RAS software which is a suitable tool for performing one-dimensional steady flow, one and two-dimensional unsteady flow calculations, sediment transport/mobile bed computations, and water temperature/water quality modelling.

River Gauge Station (RGS) data for River Nzoia was obtained from Water Resources Authority (WRA), Kakamega Office, and terrain information was obtained from the topographical surveys undertaken by the Consultant. From these inputs, a flood frequency analysis was undertaken using different methods to predict the magnitude of 10, 25, 50 and 100-year flood discharges. The peak flood values for the different Return Periods are very useful for storm/flood management in water and wastewater treatment infrastructure.

The Consultant adopted two probability distribution methods used to model the river flows, namely Gumbel method and Log Pearson method. The methods were used to model the annual maximum discharge of the River Nzoia at the proposed Matawa WWTP site, for a period of 34 years (1972 to 2006). The following results were obtained:

Table 2-7: Flood Frequency Prediction using Gumbel's and Log Pearson's Models

Return Period, T	Probability of Exceedance, P	Design Flow Qd (m^3/s)	
		Gumbel	Log Pearson
10	0.1	1,198.42	834.35
25	0.04	1,635.48	1,444.39
50	0.02	1,959.71	2,111.98
100	0.01	2,281.55	3,031.69

The 50yr and 100yr design floods were then adopted for the flood modelling in HEC-RAS. The figure below illustrates the output of the simulation.

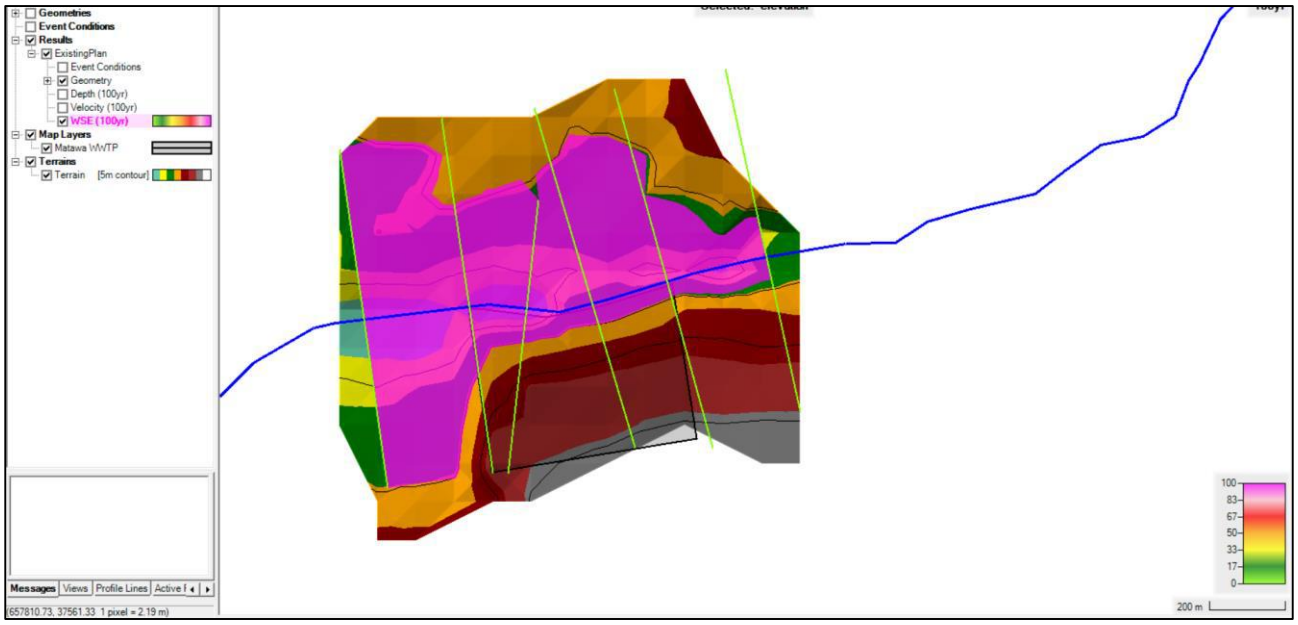


Figure 2-3: Output of flood modelling in HEC-RAS Mapper

A number of cross-sections were considered across the river to determine the water surface level for both 50yr and 100yr floods. The figure below shows the water surface levels of the cross-sections for the selected design floods.

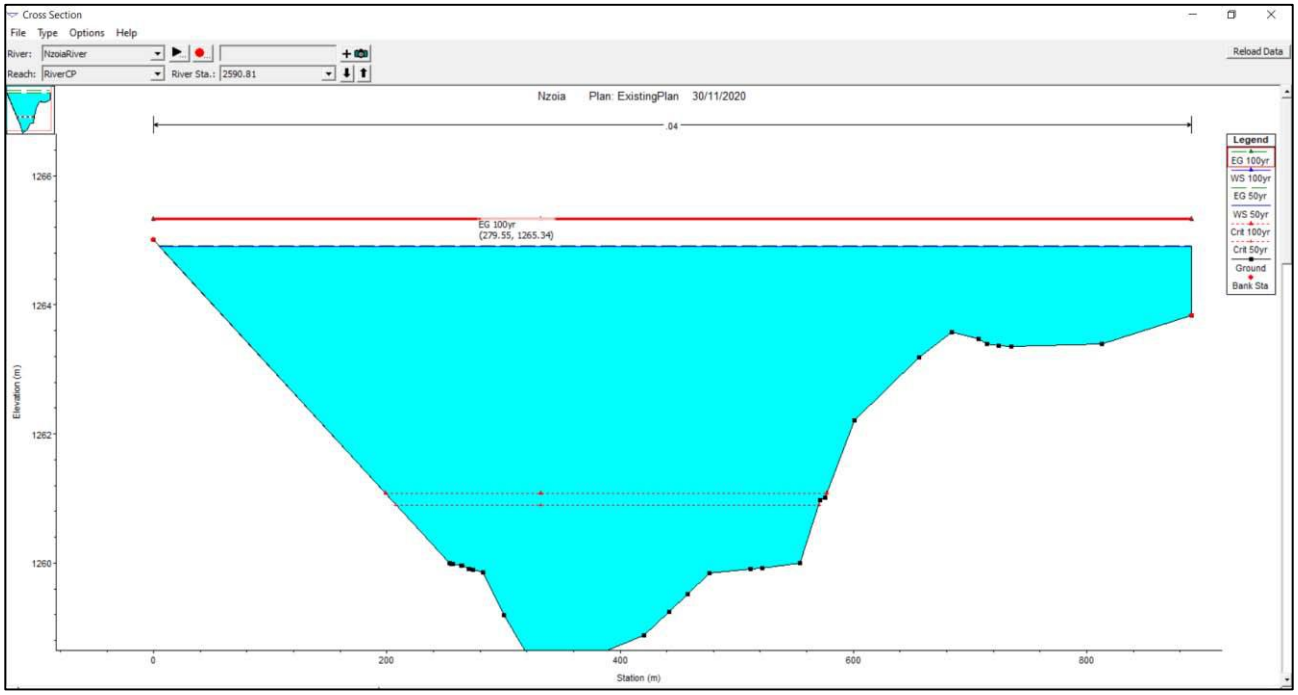


Figure 2-4: Water Surface Level of River Station 2590.81 adjacent the proposed Matawa WWTP site

From the figure above, it can be seen that the water surface level is at the 50yr design flood level, but below the 100yr design flood level (red line). In essence, this means that if the 100yr flood event occurs, the wastewater treatment infrastructure will not be flooded. The floodplain is located on the opposite river bank of the proposed wastewater treatment infrastructure and therefore no threat of flooding.

2.4.3 Design Wastewater Flows

2.4.3.1 Design Notes

Conventionally, it is most economical to design the wastewater treatment plant for the service and flows expected at full buildout of the drainage areas. However, the cost of such infrastructure in areas that remain sparsely populated can

be significant, and much of the loading may not be realized for many years. This results in trade-offs between budget limitations and the desire to provide ultimate capacity.

Therefore, the approach for the WWTW design is that wastewater treatment works will be phased based on the design horizons and respective wastewater flows as below:

- Phase I – 2035 flows;
- Phase II – 2045 flows (Full buildout).

Table 2-8: Estimated wastewater flows towards the Matawa WWTW

Wastewater Flows	2035 (Phase I)	2045 (Phase II)
Computed Flows (m^3/day)	2,674	3,596
Design Capacity (m^3/day)	2,700	4,000

From the table above, the proposed Matawa WWTP capacity will be 2,700m^3/day for Phase 1 (2035 horizon) and expanded to 4,000m^3/day for Phase 2 (2045 horizon). The Peak Factor of 2 was adopted in line with the recommendations of the Kenya Ministry of Water, Sanitation Final Practice Manual for Sewerage and Sanitation Services.

2.4.4 Process Design

The proposed hybrid system comprises waste stabilization ponds and trickling filters to produce high quality effluent of BOD < 30 mg/l, Suspended Solids < 30 mg/l and Coliform count < 1000 per 100ml.

The figure below illustrates the process flow diagram for the proposed wastewater treatment system:

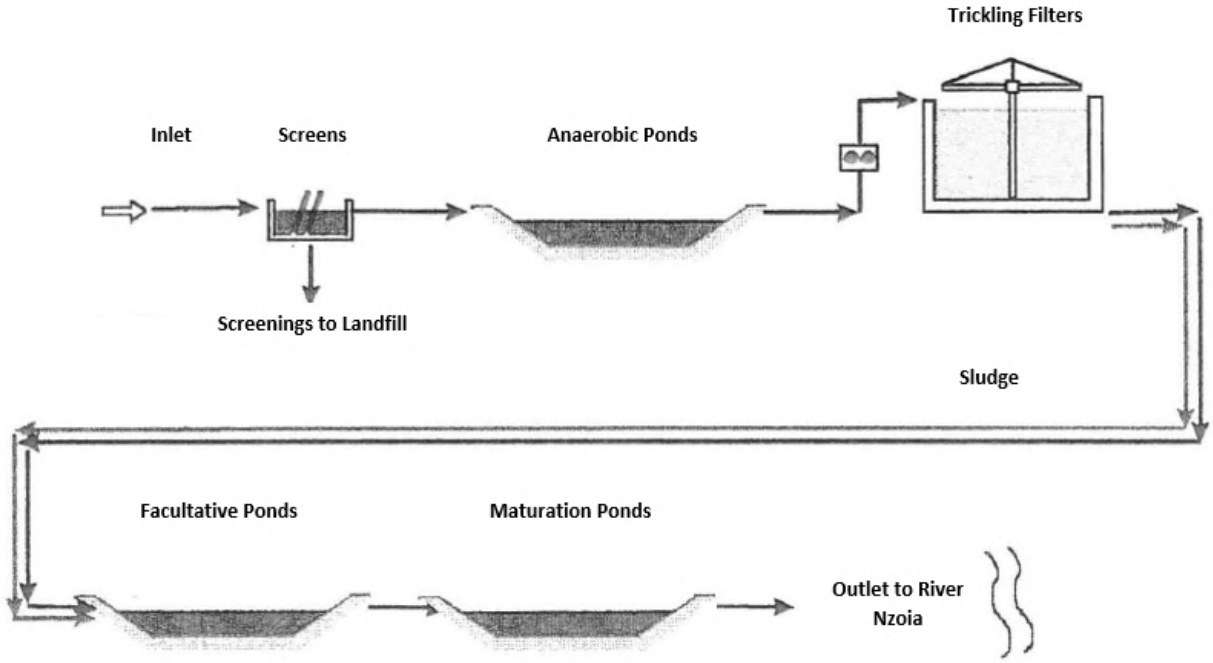


Figure 2-5: Process Flow Diagram (PFD) for the Proposed Matawa WWTP

For the waste stabilization ponds process design, the faecal coliform and helminth egg removal was determined as per below table:

Table 2-9: Faecal Coliform and Helminth Egg Removal

Parameter	2045
Faecal Coliform Removal	985 per 100ml
Helminth Egg Removal	0.29 egg/l (99.99% removal)

The overall BOD removal in the Matawa waste stabilization ponds + trickling filter system is estimated as follows:

Table 2-10: Overall BOD efficiency of Mumias WWTP

BOD Load (mg/l)	2045	BOD Removal Efficiency (%)
Load at entry to the anaerobic ponds	350	61.4
Load at entry to the trickling filter	135.1	71
Load at entry to the facultative ponds	50	94
Load at entry to maturation ponds	15	-
Load at exit	15	-

2.4.5 Physical Design

The WSP process design was translated into a physical design with actual pond dimensions consistent with the available site, embankments and pond inlet and outlet structures. The number of parallel pond series to have was determined and a decision whether or not to line the ponds made based on the findings of geotechnical investigations. By-pass pipework, security fences and notices, and operator facilities are provided.

The physical design of the waste stabilization ponds was carefully undertaken to ensure a high level of wastewater treatment efficiency and effluent quality as per prescribed design and effluent criteria.

The following tables present the physical design of the proposed waste water treatment plant components for both Phases 1 & 2:

Table 2-11: Design of Anaerobic Ponds

Design Parameter	2035 (Phase 1)	2045 (Phase 2)
Number of ponds	3	3– **remains the same**
Top Length (m)	45	45
Top Width (m)	30	30
Bottom Length (m)	20	20
Bottom Width (m)	5	5
Pond depth (m)	4.0 (2.5m water + 1.5m sludge)	4.0 (2.5m water + 1.5m sludge)
Freeboard depth (m)	1	1
Length to breadth ratio	2:1	2:1
Embankment slope H/V	2.5:1	2.5:1
BOD removal efficiency (%)	61.4	61.4
Top surface area of ponds (m^2)	4,050	4,050– **remains the same**
Retention time (days)	2	1.11

Table 2-12: Design of Facultative Ponds

Design Parameter	2035 (Phase 1)	2045 (Phase 2)
Number of ponds	2	2 – **remains the same**
Top Length (m)	124.5	124.5
Top Width (m)	66.0	66.0
Bottom Length (m)	109.5	109.5
Bottom Width (m)	51.0	51.0
Pond depth (m)	1.5 (1m water + 0.5m sludge)	1.5 (1m water + 0.5m sludge)
Freeboard depth (m)	1	1
Length to breadth ratio	2:1	2:1
Embankment slope H/V	3:1	3:1
Incoming BOD load (mg/l)	135.1	50
BOD removal efficiency (%)	71	71
Top surface area of ponds (m^2)	16,442	16,442 – **remains the same**

Table 2-13: Design of Maturation Ponds

Design Parameter	2035 (Phase 1)	2045 (Phase 2)
Number of ponds	2	2 – **remains the same**
Incoming Faecal Coliform Load (FCU/100 ml)	288,763	288,763
Effluent Faecal Coliform Load (FCU/100 ml)	883	883

Design Parameter	2035 (Phase 1)	2045 (Phase 2)
Top Length (m)	254	254
Top Width (m)	67	67
Bottom Length (m)	245	245
Bottom Width (m)	58	58
Depth of Pond (m)	1.0	1.0
Freeboard depth (m)	0.5	0.5
Top surface area of ponds (m^2)	11,624	11,624 – **remains the same**
Retention time per pond (days)	6	6

Table 2-14: Design of Trickling Filters

Design Parameter	Value
Number of Trickling Filters	2
Design Temperature (T) (°C)	20.7
Modified rate constant (K_T) (m/day)	0.057
Average flow per filter (Q) (m^3/day)	2000
Incoming BOD (L_i) (mg/l)	13.1
Outgoing BOD (L_e) (mg/l)	50
BOD removal efficiency low rate TF (%)	94
Organic/BOD loading rate (kg/m^3/day)	0.312
Hydraulic loading rate (m^3/m^2/day)	3.0
Recirculation rate	0
Filter Media surface area (S) (m^2/m^3)	40
Filter Volume (m^3)	866.2
Filter Surface (m^2)	288.75
Filter Diameter (m)	20
Filter Depth (m)	3
Retention Time (θ) (days)	1
Dosing Rate for the filter (mm/pass)	Operating dose – 50 Flushing dose - 100
Oxygen Transfer (O_2/kg BOD applied)	47.45
Airflow (AR_{STD}) (m^3/min)	63.8
Corrected air flowrate for temp. and pressure (AR_{26}) (m^3/min)	70.5
Corrected air flowrate for lower oxygen saturation (AR) (m^3/min)	76.9
Head loss/Pressure Drop (Pa)	0.0019
Natural draft pressure (Pa)	0.5025
Electrical energy for daily flow (kWh/day)	110
Distributor speed (rev/min)	Normal operation - 0.0104 Flushing - 0.0052

The following table shows the land requirements for the proposed wastewater treatment infrastructure for Phases 1 and 2:

Table 2-15: Matawa Waste Stabilization Ponds + Trickling Filter Land Requirement Estimate Summary (exact measurements rounded)

Design Horizon & WWTP Capacity	Components	Number	Retention Time (Days)	Surface Area (m^2)	Total Area (m^2)
2035 flow – 2,700 m^3/day	Anaerobic ponds	3	2	1,350	4,050
	Facultative ponds	2	9.75	8,221	16,442
	Maturation ponds	2	6	11,624	23,248
	Sludge drying beds			2,000	2,000
	TOTAL PONDS AREA				**45,740**
	Allow for additional land around ponds - ponds make up 60% of required area				27,444
	TOTAL LAND REQUIREMENT				**73,184**

Design Horizon & WWTP Capacity	Components	Number	Retention Time (Days)	Surface Area (m^2)	Total Area (m^2)
2045 flow – 4,000 m^3/day	Anaerobic pond	3	1.11	1,244	2,488
	Trickling filters	2	0.43	314	628
	Facultative pond	2	7.75	13,303	26,606
	Maturation pond	2	6 + 6	16,974	33,948
	Sludge drying beds			2963	2963
	TOTAL PONDS AREA				**66,633**
	Allow for additional land around ponds - ponds make up 60% of required area				39,980
	TOTAL LAND REQUIREMENT				**106,613**

Table 2-16: Design of Sludge Drying Beds

Parameter	Value
Population equivalent at 108 LPCD waste	25,000
Anaerobic pond sludge volume	0.04 m^3/capita/year
Total anaerobic pond sludge volume	1,000 m^3/year
Sludge volume provided in all anaerobic ponds	935.16m^3
Cleaning required period	1 year
Application layer of sludge	0.5 m
Area of Sludge Drying Beds	2000 m^2 – 2035 Horizon (4Nr. @ 28m by 18m) 2963 m^2 – 2045 Horizon (2Nr. @ 28m by 18m)

2.4.6 Onsite Wastewater Treatment Facilities

Most of the areas within the Mumias town will be served by the proposed sewerage system. However, it will not be possible to serve area like Mayoni and Shibale catchment in the immediate term, thus the Consultant has proposed ablution blocks and septic tanks for these areas.

The tables below present the dimensions of the septic tanks proposed in Mayoni Market and Shibale.

Table 2-17: Design of a two-compartment septic tank for Mayoni Market

Designed volume of the tank	108m^3
Tank Dimensions	L = 9m W = 4m D +F = 3.3m

Table 2-18: Design of a two-compartment septic tank for Shibale

Designed volume of the tank	405m^3
Tank Dimensions	L = 15m W = 9m D +F = 3.3m

2.5 Proposed Project Activities

2.5.1 Construction phase activities

The proposed sewer system will consist of localized activities in the specific areas that are marked for the activity. The project is designed to follow the existing water supply pipe network that is already operational in Mumias town. The project activities during construction phase will involve;

- Surveying, setting out and demarcation of the pipe network lines;
- Supply and installation of sewer pipes;
- Stripping top soil;
- Excavation and shoring;
- Disposal of excavated material;
- Backfilling of pipe trenches thereafter and cementing of new pipes to the respective pipeline ancillaries.

2.5.2 Materials and equipment for the proposed project

The sewers construction will involve the use of the following materials;

- Double Wall Corrugated (DWC) HDPE and Precast Concrete (PCC) pipes;
- Survey equipment;
- Excavation equipment;
- Vehicles including dumper tippers;
- Micro tunnelling equipment;
- Epoxy coated steel pipes and sleeves.

2.5.3 Site safety and Environmental considerations

The Contractor is required to ensure so far as is reasonably practicable and to the satisfaction of the supervising engineer; that the impact of the construction on the environment is kept to a minimum and that appropriate measures as outlines in the EMP are implemented to mitigate any adverse effects during the construction. Some of the key measures are:

- The project active sites be enclosed with reflective barrier materials including reflective cones and tapes to prevent intrusion by the public;
- A safe system of work be provided by the consultant for the proposed work activities;
- Casual workers identified be inducted on safe methods of work and tool box meetings provided daily;
- All workers be provided with appropriate safety wear which they must use while at work.

The table below shows the various type of products, by products and waste that will be generated during the project's cycle.

Table 2-19: The products, by products and waste generated during project cycle

Project Activities	Material /Equipment to be used	Waste/By Products Generated	Disposal Method
1. Planning and design Phase – No anticipated physical activities or processes			
2. Construction Phase			
Clearing the site	• Power Saws • Caterpillar/ Shovel	• Cut vegetation • Rock debris • Noise (by power saw)	• Soil to be used for backfilling • Wood would be used as fuel and in the construction. • Good maintenance of machines being used.
Excavation/Earthworks including removal topsoil	• Excavation equipment's including caterpillars, haulers etc.	• Soil • Roots • Noise	• Soil to be used for backfilling and landscaping.

Project Activities	Material /Equipment to be used	Waste/By Products Generated	Disposal Method
Transportation materials maintenance equipment	• Trucks • Fuel, spare parts and lubricants oil	• Fumes • Used oil, and other lubricants.	• Used oil/grease to be reused for lubricating movable parts of • Equipment.
Construction/Building Materials	• Machine cut stones • Steel • Cement • Soils • Timber • Nails, galvanized iron sheets • Gravel, sand • Glass	• Stone /Rock Debris • Timber Splits • Broken Glass • Nails and Iron Sheets • Cuts • Piping Remains • Plastic Waste • Oil and Greases Spills • Waste Water • Used Containers	• Soil and rock debris would be used for landscaping & back filling the reserves • Timber splits would be used for firewood • Plastic waste should be resold to waste collectors or dumped in appropriate designated sites.
	• Water • Packaging • Materials • Pipes and PVC • Oil and Grease • Storage • Containers e.g. Drums		• Metallic containers can be reused in storage of other materials or be sold to dealers. • Metallic wastes can be recycled or be sold to dealers. • Waste water can be recycled by watering diversions to control dust. • Oils and grease should be reused, be sold to dealer or be disposed off in areas.
Human Consumables	• Stationeries • Computers • Photocopiers • Clothing Materials • Vehicles • Medicines • Reagents • Food and Water	• Used paper • Obsolete/ spoilt clothing, computers, photocopiers and • Vehicle parts • Human waste • Expired drugs and reagents	• Sell waste paper to dealers. • All obsolete materials should be carefully sorted, stored and sold to dealers. • Septic tanks should be provided in all the workmen's camps and disposed of appropriately in designated sites.

3 BASELINE INFORMATION OF THE PROJECT AREA

3.1 Project Location

Mumias Town is located in Kakamega County at 0.33511 latitude, 34.4864 longitude. The average elevation is 1318m. Kakamega County is located in Western Kenya bordering Bungoma County to the North, Trans Nzoia County to the North East, Uasin Gishu County and Nandi County to the East, Vihiga County to the South, Siaya County to the South West and Busia County to the West.

Mumias is the second largest town in Kakamega County. It is the headquarters of Mumias Sub-County and host to Mumias Sugar Company, which is a leading sugar-producing firm in Kenya. Mumias town is 400km from Nairobi, 37 km from the county capital Kakamega Town to the east, 80km from Kisumu City to the southeast while Bungoma and Busia are 29 and 56 kilometres to the north and west respectively. It is situated at the junction of the Kakamega - Bungoma and Kakamega – Busia Roads. It is second in hierarchy of urban centres after Kakamega Town within the County of Kakamega.

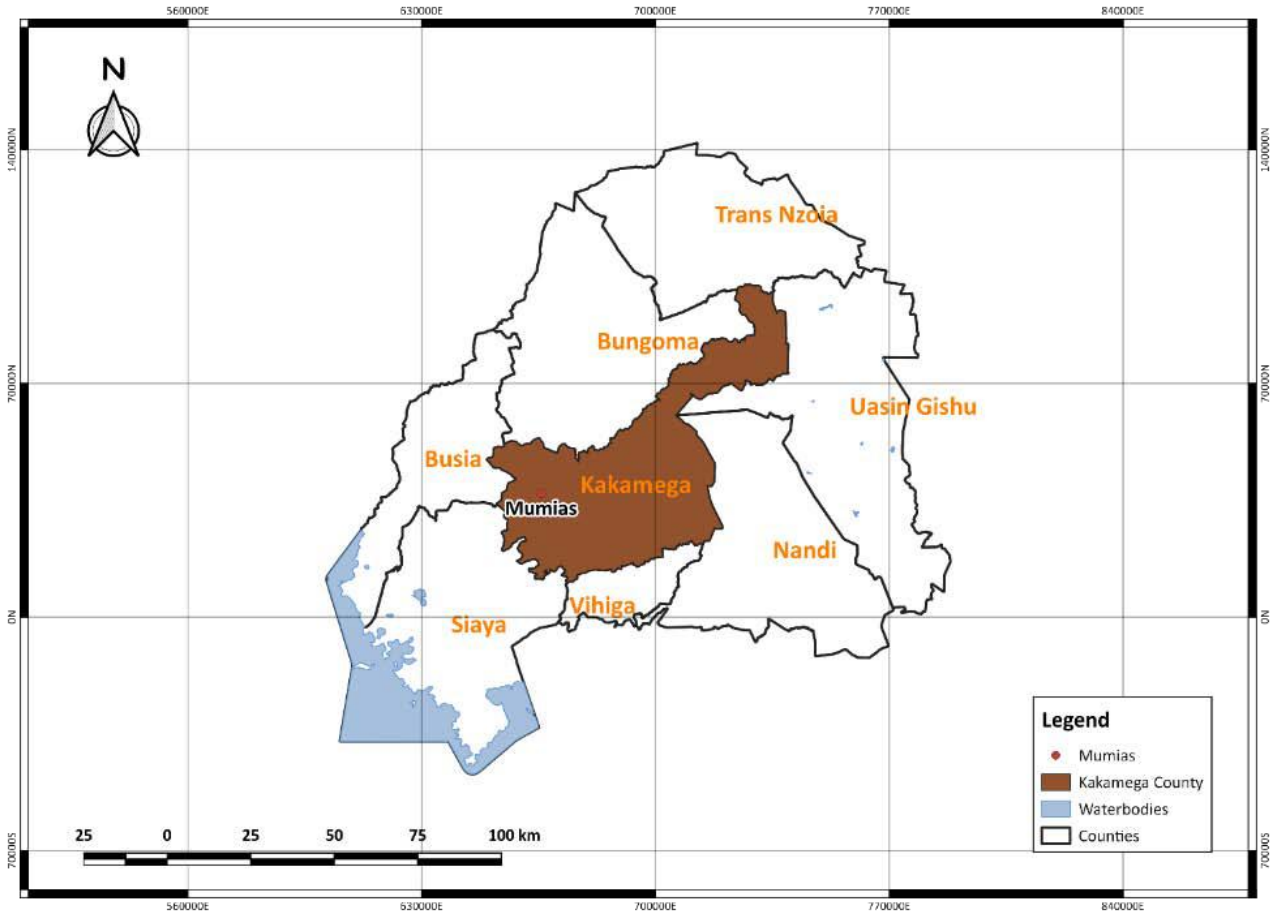


Figure 3-1: Location of Mumias Town

Mumias was the capital of the Luhya Kingdom of Wanga, ruled by King Nabongo Mumia, who came to power in 1880 and was the last sovereign king of Wanga. Mumias is regarded as the seat of power for the royal family. The origin of Mumias town, formerly called Kwa- Shiundu, dates back to around 1800. At this time, the Wanga tribe, through their famous Nabongos or rulers had become the most powerful and well-established group among Luhyias of Western Kenya. During this time, Shiundu the father of Mumia was ruling Nabongo, and Kwa Shiundu (named herein) was the traditional administrative “boma” for the entire empire of Wanga. When Mumia became Nabongo, around 1870, he moved this capital to Lureko village, his birth place, because of unhealthy conditions at Kwa Shiundu. However, when Europeans arrived in 1883, Mumia gave them the deserted Kwa Shiundu as their administrative camp. As more and Europeans passed the place, they preferred to call this place Mumias which has retained its name to this date.

3.2 Administration

3.2.1 Mumias Town

Mumias Town is located within the County Government of Kakamega. It is the headquarters of Mumias Sub-County. The town has an urban population of 116,358 (2009 census). The town is linked by road to Kakamega (in east), Busia (west), and Bungoma (north), Butere (south). The Proposed project area falls under the following areas:

Table 3-1: Mumias Town Proposed project locations

County	Constituency	Ward	Total Area (Km^2)
Kakamega	Mumias East	Malaha/Isongo/ Makunga	50
		Lusheya Lubinu	51.8
		East Wanga	47.4
	Total		149.2
	Matungu	Mayoni	49.8
		Namamali	58.3
		Koyonzo	66.8
		Kholera	61.9
		Khalaba	39
	Total		275.8

3.2.2 Historical Context

Mumias was the capital of the Luhya Kingdom of Wanga King Nabongo Mumia who came to power in 1880 and was the last sovereign king of Wanga, Mumias is regarded as the seat of power for the royal family. The origin of Mumias town formerly called Kwa- Shiundu dates back to around 1800. At this time, the Wanga tribe, through their famous Nabongo's or rulers had become the most powerful and well-established group among Luhyias of western Kenya. During this time Shiundu' the father of Mumia was ruling Nabongo, and Kwa Shiundu (named herein) was the traditional administrative "boma" for the entire empire of Wanga. When Mumia became Nabongo, around 1870, he moved this capital to Lureko village his birth place because of unhealthy conditions at Kwa Shiundu. However, when Europeans arrived in 1883, Mumia gave them the deserted Kwa Shiundu as their administrative camp. As more and Europeans passed this place, they preferred to call this place Mumias which has retained its name to this date.

3.3 Ecological characteristics of the project area

3.3.1 Ecological Zones

Mumias town is geographically located in Kakamega County which has two ecological zones namely; the Upper Medium (UM) and the Lower Medium (LM). Mumias town is under the Lower medium, which covers a major portion of the southern part of the county which includes Butere, Khwisero, Mumias East, Mumias West and Matungu. In this zone, the main economic activity is sugarcane production with some farmers practicing maize, sweet potatoes, tea, ground nuts and cassava production.

3.3.2 Climate

Mumias has high rainfall almost all year round. The highest amount is received during the long period between March and July. However, the rainfall is less in intensity between December and February. The annual rainfall ranges from 1,597 – 2,873mm per year. The area has an almost uniform rainfall distribution (mean annual of about 1800mm). It has high temperatures all the year round. The mean maximum is about 29oC. The high temperatures and rainfall allow for crop development all year round, enabling farmers to have two cropping seasons in the entire area.

3.3.3 Temperature

Mumias experiences high temperatures particularly during the months of December to February when the mean temperature is about 30.0°C. The mean annual temperature is about 15.0°C.

3.3.4 Sunshine and Solar Radiation

Mumias receives reliable sunshine throughout the year. Mumias experiences an annual mean of approximately 10 hours of sunshine per day. The intensity is high resulting in high evapo-transpiration rates. The moderate temperatures and high solar hours present an opportunity for enhancing solar power exploitation.

3.3.5 Humidity

The mean relative humidity is about 80%.

3.3.6 Wind Run

Mumias town and its environs have an annual average wind run of 196km/day. The wind run reduces as the altitude decreases.

3.3.7 Environment and Climate change

Kenya's climate is already changing. The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) presents strong evidence that surface temperatures across Africa have increased by 0.5 – 2 °C over the past 100 years, and from 1950 onwards, climate change has altered the magnitude and frequency of extreme climate events. The frequency of cold days, cold nights, and frost, has decreased; while the frequency of hot days, hot nights, and heat waves, has increased. Temperature rise has been observed across all seasons in Kenya, but particularly from March to May. Variations exist between locations, flooding normally occurs across the entire country in years with above-normal rainfall, as well as those with heavy rainfall storms. 2018 is an example of this, with some of the highest level of rainfall totals in the long rain season (March-April-May) recorded since 1950.

Rainfall patterns have also changed. The long rain season has become shorter and drier, and the short-rain season has become longer and wetter. Overall annual rainfall remains low, with the long rains declining continuously and, droughts becoming longer, more intense, and tending to continue across rainy seasons. The frequency of rainfall events that causes floods has also increased, not just in Kenya, but in the entire East African region, from an average of less than three events per year in 1980s, to over seven events per year in 1990s, and ten events per year from 2000 to 2006. The frequency of droughts and heavy rainfall has also significantly increased in the East Africa region in the last 30-60 years.

3.3.8 Topography

Mumias has a varying topography with a few hills and valleys dissected by a number of small streams. The town is located between river Lusimu and the great Nzoia river. The Town has an extensive undulating terrain that dips southwards from about 1,265m to 1,330m above mean sea level, to a further 1,310m to the west. The lowest part of the Town stands at about 1,290m above mean sea level. The figure below gives an indication of the area topography.

3.3.9 Soils and Geology

The underlying bedrock of Mumias town is fairly homogenous; with the major components consisting of granites, which vary from medium to coarse grained porypherytic granites of the Mumia type. Granitic rocks cover most parts of Mumias town. Meta-sedimentary rocks of the Kavirondian system and strips of Nyanzian system volcanic rocks such as basalts and andesites are also found within the town.

The town has a variety of soils; predominantly Mumias has loam soils which are well drained and suitable for growing a large variety of crops. The mainly cultivated crop in Mumias has been sugarcane but with the closure of Mumias sugar company many farmers have begun growing other crops including maize and beans on large scale.

The upper part of Mumias town include the well-drained sandy loams which occupy the broad tops and side of the ridges while the lower parts of the major river valleys consist of sandy clays or collovial clay soils. The latter type of soil though fertile are poorly drained and hence encourage the growth of swamps or marshy vegetation.

3.3.10 Hydrology and Drainage

Mumias is located within the Lake Victoria North Catchment Area (LVNCA) in the western part of Kenya and surrounded by Mt. Elgon in the north and Cherengani Hills and Mau Forest Complex in the east. The LVNCA borders on Uganda in the west and faces Lake Victoria in the south-west. Total area of LVNCA is 18,374 km^2, corresponding to 3.2% of the country's total land area. The whole area of the LVNCA lies in the highland having elevations greater than 1,000 m amsl. Major rivers are the Nzoia, Yala, Malaba, Malikisi, and Sio Rivers. The Nzoia River is the largest river with a drainage area of 12,853 km^2, or 70.0% of the LVNCA while Yala River is the second largest river with a drainage area of 3,259 km^2. Both rivers flow into Lake Victoria. The Sio, Lwakhakha, Malakisi and Malaba rivers flow across the border to Uganda. The Sio River pours into Lake Victoria along the border with Uganda. Total drainage area of these four transboundary rivers accounts for 2,301 km^2, or 12.5% of LVNCA. Lake Victoria is the second largest fresh water lake in the world and strides the borders of Kenya, Tanzania and Uganda.

The drainage of Mumias Municipality is largely controlled by the geology - within the Mumias granite area the streams flow in general northeast – southwest direction but on reaching the Kavirondian System, they all change to east – west

direction roughly following the strike of the rocks. Though the drainage system is mature, the major rivers and their tributaries show evidence of rejuvenation in the form of waterfalls, rapids and rock-bars, with intervening stretches of papyrus-choked swamps; while broad, gently-sloping divides often drop sharply to the newly-incised modern stream valleys. This rejuvenation has probably been caused by renewal of movement involving general uplift along the Nandi fault in fairly recent times, which has also tilted the peneplained surfaces to their present slope towards the south-west. The figure below shows the stream network, flow direction, sub catchments and drainage basin within Mumias Town and peripheral area.

3.3.11 Flora and Fauna

Mumias hosts the natural forests at the Nabongo Cultural Shrine which is still protected by the family. With the new divisions of the sub-counties in Kakamega County the Shrine is located in Matungu subcounty. Initially Matungu location and Mayoni sublocation were part of Mumias municipality. Eucalyptus is the most predominant tree species grown in Mumias and Matungu, other common trees include Markhamia Lutea, Harungana Madagascariensis locally known as Omwinala Matsai and Sesbania Sesban.

Wildlife in the Mumias is Mainly found in and on the shores of the River Nzoia mainly hippopotamus. Other animals that can be identified in Mumias town are the monitor lizards and wild rats.

3.4 Socio-economic characteristics of the project area

3.4.1 Urbanization and economic Development

3.4.1.1 Overview

The predominant economic activities in Mumias Town and its environs are agriculture, quarrying, building and construction, wholesale and retail, restaurants and hotels, transport and communications, finance, insurance, real estate and business services. The county is predominantly a crop farming economy with livestock farming taking a small portion of the available arable land. The economy of the commercial nodes within Mumias town area does not seem to relate to the expected forward and backward linkages to the main industry driving the town, i.e. sugar. There is very little subsidiary industrial development in the commercial nodes and most of the economic activities are commercial concerns with little industrial or manufacture component. The few light industrial activity is carried out in road reserves and open spaces. The economic activity in the commercial nodes is by and largely service oriented (business outlets) with considerable informal proportions.

3.4.1.2 Trade and Commerce

Mumias town is strategically positioned to be a key commercial centre for the surrounding counties and urban centres. Further, the town is situated is at the junction of the Kakamega-Bungoma and Kakamega –Busia Roads a factor that promotes transportation to and from the town and makes it an important call-point for travellers. Wholesale and retail trade and the hotel and restaurant industries are leading in formal sector employment nationwide. Commerce is the major economic activity in the town and comprises the following activities viz: formal and informal.

3.4.1.3 Formal Sector

The town is largely driven by both large scale and small scale retail activities. The town hosts supermarket chain stores among other local retails retail. Wholesalers dealing mainly in retail items are located within the town. Most of the hardware have increased in the past three years due to increase in the construction industry during the same period. Within the town there are emerging satellite centres which serve as shopping centres.

3.4.1.4 Informal commercial activities

Informal trade activities in Mumias include general retail, tailors, workshops charcoal dealers, hawkers, vegetable sellers etc. Hawkers are effective and efficient as economic agents in the distribution of goods and services found within both the CBD and peri-urban areas. The Central Business District (CBD) area of the town has been crowded with many informal commercial activities that have taken over public space. This calls for provision of places for location of informal activities.

3.4.1.5 Markets

Markets are important for towns for many reasons as they offer and create incredible opportunities for social, cultural, and economic wealth at the local level. Apart from contributing significant revenue generation to the County Government, markets also enhance the town's local economy. Market. Mumias closed market was rehabilitated by the

County Government of Kakamega. Inadequate capacity as demonstrated with the number of people who do not have stalls thus operating from the corridors. The market's infrastructure is deteriorating.

3.4.1.6 Industry

The town is home to the biggest sugar factory in the Country i.e. Mumias Sugar Factory. The presence of Mumias Sugar Company affords an opportunity for forward and backward industrial development. There exist other small-scale industries in the County, pre-dominantly in the sugarcane growing regions, such as the jaggeries, bakeries. There is need for linkages for value addition industries and attraction of development partners to develop industries that support other sectors such as eco-tourism, development of modern markets, horticulture and small-scale artisans' industries.

3.4.1.7 Tourism

Mumias is rich in cultural practices such as the existing Wanga Kingdom, which attracts a number of visitors to the town. The Nabongo Cultural Centre in Matungu, showcasing the Wanga Kingdom, is one of the main tourist attractions in Mumias. The history of the town and cultural value of the Wanga Kingdom is a major asset in branding the town and growing tourism. In addition, Bishop Hannington's grave in Mumias Town is a tourist attraction. Other attractions include bull fighting, 'Isukuti' dances, and wrestling.

3.4.1.8 Banking and Financial Services

Banks play a very important role in the economic life of a town. Banks through lending and related activities facilitate the process of production, distribution, exchange and consumption of wealth. Mumias town currently hosts commercial banking and financial institutions' branches. These include Kenya Commercial Bank (KCB), Barclay's Bank, Equity Bank, Kenya Women Finance Trust, which have taken advantage of the town's positioning as an agricultural and commercial hub. In addition, there are several finance institutions insurance services and agents are available in the town.

3.4.1.9 Agriculture

The main crops grown in Kakamega County are sugarcane, maize, beans, cassava, finger millet, sweet potatoes, bananas, tomatoes, tea and sorghum. Maize meal forms the staple food for the county. Maize and sugarcane are generally grown in large scale while beans, millets and sorghum are grown on small scales on the other hand maize, tea and sugarcane are the main cash crops grown in the County. The town and its hinterland majorly depends on agriculture for its livelihood. This has led to clearing of forests, thus affecting water catchments. The rivers are also drying up due uncontrolled human activities such as deforestation in the water catchment areas and riparian areas.

3.4.2 Demographic situation

Mumias Town had a population of over 118,000 residents as per the 2009 census. The population is quite youthful with over 60% being 30 years and below. Mumias Town has experienced a tremendous population growth rate since the development of the Urban Centre in 1907. According to the census report Mumias Town had a population of 48,730 people in 1999 while the population in 2009 was 118,309. Most of the population is concentrated around the central area and the western part of the planning area and market centres. The population structure reveals a young and growing population with a small proportion of ageing population.

Table 3-2: Mumias population size and composition by age cohort

Age Group	Male	Female	Total	%
0-4	10,572	10,855	21,427	18
5-9	8,765	9,011	17,776	15
10-14	7,528	7,541	15,069	13
15-19	6,162	6,661	2,823	2.3
20-24	5,353	6,828	12,181	10
25-29	4,765	4,904	9,669	8
30-34	3,665	3,617	7,282	6
35-39	2,704	2,674	5,378	4.5
40-44	2,062	2,150	4,212	3
45-49	1,865	1,849	3,714	2
50-54	1,422	1,296	2,718	1.6
55-59	934	940	1,874	1.6
60-64	638	674	1,312	0.7
65-69	375	437	812	0.6

Age Group	Male	Female	Total	%
70-74	303	381	684	0.56
75-79	210	324	534	0.45
80+	324	432	760	0.6
Total	**57,691**	**60,618**	**118,309**	**100**

3.4.3 Access to social infrastructure

3.4.3.1 Overview

Infrastructure improvements contribute to economic development. Inadequate infrastructure limits a town's ability to utilize its natural resources, distribute food and other finished goods, integrate the manufacturing and agricultural sectors, and supply education and medical services. Mumias has limited infrastructure such as roads, storm water drainage, water supply, sewerage system, solid waste management, power supply, telecommunication facilities and air transport. There is no existing railway line connecting the town to towns in neighbouring counties.

3.4.3.2 Transport System within the Town

In the town itself, there are a few short tarmacked streets in the CBD area and a few poorly maintained murram roads in town while the remaining roads are earth roads. Private developers have encroached the public way leaves for roads, footpaths and storm water drainage. Some of the CBD streets are too narrow to accommodate all the services required for a road. The road reserves should provide for a two-way road carriageway, storm water drainage, footpath, motorcycles, bicycles, and street lighting, water supply and sewer lines. Some of the streets have turned into one-way drives, as they are too narrow to provide space for two cars and other services. On-street parking for small cars is limited and not properly provided for at all locations in town. Approximately 10% of the roads in the CBD are tarmacked. Poor roads are an impediment to development in the town as there are no access roads to most market centres such as Mayoni; Harambee; Matungu; Koyonzo; Cholera; Lureko; Matawa Musanda; Buhuru; Ekero; Mwitoti; Shianda; Malaha; Khaunga; Makunga.

3.4.3.3 Information Communication Technology (ICT)

Mumias town is well served in terms of information, communication and technology facilities. About 94% have access to radio while 88% thereabout have television. Most national radio stations have a good coverage and a considerable share in terms of listenership. There are also the local vernacular radio stations which have high listenership mostly in Mumias town. In terms of mobile telephony communication, Mumias is served by all the five cell phone networks. About 98% of the adult population of Mumias has access to cell phones. Access to Internet is however on the lower side since only about 22% enjoy access to internet services. Most of the residents have complained of the low speed internet in the area. Use of landline telephones has been on the decline due to stiff competition from the mobile telephony.

Postal Corporation of Kenya has a Post Office at Mumias town and at Matungu. Demand for postal boxes is low as there are some postal boxes that have not been allocated. Postal offices as a conventional way of sending and receiving mails and parcels is also facing stiff competition from private courier services. The dominance of Postal Corporation of Kenya in mail and parcel delivery is facing stiff competition from the private sector hence diminishing in use of postal services. Private Courier Services G4S, KK and others are fully established and operating in Mumias town. In addition, Matatu SACCOs are actively involved in courier services and their dominance is being felt in Mumias.

3.4.3.4 Access to water supply

Access to safe water and sanitation is a universal need and a basic human right. An insufficient access to water is not only bad for health, but also contributes to a poor food security and a lagging social development. Mumias town is strategically located in region that has permanent rivers. The County has only one Water Service Provider (WSP) – Kakamega County Water and Sewerage Company. There are however seven water supply schemes and Mumias is served by Mumias Water Supply. Apart from Kakamega and Mumias Water Supply, the rest of the schemes / water supplies are dilapidated and require massive rehabilitation and alignment. The present source of water supply for Mumias area was established in 1976 and its water source is in river Lusumu approximately 5 kilometers to the south of Mumias town. A new system will have a raw water intake upstream of the present source on River Lusumu, some 28 kilometers from Mumias town. The existing system with a capacity of 3000m3 per day and is powered by gravity. The project has a reinforced concrete tank constructed at Ekero near Mumias town with a capacity of 5,000m3 to boost water storage and supply in the center. Presently, Mumias is served by a combination of Surface Water and Groundwater Systems. The main Surface Water Source is the River Lusumu, which flows along the Southern Boundary of the town.

The population relies on traditional water sources comprising shallow wells, unprotected springs, roof catchments, unprotected springs rivers and streams. The primary sources of water for domestic consumption Mumias town are rivers, water kiosks, boreholes and roof water catchment. Other sources include dams, water pans, shallow wells, seasonal streams and water vendors

3.4.3.5 Sanitation facilities

Ensuring adequate sanitation facilities is one of the Sustainable Development Goals (SDGs) goals. In the face of rapid urban growth, towns face great difficulties in providing sustainable infrastructure to their citizens. Pit latrines are the most common method of waste disposal in the town. The town has limited central sewerage disposal system covering only Camcon Estate and serves approximately 99 households. Mumias town center is not served by a sewer services and most use septic tanks. The system of waste water disposal is by septic tanks, pit latrines, bucket and bush.

3.4.3.6 Access to education

Most of the higher learning institutions are located in the town centre. The town has Masinde Muliro University of Science and Technology Mumias town campus in addition to other privately run computer colleges, vocational training centres and driving schools. The primary school going cohort is 6-13 years while the secondary school going cohort is 14-17 years.

3.4.3.7 Access to health services

Data for the health sector has been consolidated at the County level. However, the main health facilities are found within Kakamega Municipal and this forms the anchor for the network of health facilities. The County has nine sub-county hospitals, nine mission/NGO hospitals, one private hospital, eight nursing homes and twenty-seven public health centres which have a referral system to the County Referral Hospital.

The most common diseases in the town include malaria, diarrhoea malaria, typhoid, and upper Respiratory tract infections among others. Malaria prevalence remains high at 36.4 percent. The use of treated nets has helped to significantly reduce infection and transmission of Malaria and more effort is needed to ensure its continued use. There is also need for closer monitoring of HIV/AIDS infection due to its socioeconomic impact on households and communities. Females are more vulnerable to sickness than males in the county.

3.4.3.8 Sources of energy

Sources of energy for lighting in Mumias town include electricity, kerosene and solar. Sources of cooking fuel energy include wood (firewood and charcoal), gas, kerosene and electricity. Most households are connected to electric power supply.

4 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

4.1 Policy provision

4.1.1 Kenya Vision 2030

Kenya's Vision 2030 aspires to transform Kenya into a newly industrialized middle-income country by 2030. The blueprint recognizes that Kenya is a water scarce country and further that the economic and social development envisaged in the vision 2030 will require more high quality water supplies. The water and sanitation sector goal in line with the Vision 2030 is "to ensure that improved water and sanitation are available and accessible to all". One of the strategies proposed is to construct water and sanitation facilities to support industries and the growing urban population. Regarding environment, the Vision states that Kenya aims to be a nation living in a clean, secure and sustainable environment by 2030.

Relevance

The proposed project aims at improving sanitation in Mumias Town.

4.1.2 National Environment Policy (NEP)

The revised draft of the National Environmental Policy, dated April 2012, sets out important provisions relating to the management of ecosystems and the sustainable use of natural resources, and recognizes that natural systems are under intense pressure from human activities particularly for critical ecosystems including forests, grasslands and arid and semiarid lands. The objectives of the Policy include developing an integrated approach to Environmental management, strengthening the legal and institutional framework for effective coordination, promoting environmental management tools.

Relevance

An Environmental Impact Assessment has been completed for the proposed project prior to implementation and the relevant licenses applied for, the proposed Project shall also implement the Environmental Management Plan (EMP) to mitigate the impacts during the construction and operational phases of the project, this will ensure that the sensitive ecosystems are protected.

4.1.3 National Land Policy

The National Land Policy in Chapter 3 under section 3.4, Environmental Management Principles, provides for the policy actions for addressing the environmental problems such as the degradation of natural resources, soil erosion, and pollution of air, water and land. The policy advocates for environmental assessment and audit as a land management tool to ensure environmental impact assessments and audits are carried out on all land developments that may degrade the environment and take appropriate actions to correct the situation.

Public participation meetings have been held for the proposed project as required in the preliminary stages of Environmental and Social Impact Assessment.

4.1.4 National Water Policy

The National Water Policy was promulgated in April 1999 as Sessional Paper No. 1 of 1999 and calls for decentralization of operational activities from the central government to other sectors, including local authorities, the private sector and increased involvement of communities in order to improve efficiency in service delivery.

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.

4.1.5 HIV and AIDS Policy 2009

This policy shall provide a framework to both the project proponent and contractor to address issues related to HIV and Aids. In Summary the policy provides a mechanism for:

- Setting Minimum Internal Requirements (MIR) for managing HIV and AIDS;
- Establishing and promoting programs to ensure non-discrimination and non- stigmatization of the infected;
- Contributing to national efforts to minimize the spread and mitigate against the impact of HIV and AIDS;
- Ensuring adequate allocation of resources to HIV and AIDS interventions;

- Guiding human resource managers and employees on their rights and obligations regarding HIV and AIDS.

4.1.6 Gender Policy 2011

The overall goal of this Policy Framework is to mainstream gender concerns in the national development process in order to improve the social, legal/civic, economic and cultural conditions of women, men, girls and boys in Kenya.

This policy will be referred to during project implementation especially during hiring of staff to be involved in the project, procuring of suppliers and sub consultants and sub-contractors to the project.

4.1.7 National Occupational Safety and Health Policy 2012

The Policy addresses the current challenges, gaps and future development of safety and health systems and programs in Kenya. It is expected to promote basic principles of assessing occupational risks and/or hazards; combating hazards at source; and developing a national preventative safety and health culture that includes information, consultation, research and training.

The Policy applies to all workplaces in all sectors of the economy and all forms of work guided by the existing laws on Occupational Safety and Health (OSH), Work Injury Benefits and other relevant regional and International Labour Standards without any exemption. The main focus is prevention and control of work-related accidents and diseases, compensation and rehabilitation of workers injured in the course of work and those who contract occupational diseases.

4.2 Relevant Legislations

4.2.1 Constitution of Kenya

Section 42 states that *"Every person has the right to a clean and healthy environment, which includes the right:*

(a) To have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69; and

(b) To have obligations relating to the environment fulfilled under Article 70 The constitution also emphasizes on that:

(i) Land use and management shall by law benefit local communities;

(ii) Community land is protected from encroachment by State;

(iii) Law shall protect Rivers, forests and water bodies;

(iv) Equitable access to land;

(v) County governments will manage land in trust of the people in accordance with the proposed Constitution.

4.2.2 The Environment Management and Coordination Act (EMCA) Cap 387

An Act of Parliament to provide for the establishment of an appropriate legal and institutional framework for the management of the environment and for matters connected therewith and incidental thereto. PART II – GENERAL PRINCIPLES 3. Entitlement to a clean and healthy environment (1) Every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance the environment. To achieve this goal, the projects listed under the Schedule No. 2 of EMCA must be subjected to Environmental Impact Assessment (EIA). The proposed project falls within the Second schedule and must therefore comply with EMCA requirements in as far as EIA is required. The regulations under EMCA that will influence the operation of the project are;

- The Environmental (Impact Assessment and Audit) Regulations, 2003 Legal Notice No. 101;
- The Environmental Management and Coordination (Waste Management) Regulations, 2006 Legal Notice No. 121;
- The Environmental Management and Coordination (Water Quality) Regulations, 2006 Legal Notice No. 120;
- The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 Legal Notice No. 61;
- The Environmental Management and Coordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006 Legal Notice No. 160;
- Environmental Management and Coordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulation, 2009;
- The Environmental Management and Coordination (Controlled Substances) Regulations, 2007 Legal Notice No. 73.

4.2.3 Water Act 2016

The passage of Kenya's 2010 Constitution has had a wide set of implications for the water sector. Primarily, the Constitution acknowledges access to clean and safe water as a basic human right and assigns the responsibility for water supply and sanitation service provision to 47 newly established counties. The purpose of the 2016 Water Act is to align the water sector with the Constitution's primary objective of devolution. The act recognizes that water related functions are a shared responsibility between the national government and the county government. It also gives priority to use of abstracted water for domestic purposes over irrigation and other uses.

The act sets in place the Water Resources Authority (WRA) whose objective of is to protect, conserve, control and regulate use of water resources through the establishment of a national water resource strategy. In addition, the WRA is responsible for:

- formulation and enforcement of standards, procedures and regulation for the management and use of water resources;
- policy development;
- planning and issuing of water abstraction permits; and
- setting and collecting permits and water use fees.

Water Rules 2007

The Water Resources Management Rules, 2007 was gazetted to guide all policies, plans, Programs and activities that are subject to the Water Act, 2002. The Water Resources Management Rules empower Water Resources Authority (WRA) to impose management controls on land use falling under riparian land. It also enables any person with a complaint related to any matter covered by these rules to the appropriate office in WRA as per the Tenth Schedule which provides a format for report on complaints. Part A of the Sixth Schedule: Conservation of Riparian and Catchment Areas of the Rules (rule 116) define the riparian land on each side of a watercourse as a minimum of six meters or equal to the full width of the watercourse up to a maximum of thirty meters on either side of the bank. It further provides activities proscribed on riparian land as:

- Tillage or cultivation;
- Clearing of indigenous trees or vegetation;
- Building of permanent structures;
- Disposal of any form of waste within the riparian land;
- Excavation of soil or development of quarries;
- Planting of exotic species that may have adverse effect to the water resource; or
- Any other activity that in the opinion of the Authority and other relevant stakeholders may degrade the watercourse.

4.2.4 County Government Act No. 17 of 2012

An Act of Parliament to give effect to Chapter Eleven of the Constitution; to provide for county governments' powers, functions and responsibilities to deliver services and for connected purposes. In the Fourth Schedule of the Kenyan Constitution 2010 Part 2 County governments, one of the functions of the County governments is stated as "11. County public works and services, including— (a) storm water management systems in built-up areas; and (b) water and sanitation services. "

4.2.5 Occupational Health and Safety Act (OSHA 2007)

Occupational Safety and Health Act (OSHA) is an Act of Parliament that provides for the safety, health and welfare of all workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. It applies to all workplaces where any person is at work, whether temporarily or permanently. The purpose of this Act is to:

- Secure the safety, health and welfare of persons at work; and
- Protect persons other than persons at work against safety and health arising out of, or in connection with the activities of persons at work.

4.2.6 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 one for compensation shall be given in the prescribed form to the director.

4.2.7 The Public Health Act (Cap.242)

This is an Act of Parliament to make provision for securing and maintaining health. Section 115 of this act prohibits causing nuisance or other conditions liable to be injurious or dangerous to health. Section 118 provides a list of nuisances that includes any noxious matter, or wastewater, flowing or discharged from any premises, wherever situated, into any public street, or into the gutter or side channel of any watercourse, irrigation channel or bed thereof not approved for the reception of such discharge.

4.2.8 Eviction Way leave and Rehabilitation Bill (2014)

- Every person shall be protected from arbitrary eviction;
- The persons, affected by an eviction should not suffer detriment to their human rights;
- The state while carrying out eviction and resettlement, must observe the human dignity, equity, social justice, human rights, non-discrimination and protection of the marginalized and vulnerable groups; and
- Every person has the right to administrative action that is expeditious, efficient, reasonable and procedurally fair.

4.3 Institutional Framework

4.3.1 Ministry of Water and Sanitation & Irrigation

The mandate of the Ministry is to protect, conserve and manage water resources and ensure sustainable use of water for agriculture in Kenya with a view of supporting socio-economic development, reduce poverty, improve living standards and ensure a clean environment. The Ministry's Water Department has its fundamental goal and purpose as conserving, managing and protecting water resources for socio-economic development. Its aim is to improve the living standards of people by ensuring proper access to available water resources.

4.3.2 Water Services Regulatory Board (WASREB)

- Regulating the provision of water and sewerage services including licensing, quality assurance, and issuance of guidelines for tariffs, prices and disputes resolution;
- Overseeing the implementation of policies and strategies relating to provision of water services licensing of Water Services Agencies and approving their appointed Water Services Providers;
- Monitoring the performance of the Water Services Agencies and Water Services Providers;
- Establish the procedure of customer complaints;
- Inform the public on the sector performance;
- Gives advice to the Minister in charge of water affairs.

4.3.3 Water Resources Authority (WRA)

The authority is responsible for sustainable management of the Nation's Water Resources:

- Implementation of policies and strategies relating to management of water resources;
- Develop principles, guidelines and procedures for the allocation of water;
- Development of Catchments level management strategies including appointment of catchments area advisory committees;

- Regulate and protect water resources quality from adverse impact;
- Classify, monitor and allocate water resources.

4.3.4 NEMA

The National Environmental Management Authority (NEMA) is the supreme regulatory and advisory body on environmental management in Kenya under EMCA Cap 387. NEMA is charged with the responsibility of coordinating and supervising the various environmental management activities being undertaken by other lead agencies. NEMA also ensures that environmental management is integrated into development policies, programs, plans and projects. The proposed project Environmental and Social Impact Assessment report will be submitted to NEMA for Licensing prior to project implementation, also Environmental Audit and monitoring reports will be submitted as required.

4.3.5 Water Works Development Agencies (WWDAs)

- Develop the facilities, prepare business plans and performance targets;
- Planning for efficient and economical provision of Water and sewerage services within their areas of jurisdiction.

The proposed project areas are under Central Rift Valley Water Works Development Agency (CRVWWDA) and Lake Victoria North Water Works Development Agency (LVNWWDA).

4.3.6 Water Services Providers

Water Service Providers are the utilities or water companies. They are state owned but have been commercialized to improve performance and run like business within a context of efficiency, operational and financial autonomy, accountability and strategic, but minor investment. The relevant water services provider for the project area is KACWASCO.

4.4 African Development Bank Policies on Environment Protection

4.4.1 OS 1: Environmental and Social Assessment

This overarching safeguard governs the process of determining a project's environmental and social category and the resulting environmental and social assessment requirements.

4.4.2 OS 2: Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation

This safeguard consolidates the policy commitments and requirements set out in the Bank's policy on involuntary resettlement, and incorporates a number of refinements designed to improve the operational effectiveness of those requirements.

4.4.3 OS 3: Biodiversity and Ecosystem Services

This safeguard aims to conserve biological diversity and promote the sustainable use of natural resources. It also translates the commitments in the Bank's policy on integrated water resources management into operational requirements.

4.4.4 OS 4: Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials and Resource Efficiency

This safeguard covers the range of key impacts of pollution, waste, and hazardous materials for which there are agreed international conventions, as well as comprehensive industry-specific and regional standards, including greenhouse gas accounting, that other multilateral development banks follow.

4.4.5 OS 5: Labour Conditions, Health and Safety

This safeguard establishes the Bank's requirements for its borrowers or clients concerning workers' conditions, rights and protection from abuse or exploitation. It also ensures greater harmonization with most other multilateral development banks.

Table 4-1: Project Activities Triggering AfDB Operational Safeguards

Policy	Criteria in the Project	Discussions
OS 1: Environmental and Social Assessment	Yes	The Project components will trigger Environmental Assessment (EA) safeguards and is Category B due to the interaction with the physical, biological and social setting within the immediate surroundings.

Policy	Criteria in the Project	Discussions
OS 2: Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation	Yes	The Project will utilize existing public land, road reserves and river riparian, however, in some cases there will be encroachment to private land hence a RAP has to be completed as part of the project.
OS 3: Biodiversity and Ecosystem Services	No	Project activities have no direct linkage to biological diversity and ecosystem services OS 1 shall be applied in isolated minor cases of biodiversity and ecosystem services.
OS 4: Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials and Resource Efficiency	Yes	The Projects shall utilize raw materials both during construction and operation phase that could result to pollution of biophysical environment if not handled appropriately.
OS 5: Labour Conditions, Health and Safety	Yes	The Project shall involve workers both during construction and operation phases of the project.

4.5 International Conventions

Relevant international agreements, treaties and conventions that have a social and/or environmental aspect to which Kenya is a signatory or ratified to are detailed in the table below:

Table 4-2: International Conventions relevant to social and/or environmental aspects

Conventions	Date Ratified/ Acceded to
African Convention for the Conservation of Nature and Natural Resources (2003)	Ratified (12 May 1969)
Convention on Biological Diversity (1992)	Ratified (26 July 1994)
Vienna Convention for the Protection of the Ozone Layer (1985)	Acceded to (9 November 1988)
UNESCO Convention for the Protection of the World Cultural and Natural Heritage (1972)	Acceded to (1 May 1964)
Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal (1995)	Acceded to (1 June 2000)
Convention on Biological Diversity (2006)	Ratified (26 July 1994)
Convention on Climatic Change and the Kyoto Protocol (1997)	Ratified (25 February 2005)

5 PROJECT ALTERNATIVES

The objective of alternative analysis is to define the merits and demerits of realistic alternatives, thereby providing decision makers and the public with a clear basis for choosing between options. We have systematically compared feasible alternatives for the proposed project, technology, design, and operation-including the "without project" situation--in terms of their potential environmental impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional, training, and monitoring requirements. Assessment have occurred in parallel with development of the designs, to allow maximum exchange between the Environmental expert and the design engineers.

For each of the alternatives, the analysis has quantified the environmental costs and benefits to the extent possible, and attached economic values where feasible. This includes analysis of:

- Costs and benefits of environmental impacts;
- Costs, benefits, and cost-effectiveness of mitigation measures; and
- Discussion of impacts that have not been expressed in monetary values, in quantitative terms where possible;
- Operation and maintenance requirements among others.

5.1 “Without the project” scenario

In the analysis of “without the project” scenario, the following criteria is used; past, current and future effect/ impacts of the sewerage as currently existing, anticipated benefits of proposed project plus any other considerations are analysed.

The selection of “without the project” alternative would mean the discontinuation of proposed project and result in the project being retained in its existing form. As such, this alternative is likely to have the greatest implications on the socioeconomic environment of the area and surrounding communities. Due to the proposed size of the development, it is anticipated that it will have the following benefits:

- Employment opportunities during construction;
- Creation of a market for construction materials;
- Injection of money into the local economy;
- Creation of wealth to residents through direct and indirect business;
- Improved Sanitation of Town;
- Improve Health and Hygiene of residents;
- Reduced cases of Water borne related diseases;
- Creation of job opportunities during operation phase.

We have examined following alternatives to the extent possible with the available data, and compared with the proposed project in terms of potential environmental impacts, possible mitigation measures, cost, suitability etc.

5.2 Analysis of alternative construction materials and technology

The proposed project will be constructed using the following materials mainly;

- Double Wall Corrugated (DWC) HDPE and Precast Concrete (PCC) pipes;
- Survey equipment;
- Excavation equipment;
- Vehicles including dumper tippers;
- Micro tunnelling equipment;
- Epoxy coated steel pipes and sleeves.

This ESIA proposes that rainwater should be harvested and used in construction activities whenever there is water usage need. Heavy use of timber and wood during construction should be discouraged to minimize destruction of trees. The exotic tree species should be preferred to indigenous species in the construction of the project components where need will arise as they can be replanted with ease.

The equipment and vehicles should have highest levels of combustion efficiency, capability to use cleaner fuels like biofuels and should have enhanced safety features.

6 PUBLIC PARTICIPATION

This Chapter describes the process of public consultation and participation that were followed to identify the key issues and impacts of the proposed project. Stakeholder Engagement and Public Participation Process is an integral aspect of successful decision making in the ESIA processes for major developments. Public participation is a key requirement as stipulated in Article 69 Section 1 of the Kenyan Constitution, 2010, Legal Notice 101 of the Environmental Management and Coordination Act (EMCA), 2015, Section 3 of the EIA/EA regulations, 2003 and Section 87 & 113 of the County Governments Act, 2012.

The meetings carried out, attendance of the meetings/ minutes from diverse sectors of the society is attached in this report in Appendix 4.

6.1 Objectives for consultation and public participation

The general objectives of the consultation and public participation were to:

- Disclose and inform the stakeholders about the project with special reference to its key components and location;
- Create awareness among the public on the need for the ESIA for the proposed project;
- Gather comments, suggestions and concerns of the interested and affected parties;
- Incorporate the information collected in the ESIA study.

6.2 Methods used for consultation and public participation

The public consultation and participation was conducted through:

- Household socio-economic survey;
- Key stakeholder interviews;
- Public Meetings.

The procedures used for each of the above are outlined below.

6.2.1 Household Socio-Economic Survey

Random Household Socio-economic surveys were conducted during the field visit. This was done using structured questionnaires (Questionnaire attached in the Appendices) to assess the socioeconomic status of the project area.

6.2.2 Key stakeholder interviews

Key Stakeholder meeting was held on 13 June 2019 at Mumias Water Office, Kakamega County. Courtesy calls were also made to the County Commissioners Offices to follow protocol on publizing the public barazas via Deputy County Commissioners, foster better mutual understanding of public concerns as well as incorporate key stakeholders' opinions regarding the proposed project.

6.2.3 Public meetings

Two (2) public participation meetings were conducted at the proposed sites as shown in the table below. The local Chief, Sub-chiefs, Members of County Assemblies were used to mobilize the public to attend the meetings. The announcements for the meetings were made by phone calls, announcement at centres and settlements, in places of worship and chiefs barazas. A total of 65 people participated in the meetings.

Table 6-1: Public meetings held at Mumias Town

Days	Area	Date	Time	Number of Attendance
1	Matungu location	30th July 2019	10.00am-1.00pm	25
2	Lumino village	29th July 2019	10.00am-1.00pm	40

6.3 Comments obtained during the public consultation meetings:

This section provides a summary of the positive impacts of the proposed project as expressed by the stakeholders and public who were interviewed during the meetings.

Table 6-2: Issues raised and responses made during the Public Consultation Meeting, held on 29th and 30th July 2019, Mumias town

No.	Concern/Comment/Question	Response/Recommendation
Lumino Village		
3.	Mr. Joseph Ndombera Tumbo – Chairman of Mujini Development supported the proposed project stating that it will contribute to improved sanitation within Mumias town.	
4.	Mr. Joseph Musa was of the opinion that water should be distributed to every household prior to implementation of the proposed sewer project.	The Water Manager Mr. Charles Chitechi informed the meeting that the water is available in Mumias town and it is the responsibility of the individual consumer to pay for connection services.
5.	Mr. Richard Soi expressed acceptance to the proposed sewer project for Mumias town.	
6.	Mr. Ramadhan Kalande stated that majority of the residents in Nubian within Mumias belong to the Islamic religion hence they would appreciate connection to sewer and availability of water at all times.	
7.	Mrs. Njemia Alli said that the proposed project was good and needed to know if the affected properties will be compensated for, she also inquired if a pit latrine can be connected to the sewer line.	Affected properties along the project line would be compensated for according to the prevailing market prices. The pit latrines cannot be connected to the sewer line but the owners can make improved sanitation facilities that can connect to the sewer line.
8.	Mr. Ismael Hussein Mambo inquired about the location of the treatment ponds. He also needed to know if there is damage to the house and part of the land does the compensation cover both land and assets or land only.	The meeting was informed that the engineers will inform the location of the treatment ponds after preliminary survey of the town. On compensation the meeting was informed that both land and the affected assets will be valued in cases where there will be encroachment to private property by the proposed project.
9.	Mr. Alli Fariga expressed appreciation for the proposed sewerage project for Mumias town. He inquired about the river in which the treated waste water will flow to.	The meeting was informed that the likely treated waste water discharge recipient will be river Nzoia.
10.	Mr. Hussein Yasid encouraged the participants to focus on the positive impacts of the proposed sewer project. He stated that waste water treatment will increase the opportunities for recycling and reuse within the area.	
11.	Mrs. Farida Mumia commented that the land parcels in Mumias town are small hence the proposed project should create some jobs for the Youth for them to get a means of living.	
Matungu Location		
12.	Mr. Joram Karan inquired if the project involves connecting of the sewer line from one's house to the main trunk line.	The proposed project involves the construction of the main sewer trunk and the treatment ponds only, the service connection would be done by a Water service provider latter.
13.	Mr. Vincent Khamala was interested to know if the feasibility study is successful and the actual project starts would the land owners be compensated.	The meeting was informed that in actual project implementation the encroachment to private property would be valued and compensated.
14.	Mr. Rajab Omar inquired if someone has a semi-permanent house could they be able to connect to a sewer system.	It is possible to connect to a sewer system when you have a semi-permanent house, provided you develop an improved toilet that can be able to flush to the sewer.

No.	Concern/Comment/Question	Response/Recommendation
15.	Mrs. Philister Nyende wished to know if the sewer services if established will they be for free or there would be payments to be made.	The Meeting was informed that the sewer services will have to be payed to cater for the running costs hence make the project sustainable.
16.	Mr. Peter requested that the Matungu Water services provider manager Mr. Mark Shaaban to follow up on the water supply project, that would enable all the residents to get water.	
17.	Mrs. Rukia Atieno was concerned about how the sewage would pass through a densely populated area like Matungu town area where many houses have been built in the same place.	The Sewer line will be designed to follow a line where little damage would be caused to houses and structures options may involve creating a common septic tank for a residential area and then connecting it to the main sewer trunk.
18.	Mrs. Gaudencia Akoth wished to know how those who were using the pit latrines at that time would benefit from a sewerage project proposed.	The meeting was informed that for the sewage project to be of benefit for those with pit latrines they will have to upgrade and make a provision for improved sanitation facilities that would be able to flush to the sewer.
19.	Mr. Partric Musala expressed a concern that his home area had a high water table and he feared that the proposed sewage project would lead to contamination of existing shallow wells and spring water sources.	The proposed sewage project would be a better solution to ground water contamination in areas with high water tables. The Waste would be taped in an enclosed pipe and taken to a centralized place for treatment away from the drinking water sources.

7 ENVIRONMENTAL IMPACTS ASSESSMENT & MITIGATION

The proposed Mumias Sewerage project will have both positive and negative environmental impacts. Through an intensive and extensive field visits/ survey, key stakeholder consultation social survey and public participation forums conducted on the proposed project area, the impacts were identified and categorised according to different phases of the project i.e. construction, operation and decommissioning phases.

The magnitude and significance of impacts were based on the following factors:

- Location or extent: The area/volume covered;
- Timing: Whether immediate or delayed;
- Duration: Short term, long term, intermittent or continuous;
- Reversibility or irreversibility;
- Likelihood: Probability of the impact taking place;
- Significance: Whether it is local, regional or global.

To make the following observation, expert knowledge based on the magnitude of the predicted impacts was relied upon.

The scale that was applied in the analysis of impacts is shown in the table below.

Table 7-1: Levels of Scale used in the Analysis of Impacts

Value	Description	Scale Description
0	No impact	This means that to the best knowledge of the expert, the activity/action will not have any known impact on the environment. Such an impact will not in any way affect the normal functioning of either the human or the natural systems and does not therefore warrant any mitigation.
1	Minimal impact	Any activity with little impact on the environment calls for preventive measures, which are usually inexpensive and manageable. Such activities have minimum impacts on either natural or human environment or both.
2	Moderate impact	A moderate impact will have localized effect on the environment. If the effect is negative and cumulative, action in form of mitigation measures needs to be put in place to ensure that it doesn't become permanent and /or irreversible.
3	High impact	An impact is high if it affects a relatively high area (spatial), several biological resources (severity) and/or the effect is felt for a relatively long period (temporal) e.g. more than one year. In case the effect is negative, such an impact needs to be given timely consideration and proper mitigation measures put in place to prevent further direct, indirect or cumulative adverse effects.
4	Very high impacts	Such an activity rates highly in all aspects used in the scale i.e., temporal, spatial and severity. If negative, it is expected to affect a huge population of plants and animals, biodiversity in general and a large area of the geophysical environment, usually having trans-boundary consequences. Urgent and specialized mitigation measures are needed. It is the experts' opinion that any project with very high negative impacts MUST be suspended until sufficient effective mitigation measures are put in place.
5	Not known	There are activities for which impacts are not yet known e.g. some chemicals are suspected to produce carcinogenic effects, but this has not yet been confirmed.

Once potential impacts of the proposed project had been identified, the ESIA team went further to predict the nature of the impacts. Predictions were normally based on explicit assumptions about environmental processes, professional judgment and different value judgments expressed by various stakeholders during consultations. Determination of the significance of the potential impacts was based on the three broad categories of determining impact significance. These are discussed in the following section as construction, operation and decommissioning phase.

7.1 Positive environmental and social impacts during construction phase

The following are the expected positive environmental and social impacts for the proposed Mumias town sewerage project during the construction phase:

7.1.1 Creation of employment opportunities

The construction phase of the sewer project will offer job opportunities for both skilled and unskilled locals in the area. The locals will be employed as casuals, and other permanent consultancy and technical staff during the construction of the road. Civil and structural engineers, masons, carpenters, welders and other casuals will all gain employment during the construction phase of this road. These jobs are expected to improve the economy of the area and improve the livelihoods of the local people.

7.1.2 Gains in the local and national economy

Through the provision of employment to the locals, income from the salaries and wages will improve the economy of the town centres and the county at large. The contractor is also expected to purchase most of his materials from the project area and as such contribute positively to the local and national economy. The materials for construction will also be sourced from other areas within the nation hence positively affecting the national economy.

7.1.3 Transfer of skills

During construction of the proposed project, many people from within and without the area will be employed to provide different services during construction and probably maintenance. Local people will learn new skills from the civil engineers, welders, masons and other employees that come from outside.

7.1.4 Provision of market and supply for building materials

The contractors will purchase building materials such as wood, metals, sand, gravel cement etc. from suppliers within or outside the area.

7.1.5 Injection of money into the local economy

The contractors will pay suppliers and pay workers within the area

7.1.6 Creation of wealth to residents through direct and indirect business

In the construction phase, building materials will be purchased both locally and regionally. Other small-scale business people such as food vendors, kiosk owners, hotels and lodgings will also benefit during the construction.

7.1.7 Interaction of people from different communities

The members of the public revealed that this project will promote national cohesion since people from different communities in Kenya will be working together during construction phases of the project.

7.2 Negative environmental and social impacts during construction phase

The Project Construction Phase shall involve the following activities; delivery of construction of pipes and associated fittings to the Project site, manual excavation of trenches, temporary stockpiling of soils, sub-soils and rock along the trenches, importing material for bedding of concrete joints of the water lines and sewer lines (e.g. sand, cement, and concrete) and delivering pipeline sections, culverts and manhole covers to site.

The likely negative environmental and social impacts during the construction phase of the project are:

7.2.1 Disruption and loss of businesses

Project impact to private property and sources of livelihood along the roads and river riparian. During the field survey, we noted that some small-scale businesses and temporary structures may be affected. They might be displaced to pave way for construction of the proposed project. However due to the anticipated resettlement action plan (RAP), this impact will be low hence a value of 1.

7.2.2 Vegetation clearing, soil erosion and siltation

During the construction phase of the project, there will be clearance of vegetation along the corridor to pave way for the proposed sewerage. The project area has scarce vegetation and therefore there will be minimal clearance of vegetation. It is expected that the project will require huge quantities of materials such as ballast, murram, stones, conglomerates, sand, gravel, and soil, among others. In addition, the contractors will install several material camp sites as well as a batching plant that will impact on the environment, especially with smothering vegetation species around the camp sites.

The proponent is going to ensure that campsites and quarries are constructed in areas that are not high in vegetation density. Due to the need to clear vegetation existing for quarries and building of campsites. All borrow pits and quarries

will need to undergo a separate Environmental and Impact Assessment Study so as to ensure there will be no major negative impacts from them. This impact will be moderate hence value of 2.

7.2.3 Air quality pollution

Air quality pollution caused by emissions from construction plant and equipment which include dust and gaseous emissions. In the construction phase, the excavations, demolitions, and transportation of building materials will result in the emissions of large amounts of dust within the project site and surrounding areas. Asphalt, concrete and batching plants are also possible sources of dust and air pollution within the project area. The contractor is expected to conduct separate EIAs for the batching plants and monitor the dust levels periodically as stipulated in the Environmental Monitoring Plan, also will minimise this through sprinkling water on daily basis on the areas that transport trucks use and excavated areas. This impact will be moderate hence value of 2.

7.2.4 Noise and excessive vibration

Noise and excessive vibration from construction equipment and vehicles. Because of excavation, crushing, construction and demolition works, there will be high noise and vibration levels in the project area. Noise and vibrations will emanate from transportation vehicles, construction machinery, metal grinding and cutting equipment, and among others. Excavation works will also cause vibration and noise. Quarry pits that will be used for sourcing of construction material will also result to noise emissions. However, the proponent is expected to take appropriate steps to minimize noise pollution through provision of appropriate personal protective equipment to construction workers, minimizing the frequency of transport of construction materials and ensuring that all construction machinery is well maintained, all quarries will be subjected to independent Environmental Impact Assessment (EIA) studies. This impact will be moderate hence value of 2.

7.2.5 Water quality pollution

Water quality pollution from construction activities which include solid and effluents waste. It is expected increase in the generation of wastewater and sewage during the construction phase of the project. The increases will take place at construction camp sites and at project sites. There will be impact due to oil spillage, disposal practices of used oil, oil filters during the construction of the project. This impact will be moderate hence a value of 2.

7.2.6 Hydrology within Project site

Interference with drainage and hydrology within Project site. Excavated channels to follow natural water course to avoid interference with surface drains. Whenever necessary, drains along the construction line are directed towards existing drainage systems to cater for storm water during the rains. However, construction should be carried out during a dry season and should take the shortest period possible. Utilize excavated soil to level excavated ground where necessary and cover the water and sewer lines that will have been laid in the ground. This impact will be moderate hence a value of 2.

7.2.7 Interruption of existing infrastructure

Interruption of existing infrastructure such as roads, waterlines and power lines. Formal request for permission to cross, break in and lay the pipelines should be sought from affected property owners; and work plan with clear responsibilities for each party should be developed to ensure smooth execution of the construction. This impact will be moderate hence a value of 3.

7.2.8 Solid waste generation

Solid waste generation from construction activities will be expected. Volumes of solid wastes will be produced during the different phases of the project development. Solid waste materials will be generated during excavation works as well as from various packaging materials. Significant quantities of rock and soil materials will be generated from earth moving during construction activities. The contractor would need to ensure that all solid wastes are collected and disposed appropriately to promote a clean and healthy environment. The contractor shall comply with recommendations of solid waste management provided in the ESMP. This impact will be moderate hence a value of 2.

7.2.9 Extraction and Use of Construction Materials

Construction materials that will be used in the construction such as hard core, cement and rough stone will be obtained from quarries, hardware shops and sand harvesters who extract such materials from natural resource banks such as rivers and land that are supposed to be regulated to enable for their natural regeneration. This impact will be moderate hence a value of 2.

7.2.10 Occupational health and safety risks

Occupational health and safety risks associated with the Project. The Occupational safety and health issues associated with the construction will include; physical hazards, chemical hazards and noise hazards. Chemical hazards in construction will principally be associated with exposures to, dust during construction; exhaust emissions from heavy equipment and motor vehicles during all construction activities.

However, other physical hazards include exposure to weather elements (heat), noise, work in confined spaces, trenching, overhead power lines contact, falls from machinery or structures, and risk of falling objects. There is also a possibility of accidents when transporting workers to the construction sites. This impact will however be low hence a value of 2.

7.2.11 Spread of communicable diseases and HIV/AIDS infection;

Consultants and residents expressed concern that there would be an increase in incidences of sexually transmitted diseases including HIV and AIDS especially during construction of the project because of increased prostitution. The project proponent will need to work jointly with appropriate county and national government health agencies to come with a comprehensive STD, HIV and AIDs control programme during the construction and operational phases of the project. This impact will be moderate hence a value of 2.

7.2.12 Gender Based Violence

Due to inequalities between genders as a result of employment from the construction works, it is anticipated that cases of gender based violence might occur. This will be compounded by issues such as compensation for land acquisition, regular source of income, growth of businesses and among others. Though men are victims of gender based violence, women are more prone and vulnerable to experience it. This impact will be moderate hence a value of 2.

7.2.13 Cultural changes

The project is likely to increase the attractiveness, which may result in the following:

- Increase in undesirable sexual and social interaction in the area;
- Degradation of the cultural values and norms in the area;
- Increase in the levels of crime in the area.

7.2.14 Gender and equality biases

Always Gender and equality biases in construction projects may be to the basis of differential treatment of persons based on their sex roles, ethnicity, status, religion, race, age, beliefs and disability among other attributes. The Contractor and proponent should put measures in place to address issues of gender equality and freedom from discrimination among all Kenyans that will be involved in the project with a focus on Special Interest Groups, namely; women youth, children, persons with disabilities (PWDs), the elderly and minority and marginalized groups and communities. The proponent is expected to roll out programs and activities in various sectors including health, education, housing, employment and social support and justice among others. The overall goal will be the reduction of gender inequalities and the discrimination against all interest groups during the project cycle. Therefore, this impact will be low hence a value of 1.

7.2.15 Sexual Exploitation/Child Abuse

As a result of land and property compensation plus influx of workers into the area due to the project construction, it is anticipated that there will be a lot of money in circulation and this may lead to the sexual abuse of young children by the workers for exchange of money, food or other basics of life. Other forms of child abuse might be the employment of minors for labour at the construction site. This impact will be low hence value 1.

7.3 Positive environmental and social impacts during operation phase

The following were the positive environmental and social impacts for the proposed project during the operation phase:

- Creation of employment opportunities:
  - Both direct and indirect employment opportunities will emerge during the operation phase. For the direct employment, people will be employed for the normal and continuous maintenance.
- Improved Sanitation;

- Currently the locals are using pit latrines and septic tanks. Therefore, the project will automatically lead to improved infrastructure;
- Improved Health and Hygiene of residents;
- Reduced cases of water borne related diseases;
- Growth of secondary businesses in the project area;
- Achieve economic benefit by saving some healthcare expenses, improving people's productivity and improving water resources management;
- Increased revenues for the service providers;
- Improvement in groundwater quality through preventing infiltration of sewerage from porous cesspits and pit latrines;
- Improve living conditions for targeted residents through achieving the above environmental benefits, upgrade their real estate values and contribute in alleviating poverty conditions through work opportunities in construction and operation of the project;
- Strengthen community participation in environmental protection through involving community based organizations in project operation and mobilization activities;
- Land Value will go up;
- Corporate social responsibility (CSR):
  - The contractor will identify the needful areas in the project area and participate in CSR activities. Some of the noted problems in the area are: unavailability of water, poor education and health infrastructure, employment, among others. Therefore, the contractor is expected to assist in any of these areas as part of CSR. Further, material sites such as borrow pits may serve as water collection points.

7.4 Negative environmental and social impacts during operation phase

7.4.1 Risk of encroachment and construction of structures on the sewer wayleaves

Risk of encroachment and construction of structures on the sewer wayleaves will affect the service providers because they will be unable to give services whenever there is a problem of sewer bursts or blockage. The impact is very high hence value 4.

7.4.2 Risk of farming using raw sewerage, this has potential of vegetation and soil contamination

Risk of farming using raw sewerage has potential of vegetation and soil contamination. Residents might divert raw sewage to firms during dry season. Once feed on the produced food might cause cancer. The impact is very high hence value 4.

7.4.3 Risks of Illegal Connections to the Sewer lines

The is common in the low income areas where residents connect to sewer lines illegally to avoid paying the connection fee and monthly service charge, this vice leads to loss of revenue to the WSP and also if condoned eventually lead to overloaded system. The impact is very high hence value 4.

7.4.4 Risk of Vandalism of Infrastructure

Manhole covers when made of steel or iron are prone to vandalism and sold to second hand metals to dealers. The impact is very high hence value 4.

7.4.5 Health Risks associated with burst Sewers

Poorly maintained and designed sewers can lead to dispersal of raw sewage particularly at manholes and burst areas into the environment. These can cause outbreaks of water borne related diseases like cholera and typhoid from contamination of water sources by raw sewage. The impact is very high hence value 4.

7.4.6 Risks of Water Pollution from overflowing and blockage of Sewers

There is a possibility of contaminating the nearby rivers from the overflowing manholes as a result of blocked sewer trunks during operation phase.

7.4.7 Land and Soil Contamination

Possible erosion and soil loss near burst sewer lines or manhole overflow locations running along steep slopes. The related land could be contaminated. The impact is very high hence value 4.

7.5 Waste Water Treatment Works

7.5.1 Health and Hygiene Risks Associated with Sludge Management and Disposal

Sludge from the waste water treatment works is normally dried at sludge drying beds and sold off to farmers, if sludge is not appropriately handled it could pose health and hygiene risks to workers and community and also posed danger to farmers who use sludge as manure. Impact rating is presented below. The impact is very high hence value 4.

7.5.2 Odour Menace from Wastewater Treatment Works

The process of wastewater collection, conveying or treatment has the potential to generate and release odours to the surrounding area. Most odour problems occur in the collection system, in primary treatment facilities and in solids handling facilities as well as the sludge drying beds.

The most reported symptoms attributed to odours from treatment plants include:

- headache;
- alterations in mood;
- eye, nose, throat irritation;
- nausea;
- hoarseness;
- palpitations shortness of breath;
- stress;
- drowsiness;
- cough;
- nasal congestion.

Hydrogen Sulphide (H_2S) is the most prevalent gas associated with domestic wastewater collection and treatment. The conditions leading to H2S formation usually favour the production of other odorous gases such as ammonia which may have considerably higher detectable odour thresholds, and consequently H^2S may be an indicator of their presence. Exposure of receptors to levels of hydrogen sulphide above 5ppb can lead to odour nuisance. The impact is very high hence value 4.

7.5.3 Invasion of Birds and Reptiles to the Waste Water Treatment Works

The sewage discharging from the treatment plants (as well as other discharges from sources) are a determinant of the macro and micro flora and fauna in rivers. Excessive nutrients will lead into increased eutrophication of the river waters while chemical and organic loading will reduce the capacity for the rivers waters to support life (low oxygen levels and toxic conditions).

During operation, there is a possibility of birds' attraction to the sewage treatment plants arising from proliferation of insects and aquatic flora suitable for birds' food. Certain species and population of birds at Sewage treatment plant could become a safety risk to aviation sector. Certain animals including snakes may encroach the sewage treatment plants and other areas arising from overgrown vegetation. This will not only be a nuisance to the plants' operations but also pose safety threats to the immediate residents and commercial premises. The impact is very high hence value 4.

7.5.4 Increase in Social Vices

There if high likelihood of vandalism of the sewer equipment could occur during the operational stage if proper security measures are not put in place. This vandalism is common where manhole covers and step irons are made of iron are stolen by metal scrap dealers. The impact is very high hence value 4.

7.6 Positive impacts during decommissioning phase

Due to the national significance of this project, the likelihood of decommissioning is minimal, therefore impacts discussed below are almost unlikely.

7.6.1 Site Rehabilitation

Decommissioning phase will lead to rehabilitation of the site that was used to pave way for construction activities. This will ensure that the environment is left as natural as possible close to or better than before.

7.6.2 Employment opportunities

In the event of decommissioning locals will gain employment from the various jobs that will arise.

7.6.3 Reduced environmental pollution

In the event of decommissioning, the odour from the sewerage and treatment plant will reduce environmental pollution if there was any.

7.7 Negative impacts during decommissioning phase

7.7.1 Loss of jobs and income

The people that will be employed to operate and maintain the water and sewerage Project system will lose their jobs immediately after the closure of the project. The loss of jobs will have far reaching impacts as it will lead to loss of income and social stress.

7.7.2 Noise Pollution

Activities likely to produce noise during decommissioning include demolition of structures and excavation of pipeline works and structures at the intake areas as well as any staff offices and quarters built on site.

7.7.3 Odour and Air/dust Pollution

This is expected to result from demolishing of structures and excavation of waste water pipelines. This will affect demolition staff as well as the neighbouring residents

7.7.4 Solid waste generation

Although demolition waste is generally considered as less harmful to the environment since they are composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment.

It is expected that large amounts of solid waste material arising during decommissioning will include: glass panels, stones, pipes, wood, metal, paper, plastic, equipment, vegetation, etc. The proper disposal of these materials is critical.

7.7.5 Occupational health and safety

If not handled with care the demolition may lead to exposure of raw sewage to the workers and surrounding communities which poses as health risks to them. Machinery and equipment used for the same also possess as danger to the workers if not handled well and with the correct PPE.

7.7.6 Noise and vibration

The demolition works will lead to significant deterioration of the acoustic environment within the Project site and the surrounding areas.

7.7.7 Interference with private property

Project team should communicate with locals if activities will involve entering private property to avoid conflicts and destruction of property.

7.7.8 Poor sanitation

Demolition of the sewer expansion networks will result to recurrence of the current poor sanitation status. This will attract breakout of diseases that arise from poor sanitation.

7.7.9 Dust emission

Dust will be emitted by moving vehicles and from the decommissioning works through digging and excavating of the tarmac surface.

8 ENVIRONMENTAL MANAGEMENT PLAN

8.1 Introduction

This chapter presents the Environmental and Social Management Plan (ESMP) that will need to be implemented by the proponent/ contractor to prevent or reduce significant negative impacts to acceptable levels. The entire project components support infrastructure was considered when this ESMP was developed. Environmental management and social plans for all project phases have been outlined to cover:

- Design and Construction Phase;
- Operation Phase;
- Decommissioning Phase.

The following ESMP ***Table 8-1*** forms the core of this ESMP for the construction, operational and decommissioning phases of the proposed sewer project. The table details all necessary mitigation measures as well as the person responsible for implementing and monitoring such measures. The table should be used as checklist on site. Due to the magnitude of the project, compliance with the ESMP must be monitored periodically, reports prepared and provided at monthly site meetings during the construction phase, and quarterly during the operations and maintenance period as required in EMCA, Cap 387. Annual audits will be conducted during both the construction, operation and maintenance phases.

8.2 Cost of implementation the EMP

For effective implementation of the EMP, the project must establish an Environment, Health and Safety (EHS) unit that will be responsible for Project environmental Monitoring and Evaluation to ensure compliance to NEMA and Occupational Health and Safety. The project proponent will be required to produce periodic reports on project environment monitoring to be sent to the concerned agencies for information and supervision. The project proponent will be responsible for all costs of implementing the project's ESIA licence conditions, including the EMP and the actual costs of public involvement in the ESIA process. Hence, all costs proposed in the EMP below will be incurred by the project proponent who may transfer all to the contractor/ concessionaire except those of land acquisition and resettlement (Resettlement Action Plan Implementation budget).

The costs outlined are current costs mainly for project environmental monitoring and evaluation to ensure compliance to NEMA and OHS. To estimate future costs, an increase to cover annual inflation should be applied. The costs for actual activities should be included in the main bill of quantities of the project.

8.3 Project EMP Implementation

8.3.1 Role of Environmental, Health and Safety Experts

The ESIA process culminates with the formulation of a comprehensive Environmental and Social Management Plan. To ensure the latter is fully implemented, the Contractor should be required to hire Environmental, Health and Safety (EHS) and social experts who will continuously advise on EHS and social components of the project implementation. Elements in the environmental and social management plan are expected to be integrated in the project with appropriate consultations with Proponent through the supervising environmental and social experts. The EHS and social staff of the contractor will also be expected to fully understand the engineering and management aspects of the project for effective coordination of relevant environmental issues listed in the Environmental and Social Management Plan.

8.3.2 Project supervision

The supervising Engineer will ensure effective implementation of the environmental management plan. It is expected that the project supervisor will engage the services of an EHS experts who should master all environmental recommendations and the proposed action plans, timeframes and expected targets. The experts shall be the liaison persons between the contractor and the proponent on the implementation of environmental, health, safety and social concerns associated with the implementation of the project.

Table 8-1: Environmental and Social Management Plan – Design, Construction, Operation and Decommissioning Phases

Activity	Associated Impacts	Managements Actions	Responsibility	Frequency/Timing	Budget (KShs)
Pre-Construction phase					
Seeking approvals from NEMA and Approval of plans from County and National Government	Delay in implementation of the Project due to objections and Court cases	• The Contractor to ensure all permits, certificates and licences have been obtained before any activities commencing on site and are enforced/ adhered to; • The Contractor keep all permits and licences required for the contract and for pertinent activities for the duration of the contract.	CRVWWDA & Contractor	Project Cycle	2,000,000.00
Land use management	Impact on the existing urban land use pattern	• Relate the project land use plan with the existing urban future plan and over to exclude some affected area	Project consultant, contractor	During designing time and construction	Nil if the proposed action is applied
Climate change and GHGs management	Climate change incident	• Search research findings on devising ways and means to reduce GHG emissions • Plan sewer systems to address ways and means of reducing GHG emissions without jeopardizing the beneficial effects of the project.	Contractor, CRVWWDA, local community and relevant stakeholders	Throughout project cycle	Nil cost its sharing of legal responsibility
Construction phase					
EMP management records	Risks of non-conforming to ISO 9001 on QMS and ISO 14001 on EMS	• The EMP should be kept on site; • Copies of all permits and licences should be kept on site; • All site specific plans prepared as part of the updated ESMMP; • All related environmental, social, health, safety management registers, and correspondence, including any complaints. Register of audit non-conformance reports and corrective actions. Accident and incident register.	Contractor	Project construction	No additional cost.
Setting out and clearance of Project Wayleave	Delay in Project implementation due to opposition from Project Affected Persons	Proponent to ensure that land acquisition is done within the provision of Land Act 2012 Prepare and Implement RAP recommendations before commencement of any works.	CRVWWDA & Contractor	Project implementation of the project.	At cost

Activity	Associated Impacts	Managements Actions	Responsibility	Frequency/Timing	Budget (KShs)
Environmental & Social Training and Awareness	Risks of Environmental and Social degradation risks and occupational health and safety related accidents.	• The Contractor and sub-contractors shall be aware of the environmental requirements and constraints on construction activities contained in the ESIA Report EMP. • The Contractor will be required to provide for the appropriate Environmental Training. • Awareness as described in this ESIA – EMP, costs and programming. • An initial environmental awareness training session shall be held prior to any work commencing on site. (Number of trainings, attendance list of participants and training reports).	Contractor and all Workers.	Project construction	300,000.00
HIV/AIDS awareness and prevention campaign	Risks of Increased HIV and Aids transmission in the area.	• Contractor to develop appropriate training and awareness materials for Information and Education. • Develop an intervention strategy compatible with the construction programme to address success of the HIV/AIDS prevention and provide peer educators for sustainability in collaboration with other stakeholders; and • Integrate monitoring of HIV/AIDS preventive activities as part of the construction supervision. Basic knowledge, attitude and practices are among the parameters to be monitored, and particularly on provision of condoms, status testing and use of ARVs. ((Number of trainings, attendance list of participants and training reports).	Contractor and all Workers.	Project construction	300,000.00
Occupational Health and Safety	Risks of Accidents, Injuries or death of workers or community member.	• Provide construction workers with PPEs (gloves, safety shoes, overalls, reflectors, nose mask, ear muffs and helmets), • Provide temporary toilets and bathrooms for the construction workers at the work sites • Provide first aid kits accessible by the workers on need, • Isolate the site for access by the local communities during the construction for their safety and health	Contractor and Supervisor	Project Cycle	500,000.00

Activity	Associated Impacts	Managements Actions	Responsibility	Frequency/Timing	Budget (KShs)
		• Contractor to provide a Healthy and Safety Plan prior to the commencement of works to be approved by the Resident Engineer.			
Noise and Vibration control from plant and equipment.	Risk to health and safety of community and workers	• The Contractor shall keep noise level within acceptable limits and construction activities shall, where possible, be confined to normal working hours in the residential, hospitals, schools and other noise sensitive areas shall be notified by the Contractor at least 5 days before construction is due to commence in their vicinity. • Any complaints received by the Contractor regarding noise will be recorded and communicated to the Resident Engineer. • The Contractor must adhere to Noise Prevention and Control Rules of April 2005.	Contractor and Supervisor	Project Cycle	No additional cost
Air Quality.	Air pollution can cause respiratory disorders to human.	• Workers will be trained on management of air pollution from vehicles and machinery. • Construction machinery will be maintained and serviced in accordance with the specifications. • The removal of vegetation shall be avoided until such time as clearance is required and exposed surfaces shall be re-vegetated or stabilised as soon as practically possible. The contractor shall not carry out dust generating activities (excavation, handling and transport of soils) during times of strong winds. • Vehicles delivering soil materials shall be covered to reduce spills and windblown dust. • Water sprays shall be used on all earthworks areas within 200 metres of human settlement.	Contractor and Supervisor	Project Cycle	No additional cost
Local Labour / Employment	Delay in Project implementation due to opposition from community members within the project area..	• Wherever possible, the Contractor shall use local labour, and women must be encouraged to be involved in construction work. • The contractor shall ensure compliance to the gender balance as required by the 2/3 gender rule.	Contractor	Project Construction	At cost

Activity	Associated Impacts	Managements Actions	Responsibility	Frequency/Timing	Budget (KShs)
Earth moving and excavations, vegetation clearance, channelling and site preparations.	• Temporary displacement of businesses. • Health and Safety risks. • Air pollution. • Social nuisance.	• Inform immediate communities or stakeholders of the activities. • Provide barrier tapes, notices, signage and information to the public for their safety at all locations. • Install barriers along walkways, crossings and public places affected by the works for public safety. • Where there is potential for nuisance from dust generation, ensure earth moving is under dump conditions.	Contractor	Project cycle.	100,000.00
	• Vegetation cover loss/ destruction. • Loss of biodiversity	• Construction activities will be limited to Project sites/ routes, which already exist therefore limited destruction to vegetation cover.	Contractor	Project cycle.	At cost
	Top lying soil is lost	• Stock piling of top soil, construction material and wastes should be done only at designated sites approved by the supervising engineer, erosion prevention through berming of loose soil sites should be done in all areas susceptible to agents of erosion.	Contractor	Project cycle.	At cost
	• Public Health and safety risks. • Worker Occupational safety risks.	• Contractor to notify public the intent to cut sections of the road for safety precautions. • To provide signage and safety information in all work areas • To ensure compliance by workers with safety safeguards including the OHS, PPE and enforcement of application.	Contractor and Supervisor	Project cycle.	900,000.00
	Disruption of amenities (access roads, water, cables, electricity and driveways) causing inconveniences to the community.	• Notify other services providers and open sections that can be reinstated within the shortest period to avoid public disruption. • Mark the lines to avoid conflicts with other activities. • Install temporary barriers and signage.	Contractor and Supervisor	Project cycle.	To be determined
Wastes generation and disposal.	Risks of contaminating surface and underground water resources.	• Construction wastes to be removed for safe disposal. • Recycling to be encouraged. • Contaminated organic matter in the work areas to be isolated for safe disposal Material residuals to be	Contractor and Supervisor	Project Cycle	400,000.00

Activity	Associated Impacts	Managements Actions	Responsibility	Frequency/Timing	Budget (KShs)
		disposed off in accordance with established NEMA regulations.			
Spoil Storage site.	Risks of solid waste mismanagement leading to pollution.	• Preferably to be located on land already cleared wherever possible. • People within the area shall be involved in the site location to avoid conflict • The need to be more than 20meters from water courses and in a position that will facilitate the prevention of storm-water runoff from the site from entering the watercourse • Contouring of spoil site to approximate natural topography and drainage and/or reduce erosion impacts on the site. The Contractor shall ensure that the placement of spoil is done in such a manner to minimise the spread of materials and the impact on surrounding vegetation and that no materials' creep' into' no-go 'areas.	Contractor and Supervisor	Project Cycle	No additional cost
Storage of fuel oils, lubricants, chemicals and flammable materials	Hazards of fire outbreak, oil and chemical spills.	• Follow specifications of the Occupational Health and Safety Act, EMCA 1999 and others in the development and operation of stores.	Contractor and Supervisor	Project Cycle	No additional cost
Sanitation issues resulting from both solid and liquid wastes on site.	Risks associated with water borne diseases exposed to community and workforce	• The Contractor shall follow laws relating to public health and sanitation. • All temporary/ portable toilets or pit latrines shall be secured to the ground to the satisfaction of the Resident Engineer to prevent them from toppling over. • A wash basin with adequate clean water and soap shall be provided alongside each toilet. Staff shall be encouraged to wash their hands after use of the toilet, in order to minimise the spread of possible disease.	Contractor	Project Cycle	At cost
Traffic management on site.	Risks of Accidents, Injuries or death of workers or community member.	• Use of warning signage and tapes where the trenches are open and active sites. • Employ and train road safety Marshalls who will be responsible for management of traffic on sites.	Contractor and Supervisor	Project Cycle	200,000.00

Activity	Associated Impacts	Managements Actions	Responsibility	Frequency/Timing	Budget (KShs)
		• Contractor to provide a traffic management plan during construction to be approved by the Resident Engineer.			
Contractor demobilization and site reinstatement.	Associated risks of environmental degradation.	• The site is to be cleared of all construction materials, including litter prior to hand over. • Fences, barriers and demarcations associated with the construction phase must be removed from the site Fences, barriers and demarcations associated with the construction phase must be removed from the site. • Rehabilitation Activities of Environmental Cases identified must continue throughout the defect liability period.	Contractor and Supervisor	Project Cycle	No additional cost.
Operational phase					
Risk of encroachment and construction of structures on the sewer wayleaves	People living within the area will encroach the wayleave and construct permanent and semi-permanent structures.	• Mapping and installation of beacons to which illustrate the width of the pipeline reserve. • Arrest and prosecute. • Regular inspection of the sewerage corridor for encroachment. • Prosecution of encroachers as required by City County By-laws on way leaves and road reserves maintenance. • Conduct public sensitization programs on importance not interfering with way leaves and public reserve land	KACWASCO Area Chief	Project Operation	To be established
Risk of illegal connection to the Sewer and water pipeline	People living within the area might make illegal connections and by-pass.	• Seek official water connection by applying and paying connection fee. • This will require constant inspection by KACWASCO officials to identify and repair leakages. • Arrest and prosecute. • Conduct public sensitization programs on importance not interfering with the sewerage and water pipeline.	KACWASCO Area Chief and Police	Project Operation	To be established.

Activity	Associated Impacts	Managements Actions	Responsibility	Frequency/Timing	Budget (KShs)
Risk of farming using raw sewage especially vegetables.	Diversion of sewage into farms during dry season.	• This will require constant inspection by KACWASCO officials to identify farming. • Conduct public sensitization programs on importance not interfering with the sewerage and water pipeline. • Arrest and prosecute.	KACWASCO Area Chief and Police.	Project Operation	To be established.
Risk of Sewer blockage and overflows to the environment	Manholes sometimes overflowing due to blockage or when not covered,	• Community awareness not to dump solids in manholes. • Regular cleaning of grit chambers and sewer lines to remove debris that may lead to sewer backups. • Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize entry of garbage and silt into the system • Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent build- up of solids and hydrogen sulphide generation • Development of an inventory of system components, with information including age, construction materials, and drainage areas served elevations.	KACWASCO	Project Operation	To be established.
Risk of Vandalism of the infrastructure that is Manhole covers.	Stealing of man-hole covers to re-use or sell as scrap metals	• Common to manhole covers made using steel and concrete.	KACWASCO	Project Operation	To be established.
Sludge handling and disposal	Sludge used as manure.	• Repair the roofs of the sludge drying beds to ensure quick drying of sludge and appropriate disposal to reduce odour emanating from wet sludge. • Workers to be educated and made aware on safe management, handling and application of the sludge cake. • The quality and safety of the sludge cake should be ensured on a collaborative basis with (public health, agriculture, water and soil) before it is released to the users.	KACWASCO	Project Operation	To be established.
Air pollution from odour emanating from		• Ensure scum is appropriately disposed off or properly stabilized.	KACWASCO	Project Operation	To be established.

Activity	Associated Impacts	Managements Actions	Responsibility	Frequency/Timing	Budget (KShs)
wastewater treatment works		• Ensure that the pond series have adequate water flow and aeration to reduce the potential of odour formation. • The perimeter of the proposed site should be vegetated with trees and plants of varying heights thereby forming windbreaker and reduce dispersion of odour. • Repair the roofs of the sludge drying beds to ensure quick drying of sludge and appropriate disposal to reduce odour emanating from wet sludge. • Ensure appropriate covering/ventilation of the pre-treatment unit. • Ensure appropriate handling and removal of grit/grease. • Ensure proper sizing and alignment of the lagoons. • Plant trees especially bamboos and eco-friendly indigenous trees around the waste water treatment plant to limit exposure of neighbourhood to odour menace.			
Land and Soil Contamination	Raw sewage will contaminate land whenever it overflow or pipe bursts.	• The service providers to attend to burst pipes promptly to prevent excessive loss of soil. • Provide high risk areas with appropriate drainage for effective channelling of burst sewage spills. • Encourage land owners along sewer lines to maintain vegetated belts along the pipeline to control any overflows flows and trap soil. They should be encouraged to take responsibilities at the lowest levels in regard to protecting the sewer line. • Mark clearly the pipeline for ease of identification and protection by the adjacent landowners.	KACWASCO	Project Operation	To be established.

9 CONCLUSION AND RECOMMENDATIONS

The ESIA study has established that the proposed Sewerage System for Mumias Town by Central Rift Valley Water Works Development Agency (CRVWWDA) is a worthy investment by the proponent and without a doubt will contribute significantly to the economic development of the country. This will be achieved through the prior discussed positive impacts namely:

1. Positive impacts during construction phase

(a) Creation of employment opportunities;
(b) Gains in the local and national economy;
(c) Transfer of skills;
(d) Provision of market and supply for building materials;
(e) Injection of money into the local economy;
(f) Creation of wealth to residents through direct and indirect business;
(g) Interaction of people from different communities.

2. Positive impacts during operation phase

(a) Creation of employment opportunities - Both direct and indirect employment opportunities will emerge during the operation phase. For the direct employment, people will be employed for the normal and continuous maintenance.
(b) Improved Sanitation - Currently the locals are using pit latrines and septic tanks. Therefore, the project will automatically lead to improved infrastructure.
(c) Improved Health and Hygiene of residents;
(d) Reduced cases of water borne related diseases;
(e) Growth of secondary businesses in the project area;
(f) Achieve economic benefit by saving some healthcare expenses, improving people's productivity and improving water resources management;
(g) Increased revenues for the service providers;
(h) Improvement in groundwater quality through preventing infiltration of sewerage from porous cesspits and pit latrines;
(i) Improve living conditions for targeted residents through achieving the above environmental benefits, upgrade their real estate values and contribute in alleviating poverty conditions through work opportunities in construction and operation of the project;
(j) Strengthen community participation in environmental protection through involving community-based organizations in project operation and mobilization activities;
(k) Land Value will go up;
(l) Corporate social responsibility (CSR) - The contractor will identify the needful areas in the project area and participate in CSR activities. Some of the noted problems in the area are unavailability of water, poor education and health infrastructure, employment, among others. Therefore, the contractor is expected to assist in any of these areas as part of CSR. Further, material sites such as borrow pits may serve as water collection points.

However, the ESIA study has established that the proposed project will also have some negative impacts. The negative environmental impacts that will result from establishment of the proposed project which include:

3. Negative impacts during Construction

(a) Disruption and loss of businesses;
(b) Vegetation clearing, soil erosion and siltation;
(c) Air quality pollution;
(d) Noise and excessive vibration;
(e) Water quality pollution;
(f) Hydrology within Project site;
(g) Interruption of existing infrastructure;

(h) Solid waste generation;
(i) Extraction and Use of Construction Materials;
(j) Occupational health and safety risks;
(k) Spread of communicable diseases and HIV/AIDS infection;
(l) Gender Based Violence;
(m) Cultural changes;
(n) Gender and equality biases;
(o) Sexual Exploitation/Child Abuse.

4. Negative impacts during Operation

(a) Risk of encroachment and construction of structures on the sewer wayleaves;
(b) Risk of farming using raw sewerage, this has potential of vegetation and soil contamination;
(c) Risks of Illegal Connections to the Sewer lines;
(d) Risk of Vandalism of Infrastructure;
(e) Health Risks associated with burst Sewers;
(f) Risks of Water Pollution from overflowing and blockage of Sewers;
(g) Land and Soil Contamination.

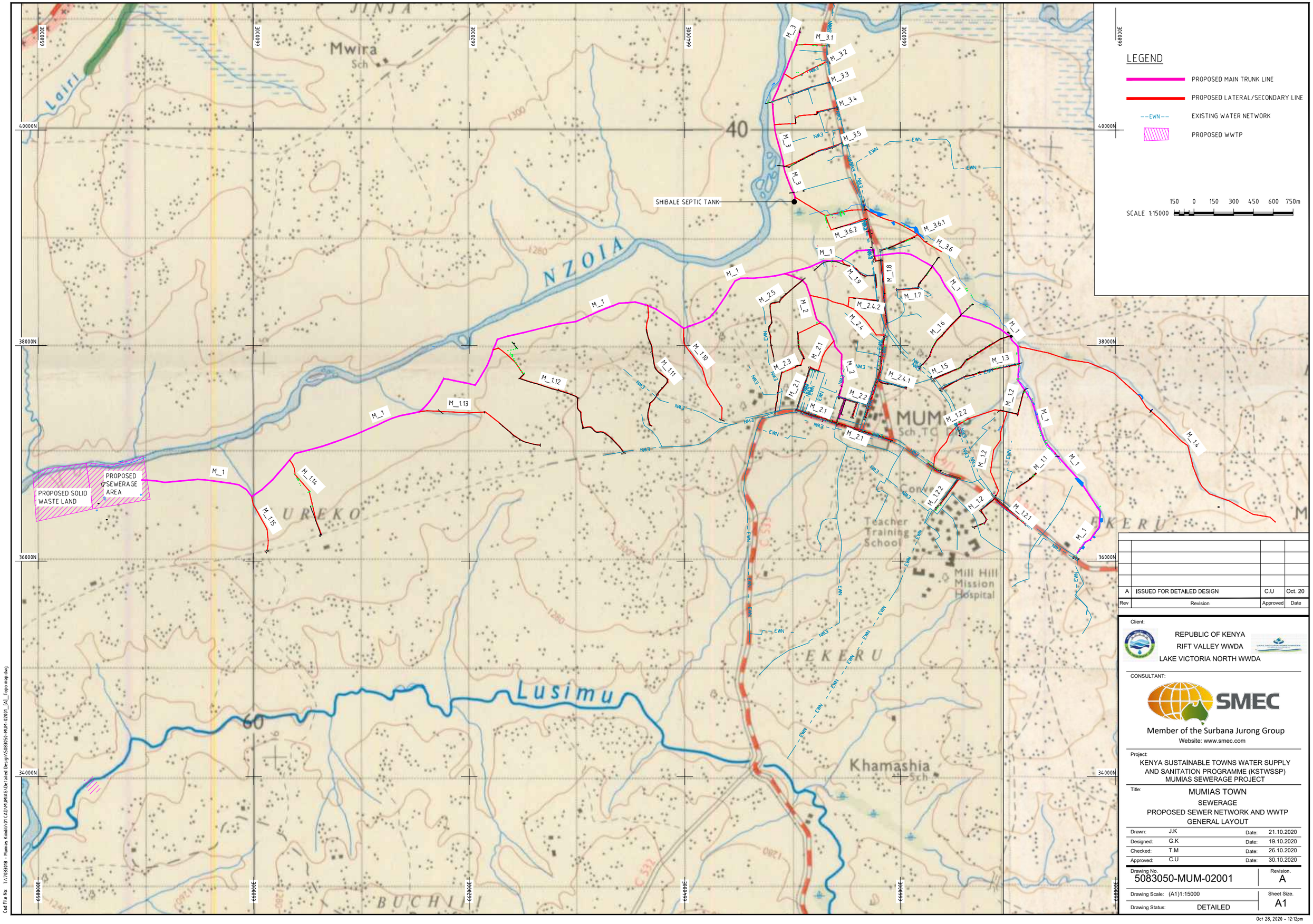
The proponent of the proposed project shall be committed to putting in place several measures to mitigate the negative environmental, safety, health and social impacts associated with the life cycle of the project. It is recommended that in addition to this commitment, the proponent shall focus on implementing the measures outlined in the Environmental Management and Monitoring Plan as well as adhering to all relevant national and international environmental, health and safety standards, policies and regulations that govern establishment and operation of such projects in Kenya. It is expected that the positive impacts that emanate from such project shall be maximized as much as possible as exhaustively outlined within the report.

Considering the positive socio-economic and environmental benefits which will accrue because of the proposed development and the ESIA study having found no major impacts to arise from the development, it is our recommendation that the project be allowed to proceed on the understanding that the proponent will adhere to the mitigation measures recommended herein and will further still implement the proposed Environmental Management and Monitoring Plan to the letter. Kenya as a country has a big shortage of such project developments. Therefore, the construction of the proposed project goes a long way in solving part of the existing challenges experienced water and sewerage sector.

10 APPENDICES

- Appendix A: Project Location and Layouts
- Appendix B: Lead Expert CV and NEMA Certificate
- Appendix C: EIA and Social Field Tools
- Appendix D: Public Meetings List of Attendants and Minutes
- Appendix E: Pictorial Presentation

Appendix A Project Location and Layouts



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A	ISSUED FOR DETAILED DESIGN	C.U	Oct. 20

Client:

REPUBLIC OF KENYA
RIFT VALLEY WWDA
LAKE VICTORIA NORTH WWDA

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SMEC
Member of the Surbana Jurong Group
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Project:
KENYA SUSTAINABLE TOWNS WATER SUPPLY AND SANITATION PROGRAMME (KSTWSSP)
MUMIAS SEWERAGE PROJECT

Title:
MUMIAS TOWN
SEWERAGE
PROPOSED SEWER NETWORK AND WWTP
GENERAL LAYOUT

Drawn:	J.K	Date:	21.10.2020
Designed:	G.K	Date:	19.10.2020
Checked:	T.M	Date:	26.10.2020
Approved:	C.U	Date:	30.10.2020

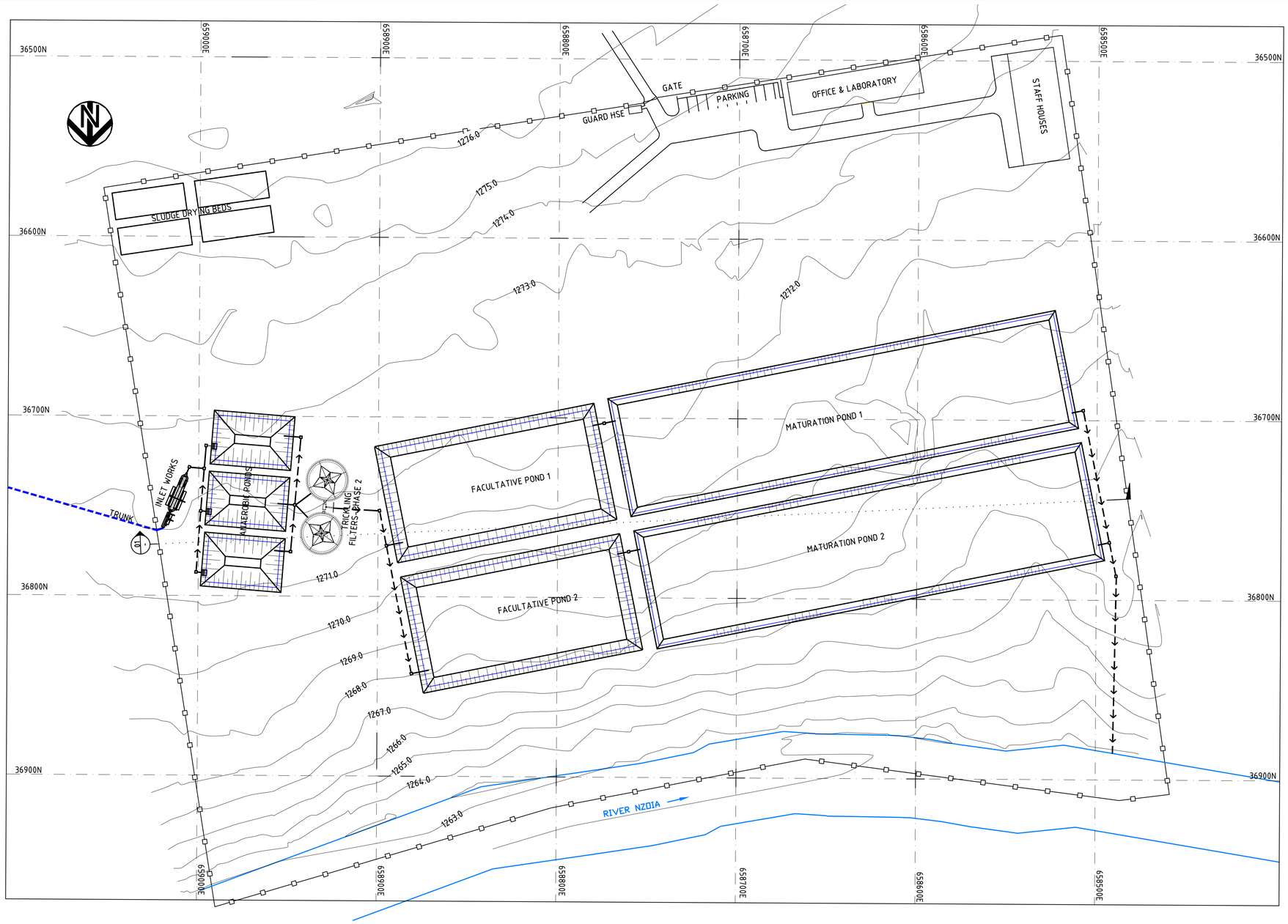
Drawing No. 5083050-MUM-02001
Revision. A
Drawing Scale: (A1)1:15000
Sheet Size. A1
Drawing Status: DETAILED

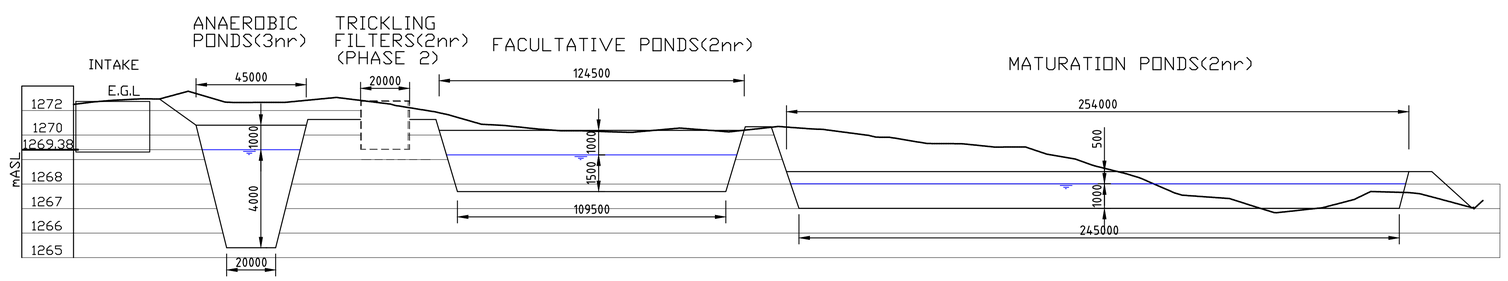
Oct 28, 2020 - 12:12pm

Cad File No: T:\7083018 - Mumias Kimilili\01 CAD\MUMIAS\Detailed Design\5083050-MUM-02001_[A]_topo map.dwg

NOTES:

1. ELEVATIONS ARE IN METRES
2. CONTOUR ARE AT 1M INTERVAL.





HORIZ. 1:1000 10 0 10 20 30 40 50
VERT. 1:100 1 0 1 2 3 4 5

Rev	Revision	Approved	Date
A	ISSUED FOR DETAILED DESIGN	C.U	20.12.20

Client:

REPUBLIC OF KENYA
RIFT VALLEY WWDA
LAKE VICTORIA NORTH WWDA

CONSULTANT:

SMEC
Member of the Surbana Jurong Group
Website: www.smec.com

Project:
KENYA SUSTAINABLE TOWNS WATER SUPPLY AND SANITATION PROGRAMME (KSTWSSP)
MUMIAS SEWERAGE PROJECT

Title:
MATAWA WTP
WASTE WATER TREATMENT
GENERAL LAYOUT

Drawn:	J.N	Date:	12.12.20
Designed:	G.K	Date:	07.12.20
Checked:	T.M	Date:	17.12.20
Approved:	C.U	Date:	20.12.20

Drawing No. 5083050-MUM-04000
Revision. A
Drawing Scale: AS SHOWN
Sheet Size. A1
Drawing Status: DETAILED DESIGN

Feb 02, 2021 - 11:33am

Cad File No: T:\7083018 - Mumias Kimilili\01 CAD\Detailed Design\PONDS\MUMIAS\january 2021\5083050-MUM-04000_JAI.dwg

Appendix B Lead Expert CV and NEMA Certificate

CURRICULUM VITAE (CV)

Position Title and No.	**Environmental Specialist**
Name of Expert:	**Charles Muyembe**
Date of Birth:	28th August 1973
Country of Citizenship/Residence	Kenyan

Education	• MSc in Geographical Information Systems, University of Nairobi (2013) • Bachelor of Science in Range Management, University of Nairobi (1998)

Employment record relevant to the assignment:

Period	Employing organization and your title/position. Contact info for references	Country	Summary of activities performed relevant to the Assignment
March 2012 – date	**Employing Organization** Charles and Baker Ltd **Title/Position** Principal Scientist and Director **Contact info for references** **Name:** Charles Muyembe - Director **Email:** lwangamc@charlesandbarker.co.ke **Tel:** +254 722729439	Kenya	• In charge of Technical and Administrative management of the firm; firms overall strategy orientation and Business Development.
Oct 2006 – Feb 2012	**Employing Organization** Howards Humphreys East Africa Limited **Title/Position** Senior Environmentalist **Contact info for references** **Name:** J. M. Mbui - Director of Operations **Tel/Email:** +254 20 4445254/6 4441712	Kenya	• Environmental Impact Assessment, Auditing and Monitoring & Evaluation of Infrastructure and industrial projects, Projects Management, Business Development and Department Manager for Safety Health and Environment.
Mar 2003 – Aug 2006	**Employing Organization** GIBB Africa Limited **Title/Position** Environmental Scientist **Contact info for references** **Name:** Eng. Sam Mambo - Director **Email:** sam.mambo@gibbafrica.com	Kenya	• Environmental Impact Assessment and Auditing of wide ranging infrastructure and industrial projects in East Africa
Oct 1998 – Mar 2003	**Employing Organization** Panafcon Development Consultants / DHV BV **Title/Position** Environmentalist/GIS Technician **Contact info for references** **Name:** No remaining contact	Kenya	• Carrying out Environmental Impact Assessment (EIA) of projects to be implemented; • GIS related tasks

Membership in Professional Associations and Publications	• Registered as Lead Environmental Assessment/Audit Expert • Member, East African Society of Range Management

Language Skills:		**Speaking**	**Reading**	**Writing**
	English	Excellent	Excellent	Excellent
	Swahili	Excellent	Excellent	Excellent

Adequacy for the Assignment:

Detailed Tasks Assigned on Consultant's Team of Experts:	**Reference to Prior Work/Assignments that Best Illustrates Capability to Handle the Assigned Tasks**
	<u>Water Projects:</u> **Name of Assignment or Project:** Consultancy Services for **Detailed Design, Tendering and Supervision of Last Mile Connectivity Works for Eldoret & Kakamega Towns** **Year:** May 2019 to date **Location:** Eldoret & Kakamega Towns, Kenya **Client:** Rift Valley Water Works Development Agency **Main Project Features:** The project entails assessment of the existing water supply infrastructure including pipelines, storage tanks, valves, chambers among others, assessment of the existing sewerage work, review the existing design reports and recommend the necessary rehabilitation and expansion measures to increase accessibility and connectivity to water and sewerage services within Eldoret Town Central Business and Kakamega Town. Supervision of the physical works and Monitoring during the defects liability period. **Position held:** Team leader/**Environmentalist** **Activities performed:** The activities on site include the development and maintenance of legal register, identification and documentation of key environmental, social and occupation health and safety aspects, proposal of mitigation and follow up of implementation of measures. **Name of Assignment or Project:** Consultancy Services for **Feasibility Study, Detailed Design and Preparation of Tender Documents for Mumias- Kimilili Sewerage Projects** **Year:** May 2019 to date **Location:** Mumias and Kimilili Towns in Western Kenya **Client:** Rift Valley Water Works Development Agency **Main Project Features:** The project entails carrying out Feasibility Study, **Detailed Design, Preparation of Tender Documents** for the towns' sewerage System and Coordinating various activities among the stakeholders towards successful development of the project. **Position held:** Team leader/**Environmentalist** **Activities performed:** The activities on site include the development and maintenance of legal register, identification and documentation of key environmental, social and occupation health and safety aspects, proposal of mitigation and follow up of implementation of measures. **Name of assignment or project:** Ex-Post Evaluation of JICA funded Project "The Project for Rural Water Supply (Phase II)" And "The Project for the Construction of Nairobi Western Ring Roads" **Year:** 2016 to date **Location:** Machakos and Makueni Counties Kenya **Client:** JICA

	Main Project Features: EX-post evaluation is an integral part of Japanese Official Development Assistance (ODA) to make ODA projects more efficient and effective, and to ensure the accountability. Ex-post evaluation is conducted two years after the completion of the project based on international evaluation criteria. The evaluation criteria are (1) Relevance, (2) Efficiency, (3) Effectiveness, (4) Impact, and (5) Sustainability **Positions held:** Survey Leader National Consultant **Activities performed:** Field Work and Ex Post Evaluation Reporting for the Machakos and Makueni Water Supply Sector. **Name of assignment or project: Supervision of the Northern Collector Tunnel Phase 1** **Year:** 2015 to date **Location:** Muranga Kenya **Client:** Athi Water Services Board **Main Project Features:** Supervision of the Construction of the Interbasin water tunnel linking three rivers as a part of the Northern Collector Tunnel, implementation of the Environmental and Social Impact Assessment and Resettlement Action Plan and health and safety plans for the project. **Positions held:** Project Team Leader, **Environment Social and Safety** **Activities performed:** Implementation of safeguards including environment, social and involuntary settlement **Name of Assignment:** Development of the Ilenye River Basin Management Plan. **Year:**2012 to date **Location:** Eastern province **Client:** Ministry of Water, Department of Land Reclamation **Main Project Features:** This involved the development of the first generation river basin management plan, identification of poverty alleviation strategies and cost estimates. **Position held:** Project Manager. **Activities Performed:** Field work and development of the River Basin Management Plan **Name of Assignment: Environmental Monitoring and Evaluation for the Works Supervision for Strengthening Water Transmission Pipelines in Nairobi** **Year:** 2009 to 2011 **Location:** Nairobi. **Client:** Athi Water Services Board **Main Project Features:** This project involves the development of a pipeline, installation of plant and securing of the wayleave from Kwa Maiko to Gigiri and Gigiri to Kabete. **Position held: Environmentalist** **Activities Performed:** The activities on site include the development and maintenance of contractor legal register, identification and documentation of key environmental, social and occupation health and safety aspects, proposal of mitigation and follow up of implementation of measures. **Name of Assignment: Construction Supervision and implementation of environmental and social monitoring and management plan** of Works in Package 4 - Lessos Cluster 1 Rural Growth Centres of Lumakanda and Kipkaren under the Lake Victoria North Water Services Board. **Year:** 2010 to date. **Location:** Eldoret, Kakamega, Nandi **Client:** Lake Victoria North Water Services Board

	Main Project Features: Construction Supervision and implementation of environmental and social monitoring and management plan of Works in Package 4 - Lessos Cluster 1 Rural Growth Centres of Lumakanda and Kipkaren **Position held: Lead Environmental Expert** **Activities Performed:** The activities on site include the development and maintenance of contractor legal register, identification and documentation of key environmental, social and occupation health and safety aspects, proposal of mitigation measures and follow up of implementation of measures. **Name of Assignment: Environmental Impact Assessment of Bulk Water Supply to Karen Country Club** **Year:** 2009/2010 **Location:** Karen **Client:** Karen Country Club **Main Project Features:** Environmental Impact Assessment of Bulk Water Supply to Karen Country Club. **Position held: Lead Environmental Expert** **Activities Performed:** Impact Assessment of Bulk Water Supply to Karen Country Club. **Name of Assignment: Feasibility Study and Detailed Design for Mukurwe-ini Water Supply Project** **Year:** 2009/2010 **Location:** Mukurwe-ini **Client: TANATHI** **Main Project Features:** Preparation of a Feasibility Study and Detailed Design report for the Mukurwe-ini Water Supply Project. **Position held: Lead Environmental Expert** **Activities Performed:** Environmental Impact Assessment. **Name of Assignment: Feasibility Study and Detailed Design for Othaya Water Supply Project** **Year:**2009/2010 **Location:** Othaya **Main Project Features:** Preparation of a Feasibility Study and Detailed Design report for the Othaya Water Supply Project. **Position held: Lead Environmental Expert** **Activities Performed:** Environmental impact assessment **Name of Assignment: Feasibility Study for Machakos Water Supply and Sanitation Project** **Year:**2009 **Location:** Machakos **Client:** Tanathi Water Services Board **Main Project Features:** Preparation of a Feasibility Study report for Machakos Water Supply and Sanitation Project. **Position held: Lead Environmental Expert** **Activities performed:** Environmental impact assessment **Name of Assignment: Design of the proposed Ruiru Water Supply** **Year:** 2007 **Location:** Ruiru **Client:** Athi Water Services Board **Main Project Features:** The project will implement the distribution network within Ruiru Municipality.

	Position held: Lead Environmental Assessment/ Audit Expert **Activities performed:** This project involves the development of the Ruiru Dam, treatment works and transmission pipelines and reservoirs. **Name of Assignment:** The proposed Detailed Design and Works Supervision for Strengthening Water Transmission Pipelines in Nairobi **Year:** 2007 to 2010 **Location:** Nairobi **Client:** Athi Water Services Board **Main Project Features:** This project involves the development of a pipeline, installation of plant and securing of the wayleave from Gigiri to Kabete, Uthiru and Karen. It will be implemented in two stages from the design of the pipeline, tendering and the construction of the pipeline. **Position held:** Lead Environmental Assessment/Audit Expert **Activities performed:** Environmental impact assessment **Name of Assignment:** Assessment of sites carried out in the East Africa region **Year:**1999 **Location:** Uganda, Sudan, Mauritius, Djibouti and Ethiopia. **Client:** Shell Global Solutions **Main Project Features:** The project work included on-site assessment and analyses of soil and water samples, installation of shallow wells (Piezometers) and deep wells (boreholes). **Position held: Project Environmental Scientist** **Activities performed:** Included assessment of depots in: Uganda, Sudan, Mauritius, Djibouti and Ethiopia. **<u>Road Projects:</u>** **Name of Assignment:** Kenya Roads Board (KRB) Audit **Year:** February 2019 to date **Location:** Nairobi, Machakos, Makueni, Kajiado, Narok, Bomet and Taita Taveta Counties; Kenya **Client:** Kenya Roads Board (KRB) **Main Project Features:** Establishing a baseline on the socio-economic and environmental impact of the roads funded by the KRB through Road Management Fuel Levy (RMLF) **Positions held:** Project Team Leader **Activities performed:** Reconnaissance field visits, development of data collection tools and key stakeholder mapping, supervision of quantitative and qualitative data collection team, report writing on the findings of the Project. **Name of Assignment: RAP and Feasibility studies for Environmental and Social Impact Assessment (ESIA)** for Baragoi-North Horr (A4) Road **Year:** November 2018 to date **Location:** Samburu and Marsabit Counties; Kenya **Client: Kenya National Highways Authority (KeNHA)** **Main Project Features:** The main aim of the project was to determine both the direct and indirect benefits of the proposed road project on the people of Samburu and Marsabit Counties. The Project further attempted to determine, characterize and assess the potential social and environmental impacts, therein, as well as develop and propose mitigation measures. **Positions held: Project** Team Leader and Lead Environmentalist **Activities performed:** Socio-economic Survey, Conduct key stakeholder consultations, Focus Group Discussions (FGDs), Consultative Public Participation

	(CPPs), Data Cleaning, Data Entry, Data Analysis and Report Writing on the Findings of the Project. **Name of assignment or project:** Consultancy Services for **Feasibility Study, Environmental and Social Impact Study, and Preliminary Engineering Design** of Kwale and Kilifi Town Roads **Year:** 2017 to date **Location:** Kilifi, Kwale and Voi Counties **Client:** KURA **Main Objective:** Preparation of Environmental Social Impact Assessment and Resettlement action plan for Kilifi, Kwale and Voi counties Urban roads **Position Held:** Project Team Leader**, Environment and Safety Safeguards** **Activities Performed:** Project review, liaisons and quality assurance **Name of assignment or project:** Proposed upgrading of kulamawe- modogashe road to bitumen standard **Year:** 2017 to Date **Location:** Isiolo County **Client:** KeNHA **Main objective:** The overall objective of the study is to ensure that all environmental and social concerns are integrated at the implementation stage of this project to contribute to sustainable development of the general area **Position held:** Project Team Leader, **Environment and Safety Safeguards** **Activities Performed:** Technical studies, field investigations, Preparation of ESIA **Name of assignment or project:** Transaction Advisory Services for the Development and Operation and Maintenance of Nairobi- Nakuru Highway (A104) PPP Project **Year:** 2015-2017 **Location**: Rironi Mau Summit **Client**: KeNHA **Main Project Features:** The objective of the project is to provide guidelines for resettlement process and operations in order to ensure that the PAPs will not be impoverished by the displacement of property or disruption of their livelihoods and to ensure that all environmental concerns are integrated at the implementation stage of this project in order to contribute to sustainable development of the area **Position Held:** Project Team Leader, **Environment and Safety Safeguards** **Activities Performed:** Preliminary Environmental and Social Impact Assessment and Resettlement Action Plan **Name of assignment or project: Feasibility Study, Environmental and Social Impact Assessment and Preliminary Design** of Malindi - Watamu Road (26KM) and Malindi Ring Road **Year:** 2015 to date **Location:** Kilifi County, Kenya **Client:** Kenya Urban Roads Authority **Main Project Features:** Preparation of Environmental and Social Impact Assessment and Resettlement Action Plan for Malindi - Watamu Road (26km) and the Malindi Ring Road. **Positions held: Project Environmental Scientist** **Activities performed:** Preparation of ESIA and Resettlement Action Plan **Name of assignment or project:** Construction of Mau Summit, Njoro and Nyahururu Interchanges (A109) Highway **Year:** 2015 to date **Location:** Nakuru County, Kenya

	Client: Kenya National Highways Authority **Main Project Features:** Implementation of the Environmental and Social Management Plan, Health and Safety Supervision for Works. **Positions held: Project Leader Environmental Health and Safety** **Activities performed:** Update of ESMP, preparation of Health and Safety Plan, Daily Reviews, Monthly reporting and maintenance of compliance register **Name of Assignment: Design, Tender and Supervision** of Second Carriage Athi River to Kyumbi (A109) Highway **Year:** 2014 to date **Location:** Eastern Province **Client:** Kenya National Highways Authority **Main Project Features:** Preparation of Environmental and Social Impact Assessment and Resettlement Action Plan for Second Carriageway from Athi River – Kyumbi (A109) highway. **Positions held: Project Environmental Scientist** **Activities performed:** Preparation of ESIA and Resettlement Action Plan **Name of Assignment:** Design and Tender for the Garissa Isiolo Road (LAPSSET PROJECTS) **Year:** 2014 to date **Location:** North Eastern Province **Client:** Kenya National Highways Authority **Main Project Features:** Preparation of Environmental and Social Impact Assessment and Resettlement Action Plan for the Garissa Isiolo Road. **Positions held: Project Environmental Scientist** **Activities performed:** Preparation of ESIA and Resettlement Action Plan **Name of Assignment:** Preliminary and Detailed Design, Preparation of Bidding Documents and Construction Supervision for the Second Carriageway of the Athi River – Machakos Turnoff Section of Nairobi – Mombasa Road (A109) **Year:** 2014 to 2015 **Location:** Machakos, Kenya **Client:** Kenya National Highways Authority **Main Project Features:** Preparation of Environmental and Social Impact Assessment for the A104 and A109 roads Athi River to Machakos Turn Off at Kyumbi. **Positions held: Project Environmental Scientist** **Activities performed:** Preparation of Environmental and Social Impact Assessment Report and incorporation of key findings and guidelines in the design and tender documentation **Name of Assignment:** Supervision of the Kisumu Kakamega Road Rehabilitation Works **Year:** 2013 to date **Location:** Nyanza and Western Kenya **Client:** Kenya National Highways Authority **Main Project Features:** Review and Implementation of the Environmental and Social Management Plan Requirements **Positions held: Project Environmental Scientist** **Activities performed:** Project Environmental and social performance documentation and mitigation measures design and implementation advisory. **Name of Assignment:** Environmental Management Review 2012/2013/14 for Base Titanium Limited Kwale Sand Mines Project **Year:**2012 to date

	Location: Coast Province **Client:** Base Titanium Limited **Main Project Features:** wale Sand Mines Project covering the Shared Facilities, Mains, the Tailings Dam, Mukurumudzi Dam, the Sand Mines Water Supply, 9km access road off the Likoni - LungaLunga Road and the Ship Loading Facility at Likoni. **Positions held: Lead Expert** **Activities performed:** I was in charge of the overall project execution of the ESIA and RAP, environment and Social concept development, socioeconomic studies, and community liaison. **Name of Assignment:** Kitui Turn - off Mwingi Garissa Road Rehabilitation **Year:**2011 to date **Location:** Eastern Province **Client:** Kenya National Highways Authority **Main Project Features:** This is a 254 kilometres road serving three Counties. It involved review of materials sites, road alignments, archaeological sites protection, protection of sensitive ecosystems, disclosure and creation of awareness among the community, socio-economic impacts assessment and monitoring/mitigation measures development and proposals for resettlement actions. **Positions held: Lead Expert and Team Leader** **Activities performed:** I was in charge of the overall project execution of the ESIA and RAP, environment and Social concept development, socioeconomic studies, and community liaison. **Name of Assignment:** One Stop Border Post (OSBP) for Rwanda / Uganda Border. **Year:** 2011 to 2012 **Location:** Kagitumba and Mirama Hills Border **Client:** Trademark East Africa **Main Project Features:** The project involves the design, tendering and supervision of construction works that will lead to the establishment of facilities for the proposed OSBP at Kagitumba and Mirama Hills Border. **Position held: Project Environmental Scientist** **Activities performed:** The project utilizes the technical, economic, environmental and social surveys and investigations to assess the requirements of stakeholders and end-users for facilities and services needed for the OSBP; preparing the necessary conceptual design for a suitable OSBP model consistent with known procedures and preparing detailed designs (architectural and engineering) and tender documents procuring the necessary works for establishing an OSBP at the border post following standard industry procedures and Guidelines. Environmental and social impact assessment for both countries has been developed and environmental supervision of contractors is due to commence. **Name of Assignment: Environmental Social Impact Assessment Study** for the Proposed Nyongoro - Witu – Hindi - Mukowe, Hindi - Kiunga Road. **Year:**2012 to 2013 **Location:** Coast Province **Client:** Kenya National Highways Authority **Main Project Features:** This is a 145 kilometres road serving three Counties. It involved review of materials sites, road alignments, archaeological sites protection, protection of sensitive ecosystems, disclosure and creation of awareness among the community, socio-economic impacts assessment and monitoring/mitigation measures development and proposals for resettlement actions. **Positions held**: **ESIA Lead expert**

	Activities performed: In charge of the project execution of the ESIA to the Project approval. **Name of Assignment:** Traffic Impact Assessment for Likoni A14 Road and Access Road. **Year:**2011 **Location:** Coast Province **Client:** Base Titanium Limited **Main Project Features:** Assessment of potential impacts related to construction of the 8 kilometres access road presented in Access Alignment Alternatives Environmental Assessment (CES 2006) and those related to transporting the heavy minerals by truck through the town of Likoni presented in the Proposed Materials Handling and Ship Loading Facility at Likoni (CES 2004) for titanium mining by Base Resources. **Positions held: Lead consultant** **Activities performed:** Assessment of potential impacts related to construction of the 8 kilometres access road **Name of Assignment:** Preparation of Resettlement Action Plan for Second Carriageway from Athi River - Ulu (A109) highway **Year:**2010 to 2011 **Location:** Eastern Province **Client:** Kenya National Highways Authority **Main Project Features:** Preparation of Resettlement Action Plan for Second Carriageway from Athi River - Ulu (A109) highway from Mombasa City to Nairobi. The study was focusing on avoiding/minimising involuntary settlement, providing guidelines for compensation where involuntary settlement is unavoidable, improving livelihoods for the affected, provide framework for consultations and mitigation of adverse impacts due to resettlement of populations. **Positions held**: **Environmental Scientist** **Activities performed:** Preparation of Resettlement Action Plan. The study focused on avoiding/minimizing involuntary settlement, providing guidelines for compensation where involuntary settlement is unavoidable, improving livelihoods for the affected, provide framework for consultations and mitigation of adverse impacts due to resettlement of populations. **Name of Assignment:** Northern Corridor Spatial Development Project for the Transit Transport Coordination Authority **Year:**2009 **Location:** Eastern Africa **Client:** Northern Corridor Transit Transport Authority **Main Project Features:** Working with engineers, economists and administration experts, the six months' joint venture project involved a strategic study to establish gaps along the eastern Africa northern Corridor and propose policy interventions in form of energy, roads, railways, airports and water supply development to support viable businesses and ensure that these businesses can compete favorable on the world market **Positions held:** Project Manager **Activities performed:** involved a strategic study to establish gaps along the eastern Africa northern Corridor and propose policy interventions in form of energy, roads, railways, airports and water supply development to support viable businesses and ensure that these businesses can compete favorable on the world market. **Name of Assignment:** Proposed Emali - Ukia Road upgrading to Bitumen Standards.

	Year:2007 to 2009 **Location:** Eastern Province **Client:** Ministry of Roads **Main Project Features:** This is a 45 kilometres earth road in Eastern Province marked for upgrading to bitumen standards. It involved review of materials sites, road alignments, archaeological sites protection, protection of sensitive ecosystems, socio-economic impacts assessment and monitoring/mitigation measures development. **Positions held: Lead Environmental Assessment/Audit Expert** **Activities performed:** It involved review of materials sites, road alignments, archaeological sites protection, protection of sensitive ecosystems, socio-economic impacts assessment and monitoring/mitigation measures development. **Name of Assignment:** Construction Supervision OlKalau - Ndundori Road. **Year:**2006 - 2009 **Location:** Nyandarua District **Client:** Ministry of Roads **Main Project Features:** This is an 85 kilometres earth road in Nyandarua which is being upgraded to bitumen standards. It involves the implementation of the Environmental Management Plan and Monitoring of construction by review of materials sites, road alignments, protection of archaeological sites and sensitive ecosystems, socio-economic impacts assessment and monitoring/mitigation measures development. **Positions held: Lead Environmental Assessment/Audit Expert** **Activities preformed:** It involved the implementation of the Environmental Management Plan and Monitoring of construction by review of materials sites, road alignments, protection of archaeological sites and sensitive ecosystems, socio-economic impacts assessment and monitoring/mitigation measures development. **Name of Assignment:** Proposed Witu – Lamu - Kiunga Road Upgrading to Bitumen Standards. **Year:** 2006 - 2007 **Location:** Coast province **Client:** Ministry of Roads **Main Project Features:** This is a 215 kilometres earth road on the Kenya Coast marked for upgrading to bitumen standards. It involved review of materials sites, road alignments, archaeological sites protection, protection of sensitive ecosystems, socio-economic impacts assessment and monitoring/mitigation measures development. **Positions held: Lead Expert** **Activities performed:** It involves the implementation of the Environmental Management Plan and Monitoring of construction by review of materials sites, road alignments, protection of archaeological sites and sensitive ecosystems, socio-economic impacts assessment and monitoring/mitigation measures development. **Name of Assignment:** Asmara Karen Road EIA **Year:**2005 **Location:** Eritrea **Client:** Government of Eritrea **Main Project Features:** Project covered aspect of environmental conservation, protection, resettlement policy and road realignment and expansion, camps development and labour issues **Position held: Environmentalist**

	Activities Performed: environmental conservation, protection, resettlement policy and road realignment and expansion, camps development and labour issues **<u>Power Projects:</u>** **Name of Assignment: Environmental Impact Assessment** of Longonot Geothermal Power Project. **Year:**2010 to date **Location:** Longonot **Client:** Longonot Geothermal Limited **Position held:** Lead expert and Team Leader **Activities performed:** He was in charge of the overall project execution of the ESIA concept development, air quality monitoring, socioeconomic studies, legal review, archaeological and heritage studies, traffic studies, water management studies and liaison with the geothermal engineering concepts to address impacts identified during the assessment. **Name of Assignment:** Design and Construction Supervision for the proposed Mombasa - Nairobi 400kv Transmission Line. **Year:** 2010 to date **Location:** Kenya **Client: KETRACO** **Position held:** Environmental Scientist **Activities performed:** Development and maintenance of contractor legal register, identification and documentation of key environmental, social and occupation health and safety aspects, proposal of mitigation and follow up of implementation of measures. **<u>Airport Projects:</u>** **Name of Assignment:** Construction Supervision and implementation of the Environmental and Social Monitoring and Management Plan for Jomo Kenyatta International Airport's Terminal 4 Expansion **Year:**2009 to 2011 **Location:** Nairobi City **Client:** Kenya Airports Authority **Main Project Features:** Construction Supervision and implementation of the Environmental and Social Monitoring and Management Plan for Jomo Kenyatta International Airport's Terminal 4 Expansion including the Passenger Arrival Building and Parking Garage. This project involved buildings development, expansion, services relocation, and electromechanical works for the airport. The activities on site include the development and maintenance of legal register, identification and documentation of key environmental, social and occupation health and safety aspects, proposal of mitigation and follow up of implementation of measures. **Positions held:** Lead **Environmental Expert** **Activities performed:** Identification and documentation of key environmental, social and occupational health and safety aspects, proposal of mitigation and follow up of implementation of measures. **<u>Railway Projects:</u>** **Name of Assignment:** Initial Environmental Audit and Risk Ranking of the Kenya Railways Corporation (KRC) Kisumu Pier, Port, Slipway and Dry Dock **Year:**2008 - 2009 **Location:** Kisumu **Client:** Kenya Railways Corporation

Main Project Features: Initial Environmental Audit and Risk Ranking of the Kenya Railways Corporation (KRC) Kisumu Pier, Port, Slipway and Dry Dock. The project involves the development of an Environmental Management and Monitoring Plan, Hazard Plan, Public and Institutional Consultations, Soil and Water Monitoring over a period of one year and Advising on Emergency Preparedness. This project is supported by a team of Civil /Structural and water engineers among other key experts

Positions held: Lead Environmental Expert

Activities Performed: Development of an Environmental Management and Monitoring Plan, Hazard Plan, Public and Institutional Consultations, Soil and Water Monitoring over a period of one year and Advising on Emergency Preparedness.

Petroleum Industry Projects:

Name of Assignment: Environmental Risk Analysis at 108 GAPCO (Total Management) Terminal, Depots and Service Stations.

Year:2015 to date

Location: Kenya, Uganda and Tanzania.

Client: Antea Group and Total Management - France

Main Project Features: PHASE I & II (Soil Gas Survey and Soil / Groundwater sampling)

- Drilling of Monitoring Wells within GAPCO operated facilities. The use of drilling rid to drill up to 21 metres bgl. The well is installed using gravel pack, bentonite and concrete. Development is done to ensure clean water is achieved.
- Soil gas sampling by drilling through concrete paving, using 1 core drill or electric drill and tools to cross concrete slabs and drill underground and/or slide hammer to push probe into ground (7 locations).
- In situ soil gas measurements with photo ionization detector (PID) and colorimetric tubes and hand sampling pump.
- Soil sample borehole drilling by using 1 core drill and tools to cross concrete slabs and drill underground and/or slide hammer to push the sampling probe in soft soil to depth of 7 metre (10 locations, PASSIVE DEPOT ONLY),
- Collection of soil samples (PASSIVE DEPOTS ONLY)
- Monitoring well installation by using 1 core drill and tools to cross concrete slabs and drill underground and/or slide hammer to push the sampling probe in soft soil to depth of 7 metre.
- Groundwater sampling and after installing 7m shallow well.
- Repair of concrete slab (filling of soil gas holes and soil sample boreholes and repair concrete).
- Site clean-up and demobilization.

Main Project Features: PHASE II (Soil Gas Survey, Monitoring Wells Installation and Soil /Groundwater sampling)

- Soil boreholes drillings (if possible core drilling) for sampling - (To collect undisturbed samples the preferred method is: - Push tubes with liners.
- Groundwater monitoring boreholes drilling and installation (20 m bgl). Equip with casing (full and screened) & cover for the head * & borehole "filter"** {Installing 2-3" diameter boreholes (diameter of casing*) - up to 20 m deep}. That was done with Hollow Auger and Solid Auger.
- Installation of Soil gas sampling boreholes (1.5 m deep, temporary soil gas) and Soil gas sampling boreholes (1.5 m deep, permanent soil gas) - Cane gaz type of sampling.

Position held: Project Team Leader and Environmental Scientist **Activities performed:** Environmental Risk Assessment of all Terminals, Depots and Service stations.

Name of Assignment: Soil gas Survey and remediation at VIVO Energy facilities.
Year:2015 to date
Location: Botswana.
Client: VIVO ENERGY (Pty) Botswana and Namibia (for SHELL)
Main Project Features: The project included on-site assessment and analyses of soil and water samples, installation of shallow wells (Piezometers) and deep wells (boreholes). Working with sub consultant in remediation activities.
Position held: Project Manager
Activities performed: Project management, design, execution, monitoring and reporting

Name of Assignment: Soil gas Survey and remediation at VIVO Energy facilities.
Year:2015 to date
Location: Namibia.
Client: VIVO ENERGY (Pty) Botswana and Namibia (for SHELL)
Main Project Features: The project included on-site assessment and analyses of soil and water samples, installation of shallow wells (Piezometers) and deep wells (boreholes). Working with sub consultant in remediation activities.
Position held: Project Manager
Activities performed: Project management, design, execution, monitoring and reporting

Name of assignment or project: Kenya Uganda Oil Pipeline Feasibility Study
Year: 2015
Location: Eldoret-Kampala Section
Client: Eiffage /CCC
Main Objective: To identify the key environmental and socio-economic risks that Eiffage / CCC will face in the construction and operation of the pipeline, to propose how these risks can be mitigated, and, where possible, to advise Eiffage / CCC on the potential costs associated with the mitigations.
Position Held: Project Team Leader, **Environment and Safety Safeguards**
Activities Performed: Technical studies, field investigations, Preparation of ESIA

Name of assignment or project: Lake Victoria Oil Transport Feasibility Study
Year: 2014-2015
Location: Kenya and Uganda
Client: M/s. Mahathi Infra Uganda Ltd
Main Objective: Preparation of ESIA for development of infrastructure facility to develop loading & unloading facilities at both Kisumu and Kampala similar to marine transport system.
Position Held: Project Team Leader, **Environment and Safety Safeguards**
Activities Performed: Technical studies, field investigations, Preparation of ESIA

Name of assignment or project: Sahara Petroleum Environmental Audits
Year: 2014, 2015 and 2016
Location: Kenya
Client: Sahara Petroleum Limited
Main Objective: Carry out an environmental audit in line with existing legal requirements. Make recommendations for remedial measures and prepare an Environmental Audit Report.
Position Held: Project Team Leader, **Environment and Safety Safeguards**
Activities Performed: Project review, liaisons and quality assurance.

Name of assignment or project: Triton Petroleum Environmental Audits

Year: 2014
Location: Kenya
Client: Indus Energy Limited
Main Objective: To review and assess the activities of the project, and its impacts on the soil, ground water, surface water, air and the surrounding community and to make recommendations for cost-effective practices to minimize environmental impacts.
Position Held: Project Team Leader, **Environment and Safety Safeguards**
Activities Performed: Project review, liaisons and quality assurance.

Name of assignment or project: Assessment of sites carried out in the East Africa region.
Year:1999
Location: Uganda, Sudan, Mauritius, Djibouti and Ethiopia.
Client: SHELL GLOBAL SOLUTIONS
Main Project Features: The project work included on-site assessment and analyses of soil and water samples, installation of shallow wells (Piezometers) and deep wells (boreholes).
Position held: Project **Environmental Scientist**
Activities performed: Included assessment of depots in: Uganda, Sudan, Mauritius, Djibouti and Ethiopia.

Solid Waste Projects:
Name of assignment or project: Error! Use the Home tab to apply ~DocTitle to the text that you want to appear here.
Year: 2016 to date
Location: Nakuru Kenya
Client: World Bank
Main Project Features: The objective of the Project is to improve waste management services and practices in the County by laying the groundwork, improving regulatory framework, and building capacity to facilitate private sector participation and investment in municipal waste management projects (waste disposal, treatment and collection)
Positions held: Project Team Leader, **Environment and Safety Safeguards**
Activities performed: Preliminary Environmental and Social Impact Assessment, Resettlement Action Plan and Hydrological Studies

Name of assignment or project: Consultancy Services for Solid Waste Management in Kibera - Development of a Solid Waste Framework, Detailed Design and Bidding Documents
Year: 2016 to date
Location: Nairobi Kenya
Client: Ministry of Transport, Infrastructure, Housing & Urban Development, State Department for Housing & Urban Development
Main Project Features: The main objective of this assignment is to increase garbage collection in Kibera from the estimated 20% to 60% in three years. This will be achieved through:

- Establishing a waste management committee in Kibera to assist in the implementation of the current NCC solid waste management reform initiatives outlined in the Nairobi City County Solid Waste Management Bill;
- Building the capacity of CBOs/NGOs in operations, governance and financial management;
- Construction of collection centres and composting plants with access roads
- Supporting the establishment and Contracting of solid waste collection and transporting operator(s);

	• Establishing a garbage collection and transportation tariff that will ensure the sustainability of solid waste management. **Positions held:** Team Leader, **Environmental and Social Safeguards** **Activities performed:** Environmental and Social Scoping and Screening, Policy and Legal Review and Establishment of the Solid Waste Management Committee for Kibera. **Name of Assignment: Environmental Impact Assessment, Preparation of designs and Cost Estimates** for the Proposed Construction of Two Sanitary Solid Waste Landfills in Galkayo North & South, Puntland **Year:**2012 to date **Location:** Somalia **Client:** COOPI INTERNAZIONALE **Main Project Features:** This project scope involves systematic and comprehensive assessment of the impacts due to construction of two landfills, environmental planning and project cost/benefit analysis, preparation of technical drawings and preparation of bills of quantity for proposed facilities. **Position held:** Project Manager **Activities performed:** Environmental scoping **Name of assignment or Project:** Feasibility Studies, Detailed Design, EIA and Tender Documentation for Solid waste management in Seven Towns (Machakos, Embu, Thika, Nyeri, Eldoret, Garissa, Malindi) in Kenya. **Year**: 2012-2015 **Client**: Ministry of Local Government/Devolution **Main Project features**: Feasibility Studies activities, explore current solid waste management initiatives, Develop Baseline for Landfill Planning, Identify Potential Sites within each Municipality, Select Candidate Sites, carry out the following technical surveys on the selected site, carry out Environmental Impact Assessment (EIA) of the facilities to be implemented, Prepare resettlement Action Plan and tender documentation. **Position:** Environmental and Social Team Leader **Name of Assignment:** Support for the Implementation of the Strategic Alliance (PPP) Regulations with the cement industry and tyre manufacturers and dealers in Kenya for Waste Tires Recycling. **Year:**2012 to date **Location**: Kenya **Client:** GIZ/IU Germany. **Main Project Features:** This project's scope includes identifying modes of waste tyre collection processing and marketing, assessment of co-processing in cement kilns, informal sector involvement, and drafting of regulations for approval by the Government of Kenya. **Position held:** Project National Expert **Activities performed:** Project Management and Liaison **Name of Assignment:** Mombasa City Solid Waste Management **Year:**2009 to date **Location:** Mombasa **Client:** AFD/GOK **Main Project Features:** An eighteen months joint venture assignment, this project involves the development of the Strategic Waste Management Plan (SWMP) for Mombasa Town, Strategic Environmental Assessment, Engineering Design,

	Environmental and Social Impact Assessment, Resettlement Actions and Safeguards, Supervision and Monitoring of construction of two sanitary landfills in Mwakirunge and Ujamaa Shonda, a Refuse Transfer Station at VOK, the closure of the Kibarani Dumpsite and development of 28.2km of unclassified access roads in Mombasa City to serve the town's population of approximately 1 million people. The landfill is to achieve a 60% collection rate. **Position held:** Lead Environmental Expert/Project Manager **Activities performed:** Apart from the overall project management, I am the team leader on the environmental management, socio economic assessment and resettlement action planning and construction supervision. **Other Projects:** • Development of the EABL Environmental Management and Monitoring Plan for expansion and Operation of the Ruaraka Brewery • The Proposed New Satellite Northlands Town in Ruiru Municipality • Environmental Impact Assessment for the Proposed Edible Oil Refinery at Mavoko • Environmental Impact Assessment for the Proposed Edible Oils Bulk Storage Facility at Shimanzi • Environmental Due Diligence, ESIA and Supervision of the Development of Blue Lagoon Peninsula in Watamu • Safaricom Kenya Limited Initial Environmental Audit for 500 Base Transceiver Sites in Kenya • Emergency Rehabilitation Works in Juba (ERWJ). • Environmental Audits, Project Reports and Environmental Impact Assessments for varying projects: • Olkaria Geothermal Field • Kenya Commercial Bank Management Centre, Karen; • Divisional Office Premises for Coca-Cola East and Central Africa; • South West Sakwa Water Supply; • ChemaseKibigori Water Supply; • Care International 11 boreholes in Rachuonyo and South Nandi; • Shalfa Holdings telecommunication development, Karen in Nairobi; • Greenlands Agro producers Limited in Kibwezi, Timau and Muranga Farms; • B & T Malinda Ranch, Lukenya; • Kenchic Limited Poultry farms and slaughter facility in Kenya; • Ngong Road Forest Sanctuary (Environmental Impact Assessment and Community consultations for EIA); • Eastern Province Horticulture and Traditional Food Crops Project (EPHTFCP) (Feasibility study, Environmental Audit); • Carnivore Restaurant & Wetlands (Environmental Audit); • Ker & Downey Safaris Limited (Environmental Audit); • Kakuzi Estate, Makuyu (Environmental Audit); • Kenya Vehicle Manufacturers (Environmental Audit); • Menengai Feedlot, Nakuru (Environmental Audit); • Mastermind Brewery (Environmental Impacts Assessment); • Magana Flowers Limited (Environmental Audit); • Carbacid (CO2) Mines and Depot (Environmental Audit); • Eastern Chemicals factory and strip mines, Msambweni (Environmental Audit); • NAS (Environmental Audit); • Kenol Kobil Distribution Networks (Environmental Audit); • Caltex Oil Kenya Network (Environmental Audit); • Petro Oil Kenya Network (Environmental Audit) (Closed);

	• Mobil Oil Kenya Network and Depots (Environmental Audit); • Shell Chemicals Depot (Environmental Audit). • Installation of groundwater monitoring wells in four petroleum storage depot facilities in Mombasa • Environmental Site Assessment (Soil Gas survey), Battery Manufacturing Plant, Nakuru • Environmental Site Assessment and modelling • Environmental Site Assessment: Kigali airport Fuel Storage Depot • Environmental Risk Assessment and tank testing, modelling and sites risk ranking for 260 locations • Environmental project report for two proposed fuel service stations • Environmental Risk Assessment of existing Project service station in Mwingi • Groundwater Assessment & Remediation Study • Sludge farming at a remediation site and installation of piezometers to monitor the degradation of hydrocarbons and heavy metals at the bioremediation farm in Mombasa • Environmental Risk Assessment of 250 retail and consumer facilities • Environmental Risk Assessment of 202 retail and Consumer facilities in twelve countries in West and Central Africa • Snap shot due diligence investigation of existing facilities to check degree of contamination by hydrocarbons in various African countries including; Ethiopia, Kenya, Uganda, Cote d'Ivoire and Eritrea • Groundwater remediation, quarterly monitoring of 8 monitoring wells and Installation of 24 additional permanent monitoring wells/ piezometers at the Kenya petroleum refineries limited (KPRL) • Hydrogeological investigations (Distribution Risk Based Tool) at Mombasa and Nairobi Shell terminals

Expert's contact information	**Email:**	lwangamc@charlesandbarker.co.ke
	Telephone:	+254 722729439

Certification:

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes myself, my qualifications, and my experience, and I am available to undertake the assignment in case of award. I understand that any misstatement or misrepresentation described herein may lead to my disqualification or dismissal by the Client, and/or sanctions by the Bank.

Charles Muyembe		**10/09/2019**
Name of Expert	Signature	Date

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/11598

Application Reference No: NEMA/EIA/EL/15699

M/S **CHARLES LWANGA MUYEMBE**
(individual or firm) of address

P.O. Box 1784-00606, Nairobi

is licensed to practice in the

capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert**
registration number **1283**

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

Issued Date: **1/9/2020** Expiry Date: **12/31/2020**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001 BUREAU VERITAS Certification UKAS

ISO 9001: 2008 Certified

FORM 5 (r. 14(4))

Application Reference No: 733
Registration No: 1283
FOR OFFICIAL USE

THE ENVIRONMENTAL MANAGEMENT AND COORDINATION ACT

CERTIFICATE OF REGISTRATION AS AN ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT EXPERT

This is to certify Ms. **MR. CHARLES L. MUYEMBE**
of **P. O. BOX 18823 - 00100, NAIROBI** (Address)
has been registered as an Environmental Impact Assessment Expert in accordance with the provisions of the Environment Management and Coordination Act and is authorized to practice in the capacity of a Lead Expert/Associate Expert/Firm of Experts (Type) **LEAD EXPERT**

Dated this **27TH** day **MARCH** of 20**07**

Signature .....

(Seal)

Director General
The National Environmental Management Authority

GPK (L)

Appendix C EIA and Social Field Tools

HOUSEHOLD QUESTIONNAIRE: WATER SUPPLY & SEWERAGE CONNECTIVITY

PROJECT NAME: FEASIBILITY STUDY, DETAILED DESIGN AND PREPARATION OF TENDER DOCUMENTS FOR MUMIAS – KIMILILI SEWERAGE PROJECT

CONTRACT No. RVWSB/LVN/KTSWSSP/C/MUMIAS – KIMILILI/2018 - 2019

CLIENT RIFT VALLEY WATER WORKS DEVELOPMENT AGENCY

A. IDENTIFIERS

1. Household ID: (hid)_____

(*Enumerator: This will be a UNIQUE identifier of the household and should NOT be repeated either by you or your teammates)*

2. Date of Interview: (date_intvw)____/____/_____

(Write the date in the format DD/MM/YYYY)

3. Name of respondent: (resp_nm)_____

(Give three names if not available give first and surname)

4. Telephone No: (tel)_____

(Mobile phone contact to reach household own or neighbours')

5. County (county) _____

6. Sub-county: (s_county)_____

7. Ward (ward)_____

8. Sub-location: (s_loc)_____

9. Village: (vil) _____

10. Enumerator Name: (ename)_____

11. Enumerator ID: (enumid)_____

12. Supervisor Name: (sname)_____

13. Supervisor ID: (svid)_____

B. HOUSEHOLD ROSTER

Enumerator: ***Read and understand the definitions below BEFORE filling the Household roster.***

a) *A household is a social unit consisting of one or more people living in the same dwelling/home and sharing meals chores and responsibilities. It may consist of a of a single family or some other grouping of people with one head of household.*

b) *A household head is the person who makes most and/or major decisions for the household regarding issues (like allocation of income to household needs).*

c) *A household member is anyone who has lived in this household (as defined above) for the last* ***12*** months. The head and spouse are considered members regardless of how long they have lived in the household. Children born recently and those away in school but dependants are also considered members regardless of how many months they have lived with the household.

Household Roster (List the members of the household as defined above beginning with the head of the household.

14. No.	15. Name *(At least two names)*	16. What is […] relationship to Head	17. W hat is […] age (years)	18. Gender 0=Female 1=Male	19. Marital status *(use options below)*	20. What is […] education level? *(use (options below)*	21. Is the […] attending school ? 0=no 1=yes	22. Does […] live in the household ? 0=no 1=yes	23. Was […] absent for more than a month over the last 12 months? 0=no 1=yes	24. If yes How many months was […] absent?	25. What were the reasons for […] absence?	26. Is […] still considered a member of the household? 0=no 1=yes
mem	name	rhead	age	gender	mstatus	educ	school	live	absent	monthab	abwhy	member
HM1												
HM2												
HM3												
HM4												
HM5												
HM6												
HM7												

Education Level code: 1=No education 2=Did not complete primary education 3=Completed primary education 4=Did not complete secondary education 5=Completed secondary education 6=Completed vocational training 7=College 8=Degree -222=Other specify

Marital status: 1=Single 2=Married 3=Widowed 4=Divorced/separated

Reasons for absence: 1=military service 2=education 3=imprisoned 4=work away 5=hospitalized -222=others (specify)

Relationship with Hh/head: 1=spouse 2=son/daughter 3=parent (mother/father) 4=brother/sister 5=brother/sister in-law 6=nephew/niece 7=grandson/daughter 8=cousin 9=other relative 10=Other non-relative -222=Other specify

C. HOUSING AND AMENITIES

27. What is the type of house is the **main** house? **hstyp**_____

1=Permanent 2=Semi-permanent 3=Temporary -222=Other(specify)

28. What material is (most of) the wall of the **main** house? **wlmt** _____

1=Brick 2=Mud 3=Tent 4=Timber 5=stones 6=Plaster 7=Iron sheet -222=Other (specify)

29. What is the ownership status for the **main** house? **hswn** _____

1=Owned 2=rented 3=Provided by employer -222=Others

30. What does the household **mainly** use for lighting? **lght** _____

1=Electricity 2=Solar 3=Kerosene lamp 4=Gas lamp 5=Electric generator 6=Candle 7=Torch 8=No lighting -222=Other (specify)

31. What does the household **mainly** use for cooking/as cooking fuel? **ck** _____

1=Electricity 2=Gas 3=Firewood 4=Charcoal 5=Kerosene -222=Other (specify)

D. HOUSEHOLD ASSETS

32. What is the total land **owned** by the household (hectares)? **land** _____

Enumerator: 1Ha=2.47 acres 1acre=0.405 Ha

33. What is the total **cultivated** land area? **land_cltv** _____

E. ASSETS

34. Does your household own any of these items?

Enumerator: Enter number owned zero(0) if none Ask for the current value (if it was to be sold to them as is)

etm	enm	evl	
1=Cooking gas			
2=Refrigerator			
3=Television			
4=Radio			
5=Sofa-set			
6=Washing machine			
7=Water pump			
8=Water tanks			
9=Borehole			
-222=Other (specify)			

F. LIVESTOCK

35. Does your household own any of these livestock?

Enumerator: Enter number owned or zero(0) if none

ltm	lnm	lvl	
1=Dairy cows			
2=Indigeneous cattle			
3=Goats			
4=Sheep			

5=Donkey			
6=Pigs			
7=Poultry			
-222=Other specify			

G. Household Income Generation

36. What is the main source of income for your household? **incm**_____

1=Farming (crops horticulture) 2=Livestock and dairy 3=Business 4=Remittances 5=Gifts/gratuities 6=Employment 7=Water vending 8=Charity 9= Money for the Elderly -222=Other (specify) _____

H. HOUSEHOLD EXPENDITURE BY CONSUMPTION ITEMS

37. How much did the household spend on **food** in the last **one** month? **fd** _____

1=(0-1000) 2=(1001-2000) 3=(2001-3000) 4=(3001-4000) 5=(4001-5000) 6=(5001 and above)

38. How much did the household spend on **education** in the last **12** months? **edc** _____

1=(0-5000); 2=(5001-10000) 3=(10001-20000); 4=(20001-40000); 5=(40001-50000); 6=(50001 and above)

39. How much did the household spend on **health** in the last **12** months? **hlth** _____

1=(0-5000); 2=(5001-10000) 3=(10001-20000); 4=(20001-40000); 5=(40001-50000); 6=(50001 and above)

40. How much did the household spend on **clothing** in the last **12** months? **clth** _____

1=(0-1000); 2=(1001-2000) 3=(2001-3000); 4=(3001-4000); 5=(4001-5000); 6=(5001 and above)

41. How much did the household spend on **water** in the last **one** month? **wtr** _____

1=(0-50); 2=(51 -100) 3=(101-150); 4=(151-200); 5=(201 and above)

42. How much did the household spend on **transport** in the last **one** month? **trspt** _____

1=(0-1000); 2=(1001-2000) 3=(2001-3000); 4=(3001-4000); 5=(4001-5000); 6=(5001 and above)

43. How much did the household spend on **electricity** in the last **one** month? **elctr** _____

1=(0-1000); 2=(1001-2000) 3=(2001-3000); 4=(3001-4000); 5=(4001-5000); 6=(5001 and above)

44. How much did the household spend on **garbage disposal** in the last **one** month? **grbg** _____

1=(0-100); 2=(101-200) 3=(201-300); 4=(301-400); 5=(401-500); 6=(501 and above)

45. What other significant expenditure in the last **one month?** **othxp** _____

1=(0-1000); 2=(1001-2000) 3=(2001-3000); 4=(3001-4000); 5=(4001-5000); 6=(5001 and above)

I. WATER ACCESS AND SUPPLY

46. What is the **main** source of drinking water for the members of your household? **wdsrc**_____

1=Piped water into the dwelling
2=Piped water to the plot
3=Community/public pipe water
7=Protected dug well
8=Unprotected dug well
9=Rain water collection
-222=Other (specify)

4=Borehole 10=Surface water (river dam lake dam lake pond)
5=Protected spring 11=Bottled water
6=Unprotected spring 12=Tanker-truck

47. How much water does your household consume per day from the **main source** for drinking **only**? **wdltr** _____

48. How long does it take to go there get water and come back? **wdtm** _____
1=Number of Minutes 2=Water is in the premise 3=Do not know

If 48=1 Who usually goes to this source to fetch water for your household? **wdpsn**_____
1=Adult woman 2=Adult man 3=Female child (under 15 years) 4=Male child (under 15 years)
5=Both adults and Kids 6=Do not know

49. In the last 6 months how frequently was drinking water from the main source available? **wdvlb** _____
1=Daily for 24 hours a day 2=Daily at certain hours 3=Three to five days a week 4=One or two days a week 5=Less frequent than once a week

50. Has there been any time in the last 6 months when you have been unable to access water from the main drinking water source in sufficient quantities when needed? **wdvlb_n** ____
1=Yes 0=No 3=Do not know

51. If 50Yes how many times was your household not able to access drinking water in sufficient quantities from the main source for the last 6 months? **(Number of times)** **wdvlb_frq**_____

52. If 50Yes what was the main reason that your household was unable to access water in sufficient quantities when needed? **wdvlb_n_wy**__
1=Water not available 2=Water too expensive 3=Source not accessible 4=Service disruption
5=Pump or pipe broken 6=Water dried up 7=Do not know -222=Other (specify)

53. What is the main source of water used by your household for other purposes i.e. cooking and general washing? **wosrc**_____
1=Piped water into the dwelling 2=Piped water to the plot 3=Community/public pipe water
4=Borehole 5=Protected spring 6=Unprotected spring 7=Protected dug well
8=Unprotected dug well 9=Rain water collection 10=Surface water (river dam lake dam lake pond) 11=Bottled water 12=Tanker-truck -222=Other specify

54. Does your household collect water for general use and consumption outside of your compound? 1=Yes 0=No **wocllct**_____

55. If yes what is the distance from your household to the commonly used water source outside your compound (Kilometers)? **wodst**_____
1=0-1 km 2=1-2 km 3=2-3 km 4=3-4 km 5=4-5 km 6=5 km and above

56. How long does it take to go fetch water and come back (including time spend waiting in line) from **this** source **wotm**_____
1=0-30 Mins 2=31-60 Mins 3=61-90 Mins 4=91-120 Mins 5=121-150 Mins 6=151-180 Mins 7=181 Mins & above

57. Who usually goes to **this** source to collect water for the general use and consumption for the household? **wopsn**_____
1=Adult woman 2=Adult man 3=Female child (under 15 years) 4=Male child (under 15 years)

5=Both Adults and Kids 6=Do not know

58. What means of transport does your household primarily use to fetch water? **wotpt**_____
1=Foot 2=Animal/human drawn cart 3=Pay others to fetch it -222=Other (specify)

59. How much water does your household consume per day f**rom the main source** for general use and consumption? **woltr**_____

60. Is this amount of water enough for general use and consumption for the household? **wongh**_____
1=Yes 0=No

61. If No what can be done to make the water enough for general use and consumption? **wongh_n**____
1=Lower the price of water 2=Increase water connectivity 3=Increase the number of boreholes in the community -222=Other (specify)

62. In the last 6 months how frequently was drinking water **from the main source** available **wovlb_frq**_____
1=Daily for 24 hours a day 2=Daily at certain hours 3=Three to five days a week 4=One or two days a week 5=Longer than once a week

63. How would you rate the quality of your drinking water from the **main source**? (3=Good 2=Fair 1=Bad)
Enumerator:Note the order of ranking

a. Quality	**r_q**____
b. Clarity	**r_c**____
c. Color	**r_cl**____
d. Smell	**r_s**_____
e. Taste	**r_t**_____
f. Safety	**r_sf**_____
g. Convenience	**r_cv**_____

64. Does your household treat drinking water from the main source? 1=Yes 0=No **wdtrt**____

65. If No why do you not treat your drinking water? **wdtrt_n**__
1=Water is safe to drink 2=Water unsafe but not necessary to treat
3=Too expensive to treat it 4=No knowledge of treatment options 5=Unavailability of treatment technologies 6=Not enough time -222=Other (Specify)

66. If Yes what does your household do to make water safer to drink? **wdtrt_y_hw**___
1=Boil the water 2=Add bleach/chlorine 3=Sieve it through cloth 4=Water filtering device
5=Other filter (ceramic sand composite) 6=Let stand and settle -222=Other (specify) 8=Do not know

67. In your household who makes decision on how to treat drinking water? **wdtrt_dc**___
1=Adult men 2=Adult women 3=Both adult men & women -222=Other (specify)

Does your household have a water storage container for storing drinking water? **wdstr**____
1=Yes 0=No

68. If No why does your household not have a water storage container for storing drinking water? **wdstr_n**___
1=Water always available 2=Storage containers too expensive/unaffordable -222=Other (specify)

69. If Yes how is drinking water usually stored at your household? **wdstr_y__**
1=Metal pots 2=Plastic bottles 3=Storage tanks (barrels) 4=Earth pots -222=Other (specify)

70. How often does your household usually clean the largest drinking water storage container? **wdcln_frq____**
1=Daily 2=Several times per week 3=Once a week 4=Once a month 5=Once every 3 months 6=Once every 6 months 7=Less often than half yearly

71. In your household who makes the decision about how to store drinking water? **wdstr_dc___**
1=Adult men 2=Adult women 3=Both adult men & women -222=Other (specify)

J. SANITATION AND HYGIENE

72. Does your household have a toilet facility? 1= Yes 0= No **tlt_____**

73. If yes what kind of toilet facility does the household have? **tlttyp___**
1=Flush/pour flush 2=Ventilated improved pit latrine 3= Pit latrine with slab 4= Pit latrine without slab/open pit -222=Other (specify)

74. Do you share the toilet facility with others who are not members of your household? **tltshr___**
1=Yes 0=No

75. If Yes how many **households** in total use the toilet facility including your own household? **tltshrnm_**

76. If does **not** have toilet facility how do you dispose off waste? **tlt_n**

77. Are you connected to a sewage system? 1=Yes 0=No **swr___**

78. If yes, do you pay for sewrage? 1=yes 0=no **swrpy___**

79. If connected to sewerage how much do you pay for sewerage services per month. **swrpy_mt__**
1=Ksh 0 -100 2=Ksh 101-200 3=Ksh 201-300 4=Ksh 301-400 5=Ksh 401 & Above

80. If connected to sewerage when there is a problem who do you report to? **swrrpt___**
1=Head of nyumba kumi/local elder 2=Chief 3=Landlord 4=Local water board official 5=Water service provider 7=Do not know -222=Other (specify)

81. How satisfied are you with the sewerage services available for you. **swrstfd___**
1=Very satisfied 2=Satisfied 3=neither 4=Dissatisfied 5=Very dissatisfied

82. If No why are you not connected to a sewerage system? **swr_nwy_**
1= Sewer system/network not available in the area 2=Not enough funds in the household 3=Not enough funds in government 5=Do not know -222=Other (specify)

83. If not connected to a sewerage system would your household like to be connected? **swrcnct__**
1=Yes 0=No

84. If No why does your household not want to connect to a sewage system? **swrcnct_n_**
1=Nobody proposed to install 2=It is too expensive and unaffordable 3=Pipes break easily 4=It will affect water availability -222=Other (specify)

85. If Yes how much is your household willing to pay for sewage system? **swrcnct_pwl**
1=Ksh. 0-100 2=Ksh 100-200 3=Ksh 200-300 4=Ksh 300-400 5=Ksh 400- and above

K. HYGIENE PRACTICES

86. Have you used soap today or yesterday? 1=Yes 0=No **sp_____**

87. If Yes what did you use the soap for? **spus__**
1=Wash clothes 2=Bathe 3=Wash hands before food preparation 4=Wash hands before feeding 5=Washing hands after visiting the toilet -222=Other (specify)

88. Have any of your household members under each of the following age categories had any of these symptoms in the last 3 months?
Enter number sick or zero if none for that category

Age Category	Fever	Headache	Constant cough	Vomiting	Panting/ wheezing	Stomach ache	Bloody urine	Bloody stool	Refuse to eat/feed	Body itching	Eye infection
If any (1=yes 0=no) *(if no move to next ailment)*											
0-1 Years											
2-5 Years											
6-14 Years											
15 years and above											

89. In the past 12 months did any member of your household suffer from these diseases? 1=Yes 0=No

Disease	Response
a. Diarrhea	
b. Typhoid	
c. Cholera	
d. Dysentery	
e. Hepatitis	
f. Anaemia	
g. Brucellosis	
h. Amoebiasis	
i. Worms	
j. Respiratory disease	
k. Other (specify)	

In the past 12 months how much did your Household spend on health? **hlthspd**_____

L. GENERAL COMMENTS & REMARKS

cmmnt_____

_____

_____

_____

_____

_____

_____

_____

INDIVIDUAL INTERVIEW QUESTIONNAIRE

Instructions

i. The questionnaire is to be completed by the Household Head/or Spouse;
ii. It contains seven parts: Parts A, B, C, D, E, F, G and H;
iii. Please answer the questions as objectively and honestly as possible;
iv. Answer the questions by either inserting a tick (√) or filling the blank spaces;
v. Your response will be treated as confidential and used solely for the project;
vi. The exercise takes about 30- 45 minutes to complete.

Introduction

Kenya Sustainable Towns Water Supply and Sanitation Programme is to improve the access, availability and sustainability of water supply and wastewater management services in Mumias and Kimilili townships. through a partnership between the Lake Victoria North Water Service Board (LVNWSB), Rift Valley Services Board and the Africa Development Fund.

The LVNWSB under the State Department of Water contracted SMEC International Ltd to undertake a Socioeconomic Household Baseline Survey being part of similar studies and consultations being undertaken towards development of improved access, availability and sustainability of water supply and wastewater management services.

You are requested to assist in providing relevant information related to this project. The information that you provide will be treated with confidentiality and used only for the purpose of reporting about this Programme. We therefore request your cooperation and support in providing relevant information. Your honest responses will be highly appreciated.

Name of Enumerator ……	**Date ……**
Start Time ……	**End time ……**
Checked by Supervisor ….	**Signed ……**

PART A: PERSONAL INFORMATION

Code No. _____

1. Location (Extraction)
   a) County ……
   b) Sub-County……
   c) Ward……Village/Estate ……..
   d) Homestead Coordinates Eastings ……..…...Northings ……..
2. Name of respondent …….....
3. Age of respondent
   a. 18 – 35 years [ ]
   b. 36 – 64 years [ ]
   c. Over 65 years [ ]

4. Gender of respondent a) Male [ ] b) Female [ ]

5. Indicate marital status of respondent

a) Single [ ] b) Married [ ] c) Divorced/ separated [ ] d) Widow [ ] e) Widower [ ]

6. Level of education attained (with certificate)
   a) University [ ]
   b) College [ ]
   c) Secondary [ ]
   d) Primary [ ]
   e) None [ ]
7. How many persons living in the household
   a) Adults above 18 years nos. ----------
   b) Children below 18 years – Nos. ----------
8. Are there any vulnerable persons in the home?

Nature of Vulnerability	Nos. Male	Nos Female
Mentally Sick		
Aged – over 70 years		
Chronically ill		
Persons with Disabilities		
Others		

9. What is the main occupation of the household head? (indicate if more than one occupations)
   a) Farmer [ ]
   b) Employed [ ]
   c) Business person [ ]
   d) Others (specify) [ ]

PART B: HOUSEHOLD SOCIOECONOMIC ASPECTS

HOUSING

10. Describe type/construction material of **main** household house

Description	Material
Roof	a)Thatch[ ] b) Corrugated[ ] c) Metal[ ] d)Mud/Sand/Plastic/Stones[ ] e)Tiles[ ]
Wall	a) Mud[ ] b) Concrete[ ] c) Brick[ ] d) timber [ ] sticks [ ]
Floor	a)Earth[ ] b) Concrete [ ] c) wood[ ]
Window	a) Wood[ ] b) Wire mesh[ ] c)Tin[ ] d)Glass[ ]

SANITATION:

11. Specify the **two** main types of solid waste within the homestead and the methods of disposal (multiple responses)

Type of household waste/garbage	**Indicate method of disposal** a) Dispose in a pit b) burning c) dispose in the farm d) Sell e) Making Compost manure f) Others specify…….
Plastics	a) Dispose in a pit

	b) burning c) dispose in the farm d) Sell e) Making Compost manure f) Others specify
Metals	a) Dispose in a pit b) burning c) dispose in the farm d) Sell e) Making Compost manure f) Others specify
Others	a) Dispose in a pit b) burning c) dispose in the farm d) Sell e) Making Compost manure f) Others specify

12. What is the **MAIN** type of facility used by the household to dispose human waste?
    Main sewer [ ]
    Septic tank: [ ]
    Bucket latrine: [ ]
    Drainage for dirty water. [ ]

13. What **MAIN** type of toilet facility does your household use '**most'** of the times? (multiple responses)
    a) Open field [ ]
    b) Pit latrine [ ]
    c) VIP latrine [ ]
    d) Flush toilet [ ]
    e) Community Toilet [ ]
    f) Direct to Drainage [ ]
    g) Others, specify… [ ]
14. How is Waste /Gray Water Disposal conducted
    1. Gutter [ ] 2. Gardening [ ] 3. Open [ ] 4. Others [ ]

15. What is the **MAIN** source of water for domestic consumption? (One response)

Main Water Sources	Types of water supply	WATER sources for Bathing, Cooking and Washing	WATER sources for Livestock Watering	WATER sources for Kitchen garden
A) Piped water supply from water project	pipe into dwelling			
	Piped into yard /plot			
	Neighbor's tap			
	Public tap/standpipe			
	Water			
b) Ground water	Tube well or borehole			

	Protected dug well			
	Unprotected spring			
	Protected spring			
c) Rainwater collection				
d) Vended water	Tank truck			
	Cart with Jerry cans/drum/buckets			
	Bicycle with buckets			
	Bottled water			
e) Surface water	Dam			
	River			
	Stream			
	Irrigation canal			
	Lake			

16. What are the storage facilities used
    a) Under Ground Tank [ ]
    b) Over Head Tank [ ]
    c) Drum (200 LTs.) [ ]
    d) Over Ground Tank [ ]
    e) None [ ]
    f) Others [ ]
17.
18. Indicate approximate distance to the nearest social amenities

Social amenities	Distance				Accessibility	
	Less than 1 Km	1 -2 km	3 -5 km	Over 5km	Accessible	Inaccessible
Wet season domestic Water source						
Dry season domestic Water source						
Wet season Livestock water source						
Dry season Livestock water source						
Dispensary						
Health centre						
Hospital						
Primary school						
Secondary school						
Electricity transformer						
Local Market centre/shopping centre						
Main/Major market						

19. What are the **numbers** of Schools in the sub location?

Primary	Secondary	College /Tertiary institution

20. What are the **numbers** of health facilities in the sub location?

Hospital	Health center	Dispensary	Private /mission hospital	Private clinic

21. In the last 12 months, did any member of your household suffer from any of the following diseases? (multiple responses)

Type of Disease	**Tick [√]**	**Frequency of occurrences in the household**				
		Once	**Twice**	**Thrice**	**Four time**	**Five times and above**
a) Malaria						
b) Diarrhea						
c) Amoeba						
d) Typhoid						
e) Cholera						
f) Respiratory disease						
g) Skin disease						
h) No sickness suffered						
i) Others /specify						

If sickness suffered, ask the next three questions. (If NO, skip to 15)

22. Was there need for that member of the household to be away from their daily routine activities?
    a) Yes [ ] b) No [ ]

23. If yes, for how long were they away from productive work?
    a) Less than a week [ ]
    b) One week
    c) One to two weeks [ ]
    d) Two to four weeks [ ]
    e) One month [ ]
    f) More than a month [ ]

24. Approximately, how much did it cost your household to treat the person?
    _____

SOURCE OF ENERGY

25. what is your **3 main** sources of energy for cooking and lighting (maximum of 3 responses per energy use)

Cooking	**Lighting**
1) Firewood [ ]	1) None [ ]
2) Charcoal [ ]	2) Battery Lamp [ ]
3) Kerosene [ ]	3) Kerosene Lamp [ ]
4) Liquid Petroleum Gas [ ]	4) LPG lamp [ ]
5) Electric Cooker [ ]	5) Electricity [ ]
6) Biogas [ ]	6) Solar [ ]
7) Others [ ]	7) Others [ ]

INFRASTRUCTURE

26. What types of roads are available in your area? (multiple responses)

a) Tarmac ☐ b) Murram ☐ c) Earth/Farm roads ☐

27. How can you rate the standard of access roads in your area?

a) Accessible all year round ☐ b) Partially accessible ☐ c) Not accessible ☐

28. What are the **3 main** means of transport in your area?
a) Bicycles ☐ b) Matatus ☐ c) Buses ☐ d) Taxis ☐ e) Pick-ups ☐ f) Boda Boda /Motor cycles ☐ g) walking ☐ h) others Specify ☐

PART C: HOUSEHOLD ECONOMIC ACTIVITIES, INCOME AND POVERTY SITUATION

29. What is the primary economic activity for the family? (indicate maximum 3 if more than 1)

1) Crop Farming; [ ] 2) Fishing/ fish farming; [ ] 3) Livestock rearing; [ ] 4) Business; [ ] 5) Others (specify)……

30. What is your major source of income? (multiple responses)

Occupation	**Tick as appropriate**	**income from each of the occupation per month,**
Crop Farming		
Livestock farming		
Fishing /Fish Farming		
Tree farming		
Salary		
Pension		
Remittances		
Business		
Wages from casual labor		
Stocks/shares		
Other /specify		
Total income		

31. If salaried, what is your profession?

1) Civil servant [ ] 2) technician in private sector [ ] 3) official in private sector [ ]

4) Local business [ ] (5) laborer [ ] (6) Other (specify)……

32. Who owns the following items in the household?(multiple responses)

Household Items	**Tick items owned**
Mobile Phone	
Bicycle	
Motor Bike	
Car/Truck	
Radio/Stereo	
Satellite Dish	
Refrigerator	

Own Water Stand Pipe	
Borehole/Well	
Own Water Tank	
TV Set/DVD	
Others (specify) _____	

33. How do you assess the economic situation of your household?

S/No.	Economic Situation	Tick
a)	Very poor, there is sometimes even not enough food available	
b)	Poor, have no food problems but sometimes have problems to buy other items like clothes	
c)	Moderate, enough money for food, clothes, healthcare and school fees	
d)	Above moderate, enough money for luxuries like a motor cycle and car	
e)	Good, can run a good car, own a good house and afford many luxury goods	

34. What is the monthly income range for the household head consider income arising from employment, household enterprises, agricultural produce, rent, pension and financial investment) per month? Give the Ranges below:

Range	Household head	Spouse	Child
Less than 2000			
2001-5000			
5001-10000			
10001-15000			
15001-20000			
20001-25000			
25001-30000			
Over 30000			
Total			

35. What is the estimated household expenditure per day in KSHS ……? (multiple responses)

Household expenditure	
Estimated Expenditure	**Tick**
Below 100	
100-200	
201-300	
301-400	
401-500	
501-600	
601-700	
Over 700	

36. How much do you spend on the following items per month

a) Food Kshs…….

b) Household utility bills Kshs…….

c) Hired labor Kshs ……. …….

d) Transport Kshs……..

37. How much do you spend on the following items per annum

e) School fees Kshs……..

f) Medical bills Kshs……..

g) Livestock Kshs……

h) Farm inputs Kshs……

38. What are the main crops planted in the last season in order of importance? (Quantity in bags may vary e.g. 90kg bags/ 50kg bags/ 20 kg debes/ 2kg gorogoro) (multiple responses)

Crop	Food crop (tick)	Cash crop (tick)	Area under cultivation-in acre (in last season)	Yield quantity in Bags* per acre (last season)
a) Maize				
b) Sorghum				
c) Millet				
d) Beans				
e) Green grams				
f) Cow peas				
g) Pigeon Peas				
h) Sugarcane				
i) Vegetables				
j) Others (Specify) _____				
_____				

39. What are the main cash crops planted in the last season in order of importance?
    a) .....
    b) .....
    c) .....

40. **Please** indicate the other Property/ items in your Homestead: (tick appropriately)

Property	Indicate item owned	Market price of item
a) Food crops/per bags 90 Kgs		
b) Cash crops/in KGs		
c) Timber tree/per tree		
d) Fruit trees/per season		

41. What are the numbers of Market centre/shopping centre in the sub location Nos----------?

42. In regards to the markets where cereals, pulses vegetable and others are traded, give the following;

Market center	Market day	Distance (km)

EXTENSION SERVICES

43. Do you receive extension services? Yes ☐ No ☐

44. If yes who was the service provider? [multiple responses]
    a) Government service …… .. [ ]
    b) Agro dealers /companies specify ……[ ]
    c) Private extension service ……..... [ ]
    d) NGOs specify …… .. [ ]
    e) Lead farmers ……..… [ ]

45. Are these extension services adequate for your needs? Yes [ ] No [ ]

46. Indicate the type of livestock that you keep, main reasons for keeping it and the estimated market value for an average livestock in the category (multiple responses)

Livestock	**Number of livestock**	**Main reason for keeping such as (Meat, Milk, savings, transport, ploughing, business, hides and skin, cultural and social value, manure production) etc.**	**Estimated market value for the average livestock (Kshs)**
Bulls			
Oxen			
Cows			
Calves			
Donkey			
Sheep			
Goats			
poultry			
Pigs			
Rabbits			
Bee hives			
Fish			
Others.....			

PART D: LAND RESOURCES

47. Specify the most common land tenure system in the area

a) Individual ownership [ ] b) communal land [ ] c) Lease [ ] d) Others specify [] ……

48. Indicate the land tenure and acreage for each of the parcels of land owned or leased by the household?

Parcel Number	**land tenure (tick)** **a) Individual ownership [ ]** **b) communal land [ ]** **c) Lease [ ]** **d) Others specify [_____]**				**Size (in acres)**	**Indicate Registration Status (tick)**	
	a	B	c	d		Yes	No
1							
2							
3							
4							
5							
6							
7							

49. Who owns the land?
    a) Male Household head [ ] b) Female household head c) Daughter [ ] d) Son [ ] e) Joint ownership (Specify) …….. f) Other (Specify)
50. For the lands you inherited, have you completed the official succession process (division of land amongst heirs)? 1. Yes / 2. No
51. Do you have any documentation for these ownerships? 1. Yes 2. No
52. For the lands you bought, how much did you pay per acre KSHS----------
53. For the land you bought have you registered it in your name and do you have the title-deed? 1. Yes 2. No

54. Do you have any documentation for these ownerships? 1. Yes 2. No
55. If no, why don't you have ownership documents? ----------
---
56. Are you planning to get the title-deed of your plot?
    1. Yes (when) ---------- 2. No (why not)? ----------
57. Do you intend or plan to subdivide the land in this area in the near future?

    a) Yes { } b) No { }

58. Are there any sites of cultural significance affecting agriculture around your home?
    a) Yes { } b) No { }
59. If yes name them and indicate where they are----------

PART E: HOUSEHOLD SAVING AND CREDIT CHARACTERISTICS

Access to Financial Services

Bank accounts

60. Do **you** have a bank account? Yes [ ] No [ ]
61. If yes, specify the purpose/use of the account (multiple responses)
    a. Payment [ ]
    b. Savings [ ]
    c. Others [ ]

Access to Credit

62. Have you accessed credit from any source within the last year?
    Yes [ ] No[ ]
63. If yes, where did you source the credit? (Multiple responses)

Formal	**Tick**	**Informal**	**Tick**
SACCOs		Friends/ Neighbors	
Commercial Banks		Relatives	
Mobile Phone Platform		Local money lenders or shylocks.	
Micro-Finance Institution		Self-Help Groups/ Chamas	
Employer		Religious Institution	
NGOs		Others (Specify)	
Others (Specify)			

64. What is the approximate distance to the nearest bank or finance facility?
a) Less than 5km [ ] b) 6 to 10km [ ] c) 11 to 15km [ ] d) 16-20km e) Over 20km [ ]

65. What are the challenges you have faced in accessing credit?

PART F: FOOD SUFFICIENCY AND COPING MECHANISMS

66. Does your household produce sufficient food for home consumption throughout the year? Yes☐ No ☐
67. If NO, which are the food insufficient months for the household? (tick appropriately)

January	1
February	2
March	3
April	4
May	5
June	6

July	7
August	8
September	9
October	10
November	11
December	12

68. Which foodstuffs are bought during food insufficient months? (Multiple responses)

Item	**List the foods bought before harvest**
Cereals: (Sorghum, Millet, Wheat, Maize, etc)	**a)** …… **b)**…….. **c)** ……..
Pulses: (beans, green peas, cowpeas, pigeon peas, etc)	**a)** …… **b)**…….. **c)** ……..

69. How do you meet your food requirements during the months of food insufficiency? (Tick appropriately) (Multiple responses)
    a) Food Aid ☐
    b) Buy ☐
    c) Assistance from relatives and neighbors ☐
    d) Barter trade ☐
    e) Others ☐

70. Are there any cultural practices that need to be considered in the water and waste water sector?
    ……
    ……..

GENDER ROLES ASSESSMENT

Activity	**Men**	**Women**	**Boy**	**Girls**
Land preparation and clearing				
Providing farm Labor				
Collect food ingredients and preparation				
Collect Vegetables				
Fetching water				
Washing utensils				
Washing clothes				
Collecting firewood				
Looking after animals				
Sale of livestock				
Sell farm produce in market				
Buying from market				
Taking children to hospital				
Total task				

PART G: NATURAL RESOURCES MANAGEMENT

71. Specify any natural resource products harvested from the immediate environment and the key restoration measures applied by the household(multiple responses)

Natural products	**Tick [√]**	**Key restoration Measure for environment**
Fire wood		
Charcoal making		
Forage fodder for livestock		
Grass for livestock		
Thatching grass		
Sand		
Stones /soil for building		

PART H: PROJECT AWARENESS AND PARTICIPATION

72. Are you aware of the proposed project in this area? (1)Yes [ ] (2) No [ ]
73. If yes, how did you get that information? THROUGH: 1) Extension Service/MOA 2) Chief's Baraza 3) Friends/Neighbors 4) Mass media 5) other specify ……
74. Do you support the project? (1). Yes [ ] (2). No [ ]
75. Do you expect the proposed project to have any impacts? (1). Yes [ ] (2). No [ ]
76. If yes, list them below;
    Negative impacts
    (i)……...……(ii)……
    ……(iii)……
    Positive impacts
    (i)……...……(ii)……
    ……(iii)……
77. What are the major positive effects of the project? (rank in order of priority)
    1) A boost in food security ---------
    2) Water will be available for Irrigation in dry season ---------
    3) Increased incomes ----------
    4) Increased employment ----------
    highly (2) Moderate (3) Least (select a number for each)
78. What are the negative effects of the project? (tick appropriately)
    1) Displacement of persons -------
    2) Increase in waterborne diseases ---------
    3) Influx of people leading to social vices -------
    4) Others specify
    highly (2) Moderate (3) Least) (select a number for each)
79. How do you think these negative effects can be mitigated? (tick appropriately)
    a. Enough land for resettlement
    b. Health/social education
    c. Others specify
80. If the pipeline passes by your land, are you willing to contribute the land 1. Yes 2. No

Approach and Methodology
Socioeconomic Baseline Survey

Secondary Data Collection and Stakeholders Consultation:

The study shall begin by carrying out a desk study to comprehensively review both secondary data, planning and development reports on Kakamega and Bungoma Counties and the targeted region of Mumias and Kimilili Sub Counties and Townships. The team will undertake a thorough desk review of all the relevant documents, policies, strategies and other related sector documents with an objective of having a clear background understanding of the assignment. Secondary data will also be collected during the desk review. Meetings and visits will be arranged and conducted with relevant offices of the Water departments, Public Health Offices Statistics, Department of Social Services, Youths department, County Commission offices.

Primary Data Collection and Community Meetings

A Participatory approach will be adopted for collecting primary data, and this requires development of the data collection tools. The tools used for primary data was collection will be both qualitative and quantitative tools designed to capture the status of the households before the interventions. Questionnaires will be utilized in collecting quantitative data from target respondents. Key Informant guides, Focused Group Discussions FGD guide and an observation checklist will be utilized in collecting qualitative information from purposively and randomly selected respondents in each of the two project sites.

With the support of the local administrative leaders' community meetings will be organized. The community sensitization meetings/barazas are organized by the local County administration officials in order to initiate community dialogue. Further informal discussions will be held with community members during the FGD.

Sampling Framework for the Survey

In Sampling we are proposing to use the following methods: -

a) Purposeful / convenience sampling
the sample will be picked from all the lowest administrative unit which may be in Estate /sub location in MumIas and Kimilili target area in order to have representatives drawn from the whole project area.

b) Random sampling

To access the members of the community we shall use a simple random sampling method after obtaining the relevant information at literature review stage. Random and convenient sampling will be used when conducting the interviews.

Specific Evaluation Methods for data collection to be used is as outlined below: -

Structured interviews
- Structure interviews will be used to collect data from Households

Semi structured Interviews

Semi structured interviews will be used with key informants and focused group discussions.
- Key informant include Water departments, Public Health Offices Statistics, Department of Social Services, Youths department

- FGDs will be organized for various target groups like men, women, youths and people with disabilities drawn from project area.

Observations
Non-obtrusive observations will be used together with the other methods to validate information collected. The data collectors will note down key factors observed.

Triangulation and Validation of Data

All data collected will be collected and cleaned ready for analysis. It will be triangulated for accuracy of facts. Appropriate software will be used to analyze the data, from which a report will be written.

THE SURVEY PROCESS

The following process will be adopted by the survey: -

	Activity	**Parties**
2.	Literature Review	SMEC/County Government /LVNWSB
3.	Develop and Review Tools	SMEC
4.	Recruit and train the survey team	SMEC
5.	Field work /pretest the tools • Household Interview • Key informants' interviews • Observations • Focused Group Discussions	• SMEC • GOK - Education - Social services - Health - Local administrators - Water/sanitation • CBOs/CSOs
6.	Data Analysis, Collation and Report Writing	SMEC
8.	Final Reports Presentation	SMEC/ LVNWSB

HEALTH INSTTITUTION QUESTIONNAIRE: WATER SUPPLY & SEWERAGE CONNECTIVITY

PROJECT NAME: FEASIBILITY STUDY, DETAILED DESIGN AND PREPARATION OF TENDER DOCUMENTS
CLIENT RIFT VALLEY WATER WORKS DEVELOPMENT AGENCY

A. IDENTIFIERS

1. Institution Name: (**insnm**)_____	**2.** Institution ID: (**insid**) _____ (*Enumerator: This will be a UNIQUE identifier of the Institution and should NOT be repeated either by you or your teammates)*
3. Project area**:** **(par)**_____	**4.** Date of Interview**:** **(date_intvw**)____/____/_____ *(Write the date in the format DD/MM/YYYY)*
5. Type of health facility ; (**hlthtyp)** _____	**6.** Ownership of institution **(insown): _____**
7. Name of respondent**:** (**resp_nm)**_____ *(Give three names if not available give first and surname)*	**8.** Telephone No**:** **(tel)**_____ *(Official phone contact to reach facility/respondent)*
9. Position of Repsondent: **(rspps)**_____	**10.** Gender of the respondent: (**rspgdr)**: _____ *(Enumerator: observe do not ask)*
11. County **(county)** _____	**12.** Sub-county**: (s_county)**_____
13. Ward **(ward)**_____	**14. Sub-location: (s_loc)**_____
15. Village**: (vil)** _____	
16. Enumerator Name**: (enm)**_____	**17.** Enumerator ID**: (enumid)**_____
18. Supervisor Name**: (snm)**_____	**19.** Supervisor ID**: (svid)**_____

Position (**rspps)** 1=Facility in-charge, 2=Facility administrator, 3=Facility assistant, 4=Owner, 5=Nurse in-charge, 6=Nurse, 7=Matron, 8=Lab technician, 9=Stores in-charge, -222=Other, specify
Facility type (**hlthtyp):** 1=Community (level1), 2=Dispensary (level2), 3=Healthcentre (level3), 4=County referral (level4) 5=Regional referral (level5) 6=National referral (level6)
Ownership (**insown):** 1=Government, 2=FBO/NGO, 3=private 4=Community -222=other (specify)

B. **WATER ACCESS AND SUPPLY**

20. What is the main source of drinking water for the members of your household? w**dsrc**_____

1=No source
2=Protected pipe water supply
3=Protected well/spring
4=Rainwater
5=Unprotected well/spring
6=Packaged bottled water
7=Tanker, truck or cart
8=Surface water (lake, river, stream)
-222=Other (specify)
-444=Do not know

21. Is water outlet from this main source available on site within 500 meters of the facility, or beyond 500 meters of facility? 1=within premise 2=outside within 500 metres 3=outside beyond 500 metres **wtdst**_____

22. If 21 not =1, what is the average walking time to and from the main source of water (including waiting time) **wttm** _____

23. How much water does the facility consume per day from the **main source** for drinking **only**? **wtltr** _____

24. Does the main source of water provide enough water for all the health facility's' needs when it is fully functional? **wtngh**_____
1=No, never enough water, 2=Yes, sometimes, only seasonally, 3=Yes, enough water all year, -444=Do not know

25. Does the health facility have a supplementary source of water (besides the main one)? 1=yes 0=no **wtsp**_____

26. If Yes, what is the type of the supplementary source of water for the facility? **wtspl**_____
1=Protected pipe water supply, 2=Protected well/spring, 3=Rainwater, 4=Unprotected well/spring, 5=Packaged bottled water, 6=Tanker, truck or cart, 7=Surface water (lake, river, stream), -222=Other (specify)

27. Are those water sources (main and supplementary) used for drinking purposes? 1=yes 0=no **wtspd**_____

28. Does the facility treat drinking water from the main source? 1=Yes 0=No **wttrt**_____

29. If Yes what methods are used do to purify water? **wttrt_y_hw**___
1=Filtration, 2= Disinfection by boiling, 3=Disinfection by chlorine, 4=Other (specify)

30. If No why does the facillity not treat water? **wttrt_n**_____
1=Drinking water source is considered safe, 2=Health facility does not have filter or purification materials, 3=None of the staff know how to treat the water, 4=Other (specify)

31. What is the source of **drinking** water for the health facility staff? **wtdsrc**_____
1=Available health facility water, 2=Purchased bottled water, 3=Staff carry own water, -222=Other (specify)

32. In total, do all the available water sources provide enough water for all the needs (drinking, food preparation, personal hygiene, medical activities, cleaning and laundry) of the health facility throughout the year? **wtngh**_____
1=No, never enough water, 2=Yes, enough water all year for general purposes other than drinking, 3=Yes, enough water all year for

all purposes, including drinking, -444=Do not know

33. During the past 3 months, how many times was the water supply from the main source interrupted? **wtct_____**
1= no interruption, 2= 1- 10 times, 3=Over 10 times

34. Is there routinely a time of year when the facility has a severe shortage of water? 1=yes 0=no **wtsht_____**

35. Do you pay for water 1=yes 0=no **wtpy_____**

36. If yes above what is the average cost of the monthly water charges (KES) **wtpymt_____**
1=100-500, 2=501-1000, 3=1001-5000, 4=above 5001, -444= Don't know

37. If not connected, would the facility wish to be connected to a water supply 1=yes 0=no **wtcnct_____**

38. If Yes what would be your proposed budget for water monthly (Ksh) **wtbdgt_____**
1= 100-500, 2= 501-1000, 3=1001-5000, 4= above 5001, -444= Don't know

C. SANITATION AND HYGIENE

39. What **type and number** of toilet facilities does the facility have?

tlytyp	cnt	tlytyp	cnt
1=No toilet/latrine		5=Pit latrines without slab	
2=Flush/pour flush toilets		6=Hanging latrine	
3=Pit latrines with slab		7=Bucket latrines	
4=Composting toilets		8=Other (specify)	

40. Are there separate toilets/latrines for both men and women/girls (at least one for each group) 1=Yes 0=No	**tltspt_____**
41. How are faecal wastes from the toilets/latrines managed? 1=Flush to sewer, 2=Onsite storage in septic tank, 3=Onsite storage in latrine, 4=Other (specify), -444=Do not know	**swrfc_____**
42. If 41 above=1 or 2, how much do you pay for exhauster services? 1= 100-500, 2= 501-1000, 3=1001-5000. 4= above 5001	**swrexh_____**
43. Are you connected to a sewage system? (If 41 not=1) 1=Yes 0=No	**swr_____**
44. If yes, do you pay for sewrage? 1=yes 0=no	**swrpy___**
45. If paying for sewerage, how much do you pay for sewerage services per month 1=Ksh 0 -100 2=Ksh 101-200 3=Ksh 201-300 4=Ksh 301-400 5=Ksh 401 & Above	**swrpy_mt__**
46. If 43=0 would the facility wish to be connected to a sewerage system? 1=Yes 0=No	**swrcnct**

47. If 46=1, what would be your proposed budget for sewerage disposal monthly (KES) 1= 100-500, 2= 501-1000, 3=1001-5000, 4= above 5001, -444= Don't know	**swrbdgt_____**

48. Are floors, surfaces and toilets/latrines of the health facility cleaned on a routine basis? 1=Yes 0=No	**hgncln**_____
49. If Yes, at what frequency are the floors, surfaces and toilets/latrines cleaned?	**hgnfrq____**
50. How is wastewater for cleaning the ward floors and toilet floors in the health facility disposed? 1=Flush to sewer, 2=Onsite storage in septic tank, 3=Onsite storage in latrine, -444=Do not know, -222=Other (specify)	**hgnwf**_____
51. How is wastewater from cleaning and washing of health facility clothes disposed? 1=Flush to sewer, 2=Onsite storage in septic tank, 3=Onsite storage in latrine, -444=Do not know, -222=Other (specify)	**hgnwc**_____
52. Is there a functioning system in place to adequately drain rainwater away from the health facility and health center grounds? 1=yes 0=no -444=do not know	**hgnsys**_____

D. DISEASES

53. Has the facility recorded any cases of the water borne diseases, under each of the following age categories, for the last 3 months?

Enter number sick or zero if none for that category

Age Category	Fever	Headache	Constant cough	Vomiting	Panting/ wheezing	Stomach ache	Bloody urine	Bloody stool	Refuse to eat/feed	Body itching	Eye infection
0-1 Years											
2-5 Years											
6-14 Years											
15 years and above											

54. In the past 12 months did any member of your household suffer from these diseases? 1=Yes 0=No

Disease	Response
a. Diarrhea	
b. Typhoid	
c. Cholera	
d. Dysentery	
e. Hepatitis	
f. Anaemia	
g. Brucellosis	
h. Amoebiasis	
i. Worms	
j. Respiratory disease	
k. Other (specify)	

E. **GENERAL COMMENTS & REMARKS**

55. What are the major challenges/constraints in water, sanitation and hygiene that your facility has been facing? **cmmntwsh**_____

_____

_____

_____

_____

_____

56. What are your suggested solutions to address/meet the above major challenges? **Cmmntwshs**_____

_____

_____

_____

_____

_____

EDUCATION INSTTITUTION QUESTIONNAIRE: WATER SUPPLY & SEWERAGE CONNECTIVITY

PROJECT NAME: FEASIBILITY STUDY, DETAILED DESIGN AND PREPARATION OF TENDER DOCUMENTS
CLIENT RIFT VALLEY WATER WORKS DEVELOPMENT AGENCY

A. IDENTIFIERS

1. Institution Name: (**insnm**)_____

2. Institution ID: (**insid**) _____
(*Enumerator: This will be a UNIQUE identifier of the Institution and should NOT be repeated either by you or your teammates)*

3. Project area**:** **(par)**_____

4. Date of Interview**:** **(date_intvw**)____/____/_____
(Write the date in the format DD/MM/YYYY)

5. Type of education institution ; (**insttyp)** _____

6. Ownership of institution **(insown):** _____

7. Female student population: **(stdf)** _____

8. Male stduent poulation: **(stdm)** _____

9. Name of respondent**:** (**resp_nm)**_____
(Give three names if not available give first and surname)

10. Telephone No**:** **(tel)**_____
(Official phone contact to reach facility/respondent)

11. Position of Repsondent: **(rspps)**_____

12. Gender of the respondent: (**rspgdr)**: _____
(Enumerator: observe do not ask)

13. County **(county)** _____

14. Sub-county**: (s_county)** _____

15. Ward **(ward)**_____

16. Sub-location: **(s_loc)**_____

17. Village**: (vil)** _____

18. Enumerator Name**: (enm)**_____

19. Enumerator ID**: (enumid)**_____

20. Supervisor Name**: (snm)**_____

21. Supervisor ID**: (svid)**_____

Position (**rspps)** 1=Institution in-charge, 2=Institution administrator, 3=Insntitution deputy, 4=Owner, 5=teacher in-charge, 6=teacher, 7=administrative staff, 8=Technician -222=Other, specify
Facility type (**insttyp):** 1=Community (level1), 2=Dispensary (level2), 3=Healthcentre (level3), 4=County referral (level4) 5=Regional referral (level5) 6=National referral (level6)
Ownership (**insown):** 1=Government, 2=FBO/NGO, 3=private 4=Community -222=other (specify)

B. WATER ACCESS AND SUPPLY

22. What is the main source of drinking water for the members of your household? w**dsrc**_____

1=No source
2=Protected pipe water supply
3=Protected well/spring
4=Rainwater
5=Unprotected well/spring
6=Packaged bottled water
7=Tanker, truck or cart
8=Surface water (lake, river, stream)
-222=Other (specify)
-444=Do not know

23. Is drinking water from the main source currently available at the school? 1=yes 0=no **wsvlb**_____

24. Does your insttitution have a water storage container for drinking water? 1=yes 0=no **wsstrc**_____

25. If 24=yes, how is drinking water usually stored at your school?
1=Elevated water tank 2=Plastic water tank 3=Masonry water tank 4=Plastic water bottles -222= Other specify **wsstrd**_____

26. If 24=no, why does your school not have a water storage container for drinking water?
1=Water always available 2=Water storage containers are too expensive or unaffordable 3=The pupils carry their own drinking water -222= Other specify **wsstrn**_____

27. Does the school do anything to the water from the main source to make it safe to drink? 1=yes 0=no **wstrt**_____

28. If Yes, what treatment method is used?
1=Filtration 2=Boiling 3=Chlorination 4=Solar disinfection (SODIS) 5=Ultraviolet disinfection -222=Other (specify) **wstrtmt**_____

C. SANITATION AND HYGIENE

29. What **type and number** of toilet facilities does the facility have?

tlytyp	cnt	tlytyp	cnt
1=No toilet/latrine		5=Pit latrines without slab	
2=Flush/pour flush toilets		6=Hanging latrine	
3=Pit latrines with slab		7=Bucket latrines	
4=Composting toilets		-222=Other (specify)	

30. If **tlytyp**=2 to where does it flush ?
1=Flush to sewer system 2=Flush to septic tank 3=Flush to pit latrine 4=Flush to unknown place/not sure **swrfls**_____

31. Are you connected to a sewage system? (If 30 not=1) 1=Yes 0=No **sswr**_____

32. If yes, do you pay for sewrage? 1=yes 0=no **swrpy**___

33. If 32=1 how much do you pay for sewerage? (KES)
1=0-1000, 2=Ksh 1001-2000, 3=Ksh 2001-3000, 4=Ksh 3001-4000, 5=Ksh 4001-5000, 6=5001 & above **sswrpy**_____

34. How satisfied are you with the sewerage services available for you?
1=Very satisfied 2=Satisfied 3=Neither satisfied nor dissatisfied 4=Dissatisfied 5=Very dissatisfied **sswrstfd**___

35. If 31=0 would the institution wish to be connected to a sewerage system? 1=Yes 0=No **sswrcnct**

36. If 30=2, is the septic tank emptied? 1=Yes 0=No **sptmpt**____

37. If 36=yes how frequent is the septic tank emptied
1=weekly 2=monthly 3=quarterly 4=when full -444=Don't know **sptfrq**____

38. What is the cost of emptying the septic tank per trip (KES) **sptcst**_____

39. How many student toilets/latrines are currently usable? (Accessible, functional) **tltfnc**_____

40. Are the toilets/latrines separate for girls and boys? 1=Yes 0=No **tltbg**_____

41. How many times per week are the student toilets/latrines cleaned?
1=At least once per day 2=2-4 days per week 3=Once per week 4=Less than once per week **tltcln**_____

42. B.9 Are there handwashing facilities at the school? 1=Yes 0=No **hgnhw**____

43. Are both soap and water currently available at the handwashing facilities?
1=Yes; water & soap 2=Water only 3=Soap only 4=No soap and water available **hgnspw**_____

D. GENERAL COMMENTS & REMARKS

44. What are the major challenges/constraints in water, sanitation and hygiene that your institution has been facing? **csmmntwsh**_____

_____
_____
_____
_____
_____

45. What are your suggested solutions to address/meet the above major challenges? cs**mmntwshs**____

_____
_____
_____
_____
_____

Lake Victoria North Water Service Board

Water Supply and Wastewater Management Services Project for Mumias and Kimilili Townships

STAKEHOLDER INTERVIEW GUIDE

Local Administrator (Chief)

Introduction

The aim of this study is to collect information at household level, community level and from stakeholders for the purposes of Socio economic survey and collection of Baseline information for the water supply and wastewater management services project

Project Knowledge

1. Do you know about the project? When, how did you learn about this project?

Administrative Units

2. How many villages/Estates are there in your sub-location? Can you please give us their names and population numbers?

Village	Population

3. In total how many people are living in this sub-location?
4. Does the number of people in the sub-location fluctuate with seasons? If yes give details of when, how, and why.

5. Which ethnic groups are there in the sub-location? ----------
---
6. What is the approximate size of each group (which is biggest/smallest)? ----------
---
7. Are there any social/cultural/political differences between these groups? ----------
---
8. Are there any disagreements between these groups? If yes, which groups are involved and what are the causes of the disagreements? How are the disagreements resolved?
9. Are there any indigenous communities who are different than the rest of the society and distinctly attached to the geographical areas and natural resources they occupy?
10. How are the decisions made in the sub-location? ----------
---
11. 14. Who are consulted when making decisions? Only elders or any other leaders? ----
---
12. Do you meet with elders regularly or frequently? How many times a month? For which reasons?
13. Have you experienced any disagreements between villages? What are these? How are these resolved?
14. Are there any civil organizations in the sub-location or in the villages (e.g. agriculture related programs ----------)? How do they function, what do they do? ----------
---
15. Apart from government officers are there any traditional leaders (for example clan leaders) recognized and respected in the area? On which subjects do they lead or advice the community?

Settlement patterns and Sewerage project:

1. Has there been migration into the area? Where have these people come from and why? -----
---
2. What are the effects of in migration? (Ask for both positive and negative effects.)
3. Do you think the Sewerage Management project might cause a migration into your sub-location? How do you think this would affect the sub-location? ----------

Livelihoods

1. What are the main livelihoods in this sub-location? Are these seasonal or year-round jobs? -------
---

2. Do people work in their villages, or do they commute to other places for employment? Where do they go to and for which jobs? ----------

3. Do people come from other settlements to work here? What kind of jobs do they do? ----------

4. Do you think the local economy is improving, or is it worsening, why? ----------

5. How do you think the Sewerage Improvement project will affect the livelihoods in this sub-location?..... Do you know if any of these livelihoods would disappear or be adversely affected? Please explain. ----------

6. If you think the sewerage improvement project might have any negative impacts on any livelihoods, how do you think this can be avoided /mitigated? ----------

Land use and Land Ownership

1. Are there any lands that are not registered here? If yes, why? Do you know the size of the unregistered lands? ----------

   How do people generally obtain land here (buying, inheritance, clearing new land)? ----------

   Do all households own their own land? If no, why not? What percentage of the families do not own any land? ----------

2. Are there people who are using government lands? How? ----------
   Do you ever experience conflicts over lands? What are the reasons for these conflicts? How are they resolved? ----------

3. Do you receive any advanced possession (claim of land ownership after 12 years of usage? If yes, how many claims do you receive every year?

4. Do you have any communal lands in this sub-location? How big are they? Who are they managed by? How are they used? ----------

---

Are there people who are using communal lands? How?

5. With the sewerage project do you think it will have a significant impact on the land issues? Do you think any groups might face injustices/difficulties due to the existing land system? Please explain how? ----------

---

If you think any groups might face injustices /difficulties, what can be done to avoid or minimize such cases? ----------

---

Targeting Vulnerable Groups and Gender

1. What percentage of the households is female-headed in your sub location? ----------

---

2. What are the income sources of these households? ----------
   Are they poorer than other households? Why? ----------
   Do they suffer from any discrimination or other social difficulties? What are they? ----------

---

3. What percentages of the households are child-headed in your sub location? ----------

---

4. Are child-headed households taken care of by the relatives? Most of them or few of them are taken care? ----------

5. What are the income sources of child-headed households? ----------

6. Are child-headed households poorer than other households? Why? ----------

7. Do child-headed households suffer from any discrimination or other social difficulties? What are they? ----------

8. Other than these, are there families that are particularly vulnerable in this settlement? Who are they? What do they depend on? What is their percentage in the society? ----------

---

9. Do you think the Sewerage Improvement project might benefit or disadvantage these child-headed or women-headed households or the vulnerable groups you mentioned in the area? Why? ----------If

you think the Sewerage Improvement project might have any negative impacts on these groups, what should be done to avoid/mitigate these impacts? ----------

Education

1. What are the education facilities in this sub-location and ----------
   What are their capacities? ----------
2. What kind of difficulties do you have about facilities or provision of education services and facilities? ----------
   How do you think the Sewerage improvement project will affect the education facilities? What should be done for this?

Health

3. Are there traditional healers in the area? For which health problems and why are they preferred? ----------
4. What kind of difficulties are there about provision of health services? ----------
   ----
   How do you think the sewerage improvement project will affect the health facilities? If negative, what should be done for this? ----------

Infrastructure and Institutions

1. Do you have churches, how many? ----------
2. Do you have mosques, how many? ----------
3. Do you have telephone/postal/internet networks? ----------
4. Do you have an operating police post? If no, where is the closest one? ----------
5. What is the condition of the roads? ----------
6. What are the most commonly used types of transport? ----------
7. How many boreholes (deep wells) do you have? Are they private or common? ----------
8. What is the quality/reliability of these water supplies? Does it change seasonally? How? Why? ----------
   What do you do for the quality of waters? Do you use any filtration or chlorination etc.? ------

Do you have electricity network? In which villages or is it only in the centre? Approximately how many houses have it in your sub-location? ----------

9. Apart from the facilities mentioned above, are there other common facilities/assets in the villages? ----------

10. Do you think any of the common resources will be adversely affected by the project? If yes, please explain how. What do you think should be done to avoid/minimize the adverse effects? ----------

11. Are there any sites/areas/trees/buildings that have a particular cultural/religious/historical importance in the sub-location? If yes, what are they? Where are they? Are there any specific periods when they are particularly significant? ----------
    Is there any risk that this heritage might be affected by the Project? How? What do you think should be done to avoid/minimize the adverse effects? ----------
    Apart from the things we have already discussed do you think the project will have any other positive impacts? ----------

12. Apart from the things we have already discussed do you think the project will have any other negative impacts? What should be done to avoid, mitigate or compensate these impacts? ---
    ----

Name:	
Office Represented:	
Designation:	
Signature	

Lake Victoria North Water Service Board

Water Supply and Wastewater Management Services Project for Mumias and Kimilili Townships

STAKEHOLDER INTERVIEW GUIDE

SUB-COUNTY EDUCATION OFFICER

Introduction

The aim of this study is to collect information at household level, community level and from stakeholders for the purposes of Socio economic survey and collection of Baseline information for the water supply and wastewater management services project

Name:	
Designation:	

1. Please give the number of the following institutions in the township/sub county within project area
    a. secondary schools ----------
    b. Tertiary Institutions ----------
    c. primary schools ----------
    d. others ----------
2. What are the primary school enrollment rates in the project area? – (boys ----------girls ----------)

3. What are the rates for enrollment (for boys ----------and for girls ----------to secondary schools in the project area?

4. What are the rates for enrollment (for boys ----------and for girls ----------to tertiary education institution in the project area?

5. What are the challenges facing the girl child / boy child?

_____

_____

_____

6. What sanitation and waste disposal facilities are used in the institutions?

_____

_____

_____

_____

_____

7. Do you foresee any positive impacts from the proposed Project?
   Yes or No, if yes what impacts do you see
   i. During construction

_____
_____
_____
_____
_____
_____
_____
_____

   ii. During operation

_____
_____
_____
_____
_____
_____
_____

8. Do you foresee any negative impacts from the proposed Project
   Yes or No, if yes what impacts do you see
   iii. During construction

_____
_____
_____
_____
_____
_____
_____
_____

   iv. During operation

_____
_____
_____
_____
_____
_____
_____
_____

9. If your answer No. 7 is Yes, please suggest how the anticipated negative impacts can be mitigated.
   i. During construction

ii. During operation

Lake Victoria North Water Service Board

Water Supply and Wastewater Management Services project for Mumias and Kimilili Townships

STAKEHOLDER INTERVIEW GUIDE
SUB-COUNTY / MEDICAL OFFICER OF HEALTH

Introduction

The aim of this study is to collect information at household level, community level and from stakeholders for the purposes of Socio economic survey and collection of Baseline information for the water supply and wastewater management services project

Name:	
Designation:	

1. What are the top ten common illnesses within the Sub-County specifically the project area?

2. What initiatives are in place to mitigate the spread of the above illnesses?

_____

_____

_____

_____

3. Has there been any change in the types of health problems in this Sub County in the last 5 years? (E.g. new diseases, eradication / improved treatment for other diseases?)

_____

_____

_____

_____

4. What is the status of HIV / AIDs prevalence? in the Sub-county?

_____

_____

_____

5. Which is the most vulnerable group to HIV/ AIDS infections and what is the prevalence rate within these groups?

_____

6. What programs does the department have to deal with HIV/AIDs menace?

_____

_____

_____

7. What is the number of health facilities available in the Sub County? What are the categories and distribution?

Names of Health facilities	Categories and distribution	Population in the Facility Bed Occupancy and Staff

8. What are the services offered in the health facilities?

_____

_____

_____

9. Do you foresee any positive impacts from the proposed Project?
   Yes or No,

   if yes what impacts do you see
   i. During construction

_____
_____
_____
_____
_____
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_____

_____

ii. During operation

_____
_____
_____
_____
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_____

10. Do you foresee any negative impacts from the proposed Project?
    Yes or No,
    if yes what impacts do you see
    iii. During construction

_____
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iv. During operation

_____
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11. If your answer No. 7 is Yes, please suggesting how the anticipated negative impacts can be mitigated.
    i. During construction

_____
_____
_____
_____
_____

ii. During operation

_____
_____
_____
_____

Appendix D Public Meetings List of Attendants and Minutes

MINUTES OF PUBLIC CONSULTATION MEETING HELD ON 29TH JULY 2019 AT LUMINO VILLAGE-MUMIAS TOWNSHIP SUB LOCATION FOR THE PROPOSED MUMIAS TOWN SEWERAGE PROJECT, KAKAMEGA COUNTY.

PRESENT

1. Jason Opanda, SMEC
2. Everlyne Mbithi, SMEC
3. Charles Chitect , KACWASCO- Area Water Manager Mumias Town
4. Suleiman Matiro Chief Nabongo location Mumias
5. Local community **(Attendance sheet attached)**

MIN 01/07/2019: PRELIMINARIES.

The meeting began with a word of prayer from one of the community member. The Village Elder welcomed members of the public to the meeting and led the meeting in introductions, then ushered in the Chief. The Chief appreciated all for comming for the meeting and informed the them the purpose for the meeting as being a public participation for a proposed sewage project for Mumias town. The Chief then handed over the meeting to the consultants team.

MIN 02/07/2019: OPENING REMARKS.

Mr. Charles Chitech gave a brief overview of the purpose of the meeting and emphasized the necessity of public participation in projects that intent to benefit the community. In his remarks Mr. Charles noted that Mumias town is well supplied with water even though there are challenges in distribution efficiency; he encouraged the community members to apply for the water and get connected. He then welcomed the SMEC officials to continue and break down the details of the business of that day.

MIN 03/07/2019: PROJECT OVERVIEW.

Jason Opanda thanked the participants for turning up for the meeting; he clarified the purpose of the consultative meeting as being both a disclosure of the proposed project and a means to get the community's' views of the proposed project as well as get to know the concerns associated with the proposed project in the particular location prior to actual implementation. The meeting was informed that SMEC is an Engineering consultancy firm that had been contracted to undertake Feasibility study, detailed design and preparation of tender documents for Mumias-Kimilili sewerage project by Lake Victoria North Water Services Board (LVNWWDA), through the Rift Valley Water Services Board (RVWWDA)

MIN 04/07/2019: PRESENTATION ON THE EXPECTED PROJECT IMPACTS

Jason Opanda gave a presentation of the anticipated positive and negative environmental and social impacts during construction and operation phases of the proposed project the potential impacts discussed include, Creation of employment, improved sanitation and hygiene, improved living standards, odors at the treatment plant, destruction of property along the main sewer trunk. At this point Jason explained that the main purpose of the meeting was to get to listen to the concerns and reactions from the meeting participants he then requested that they present their views in order by raising one's hand then mentioning their name then record their question, concern or comment.

MIN 05/07/2019: CONCERNS RAISED AND RESPONSES

*Table No. 1: Issues raised and responses made during the **Public Consultation Meeting**, held on 29th July 2019, at Lumino village, Mumias town.*

No.	Concern/Comment/Question	Response/Recommendation
1	Mr. Joseph Ndombera Tumbo – Chairman of Mujini Development supported the proposed project stating that it will contribute to improved sanitation within Mumias town.	
2	Mr. Joseph Musa was of the opinion that water should be distributed to every household prior to implementation of the proposed sewer project.	The Water Manager Mr. Charles Chitechi informed the meeting that the water is available in Mumias town and it is the responsibility of the individual consumer to pay for connection services.
3	Mr. Richard Soi expressed acceptance to the proposed sewer project for Mumias town.	
4	Mr. Ramadhan Kalande stated that majority of the residents in Nubian within Mumias belong to the Islamic religion hence they would appreciate connection to sewer and availability of water at all times	
5	Mrs. Njemia Alli said that the proposed project was good and needed to know if the affected properties will be compensated for, she also inquired if a pit latrine can be connected to the sewer line.	Affected properties along the project line would be compensated for according to the prevailing market prices. The pit latrines cannot be connected to the sewer line but the owners can make improved sanitation facilities that can connect to the sewer line.
6	Mr. Ismael Hussein Mambo inquired about the location of the treatment ponds He also needed to know if there is damage to the house and part of the land does the compensation cover both land and assets or land only.	The meeting was informed that the engineers will inform the location of the treatment ponds after preliminary survey of the town. On compensation the meeting was informed that both land and the affected assets will be valued in cases where there will be encroachment to private property by the proposed project.
7	Mr. Alli Fariga expressed appreciation for the proposed sewerage project for Mumias town. He inquired about the river in which the treated waste water will flow to.	The meeting was informed that the likely treated waste water discharge recipient will be river Nzoia.

8	Mr. Hussein Yasid encouraged the participants to focus on the positive impacts of the proposed sewer project. He stated that waste water treatment will increase the opportunities for recycling and reuse within the area.	
9	Mrs. Farida Mumia commented that the land parcels in Mumias town are small hence the proposed project should create some jobs for the Youth for them to gat a means of living.	

MIN/O6/07/2019: CONCLUDING REMARKS

The Chief thanked all for coming and participating in the meeting, he requested that they should support other projects in the same manner as they did on that day. The meeting ended at 1:00PM after a word of prayer from one of the community members.

MINUTES OF PUBLIC CONSULTATION MEETING HELD ON 30TH JULY 2019 AT MATUNGU LOCATION FOR THE PROPOSED MUMIAS TOWN SEWERAGE PROJECT, KAKAMEGA COUNTY.

PRESENT

1. Jason Opanda, SMEC
2. Everlyne Mbithi, SMEC
3. Eng. Kufwoyi Mark Shaban, Matugu water supply- Area Water Manager Mumias Town
4. Angela Adala Assistant Chief Matungu sub location
5. Local community **(Attendance sheet attached)**

MIN 01/07/2019: PRELIMINARIES/OPENING REMARKS.

The meeting began with a word of prayer from one of the community members present. The assistant Chief welcomed participants to the public meeting and led the meeting in introductions. In her opening remarks the assistant chief stated that matungu Location was previously part of Mumias town administration. It then cut out and is now in the Matungu sub county. According to the chief the population of matungu sub location is approximately 11830 and the schools in the sublocation are Marinda primary, Kholera Primary and Kholera secondary schools. Mayoni market has piped water connection in 2 households only and there is no sewarage system in the location. The average cost of a 20 litres jerican of water during dry seasons was 25 shilllings, sources of water in the area include shallow wells, springs and rivers. The Chief then ushered in the SMEC team to proceed.

MIN 02/07/2019: PROJECT OVERVIEW.

Jason Opanda thanked the participants for turning up for the meeting; he clarified the purpose of the consultative meeting as being both a disclosure of the proposed project and a means to get the community's' views of the proposed project as well as get to know the concerns associated with the proposed project in the particular location prior to actual implementation. The meeting was informed that SMEC is an Engineering consultancy firm that had been contracted to undertake Feasibility study, detailed design and preparation of tender documents for Mumias-Kimilili sewerage project by Lake Victoria North Water Services Board (LVNWWDA), through the Rift Valley Water Services Board (RVWWDA)

MIN 03/07/2019: PRESENTATION ON THE EXPECTED PROJECT IMPACTS

Jason Opanda gave a presentation of the anticipated positive and negative environmental and social impacts during construction and operation phases of the proposed project the potential impacts discussed include, Creation of employment, improved sanitation and hygiene, improved living standards, odors at the treatment plant, destruction of property along the main sewer trunk. At this point Jason explained that the main purpose of the meeting was to get to listen to the concerns and reactions from the meeting participants he then requested that they present their views in order by raising one's hand then mentioning their name then record their question, concern or comment.

ATTENDANCE LIST

PROJECT NAME:	FEASIBILITY STUDY, DETAILED DESIGN AND PREPARATION OF TENDER DOCUMENTS FOR MUMIAS – KIMILILI SEWERAGE PROJECT
CONTRACT No.	RVWSB/LVN/KTSWSSP/C/MUMIAS – KIMILILI/2018 - 2019
CLIENT	RIFT VALLEY WATER WORKS DEVELOPMENT AGENCY

TOWN... Mumias (Nabongo Location) ..... DATE... 29/07/2019 .....

No.	NAME	CONTACT	SIGN
1	SULEIMAN O. MATIRO	0713812016	
2	Ali Farichala	0714116728	
3	Adija Chitechi	0706 35890	
4	Farida Munyendo	0712191191	
5	ZARA RAMADHAN	0752967951	
6	ISMAIL W. MAMBO	0721569136	
7	ABUBAKAR ABDI	07 96769740	
8	JEMIAH K. ALI	0790063511	
9	Ibrahim Kalhareff	0740044059	
10	ASHA MOHAMED	072.....	
11	Zubeda A. Ahmed	0710593316	
12	Robert Opoloto	11	
13	Hussein Yasin	0745120146	
14	Ramadhan Kalande	0713047711	
15	Richard K. Sioi	0728433964	
16	Joseph Musa	0728391252	
17.	Hunia Mohammed	0715 619372.	
18.	Zamzam Ahmed		

ATTENDANCE LIST

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CLIENT	RIFT VALLEY WATER WORKS DEVELOPMENT AGENCY

TOWN.. MUMIAS NABONGO LOCATION. DATE.....29/07/2019.....

No.	NAME	CONTACT	SIGN
19.	JOSEPH NDOMBERA	0714961330	
20	Halima Yusuf	0716842002	
21.	IBRAHIM OPARA KWEYU	0727919061	
22.	NANCY O. ESHITEMI	0702033876	
23	HADIJA CHITECHI	0706358909	
24.	Sakina Suleiman	0	Sakina
25.	Abdallah Shaban Njoroge	0701543793	
26	Mohammed cloka	0728661123	cloka
27	Phamel Nyoti	0729699123	
28	ABEMO SAMWEL	0740079155	Samuel
29	FREDRICK DUMA	0712829061	
30	Abdu Abubakar	0798769740	
31	Hassan Ali		
32	Zahara B. Ramadhan	0710593316	
33	Shaban Tabu	0710555572	
34	Ali JUMA	0713674875	
35	Geoffrey Sagal	0768434950	
36	Esther Mbone	0707244505	

ATTENDANCE LIST

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CONTRACT No.	RVWSB/LVN/KTSWSSP/C/MUMIAS – KIMILILI/2018 - 2019
CLIENT	RIFT VALLEY WATER WORKS DEVELOPMENT AGENCY

TOWN... MUMIAS ..... DATE... 29/07/2019 .....

MABONGO LOCATION

No.	NAME	CONTACT	SIGN
37	Umi K. Ramachan	0716224004	
38	Lydia A MUSIKO		
39	Chitechi Charles	0723898195	
40	EMMANUEL KOMBO	0716027974	

FEASIBILITY STUDY, DETAILED DESIGN AND PREPARATION OF TENDER DOCUMENTS FOR MUMIAS - KIMILILI SEWERAGE PROJECT

PUBLIC CONSULTATION FORM

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Participation of interested and affected parties in the environmental and social impact assessment (ESIA) is a requirement under Environmental Management and Coordination Act, 2015. The Consultant seeks your views of the proposed project in the sections outlined below.

1. **Respondent details ((Please provide above details for the purpose of authentication)**

Name:	Uma H. Ramadhan
Contact:	0716224004
Location/Sublocation:	
Designation:	
ID No	20622570

2. **What are the current practices of human waste disposal? Are they Sartisfactory?**

The Current Practice of human Waste is not good

3. **Negative Impacts**

What impacts do you think will result from the proposed project in terms of:

Aspect	-ve	+ve	Comments
Health		✓	Health wise will be good b.coz of the sanitation
Employment		✓	Atleast the youth will not be idoll
Business Income		✓	It will bring the good business b-coz of good environment
Air pollution			We need to stray in good environment

Signature: _____ Date 29/07/19

FEASIBILITY STUDY, DETAILED DESIGN AND PREPARATION OF TENDER DOCUMENTS FOR MUMIAS - KIMILILI SEWERAGE PROJECT

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1. **Respondent details ((Please provide above details for the purpose of authentication)**

Name:	IBRAHIM OPARA ICWE40
Contact:	0727919061
Location/Sublocation:	NIABONGO LOCATION/TOWNSHIP SUBLO.
Designation:	BISHP. CHAIRMAN/ WANYUMBA KUMI COMMITT
ID No	5304345

2. **What are the current practices of human waste disposal? Are they Sartisfactory?**

Satisfactory.

3. **Negative Impacts**

What impacts do you think will result from the proposed project in terms of:

Aspect	-ve	+ve	Comments
Health			At least the health will improve.
Employment			Jobless will have employed.
Business Income			Mitumba.
Air pollution			

Signature: _____ Date 29/7/2019

FEASIBILITY STUDY, DETAILED DESIGN AND PREPARATION OF TENDER DOCUMENTS FOR MUMIAS - KIMILILI SEWERAGE PROJECT

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1. **Respondent details ((Please provide above details for the purpose of authentication)**

Name:	NANCY O. ESHIEMI
Contact:	0702033876
Location/Sublocation:	MABONGO / TOWNSHIP SUBLOCATION
Designation:	RESIDENCE IN THE AREA
ID No	23775536.

2. **What are the current practices of human waste disposal? Are they Sartisfactory?**

— Yes they are Sartisfactory.

3. **Negative Impacts**

What impacts do you think will result from the proposed project in terms of:

Aspect	-ve	+ve	Comments
Health		✓	There will be improvement
Employment		✓	Employment will be available.
Business Income			Fish manger.
Air pollution			

Signature: _____ Date 29/7/2019.

FEASIBILITY STUDY, DETAILED DESIGN AND PREPARATION OF TENDER DOCUMENTS FOR MUMIAS - KIMILILI SEWERAGE PROJECT

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1. Respondent details ((Please provide above details for the purpose of authentication)

Name:	JOSEPH NABOMBERA TUMBO
Contact:	0714961330
Location/Sublocation:	Loc. NABONGO S/L TOWNSHIP
Designation:	OPINION LEADER
ID No	1136572

2. What are the current practices of human waste disposal? Are they Sartisfactory?

- Pit latrines
- Not sartisfactory

3. Negative Impacts

What impacts do you think will result from the proposed project in terms of:

Aspect	-ve	+ve	Comments
Health		✓	Project affected pers compasation
Employment		✓	Use the locals-Unskled labour
Business Income		✓	Will promote business income
Air pollution	✓		Treatment at the final end

Signature: _____ Date 29/7/2019

FEASIBILITY STUDY, DETAILED DESIGN AND PREPARATION OF TENDER DOCUMENTS FOR MUMIAS - KIMILILI SEWERAGE PROJECT

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1. **Respondent details ((Please provide above details for the purpose of authentication)**

Name:	Abdallah shaban NGIRIMO DEPUTY YOUTH LEADER
Contact:	0701543793 / KUBIAN LUMINO
Location/Sublocation:	NABONGO / TOWNSHIP
Designation:	DEPUTY YOUTH LEADER LUMINO
ID No	28385374 / 28385374

2. **What are the current practices of human waste disposal? Are they Sartisfactory?**

NO

3. **Negative Impacts**

What impacts do you think will result from the proposed project in terms of:

Aspect	-ve	+ve	Comments
Health		✓	Good health no disease
Employment		✓	Youth employment and residents
Business Income		✓	improve more business
Air pollution		✓	best enviroment no diseases

Signature: _____ Date 29/7/2019

FEASIBILITY STUDY, DETAILED DESIGN AND PREPARATION OF TENDER DOCUMENTS FOR MUMIAS - KIMILILI SEWERAGE PROJECT

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1. **Respondent details ((Please provide above details for the purpose of authentication)**

Name:	Richard Kimatwai Soi
Contact:	0728433964
Location/Sublocation:	Township sub-location
Designation:	
ID No	0549519

2. **What are the current practices of human waste disposal? Are they Sartisfactory?**

They are not satisfactory. dispersed anyhowly

3. **Negative Impacts**

What impacts do you think will result from the proposed project in terms of:

Aspect	-ve	+ve	Comments
Health		✓	some measures have been taken as per the participation by the consultants.
Employment		✓	Youths in the community will get employment opportunities.
Business Income		✓	It will not affect my business
Air pollution	✓		It will affect though very low impact.

Signature: _____ Date 29/7/19

FEASIBILITY STUDY, DETAILED DESIGN AND PREPARATION OF TENDER DOCUMENTS FOR MUMIAS - KIMILILI SEWERAGE PROJECT

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1. **Respondent details ((Please provide above details for the purpose of authentication)**

Name:	Phanuel Nyoti
Contact:	0729699123
Location/Sublocation:	Nabongo / Township
Designation:	Resident
ID No	31696244

2. **What are the current practices of human waste disposal? Are they Sartisfactory?**

3. Negative Impacts

What impacts do you think will result from the proposed project in terms of:

Aspect	-ve	+ve	Comments
Health		✓	It will creat job
Employment			
Business Income			
Air pollution			

Signature: _____ Date 29/7/2017

FEASIBILITY STUDY, DETAILED DESIGN AND PREPARATION OF TENDER DOCUMENTS FOR MUMIAS - KIMILILI SEWERAGE PROJECT

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1. Respondent details ((Please provide above details for the purpose of authentication)

Name:	HUSSEIN YATIN KWEREBE
Contact:	0745120146
Location/Sublocation:	Township Sublocation
Designation:	
ID No	37456875

2. What are the current practices of human waste disposal? Are they Sartisfactory?

No. They are not satisfactory because it is being disposed anyhowly without considering peoples health and environmental impact.

3. Negative Impacts

What impacts do you think will result from the proposed project in terms of:

Aspect	-ve	+ve	Comments
Health		✓	because there are some measures we have being told that will be taken to curb it
Employment		✓	youths in the community will get employment opportunities
Business Income		✓	It will not affect it because affected people will be compensated. Interms of land may be there will be destruction.
Air pollution		✓	I think there will be low effect though not completely curbed as per the measures told

Signature: ~~HY~~ Date 29/07/19

ATTENDANCE LIST

PROJECT NAME:	FEASIBILITY STUDY, DETAILED DESIGN AND PREPARATION OF TENDER DOCUMENTS FOR MUMIAS – KIMILILI SEWERAGE PROJECT
CONTRACT No.	RVWSB/LVN/KTSWSSP/C/MUMIAS – KIMILILI/2018 - 2019
CLIENT	RIFT VALLEY WATER WORKS DEVELOPMENT AGENCY

TOWN. MATUNGU(MAYONI) DATE. 30/07/2019

No.	NAME	CONTACT	SIGN
1	RAJAB WABUTI	0712303547	[signature]
2	HASSAN ABUTETSO	0727473892	[signature]
3.	PATRICK MUSALA	0718529946	[signature]
4	PHILISTER NYENDE	0710961712	[signature]
5	ANTONINA AKELO	0706074209	[signature]
6	JOTHAM L. KARANI	0723306052	[signature]
7	RUKIYA ATIENO	0791433078	[signature]
8	VINCENT KHAMALAH	0704411174	[signature]
9.	GAUDENCIA YAMBOKO	0711136350	[signature]
10	EZEKIAH RAPANDO	0790342672	[signature]
11	IBRAHIM SHIUNDU	0700885673	[signature]
12	PETER SHIBIA	07143049	[signature]
13	BEATRICE OUMA	0707554154	[signature]
14	SHABANI ORWORI	0726490012	[signature]
15	EGLAY MALOBA	0718748947	[signature]
16	SALIMA TOLOYI	0734314875	[signature]
17	ALIMA OLUMU	0718311497	
18	TITUS WESONGA	0714883213	[signature]

19. FRANCIS NYANGWESO 0715824199 [signature]
20. BENATANDA CHITECHI 07 [signature]
21. Lilly Wakhungu 0711582591 Lilly
22.

ATTENDANCE LIST

PROJECT NAME:	FEASIBILITY STUDY, DETAILED DESIGN AND PREPARATION OF TENDER DOCUMENTS FOR MUMIAS – KIMILILI SEWERAGE PROJECT
CONTRACT No.	RVWSB/LVN/KTSWSSP/C/MUMIAS – KIMILILI/2018 - 2019
CLIENT	RIFT VALLEY WATER WORKS DEVELOPMENT AGENCY

TOWN....MATUNDA (MAYONI)..... DATE....30/07/2019.....

No.	NAME	CONTACT	SIGN
22.	VIOLET MURANDA	0712716263	
23.	AMINA HUSSEIN	—	
24.	Eng. Mufungi Mark Shaban	0726822247	
25.	ANGELA E. ADALA	0715223399	

FEASIBILITY STUDY, DETAILED DESIGN AND PREPARATION OF TENDER DOCUMENTS FOR MUMIAS - KIMILILI SEWERAGE PROJECT

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1. Respondent details ((Please provide above details for the purpose of authentication)

Name:	KUFWOYI MARK SHABAN (Eng)
Contact.	0726822247.
Location/Sublocation:	MATUNGU
Designation:	WATER SERVICES MANAGER.
ID No	11737428

2. What are the current practices of human waste disposal? Are they Sartisfactory?

Current practices: pit latrine and septic tanks.
(b) The practices are not satisfatory. There is need for sewerage system disposal.

3. Negative Impacts

What impacts do you think will result from the proposed project in terms of:

Aspect	-ve	+ve	Comments
Health		✓	Health of the environs shall improve
Employment		✓	Ramil and non-Ramil shall benefit
Business Income		✓	modern Sanitary facilities shall be sited inducing creation of businesses.
Air pollution		✓	Smell and stench shall be reduced

Signature: _____ Date 30/7/2019.

Appendix E Pictorial Presentation

1. Meeting at Lumino, Nabongo Location

2. Meeting at Mayoni, Matungu Location

local people
global experience

SMEC is recognised for providing technical excellence and consultancy expertise in urban, infrastructure and management advisory. From concept to completion, our core service offering covers the life-cycle of a project and maximises value to our clients and communities. We align global expertise with local knowledge and state-of-the-art processes and systems to deliver innovative solutions to a range of industry sectors.

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