**THE REPUBLIC OF KENYA**

**CENTRAL RIFT VALLEY WATER WORKS DEVELOPMENT AGENCY (CRVWWDA)**

# KENYA TOWNS SUSTAINABLE WATER SUPPLY AND SANITATION PROGRAMME (KTSWSSP)

## CONTRACT No. RVWWDA/LVN/KTSWSSP/C/KITALE/2019-2020

*Bidii WWTP*

*Machinjoni WWTP*

## FEASIBILITY STUDY, PRELIMINARY AND DETAILED DESIGN AND PREPARATION OF TENDER DOCUMENTS FOR KITALE TOWN SEWERAGE SYSTEM

# ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY (ESIA) REPORT"


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# "DOCUMENT CONTROL"

# KENYA TOWNS SUSTAINABLE WATER SUPPLY AND SANITATION PROGRAMME (KTSWSSP)

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CES

**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) STUDY REPORT**

## VERSION 02

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# FEASIBILITY STUDY, PRELIMINARY AND DETAILED DESIGN AND PREPARATION OF TENDER DOCUMENTS FOR KITALE TOWN SEWERAGE SYSTEM

# ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) STUDY REPORT

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| | |
|---|---|
| ASK | Agricultural Society of Kenya |
| AfDB | African Development Bank |
| BOD | Biological Oxygen Demand |
| CRVWWDA | Central Rift Valley Water Works Development Agency |
| C-ESMP | Construction Environment and Social Management Plans |
| DOSH | Directorate of Occupational Health and Safety |
| DMP | Dust Management Plan |
| GHG | Green House Gases |
| EA | Environmental Assessment |
| EHS | Environment Health and Safety |
| ESIA | Environmental and Social Impact Assessment |
| ESMMP | Environment and Social Management & Monitoring Plan |
| EMSF | Environmental and Social Management Framework |
| EMCA | Environmental Management and Coordination Act |
| ESIA | Environmental and Social Impact Assessment |
| ESHS | Environmental, Social Health and Safety Guidelines |
| ERP | Emergency Response Plan |
| ESAAP | Environment and Social Assessment Action Plan |
| IRR | Internal Rate of Return |
| ILO | International Labour Organization |
| KCC | Kenya Cooperative Creameries |
| KTSWSP | Kenya Towns Sustainable Water and Sanitation Project |
| KII | Key Informant Interview |
| KWS | Kenya Wildlife Services |
| LVNWWDA | Lake Victoria North Water Works Development Agency |
| MAS | Modified Activated Sludge |
| NLC | National Lands Commission |
| NEC | National Environment Council |
| NEP | National Environment Policy |
| NEMA | National Environment Management Authority |
| NPV | Net Present Value |
| PPE | Personal Protective Equipment |
| OS | Operation Safeguards |
| PPP | Private Public Participation |
| PEA | Project Executing Agency |
| RAP | Resettlement Action Plan |
| SDG | Sustainable Development Goals |
| SUP | Socially Uplifting Project |
| TGA | Target Group Analysis |
| WASREB | Water Services Regulatory Authority |
| WRA | Water Resources Authority |
| WWTP | Waste Water Treatment Plant |
| WMP | Waste Management Plan |
| NZOWASCO | Nzoia Water and Sanitation Company |

# EXECUTIVE SUMMARY

# EXECUTIVE SUMMARY

## E.1. Background Information

The Government of Kenya (GoK) has received financing from the African Development Bank (AfDB) to support the Kenya Towns Sustainable Water Supply and Sanitation Programme (KTSWSSP). The main objective of the Programme is to improve the access, availability and sustainability of water supply and wastewater management services in multiple towns. Kitale Town has been prioritized as one of the Towns to benefit from the Program with the proposed design of Kitale Town Sewerage System.

The Project Executing Agency (PEA) is Central Rift Valley Water Works Development Agency (CRVWWDA) on behalf of Lake Victoria North Water Works Development Agency (LVNWWDA). CRVWWDA and LVNWWDA are state corporations under the Ministry of Water & Sanitation and Irrigation, responsible for development, maintenance and management of Water and Sanitation Infrastructure in their areas of jurisdiction.

## E.2. Project Scope

The proposed measures for Kitale Municipality Sewerage System Includes investment in wastewater collection, conveyance and treatment. Project implementation for Ultimate Design Horizon (year 2045) has been Phased into two as shown below:

**Table E-1: Summary of the Proposed Project Implementation Phases**

| Component | Phase 1 (2025-2035) | Phase 2 (2035-2045) |
|---|---|---|
| Sewer Network | • Rehabilitation of the existing Sewer Network (43 Km)<br>• Expansion of the Sewer Network<br>- Trunk Sewers:<br>- Secondary Sewers | • Expansion of the Sewer Network<br>- Trunk Sewers:<br>- Secondary Sewers |
| Wastewater Treatment Plants | • Decommissioning of Bidii WWTP<br>• Decommissioning of Machinjoni Wastewater Treatment Plant and Matisi Maturation Pond.<br>• Construction of Wastewater Treatment Plant at Sirende Site- 2 Nr Streams each 2,800 $m^3$/d.<br>• Construction of Wastewater Treatment Plant at Rafiki Site- 2 Nr Streams each 2,300 $m^3$/d. | • Construction of Wastewater Treatment Plant at Sirende Site- 1 Nr Stream Capacity 2,800 $m^3$/d.<br>• Construction of Wastewater Treatment Plant at Rafiki Site- 1 Nr Stream Capacity; 2,300 $m^3$/d. |

Works under Phase 1 are further divided into **LOT 1** and **LOT 2** as follows:

| Work under LOT 1 | Work under LOT 2 |
|---|---|
| • Rehabilitation of existing sewer network<br>• Construction of 14 km of Trunk Sewers<br>• Construction of 23 Km of Secondary Sewers<br>• Construction of 2,500 new Plot Connections including reconnection for realigned sewers. | • Construction of 31 km of Trunk Sewers<br>• Construction of 30 Km of Secondary Sewers<br>• Construction of 2,500 new Plot Connections including reconnection for realigned sewers. |

| Work under LOT 1 | Work under LOT 2 |
|---|---|
| • Construction of Rafiki WWTP, Capacity 4,600 $m^3$/d and Decommissioning of Machinjoni WWTP and Matisi Maturation Pond<br>• Capacity Building including procurement of tools and equipment and training of staff. | • Construction of Sirende WWTP, Capacity 5,600 $m^3$/d and Decommissioning of Bidii WWTP |

## E.3. Objectives of the ESIA Assessment

This Environmental & Social Impact Assessment (ESIA) has been conducted in compliance with the Environmental Impact Assessment Regulation as outlined under the Gazette Notice No. 56 of 2003 established under the Environmental Management and Coordination Act (EMCA) 1999 Cap 387 and African Development Bank (AfDB) Operational Safeguards Policies.

The main objectives of the ESIA study were to:

- Identify potential significant environmental and social impacts of the proposed Kitale Sewerage Project and recommend measures for mitigation.
- Generate baseline data that will be used for monitoring and evaluating how well the mitigation measures will be implemented during the Project cycle.
- Promote stakeholders' engagements and public participation through holding public barazas and Key Informant Interviews (KII)
- Design an Environmental and Social Management Plan that will used by the contractor to prepare specific Construction Environment and Social Management Plan (C-ESMP) during Project construction stage.

## E.4. Approach and Methodology of ESIA Assessment

The approach and Methodology adopted in carrying out the ESIA was based on the following Stages:

i) Literature Review
ii) Environmental and Social Screening
iii) Environmental and Social Impact Ranking
iv) Specialized Surveys (Environmental Analysis)
v) Stakeholders Consultations
    - Key Informants Interviews
    - Target Group Analysis
    - Public Participation
vi) Environmental and Social Impact Assessment and Mitigation
vii) Environmental and Social Management and Monitoring Plan (ESMMP)

Stages 1, 2 and 3 have been detailed in Chapter 5 of this Report while Stages 4, 5 and 6 have been detailed in Chapters 7, 8 and 9 respectively.

## E.5. Legal and Policy Regulatory Instruments

Development of infrastructure Projects such as the Proposed Kitale Sewerage Project is guided by several laws, by-laws, regulations, Acts of Parliament as well as policy documents. Legal and Policy Statutes summarized in **Table E-2** were reviewed with the objective of assessing the existing Policies and Legislative Framework, Economic Tools and Enforcement Mechanisms for the Management of Infrastructure Projects at different stages.

**Table E-2: Applicable Legal and Policies Statutes**

| Statute Category | Specific Statute |
|---|---|
| Policy Provisions | Constitution of Kenya 2010 |
| | Kenya Vision 2030 |
| | National Policy on Water Resources Management and Development (Sessional Paper No.1 of 1999) |
| | The National Water Policy 2012 (Draft) |
| | The National Environmental Sanitation and Hygiene Policy-July 2007: |
| | National Environment Policy (NEP) 2013 |
| | HIV and AIDS Policy 2009 |
| | National Land Policy 2009 |
| | Gender Policy 2011 |
| | Kenya National Youth Policy 2006 |
| | Sustainable Development Goals (SDGs) 2015 |
| | National Climate Change Response Strategy 2010 |
| Acts of parliament | EMCA 1999 Cap 387 |
| | Land Act 2012 |
| | Water Act 2016 |
| | Physical and Land Use Development Planning Act 2019 |
| | The Urban Areas and Cities Act 201 |
| | The Public Health Act (Cap.242) |
| | HIV and AIDS Prevention and Control Act 2011, |
| | Occupational Health and Safety Act (OSHA 2007), |
| | Sexual Offences Act 2006, |
| | Child Rights Act (Amendment Bill) 2014, |
| | Labour Relations Act 2012 |
| | National Gender and Equality Commission Act 2011, |
| African Development Bank's (AfDB) Operational Safeguards (OS) Policies | Operational Safeguard (OS) 1: Environmental and Social Assessment |
| | OS 2: Involuntary Resettlement, Land Acquisition, Population Displacement and Compensation |
| | OS 5: Labour Conditions, Health and Safety |
| | OS 4: Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials and Resource Efficiency |
| | OS 3: Biodiversity and Ecosystem Services |

## E.6. Stakeholder Consultations

Key Informant Interviews (KII) were conducted from **20th July 2020** to **4th August 2020**. The target respondents were Head Teachers of both private and public schools, GK Prison Warden, Kenya Cooperative Creameries (KCC) Managing Director and Nurses in-charge of Health Institutions as summarized in **Table E-3.**

**Table E-3: Key informant Interview (KII) Schedule**

| Institution | Informant | Location | Interview Date |
|---|---|---|---|
| Showground Primary & ECD Centre | Deputy Head Teacher | Kitale Town next to Showground | 20th July 2020 |
| Weaver Bird High School | Proprietor | Kibomet | 20th July 2020 |

| Institution | Informant | Location | Interview Date |
|---|---|---|---|
| Manor House | Proprietor | Kitale Town next to Showground | 20th July 2020 |
| Green Field | Proprietor | Kitale Town next to Showground | 20th July 2020 |
| Trans Nzoia Primary | Head Teacher | Kitale CBD | 20th July 2020 |
| Milimani Primary School | Senior Teacher | Milimani | 20th July 2020 |
| St Theresa Boys | Boarding Master | Bikeke Centre –Kitale – Eldoret Highway | 21st July 2020 |
| St Theresa Boys | Deputy Teacher | Bikeke Centre – Kitale – Eldoret Highway | 21st July 2020 |
| Bikeke Primary School | Teacher | Bikeke Centre – Kitale – Eldoret Highway | 21st July 2020 |
| Lumuli Primary School | Head teacher | Lumuli centre located along Kitale – Eldoret Highway | 21st July 2020 |
| Hill School Primary | Head Teacher | Alakara - Kitale – Eldoret Highway | 22nd July 2020 |
| Namgoi Primary School | Teacher | Namgoi Kitale – Eldoret Highway | 22nd July 2020 |
| St Michael Secondary School | Senior Teacher | Kwa Muthoni | 22nd July 2020 |
| St Joseph's Boys | Principle | Wamwini – Kitale Webuye Road | 22nd July 2020 |
| St Joseph's Boys | Principle | Wamwini – Kitale Webuye Road | 23rd July 2020 |
| Sirende Primary School | Teacher | Sirende - Kitale – Eldoret Highway | 23rd July 2020 |
| Top Station Primary Schools | Teacher | Kwa Muthoni | 23rd July 2020 |
| **Health Facilities** | | | |
| Kitale County Hospital | Public | County Public Health Officer | 3rd August 2020 |
| Mt. Elgon Hospital | Public | County Public Health Officer | 3rd August 2020 |
| Grassland Dispensary | Public | County Public Health Officer | 3rd August 2020 |
| GK Remand Dispensary | Public | County Public Health Officer | 3rd August 2020 |
| Top Station Dispensary | Public | County Public Health Officer | 3rd August 2020 |
| Mitume Dispensary | Public | County Public Health Officer | 3rd August 2020 |
| Bidii Health Centre | Public | County Public Health Officer | 3rd August 2020 |
| Crystal Hospital | Private | Nurse In-charge | 4th August 2020 |
| St. Anne Hospital | Private | Nurse In-charge | 4th August 2020 |
| Galilee Hospital | Private | Nurse In-charge | 4th August 2020 |
| Marie Stopes M.C | Private | Nurse In-charge | 4th August 2020 |
| Mwananchi M.C | Private | Nurse In-charge | 4th August 2020 |
| Dr. Maamuud M.C | Private | Nurse In-charge | 4th August 2020 |
| Kitale Nursing Home | Private | Nurse In-charge | 4th August 2020 |
| Dr. Khisa M.C | Private | Nurse In-charge | 4th August 2020 |
| Royal hospital | Private | Nurse In-charge | 4th August 2020 |
| Cherangany Nursing Home | Private | Nurse In-charge | 4th August 2020 |
| Cherangany Nursing Home (Annex) | Private | Nurse In-charge | 4th August 2020 |
| Dr. Litonya M.C | Private | Nurse In-charge | 4th August 2020 |
| Mitume M.C | Private | Nurse In-charge | 4th August 2020 |
| Highway M.C | Private | Nurse In-charge | 4th August 2020 |
| Mucharage M.C | Private | Nurse In-charge | 4th August 2020 |
| VIEBI M.C | Private | Nurse In-charge | 4th August 2020 |
| Vision Dental M.C | Private | Nurse In-charge | 4th August 2020 |
| Kitale Medical Centre | Private | Nurse In-charge | 4th August 2020 |
| Tom Mboya Health Centre | Public | Nurse In-charge | 4th August 2020 |
| **Other Informants** | | | |
| GK Prison | Chaplain | Kitale CBD | 23rd July 2020 |
| KCC | Engineer | Kibomet | 23rd July 2020 |
| Public Health Department | County Public Health Officer | CBD | 17th July and 4th August 2020 |

Five (5) Public Participation Meetings were held within the Project Area from 11th to 13th November 2020. The Meeting locations were Tuwan, Matisi, Lessos, Milimani and

Machungwa Locations with a total attendance of 236 residents. A schedule of the meetings is shown in **Table E-4**.

**Table E-4: Public Participation Meetings**

| Date | Venue | Groups of Residents Presents | No. of Participants |
|---|---|---|---|
| 11th November 2020 – 10am | Tuwan Location – Dominion Church Grounds | • Tuwan Location Chief<br>• Ward Administrator Tuwan Ward<br>• Village elders for Nyumba Kumi – Mitume<br>• Residents of Mitume | 50 |
| 11th November 2020 – 3pm | Matisi Location –Pkach P.A.G church Rafiki. | • Matisi Location Chief<br>• Ward Administrator Matisi Ward<br>• Village elders for Nyumba Kumi – Rafiki<br>• Residents of Rafiki Village | 77 |
| 12th November 2020 – 2pm | Milimani Location – Gatua. | • MilimaniLocation Chief<br>• Ward Administrator Milimani Ward<br>• Village elders for Nyumba Kumi – Gatua<br>• Residents of Gatua Village | 18 |
| 13th November 2020 – 11am | Lessos Location Chief's Office | • Lessos Location Chief<br>• Ward Administrator Matisi Ward<br>• Village elders for Nyumba Kumi – Lessos<br>• Residents of Lessos | 44 |
| 13th November 2020 – 2pm | Machungwa Location- Mzee Juma's Compound In Machungwa | • Matisi Location Chief<br>• Ward Administrator Matisi Ward<br>• Village elders for Nyumba Kumi – Machungwa<br>• Residents of Machungwa | 47 |

The residents during the Public Participation gave inputs/comments and sought clarifications on the Proposed Sewerage Project as summarized in **Table E-5**.

**Table E-5: Issues Discussed and Response During Public Barazas**

| Suggestion / Question | Response |
|---|---|
| **Land Acquisition Impacts**<br>Residents sought clarification on the process for land acquisition and impacts for the establishment of Sirende and Rafiki WWTPs | The site for establishment of Sirende Wastewater Treatment. belongs to private individual and will be acquired on a willing buyer willing seller arrangement. Similarly, Rafiki site that serve persons living in the southern estates of Mitume and Matisi will also be acquired through willing buyer willing seller arrangement between the owner and Trans Nzoia County Government. |
| **Resettlement Impact Along Sewer Wayleaves**<br>The Residents inquired about the state of wayleaves for the trunk and secondary trunk sewers and whether PAPs who have assets along these | Residents were informed that the wayleave for the secondary lines will be about three meters wide while for the trunk mains will be about six meters wide. |

| Suggestion / Question | Response |
|---|---|
| wayleaves will be compensated.<br><br>In addition, they sought clarification on the type of activities that are allowed along the wayleaves. | The design has aligned the trunks and secondary sewers within road reserves and river riparian in an effort to minimize impact on private land and property. However, in the event that the sewer alignment is beyond the riparian / public land, a RAP assessment will be undertaken and such PAPs will be adequately facilitated<br><br>Residents were informed that it is best practice to leave wayleaves clear so that in the event maintenance is required, they will not experience loss of property. However, they were informed that they were free to plant seasonal crops like animal fodder but not to put up structure and plant trees on the wayleave. |
| **Demolition of Existing Septic Tanks and Pit Latrines**<br>Residents sought clarification on whether the existing septic tanks and pit latrines will be decommissioned under the project and the mode of connecting such facilities to the sewerage network | The residents were informed that those who have septic tanks will not be required to demolish them. The project will eliminate need to exhaust because they will be connected to the sewer line. The septic tanks will act as holding tanks of the raw wastewater before flowing into the sewer lines.<br><br>Those using pit latrines will be required to decommission the pit latrine and install flush/pour flush toilets (water borne system) that will be connected to the Sewer Network. |
| **Project Commencement and Improvement**<br>Residents inquired on the Project Timeline and the commencement date. | Residents were informed that the current assignment was only split into 3 stages; Feasibility Studies, Preliminary Design and Final Design and Tender Documentation. The Tender documents will be utilized in sourcing of the Project funds and in procurement of Works Contractor by LVNWWDA and CRVWWDA. |
| **Water Supply**<br>Residents noted that the existing water supply system requires improvement as it is an essential requirement for the sewerage Project to function well. | The Technical Manager-NZOWASCO informed the Residents that that Kiptogot Water Project and expansion of Kapolet water Supply System to increases water supply within Kitale Municipality was underway.<br>Residents were further advised to approach their MCA on water needs for inclusion in budget allocation from the Ward Fund for expansion of water distribution network. |
| **Sewer Connection**<br>The process for sewer connection and the cost of connection for those along the proposed sewers and are willing to connect should be clarified. | The meeting was informed that it was the government's objective to bring services closer to the people as much as possible and this will be the case for the Sewerage Project. However, residents will be expected to apply through NZOWASCO in order to be connected.<br><br>Sewerage will be charged as a percentage of the monthly water consumption charge. |
| **Employment Opportunities**<br>The works contractor should source for workforce within the | The team pointed out that all unskilled labour and some skilled will be sourced from the local community. Youths were |

| Suggestion / Question | Response |
|---|---|
| community during the implementation stage. | encouraged to organize themselves into groups and avail themselves for the job opportunities for consideration.<br><br>Those that will get these job opportunities were encouraged to work responsively to avoid termination before the project is complete. |

Disclosure of the Environment and Social Impact Assessment Study Report (ESIA) and Resettlement Action Plan (RAP) was done on the 25th June 2021 at the Aturukan Hotel Kitale. The meeting was attended by representatives of institutions listed below

1) Central Rift Valley Water Works Development Agency (CRVWWDA)
2) Lake Victoria North Water Works Development Agency (LVNWWDA) – Beneficiary Agency
3) Nzoia Water and Sanitation Company (NZOWASCO)
4) Trans Nzoia County
5) National Environmental Management Authority (NEMA)
6) Water Resources Authority

A summary of issues discussed during the disclosure meeting is presented below

**Table E-6: Issues Discussed and Response during Disclosure Workshop**

| Institution | Issue | Response |
|---|---|---|
| Environmental Engineer - LVNWWDA | Clarification was sought on the cut-off date indicated in the RAP Report. | MIBP/CES clarified that the cut-off date was set to allow for census and in determining of the initial budget. A new date will be set during RAP review when compensation is set to start |
| | The grievance redress mechanism was missing in the ESIA Report Submitted. | The grievance redress mechanism has been provided in the RAP Report. However, the section will be added in the ESIA Report |
| Director NEMA -Trans Nzoia County | The community might reject the Project due to odour and reduced land values. A suggested solution is a tree buffer zone around the WWTP and if managed well can be used as a tourist site. The public should be assured of better technology as opposed to the existing ones. | The Proposed WWTPs sites are at the fridges of the municipality boundary. The selected areas are sparsely populated. The land is owned by one person for each site. The proposed Technology ensures little, or no odour form the WWTP components. The land to be acquired has an allowance for tree planting to act as a buffer. The technology adopted is easy to operate since its gravity flow and therefore, minimal probability of failure. |
| | The community should be given incentives to prevent project rejection. | The Project itself is an incentive since it helps in cleaning the environment/and rivers in the project area. In addition, roads leading to the WWTPs will be upgraded to all weather roads benefiting the community around. Since water is required in the WWTPs, provisions for water lines to supply wastewater treatment plants has been made and will also benefit the community. |

| | | |
|---|---|---|
| | Clarification was sought on whether the aspect of water reuse was analysed. | During the Feasibility Study, the possibility of water re-use was analysed. Kitale Town has adequate river flows to satisfy the water demand if optimally utilised. Wastewater re-use for drinking water is therefore not needed. The treated wastewater will be used to recharge the rivers and can be used downstream for drinking (further treatment) or for irrigation. |
| | People may opt for bio-digesters and therefore a low connectivity rate to the proposed sewerage system. This may result to wastage of resources. | During the Inception stage of the Project assignment, The County Government and NZOWASCO were requested to develop a sewer connection strategy/policy that will ensure that properties next to the sewers are connected. This is in accordance with the public health act CAP-242 section 126. The Act requires that properties within |
| Environmental Engineer-LVNWWDA | A suggestion to add a constructed wetland just before treated wastewater discharge into the river was raised. | The design has ensured that the treated effluent has a better quality than the set effluent standards. Addition of a wetland is not warranted and will only increase the cost. |
| | The design should include operation and maintenance manuals to guide in the operation of the proposed systems. | Operation and Maintenance Manuals are prepared before commissioning of works by the supervision consultant. However, to enable efficient and effective running of the system, a training needs assessment of the sewerage department staff was carried out identifying the required training courses. The training will be carried out during construction and after commissioning of the project. |
| *Technical Manager-NZOWASCO* | It was suggested that the existing WWTPs should be left to serve the current service area while the new WWTPs serves the proposed expansion areas. | The current WWTPs are very close to Town/development and not aesthetic for a Town setup. In addition, the operation costs for manging 3/4, WWTPs is higher than managing 2 WWTPs. The land where the existing WWTPs are located can be used for other purposes. |
| *Development Officer-LVNWWDA* | Clarification was sought on whether discharge of hazardous waste into the sewerage system was considered. | The water quality regulations requires that any industry should pre-treat their waste before discharge into the public sewers. A tripartite agreement is entered between the NZOWASCO, the industry and the County Government to ensure this is followed. Therefore, discharge of hazardous waste is not anticipated. However, in case of this, the system can absorb shock due to the long retention period > 20 days. Mitigation measures have been provided in the Effluent Discharge Control Plan. |
| *Water Officer-County Government of Trans Nzoia* | A concern was raised on the WWTP ponds acting as a breeding ground for mosquitoes, considering that Kitale is a high malaria risk zone. | The WWTP is a continuous flow system. Mosquito bleeding grounds are usually stagnant waters which is not the case. Mosquito eggs would be carried by the flow currents. |

## E.7. Project Area Baseline Information

### E.7.1. Biophysical Baseline

The biophysical Baseline of the Project Area is as summarized below;

- Kitale Town, the proposed Project Area is the largest urban centre in Trans-Nzoia County and serves as the County Headquarter. It is located between Mt. Elgon and Cherangany Hills at 1˚ 0' 56" North, 35˚ 0' 22" East, at an elevation of around 1897m. It is 62 km from Eldoret Town and 390 km from Nairobi City.

- Trans-Nzoia County comprises of five administrative sub counties namely, Kiminini, Saboti, Cherangany, Endebess and Kwanza. Kitale Town is located in Saboti Sub County with some sections in Kwanza Sub-county, Kiminini Sub County The Eastern parts of Saboti and Kiminini Sub Counties, Southern parts of Kwanza Sub County, western and central parts of Cherang'any Sub County receive moderate rainfall ranging from 1,200 to 1,300mm.

- The river valleys within Kitale municipality exhibit irregular bedded layers of coarse pebbles, coarse sands, fine sands and sills. These Pleistocene, sediments form part of old river terraces deposited during the period of glaciations of Mount Elgon when abundant water from the melting glaciers not only incised deep gorges through the volcanic rocks but, on reaching the flat Kitale Plains, spread out into broad torrential rivers, of which the limits are shown by the outcrop of black cotton soils.

- Soils vary in type, corresponding largely with the underlying bedrock, though there is a modification in certain portions of the area due to the disintegration of the laterite caps. Buff or light brown sandy soils are produced by the breakdown of Kavirondian grits and bright red clayey soils by the mudstones

- Kitale Municipality is divided into 3 main drainage areas with most of the area draining into River Koitobos. River Koitobos flows to the Southeast and forms the current Northern boundary of Kitale Municipality. Machinjoni River Basin is an urban river basin whose source is at the center of Kitale Municipality, drains westwards from the municipality center and drains into River Nzoia.

- Kitale municipality vegetation cover is influenced by the Mt. Elgon's ecosystem which is banded into broad zones whose characteristics are dictated by altitude and rainfall. Dominant tree species include; Croton macrostachus, Croton megalocarpus, Bridelia micrantha, Erythrina abyssinica, Cussonia holstii, Markhamia lutea and Ekebergia capensis. In this zone there is also a large percentage of introduced species of which the most common is the Grevillea robusta. Other exotic species include Cuppressus lusitanica, Eucalyptus saligna, Eucalyptus camaldulensis, Cassia siamea and Leucaena leucocephala.

### E.7.2. Social Economic Baseline

The Social Economic Baseline of the Project Area is as summarized below;

- The current urban fabric of Kitale Town is such that most of the municipality's activities and settlements are located along major roads such as Kitale-Kapenguria (A1), Kitale-Eldoret (B2), Kitale-Cherangany (C48) and along Endebess Road.

- The existing Kitale Water Supply System covers an area of approximately 122 $km^2$ comprising of current Kitale Municipality (92 $km^2$) and parts of the adjoining peri-urban and rural areas. Kitale Town mainly depends on water supply from Kapolet Treatment Works which was commissioned in 2010 and Nzoia Water Treatment Plant commissioned in 1986 and has had rehabilitation works done in the 90's and most recently in 2007/2010.

- The Water Borne Sewerage System for Kitale Town covers an area of approximately 10.5 $Km^2$. The system consists of sewer reticulation network approximately 43.3 Km and 2Nr. Wastewater Treatment Plants (WWTP) namely Bidii and Matisi WWTP.

- There are four main land uses within the County namely agriculture, industrial, commercial/residential use and other uses including road infrastructure. Land was mainly under agricultural use but due to increase in population most farms have changed use to commercial and residential.

- Trans-Nzoia County is known as the country's food basket. Agriculture is the backbone of the Trans-Nzoia county economy. Majority of the residents practice mixed farming of crop growing and animal rearing. The major crops grown includes maize, bananas, wheat, coffee, and tea. Horticultural crops and fruits have gained prominence in the recent past. Livestock is mainly for milk and meat production.
- Kitale Town hosts several agricultural dependent companies such as Kenya Seeds Company, Western Seed Company, National Cereals and Produce Board (NCPB), Kitale Grains Services, Maize Millers such as Kitale, Royal and Mombasa Millers, Kenya Creameries Company (KCC) etc.

- Trans-Nzoia County has potential for tourism development given its endowment with rich tourist attraction features. It is part of the western tourism circuit which has been a key marketing focus by the Kenya Tourism Board. The main tourism attractions in the County are within the Mt. Elgon ecosystem that includes elephants, antelopes, buffaloes, monkeys, leopards among others. The Saiwa Swamp is another tourist attraction with the famous Sitatunga antelopes.

- Kitale Municipality is endowed with numerous education institutions that provide basic to university education to the community living within Kitale Town. Similarly, the town is also endowed with numerous health institutions that provide health services to the community living within Kitale Town.

## E.8. Project Impacts

### E.8.1. Positive Project Impacts

The Project is divided into two Phases; Construction Phase and Operation and Maintenance Phase. The Construction Phase includes Pre-Construction Phase and Construction Phase. Construction period depends on the nature of the project activities and is estimated to be approximately 18 months.

The positive impacts during construction phase are summarized below:

- **Employment opportunities during construction:** It is anticipated that 90% of unskilled labour and 60% of skilled labourers will be sourced from the local market.
- **Provision of ready market for construction materials** such as sand, ballast and cement that will be sourced from local market, this will lead to injection of money into the local economy
- **The Project will be associated with technological and knowledge transfer to the local sector**: This will be through the artisan who will be employed and trained by the Project.

The main objective of the Project is to improve the quality of life of people within Kitale Municipality through provision of improved sanitation services. The positive impacts associated with the Project operation phase include:

- Reduced pollution of natural drainage systems including rivers and streams within Kitale Municipality such as River Koitobos and River Katalele.
- Reduced cases of water borne diseases associated with pollution of water resources by raw sewage.
- Improve aesthetic outlook of Kitale Town that is currently comprised by raw sewer flowing in storm drains
- Trigger development of modern infrastructure within Kitale town due to availability of adequate sewer infrastructure.
- Reduce distances covered by exhausters to sludge discharge points (reduced costs)
- Residents will decommission pit latrines which are expensive to construct and unsustainable in the long run due to short fill-up duration. This will reduce contamination of ground water.

### E.8.2. Negative Impacts Severity during Construction Phase

Negative impacts severity during construction phase are presented in **Table E-76.**

**Table E-76: Negative Impacts Severity**

| Environmental / Social Variable and receptors | Impact Type | Severity Rating | |
|---|---|---|---|
| | | Before Mitigation | After Mitigation |
| Impact on Water Resources (Koitobos and Katalele rivers and associated streams) | Direct | Minor | Negligible |
| Impact on Vegetation Cover | Direct | Minor | Negligible |
| Impacts on Soil Resources | Direct | Minor | Negligible |
| Impact on Air Quality | Direct | Moderate | Negligible |
| Noise and Vibration Impacts | Direct | Minor | Negligible |
| Impacts on Flora and Vegetation Cover | Direct | Minor | Negligible |
| Community Health and Safety | Direct | Moderate | Minor |
| Workers Health and Safety | Direct | Moderate | Minor |
| Land Acquisition and Resettlement Impacts | Direct | Moderate | Minor |

### E.8.3. Mitigation of Negative Impacts During Construction Phase

Negative impacts during construction phase and mitigation measure are presented in **Table E-87**.

**Table E-87: Negative Impacts and Mitigation Measures During Construction Phase**

| Environmental / Social Variable and Receptors | Project Activities / Impacts |
|---|---|
| Impact on Water Resources (Koitobos and Katalele rivers and associated streams) | • Earthworks such as excavation and backfilling could result to loosening of soils that are eventually washed down through storm water channels into rivers, this ultimately results to increased sedimentation of the rivers.<br>• Water from rivers will be abstracted for Project activities such as dust control and concreting.<br>• Un-serviced plant and equipment on site could result to oil spills and fuels leaks that contaminate water resources affecting ultimately affecting aquatic organism<br>• At operation stage, there might be direct interaction of water resources and raw wastewater from blocked overflowing un-maintained manholes/ sewers. |
| Impact on Vegetation Cover | • Minimal interference with vegetation within proposed sewer wayleaves including isolated marshlands and protected man-made Lessos forest<br>• Potential interference with privately owned Kitale Nature reserve located within Koitobos drainages basin at Kapenguria road river crossing |
| Impacts on Soil Resources | • Project activities will interfere with the soil structure exposing the soils to agents of erosion such as wind and water. If not properly restored or managed, such soils may erode and wash into nearby surface water bodies. |

| Environmental / Social Variable and Receptors | Project Activities / Impacts |
|---|---|
| | • Soil contamination as a result of oil spills and fuel leaks from un-serviced plant and equipment on site |
| Impact on Air Quality | Project activities that have potential to impact air quality include, emissions of air pollutants from temporary diesel generators, construction equipment and vehicles and dust generated from construction activities and traffic movement<br><br>The following would be expected during construction.<br><br>• Emissions of oxides of nitrogen ($NO_2$ in particular) mainly from construction-related vehicles (and to a lesser degree from construction generators and other hydrocarbon powered equipment)<br>• Dust and particulate matter (as $PM_{10}$) created by construction-related vehicle traffic on unpaved roads and construction activities<br><br>Once the proposed works are built and operational and all construction sites reinstated, no significant effects on air quality will be anticipated. |
| Noise and Vibration Impacts | Potential noise impacts may arise as a result of the construction activities associated with the construction of the sewer lines.<br><br>Construction activities and equipment are not expected to result in significant levels of vibration. Equipment that might high levels of vibration (such as impact piling or vibratory compaction) will not be used |
| Impacts on Flora and Vegetation Cover | According to data from the survey carried out during the assessment, the vegetation cover within all the settlement has been largely modified to give room for anthropogenic activities. There are not protected vegetation cover within the settlement that is considered a fragile ecosystem, sensitive to changes to its components. However, stripping of vegetation cover will be on isolated cases only limited to exotic species of trees and boundary hedges. |
| Community Health and Safety | The presence of the Project could affect the health, safety and wellbeing of the communities living within the Project Area. Increased project-related traffic, civil works for site preparation including site clearance and excavation work for sewer pipes, change to the environment due to increased noise, decreased air quality, inappropriate waste handling or disposal, and accidental leaks and spills, and the presence of the Project workforce all present potential hazards for the health and safety of local communities |
| Workers Health and Safety | Workers' rights including occupational health and safety need to be considered to avoid accidents and injuries, loss of man-hours, labour abuses and to ensure fair treatment, remuneration and working conditions. These issues should be considered not only for |

| Environmental / Social Variable and Receptors | Project Activities / Impacts |
|---|---|
| | those who are directly employed on the Project. The Project could potentially lead to workforce-related social and health issues throughout the life cycle of the Project if worker management and rights do not meet Kenyan law or international best practice. |
| Land Acquisition and Resettlement Impacts | The proposed sewer lines are designed to be laid within existing road reserves and wayleaves owned by the relevant Road Authorities i.e. Kenya Urban Roads Authority (KURA), Kenya Rural Roads Authority (KeRRA) or Kenya National Highways Authority (KeNHA) including Trans Nzoia County Government.<br>In addition, the trunk sewers will be laid along river riparian under custody of Water Resources Authority (WRA).<br><br>From RAP report, the Project will physically and economically impact 248 PAPs in both Rafiki Sewerage System (Lot 1) and Sirende Sewerage System (Lot 2). Rafiki Sewerage System Project will physically and economically impact 100 PAPs comprising of 28 female PAPs and 72 male PAPs in Matisi Location. 1 PAP in Grassland (Rafiki) will transfer 119 acres required for establishment of Waste Water Treatment Plant (WWTP) while 28 PAPs will transfer a cumulative of 5.09 acres as easement for the Sewers<br><br>Sirende Sewerage System Project will physically and economically impact 148 PAPs comprising of 30 female PAPs and 118 male PAPs in Bidii, Milimani, Naisambu and Sirende Locations. 1 PAP in Sirende (Eldoret Express Bus Company Limited) will transfer 173 acres required for establishment of Waste Water Treatment Plant (WWTP) while 103 PAPs will transfer a cumulative of 20.96 acres as easement for the Sewers |

### E.8.4. Mitigation of Negative Impacts during Operation Phase

Negative impacts during operation phase and mitigation measures are presented in **Table E-98**.

**Table E-98: Negative Impacts and Mitigation Measures during Operation Phase**

| Issue | Action Required |
|---|---|
| Pollution of Water Resources by raw sewage from blocked Sewer pipes and Manholes. | • NZOWASCO will ensure proper and periodic maintenance of sewers and wastewater treatment plants<br>• NZOWASCO will activate a community watch group for information sharing on the status of the sewers<br>• Regular cleaning of grit chambers and sewers to remove grease, grit, and other debris that may lead to sewer backups<br>• Development of an inventory of system components, with information including age, construction materials, and drainage areas served<br>• 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 sewer system<br>• Ensure sufficient hydraulic capacity to accommodate peak |

| Issue | Action Required |
|---|---|
| | flows and adequate slope in gravity mains to prevent build-up of solids and hydrogen sulphide generation<br>• Regular inspection of the system to ensure performance is maintained at high levels<br>• Blockages should be detected and promptly replaced<br>• Regular monitoring and sampling of the wastewater at influent and effluent points as well as in the receiving water bodies<br>• Communities living within the river basins where the trunk sewers will be constructed should be enlightened on dangers of using raw sewerage to irrigate farmlands. |
| Odour Menace from Wastewater Treatment Works | • NZOWASCO will ensure appropriate covering/ventilation of the pre-treatment unit<br>• NZOWASCO will ensure appropriate handling and removal of grit/grease<br>• NZOWASCO will ensure scum is appropriately disposed off or properly stabilized<br>• NZOWASCO will ensure that the pond series have adequate water flow and aeration to reduce the potential of odour formation<br>• The perimeter of the proposed site should be vegetated with trees and plants of varying heights thereby forming windbreaker and reduce dispersion of odour<br>• Repairing dilapidated roofs of the sludge drying beds to ensure quick drying of sludge and appropriate disposal to reduce odour emanating from wet sludge. |
| Risks Associated with Sludge from the WWTP | • NZOWASCO will dry sludge on the drying beds before disposing it off<br>• Dried sludge could be used to make briquettes as a charcoal substitute or be sold to farmers as fertilizers<br>• Excess sludge can be disposed in a designated landfill which shall only be for disposing dry odourless sludge.<br>• Preparation and enforcement of operational guidelines for sludge management by Trans-Nzoia County Government |
| Solid Wastes Impacts at WWTP Screens | • NZOWASCO will develop a comprehensive Waste Management Plan (WMP) for management of solid wastes from screen chambers<br>• NZOWASCO will employ personnel who will be in charge of maintaining hygiene and cleanliness of the WWTP including removal of solid wastes from screen chambers<br>• Properly labelled and strategically placed waste disposal containers shall be provided at all places within the WWTP<br>• Solid wastes once removed from screens shall be collected and disposed appropriately as required by waste Management Regulations of (2006) and Trans Nzoia County Government by laws. |
| Inversion of Birds and Reptiles to the WWTP | • The wastewater treatment plants should be protected from animal encroachments by providing secure barriers to keep off the animals from interfering with the plant operations and safety<br>• In the event of larger wildlife e.g. hippos, NZOWASCO will ensure appropriate consultations with the Kenya Wildlife Services (KWS) on appropriate management actions. |

| Issue | Action Required |
|---|---|
| | • The quality of the effluent discharged into the river will be an important parameter on the regional control of the river ecology |

## E.9. Conclusion

The Environmental and Social Impact Assessment (ESIA) concludes the following.

(i) The Project is proposed to be implemented within human settlements where anthropogenic activities has led to clearing of natural vegetation to provide land for housing and farming. Therefore, no direct interaction of the Project activities with natural sensitive ecosystems at the time of construction will occur.

(ii) There exist 3Nr man-made forest blocks within Kitale municipality namely Block 6, KCC and Agricultural Society of Kenya (ASK) forest. However, proposed trunk and secondary sewers will not directly interact / traverse the forests. CRWWDA will seek wayleave permits from Kenya forest services in the event that works are to be undertaken within the forests

(iii) Kitale Municipality is divided into 3 main drainage areas with most of the area draining into River Koitobos. River Koitobos flows to the Southeast and forms the current Northern boundary of Kitale Municipality. Machinjoni River Basin is an urban river basin whose source is at the center of Kitale Municipality. The baseline Biological Oxygen Demand (BoD) of the rivers was collected during the ESIA, at Project operational stage, the baseline BoD will be a critical parameter during monitoring of river pollution.

(iv) The Proposed site for construction Sirende Wastewater Treatment Plant is located in a privately owned agricultural land which must be acquired for construction of Wastewater Stabilization Ponds (approx. 70 Ha) for treatment of the projected wastewater flow of 5,600 $m^3$/d for medium term (2035) and 8,400 $m^3$/d for long term (2045)

(v) The Proposed site for construction of Rafiki Wastewater Treatment Plant is located in a privately owned agricultural land which must be acquired for construction of of wastewater stabilization ponds (approx. 48 Ha is required) for treatment of the projected wastewater flow of 4,600 $m^3$/d for medium term (2035) and 6,900 $m^3$/d long term (2045)

(vi) The proposed sewers are designed to be laid within existing road reserves and wayleaves owned by the relevant Road Authorities i.e. Kenya Urban Roads Authority (KURA), Kenya Rural Roads Authority (KeRRA) or Kenya National Highways Authority (KeNHA) including Trans Nzoia County Government Trunk sewers will also be laid along river riparian under custody of Water Resources Authority (WRA).

Specific Resettlement Action Plan (RAP) has been prepared for potential impacts on private assets as a result of demolition (loss) of structures/household assets to provide space for laying of sewers within build up estates such as Mitume,

Matisi, Kipsongo among others in addition to crops and woodlots belonging to private individuals along the main trunk sewers to Sirende and Rafiki Wastewater Treatment Plants.

(vii) The cost of implementing the Environment and Social Management Plan (ESMP) is approximately Ksh 7.5 million

## E.10. Recommendations

The **Bid Documents** prepared for the Project incorporates the Environment, Social Health and Safety Provisions discussed under **Chapter 8** (Environment and Social Impact Assessment and Mitigation Measures). The Project Contract Document have included provisions for the contractor preparing and implementing Construction Environment and Social Management Plan (C-EMSP), annexes to the C-EMSP will include but not limited to:

- ✓ *Soil and Sedimentation Control Plan*
- ✓ *Decommissioning and Rehabilitation Plan for Matisi and Bidii WWTPs as illustrated in section 9.5*
- ✓ *Spoil Management Control Plan*
- ✓ *Health, Hygiene and Safety Plan*
- ✓ *Labour Management Plan*
- ✓ *Child Protection Strategy*
- ✓ Gender-based Violence Action Plan
- ✓ *Waste Management Plan*
- ✓ *Contractors Code of Conduct*
- ✓ *Gender Inclusivity Strategy*
- ✓ *HIV/Aid Prevention Strategy*

At Project implementation stage, the Contractor to report to the Project management team comprising of the Consultant and the Project proponent on a monthly basis on how ESHS provision detailed in this ESIA are addressed at each Project Site. In addition, the contractor will hire 2Nr Environment Health and Safety Managers under the contract.

At Project completion stage, within the defects liability Period, NZOWASCO should initiate an Initial Environment and Social Audit for the Project as required by EIA/EA Audit regulation of the year 2003 and subsequent annual self-audits. The audit will develop an Environment and Social Audit Action Plan (ESAAP) that will be used to track Project Environment and Social Compliance during Project implementation stage.

# MAIN REPORT

# CHAPTER 1: INTRODUCTION

## 1.1 General

The Government of the Republic of Kenya (GoK) has mainstreamed its National Water Policy to envisage 100% access to safe water for the Country's population by year 2030 This is in line with the United Nations Sustainable Development Goals (SDG) No. 6 objective of "ensuring availability and sustainable management of water and sanitation for all".

The Government of Kenya has further initiated the "Big Four Agenda" with a goal of ensuring improved services to the public in line with the New Constitution of 2010. A key benchmark of the new Constitution is stipulated under Chapter IV-Bill of Rights, paragraph 43(1)(b) and (d) which stipulates: "Every person has the right to (b).... reasonable standards of sanitation and (d) clean and safe water in adequate quantities

It is in this respect that the Government of Kenya (GoK) has received financing from the African Development Bank (AfDB) to support the Kenya Towns Sustainable Water Supply and Sanitation Programme (KTSWSSP). The main objective of the Programme is to improve the access, availability and sustainability of water supply and wastewater management services in multiple towns with the aim of:

- Catalyzing commercial services
- Driving economic growth
- Improving quality of life of people
- Reducing poverty levels
- Building resilience against climatic variability and change

To achieve this objective, Kitale Town has been prioritized as one of the Towns to benefit from the Program with the proposed design of Kitale Town Sewerage System and implementation once funds have been received

The Project Executing Agency (PEA) is Central Rift Valley Water Works Development Agency (CRVWWDA) on behalf of Lake Victoria North Water Works Development Agency (LVNWWDA). CRVWWDA and LVNWWDA are state corporations under the Ministry of Water & Sanitation and Irrigation, responsible for development, maintenance and management of Water and Sanitation Infrastructure in their areas of jurisdiction.

LVNWWDA was established under the Water Act 2016 through Gazette Notice of 20th September 2016 with the mandate of ensuring efficient and economic provision of Water and Sanitation Services in its area of jurisdiction. CRVWWDA was established after the splitting of the former Rift Valley Water Works Development Agency (RVWWDA) in 2020.

Lake Victoria North Water Works Development Agency (LVNWWDA) is responsible for executing and implementing Water and Sewerage Projects as well as contracting Water Service Providers (WSPs) in its area of jurisdiction that comprises of Bungoma, Kakamega, Vihiga, Busia, Uasin Gishu, Trans-Nzoia and Nandi Counties. In addition, LVNWWDA provides capacity building to the WSPs within its area of jurisdiction.

As stipulated in the Water Act 2016 Part IV section 69 (Handover of Completed Works), the Water Works Development Authority hands over National Public Works to the County Government of the area the assets rests geographically within the specific area of jurisdiction. The proposed Project is located within Trans-Nzoia County with the water and sewerage management under Nzoia Water Services Company Ltd (NZOWASCO).

Nzoia Water Services Company Limited (NZOWASCO) was formed under the Companies Act (CAP 486) on 4th February 2004 and became operational a year later on 9th February 2005 and is owned by the County Governments of Bungoma and Trans-Nzoia. LVNWWDA has contracted Nzoia Water Services Company (NZOWASCO) to provide water and sanitation services in Kitale, Kimilili, Bungoma and Webuye Towns.

## 1.2 Project Background

Kitale Town is one of the major urban centers in the western region of Kenya and the Headquarters of Trans-Nzoia County. The Sewerage system for Kitale Town was first developed in 1957, upgraded in 1978/1984. In 2007, minor rehabilitation works were carried out on the sewerage system. Further expansion of the sewer network by construction of Secondary and Infill sewers has been carried out by Nzoia Water Services Company.

The Water Borne Sewerage System for Kitale Town covers an area of approximately 10.5 $Km^2$ (11.4%) of the current Municipality (92$km^2$). The system consists of a sewer reticulation network, approximately 43.3 Km and 2Nr. Wastewater Treatment Plants (WWTP) with capacities of 650 $m^3$/d (Machinjoni WWTP) and 2,930 $m^3$/d (Bidii WWTP). However, Machinjoni WWTP is currently not operational; wastewater from this WWTP is only treated in a series of 3Nr. Maturation Ponds before discharge into the River.

Kitale Municipality is supplied with water from 2 Nr. sources; Kapolet and Nzoia water production facilities with installed capacities of 10,300$m^3$/d and 10,500 $m^3$/d respectively. Currently, Kitale Municipality receives approximately 14,000 $m^3$/d of water with a Non-Revenue Water of 47%. Assuming an average wastewater contribution factor of 80%, the current wastewater collection is relatively low (approximately 1,900 $m^3$/d) compared to the expected wastewater generation (5,300 $m^3$/d)

Currently, NZOWASCO is faced with the following challenges in management of wastewater in Kitale Town:

i) Low sewer network coverage; approximately (10.5$km^2$) 11.4% of the current Municipality area (92 $km^2$)
ii) Low sewer connectivity; approximately 2,976 sewer connections
iii) Discharge of Industrial wastewater into the sewerage system without pre-treatment
iv) Old/Dilapidated infrastructure that lead to occasional failure
v) Undersize sewers. Some sewers have a diameter of 160/150 mm.
vi) Inefficient and Ineffective wastewater treatment
vii) Vandalism of manhole covers and step irons
viii) Inadequate operational and maintenance of the sewerage system
ix) Inadequate tools and equipment for operation and maintenance.

x) Encroachment of wastewater treatment plants land and sewer wayleaves by local residents.
xi) Discharge of partly treated wastewater into the natural water courses.

Blockages in the sewers results in overflowing of wastewater discharging into natural watercourses. Wastewater from the unsewered areas such as Kaloleni flows into storm water drains that discharge into the natural water courses within Kitale Town such as River Katalele, Prison Ravine River etc. In some cases, wastewater finds its way into the treated water pipes through leaking joints and bursts. Furthermore, some of the residents depend on shallow wells and river/stream water for drinking which in most cases is contaminated.

The most prevalent diseases in Kitale, especially in the high density areas include Malaria, upper respiratory tract infections, skin diseases, Cholera, Urinary tract infections, eye infections etc. Some of these diseases are directly or indirectly linked to poor wastewater management.

Considering the above wastewater management situation in Kitale Town, the Project was considered urgent to improve the living conditions of the residents of Kitale Municipality and its surrounding areas.

# CHAPTER 2: BASELINE INFORMATION OF THE PROJECT AREA

## 2.1 Location and Size

Trans-Nzoia County lies between latitudes 00° 52´ and 10° 18´ North of the equator and longitudes 34° 38´ and 35° 23´ East of the great Meridian. The County covers an area of approximately 2,495 square kilometers.

The County borders Bungoma and Kakamega Counties to the South, West Pokot County to the East, Elgeyo Marakwet and Uasin Gishu Counties to the South East and the Republic of Uganda to the West. The County is situated in the North Rift of the former Rift Valley province and is home to Mt. Elgon the second highest mountain in Kenya, a Trans-boundary feature shared with the Republic of Uganda. The International Trunk Road A1 that links Isebania to Tanzania border and Nadapal to the Southern Sudan border, transverse the County.

Kitale Town, the proposed Project Area is the largest urban centre in Trans-Nzoia County and serves as the County Headquarter. It is located between Mt. Elgon and Cherangany Hills at 1˚ 0' 56" North, 35˚ 0' 22" East, at an elevation of around 1897m. It is 62 km from Eldoret Town and 390 km from Nairobi City.

The Town was founded in 1908 by white settlers and started as a relay station on the slave route between Uganda and Tanzania. Slaves were lodged at what is now the Kitale Club. The present Kitale Municipality was founded in 1920 and has grown enormously over the years. The first Municipality covered 18 $km^2$ while the current one covers 92 $km^2$. The proposed Municipal Boundary in the proposed Kitale Municipality Integrated Urban Development Plan (GEODEV (K) Ltd) is 162 $km^2$.


**Photographs of Kitale Town Main Transit Corridor to Kapenguria**

A Location Plan of Trans-Nzoia County and Kitale Town is given on **Figure 2-1** on **Page 2.2**

Figure 2-1

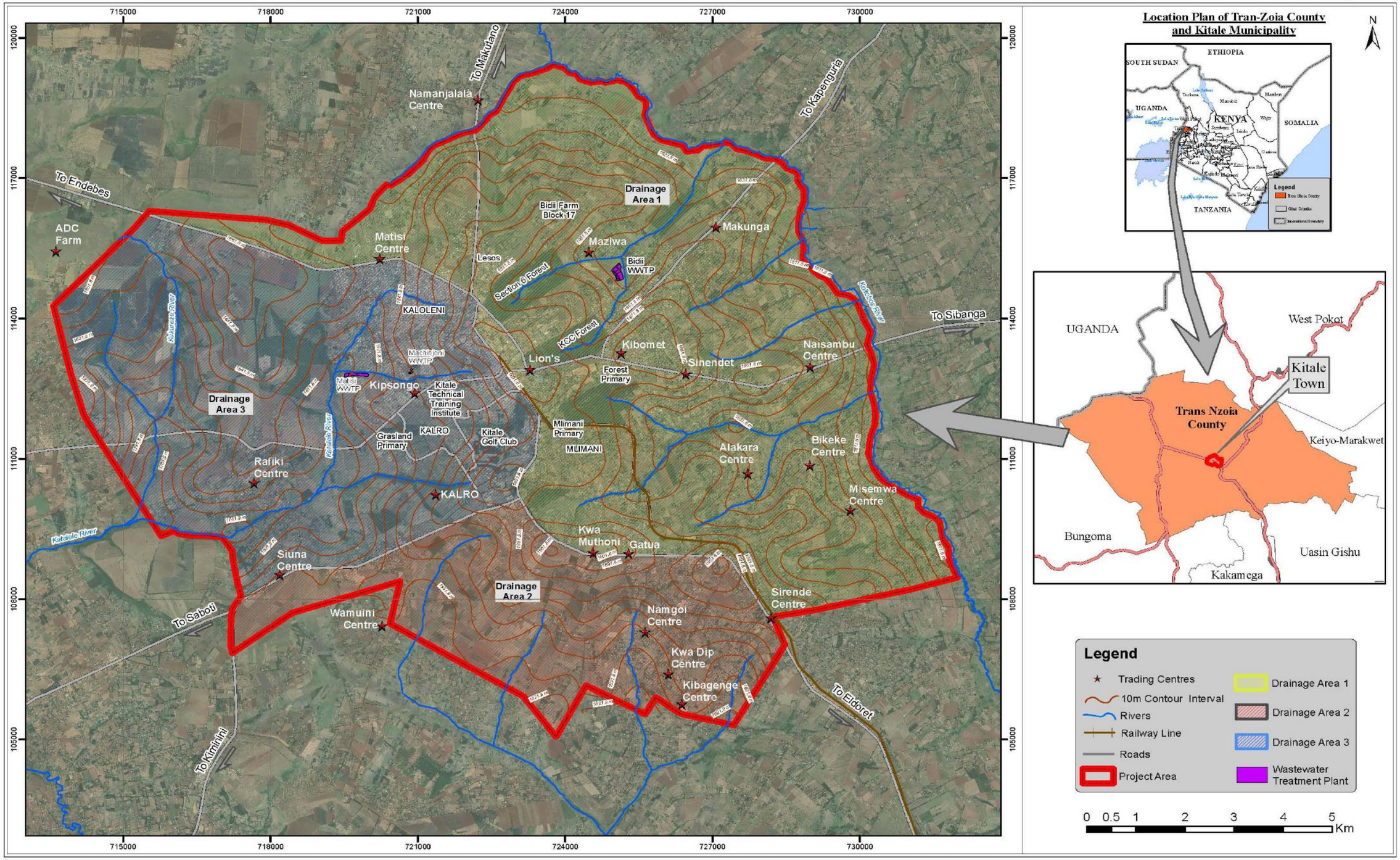



**Figure 2-1: Location Plan of Trans-Nzoia County and Kitale Town**

## 2.2 Administrative Units

Trans-Nzoia County comprises of five administrative sub counties namely, Kiminini, Saboti, Cherangany, Endebess and Kwanza. The sub counties are further sub divided into 25 Wards as shown on **Table 2-1.**

**Table 2-1: Administrative and Political Units of Trans-Nzoia County**

| S/No. | Sub-county | Area ($km^2$) | Wards |
|---|---|---|---|
| 1 | Kiminini | 395.3 | 6 |
| 2 | Saboti | 323.6 | 5 |
| 3 | Cherangany | 629.8 | 7 |
| 4 | Endebess | 680.0 | 3 |
| 5 | Kwanza | 466.9 | 4 |
| | **Total** | **2495.6** | **25** |

*Source: Trans Nzoia County Integrated Development Plan (2018-2022)*

## 2.3 Biophysical Setting

### 2.3.1 Climate

Trans-Nzoia County has a cool and temperate climate with mean maximum (day time) temperatures ranging between 23.4°C and 28.4°C and mean minimum (night time) temperatures ranging between 11.0°C and 13.5°C. The maximum and minimum extreme temperature are recorded in February (about 34.2°C) and July (about 6.5°C) respectively.

The County receives annual rainfall ranging from 1,000 mm to 1,700 mm. Western parts of Endebess, Saboti and Kiminini Sub Counties, and North Western parts of Cherang'any Sub County receive the highest rainfall ranging between 1,300 mm and 1,700 mm per year. The Eastern parts of Saboti and Kiminini Sub Counties, Southern parts of Kwanza Sub County, western and central parts of Cherang'any Sub County receive moderate rainfall ranging from 1,200 to 1,300mm. The parts of the County that receive the lowest rainfall (1,000mm -1,200mm) are Northern parts of Kwanza Sub County, Eastern parts of Endebess Sub County, South Eastern parts of Cherangany Sub County (Tuigoin) and South Eastern parts of Kiminini Sub County (Waitaluk).

The annual rainfall is distributed into three major seasons namely; Long rainfall season - March, April, May (MAM), Intermediate Season - June-July-August (JJA); and short rainfall season - October-November-December (OND). The long and intermediate seasons are more reliable for agricultural production as compared to the short rainfall season. In the recent past, drought, dry spells and floods hazards have increased in frequency and complexity, probably exacerbated by climate change. The level of devastation due to drought, dry spells and floods are becoming increasingly severe with loss of livelihoods and negative impacts to key sectors within the County.

The average temperature in Kitale Town is $18.3^0$C with an average Rainfall of 1,097 mm per year. March is the hottest month at an average temperature of $19.5^0$C while July is the coldest month of the year at an average temperature of $17.2^0$C as shown in **Table 2-2** on **Page 2-4.**

**Table 2-2: Kitale Town Average Monthly Temperatures**

| Month | J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg. Temperature (°C) | 18.7 | 19.3 | 19.5 | 19.1 | 18.7 | 17.7 | 17.2 | 17.3 | 17.8 | 18.2 | 18 | 18 |

### 2.3.2 Geology and Soils

#### a) Geology

The river valleys within Kitale municipality exhibit irregular bedded layers of coarse pebbles, coarse sands, fine sands and sills. These Pleistocene, sediments form part of old river terraces deposited during the period of glaciations of Mount Elgon when abundant water from the melting glaciers not only incised deep gorges through the volcanic rocks but, on reaching the flat Kitale Plains, spread out into broad torrential rivers, of which the limits are shown by the outcrop of black cotton soil.

The Tertiary Lavas-Mount Elgon is formed of a great mass of agglomerate, breccia and tuff with intercalated bands of lava, the whole having been ejected from a vent during Tertiary times. The boulders of lava in the agglomerate, like the lava flows themselves, are composed of nephelinites that contain much made material such as olivine, augite, magnetite, ilmenite and perovskite. Surrounding the caldera produced round the vent are lavas and breccias of phonolitic-nephelinites in which aegirine-augite and orthoclaseappear.

The floor of the caldera, lying over 300 meters below the caldera rim, is composed of volcanicash, the last eruptive material ejected from the volcano. Basement System rocks in the study area consists of metamorphic rock-types which originated solely by the effect of pressure, and consequentrise in temperature. In the study area they mainly include quartzite and schists derived fromargillaceous and arenaceous sediments which have been transformed by metamorphism and recrystallization into quartz and feldspar-rich rocks with much muscovite, biotite, and hornblende minerals.

#### b) Soils

Soils vary in type, corresponding largely with the underlying bedrock, though there is a modification in certain portions of the area due to the disintegration of the laterite caps. Buff or light brown sandy soils are produced by the breakdown of Kavirondian grits and bright red clayey soils by the mudstones. Where, however, there is close inter-banding of the grits and mudstones the grit type soils are obscured by the mudstone disintegration products. The granites give rise to coarse light brown, sandy, soils more subject to soil erosion than the more clayey varieties mentioned above, while the diorites, syeno-diorites and syenites, having a greater proportion of mafic minerals, give darker red brown, more clayey, types. This also applies to areas in the granite rich in basic xenoliths

The main types of erosion occurring in Trans-Nzoia County are splash erosion, rills, gullies, and sediment deposition. A steep slope terrain, low vegetation cover, erosive soil, high intensity rainfall and improper soil, crop and water management are factors leading to, or increasing, soil erosion. Excavation of sewer pipeline trenches has the capacity of exposing soils to agents of erosion such as wind and water.

**Photographs Showing Soils in Milimani Estate within Kitale Municipality**

## 2.4 Hydrology

There are a number of rivers in the Project region with River Nzoia catchment forming the dominant drainage system in the Lake Victoria North Drainage Basin. The river drains the region with its major tributaries Ewaso, Rongai, Koitobos and Ainomaget rivers. These rivers flow into Lake Victoria through River Nzoia while Suam River drains into Lake Turkana.

The principal river of the Kitale Plain is the Koitoboss which rises at the foot of Koitoboss Peak. All streams between Endebess Bluff and the Chepchoina River are tributary, to it. The southern watershed separating the Koitoboss tributaries from those of the Rongai River runs in an east-west direction roughly parallel to the Endebess road. The county has two water towers namely Mount Elgon and Cherangany Hills. Conservation of these water catchments is crucial for the County's ecosystem.

Kitale Municipality is divided into 3 main drainage areas with most of the area draining into River Koitobos. River Koitobos flows to the Southeast and forms the current Northern boundary of Kitale Municipality. Machinjoni River Basin is an urban river basin whose source is at the center of Kitale Municipality. It drains westwards from the municipality center and carries with it, loads of pollution from surface run-off from the CBD, neighboring residential areas and siltation from farms and discharges these polluted waters into River Nzoia.

*Excavation of sewer pipeline trenches could trigger increased river sedimentation and siltation and further pollution by plant and equipment if not properly undertaken.*

**Photograph Showing Koitobos River at Kapenguria Road Bridge**

**Photograph Showing Katalele River at KALRO**

## 2.5 Vegetation Cover

Kitale municipality vegetation cover is influenced by the Mt. Elgon's ecosystem which is banded into broad zones whose characteristics are dictated by altitude and rainfall. The lower mountain slopes are covered with dense forest and regenerating forests, hung with vine-like lianas, epiphytes and lichens. The floor is covered with a carpet of ferns, orchids and flowering plants. Common tree species encountered in the tropical montane forest (1,500-2,500m asl) are *olive Oleahochstetteri, prunus africanas, Elgon teak, podocarpus, cedar, Cordia, Neoboutania, allophyllus tombea and Aningueriaadolfi-friedericii: Ardisiandra wettsteinii, Carduus afromontanus, Echinops hoehnelii, Ranunculus keniensis (previously thought endemic to Mount Kenya), and Romulea keniensis.*

The vegetation cover is also influenced by anthropogenic activities, in areas where human activities is significant for instance Kitale municipality, dominant tree species include; *Croton macrostachus, Croton megalocarpus, Bridelia micrantha, Erythrina abyssinica, Cussonia holstii, Markhamia lutea and Ekebergia capensis*. In this zone there is also a large percentage of introduced species of which the most common is the Grevillea robusta. Other exotic species include *Cuppressus lusitanica, Eucalyptus saligna, Eucalyptus camaldulensis, Cassia siamea and Leucaena leucocephala.*

**Photograph Showing Eucalyptus woodland in private farms**

**Photograph Showing Lessos Forest**

## 2.6 Fauna

Kitale municipality is largely human settlement with no protected ecosystem except for notable man-made forest blocks include; Section 6, KCC Forest, Showground Forest and Block 1 Forest. Additionally, there exist a private nature conservancy situated along Kitale – Kapenguria road. In these modified ecosystems, notable fauna includes; mammals tamed lion, hyena, birds, reptiles, insects, amphibians and mollusks.

## 2.7 Social Economic Baseline

The Socio economic baseline was collected from literature review and the Target Groups Analysis (TGA) that was done during screening assessment done for the Project in August 2020. The objective of the Target Group Analysis (TGA) was to assess the socio-economic situation of the population in Kitale Municipality so as to appropriately inform Project Designs, ESIA and Resettlement Action Plan (RAP) assessments.

## 2.8 Settlement Patterns

The current urban fabric of Kitale Town is such that most of the municipality's activities and settlements are located along major roads such as Kitale-Kapenguria (A1), Kitale-Eldoret (B2), Kitale-Cherangany (C48) and along Endebess Road. However, the Kitale-Webuye Road experiences reduced development due to minimal land available for development as most land belong to public institutions such as Kenya Agriculture and Livestock Research Organization (KARLO), Kenya Airport Authority (KAA), GK Prison etc.

Kitale Town has mixed population distribution varying from one residential area to the other as shown in **Table 2-3**.

**Table 2-3: Population Distribution in Kitale Town**

| Population Density | Area |
|---|---|
| Mix of low and Medium Density | In the south; Milimani and along Webuye and Eldoret Roads |
| Medium Density | North East along Kapenguria and Cherangany Roads |
| High Density | North West (Tuwani and Matisi) along Kitale Suam Road |

Presence of large tracts of private farms has also affected settlement patterns in Kitale Town. Mostly, settlement patterns in Kitale are influenced by land ownership and the major roads which act as arteries on which most activities are centered on.

### a) Housing Conditions

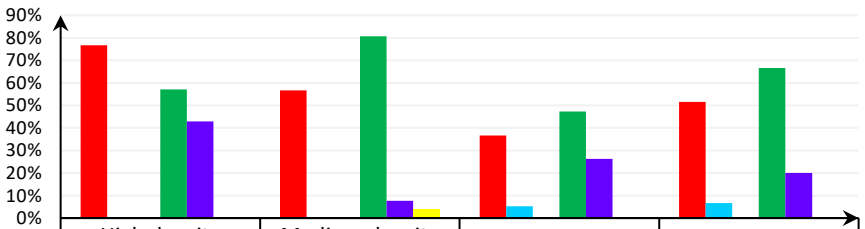
Housing condition data was derived from the Target Group Analysis (TGA) that was carried out in August 2020 to assess the socio-economic situation of the population in Kitale Municipality. The Housing Conditions of the people interviewed in the TGA is presented in the subtopics below including; Housing Categories, House Ownership, Type of Ownership, Monthly Rent, House Sizes and Characteristics of the Households.

### b) House Ownership

In high density informal settlement of (Kipsongo, Kaloleni, Mitume and Matisi), 76% of respondents live in rented houses while 23.3% own the houses they live in. For medium density formal settlements namely; Lesos, Kibomet and Sinendet, 56.7% of respondents live in rented houses while 43.3% own the houses they live in.

63.3 % of the respondents from the low density formal settlement of Milimani own the houses they live in with only 36.7% of the respondents live in rented houses. The peri urban settlements of Gatua and Kwa Muthoni house ownership is 48.4% against 51.6% renting among the household that were interviewed. For the respondents who own the houses, the mode of acquisition was represented by 57.1% (owner built) for high density informal settlement of (Kipsonga, Kaloleni, Mitume and Matisi), 80.8% (owner built) for medium density formal settlements namely; Lesos, Kibomet and Sinendet, 47.4% (owner build) for the low density formal settlement of Milimani and 66.7% (owner built) peri urban settlements of Gatua and Kwa Muthoni.

The house ownership types are shown in **Figure 2-2** on **Page 2-8.**




| | High density informal (Kipsongo/Kaloleni /Matisi/ Mitume) | Medium density formal (Lessos/Kibomet/Sinendet) | Low density formal (Milimani) | Peri-urban (Gatua/Kwa Muthoni) |
|---|---|---|---|---|
| Rented | 76.7% | 56.7% | 36.7% | 51.6% |
| Tenant Purchase | 0.0% | 0.0% | 5.3% | 6.7% |
| Mortgage | 0.0% | 0.0% | 0.0% | 0.0% |
| Owner Built | 57.1% | 80.8% | 47.4% | 66.7% |
| Inherited | 42.9% | 7.7% | 26.3% | 20.0% |
| Other | 0.0% | 3.8% | 0.0% | 0.0% |

**Figure 2-2: Type of House Ownership**

### c) Rent

For the respondents who pay rent, the amount paid varies from one village to the other with an average of 6,100 Kshs. per month as shown in **Table 2-4**.

**Table 2-4: Rent Per Month**

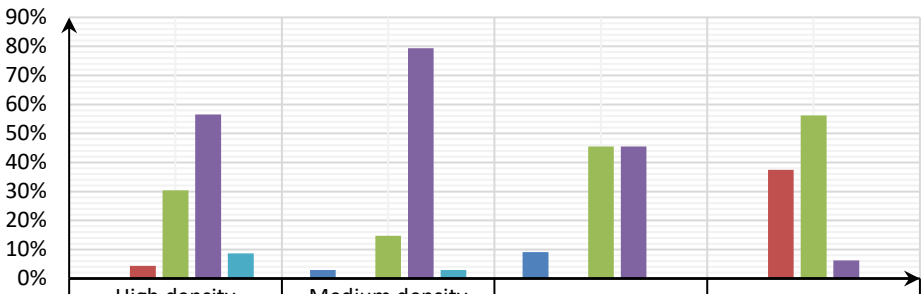
| Type of Settlement | Rent (Kshs./ Month) |
|---|---|
| High density informal | 2,176 |
| Medium density formal | 5,986 |
| Low density formal | 12,954 |
| Peri-urban | 3,188 |

From the survey, 30.4% of respondents within the high density informal settlement of Kipsonga, Kaloleni, Mitume and Matisi, pay rent that is inclusive of water and electricity bills while 56.5% pay rent exclusive of water and electricity bills.

In medium formal settlements namely; Lesos, Kibomet and Sinendet, 79% of interviewed households pay rent that is exclusive of water and electricity bills, only 14.7% pay rent that includes water and electricity bills. For the low density formal settlement of Milimani, an equal percentage of 45.5% pay rent that is exclusive and also inclusive of water and electricity bills.

For the peri urban settlements of Gatua and Kwa Muthoni, 56.3% of respondents pay rent that is inclusive of water and electricity bills while 37.5% pay rent that is inclusive of electricity bills.

The components of rent for different settlements are shown on **Figure 2-3** on **Page 2-9.**

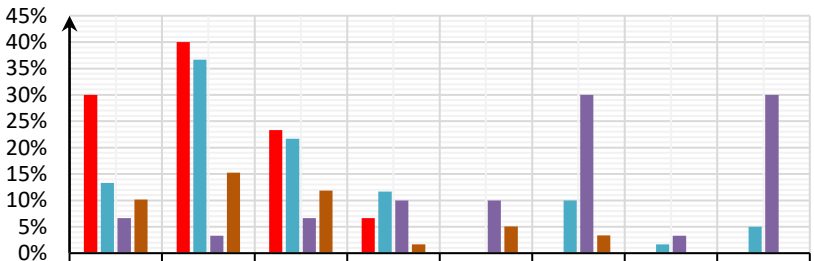



| | High density informal (Kipsongo/Kaloleni/ Matisi/ Mitume) | Medium density formal (Lessos/Kibomet/Si nendet) | Low density formal (Milimani) | Peri-urban (Gatua/Kwa Muthoni) |
|---|---|---|---|---|
| water | 0.0% | 2.9% | 9.1% | 0.0% |
| electricity | 4.3% | 0.0% | 0.0% | 37.5% |
| water & electricity | 30.4% | 14.7% | 45.5% | 56.3% |
| none | 56.5% | 79.4% | 45.5% | 6.3% |
| no response | 8.7% | 2.9% | 0.0% | 0.0% |

**Figure 2-3: Rent Distribution**

### d) House Size

From the TGA, high density informal settlement of Kipsonga, Kaloleni, Mitume and Matisi have majority of the structures with 1Nr room, 2Nr rooms and 3Nr rooms at 30%, 40% and 23.3% respectively. The low density formal settlement of Milimani is popular with 5nr rooms and 6 – 10nr rooms at 10% and 30% respectively as illustrated in **Figure 2-4**.

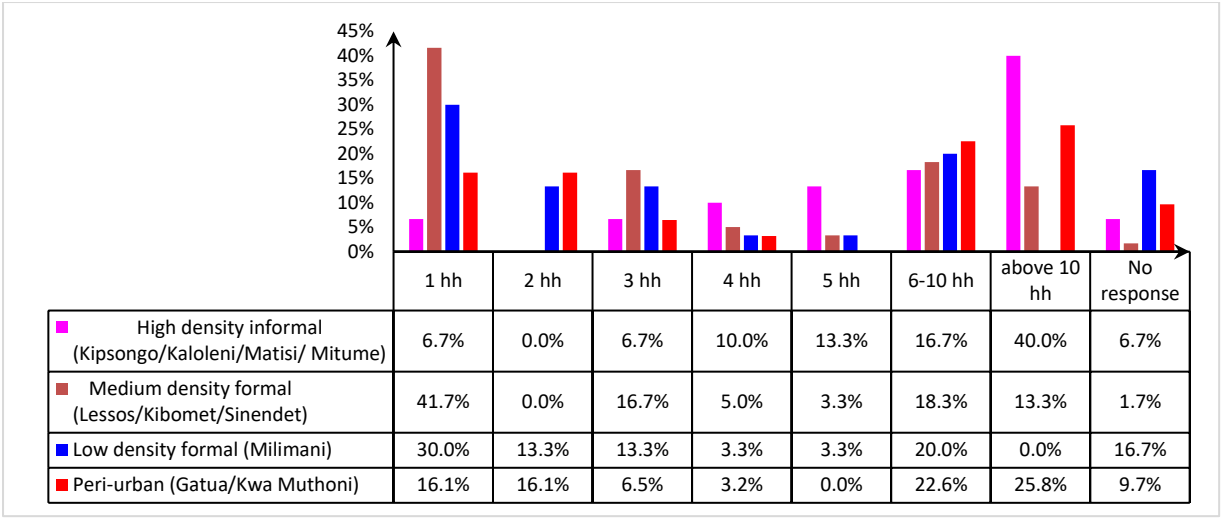



| | 1 room | 2 room | 3 rooms | 4 rooms | 5 rooms | 6-10 rooms | above 10 rooms | no response |
|---|---|---|---|---|---|---|---|---|
| High density informal (Kipsongo/Kaloleni/Matisi/ Mitume) | 30.0% | 40.0% | 23.3% | 6.7% | 0.0% | 0.0% | 0.0% | 0.0% |
| Medium density formal (Lessos/Kibomet/Sinendet) | 13.3% | 36.7% | 21.7% | 11.7% | 0.0% | 10.0% | 1.7% | 5.0% |
| Low density formal (Milimani) | 6.7% | 3.3% | 6.7% | 10.0% | 10.0% | 30.0% | 3.3% | 30.0% |
| Peri-urban (Gatua/Kwa Muthoni) | 10.2% | 15.3% | 11.9% | 1.7% | 5.1% | 3.4% | 0.0% | 0.0% |

**Figure 2-4: House Sizes**

### e) Number of Households per Plot

In high density informal settlement of Kipsongo, Kaloleni, Mitume and Matisi, 40% of the plots have more than 10nr households, 16.7% have 6 -10nr households while 13.3% of the plots have 5nr households in medium density formal settlements of Lessos, Kibomet and Sinendet and low density settlement of Milimani, 41.7% and 30% of the plots have 1 Nr household respectively as shown in **Figure 2-5** on **Page 2-10.**




| | 1 hh | 2 hh | 3 hh | 4 hh | 5 hh | 6-10 hh | above 10 hh | No response |
|---|---|---|---|---|---|---|---|---|
| High density informal (Kipsongo/Kaloleni/Matisi/ Mitume) | 6.7% | 0.0% | 6.7% | 10.0% | 13.3% | 16.7% | 40.0% | 6.7% |
| Medium density formal (Lessos/Kibomet/Sinendet) | 41.7% | 0.0% | 16.7% | 5.0% | 3.3% | 18.3% | 13.3% | 1.7% |
| Low density formal (Milimani) | 30.0% | 13.3% | 13.3% | 3.3% | 3.3% | 20.0% | 0.0% | 16.7% |
| Peri-urban (Gatua/Kwa Muthoni) | 16.1% | 16.1% | 6.5% | 3.2% | 0.0% | 22.6% | 25.8% | 9.7% |

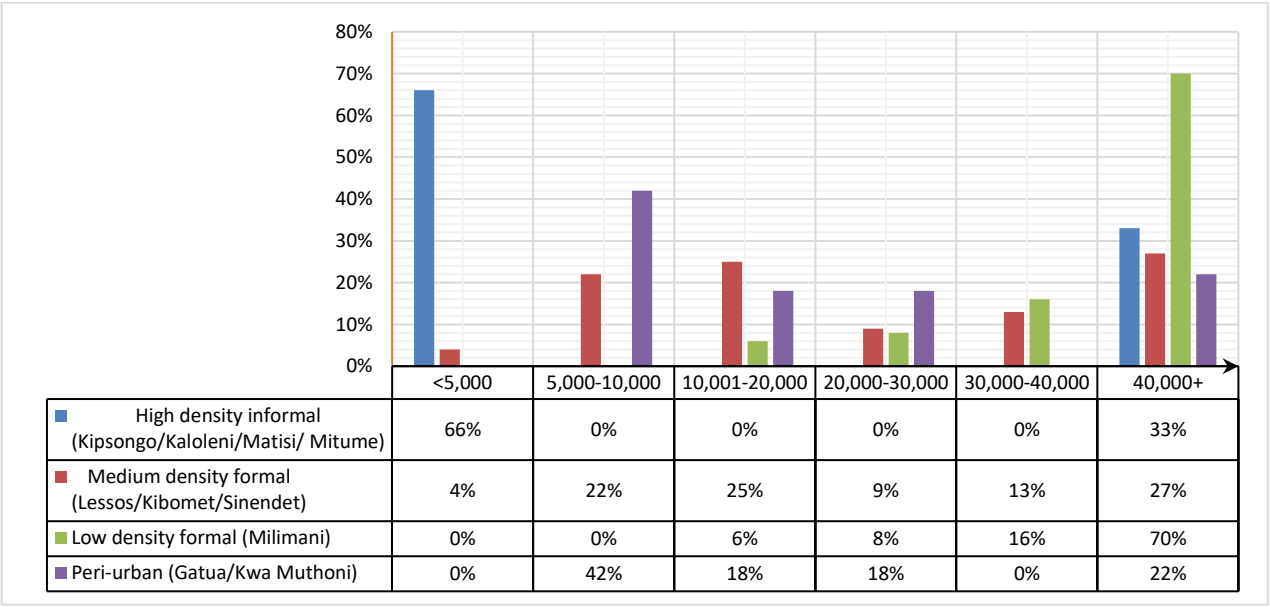
**Figure 2-5: Number of Households Per Plot**

## 2.9 Land Use and Income Streams

There are four main land uses within the County; agriculture, industrial, commercial and residential use. Other uses include transport, recreation, education etc. Land was initially mainly under agricultural use but due to increase in population most farms have changed use to commercial and residential. The once large farms have been subdivided and fragmented due to high demand for residential and commercial land. This has impacted on the settlement pattern such that there are more people settling on small-uneconomical pieces of land especially around the major roads and near market centers. Pressure on land has also led to the destruction of forest farmland, clearance of catchment areas and wetlands thus impacting negatively on the environment.

### 2.9.1 Household Income

Average household incomes in Kitale Municipality as found in the Study are as shown in **Figure 2-6.**




| | <5,000 | 5,000-10,000 | 10,001-20,000 | 20,000-30,000 | 30,000-40,000 | 40,000+ |
|---|---|---|---|---|---|---|
| High density informal (Kipsongo/Kaloleni/Matisi/ Mitume) | 66% | 0% | 0% | 0% | 0% | 33% |
| Medium density formal (Lessos/Kibomet/Sinendet) | 4% | 22% | 25% | 9% | 13% | 27% |
| Low density formal (Milimani) | 0% | 0% | 6% | 8% | 16% | 70% |
| Peri-urban (Gatua/Kwa Muthoni) | 0% | 42% | 18% | 18% | 0% | 22% |

**Figure 2-6: Average Households Income**

### 2.9.2 Household Expenditure

On average, food is the most important expenditure item accounting for an average of 32% of all household expenses. School fees is the second most important expenditure item responsible for up to 23% of the household expenses as shown in **Table 2.5**.

**Table 2-5: Household Expenditure**

| Variables | High Density Informal | Medium Density Formal | Low Density Formal | Peri-urban |
|---|---|---|---|---|
| | Month | Month | Month | Month |
| Food | 5,211 | 7,050 | 15,190 | 6,032 |
| Clothes/Shoes | 261 | 1,186 | 1,033 | 2,816 |
| Transport | 13 | 3,361 | 2,740 | 1,184 |
| Fuel (Cooking / lighting) | 1,638 | 681 | 718 | 129 |
| Electricity | 718 | 756 | 432 | 798 |
| Rent | 1,293 | 2,705 | 40,000 | 1,742 |
| Medical costs | 459 | 178 | 6,000 | 258 |
| School fees | 1,640 | 1,724 | 60,000 | 4,000 |
| Water | 730 | 514 | 517 | 616 |
| Sanitation Services | Included in Water bill | 3,045 in six month to exhaust septic | included in Water bill | 3,045 in six month to exhaust septic |
| **Total** | **11,961.9** | **18,662.1** | **126,630** | **18,083.3** |

### 2.9.3 Trade and Tourism

Trans-Nzoia County is known as the country's food basket. Agriculture is the backbone of the Trans-Nzoia county economy. Majority of the residents practice mixed farming of crop growing and animal rearing. The major crops grown includes maize, bananas, wheat, coffee, and Tea. Horticultural crops and fruits have gained prominence in the recent past. Livestock is mainly for milk and meat production.

Kitale Town hosts several agricultural dependent companies such as Kenya Seeds Company, Western Seed Company, National Cereals and Produce Board (NCPB), Kitale Grains Services, Maize Millers such as Kitale, Royal and Mombasa Millers, Kenya Creameries Company (KCC) etc.

Trans-Nzoia County has potential for development of Tourism given its endowment with rich tourist attraction features. It is part of the western tourism circuit which has been a key marketing focus by the Kenya Tourism Board. The main tourism attractions in the County are within the Mt. Elgon ecosystem that includes elephants, antelopes, buffaloes, monkeys, leopards among others. The Saiwa Swamp is another tourist attraction with the famous Sitatunga antelopes. Trans border mountain climbing is also becoming a major tourist attraction. Other tourist attraction sites in the County include; Kitale Museum, Kitale Nature and Conservancy, Treasures of Africa Museums, Vi Agroforestry, Agro-Tourism, Cultural and Sports Tourism, Historical Sites and Sceneries which include caves and mountain escapements.

The Tourism sector and the agriculture sectors have resulted into surge of people visiting Kitale Town or travelling through the Town. This has catalyzed the growth of the service and commercial industries such as hotels and financial institutions.


**Photograph Showing Kitale Nature Reserve along Kapenguria Road**

### 2.9.4 Employment

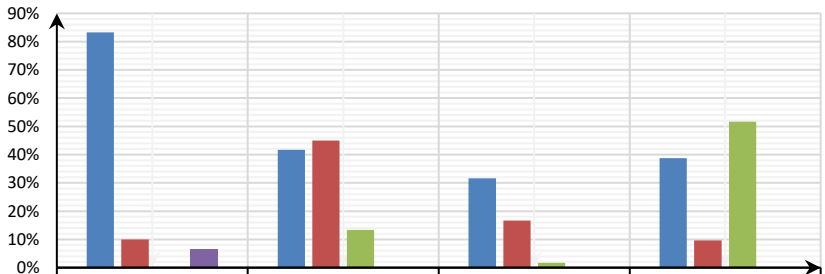
Despite all the above, Trans-Nzoia County unemployment level stands at 17.6 % (CIDP-2018-2022). Most of those earning wages are in the rural areas where they work in the maize plantations and flower farms, where labour is only required during planting, weeding and harvesting seasons.

According to the Labour Department in Trans-Nzoia County, wage earnings as at 2017 vary within different sectors and skill levels. In the agriculture sector, the unskilled earn an average of KShs. 6, 912 while the skilled and semi-skilled earn an average of KShs. 9,014 per month. Those with artisan qualifications earn an average of KShs 21,580 for those working in urban areas and KShs. 19,348 for those in rural areas. In other sectors, the skilled and semi-skilled earn an average of KShs. 17, 867 in urban areas and KShs 14,835 per month in the rural areas.

Of the total wage earners, 65% are self-employed. The jua kali sector is the main source of income for the self-employed in the County with majority of the male youths employed as motorcyclists offering transport services.

#### a) Household's Employment Status

From the TGA, majority of the respondents (85.83%) reported being employed with 48.84% being self-employed, 20.34% being in formal employment and 16.65% being under casual employment terms. The household employment status is shown in **Figure 2-7** on **Page 2-13.**




| | High density informal (Kipsongo/Kalolen i/Matisi/ Mitume) | Medium density formal (Lessos/Kibomet/ Sinendet) | Low density formal (Milimani) | Peri-urban (Gatua/Kwa Muthoni) |
|---|---|---|---|---|
| Self Employed | 83.33% | 41.67% | 31.67% | 38.71% |
| Formally Employed | 10.00% | 45.00% | 16.67% | 9.68% |
| Casually Employed | 0.00% | 13.33% | 1.67% | 51.61% |
| Currently Un Employed | 6.67% | 0.00% | 0.00% | 0.00% |

**Figure 2-7: Households Employment Status**

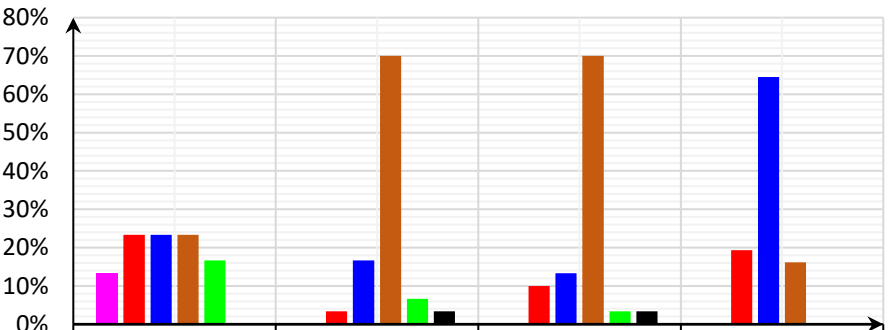
## 2.10 Education Levels

From the TGA, 46.7% of the residents in the high density informal settlements have secondary education level and above with a significant proportion (23.3%) having post-secondary education. It is also notable that a significant proportion of the population (30%) reported either no formal education (16.7%) or below Class 8 (13.3%).

86.7 % of the residents in the medium density formal settlement have secondary education level and above with a significant proportion (70%) having post-secondary education. It is also notable that a negligible proportion of the population (6.7%) reported no formal education.

83.3 % of the residents in the low density formal settlement have secondary education level and above with a significant proportion (70%) having post-secondary education. It is also notable that a negligible proportion of the population (3.3%) reported no formal education.

80.6 % of the residents in the Peri-Urban Settlements have secondary education level and above with a significant proportion (16.1%) having post-secondary education as shown on **Figure 2-8** on **Page 2-14**.

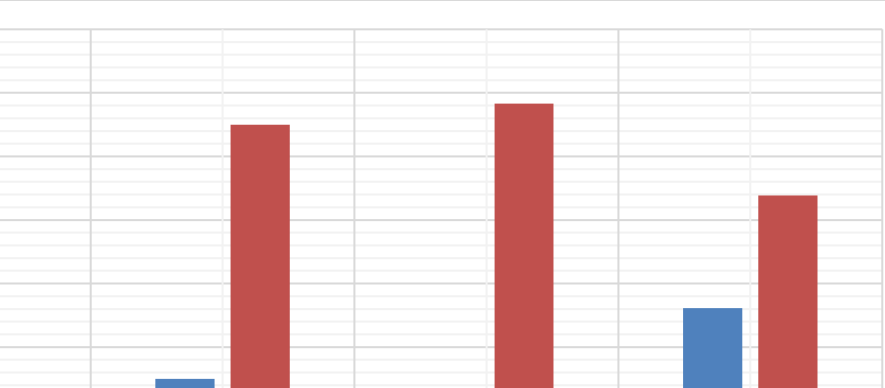



| | High density informal (Kipsongo/Kaloleni /Matisi/ Mitume) | Medium density formal (Lessos/Kibomet/Sinendet) | Low density formal (Milimani) | Peri-urban (Gatua/Kwa Muthoni) |
|---|---|---|---|---|
| below std. 8 | 13.3% | 0.0% | 0.0% | 0.0% |
| completed primary school | 23.3% | 3.3% | 10.0% | 19.4% |
| completed secondary school | 23.3% | 16.7% | 13.3% | 64.5% |
| post secondary school | 23.3% | 70.0% | 70.0% | 16.1% |
| none | 16.7% | 6.7% | 3.3% | 0.0% |
| no response | 0.0% | 3.3% | 3.3% | 0.0% |

**Figure 2-8: Education Levels of the Households Heads**

## 2.11 Health Institutions

From the TGA analysis, 93.3% of the respondents in the high density areas reported that members of their households have in the past been rendered ill by the prevailing water and sanitation conditions. However, only 3.3% and 10% of the respondents in the low density and medium density respectively reported that the prevailing water and sanitation conditions had in the past rendered their household's members is as shown in **Figure 2-9.**




| | High density informal (Kipsongo/Kaloleni/Matisi/ Mitume) | Medium density formal (Lessos/Kibomet/Sinendet) | Low density formal (Milimani) | Peri-urban (Gatua/Kwa Muthoni) |
|---|---|---|---|---|
| Yes | 93.3% | 10.0% | 3.3% | 32.3% |
| No | 6.7% | 90.0% | 96.7% | 67.7% |

**Figure 2-9: Effects of Prevailing Water and Sanitation on Resident's Health**

## 2.12 Water and Sanitation Baseline

### 2.12.1 Existing Water Infrastructure

The existing Kitale Water Supply System covers an area of approximately 122 km$^2$ comprising of current Kitale Municipality (92 km$^2$) and parts of the adjoining peri-urban and rural areas. Kitale Town mainly depends on water supply from Kapolet Treatment Works which was commissioned in 2010 and Nzoia Water Treatment Plant commissioned in 1986 and has had rehabilitation works done in the 90's and most recently in 2007/2010.

A brief description of the existing Water Supply System for Kitale Town is given in **Table 2-6**.

**Table 2-6: Summary of Existing Water Supply System**

<table>
<tr><th>Component</th><th>Description</th></tr>
<tr><td>Coverage</td><td>• Overall coverage of approximately 122 Km$^2$</td></tr>
<tr><td>Sources</td><td>• Intake across River Nzoia: abstraction capacity limited to 10,300 m$^3$/d by pumps and pumping mains<br>• Intake across River Kapolet: Capacity 20,014 m$^3$/d<br>• Other Sources:<br>- Shallow wells<br>- Private Boreholes<br>- Springs<br>- Rainwater Harvesting</td></tr>
<tr><td>Water Treatment Plants (WTPs)</td><td>
<table>
<tr><th>WTP</th><th>Capacity (m$^3$/d)</th></tr>
<tr><td>Nzoia WTP</td><td>Has an installed capacity of 10,300 m$^3$/d but is currently producing an average of 4,000 m$^3$/d since the pumping main to the Southern Compound was cut off during the construction of Kitale -Webuye Interchange</td></tr>
<tr><td>Kapolet WTP</td><td>10,500 (Only about 50% of the treated water reaches Kitale Town due to enroute tapping</td></tr>
<tr><td>Total</td><td>Installed Capacity: 20,800 m$^3$/d<br>Total Production: 14,500 m$^3$/d</td></tr>
</table>
</td></tr>
<tr><td>Reservoirs</td><td>
<table>
<tr><th>Tank Nr.</th><th>Tank Type</th><th>Material</th><th>Capacity (m$^3$)</th><th>Status</th></tr>
<tr><td colspan="5">Northern Compound (Within NZOWASCO – Kitale offices)</td></tr>
<tr><td>Tank N.C 1</td><td>Ground Level</td><td>Concrete</td><td>3,250</td><td rowspan="3">In good Condition and Operational</td></tr>
<tr><td>Tank N.C.2</td><td>Ground Level</td><td>Concrete</td><td>3,250</td></tr>
<tr><td>Tank N.C.3</td><td>Elevated</td><td>Concrete</td><td>225</td></tr>
<tr><td colspan="3">Sub- Total 1</td><td>6,725</td><td></td></tr>
<tr><td colspan="5">Southern Compound (Milimani Area)</td></tr>
<tr><td>Tank S.C.1</td><td>Ground Level</td><td>Concrete</td><td>1,500</td><td rowspan="2">In good condition but not receiving water from Nzoia WTP</td></tr>
<tr><td>Tank S.C.2</td><td>Ground Level</td><td>Concrete</td><td>1,135</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Component</th><th>Description</th></tr>
<tr><td></td><td>
<table>
<tr><td>Tank S.C.3</td><td>Elevated</td><td>Steel</td><td>270</td><td rowspan="2">Undergoing Rehabilitation</td></tr>
<tr><td>Tank S.C.4</td><td>Elevated</td><td>Steel</td><td>230</td></tr>
<tr><td colspan="3">Sub- Total 1</td><td>3,135</td><td></td></tr>
<tr><td>Kapolet WTP Reservoir</td><td>Ground Level</td><td>Concrete</td><td>2,500</td><td rowspan="2">In good Condition and Operational</td></tr>
<tr><td>Nzoia WTP Reservoir</td><td>Ground Level</td><td>Concrete</td><td>400</td></tr>
<tr><td colspan="3">Total Storage Capacity</td><td>12,760</td><td></td></tr>
</table>
</td></tr>
<tr><td>Distribution System</td><td>• Length: approximately 400 Km<br>• Diameters range from 12.5 mm to 500 mm<br>• Materials: Ferrous, uPVC, HDPE</td></tr>
<tr><td>Other water Sources</td><td>Residents without access to piped water get water from:<br>• Water kiosks connected to the main water supply<br>• Private boreholes,<br>• Shallow wells,<br>• Rivers and spring</td></tr>
</table>

A Layout Plan of the existing Water Supply System for Kitale Town is as shown in **Figure 2-10** on **Page 2-17**.

Figure 2-10

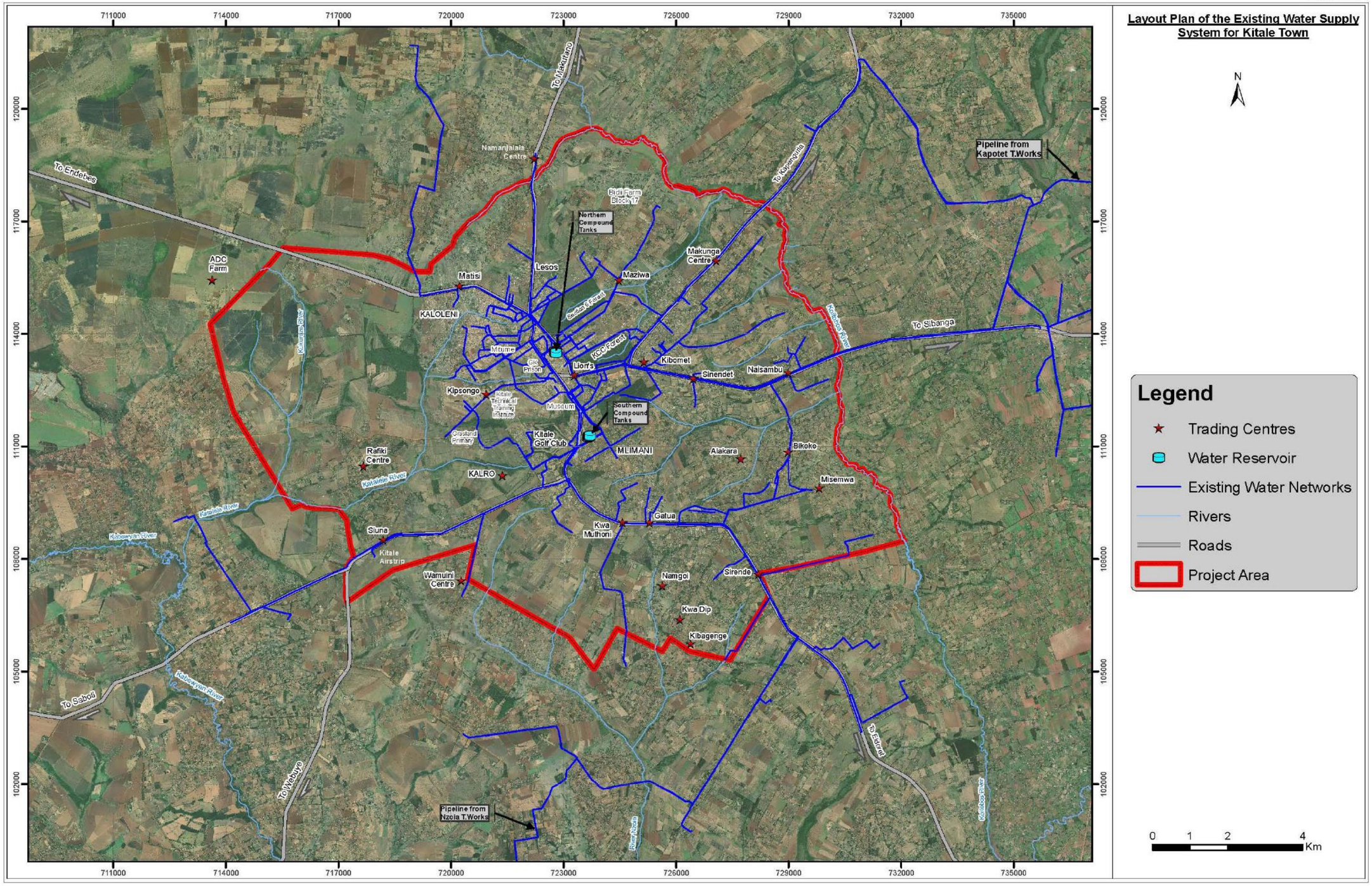



**Figure 2-10: A Layout Plan of the existing Water Supply System for Kitale Town**

### 2.12.2 Existing Kitale Town Sewerage System

The Water Borne Sewerage System for Kitale Town covers an area of approximately 10.5 $Km^2$. The system consists of sewer reticulation network approximately 43.3 Km and 2Nr. Wastewater Treatment Plants (WWTP). A brief description of the existing Sewerage System is summarized in **Table 2-7**.

**Table 2-7: Summary of Existing Sanitation System**

| Component | Description |
|---|---|
| **Coverage** | • Overall Coverage area of 10.5 $Km^2$ |
| **Reticulation Sewers** | • Material: Concrete, PVC and Steel<br>• Diameter: Range from 150mm -375mm<br>• Length: Approximately 43.33 Km |
| **Pumping Stations** | • Milimani Pumping Station<br>- Retention/ Overflow pond<br>- Pump house with a sump<br>- Control panel<br>- 1 Nr. Pumps<br>• Webuye Gardens pumping station has since been decommissioned. Wastewater that was previously been pumped to Machinjoni WWTP flows by gravity to Bidii WWTP |
| **Wastewater Treatment Plants** | **<u>Bidii Wastewater Treatment Plant</u>**<br>• Commissioned in 1984<br>• Capacity: 2,930 $m^3/d$<br>• Components:<br>- Inlet Works<br>- 4 Nr. Anaerobic Ponds<br>- 2 Nr. Facultative Ponds<br>- 2 Nr. maturation Ponds<br>- Outflow Structure and Channel<br>- 1 Nr operators building<br><br>**<u>Machinjoni Wastewater Treatment Plant</u>**<br>• Commissioned in 1957<br>• Capacity: 650 $m^3/d$<br>• Components:<br>- Inlet Works<br>- 2 Nr. Primary Clarifiers<br>- 2 Nr Trickling Filters<br>- 2Nr. Secondary Clarifier<br>- 2 Nr Sludge Thickeners<br>- Sludge Drying Beds<br>- 3 Nr Maturation Ponds in series at Matisi- 1 Km away from the conventional Treatment Facility (Constructed in 1977)<br><br>******The Conventional System is currently not operational and therefore, wastewater bypasses the plant directly into the maturation Ponds*** |
| **Public Ablution Blocks** | • Kitale Town has 16 Nr Ablution Blocks spread within the Central Business District (CBD). NZOWASCO operates one Ablution Block constructed |

| Component | Description |
|---|---|
| | through WSTF. The rest are operated by Trans Nzoia County Government and Private Institutions/Individuals. |
| **On-Site Systems** | • Only 11.7% (10.5 $km^2$) of current Kitale Municipality boundary (92 $km^2$) (6.5% of the proposed Kitale Municipality Boundary) is served by the waterborne sewerage system. The rest of the area (88.3%) use On-site Sanitation facilities such as Pit Latrines and Septic Tanks |

**Photograph Showing Bidii Wastewater Treatment Works**

**Photograph Showing Matisi Maturation Ponds**

A Layout Plan of the existing Sewerage System for Kitale Town is shown on **Figure 2-11** on **Page 2-20.**

Figure 2-11

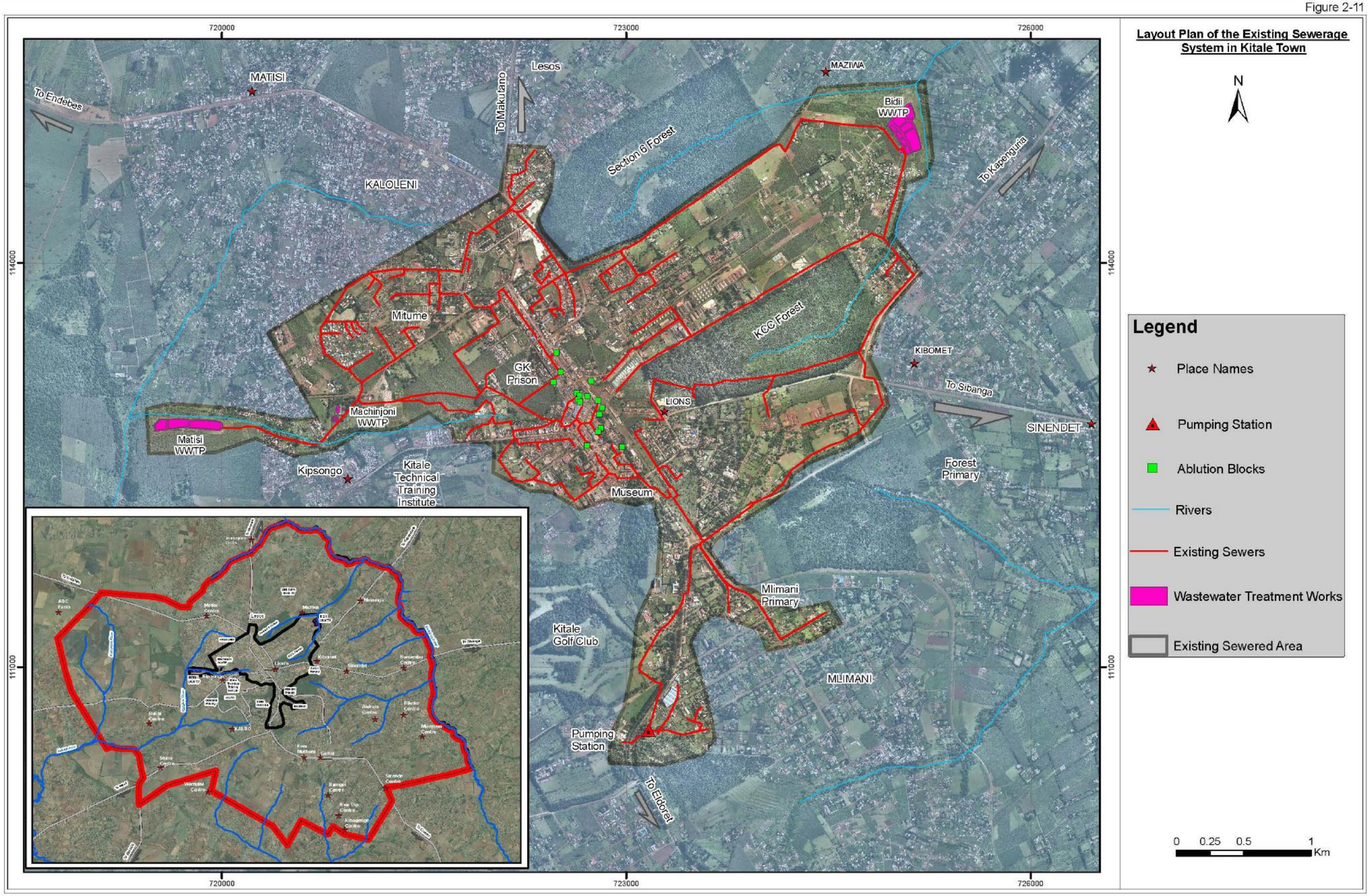



**Figure 2-11: Layout Plan of the Existing Sewerage System in Kitale Town**

### 2.12.3 Constraints in Kitale Town Sanitation System

The main challenges facing the existing Sewerage System in Kitale Town are as summarized in **Table 2-8**.

**Table 2-8: Constraint in Kitale Town Sanitation System**

<table>
<tr><th>Item</th><th>Constraint</th><th>Proposed Action</th></tr>
<tr><td>1</td><td><u>Sewer Network Coverage</u><br>▪ Sewer Networks coverage in Kitale Town is low, covering 11.7% (10.5 Km$^2$) of the current Municipality (92 km$^2$) mainly the Central Business District (CBD) and adjoining residential areas such as Milimani ,Bondeni, Shauri Moyo and high density areas such as Mitume.<br><br>▪ The Network Expansion has been slow since 2007 with only a few additional secondary and infill sewers.<br><br>▪ The priority areas indicated by NZOWASCO for potential expansion and densification of sewers and our preliminary evaluation with reference to the existing Sewerage System are as follows;<br><br>
<table>
<tr><th>Proposed Area</th><th>Preliminary Evaluation</th></tr>
<tr><td>Lessos</td><td>Lessos is a developing medium density residential area along Kitale/Makutano Road with development on both sides of the road. The area on the Section 6 Forest side can be drained into Bidii WWTP. However, sections on the Matisi Center side cannot drain to Bidii WWTP without pumping.</td></tr>
<tr><td>Kaloleni / Mitume</td><td>Kalolen and Mitume are high density residential areas located west of Kitale Municipality, South of Kitale-Endebess Road. Wastewater from Kaloleni and Western parts of Mitume cannot gravitate to Machinjoni WWTP.</td></tr>
<tr><td>Shimo la Tewa</td><td>Shimo la Tewa is an Informal Settlement on the Eastern Parts of Milimani Area. Wastewater from this area would require pumping to</td></tr>
</table>
</td><td>• Expansion of Sewer Network is required to increase the Network Coverage,<br>• Kitale Town is expanding both horizontally and Vertically with population densification even beyond the Current Municipal boundaries.<br><br>• For these priority areas to be connected and as much as possible to ensure gravity flow, the following key considerations should be taken into account;<br><br>• The WWTPs should be located to enable the majority of wastewater from the catchment to by gravity<br><br>• Pumping Stations should only be introduced to the system to transfer wastewater from low lying areas to the existing WWTPs if gravity flow is not possible.</td></tr>
</table>

<table>
<tr><th>Item</th><th>Constraint</th><th>Proposed Action</th></tr>
<tr><td></td><td>
<table>
<tr><td></td><td>connect to the existing sewerage infrastructure.</td></tr>
<tr><td>Milimani</td><td>Milimani is a low-density area, Southwest of the CBD, located between Kitale Eldoret Road and the Railway line. The upper side of Milimani area is connected to the existing sewer network. Areas near Shimo la Tewa Primary would require pumping to connect to the existing sewerage infrastructure</td></tr>
<tr><td>Kibomet</td><td>Kibomet is a medium density area located between the Road to Kapenguria and the Road to Sibanga. Areas along the Kitale Sibanga Road cannot gravitate to the existing Bidii WWTP. For areas along Kitale- Kapenguria Road, only areas within 2km from the Kapenguria-Sibanga Junction can be connected to the existing sewer network without investment in a pumping station.</td></tr>
<tr><td>Gatua</td><td>Gatua is a medium density area along Kitale- Eldoret Road. The development in Gatua is on both sides of the road and therefore falls under two drainage areas both of which cannot be connected to the existing sewerage infrastructure without investment in pumping.</td></tr>
</table>
</td><td></td></tr>
<tr><td>2</td><td><u>Sewer Connectivity</u><br>▪ Connectivity to the existing Sewer Network is low.<br>▪ NZOWASCO only carries out an average of 3 new connections per month.<br>▪ This is caused by the low network coverage and the since most of the sewers are too far from the households since most sewers are trunks sewers with no secondary and infill sewers.</td><td>• Development of a sewer connection strategy and Policy<br>• The Strategy should include measures to ensure that sewer connectivity is affordable to the low-income population especially those living in informal settlements<br>• Construction of secondary and infill sewers to enable easy connections to the households</td></tr>
</table>

| Item | Constraint | Proposed Action |
|---|---|---|
| 3 | **Industrial Discharge**<br>▪ Discharge of wastewater from industries without pre-treatment.<br>▪ Wastewater from industries such as KCC contains fat and grease that when released into the treatment works hinders efficient wastewater treatment. In addition, the high content of Total Suspended Solid (TSS), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) and other components leads to overloading of WWTP<br>▪ Wastewater from Machinjoni Slaughterhouse is discharged into Machinjoni WWTP without Pre-treatment which leads to introduction of high strength wastewater into the WWTP. | • As in item 2 above, the Policy should detail the requirement for pre-treatment of wastewater from industries especially food processing industries such as slaughterhouses and milk processing industries.<br>• The pre-treated wastewater should meet the EMCR, 2006 effluent standards for discharge into public sewers<br>• A tripartite Contract should be signed between the County Government of Trans-Nzoia, NZOWASCO and the Industries |
| 4 | **Wastewater Collection and Conveyance**<br>▪ Wastewater collection and treatment in and around the town is poor, wastewater is being discharged into natural water courses especially in the unsewered high density areas such as Mitume and Kaloleni. | • With expansion of sewer network, construction of secondary and lateral sewers and connection to the sewer network, wastewater collection and conveyance will be improved |
| 5 | **Wastewater Treatment**<br>▪ Wastewater Treatment effluent especially from Machinjoni WWTP does not meet the effluent standards. The conventional system for Machinjoni WWTP has been by passed leaving the Maturation Ponds as the only active components. The treatment process is therefore not effective. | • Control of the quality of wastewater discharged into the sewers will reduce overloading WWTP<br>• Expansion/ Relocation and redesign of the WWTP and/or the treatment process will ensure that the effluent form the WWTP meets the EMCR,2006 effluent standards for discharge into the environment.<br>• Preparation of An Effluent Discharge Control Plan will help in monitoring the quality of effluent discharged into the water course and the plan will also detail the measures to be adopted if the effluent is not meeting the required standards. |
| 6 | **Old/Dilapidated Sewers**<br>▪ Some of the concrete pipes in the sewer Network are 42(1978/1984) and 63 (1957) years old. This leads to occasional collapse of pipes due to Hydrogen Sulphide attack especially along the Roads leading to wastewater backflow and overflow into natural water courses. | • Replacement of critical sewers in the network |

| Item | Constraint | Proposed Action |
|---|---|---|
| 7 | **Undersize Sewers**<br>▪ Some of the secondary sewers are 150mm dia. With uncontrolled use of toiletry and deposit of solid waste into the manholes, the small diameter sewers are easily blocked leading to backflow and overflow of wastewater into natural water courses. | • Replacement of undersize sewers |
| 8 | **Suppressed Water Supply**<br>▪ Kapolet Water Treatment Plant was designed to supply water to Kitale Town. Currently, only 50% of water is reaching Kitale Town due to enroute tapping.<br>▪ Nzoia water intake and treatment plant was initially intended for water supply when Kapolet River flow is low. Currently, 4,000$m^3$/d treated water is been pumped from Nzoia Water Supply System.<br>▪ Due to demand pressure in the existing water supply system, NZOWASCO is considering rationing of water within its area of supply.<br>▪ A waterborne sewerage system requires adequate amount of water to allow for flushing of solids in wastewater. In small diameter sewers, suppressed water might lead to blockages considering that some of the facilities are pour flush type that use little and sometimes recycled cleaning water for flushing. | • Rehabilitation and Realignment of the pumping main from Nzoia Water Treatment Plant to the Southern Compound Reservoirs<br>• Implementation of Non-Revenue Water (NRW) reduction measures |
| 9 | **Sewers in Private Properties**<br>▪ About 80% of the sewers are laid in private properties or impassable thick forests which makes access for maintenance difficult. The sewers are aligned in the forest to provide best alignment for gravity flow The property owners are using the manholes for solid waste disposal leading to blockages.<br>▪ New Developments are being built on top of the existing sewers making maintenance of the sewers difficult /impossible. | • Realignment of sewers to public wayleaves and restriction of activities along the wayleaves<br>• Repossession of public land |
| 10 | **Vandalism of Manhole Covers and Step Irons.**<br>• Most manholes are missing Manhole Covers and Step Irons. The missing manhole covers are those that have metal frames which are vandalised and resold as scrap metals.<br>• Most Reinforced Concrete (RC) covers are in good conditions and well mounted in their respective manholes.<br>• The most Vandalised manholes are those on Public land and wayleaves. | • Use of Manhole Covers made of material that has little reuse value such as concrete and high density reinforced plastic covers |

| Item | Constraint | Proposed Action |
|---|---|---|
| **11** | **Hydrogen Sulphide Attack**<br>▪ Hydrogen Suphide gas in wastewater is generated under anaerobic condition where due to depletion of oxygen, sulphur compounds are reduced by bacteria and react with hydrogen to form the gas.<br>▪ The gas rises to the inner crown of sewers where in presence of water it is oxidised into Sulphuric Acid which corrodes the pipe.<br>▪ The thickness of the top wall of the pipe reduces and weakens the pipe leading to pipe collapse if any loading is applied onto it. | • Replacement of the old concrete pipes<br>• Use of acid resistance pipes such as HDPE and uPVC<br>• Use of sulphate resistance lining on wastewater treatment plant structures<br>• Sewer design to allow high velocity flow in pipes<br>• Pipe/System flushing |
| **12** | **Inadequate Operation and Maintenance**<br>▪ Manholes and the WWTPs are overgrown by bushes and some manholes are buried due to deposit of soil either by storm water, people farming around the manholes etc. | • Adequate training of staff on Operation and maintenance |
| **13** | **Inadequate tools and Equipment**<br>▪ NZOWASCO Kitale only exhauster has broken down.<br>▪ Households with septic tanks depend on Private Exhausters to empty septic tanks and transport the sludge to the WWTP.<br>▪ NZOWASCO has a Laboratory in Matisi Water Treatment Plant and in Kapolet Water Treatment Plant. However, NZOWASCO usually takes their wastewater samples for testing in Eldoret due to lack of requisite testing Kits | • Provision of requisite tools and equipment<br>• The water treatment lab should be well equipped to handle wastewater tests, or a new independent lab be provide for wastewater testing |
| **14** | **Encroachment of WWTP Land**<br>▪ The land where Bidii and Machinjoni WWTP are located is reported to be encroached. | • Repossession of Public land and acquiring of Title Deeds |

# CHAPTER 3: PROJECT ALTERNATIVES

## 3.1 Alternative Wastewater Treatment Options

Wastewater Treatment Technologies were selected after taking consideration of the pertinent technical, operational and economic factors, limitation and constraints. The technologies were evaluated based on the following key factors:

i) Nature and Strength of Wastewater
ii) Capital and Operation & Maintenance Cost of the Wastewater Treatment Technology
iii) Land requirement
iv) Operation skills and mechanical equipment requirements
v) Sludge production and sludge handling
vi) Energy recovery
vii) Fertilizer recovery
viii) The degree of colour odour and noise

Several Wastewater Treatment Technologies may be considered for wastewater treatment. These include:

i) Waste Stabilization Ponds
ii) Activated Sludge
iii) Extended Aeration (Oxidation Ditches)
iv) Aerated lagoons
v) Sequencing Batch Reactor
vi) Bio-Filtration
vii) Anaerobic Digestion
viii) Reed Beds
ix) Floating Aquatic Plant Systems
x) Land Application

The above wastewater technologies have been analyzed in detail using the criteria above and a summary of comparison of these different wastewater treatment technologies is given in **Table 3-1** on **Page 3.2.**

## Table 3-1: Comparison of Wastewater Treatment Technologies

| Item No. | Treatment Process | Standard of Treatment | Process Reliability | Process Complexity | Operation & Maintenance Requirements | land Requirements | Civil Construction Requirements | M & E Equipment | Sludge production | Environmental Considerations |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Waste Stabilisation Ponds (WSPs) | Good, except for nutrient removal | Very good, but climate dependent | Extremely simple. No skills needed | Very limited and simple | Large areas of land needed | Very Simple | Almost none, except possibly at the inlet works | Limited sludge production. Sludge is stable and requires no further treatment | High Environmental acceptance |
| 2 | Aerated Lagoons | Good, except for nutrient & bacteria removal | Good, but partly subject to power outages and mechanical failure | Very simple. No skills needed | Limited and straight forward | High land requirements, but not as large as WSPs | Very simple | Apart from the inlet works, only the surface aerators | Limited sludge production. Sludge is stable and requires no further treatment | Moderate environmental acceptance |
| 3 | Biological Filters | Very good for nutrient and bacterial removal | Good, but partly subject to power outages and mechanical failure | Simple . Limited skills needed | Moderate but straight forward | Moderate land requirement | Complicated RC structural requirements | Moderate degree of M&E plant needed | Sludge from primary & secondary settlement needs treatment | Some aspects need further environmental consideration |
| 4 | Combined System (Biological Filters , Sedimentation Tanks and wastewater stabilization ponds Ponds) | Very good for nutrient and bacterial removal | Good, but partly subject to power outages and mechanical failure | Simple . Limited skills needed | Moderate but straight forward | Moderate land requirement | Complicated RC structural requirements | Moderate degree of M&E plant needed | Limited sludge production. Sludge is stable and requires no further treatment | High Environmental acceptance |
| 5 | Anaerobic Baffle Reactor | Good, except for nutrient & bacteria removal | Good, wastewater characteristics dependent | Extremely simple. No skills needed | Very limited and simple | Moderate land requirement | Very Simple | Almost none, except possibly at the inlet works | Sludge needs treatment | Many aspects need further environmental consideration |
| 6 | Activated Sludge | Very good except for nutrient and bacterial removal | Good, but partly subject to power outages and mechanical failure | Complex highly skilled manpower needed | High requirement for O&M and skilled staff | Minimum land requirements | Very Complicated RC Structural requirements | High input of M&E equipment needs | Sludge from primary & secondary settlement needs treatment | Many aspects need further environmental consideration |
| 7 | Oxidation Ditch | Very good except for nutrient and bacterial removal | Good, but partly subject to power outages and mechanical failure | Simple limited skills required | Moderate requirement for skilled O&M staff | Moderate land requirements | Moderate construction requirements | Moderate degree of M&E plant needed | Limited sludge production. Sludge is stable and requires no further treatment | Some aspects need further environmental consideration |
| 8 | Upflow Anaerobic Sludge Blankets (UASB) | Very good except for nutrient removal. *(especially for COD>2000mg/l)* | Good, but subject to power outages and mechanical failure | Complex highly skilled manpower needed | Moderate requirement for skilled O&M staff | Minimum land requirements | Moderate construction requirements | Moderate degree of M&E plant needed | Limited sludge production. Sludge is stable and requires no further treatment | Moderate environmental acceptance |
| 9 | Sequencing Batch Reactor (SBR) | High level of carbon oxidation, nitrification and phosphorus removal | Good, but subject to power outages and mechanical failure | Simple limited skills required | High requirement for O&M and skilled staff | Minimum land requirements | Complicated Construction requirement | High input of M&E equipment needs | Limited sludge production. Sludge is stable and requires no further treatment | Some aspects need further environmental consideration |
| 10 | Constructed Wetlands | Very good for nutrient and bacterial removal | Good, but climate dependent | Simple limited skills required | Moderate but straight forward | High land requirements, but not as large as WSPs | Moderate construction requirements | Almost none, except possibly at the inlet works | Requires inclusion of a primary sedimentation components: Usually clogged by presence of sludge | High Environmental acceptance |

**Notes:**

*i) All the treatment processes except Waste Stabilisation Ponds and Combined System will require additional treatment such as; Sand Filtration and disinfection or Maturation Ponds to achieve bacteriological reduction*
*ii) All the treatment processes considered except for well-designed Biological Filters, Combined System and SBR, will require additional process units to achieve nutrients removal.*
*iii) The activated sludge process and the Oxidation Ditch most easily lend themselves to nutrient reduction using the modified Activated Sludge (MAS) process*

## 3.2 Effluent Disinfection Alternatives

### 3.2.1 Maturation Lagoons

Maturation lagoons are considered to be the ideal method for wastewater disinfection in warm climates wherever sufficient land is available at reasonable cost Pathogen removal rates are high, operation and maintenance is simple, and costs are low.

### 3.2.2 Chlorination

Chlorination has traditionally been the most widespread form of wastewater disinfection world· wide. However, it is now gradually being replaced by other forms of disinfection due to a number of disadvantages which are now recognized:

- The efficiency of the process is greatly reduced when organic matter and ammonia is present in the effluent as these also react with chlorine
- A high degree of process control is needed to achieve the necessary efficiency
- Environmental concerns have been raised over the production of hazardous by-products such as organochlorine compounds which are thought to be carcinogenic (chlorination of wastewater effluents has been banned is some countries e.g. Germany, because of this)
- Protozoa such as Giardia and Cryptosporidium are resistant to chlorination
- Efficiency of virus removal is also thought to be low
- Regrowth of residual populations of pathogens can occur due to the removal of populations of harmless bacteria which would otherwise prevent multiplication of pathogens

It is therefore recommended that chlorination should be avoided provided a suitable alternative form of disinfection can be found.

### 3.2.3 UV Light

UV disinfection is essentially an enhanced form of natural disinfection via sunlight which is one of the principal mechanisms by which maturation ponds operate. The process has gained increasing popularity in recent years as technology advancements have provided more' reliable equipment However, UV light disinfection generally costs around twice that of chlorination and it is still a comparatively complex process to operate, with a high degree of maintenance required. particularly for cleaning of the lamps. It is therefore considered to be an unsuitable process for the Project.

### 3.2.4 Ozonation

Capital costs of Ozonation are reported to be higher than the capital cost for most other disinfection methods, the major capital item being the ozone generation equipment. including the air-preparation system. Large, possibly multi-stage, tanks or columns are also required. Total capital costs may be 4-5 times greater than for chlorination systems. while operating costs (primarily electrical requirements) are thought to be around three times greater than for chlorination. The high costs combined with the complexity of operation would make this process unsuitable for this Project.

### 3.2.5 Sand Filters

Two types of sand filter can be described:

i) Rapid sand filters (essentially similar to those used at clean water works)
ii) Slow sand filters

Rapid sand filters are only suitable for large treatment works where skilled personnel are available to provide the necessary operation and maintenance. Clogging of the filters is common and frequent backwashing is required. Slow sand filters do not require backwashing facilities but require a relatively large area of land and involve a high capital expenditure.

## 3.3 Recommendation

It has been observed that several existing mechanized WWTPs in Kenya are not operating optimally and at times are completely dysfunctional and in a state of disrepair, primarily due to lack of operation and maintenance capacity, inadequate investment from the recurrent expenditure, unavailability locally of critical and specific spare parts, inability to meet energy costs, amongst other reasons. In addition, some of the mechanical parts are expensive to maintain and replace when they become obsolete or are worn out. Mechanical systems have a useful life of between 10 and 12 years and require major overhaul after every 5 years.

Considering the above challenges in operation and maintenance of mechanized wastewater treatment systems, characteristics and quantities of wastewater generated in Kitale Municipality, the following 3 Nr. Technologies have been selected for further analysis:

**Table 3-2: Wastewater Treatment Technologies Selected for Further Analysis**

| Technology | | Components |
|---|---|---|
| 1 | Wastewater Stabilization Ponds | Screening + Anaerobic Ponds +Facultative Ponds + Maturation Ponds |
| 2 | Combined System 1 | Screening + Anaerobic Ponds + Trickling Filters + Sedimentation Tanks + Maturation Pond |
| 3 | Combined System 2 | Screening + Primary Sedimentation Tanks + High Rate Trickling Filters + Intermediate Sedimentation Tanks + Slow Rate Trickling Filters + Secondary Sedimentation Tanks + Maturation Ponds |

The Schematic Layout Plans of the above Wastewater Treatment Technologies are shown on **Figures 3-1** to **3-3** on **Pages 3-5** to **3-7** respectively.

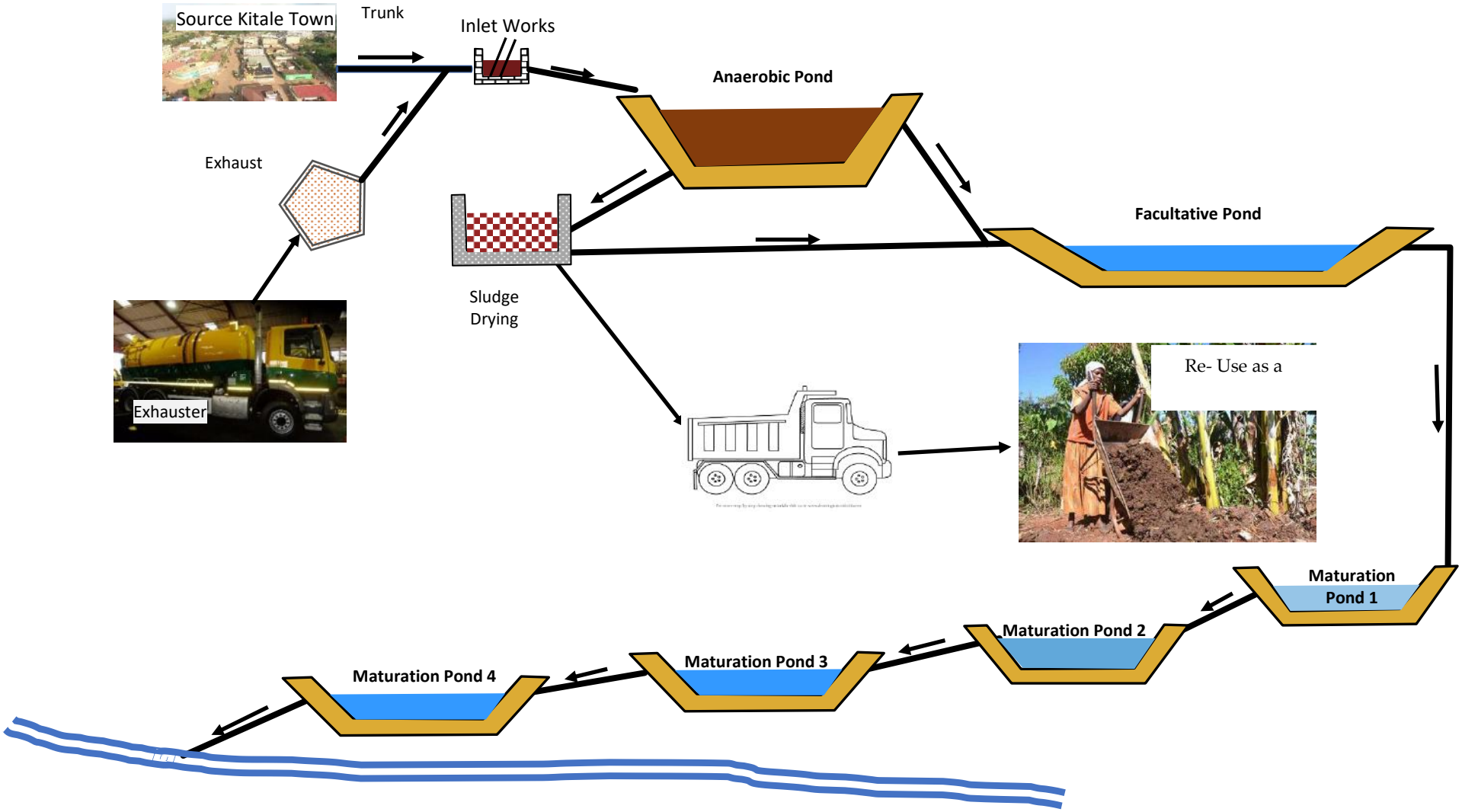



**Figure 3-1: Schematic Layout Plan of the Wastewater Stabilization Ponds Technology**

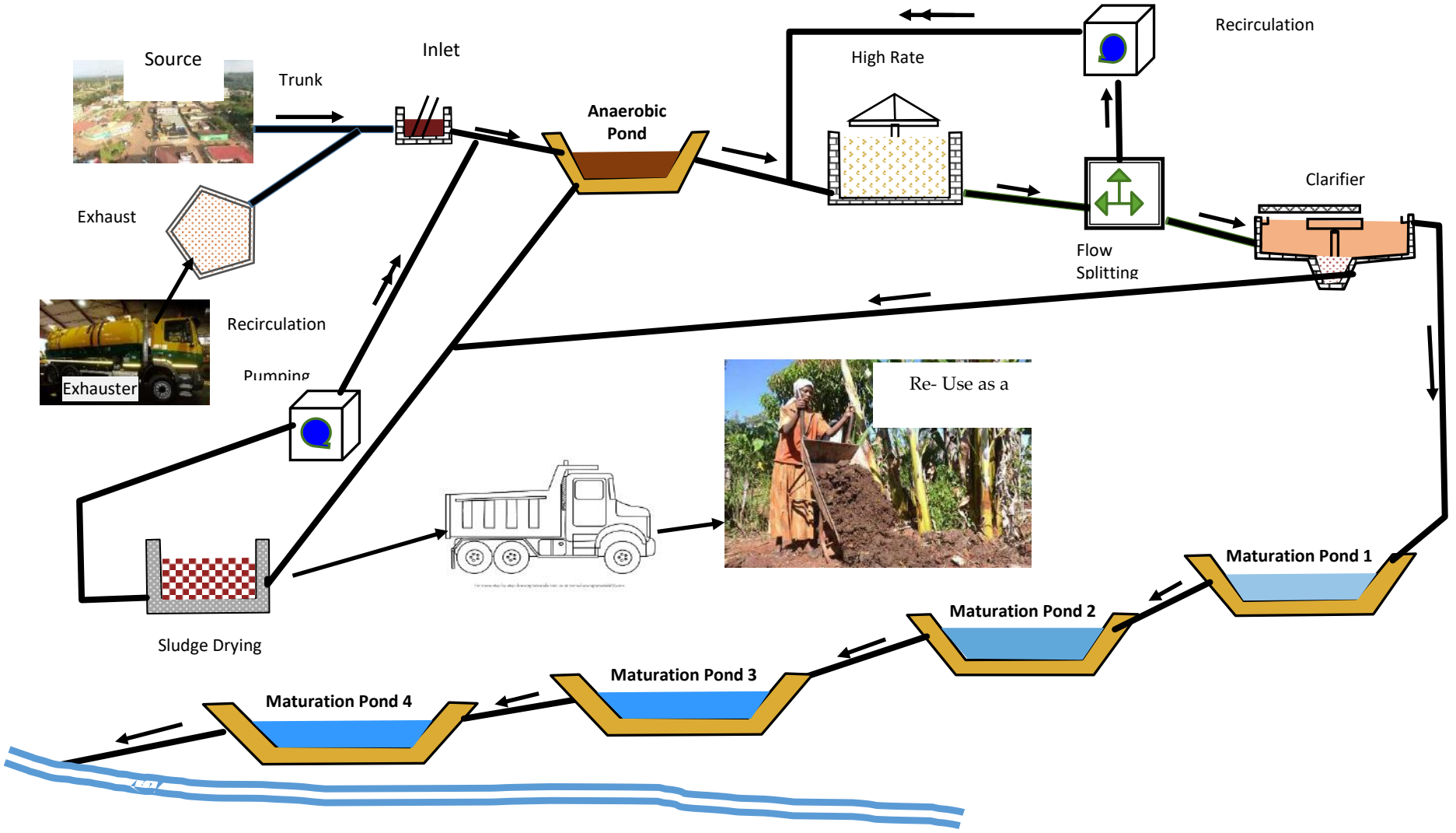



**Figure 3-2: Schematic Layout Plan of Combined System 1 Technology**

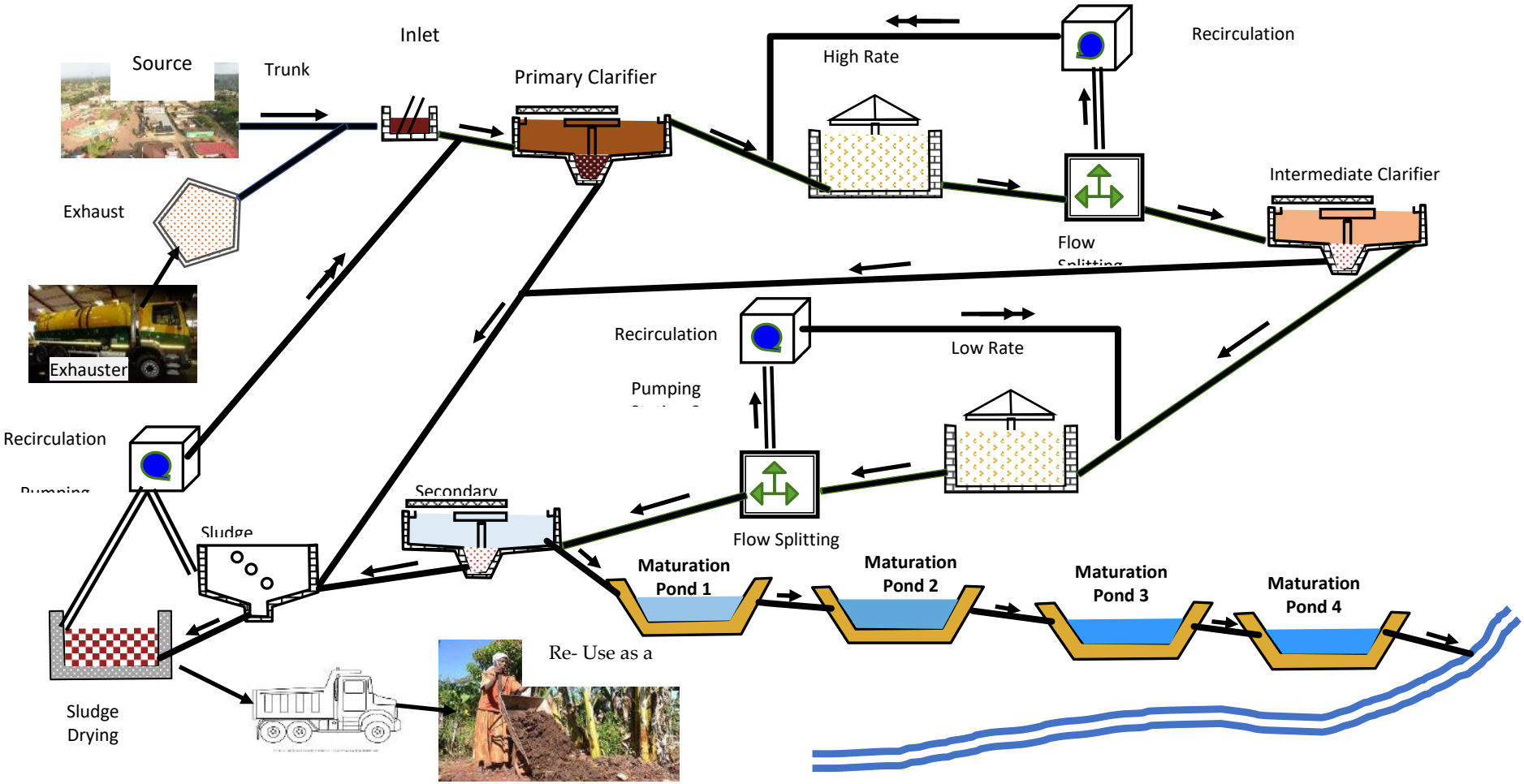



**Figure 3-3: Schematic Layout Plan of Combined System 2 Technology**

## 3.4 Factors Affecting Choice of Wastewater Treatment Site

The location of the proposed Wastewater Treatment Plant(s) is identified after the selection of wastewater treatment technology and determination of the land required for the installation of the various units of the WWTPs. Possibilities of future extension of the WWTP is also considered.

The factors considered in the selection of WWTP site are briefly discussed below.

### 3.4.1 Land-Use

In the Land-use Map, different areas of Kitale Municipality have been assigned varied existing and proposed uses. Areas earmarked for residential, industries, agriculture, forests and social amenities are considered less suitable for the location of a Wastewater Treatment Plant (WWTP). On the other hand, public utility or undeveloped Agricultural Land located away from the sensitive residential areas are preferred.

### 3.4.2 Distance of Effluent Discharge Point

The distance from the WWTP site to the final receiving environment such natural water courses, is an important consideration in site selection. Preference is given to the sites that require shorter lengths of the effluent conveyance channel.

### 3.4.3 Topography of the Sewered Area

An ideal WWTP site should be located on a low-lying area of the sewerage system for gravity conveyance. Otherwise, pumping stations become necessary thereby increasing both capital cost and the operation and maintenance requirements of the sewerage system.

### 3.4.4 Topography of Site

The slope at an ideal site should permit the gravity flow within the WWTP without requiring excessive excavations for the structures. Slopes less than 1:20 are preferred.

### 3.4.5 Geological Conditions

A site with low water table and whose soils are impermeable is considered ideal with respect to geological considerations. For instance, silt or clay soils are suitable for pond construction.

More often, the geological formation within a Town is fairly similar. Kitale Municipality comprise of a mixture of well drained, deep, dark red to reddish brown, friable, sandy clay loam to sandy clay, with top soil of loamy sand and well drained, very deep, yellowish red, very friable, fine sandy loam to fine sandy clay loam. These soils are suitable for WWTP.

### 3.4.6 Existing Infrastructure

Proximity to infrastructural systems such as roads, electricity and portable water is sought for while siting for a WWTP location. It reduces cost of construction and operation & maintenance requirements of the WWTP. Sites that are closer to existing infrastructure are preferred.

### 3.4.7 Potential for Reuse of Treated Wastewater

Treated wastewater can be reused for beneficial purposes such as agricultural irrigation, industrial processes, ground water recharge, etc. Proximity to the potential re-use application and relative elevation difference (for gravity conveyance) is preferred in siting of WWTP. For instance, downstream arable land would make a WWTP site ideal for agricultural irrigation.

### 3.4.8 Land Acquisition

In this criterion, preference is given to sites owned by government agencies such as Ministries, County Governments, etc. This ensures that the project affected persons are kept to a minimal and reduces the cost of resettlement and compensation.

## 3.5 Alternative Wastewater Treatment Works Site

At present, there are 2 Nr. Existing Wastewater Treatment Works Sites in Kitale Municipality; Combined Machinjoni & Matisi WWTP and Bidii WWTP. It is proposed to abandon Machinjoni WWTP due to it is location in the middle of the development and only use it for pretreatment of wastewater from Machinjoni Slaughterhouse.

The criteria for the selection of the sites for Wastewater Treatment Plants Sites has mainly been based on the following:

- Potential of gravity feed from the drainage areas to the proposed WWTP sites with limited pumping.
- Land availability (if possible, expansion of the existing facilities)
- Development Trend of Kitale Town and the proposed Municipality Boundaries.
- Proximity to existing infrastructure specifically roads, electricity, water supply, etc.
- Economic consideration specifically conveyance system of wastewater and treated effluent.

Based on the above criteria, seven possible sites have been identified with 3 located in drainage area 1, 1 in drainage area 2 and 3 in drainage area 3.

However, level of development in Drainage area 2 is currently slow due to the large tracts of land owned by the GoK Institutions. The Projected future development in these areas is also expected to be low since it is anticipated that these lands will remain undeveloped in the medium (2035) and long term (2045).

The locations of the Alternative Wastewater Treatment Plants Sites are shown in **Figure 3-4** on **Page 3-10** and described in the following sub sections:

Figure 3-4

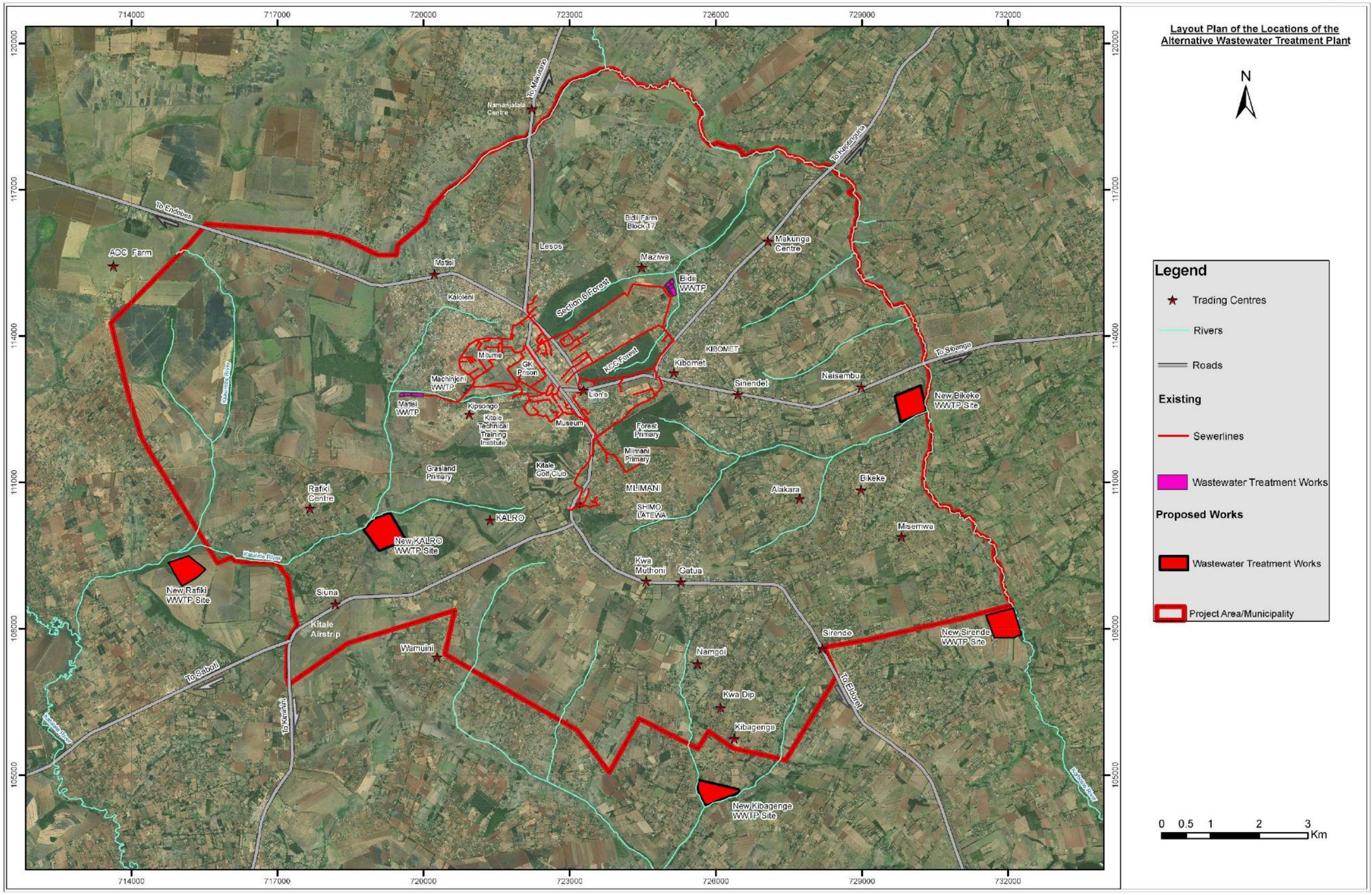



**Figure 3-4:Layout Plan of the Locations of the Alternative Wastewater Treatment Plant Sites**

### 3.5.1 Drainage Area 1

#### i) Site at the Existing Bidii WWTP

This site is located in Bidii area Northeast of KCC Forest, West of Kitale Kapenguria Road. The site is located within Drainage Area 1 next to developing Areas such as Maziwa to the North and Kibomet to the South.

Some of the areas within Drainage Area 1 such as the eastern parts of the CBD, Section 6, District Hospital, Lessos (areas between Section 6 and Makutano-Kitale Road) and Kibomet (areas within 2km from Kapenguria Sibanga Junction along the Kapenguria-Kitale Road) can drain by gravity to Bidii WWTP. Other areas within Drainage Area 1 such as Milimani, Sinendet, Shimo La Tewa, Gatua Kwa Muthoni, Ragira and Norec would require pumping to transfer wastewater to Bidii WWTP.

The available land within the existing Bidii WWTP is approximately 30 ha. However, some part of the land has been occupied by Bidii Primary School. The available land is adequate for construction of Combined System 1 (approx. 28 Ha is required) with relocation of Bidii Primary School or a Combined System 2 (approx. 21 Ha required) for treatment of the projected wastewater flow of 5,600 $m^3$/d for medium term (2035) and 8,400 $m^3$/d long term (2045)

The main advantage of this site is that no Land acquisition will be required for the combined system 2. For Combined System 1, land for relocation of the school will be required including reconstruction of the school infrastructure. The Sewer Network would require 3 Nr wastewater pumping stations to transfer wastewater to Bidii WWTP. In addition, land acquisition will be required for the New Pumping Stations.

#### ii) New Bikeke Site

The site is located at the banks of Koitobos River near Bikeke Center. The site is located within Drainage Area 1 in a sparsely populated area within the proposed Municipality Boundary.

All the wastewater from Drainage Area 1 can gravitate to this site apart from the developing Sirende and Misemwe Center which would require a pumping station to transfer wastewater generated to the WWTP. The land at the proposed site is designated as public land in the proposed Land Use Plan and has an area of approximately 21 Ha However, the County Government has not acquired the land. The land requires acquisition for construction of Wastewater Stabilization Ponds (approx.48 Ha required) or a Combined System 1 (approx. 28 Ha is required) or a Combined System 2 (approx.21 Ha required) for treatment of the projected wastewater flow of 5,600 $m^3$/d for medium term (2035) and 8,400 $m^3$/d for long term (2045).

The main advantage of this site is that all wastewater within Drainage Areas 1 will flow by gravity. However, the development of this site would require investment into an additional 7 Km Trunk Sewer and future pumping of wastewater from Sirende and Misemwa center.

#### iii) New Sirende Site

The site is located at the banks of Koitobos River East of Sirende Centre. The site is located within Drainage Area 1 in a sparsely populated area at the proposed Municipality Boundary.

Wastewater from Drainage Area 1 can gravitate to this site. The land at the proposed site is private agricultural land and therefore require acquisition for construction of Wastewater Stabilization Ponds (approx. 48 Ha is required) or a Combined System 1 (Approx. 28 Ha is required) or Combined System 2 (approx. 21 Ha is required) for treatment of the projected wastewater flow of 5,600 $m^3$/d for medium term (2035) and 8,400 $m^3$/d for long term (2045).

The main advantage of this site is that all wastewater within Drainage Areas 1 will flow by gravity. However, the development of this site would require investment into a 12 Km Trunk Sewer and land acquisition for the construction of the wastewater treatment plant.

### 3.5.2 Drainage Area 2

Drainage area 2 forms the Southern parts of Kitale Municipality. Most of the land in this area is occupied by Government Institutions such as KALRO and GoK Prison which hinder private development.

#### i) New Kibagenge Site

This site is located within Drainage Area 2 in a sparsely populated area outside the proposed Municipality Boundary.

Development in Drainage Area 2 is anticipated in the western areas such as Sirende, Namgoi, Kwa Dip and Kibagenge Centers. In future (beyond year 2045), wastewater from these areas can be collected to a central point with the option of constructing an independent WWTP. The land at the proposed site is private agricultural land and therefore require acquisition for construction of the WWTP (approx. 1.5 Ha is required) for treatment of the projected wastewater flow of 350 $m^3$/d for medium term (2035) and 700 $m^3$/d for long term (2045

Provision of public sanitation facilities has not been considered for these areas for Medium term (2035) and long term (2045) due to the current level of development which display rural characteristics.

### 3.5.3 Drainage Area 3

#### i) Site at the Existing Matisi Maturation Ponds

This site is located at the confluence of Katalele River and Prison Ravine River. The site is located within Drainage Area 3 next to high density areas such as Kaloleni and Kipsongo.

Wastewater from the developed areas of Drainage Area 3 can gravitate to Matisi WWTP. However, a lifting station will be required to transfer wastewater to the WWTP Inlet. In the long term and in future, the developing areas such as Rafiki Center and Siuna Center would require pumping to transfer wastewater to Matisi WWTP.

The available land within the existing Matisi Maturation Ponds is approximately 7 ha. The available land is not adequate for construction of Combined System 1 (approx. 21 Ha is required) or a combined System 2 (Approx.17 Ha is required) for treatment of the projected wastewater flow of 4,600 $m^3$/d for medium term (2035) and 6,900 $m^3$/d long term (2045).

The main advantage of this site is that the Trunk sewer will be of a short length. However, additional land acquisition is required for the construction of the wastewater treatment plant. In addition, pumping stations to transfer wastewater from areas beyond Matisi Maturation Ponds will be required in the long term.

**ii) New KARLO Site**

The site is located at the banks of Katalele River between KALRO and Rafiki Centre. The site is located within Drainage Area 3 in a sparsely populated area within the proposed Municipality Boundary.

Wastewater from Drainage Area 3 can gravitate to this site except for the developing areas of Rafiki and Siuna Centers. The land at the proposed site is private agricultural land and therefore require acquisition for construction of wastewater stabilization ponds (approx. 40 Ha is required) or a Combined System 1 (Approx.21 Ha is required) or a Combined System 2 (Approx.17 Ha is required) for treatment of the projected wastewater flow of 4,600 $m^3$/d for medium term (2035) and 6,900 $m^3$/d long term (2045).

The main advantage of this site is that all wastewater within Drainage Areas 3 will flow by gravity. However, the development of this site would require investment into a 3.9 Km Trunk Sewer and land acquisition for the construction of the wastewater treatment plant. In future, a pumping station will be required to transfer wastewater from the developing Rafiki Centre to the WWTP.

**iii) New Rafiki Site**

The site is located at the banks of Katalele River at its confluence with Kukureze River. The site is located within Drainage Area 3 in a sparsely populated area at the proposed Municipality Boundary.

All the wastewater from Drainage Area 3 can gravitate to this site. The land at the proposed site is designated as public land in the proposed Land Use Plan and has an area of approximately 51 ha. However, the County Government has not yet acquired the land. The land requires acquisition for construction of wastewater stabilization ponds (approx. 40 Ha is required) or a Combined System 1 (Approx. 21 Ha is required) or a Combined System 2 (Approx.17 Ha is required) for treatment of the projected wastewater flow of 4,600 $m^3$/d for medium term (2035) and 6,900 $m^3$/d long term (2045).

The main advantage of this site is that all wastewater within Drainage Areas 3 will flow by gravity. However, the development of this site would require investment into a 6.8 Km Trunk Sewer.

## 3.6 Alternative Wastewater Treatment Schemes

From analysis of the potential Wastewater Treatment Sites and Treatment Technology, 3 Nr. Alternative Sewerage Systems for Kitale Municipality have been formulated to treat the Projected Ultimate Wastewater Generated of approx.16,000 $m^3$/d as shown on **Table 3-3**.

**Table 3-3: Summary of the Alternative Wastewater Treatment Schemes for Kitale Municipality**

| Alternative Scheme | Wastewater Treatment Works Site | Wastewater Technology (Sub-Alternatives) |
|---|---|---|
| A | Treatment of wastewater at the New Rafiki Site (6,900 $m^3$/d) - Drainage Area 3 | • Waste Stabilization Ponds<br>• Combined System 1<br>• Combined System 2 |
| | Treatment of wastewater at the New Sirende Site (8,400 $m^3$/d)- Drainage Area 1 | |
| | Treatment of Wastewater at New Kabagenge Site (700 $m^3$/d)- Drainage Area 2 | • Anaerobic Baffle Reactor+ Constructed Wetland |
| B | Treatment of wastewater at the New KALRO Site (6,900 $m^3$/d)- Drainage Area 3 | • Waste Stabilization Ponds<br>• Combined System 1<br>• Combined System 2 |
| | Treatment of wastewater at the New Bikeke Site (8,400 $m^3$/d)- Drainage Area 1 | |
| | Treatment of Wastewater at New Kabagenge Site (700 $m^3$/d)- Drainage Area 2 | • Anaerobic Baffle Reactor+ Constructed Wetland |
| C | Treatment of wastewater at the Existing Bidii WWTP (8,400 $m^3$/d)- Drainage Area 1 | • Combined System 1<br>• Combined System 2 |
| | Treatment of wastewater Matisi Maturation Ponds using Waste Stabilization Ponds (6,900 $m^3$/d)- Drainage Area 3 | |
| | Treatment of Wastewater at New Kabagenege Site (700 $m^3$/d)- Drainage Area 2 | • Anaerobic Baffle Reactor+ Constructed Wetland |

Descriptions of the above alternative Sewerage Systems is presented in the Feasibility Study Report for Kitale Sewerage System, MIBP/CES (2020). A Multi-Criteria Analysis of the alternatives was carried out and Alternative A 1 was found to be the most viable. The main considerations made were:

1. Alternative Scheme A1 had the least Net Present Value (NPV) Cost

2. The Wastewater Treatment Plant (WWTP) site for alternative Scheme A1 provide for expansion of the Municipality boundary with minimal disruption of the Sewerage System.

3. At the WWTP Sites for Alternative Scheme A1, the discharge rivers have higher flows hence higher dilution capabilities due to large catchment areas

4. WWTPs Sites for Alternative Scheme B1 are located in a more densely populated area as compared to other sites

**Alternative Scheme A1: Wastewater Treatment at New Sirende WWTP Site (8,400 $m^3$/d: WSP System), New Rafiki WWTP Site (6,900 $m^3$/d: WSP System), and New Kibagenge WWTP Site (700 $m^3$/d: ABR+Constructed Wetland System) is recommended for Kitale Municipality Sewerage System.**

# CHAPTER 4: PROPOSED WORKS UNDER THE PROJECT

## 4.1 General

The proposed measures for Kitale Municipality Sewerage System Includes investment in wastewater collection, conveyance and treatment. The proposed measures have been developed based on the following salient points:

i) The anticipated development of Kitale Municipality will be gradual up to the ultimate design horizon (2045) and in future. Therefore, construction of some of the system components can be phased to be at per with the development and to avoid redundant sewerage system components.

ii) The sewers have been designed for ultimate condition to avoid sewer duplication which might prove more expensive than laying one sewer. There is also limited wayleave for laying duplicate sewers. Though economical for long design period, duplication of sewers is uneconomical for short design period as is the case for this study *(Ministry of Water and Irrigation Manual for Sewerage and Sanitation Services)*

iii) At any time, it is prudent to have two (2) or more wastewater treatment streams in a Wastewater Treatment Plant (WWTP). This is to avoid total lockdown in case repair/ maintenance of the WWTP is required.

Considering the above points, the Project implementation for Ultimate Design Horizon (year 2045) has been Phased into two as shown in **Table 4-1**:

**Table 4-1: Summary of the Proposed Project Implementation Phases**

| Component | Phase 1 (2025-2035) | Phase 2 (2035-2045) |
|---|---|---|
| Sewer Network | • Rehabilitation of the existing Sewer Network (43 Km)<br>• Expansion of the Sewer Network<br>- Trunk Sewers:<br>- Secondary Sewers | • Expansion of the Sewer Network<br>- Trunk Sewers:<br>- Secondary Sewers |
| Wastewater Treatment Plants | • Decommissioning of Bidii WWTP<br>• Decommissioning of Machinjoni Wastewater Treatment Plant and Matisi Maturation Pond.<br>• Construction of Wastewater Treatment Plant at Sirende Site- 2 Nr Streams each 2,800 $m^3$/d.<br>• Construction of Wastewater Treatment Plant at Rafiki Site- 2 Nr Streams each 2,300 $m^3$/d. | • Construction of Wastewater Treatment Plant at Sirende Site- 1 Nr Stream Capacity 2,800 $m^3$/d.<br>• Construction of Wastewater Treatment Plant at Rafiki Site- 1 Nr Stream Capacity; 2,300 $m^3$/d. |

Works under Phase 1 are further divided into **LOT 1** and **LOT 2** as follows:

| Work under LOT 1 | Work under LOT 2 |
|---|---|
| • Rehabilitation of existing sewer network<br>• Construction of 14 km of Trunk Sewers<br>• Construction of 23 Km of Secondary Sewers<br>• Construction of 2,500 new Plot Connections including reconnection for realigned sewers.<br>• Construction of Rafiki WWTP, Capacity 4,600 $m^3$/d and Decommissioning of Machinjoni WWTP and Matisi Maturation Pond<br>• Capacity Building including procurement of tools and equipment and training of staff. | • Construction of 31 km of Trunk Sewers<br>• Construction of 30 Km of Secondary Sewers<br>• Construction of 2,500 new Plot Connections including reconnection for realigned sewers.<br>• Construction of Sirende WWTP, Capacity 5,600 $m^3$/d and Decommissioning of Bidii WWTP |

## 4.2 Proposed Works under LOT 1

### 4.2.1 Rehabilitation of the Existing Sewer Network

Rehabilitation measures in the existing Sewer Network involves replacement of critical sewers and undersized sewers, realignment of sewers which are within private properties/limited access and repair of damaged/vandalised manholes including manhole covers.

### 4.2.2 Expansion of the Sewer Network and Plot Connections

This entails construction of 14 Km of Trunk and 23 km of Secondary Sewers, diameter ranging from 200 mm to 600mm including 2,500 Plot Connections in order to convey wastewater to the Proposed Rafiki WWTP (4,600 $m^3$/d). A Layout Plan of the proposed Sewer Network for **LOT 1** is shown in **Figure 4-1** on **Page 4-3.**

### 4.2.3 Construction of Rafiki Wastewater Treatment Plant (4,600 $m^3$/d) and Decommissioning of Machinjoni WWTP and Matisi Maturation Ponds

#### i) Construction of Rafiki Wastewater Treatment Plant

The proposed investment entails construction of a 2 Nr streams of Wastewater Stabilization Ponds each with a capacity to treat 2,300 $m^3$/d comprising of the following components:

- Inlet Works and Exhauster Discharge Bay
- 2 Nr. Anaerobic Ponds
- 2 Nr. Facultative Ponds
- 6 Nr Maturation Ponds
- 10 Nr. Sludge Drying Beds
- 2Nr type C Staff Houses
- Administration building with a Laboratory

A Layout Plan of the proposed Rafiki WWTP is shown in **Figure 4-2** on **Page 4-4.**

Figure 4-1

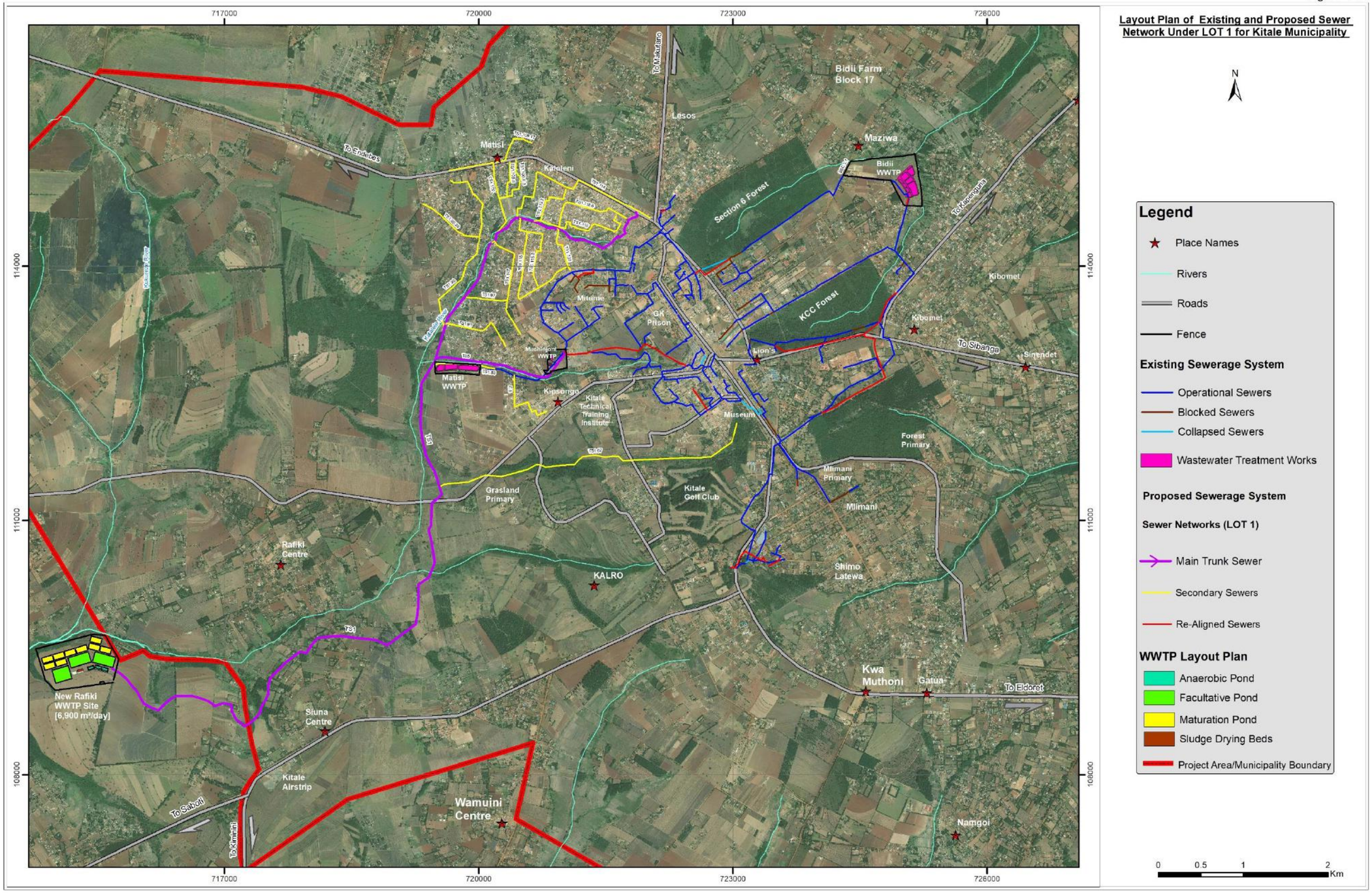



**Figure 4-1: Layout Plan of the Existing and Proposed Sewer Network for LOT 1**

Figure 4-2

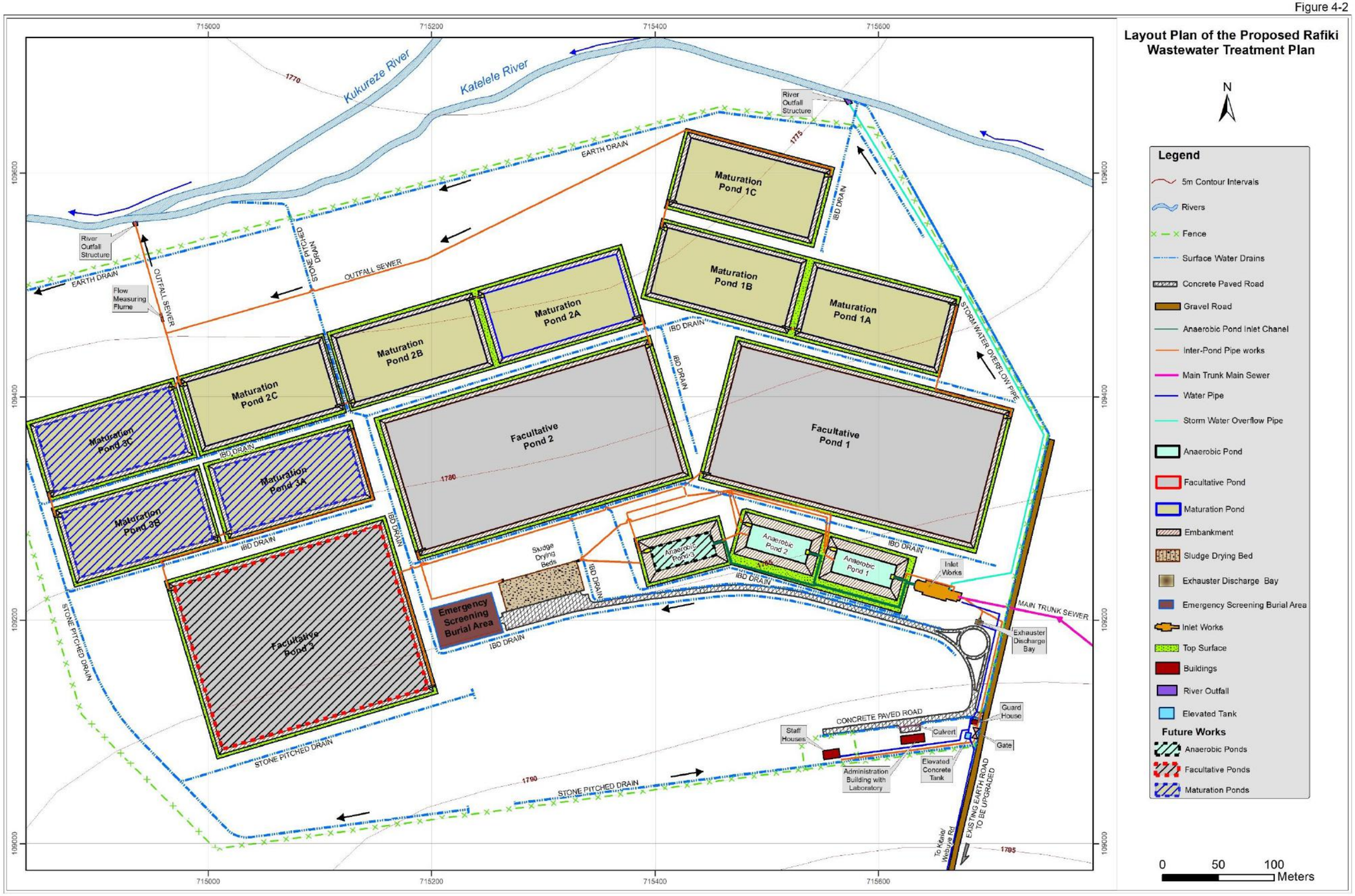



**Figure 4-2: A Layout Plan of the proposed Rafiki WWTP**

**ii) Decommissioning of Machinjoni WWTP and Matisi Maturation Ponds**

The analysis carried out for alternative Kitale Sewerage Systems in the Feasibility Study report, MIBP/CES (2020) concluded that retaining the location of Machinjoni WWTP would result to a design of a highly mechanised system both for wastewater conveyance and wastewater treatment and therefore, Machinjoni WWTP and Matisi Maturation Ponds will be decommissioned. **The land occupied by Machinjoni Wastewater Treatment Plant can be used to construct a slaughterhouse wastewater pre-treatment facility.**

### 4.2.4 Capacity Building

In order to ensure effective and efficient operation of the sewerage network, its is proposed that requisite tools and equipment be procured under the contract including exhaust vehicles and laboratory equipment and reagents. In addition, staff involved in operation and maintenance of the sewerage system will be trained on both skills and knowledge of operating and maintain each component effectively and safely.

### 4.2.5 Summary of the Estimated Investment Cost for LOT 1

The estimated total cost for LOT 1 based on Priced Detailed Bills of Quantities is **Kshs 1,721,388,308 (15,648,985 USD)** as summarized in **Table 4-2**

**Table 4-2: Summary of the Estimated Cost for LOT 1**

| Bill No. | Description | | Amount (Kshs) | Amount (USD) |
|---|---|---|---|---|
| 1 | Preliminary and General | | 186,954,761 | 1,699,589 |
| 2 | Trunk Sewers | | 206,779,289 | 1,879,812 |
| 3 | Secondary Sewers | | 135,405,420 | 1,230,958 |
| 4 | Rafiki Wastewater Treatment Plant | | 739,762,672 | 6,725,115 |
| 5 | Rehabilitation of Existing Sewers | | 73,287,924 | 666,254 |
| 6 | Re-alignment of Existing Sewers | | 7,111,104 | 64,646 |
| 7 | Decommissioning of Machinjoni / Matisi WWTP | | 39,912,555 | 362,841 |
| 8 | Plot Connections | | 93,114,247 | 846,493 |
| 9 | Schedule of Day Works | | 5,467,388 | 49,704 |
| 10 | Capacity Building | | 76,953,100 | 699,574 |
| **Bills Total Exclusive of VAT** | | **(A)** | **1,564,898462** | **14,226,350** |
| Add 10% of (A) for General and Physical Contingencies | | (B) | 156,489,846 | 1,422,635 |
| **Bills Total Inclusive of Contingencies (A+B)** | | **(C)** | **1,721,388,308** | **15,648,985** |

## 4.3 Proposed Works under LOT 2

### 4.3.1 Expansion of the Sewer Network and Plot Connections

This entails construction of 31 Km of Trunk and 30 km of Secondary Sewers, diameter ranging from 200 mm to 600mm including 2,500 Plot Connections in order to convey wastewater to the Proposed Sirende WWTP (5,600 $m^3$/d). A layout plan of the proposed sewers Network for **LOT 2** is shown in **Figure 4-3** on **Page 4-7.**

### 4.3.2 Construction Sirende WWTP and Decommissioning of Bidii WWTP

#### i) Construction of Sirende WWTP

The proposed investment entails construction of a 2 Nr streams of Wastewater Stabilization Ponds each with a capacity to treat 2,800 $m^3$/d comprising of the following components:

- Inlet Works and Exhauster Discharge Bay
- 2 Nr. Anaerobic Ponds
- 2 Nr. Facultative Ponds
- 6 Nr Maturation Ponds
- 12 Nr. Sludge Drying Beds
- 2 Nr. type C Staff Houses
- Guard House
- Site and Ancillary works

A Layout Plan of the proposed Sirende WWTP is shown in **Figure 4-4** on **Page 4-8.**

#### ii) Decommissioning of Bidii WWTP

The analysis carried out for alternative Kitale Sewerage Systems concluded that retaining the Bidii WWTP location would result to a design of a highly mechanised system both for wastewater conveyance and wastewater treatment. In addition, the existing wastewater treatment plants lack the capacity to treat wastewater generated in Kitale Municipality in the medium and the long term and the treatment technology is not effective. Bidii WWTP will be decommissioned and the land occupied by the systems can be repurposed for other uses such as recreational parks.

### 4.3.3 Summary of the Estimated Investment Cost for LOT 2

The estimated total cost for LOT 2 based on Priced Bills of Quantities is **Kshs 2,107,555,648 (19,159,597 USD)** as summarized in **Table 4-3**.

**Table 4-3: Summary of the Estimated Cost for LOT 2**

| Bill No. | Description | | Amount (Kshs) | Amount (USD) |
|---|---|---|---|---|
| 1 | Preliminary and General | | 196,664,494 | 1,787,859 |
| 2 | Trunk Sewers | | 524,764,380 | 4,770,585 |
| 3 | Secondary Sewers | | 162,004,858 | 1,472,771 |
| 4 | Sirende Wastewater Treatment Plant | | 850,537,729 | 7,732,161 |
| 5 | Re-alignment of Existing Sewers | | 42,337,786 | 384,889 |
| 6 | Decommissioning of Bidii WWTP | | 40,918,795 | 371,989 |
| 7 | Plot Connections | | 93,114,247 | 846,493 |
| 8 | Schedule of Day Works | | 5,617,388 | 51,067 |
| **Bills Total Exclusive of VAT** | | **(A)** | **1,915,959,680** | **17,417,815** |
| Add 10% of (A) for General and Physical Contingencies | | (B) | 191,595,968 | 1,741,782 |
| **Bills Total Inclusive of Contingencies (A+B)** | | **(C)** | **2,107,555,648** | **19,159,597** |

**The Total Investment Cost for LOT 1 and LOT 2 is 3,828,943,956 Kshs (34,808,582 USD).**

Figure 4-3

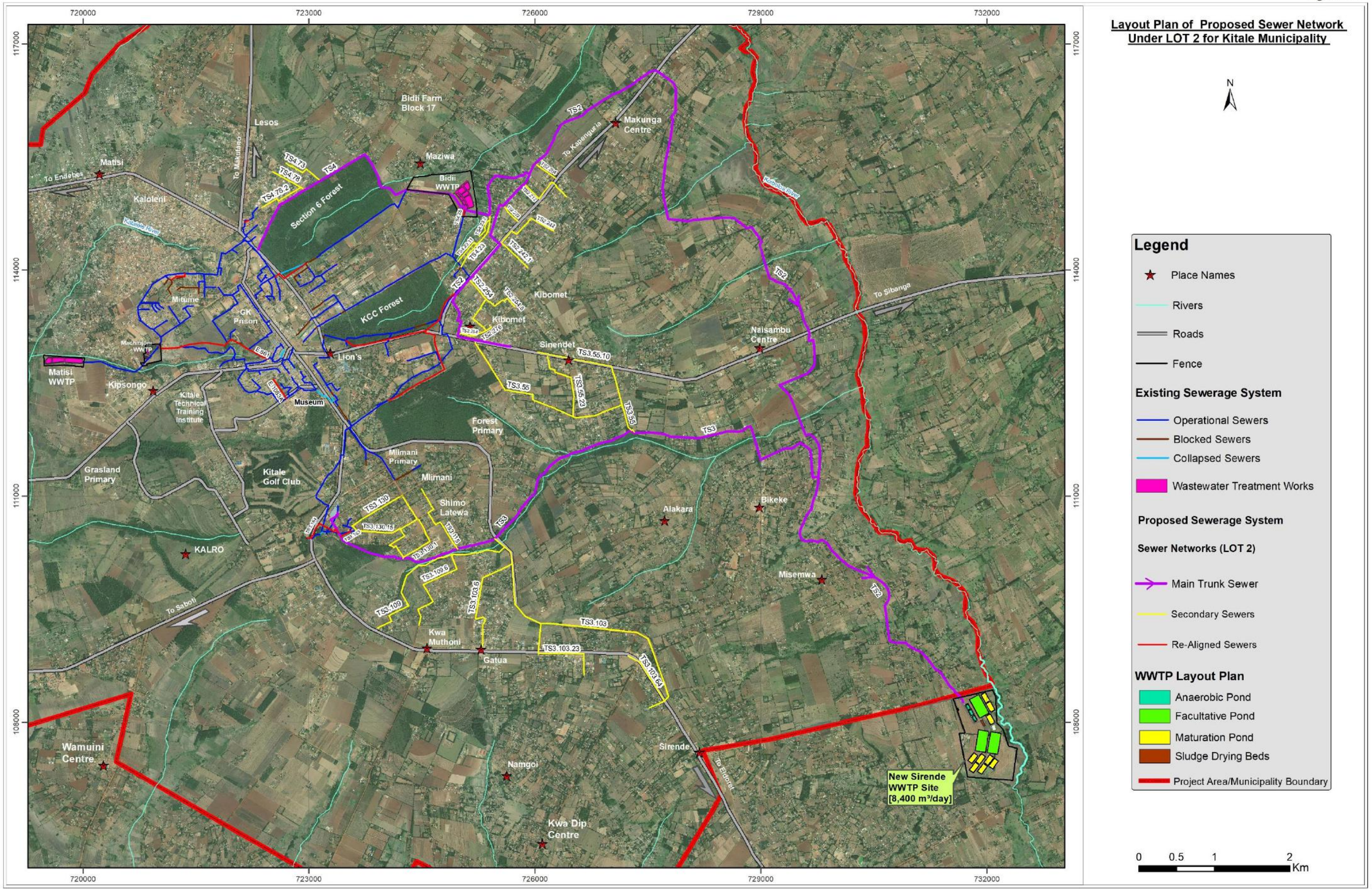



**Figure 4-3:Layout Plan of the Proposed Sewer Network for LOT 2**

Figure 4-4

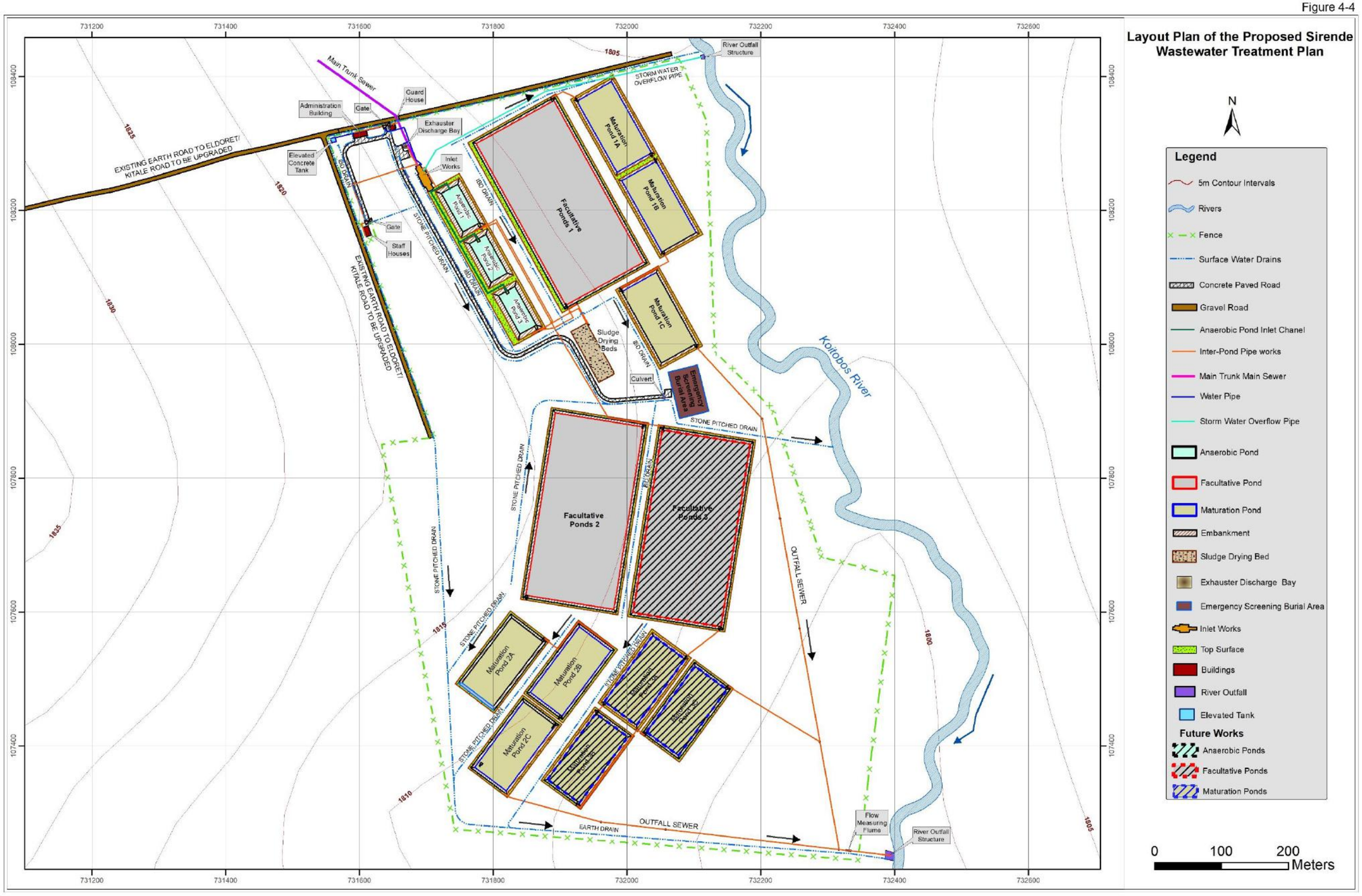



**Figure 4-4: Layout Plan of the Proposed Sirende WWTP**

# CHAPTER 5: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

## 5.1 Objectives of ESIA Assessment

This Environmental & Social Impact Assessment (ESIA) has been conducted in compliance with the Environmental Impact Assessment Regulation as outlined under the Gazette Notice No. 56 of 2003 established under the Environmental Management and Coordination Act (EMCA) 1999 Cap 387 and African Development Bank (AfDB) Operational Safeguards Policies.

The main objectives of the ESIA were to

- Identify potential significant environmental and social impacts of the proposed Kitale Sewerage Project and recommend measures for mitigation.
- Generate baseline data that will be used for monitoring and evaluating how well the mitigation measures will be implemented during the Project cycle.
- Promote stakeholders' engagements and public participation through holding public barazas and Key Informant Interviews (KII)
- Design an Environmental and Social Management Plan that will used by the contractor to prepare specific Construction Environment and Social Management Plan (C-ESMP) during Project construction stage.

## 5.2 Data Collection

In order to understand the existing baseline Environmental and Social conditions in an area, a variety of quantitative and qualitative data collection methods were adopted. The data collection methods were classified into two classes as summarized below.

| Data Type | Methods Adopted |
|---|---|
| Primary Data | • Transect Walks /Observations<br>• Interviews<br>• Focus Group Discussions<br>• Questioners and Surveys |
| Secondary Data | • Previous Water and Sanitation Design Reports<br>• Trans Nzoia County Integrated Development Plans<br>• Kenya National Bureau of Statistics Reports<br>• Kitale Municipality Integrated Urban Development Plan |

During data collection, a physical evaluation of the Project area was carried out with specific focus on the Environmental and Social risks as indicated below.

(i) **Physical environment which include** - climate, air quality, water resources and water quality, noise, topography, soils, geology, hydrology including risks due to natural disasters.
(ii) **Biological conditions which include** - biodiversity, ecology and nature conservation especially endangered species, protected ecosystems, habitat,

species of commercial importance, invasive species and their impacts were assessed.

(iii) **Social-economic conditions and human health** which include – including archaeology and cultural heritage landscape and facial aspects, recreational, social-economic aspects, land use, transportation, infrastructure, agricultural development, tourism, and human health

## 5.3 ESIA Methodology

The approach and Methodology adopted in carrying out the ESIA was based on the following stages:

i) Literature Review
ii) Environmental and Social Screening
iii) Environmental and Social Impact Ranking
iv) Specialized Surveys (Environmental Analysis)
v) Stakeholders Consultations
    a. Key Informants Interviews
    b. Target Group Analysis
    c. Public Participation
vi) Environmental and Social Impact Assessment and Mitigation
vii) Environmental and Social Management and Monitoring Plan (ESMMP)

Stages 1, 2 and 3 have been detailed in the following subsequent subsections while Stages 4, 5 and 6 have been detailed in Chapters 7, 8 and 9 respectively.

### 5.3.1 Literature Review

The following previous documents and studies relevant to the Project were reviewed.

- Previous Water and Sanitation Design Reports
- Trans Nzoia County Integrated Development Plans (CIDP)
- Kenya National Bureau of Statistics Reports
- Kitale Municipality Integrated Urban Development Plan
- Topographic Maps
- Kitale Aerial Imagery
- Trans Nzoia Integrated Spatial Planning Report including Cadastral Maps, RIM Maps and Rolio Register (FR) Maps of the Project Area.

In addition, the following Policies, Legal and Institutional Frameworks were reviewed as detailed in **Chapter 6 of this Report.**

- Kenya Legal and Policy Framework
- Applicable Acts of Parliament
- African Development Bank Operation (AfDB) Safeguards Policies (OS)

### 5.3.2 Environment and Social Screening

An essential element of the ESIA is Environmental Screening for potential environment and social impacts that are likely to be triggered by infrastructure Projects. A standard

screening checklist as attached in **Appendix 1 of this Report** was used to preliminary screen potential Environmental and Social Impacts that might be triggered by the sewerage Project along the alignment wayleaves and the Proposed WWTPs sites.

At the Screening Stage, the following Objectives were achieved:

- Identification of the Environmental and Social Opportunities and risks likely to result from the proposed Sewerage Project.
- Assessment of the scale and scope of the potential environmental and social risks of the proposed Project
- Determination of the Environmental and Social Assessment required to mitigate against potential risks
- Determination of the relevant Stakeholders as detailed in **Chapter 7 of this Report**
- Determination of the geographical extent of the Environmental and Social Impacts to be analysed at the ESIA stage.

A summary of the findings of screening assessment in terms of environment, social, health and safety risks is presented below in **Table 5-1**.

**Table 5-1: Screening Assessment Findings**

| Field | Risks identified at Screening Stage |
|---|---|
| **Risks During Project Construction** | |
| Environment Risks | • Less significant interference with vegetation within proposed sewer wayleaves including isolated marshlands and protected man-made Lessos forest<br>• Potential interference with privately owned Kitale Nature reserve located within Koitobos drainages basin at Kapenguria road river crossing during construction stage.<br>• Increased soil erosion/degradation due to sewer pipeline trench excavations, excavations will increase sedimentations risks of storm water drainage infrastructure and receiving rivers (Koitobos and katalele among other streams)<br>• Generation of solid wastes (construction waste etc.) or machine wastes (oil, etc.) that could choke or pollute water resources<br>• Air pollution associated with Project civil works such dust responsible for Particulate Matter ($PM_{2.5}$), un-serviced plant and equipment on site could also release limited NOx and SOx from vehicular exhaust emissions. |
| Social Risk and Health and Safety Risks | • Demolition (loss) of temporary structures/household assets along wayleaves to provide space for laying of sewer pipeline within build up estates such as Mitume, Matisi, Kipsongo among other.<br>• Crops and woodlots belonging to private individuals along the main trunk sewers to Sirende WWTP and Rafiki WWTP might be affected<br>• Risk of affecting vulnerable people who own structures, crops and trees indicated above and therefore exacerbating the vulnerability.<br>• Interference with normal health and safety of community members and workers through risks posed by open uncovered sewer trenches or by pollution of water resources by raw sewerage from |

| Field | Risks identified at Screening Stage |
|---|---|
| | overflowing manholes<br>• Influx of workers to work for the Project could exacerbate new HIV infections and trigger Sexual Exploitation and Abuse (SEA) and Violence Against Children (VAC) |
| **Risk during Project Operation** | |
| Risks During Project Operation | • Pollution Impacts associated with raw sewerage flowing into Koitobos and Katalele rivers and other associated streams within close proximity to sewer lines.<br>• Odour menace to communities living near sewer lines manhole covers and the proposed new Sirende and new Rafiki WWTPs<br>• Leachates from sludge drying beds at the WWTP that could result to soil and water resources contamination.<br>• Infestation of the WWTP by rodents and scavenger birds if the new Sirende and new Rafiki WWTPs not properly maintained including appropriate disposal of Solid Wastes from Inlet screens |

### 5.3.3 Environment and Social Impacts Ranking

The environment and social impact identification and analysis was done using the Leopold matrix, a qualitative environmental impact assessment method pioneered in 1971 and used to identify the potential impact of a project on the environment. The matrix is a grid that is used to identify the interaction between project activities, which are displayed along one axis, and environmental characteristics, which are displayed along the other axis. The identified impacts were analyzed to determine the impact rating, severity and mitigation as described in the following sub-sections.

#### i) Impact Rating Variables

The impact rating variables evaluated include; the extent of the impact, timing of occurrence of the impact, intensity of the impact and probability of the impact occurring as explained in **Table 5-2**.

**Table 5-2: Impact Rating Variables**

| Impact Rating | Description |
|---|---|
| Extent | An area of influence covered by the impact, if the action produces a much-localized effect within the space, it is considered that the impact is **low (1).** If, however, the effect does not support a precise location within the project environment, having a pervasive influence beyond the project footprint, the impact will be at location **level (3)** or could be **Beyond County (5)** |
| Timing: | Refers to the moment of occurrence, the time lag between the onset of action and effect on the appearance of the corresponding factor, classified in five categories from zero-time **period (1) to permanent (5).** |
| Intensity | Refers to the degree of impact on the factor, in the specific area in which it operates, ranked from **low (1) to high (5).** |
| Probability | Refers to the likelihood of the impact occurring during the project implementation, this is also ranked as **probable to highly probable.** |

### ii) Impact Severity

Impact severity was determined based on the capacity of the receptor to sustain shocks triggered by the impact. In this regard the impact severity can be classified as negligible, low, medium or high as summarized in **Table 5-3**.

**Table 5-3: Impact Severity**

| Sensitivity | Description (considers duration of the impact, spatial extent, reversibility, | Colour Connotation |
|---|---|---|
| High | Vulnerable receptor (human or ecological) with little or no capacity to absorb proposed changes or minimal opportunities for mitigation. | |
| Medium | Vulnerable receptor (human or ecological) with limited capacity to absorb proposed changes or limited opportunities for mitigation. | |
| Low | Vulnerable receptor (human or ecological) with some capacity to absorb proposed changes or moderate opportunities for mitigation | |
| Negligible | Vulnerable receptor (human or ecological) with good capacity to absorb proposed changes or and good opportunities for mitigation | |

For effective impact identification, the environment characteristics are assigned weights based on the severity of environment impacts (Leopold, 1971) as detailed in **Table 5-4**.

**Table 5-4: Impact Rating Criteria for Environment and Social Risks**

| Extent | | Duration | | Intensity | | Probability | | Weighting Factor (WF) | | Severity Rating (SR) | | Mitigation efficiency | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Foot print | 1 | Short term | 1 | Low | 1 | Probable | 1 | Low | 1 | Low | 0-19 | High | 0,2 |
| Site (1km radius) | 2 | Short to medium | 2 | | | Possible | 2 | Low to Medium | 2 | Low to Medium | 20-39 | Medium to High | 0,4 |
| Location | 3 | Medium term | 3 | Medium | 3 | Likely | 3 | medium | 3 | medium | 40-59 | medium | 0,6 |
| Sub County | 4 | Long term | 4 | | | Highly likely | 4 | Medium to high | 4 | Medium to high | 60-79 | Low to medium | 0,8 |
| Beyond County | 5 | Permanent | 5 | High | 5 | High | 5 | High | 5 | High | 80-100 | low | 1,0 |

### iii) Approach to Impact Mitigation and Management

The Assessment includes a description of the measures envisaged to prevent, reduce and where possible offset any significant adverse impacts on the environment. The identification of such measures is an interactive process which needs to be undertaken in parallel with the design to aid the incorporation of measures into the design during Project development. Early adoption of appropriate mitigation will help reduce significant environmental impacts to a practicable minimum.

### 5.3.4 Specialized Studies (Environmental Analysis)

As part of baseline water quality assurance at EIA stage, surface water quality analysis for the receiving River; Koitobos and Katalele Rivers was carried out at the proposed river outfall points. The objective was to assess the baseline Biological Oxygen Demand ($BoD_5$) of the rivers before establishment of the WWTP.

Additionally, inflow raw wastewater and treated effluent from Bidii and Matisi Ponds analysis was carried out. The analyzed wastewater qualities included, pH, Total Suspended solids, Total Dissolved Solids, Conductivity, Biochemical Oxygen Demand (BOD5), Chemical Oxygen Demand (COD) and Transparency.

**Photograph Showing Bidii WWTP**

**Photograph Showing Sample Collection at Matisi Maturation Ponds**

The results of water sampling are summarized in **Table 5-5**. Detailed Laboratory Report is given in **Appendix 3 of this Report.**

**Table 5-5: Results of Environment Laboratory Analysis**

| Site | pH | Conductivity | TSS (mg/l) | TDS (mg/l) | BOD (mg/l) | COD (mg/l) |
|---|---|---|---|---|---|---|
| Koitobos River at proposed Sirende T/works site | - | - | - | - | 2 | 23 |
| Katalele River at proposed Rafiki T/works site | - | - | - | - | 11 | 14 |
| Bidii WWTP Influent | 7.1 | 1005 | 189 | 704 | 160 | 326 |
| Bidii WWTP Effluent | 9.3 | 588 | 122 | 412 | 64 | 163 |
| Matisi Ponds Influent | 7.1 | 1873 | 280 | 1311 | 820 | 1695 |
| Matisi Ponds Effluent | 8.5 | 1513 | 28 | 1059 | 188 | 71 |

# CHAPTER 6: POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

## 6.1 Introduction

Development of infrastructure Projects such as the Proposed Kitale Sewerage Project is guided by several laws, by-laws, regulations, Acts of Parliament as well as policy documents. This objective of this section is to assess the existing Policies and Legislative Framework, Economic Tools and Enforcement Mechanisms for the Management of Infrastructure Projects at different stages.

## 6.2 Policy Provision

The water sector in Kenya is guided by the Kenya Vision 2030, Water Act 2016, the Water Policy 1999 and the water strategic plan 2018-2022 among other instruments. **Table 6-1** presents a summary relevant policy provisions and legal statutes that were analyzed at scoping stage of the Project.

**Table 6-1: Policy Framework**

| No | Policy | Applicability |
|---|---|---|
| 1 | Constitution of Kenya (CoK) 2010 | Article 43 (1) provides that every person has the right – (b) to accessible and adequate housing, to reasonable standards or sanitation; and, (d) to clean and safe water in adequate quantities. These provisions cover oblige state organs and bind them to provide not just high quality or clean and safe water but also adequate quantities to all people that they will serve. Kitale Sewerage Project will ensure this goal is achieved through adequate treatment of raw sewage before it is released into the environment<br><br>Also, the Constitution of Kenya provides for sound management and sustainable development of all Projects, both public and private investments. It also calls for the duty given to the Project proponent to co-operate with State organs and other persons to protect and conserve the environment as mentioned in Part II. |
| 2 | National Environment Policy (NEP) 2013: | The revised draft of the National Environmental Policy, dated April 2013, sets out important provisions relating to the management of ecosystems and the sustainable use of natural resources.<br><br>Among other objective, the (NEP) endeavors to ensure sustainable management of the environment and natural resources, such as unique terrestrial and aquatic ecosystems, for national economic growth and improved livelihoods.<br><br>Kitale town in reference to *Sombroek, W.G., Braun, H.M.H. and van der Pouw, B.J.A., 1982* falls within the western Kenya which is within Agro Ecological Zone (III) which has a mix of forest and fresh water ecosystem that must be protected in accordance with Policy statements (4.1 and 4.2 of NEP 2013). |

| No | Policy | Applicability |
|---|---|---|
| 3 | The National Environmental Sanitation and Hygiene Policy-July 2016 - 2030: | The Policy is devoted to environmental sanitation and hygiene in Kenya as a major contribution to the dignity, health, welfare, social well-being and prosperity of all Kenyan residents. The Policy recognizes that healthy and hygienic behavior and practices begin with the individual. The implementation of the Policy will greatly increase the demand for sanitation, hygiene, food safety, improved housing, use of safe drinking water, waste management, vector control at the household level and encourage communities to take responsibility for improving the sanitary conditions of their immediate environment. |
| 4 | National Policy on Water Resources Management and Development (Sessional Paper No.1 of 1999) | The management of water resources in Kenya is guided by four specific policy objectives, namely:<br>• Preserve, conserve, and protect available water resources and allocate it in a sustainable rational and economic way;<br>• Supply water of good quality in sufficient quantities to meet the various water needs, including poverty alleviation, while ensuring the safe disposal of wastewater and environmental protection;<br>• Establish an efficient and effective institutional framework to achieve a systematic development and management of the water sector; and<br>• Develop a sound and sustainable financing system for effective water resources management, water supply and sanitation development. |
| 5 | The National Water Policy 2012 (Draft) | The Policy is built on the achievements of the sector reform commenced with the Water Act and based on the sector principles lined out in the National Water Policy 1999.<br><br>On water resources management, the policy seeks the management of water resources along natural catchment/basin boundaries following the Integrated Water Resource Management approach. It aims to ensure a comprehensive framework for promoting optimal, sustainable, and equitable development and use of water resources for livelihoods of Kenyans through:<br><br>• Progressive restoration and protection of ecological systems and biodiversity in strategic water catchments;<br>• increasing per capita water availability above the international benchmark of 1000 m. by 2030;<br>• Maximizing use of trans-boundary water resources in coordination with other riparian countries;<br>• Enhancing storm water management and rainwater harvesting;<br>• Enhancing inter-basin water transfer in Kenya as a strategic intervention for optimized used of water resources;<br>• Improving effluent waters treatment and recycling for use;<br>• Ensuring sustainable groundwater resources for present and future generations; and<br>• Developing a water management system which contributes to the protection of the environment. |

| No | Policy | Applicability |
|---|---|---|
| 6 | Kenya Vision 2030 | The Kenya Vision 2030 is the current National Development blueprint for period 2008 to 2030. The vision has three pillars; economic, social and political. It is recognized that Kenya is a water scarce Country but stated (Kenya, 2007: 115) that the Vision for the water and sanitation sector is "to ensure water and improved sanitation services availability. The Project will directly contribute towards achievement of objectives of vision under the environment and social pillar through provision of the planned dam projects. |
| 7 | National Climate Change Response Strategy, 2010 | The strategy paper recognizes that Kenya is a water scarce country and offers a variety of strategies for ensuring that the resource is utilized in ways that recognize that it is a finite resource. The paper also argues that interventions in the water sector should take a participatory approach involving different water users including gender groups, socioeconomic groups, planners and policy makers in water resource management (Kenya, 2010: 53). |
| 8 | The National Land Policy (Sessional Paper No. 3 of 2009) | The policy regulates rights over land and provides for sustainable growth, investment and the reduction of poverty in line with the Government s overall development objectives. Specifically, "the policy offers a framework of policies and laws designed to ensure the maintenance of a system of land administration and management.<br><br>The overall objective of the National Land Policy is to secure land rights and provide for sustainable growth, investment, and the reduction of poverty in line with the governments overall development objectives. |
| 9 | Economic Recovery for Wealth and Employment Creation Strategy 2006 | The overall goal of the strategy is to ensure clear improvement in the social and economic wellbeing of all Kenyans; thereby giving Kenyans a better deal in their lives, and in their struggle to build a modern and prosperous nation. The key areas covered in the strategy are:<br>• Expanding and improving infrastructure;<br>• Reforms in trade and industry;<br>• Reforms in forestry;<br>• Affordable shelter and housing;<br>• Developing arid and semi-arid lands, and<br>• Safeguarding environment and natural resources. |
| 10 | HIV and AIDS Policy 2009 | The HIV Policy therefore will be complied with during implementation of the Project; the Contract prepare Construction Specific Environment and Social Management Plan (C-ESMP) that will address issues related to awareness and prevention of HIV / AIDS and other communicable diseases. |
| 11 | Gender Policy 2011 | This Policy will be referred to during Project implementation especially during hiring of staff to be involved in the Project, procuring of suppliers, sub consultants and sub-contractors to the Project |

| No | Policy | Applicability |
|---|---|---|
| 12 | The Sustainable Development Goals (SDGs) | The concept of the SDGs was born at the United Nations Conference on Sustainable Development, Rio+20, in 2012. The objective was to produce a set of universally applicable goals that balances the three dimensions of sustainable development: environmental, social and economic. The Investments will therefore contribute towards achieving this goal through the ensuring development of Kitale Municipality by provision of sewerage infrastructure and at the same time eliminating pollutions of rivers Koitobos and Kitalele by untreated wastewater |
| 13 | Kenya National Youth Policy 2006 | This Policy aims at ensuring that the youth play their role alongside adults in the development of the Country. The National Youth Policy visualizes a society where youth have an equal opportunity as other citizens to realize their fullest potential. Proposed Kitale Sewerage Project will provide direct employment to the youth as required by the Policy. |

## 6.3 Kenyan Legislations

The proposed investment will be implemented within provisions of various Acts of Parliament and Local Legislations as summarized in **Table 6-2.**

**Table 6-2: Acts of Parliament**

| Policy | Applicability |
|---|---|
| EMCA 1999 Cap 387 | The Environmental Management and Coordination Act of 1999 (EMCA) Cap 387 was enacted to provide an appropriate legal and institutional framework for the management of the environment and for matters connected therewith and incidental thereto. EMCA does not repeal the sectoral legislation but seeks to coordinate the activities of the various institutions tasked to regulate the various sectors. These institutions are referred to as Lead Agencies in EMCA. Lead Agencies are defined in Section 2 as any Government ministry, department, parastatal, and State Corporation or local authority in which any law vests functions of control or management of any element of the environment or natural resource.<br><br>EMCA addresses itself primarily to Environmental Impact Assessment (Section 58). The Environmental (Impact Assessment and Audit) Regulations of 2003, however, recognizes SEAs as a measure of environmental impact assessment at strategic level such as policy, plans and programmes.<br><br>Waste Management Regulations, 2006: Regulation 4 (1) states that no person shall dispose of any waste on a public highway, street, road, recreational area or in any place except in a designated receptacle". Regulation 4 (2) further states that "a waste generator shall collect, segregate and dispose such waste in the manner provided for under these regulations". The proponent will use provisions of this regulation to ensure that waste is handled, stored, transported and disposed as per this regulation. |
| Land Act, 2012 | It is the substantive law governing land in Kenya and provides legal regime over administration of public and private lands. It also provides for the acquisition of land for public benefit. The government has the powers under |

| Policy | Applicability |
|---|---|
| | this Act to acquire land for projects, which are intended to benefit the general public.<br><br>This Act provides for the procedure to be followed during compulsory acquisition of land by the Government and the just compensation which should be paid promptly and in full to all persons whose interest in land has been affected. This Act will be applied during land acquisition if required. |
| Water Act, 2016 | Article 43 of the Constitution stipulates that every person in Kenya has the right to clean and safe water in adequate quantities and to reasonable standards of sanitation. In conformity to this constitutional requirement, the Water Act, 2016 was enacted.<br><br>It is "An ACT of Parliament to provide for the regulation, management and development of water resources, water and sewerage services; and for other connected purposes". The law provides for national public water works (Article 8(2)) that include water storage, water works for bulk distribution and provision of water services, inter-basin water transfer facilities, and reservoirs for impounding surface run-off and for regulating stream flows to synchronize them with water demand patterns which are of strategic or national importance. It vests the administration of water resources to the National Government (Article 9) and calls for public participation in the formulation of a National Water Resource<br><br>Strategy (Article 10 (1)) on five-year cycles. The Strategy shall provide the Government's plans and programs for the protection, conservation, control and management of water resources (2). Article 10(3) gives the details of the contents of the National Water Resource Strategy, i.e.:<br><br>(a) existing water resources and their defined riparian areas; (b) measures for the protection, conservation, control and management of water resources and approved land use for the riparian area;<br>(c) minimum water reserve levels at national and county levels;<br>(d) institutional capacity for water research and technological development;<br>(e) functional responsibility for national and county governments in relation to water resources management; and<br>(f) any other matters the Cabinet Secretary considers necessary.<br><br>The new law aligned national water management and water services provision with the requirements of the Constitution of Kenya 2010 particularly on the clauses devolving water and sanitation services to the County governments. Service provision is devolved to the Counties who are the owners of Water Service Providers (WSPs).<br><br>Kitale Sewerage Project once implemented will be handed to Nzoia Water Services Company (NZOWASCO) Water Service Provider (WSP) for operation and maintenance as provided by Water Act 2016 |
| County Government Act No. 17 of 2012 | The preamble to the Act gives overriding object and purpose of the Act. It states that, '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. Part II elaborate on the functions and powers of the county government, emphasizing its constitutional authority to enter into contracts, acquire and |

| Policy | Applicability |
|---|---|
| | hold and dispose of assets, and delegate functions, such as through sub-contracts and partnerships. Part VI considers the foci and administration of decentralization to the sub-county level, including to urban areas and cities.<br><br>The County Government Act, 2012, provides the basis for spatial plans as statutory requirements in the county. The Act stipulates a 10-year spatial plan be developed by each county to provide for:<br><br>(a) spatial depiction of the social and economic development programme of the county as articulated in the integrated county development plan;<br>(b) a clear statement of how the spatial plan is linked to the regional, national and other county plans; and<br>(c) a clear clarification on the anticipated sustainable development outcomes of the spatial plan. |
| Physical and Land Use Development Plan Act 2019 | Section 16 of the Physical Planning Act (Chapter 286) provides that the Director may prepare a regional physical development plan. The plan shall consist of inter alia, a statement of policies and proposals with regard to the allocation of resources and the locations for development within the area. The Act requires the Director to invite any person interested to make representations to do so within sixty days of the publication of the plan. On approval of the regional physical development plan no development shall take place on any land unless it is in conformity with the plan.<br><br>Section 24 provides for the Director to prepare also a local physical development plan whose purpose is to guide and coordinate development and for the control of the use and development of land. The proposed sanitation works will be implemented in line with the approved Local Physical Development Plans (LPDPs) for Kitale town. Particular interest will be site for WWTP and alignment of trunk and secondary sewers along road reserves and river riparian |
| The Urban Areas and Cities Act 2011 | This Law passed in 2011 provides legal basis for classification of urban areas (City) when the population exceeds 500,000; a municipality when it exceeds 250,000; and a town when it exceeds 10,000) and requires the city and municipality to formulate County Integrated Development Plan (Article 36 of the Act). |
| Occupational Health and Safety Act (OSHA 2007) | The Act provides Environment Health and Safety (EHS) Guidelines which shall be followed by both the Contractor and Supervising Consultant during implementation of the Project to avoid injuries and even loss of life to workers and neighboring community. |
| The Public Health Act (Cap.242) | This is an Act of Parliament that makes provision for securing and maintaining health. Part IX contains provision regarding sanitation and housing. Section 115 of the Act states that no person shall cause nuisance or cause to exist on any land or premises any condition liable to be injurious or dangerous to human health. Section 116 requires that Local Authorities take all lawful, necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable to be injurious or dangerous to human health.<br><br>The Act also contains provisions on discharges of pollutants into water sources. On responsibility of the Local Authorities Part XI, section 129, of the Act states in part “It shall be the duty of every local authority to take all lawful, necessary and reasonably practicable measures for preventing any pollution |

| Policy | Applicability |
|---|---|
| | dangerous to health of any supply of water which the public within its district has a right to use and does use for drinking or domestic purposes.<br><br>Part XII, Section 136, states that all collections of water, sewage, rubbish, refuse and other fluids which permit or facilitate the breeding or multiplication of pests shall be deemed nuisances under this Act. |
| HIV and AIDS Prevention and Control Act 2011 | The objective and purpose of this Act is to (a) promote public awareness about the causes, modes of transmission, consequences, means of prevention and control of HIV and AIDS; (b) extend to every person suspected or known to be infected with HIV and AIDS full protection of his human rights and civil liberties. The Act provisions will be applied during Project implementation phase where the contractor will be required to create awareness among workers and community at large. |
| Sexual Offences Act 2006 | An Act of Parliament that makes provision about sexual offences aims at prevention and the protection of all persons from harm from unlawful sexual acts and for connected purposes. Section 15, 17 and 18 focuses mainly on sexual offenses on minor (children). |
| Child Rights Act (Amendment Bill) 2014 | This Act of Parliament makes provision for parental responsibility, fostering, adoption, custody, maintenance, guardianship, care and protection of children. It also makes provision for the administration of children's institutions, gives effect to the principles of the Convention on the Rights of the Child and the African Charter on the Rights and Welfare of the Child. Contractors implementing the various Project components envisaged under the Master Plan Study will be required to comply to provisions of the Act during Project implementation. |
| Labour Relations Act 2012 | An Act of Parliament to consolidate the law relating to trade unions and trade disputes, to provide for the registration, regulation, management and democratization of trade unions and employers organizations or federations, to promote sound labour relations through the protection and promotion of freedom of association. This act will be applied by labour force on site in addressing disputes related to working conditions. |
| National Gender and Equality Commission Act 2011 | The over-arching goal for NGEC is to contribute to the reduction of gender inequalities and the discrimination against all; women, men, persons with disabilities, the youth, children, the elderly, minorities and marginalized communities. This Act will be applied during hiring of workforce on site. |
| The National Museums and Heritage Act 2006 | An Act of Parliament to consolidate the law relating to national museums and heritage; to provide for the establishment, control, management and development of national museums and the identification, protection, conservation and transmission of the cultural and natural heritage of Kenya; to repeal the Antiquities and Monuments Act (Cap. 215) and the National Museums Act; and for connected purposes. This act together with world bank policy OP 4.11 on Physical Cultural Resources will be quoted in the event that the project will encounter such materials, chance find procedures will be provided to specific ESIAs that will be prepared. |

## 6.4 Permits and Licences

The permits and licenses listed below will be secured by CRVWWDA before Project civil works are commissioned.

- Environment License issued by NEMA and per the provisions of the EMCA 1999 Cap 387
- Environment Licenses for any camp sites, burrow pits, cement batching plants or quarries from NEMA.
- Registration of the Project as a workplace with the Occupational Health and Safety Registration (DOSH). Before registration, the contractor will carry out health and safety audits, risk assessment, fire trainings and basic first aid trainings to workers among others.
- Approval of Plans by Kitale County Government Physical Planning Department of any structures on site.
- Permits from Public Health Department (Kitale County) of sanitation facilities installed on site
- Authority to Construct Works within river riparian from Water Resources Authority (WRA) and also authority to abstract water from the rivers during project construction.
- Authority to Construct Works within protected Man Made Lessos Forest from Kenya Forest Services (KFS)

The Contractor shall maintain a database of all pertinent permits and licenses required for the contract as a whole and for pertinent activities for the duration of the contract

## 6.5 African Development Bank Policy Provisions

Applicable African Development Bank Operational (AfDB) Safeguard Polices (OS) are listed in **Table 6-3.**

**Table 6-3: AfDB OS Relevant to Sewerage Infrastructure**

| Policy | Discussions |
|---|---|
| OS 1: Environmental and Social Assessment. | Project components will trigger OS 1. Detailed Project Assessment identified that according to OS 1 screening provisions, Kitale Sewerage Project is a Category 1, i.e. the Project is likely to have detrimental site-specific environmental and/or social impacts that are more adverse and but can be reversible, and minimized by applying appropriate management and mitigation measures. Mitigation measures for impacts that will be presented in the ESIA<br><br>Significant impact identified to be triggered during operation is likely pollution of Koitobos and Katalele Rivers by blocked sewer manholes or release of effluent into the river which does not meet the required standards as provided by Water Quality Regulation of 2006. Other streams include Meru farm stream and Kipsongo stream among others. |
| OS 2: Involuntary Resettlement: Land Acquisition, Population | The policy aims to avoid involuntary resettlement where feasible, or minimize resettlement impacts where involuntary resettlement is deemed unavoidable after all alternative Project designs have been explored. For Kitale Sewerage Project, displacement of population |

| Policy | Discussions |
|---|---|
| Displacement and Compensation. | is not triggered as Sewers are aligned with River Riparian- However, the Project will impact crops/trees / structures/fences while land for WWTP will be acquired through willing buyer willing seller arrangement between Trans Nzoia County Government and land owners. Specific Resettlement Action Plan (RAP) reports has been prepared separately. |
| OS 3: Biodiversity, Renewable Resources and Ecosystem Services. | The safeguard aims to conserve biological diversity and ecosystem integrity by avoiding or, if avoidance is not possible, reducing and mitigating any adverse environment and social risks. ,<br><br>For Proposed Kitale Sewerage Project, the focus will be on the quality of effluent that will be released into river Koitobos and River Katalelei, Water Quality Regulations of 2006 provide that Biological Oxygen Demand (BOD) for treated effluent should be less that 30mg/l. Primary evaluation indicated that Koitobos and Katalele Rivers have adequate oxygen and therefore sustains aquatic ecosystem. This should be maintained during both phases of the Project in order to ensure sustainability of the river ecology.<br><br>The proposed "Waste Stabilization Ponds" technology will ensure the effluent is treated to the required effluent BOD and pathogen reduction levels; proper and routine operation and maintenance procedures will be adhered to so that the quality of water is guaranteed for downstream users and aquatic ecosystem.<br><br>BoD of rivers Katalele and Koitobos was analyzed during the ESIA and the Results are as detailed in **Section 6.3.4.** |
| OS 4: Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials and Resource Efficiency. | The Project shall utilize raw materials both during construction and operation phase that could result to pollution of biophysical environment if not handled appropriately. Appropriate mitigation measures for likely waste to be generated by the Project will be detailed in the ESIA<br><br>Project activities shall not result to significant amount of greenhouse gases. The ESIA shall provide measures for management of odour emanating from Hydrogen Sulphide and Methane Gases which are associated with greenhouse gases. Also, the Project design has ensured that sewer flows through by gravity hence reducing the need for pumping which would lead to increased emissions. |
| OS 5: Labour Conditions, Health and Safety. | The Project shall involve workers both during construction and operation phases of the project. This policy read together with OSHA 2007 shall form integral instruments to be used in ensuring that health, safety and working conditions of both works and community is safeguards. The Labour Relations Act 2011 will be applied by labour force on site in addressing disputes related to working conditions. |

# CHAPTER 7: STAKEHOLDER CONSULTATIONS

## 7.1 General

Project stakeholders are defined as individuals, groups or other entities who:

i) Are impacted or likely to be impacted directly or indirectly, positively or adversely, by the Project (also known as 'affected parties')

ii) May have an interest in the Project ('interested parties'). They include individuals or groups whose interests may be affected by the Project and who have the potential to influence the Project outcomes in any way.

The objectives of stakeholder consultations include the following:

- Identifying and mapping of all relevant stakeholders, their context, interests and concerns
- Establishing a two-way dialogue to understand concerns, management options and external perspectives
- Managing stakeholders' expectations
- Facilitating the collection of quality primary and secondary information relevant to the project processes including monitoring
- Triangulating data collected and analysis done to inform decision making
- Documenting information disclosed and public consultation efforts
- Complying with regulations and requirements on disclosure and consultation
- Providing information about the project and its potential impacts to those interested in or affected by the project, and solicit their opinion in this regard
- Identifying additional impacts/issues and possible mitigation measures
- Facilitating the process of developing appropriate mitigation measures and consideration of alternatives and trade-offs (if any)
- Reducing chances of conflict through early identification of contentious issues
- Ensuring transparency and accountability of decision-making
- Increasing public confidence in the project.

## 7.2 Stakeholder Mapping and Identification

A stakeholder identification, mapping and analysis exercise was carried out to determine all organizations and individuals who may be directly or indirectly (positively or negatively) affected by the proposed Kitale Sewerage Project. All identified stakeholders were consulted at the ESIA stage with the motive of collecting their views in relation to the project and associated beneficial and adverse impacts. The identified stakeholders were grouped into two main categories depending on their various needs, interest, and potential influence to the project as follows:

**Primary Stakeholders**: These are stakeholders directly affected by the project such as the local community, local administration, institutions such as schools and health centers within target drainage areas 1, 2 and 3 within Kitale Municipality.

**Secondary Stakeholders:** These are stakeholders indirectly affected by the project but influence development through Project implementation. These include but not limited to: National Government and Trans Nzoia County Government instituions.

An Inventory of the Stakeholder relevant to the Proposed Project is summarized in **Table 7-1**.

**Table 7-1: Inventory of the Project Stakeholder**

| Stakeholder Category | Stakeholder Name |
|---|---|
| Primary Stakeholders | • Local community<br>• Local administration,<br>• Institutions such as schools and health centres<br>• NGOs<br>• Businesses and business –organizations |
| Secondary Stakeholders | • Government of Kenya<br>• GoK -Ministry of Water and Sanitation<br>• Central Rift Valley Water Works Development Agency (CRVWWDA)<br>• Lake Victoria North Water Works Development Agency (LVNWWDA)<br>• Ministry of Environment and forestry<br>• Water Resources Authority (WRA)<br>• Nzoia Water and Sanitation Company (NZOWASCO)<br>• Trans Nzoia County<br>• Kitale town (Saboti Sub County)<br>• Kiminini Constituency<br>• Press and media |

## 7.3 Key Informants Interviews

Key informant interviews (KII) were conducted from the **20th July 2020 to 4th August 2020.** The target respondents were Head Teachers of both private and public schools, GK prison warden, Kenya Cooperative Creameries (KCC) Managing Director and Nurses In-charge of Health Institutions as summarized in **Table 7-2**.

**Table 7-2: Key informant Interview Schedule (Schools)**

| Institution | Informant | Location | Interview Date |
|---|---|---|---|
| Showground Primary & ECD Centre | Deputy Head Teacher | Kitale Town next to Showground | 20th July 2020 |
| Weaver Bird High School | Proprietor | Kibomet | 20th July 2020 |
| Manor House | Proprietor | Kitale Town next to Showground | 20th July 2020 |
| Green Field | Proprietor | Kitale Town next to Showground | 20th July 2020 |
| Trans Nzoia Primary | Head Teacher | Kitale CBD | 20th July 2020 |
| Milimani Primary School | Senior Teacher | Milimani | 20th July 2020 |
| St Theresa Boys | Boarding Master | Bikeke Centre –Kitale – Eldoret High way | 21th July 2020 |
| St Theresa Boys | Deputy Teacher | Bikeke Centre – Kitale – Eldoret High way | 21th July 2020 |
| Bikeke Primary School | Teacher | Bikeke Centre – Kitale – Eldoret High way | 21th July 2020 |
| Lumuli Primary School | Head teacher | Lumuli centre located along Kitale – Eldoret High way | 21th July 2020 |

| Institution | Informant | Location | Interview Date |
|---|---|---|---|
| Hill School Primary | Head Teacher | Alakara - Kitale – Eldoret High way | 22nd July 2020 |
| Namgoi Primary School | Teacher | Namgoi Kitale – Eldoret High way | 22nd July 2020 |
| St Michael Secondary School | Sineior Teacher | Kwa Muthoni | 22nd July 2020 |
| St Joseph's Boys | Principle | Wamwini – Kitale Webuye Road | 22nd July 2020 |
| St Joseph's Boys | Principle | Wamwini – Kitale Webuye Road | 23rd July 2020 |
| Sirende Primary School | Teacher | Sirende - Kitale – Eldoret Highway | 23rd July 2020 |
| Top Station Primary Schools | Teacher | Kwa Muthoni | 23rd July 2020 |
| **Health Facilities** | | | |
| Kitale County Hospital | Public | County Public Health Officer | 3rd August 2020 |
| Mt. Elgon Hospital | Public | County Public Health Officer | 3rd August 2020 |
| Grassland Dispensary | Public | County Public Health Officer | 3rd August 2020 |
| GK Remand Dispensary | Public | County Public Health Officer | 3rd August 2020 |
| Top Station Dispensary | Public | County Public Health Officer | 3rd August 2020 |
| Mitume Dispensary | Public | County Public Health Officer | 3rd August 2020 |
| Bidii Health Centre | Public | County Public Health Officer | 3rd August 2020 |
| Crystal Hospital | Private | Nurse In-charge | 4th August 2020 |
| St. Anne Hospital | Private | Nurse In-charge | 4th August 2020 |
| Galilee Hospital | Private | Nurse In-charge | 4th August 2020 |
| Marie Stopes M.C | Private | Nurse In-charge | 4th August 2020 |
| Mwananchi M.C | Private | Nurse In-charge | 4th August 2020 |
| Dr. Maamuud M.C | Private | Nurse In-charge | 4th August 2020 |
| Kitale Nursing Home | Private | Nurse In-charge | 4th August 2020 |
| Dr. Khisa M.C | Private | Nurse In-charge | 4th August 2020 |
| Royal hospital | Private | Nurse In-charge | 4th August 2020 |
| Cherangany Nursing Home | Private | Nurse In-charge | 4th August 2020 |
| Cherangany Nursing Home (Annex) | Private | Nurse In-charge | 4th August 2020 |
| Dr. Litonya M.C | Private | Nurse In-charge | 4th August 2020 |
| Mitume M.C | Private | Nurse In-charge | 4th August 2020 |
| Highway M.C | Private | Nurse In-charge | 4th August 2020 |
| Mucharage M.C | Private | Nurse In-charge | 4th August 2020 |
| VIEBI M.C | Private | Nurse In-charge | 4th August 2020 |
| Vision Dental M.C | Private | Nurse In-charge | 4th August 2020 |
| Kitale Medical Centre | Private | Nurse In-charge | 4th August 2020 |
| Tom Mboya Health Centre | Public | Nurse In-charge | 4th August 2020 |
| **Other Informants** | | | |
| GK Prison | Chaplain | Kitale CBD | 23rd July 2020 |
| KCC | Engineer | Kibomet | 23rd July 2020 |
| Public Health Department | County Public Health Officer | CBD | 17th July and 4th August 2020 |

## 7.4 Target Group Analysis

**The Target Group Analysis (TGA) Survey** was carried out using a Questionnaire divided into 11 sections that included;

i) Settlements Details
ii) Housing Conditions
iii) Households Characteristics
iv) Household Income
v) Household Possession
vi) Household Expenditure
vii) Water Supply

viii) Willingness to pay for Improved Water Supply
ix) Sanitation, (excreta disposal)
x) Health and Hygiene
xi) Open Discussion and Comments with a total of 58 questions

The Questions comprised of pre-coded questions, open ended questions, single response questions and multiple response questions. A sample copy of the Questionnaire used for the TGA Survey is given in **Appendix 2 of this Report.**

The Questionnaire was administered by trained Research Assistants. The Research Assistants were specifically trained on:

i) **Research Ethics** - not to induce responses, to avoid the temptation of filling in the Questionnaire without interviews, not to give out the Questionnaire to respondents for self-administration and general courtesy.

**Photograph Showing Training of Enumerators**

ii) **Sampling Methods** - the Sampling Units and how to pick out Sampling Points and the subsequent random identification of respondents.

**Photograph Showing Mapping of Interviewed Households**

iii) **A test-run of the Questionnaire** - the significance of each question, the meaning and context of each question and the expected responses. A subsequent test-run helped to identify possible areas of difficulty and expected time taken per Respondent.

### 7.4.1 Sampling Methodology

Villages were used as Sampling Units where Sampling Points were identified in within village. From the Sampling Points, random samples were drawn from households.

The Study was Household based and thus all the respondents were picked from the random houses. From the households, the Questionnaire was administered to the household head or the spouse. The Study thus involved the use of Deliberate Sampling, Stratified Sampling and eventually Random Sampling.

### 7.4.2 Sample Size and Distribution

The Study sample size for Kitale Municipality was 151 Nr. Households. Of significance however was how the sample distribution was achieved within the various villages for different population distributions as shown in **Table 7.3.**

**Table 7-3: Sample Distribution for Kitale Municipality Target Group Analysis**

| Settlement Category | Estates / settlement | Respondent |
|---|---|---|
| High density informal | Kipsonga, Kaloleni Mitume and Matisi | 31 |
| Medium density formal | Lesos | 30 |
| Medium density formal | Kibomet and Sinendet | 30 |
| Low density formal | Milimani | 30 |
| Peri urban characteristics | Gatua and Kwa Muthoni | 30 |
| | **Total** | **151** |

### 7.4.3 Findings of the Target Group Analysis

The following were the key findings in a Target Group Analysis Survey (TGA) carried out by MIBP/CES (2020)

i) Residents in Kitale Municipality can be categorized into 3 Socio-Economic groups and 4 settlement categories as shown in **Table 7-4.**

**Table 7-4: Socio-Economic Groups and Categories**

| Social Economic Group | Monthly Expenditure | Settlement Category |
|---|---|---|
| Low Income | <10,000 | High Density Urban |
| Middle Income | 10,001-30,000 | Medium Density Urban<br>Peri-Urban |
| High Income | >30,000 | Low Density Urban |

ii) The Sewer Network Coverage is low with only 20% of the population relying on public sewer connection

iii) Due to poor access to safe water and proper sanitation in the densely populated settlements, there is high prevalence of water and sanitation related diseases with 93% of the high-density settlements residents reporting cases of illness as a result of the prevailing water and sanitation situation.

iv) Low Sewer Network Coverage is a major cause of low connectivity to the public sewer network, with a significant majority of the population willing to pay for both improved sanitation services (86.7%) and sewer connection cost (84%)

**The Study Findings are detailed in the Feasibility Study Report for Kitale Sewerage System, MIBP/CES 2020.**

## 7.5 Public Participation Meetings (Public Barazas)

Five (5) Public Participation Meetings were held within the Project Area from **11th to 13th November 2020**. The Meeting locations were Tuwan, Matisi, Lessos, Milimani and Machungwa Locations with a total attendance of 236 residents **.** A schedule of the meetings is shown in **Table 7-5**.

**Table 7-5: Public Participation Meetings at Project Report Stage**

| Date | Venue | Groups of Residents Presents | No. of Participants |
|---|---|---|---|
| 11th November 2020 – 10am | Tuwan Location – Dominion Church Grounds | • Tuwan Location Chief<br>• Ward Administrator Tuwan Ward<br>• Village elders for Nyumba Kumi – Mitume<br>• Residents of Mitume | 50 |
| 11th November 2020 – 2pm | Matisi Location –Pkach P.A.G church Rafiki. | • Matisi Location Chief<br>• Ward Administrator Matisi Ward<br>• Village elders for Nyumba Kumi – Rafiki<br>• Residents of Rafiki Village | 77 |
| 12th November 2020 – 2pm | Milimani Location – Gatua. | • MilimaniLocation Chief<br>• Ward Administrator Milimani Ward<br>• Village elders for Nyumba Kumi – Gatua<br>• Residents of Gatua Village | 18 |
| 13th November 2020 – 11am | Lessos Location Chief's Office | • Lessos Location Chief<br>• Ward Administrator Matisi Ward<br>• Village elders for Nyumba Kumi – Rafiki<br>• Residents of Rafiki Village | 44 |
| 13th November 2020 – 2pm | Machungwa Location- Mzee Juma's Compound In Machungwa | • Matisi Location Chief<br>• Ward Administrator Matisi Ward<br>• Village elders for Nyumba Kumi – Rafiki<br>• Residents of Rafiki Village | 47 |

Photographs taken during the Public Participation Meetings are shown on **Page 7-7**.


**Tuwan Location meeting in Mitume**

**Sirende Meeting in Machungwa Machungwa Location**

**Lessos Location Meeting**

**Rafiki Meeting in Matisi Location**

**Table 7-6** gives a summary of Issues discussed in the Public Participation Meetings.

**Table 7-6: Issues Discussed and Response**

| Suggestion / Question | Response |
|---|---|
| **Land Acquisition Impacts**<br>The Residents inquired about land for the establishment of Sirende and Rafiki WWTPs | The site for establishment of Sirende Wastewater Treatment. belongs to private individual and will be acquired on a willing buyer willing seller arrangement. Similarly, Rafiki site that serve persons living in the southern estates of Mitume and Matisi will also be acquired through willing buyer willing seller arrangement between the owner and Trans Nzoia County Government. |
| **Resettlement Impact along Sewer Wayleaves**<br>The Residents inquired about the state of wayleaves for the trunk and secondary trunk sewers and whether PAPs who have assets along these wayleaves will be compensated.<br><br>They also requested to know categories of activities that are allowed with such wayleaves. | Residents were informed that the wayleave for the secondary lines will be about three meters wide while for the trunk mains will be about six meters wide.<br><br>The design has aligned the trunks and secondary sewers within road reserves and river riparian in an effort to minimize impact on private land and property. However, in the event that the sewer alignment is beyond the riparian / public land, a RAP assessment will be undertaken and such PAPs will be adequately facilitated.<br><br>Residents were informed that it is best practice to leave wayleaves clear so that in the event maintenance is required, they will not experience loss of property. However, they were informed that they were free to plant seasonal crops like animal fodder but not to put up structures and plant trees on the wayleave. |

| Suggestion / Question | Response |
|---|---|
| **Demolition of Existing Septic Tanks and Pit Latrines**<br>Residents inquired on whether the existing septic tanks and pit latrines will be decommissioned under the project, they also required to be informed on the mode of connecting such facilities to the sewerage network | The residents were informed that those who have septic tanks will not be required to demolish them. The project will eliminate need to exhaust because they will be connected to the sewer line. The septic tanks will now act as holding tanks of the raw sewerage before the sewerage flows into the sewer lines.<br><br>Those using pit latrines will be required to decommission the pit latrine and install flush/pour flush toilets (water borne system) that is connected to the Sewer Network. |
| **Project Commencement and Improvement of Water Supply**<br>Residents inquired on when the project will commence,<br><br>In addition, the resident inquired on whether there are any plans to improve water supply in the area since water is essential for the sewer system to function well. | Residents were informed that the current assignment was only to do Feasibility Studies, Prepare Sewer Design and Generate Tender Documents. LVNWWDA and CRVWWDA will use the Tender Documents to source for funds and in procurement of Works Contractor.<br><br>The Technical Manager-NZOWASCO informed the Residents that that Kiptogot Water Project and expansion of Kapolet water Supply System to increases water supply within Kitale Municipality was underway.<br><br>Residents were further advised to approach their MCA on water needs for inclusion in budget allocation from the Ward Fund for expansion of water distribution network. |
| **Sewer Connection**<br>A resident inquired on how residents will be connected to the sewer line and if there will be monthly charges for the sewer. | The meeting was informed that it was the government's objective to bring services closer to the people as much as possible and this will be the case for the Sewerage Project. However, residents will be expected to apply through NZOWASCO in order to be connected. Sewerage will be charged as a percentage of the monthly water consumption. |
| **Project Employment Opportunities**<br>Residents wanted to know if the contractor will source for workforce within the community where the works will be implemented. | Residents were informed that all unskilled labour and some skilled will be sourced from the local community. Youths were encouraged to organize themselves into groups and avail themselves for the job opportunities for consideration.<br><br>Those that will get these job opportunities were encouraged to work responsively to avoid termination before the project is complete. |

Disclosure of the Environment and Social Impact Assessment Study Report (ESIA) and Resettlement Action Plan (RAP) was done on the 25th June 2021 at the Aturukan Hotel Kitale. The meeting was attended by representatives of institutions listed below

1) Central Rift Valley Water Works Development Agency (CRVWWDA)
2) Lake Victoria North Water Works Development Agency (LVNWWDA) – Beneficiary Agency

3) Nzoia Water and Sanitation Company (NZOWASCO)
4) Trans Nzoia County
5) National Environmental Management

A summary of issues discussed during the disclosure meeting is presented below

**Table E-7: Issues Discussed and Response during Disclosure Workshop**

| Institution | Issue | Response |
|---|---|---|
| Environmental Engineer - LVNWWDA | Clarification was sought on the cut-off date indicated in the RAP Report. | MIBP/CES clarified that the cut-off date was set to allow for census and in determining of the initial budget. A new date will be set during RAP review when compensation is set to start |
| | The grievance redress mechanism was missing in the ESIA Report Submitted. | The grievance redress mechanism has been provided in the RAP Report. However, the section will be added in the ESIA Report |
| Director NEMA -Trans Nzoia County | The community might reject the Project due to odour and reduced land values. A suggested solution is a tree buffer zone around the WWTP and if managed well can be used as a tourist site. The public should be assured of better technology as opposed to the existing ones. | The Proposed WWTPs sites are at the fridges of the municipality boundary. The selected areas are sparsely populated. The land is owned by one person for each site. The proposed Technology ensures little, or no odour form the WWTP components. The land to be acquired has an allowance for tree planting to act as a buffer. The technology adopted is easy to operate since its gravity flow and therefore, minimal probability of failure. |
| | The community should be given incentives to prevent project rejection. | The Project itself is an incentive since it helps in cleaning the environment/and rivers in the project area. In addition, roads leading to the WWTPs will be upgraded to all weather roads benefiting the community around. Since water is required in the WWTPs, provisions for water lines to supply wastewater treatment plants has been made and will also benefit the community. |
| | Clarification was sought on whether the aspect of water reuse was analysed. | During the Feasibility Study, the possibility of water re-use was analysed. Kitale Town has adequate river flows to satisfy the water demand if optimally utilised. Wastewater re-use for drinking water is therefore not needed. The treated wastewater will be used to recharge the rivers and can be used downstream for drinking (further treatment) or for irrigation. |
| | People may opt for bio-digesters and therefore a low connectivity rate to the proposed sewerage system. This may result to wastage of resources. | During the Inception stage of the Project assignment, The County Government and NZOWASCO were requested to develop a sewer connection strategy/policy that will ensure that properties next to the sewers are connected. This is in accordance with the |

| | | |
|---|---|---|
| | | public health act CAP-242 section 126. The Act requires that properties within |
| Environmental Engineer-LVNWWDA | A suggestion to add a constructed wetland just before treated wastewater discharge into the river was raised. | The design has ensured that the treated effluent has a better quality than the set effluent standards. Addition of a wetland is not warranted and will only increase the cost. |
| | The design should include operation and maintenance manuals to guide in the operation of the proposed systems. | Operation and Maintenance Manuals are prepared before commissioning of works by the supervision consultant. However, to enable efficient and effective running of the system, a training needs assessment of the sewerage department staff was carried out identifying the required training courses. The training will be carried out during construction and after commissioning of the project. |
| *Technical Manager-NZOWASCO* | It was suggested that the existing WWTPs should be left to serve the current service area while the new WWTPs serves the proposed expansion areas. | The current WWTPs are very close to Town/development and not aesthetic for a Town setup. In addition, the operation costs for manging 3/4, WWTPs is higher than managing 2 WWTPs. The land where the existing WWTPs are located can be used for other purposes. |
| *Development Officer-LVNWWDA* | Clarification was sought on whether discharge of hazardous waste into the sewerage system was considered. | The water quality regulations requires that any industry should pre-treat their waste before discharge into the public sewers. A tripartite agreement is entered between the NZOWASCO, the industry and the County Government to ensure this is followed. Therefore, discharge of hazardous waste is not anticipated. However, in case of this, the system can absorb shock due to the long retention period > 20 days. Mitigation measures have been provided in the Effluent Discharge Control Plan. |
| *Water Officer-County Government of Trans Nzoia* | A concern was raised on the WWTP ponds acting as a breeding ground for mosquitoes, considering that Kitale is a high malaria risk zone. | The WWTP is a continuous flow system. Mosquito bleeding grounds are usually stagnant waters which is not the case. Mosquito eggs would be carried by the flow currents. |

Minutes of the Meeting are given in **Appendix 2 of this Report**

# CHAPTER 8: ENVIRONMENTAL AND SOCIAL IMPACTS ASSESSMENT & MITIGATION MEASURES

## 8.1 Introduction

This ESIA assessment was systematically conducted to determine likely impacts associated with the Project during construction and operation stage. The Environmental (Impact Assessment and Audit) Regulations, 2003 provides the legal and statutory guideline for the Environment and Social Impact Assessment process in Kenya in addition to provisions of the African Development Bank (AfDB) Operational Safeguards (OS).

The Project impacts on the natural and human environment were assessed in terms of direct, indirect, induced or cumulative impacts on receptors within the Project Area as detailed in the subsequent subsections.

## 8.2 Positive Impacts

### 8.2.1 Construction Phase

This Phase includes Pre-Construction Phase and Construction Phase. Construction period depends on the nature of the project activities and normally vary from one year to three years.

The positive impacts during construction phase are summarized below:

- **Employment opportunities during construction:** The design report has provided for 90% of unskilled labour and 60% of skilled labourers to be sourced from the local market.
- **Provision of ready market for construction materials** such as sand, ballast and cement that will be sourced from local market, this will lead to injection of money into the local economy
- **The Project will be associated with technological and knowledge transfer to the local sector**: This will be through the artisan who will be employed and trained by the Project.

### 8.2.2 Operation Phase

The main objective of the Project is to improve the quality of life of people within Kitale Municipality through provision of improved sanitation services. The positive impacts associated with the Project operation phase include:

- Reduced pollution of natural river systems including Koitobos and Katalele rivers.
- Reduced cases of water borne diseases associated with pollution of water resources by raw sewage.
- Improve aesthetic outlook of Kitale Town that is currently comprised by raw sewer flowing in storm drains
- Trigger development of modern infrastructure within Kitale town due to

availability of adequate sewer infrastructure.

- Reduce distances covered by exhausters to sludge discharge points (reduced costs)
- Residents will decommission pit latrines which are expensive to construct and unsustainable in the long run due to short fill-up duration. This will reduce contamination of ground water.

## 8.3 Negative Impacts of the Project During Construction Phase

Environment and social Impacts severity summary during construction phase of the proposed Kitale Sewerage Project is presented in **Table 8-1** on **Pages 8-3** and **8-4.** Detailed assessment of the impacts is presented in subsequence sub chapters.

## Table 8-1: Summary of Environment and Social Impacts Severity

| Environmental / Social Variable and Receptors | Project Activities / Impacts | Impact Type | Severity Rating | |
|---|---|---|---|---|
| | | | Before Mitigation | After Mitigation |
| Impact on Water Resources (Koitobos and Katalele rivers and associated streams) | • Earthworks such as excavation and backfilling may result to loosening of soils that are eventually washed down through storm water channels into rivers, this ultimately results to increased sedimentation of the rivers.<br>• Water from rivers will be abstracted for Project activities such as dust control and cement batching.<br>• Un-serviced plant and equipment on site could result to oil spills and fuels leaks that contaminate water resources affecting ultimately affecting aquatic organism<br>• At operation stage, there might be direct interaction of water resources and raw sewerage from blocked overflowing un-maintained manholes | Direct | Minor | Negligible |
| Impact on Vegetation Cover | • Minimal interference with vegetation within proposed sewer wayleaves including isolated marshlands and protected man-made Lessos forest<br>• Potential interference with privately owned Kitale Nature reserve located within Koitobos drainages basin at Kapenguria road river crossing | Direct | Minor | Negligible |
| Impacts on Soil Resources | • Increased soil erosion/degradation due to sewer pipeline trench excavations, excavations will increase sedimentations risks of storm water drainage<br>• Project activities will have direct physical impacts to soil within proposed sewer alignment in the settlement. Possible direct physical impacts to soil include erosion resulting from activities such as excavation of sewer trenches, clearing of vegetation for infrastructure such as access roads, laydown areas and construction zones among others. | Direct | Minor | Negligible |
| Impact on Air Quality | Project activities that have potential to impact air quality include, emissions of air pollutants from temporary diesel generators, construction equipment, and vehicles. Construction activities will also create dust. The following would be expected during construction.<br>• Emissions of oxides of nitrogen ($NO_2$ in particular) mainly from construction-related vehicles (and to a lesser degree from construction generators and other hydrocarbon powered equipment); and<br>• Dust and particulate matter (as $PM_{10}$) created by construction-related vehicle traffic on unpaved roads.<br>Once the sewer lines are built and operational and the sewer wayleave is reinstated, no significant effects on air quality are anticipated. | Direct | Moderate | Negligible |

| Environmental / Social Variable and Receptors | Project Activities / Impacts | Impact Type | Severity Rating | |
|---|---|---|---|---|
| | | | Before Mitigation | After Mitigation |
| Noise and Vibration Impacts | Potential noise impacts may arise as a result of the construction activities associated with the construction of the sewer lines. Construction activities and equipment are not expected to result in significant levels of vibration. Equipment that might high levels of vibration (such as impact piling or vibratory compaction) will not be used | Direct | Minor | Negligible |
| Community Health and Safety | The presence of the Project could affect the health, safety and wellbeing of the communities living within the Project Area. Increased project-related traffic, civil works for site preparation including site clearance and excavation work for sewer pipes, change to the environment due to increased noise, decreased air quality, inappropriate waste handling or disposal, and accidental leaks and spills, and the presence of the Project workforce all present potential hazards for the health and safety of local communities | Direct | Moderate | Minor |
| Workers Health and Safety | Workers' rights including occupational health and safety need to be considered to avoid accidents and injuries, loss of man-hours, labour abuses and to ensure fair treatment, remuneration and working conditions. These issues should be considered not only for those who are directly employed on the Project. The Project could potentially lead to workforce-related social and health issues throughout the life cycle of the Project if worker management and rights do not meet Kenyan law or international best practice. | Direct | Moderate | Minor |
| Land Acquisition and Resettlement Impacts | The proposed sewer lines are designed to be laid within existing road reserves and wayleaves owned by the relevant Road Authorities i.e. Kenya Urban Roads Authority (KURA), Kenya Rural Roads Authority (KeRRA) or Kenya National Highways Authority (KeNHA) including Trans Nzoia County Government. In addition, the trunk sewers will be laid along river riparian under custody of Water Resources Authority (WRA).<br><br>From RAP report, the Project will physically and economically impact 248 PAPs in both Rafiki Sewerage System (Lot 1) and Sirende Sewerage System (Lot 2) Projects. Rafiki Sewerage System Project will physically and economically impact 100 PAPs comprising of 28 female PAPs and 72 male PAPs in Matisi Location.1 PAP in Grassland (Rafiki) will transfer 119 acres required for establishment of Waste Water Treatment Plant (WWTP) while 28 PAPs will transfer a cumulative of 5.09 acres as easement for the sewers. Sirende Sewerage System Project will physically and economically impact 148 PAPs comprising of 30 female PAPs and 118 male PAPs in Bidii, Milimani, Naisambu and Sirende Locations. 1 PAP in Sirende (Eldoret Express Bus Company Limited) will transfer 173acres required for establishment of Waste Water Treatment Plant (WWTP) while 103PAPs will transfer a cumulative of 20.96 acres as easement for the sewers | Direct | Moderate | Minor |

### 8.3.1 Impacts on Water Resources

#### a) Potential Impacts

Project activities related to excavation, pipe laying and back filling will interact with water resources within the Project Area in the following ways.

- Earthworks such as excavation and backfilling could result to loosening of soils that are eventually washed down through storm water channels and into receiving rivers, this ultimately results to increased sedimentation of the rivers.
- Water from rivers will be abstracted for Project activities such as dust control and cement batching.
- Un-serviced plant and equipment on site could result to oil spills and fuels leaks that contaminate water resources ultimately affecting aquatic organism
- At operation stage, there might be direct interaction of water resources and raw sewerage from blocked overflowing un-maintained manholes

#### b) Baseline Conditions

Kitale Municipality is divided into 3 main drainage areas with most of the area draining into River Koitobos which eventually flows to the Southeast and forms the current Northern boundary of Kitale Municipality. Machinjoni River Basin is an urban river basin whose source is at the center of Kitale Municipality. It drains westwards from the municipality centre and carries with it loads of pollution from surface run-off from the CBD, neighboring residential areas and siltation from farms and discharges these polluted waters into River Nzoia.

The Biochemical Oxygen Demand ($BOD_5$) of Katalele and Koitobos rivers was analyzed during the ESIA indicating a BOD5 of 11 mg/l and 2 mg/l respectively. Detailed lab results are presented in **Appendix 3 of this Report.**

The volume of soil likely to be disturbed by excavation works is likely to be **minor** and therefore the extent of the impacts as a result of sediment addition to the rivers and streams is considered to be **local**.

Due to the subtropical location of Kitale and high rainfall of 1000mm to 1300mm, there is a high probability that cleared areas will revegetate naturally thereby limiting erosion, the duration of this impact is anticipated to be **short term.**

The **small** magnitude of this impact on surface water quality and the **low** sensitivity of the rivers to increased turbidity means the significance of this impact is assessed as **mino**r. Pre- Mitigation Impact Assessment is presented in **Table 8-2** on **Page 8-6.**

**Table 8-2: Pre-Mitigation Impact Assessment**

| **Impact** | **Siltation and pollution of Surface Waters Resources** | | | | |
|---|---|---|---|---|---|
| Nature of Impact | Negative | Positive | Neutral | | |
| | Eroded soils, oil spills and fuel leaks flowing into surface water courses such as River Koitobos and River Katalele within the Project Area. | | | | |
| Type of Impact | Direct | Indirect | Induced | | |
| | The impact is as a result of direct interaction between earthworks and the environment along the sewer alignments. | | | | |
| Duration of Impact | Temporal | Short term | Long term | Permanent | |
| | The impact is expected to be short term, however in the case of serious erosion the impacts of siltation of surface water may be experienced on a long-term basis. | | | | |
| Impact Extent | Local | Regional | International | | |
| | The impact will be limited to the sewer alignment and wastewater treatment plant construction sites, the dilution of sediments in the river will render this impact negligible at regional scale | | | | |
| Impact scale | The impact is considered as small (local) scale. | | | | |
| Frequency | Continuous | | | | |
| Likelihood | Possible | | | | |
| Impact magnitude | Positive | Negligible | Small | Medium | Large |
| | Based on the above the impact magnitude is considered small. | | | | |
| Resource / Receptor Sensitivity | Low | Medium | High | | |
| | The sensitivity of the rivers along the proposed construction sites to siltation and pollution is considered to be medium to low. | | | | |
| Impact Significance | Negligible | Minor | Moderate | Major | |
| | Considering the impact magnitude is small and the sensitivity is medium to low, the overall significance is considered to be minor | | | | |

### c) Mitigation

The following mitigation measures will be implemented to minimize siltation/sedimentation of surface water by soils eroded from construction sites and pollution of water bodies by hydro-carbons from plants and equipment.

- Discharge of Grey water or uncontrolled discharges from the site/working areas (including wash down areas) to adjacent rivers shall not be permitted
- Water containing pollutants such as cements, concrete, lime, chemicals and fuels shall be discharged into a conservancy tank for planned removal from site
- Works that are likely to generate silt-laden runoff such excavations will be undertaken preferentially during the drier months of the year; December-March
- The drainage system will be developed to prevent silt-laden runoff from entering surface water drains and streams without treatment (e.g. earth bunds, silt fences, straw bales, or proprietary treatment) under any circumstances
- Where possible an 8m buffer strip of existing vegetation will be maintained along the affected rivers such as River Koitobos and River Katalele
- Earth stockpiles will be seeded as soon as possible, covered with geotextile mats or surrounded by a bund to minimise the risk of sediment-rich runoff
- Tools and plant will be cleaned in designated areas within the site where runoff can be isolated for treatment before discharge to the river
- Debris and other material will be prevented from entering watercourses; Construction sites (such as settlement lagoons or other temporary attenuation) to be used during construction if necessary; Diversion of minor watercourses will

be carefully managed to prevent suspension of silt (or contamination by other pollutants)

- Discharge into watercourses and water bodies will only be carried out under consent of the relevant governing bodies such as WRMA
- All wastewater which may be contaminated with oily substances must be managed in accordance with an appropriate Waste Management Plan (WMP)
- Hydrocarbon-contaminated water shall not be discharged into the environment.
- At operation stage, the sewer infrastructure will be constantly inspected and blockages repaired
- At construction stage, the contractor will prepare Specific Construction Environment and Social Management Plan (C-ESMP) which included among others: *Soil and Sedimentation Control Plan, Spoil Management Control Plan and Waste Management Plan.*

#### d) Residual Impact

The implementation of the proposed mitigation measures reduces the significance of the residual impact from minor to negligible. **Table 8-3** presents residual impact significance following mitigation measures.

**Table 8-3: Residual Impact Significance**

| Impact | Project Phase | Significance (Pre-mitigation) | Residual Impact Significance (Post-mitigation) |
|---|---|---|---|
| Siltation and pollution of Surface Waters Resources | Construction | Minor | Negligible |

### 8.3.2 Soil Resources

#### a) Potential Impacts

Project activities related to clearing of vegetation, earthworks such as excavations and back filling will interact with soil resources within the Project Area in the following ways:

The interaction will interfere with the soil structure exposing the soils to agents of erosion such as wind and water. If not properly restored or managed, such soils may erode and wash into nearby surface water bodies.

Soil contamination as a result of oil spills and fuel leaks from un-serviced plant and equipment on site.

#### b) Baseline Conditions

The potential for soil erosion to occur during construction phase is based on a number of factors that include; type and physical properties of the soil, the topographic slope, the vegetation cover and the nature and duration of construction activities.

Soils vary in type corresponding largely with the underlying bedrock, though there is a modification in certain portions of the area due to the disintegration of the laterite caps. Buff or light brown sandy soils are produced by the breakdown of Kavirondian grits and bright red clayey soils by the mudstones.

The main types of erosion occurring in Trans-Nzoia County are splash erosion, rills, gullies, and sediment deposition. A steep slope terrain, low vegetation cover, erosive soil, high intensity rainfall and improper soil, crop and water management are factors leading to, or increasing, soil erosion. Excavation of sewer pipeline trenches has the capacity of exposing soils to agents of erosion such as wind and water.

**c) Impact Assessment**

The impact is likely to occur but the extent of the impact is likely to be limited to the footprint of the activities, particularly the construction sites, use of access roads, laydown areas etc. (i.e. **local** extent).

The impacts of construction activities on soil erosion are anticipated to last for the duration of the construction phase only (i.e**. short term**).

Due to the subtropical location of the Kitale Town and high rainfall of 1000mm to 1300mm, there is a high probability that cleared areas will revegetate naturally thereby limiting erosion, the duration of this impact is anticipated to be **short term. Table 8-4** presents Pre- Mitigation Impact Assessment.

**Table 8-4: Pre-Mitigation Impact Assessment**

| **Impact** | **Soil Erosion during Construction** | | | | |
|---|---|---|---|---|---|
| Nature of Impact | Negative | Positive | Neutral | | |
| | Loss of soil cohesion contributing to erosion. | | | | |
| Type of Impact | Direct | Indirect | Induced | | |
| | Impact is as a result of direct interaction between Project activities and the environment adjacent to construction sites | | | | |
| Duration of Impact | Temporal | Short term | Long term | Permanent | |
| | The impact is expected to be short term, however in the case of serious erosion the impacts may be experienced long term. | | | | |
| Impact Extent | Local | Regional | International | | |
| | The impact will be limited to the footprint of the project and immediate surrounds. | | | | |
| Impact scale | The impact is considered as small (**local**) scale. | | | | |
| Frequency | Continuous | | | | |
| Likelihood | Possible | | | | |
| Impact magnitude | Positive | Negligible | Small | Medium | Large |
| | Based on the above the impact magnitude is considered small. | | | | |
| Resource / Receptor Sensitivity | Low | Medium | High | | |
| | The sensitivity of the rivers along the proposed sewer lines to erosion is considered to be medium to low. | | | | |
| Impact Significance | Negligible | Minor | Moderate | Major | |
| | Considering the impact magnitude is small and the sensitivity is medium to low, the overall significance is considered to be minor | | | | |

**d) Mitigation**

The following mitigation measures will be implemented to minimize potential of soil erosion:

- Vegetation clearing and topsoil disturbance will be minimised where possible
- Contouring temporary and permanent access roads / laydown areas to minimise surface water runoff and erosion

- Sheet and rill erosion of soil shall be prevented where necessary through the use of sandbags, diversion berms, culverts, or other physical means
- Topsoil shall be stockpiled separately from subsoil. Stockpiles shall not exceed 2 m height, shall be located away from drainage lines, shall be protected from rain and wind erosion, and shall not be contaminated.
- Wherever possible construction work will take place during the dry season.
- Topsoil shall be evenly spread across the cleared areas when reinstated.
- Accelerated erosion from storm events during construction shall be minimised through managing storm water runoff (e.g. velocity control measures).
- Soil backfilled into excavations shall be replaced in the order of removal in order to preserve the soil profile.
- Mulch generated from indigenous cleared vegetation shall be spread across exposed soils after construction
- At construction stage, the contractor will prepare Specific Construction Environment and Social Management Plan (C-ESMP) which included among other: *Soil and Sedimentation Control Plan, Spoil Management Control Plan and Waste Management Plan.*

**e) Residual Impact**

The implementation of the proposed mitigation measures reduces the significance of the residual impact from minor to general at the proposed construction sites. **Table 8-5** presents residual impact significance following mitigation measures.

**Table 8-5: Residual Impact Significance**

| Impact | Project Phase | Significance (Pre-mitigation) | Residual Impact Significance (Post-mitigation) |
|---|---|---|---|
| Soil Erosion during Construction | Construction | Minor | Negligible |

### 8.3.3 Impacts on Vegetation Cover

**a) Potential Impacts**

The Project is proposed to be implemented within human settlements where anthropogenic activities has led to clearing of natural vegetation to provide land for housing and farming. During the assessment, no natural protected forests or habitats were identified except for Blocks 6 and KCC man-made forests.

Project activities related to clearing of vegetation and earthworks such as excavation and back filling will interact with vegetation cover within the Project Area in the following ways;

- Clearing of vegetation cover along the sewer lines alignment triggering loss of biodiversity and habitats for terrestrial ecosystems especially along Koitobos river which still exhibit pockets of natural vegetation and marshlands
- Clearing of vegetation cover in all construction sites exposes soils to agents of soil erosion such as wind and runoff, this could lead to soil degradation which eventually triggers sedimentation in nearby rivers, increased river turbidity, could also lead to flooding

### b) Baseline Conditions

The vegetation cover is influenced by anthropogenic activities. In areas where human activities is significant such as in Kitale municipality, dominant tree species include; *Croton macrostachus, Croton megalocarpus, Bridelia micrantha, Erythrina abyssinica, Cussonia holstii, Markhamia lutea and Ekebergia capensis*. In addition, there is a large percentage of introduced species of which the most dominant is the Grevillea robusta. Other exotic species include *Cuppressus lusitanica, Eucalyptus saligna, Eucalyptus camaldulensis, Cassia siamea and Leucaena leucocephala, dominant grass is Themeda triandra*.

Kitale Municipality is a human settlement zone with no protected ecosystem except for notable manmade forests such as: Section 6, KCC Forest, Showground Forest and Block 1 Forest. Additionally, there exist a private nature conservancy situated along Kitale – Kapenguria road. In these modified ecosystems, notable fauna include: mammals, birds, reptiles, insects, amphibians and mollusks.

### c) Impact Assessment

The impact is likely to occur but the extent of the impact is likely to be limited to the footprint of the activities, particularly the construction site, use of access roads, laydown areas and along sewer alignment that will require to be cleared of vegetation cover (i.e. **local** extent).

The impacts of construction activities on vegetation cover are anticipated to last for the duration of the construction phase only (i.e**. short term**).

Due to the subtropical location of the Kitale Town and the high rainfall of 1000mm to 1300mm, there is a high probability that cleared areas will revegetate naturally. The duration of this impact is anticipated to be **short term. Table 8-6** presents Pre-mitigation Impact Assessment.

**Table 8-6: Pre-Mitigation Impact Assessment**

| **Impact** | **Loss of Vegetation Cover During Construction** | | | | |
|---|---|---|---|---|---|
| Nature of Impact | Negative | Positive | Neutral | | |
| | Loss of vegetation cover leading to loss of biodiversity | | | | |
| Type of Impact | Direct | Indirect | Induced | | |
| | Impact is a result as a direct interaction between project activities and the vegetation cover in construction sites. | | | | |
| Duration of Impact | Temporal | Short term | Long term | Permanent | |
| | The impact is expected to be short term | | | | |
| Impact Extent | Local | Regional | International | | |
| | Impact will be limited to the footprint of the project and immediate surrounds. | | | | |
| Impact scale | The impact is considered as small (**local**) scale. | | | | |
| Frequency | Continuous | | | | |
| Likelihood | Possible | | | | |
| Impact magnitude | Positive | Negligible | Small | Medium | Large |
| | Based on the above the impact magnitude is considered small. | | | | |
| Resource / receptor sensitivity | Low | Medium | High | | |
| | The sensitivity of the rivers along the proposed sewer lines to loss of biodiversity is considered to be medium to low. | | | | |
| Impact significance | Negligible | Minor | Moderate | Major | |
| | Considering the impact magnitude is small and the sensitivity is medium to low, the overall significance is considered to be minor | | | | |

#### d) Mitigation

The following mitigation measures will be implemented to minimize the potential for loss of vegetation cover:

- Compensatory planting of trees i.e. plants at least twice the number of trees, about 900 in total either on farmers land or in public land within the project area.
- The local community should be given a chance to harvest the targeted vegetation if they so wish.
- Areas to be cleared shall be identified and demarcated before hand
- Avoidance of impacts should be prioritised, however, if not possible then compulsory planting of trees that will be cut by the contractor during construction of works should be done
- Clearing of vegetation will be carried out during construction of works if deemed necessary
- Staged vegetation clearance is also recommended so as not to clear the entire corridor all at once.
- The use of existing cleared or disturbed areas for the Contractor's Camp, stockpiling of materials etc. shall be encouraged.
- Whenever possible, all damaged areas shall be reinstated and rehabilitated upon completion of the contract to as near pre-construction conditions as possible.
- Reinstatement of temporary construction sites and pioneer camps (if needed) should be done as swiftly as possible and always with suitable native grasses and other plants

#### e) Residual Impact

The impact significance is **minor** after mitigation measures during construction and **negligible** post-mitigation for operations. Residual Impact Significance is presented in **Table 8-7** below.

**Table 8-7: Residual Impact Significance**

| Impact | Project Phase | Significance (Pre-mitigation) | Residual Impact Significance (Post-mitigation) |
|---|---|---|---|
| Disturbance to vegetation cover | Construction | Minor | Negligible |

### 8.3.4 Air Quality Impacts

#### a) Impact Assessment

#### i) Exhaust Emissions

The numbers of Heavy Duty Vehicles (HDV) and Light Duty Vehicles (LDVs) are expected to be well below the thresholds for potentially significant impacts. On this basis, the magnitude of impacts associated with road traffic exhaust emissions are predicted to be Negligible. Combined with the Medium and Low receptor sensitivities identified, the overall significance of impacts is **Negligible** at all locations.

### ii) Dust and PM10

There is potential of impacts to arise from construction related plant and equipment traffic on unpaved roads, excavation works and general construction activities. The Project will generate traffic on unpaved roads close to dwellings within the Project Area. As this is expected to be less than five HDVs/day, and at some locations for more than four weeks, the magnitude is **medium**.

The Project will involve excavation and backfilling in trenches and in the Wastewater Stabilization Ponds. These works will include stripping of vegetation, construction of access roads and the route haul tracks and the construction of contractor's camp. Due to the scale of these activities, the Magnitude is **medium**.

Combined with the Medium and Low receptor sensitivities identified, the significance of unmitigated impacts include:

- Traffic on unpaved roads are **Medium** where there are receptors within 50m of unpaved roads used by construction plant and equipment traffic, or the haul routes
- Trench excavations are **Medium** where there are receptors within 50 m of locations where excavations is being carried out.

On this basis there is a need for mitigation to be implemented to reduce dust emissions/ impacts as presented in Pre- Mitigation Impact Assessment in **Table 8-8.**

**Table 8-8: Pre-Mitigation Impact Assessment**

| **Impact** | **Degradation of the Air-shed during Construction** | | | | |
|---|---|---|---|---|---|
| Nature of Impact | Negative | | Positive | | Neutral |
| | Increase in airborne pollution from construction activities | | | | |
| Type of Impact | Direct | | Indirect | | Induced |
| | Impact is as a result of direct interaction between Project activities such as traffic on unpaved roads and earthworks and the environment near construction sites. | | | | |
| Duration of Impact | Temporal | Short term | | Long term | Permanent |
| | The impact is expected to be temporary as emissions arise during working hours | | | | |
| Impact Extent | Local | | Regional | | International |
| | The impact will be limited to the footprint of the project and immediate surroundings. | | | | |
| Impact scale | The impact is considered as small (local) scale. | | | | |
| Frequency | Intermittent – impacts will typically only arise during working hours | | | | |
| Likelihood | Inevitable | | | | |
| Impact magnitude | Positive | Negligible | Small | Medium | Large |
| | Based on the above the impact magnitude is considered **medium**. | | | | |
| Resource / receptor sensitivity | Low | | Medium | | High |
| | The sensitivity of human receptors is **Medium** in dwellings | | | | |
| Impact significance | Negligible | Minor | | Moderate | Major |
| | Dust emissions have the potentially to have **Moderate** significant impacts at nearby sensitive human receptors. | | | | |

### b) Mitigation

#### i) Exhaust Emissions

No mitigation is required. It is assumed that the project will only use vehicles that are efficiently/effectively operated and maintained as per the manufacturer specifications.

#### ii) Dust and PM10

The impact assessment identified Major impacts associated with earthworks and plant and equipment traffic on unpaved roads. The following mitigation are therefore recommended to manage these impacts. Mitigation measures should be implemented in locations where there are receptors within the relevant distance.

As general measures for all locations:

- Developing a Dust Management Plan (DMP)
- Recording all dust and air quality complaints, identifying cause(s), taking appropriate measures
- Liaising with local communities to forewarn of potentially dusty activities
- Close monitoring of dusty activities, noting that this may be daily visual inspections, or passive/active monitoring as parameter
- Performing regular inspections to ensure compliance with the Dust Management Plan
- Planning potentially dusty activities so that these are located as far from receptors as feasible
- Erecting solid screens if feasible around stockpiles and concrete batching
- Avoiding run off of mud and water and maintaining drains in a clean state
- Removing dusty materials from construction sites as soon as possible if not being re-used. re-used materials should be covered or vegetated if possible
- Imposing speed limits on haul routes and in construction compounds to reduce dust generation
- Minimizing drop heights when loading stockpiles or transferring materials
- Avoiding disposal of waste by burning

For traffic on unpaved roads:

- Watering shall be done to attenuate dust near sensitive receptors. The duration and frequency shall be set out in the Dust Management Plan and will consider water availability and any stakeholder grievances

For earthworks:

- Revegetation of exposed areas if feasible
- Revegetation or covering stockpiles if feasible
- Exposure of the minimum area required for the works, undertaken on a staged basis to minimise dust blow

**c) Residual Impact**

The residual impacts associated with road traffic exhaust emissions are **Negligible.**

With the implementation of suitable mitigation measures and with adequate monitoring, residual impacts associated with dust and $PM_{10}$ from construction activities are **Moderate** as presented in **Table 8-9**.

**Table 8-9: Residual Impact Significance**

| Impact | Project Phase | Significance (Pre-mitigation) | Residual Impact Significance (Post-mitigation) |
|---|---|---|---|
| Road Traffic Exhaust Emissions | Construction | Negligible | Negligible |
| Dust and PM from construction activities | Construction | Moderate | Negligible |

### 8.3.5 Noise and Vibration

**a) Potential Impact**

Potential noise impacts may arise as a result of the construction activities mainly from Plant and Equipment. At the wastewater treatment plants, vibratory compaction is expected in works execution.

**b) Baseline Conditions**

The households ambient noise along the proposed works is influenced by human activities, animals (such as birds) and weather (wind, rain).

The noise baseline survey carried out concluded that daytime noise levels (LAeq) were generally low and in the range 35dB to 41dB. World Bank Group General EHS Guidelines on acceptable noise levels based on WHO standards are as shown in **Table 8-10**.

**Table 8-10: World Bank Group Noise Level Guidelines**

| | Maximum Allowable Ambient Noise Levels, LAeq,1hr, dBA Free field | |
|---|---|---|
| | Daytime | Night-time |
| | 07:00 – 22:00 | 22:00 – 07:00 |
| Residential, Institutional and Educational | 55 | 45 |
| Industrial and Commercial | 70 | 70 |

The stipulated maximum permissible noise levels for construction sites by the National Environment Management Authority (NEMA) (Measurement taken within the facility) are shown in **Table 8-11** on **Page 8-15.**

**Table 8-11. NEMA Noise Level Guidelines**

| Site | Day | Night |
|---|---|---|
| Health facilities, educational institutions, homes for disabled | 60dBA | 35dBA |
| Residential | 60dBA | 35dBA |
| Other areas | 75dBA | 65dBA |

There is need for pre-mitigation of noise and vibrations though not significant as provided in **Table 8-12.**

**Table 8-12: Pre-Mitigation Impact Assessment**

| Impact | Noise during Construction | | | | |
|---|---|---|---|---|---|
| Nature of Impact | Negative | Positive | Neutral | | |
| | Elevated noise levels and vibrations from operation of construction equipment. | | | | |
| Type of Impact | Direct | Indirect | Induced | | |
| | Impact is as a result of noise and vibrations generated by construction activities. | | | | |
| Duration of Impact | Temporal | Short term | Long term | Permanent | |
| | Impacts are expected to be short term (up to one month) along individual sewer alignments within each of the target settlement and WWTP construction site | | | | |
| Impact Extent | Local | Regional | International | | |
| | The impact will be limited to the footprint of the project and immediate surroundings. | | | | |
| Impact scale | The impact is considered as small (local) scale. | | | | |
| Frequency | Impacts may occur during daytime periods over a short-term duration | | | | |
| Likelihood | Inevitable | | | | |
| Impact magnitude | Positive | Negligible | Small | Medium | Large |
| | Based on the above the impact magnitude is considered negligible to small. | | | | |
| Resource / receptor sensitivity | Low | Medium | High | | |
| | Dwellings are considered to have a high sensitivity to noise | | | | |
| Impact significance | Negligible | Minor | Moderate | Major | |
| | Considering the impact magnitude is small to negligible and the sensitivity is high, the overall significance is considered to be minor | | | | |

### c) Mitigation

The following base case assessment Mitigation measures are assumed to result in a 5dB (A) reduction in the overall noise from construction plant teams.

- Siting noisy plant and equipment as far away as possible from human settlement, and use of barriers (e.g. site huts, acoustic sheds or partitions) to reduce the level of construction noise wherever practicable
- Where practicable noisy equipment will be orientated to face away from the nearest Human settlement and other receptors
- Works expected to generate significant noise will be executed during the day
- Alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electric-controlled units, will be used, where practical
- Where practical, stationary equipment will be located in an acoustically treated enclosure
- For machines with fitted enclosures, doors and door seals will be checked to

ensure they are in good working order and that the doors close properly against the seals
- Throttle settings of plant and equipment will be minimized or turned off when not in use
- Equipment will be regularly inspected and maintained to ensure there are in good working condition. Additionally, mufflers, fittings and silencers will be routinely checked as recommended by the manufacturers.

**d) Residual Impact**

Standard mitigation measures listed above have been assumed for the base case noise assessment. The impact magnitude predicted is **small** with **minor** significance and therefore no further mitigation is required. Consequently, the residual impacts are the same as those presented above and as presented in **Table 8-13**.

**Table 8-13: Residual Impact Significance**

| Impact | Project Phase | Significance (Pre-mitigation) | Residual Impact Significance (Post-mitigation) |
|---|---|---|---|
| Noise from construction activities affecting nearby dwellings | Construction | Minor | Negligible |

### 8.3.6 Community Health Safety and Security

**a) Potential Impact**

The project could affect the health, safety and wellbeing of the communities during construction phases due to the following:

- Increased project-related traffic
- Air pollution from construction related activities
- Noise pollution
- Improper handling and disposal of waste
- Accidental oil spills and leaks
- Presence of the project workforce in the community

**b) Baseline Conditions**

Social receptors within 10m from the proposed sewer alignments and WWTP Sites were identified and mapped as presented in **Table 8-14.** The receptors are at risk due to Project activities, such as accident associated with plant and equipment movement, open un-barricaded trenches or open trenches etc.Pre mitigation Impact Assessment is presented in **Table 8-15** on **Page 8-17.**

**Table 8-14: Receptors Likely to be Impacted by Health and Safety Risks**

| Institution | Location | Drainage Area |
|---|---|---|
| Showground Primary & ECD Centre | Kitale Town next to Showground | 1 |
| Weaver Bird High School | Kibomet | 1 |
| Manor House | Kitale Town next to Showground | 1 |
| Green Field | Kitale Town next to Showground | 1 |

| Institution | Location | Drainage Area |
|---|---|---|
| Trans Nzoia Primary | Kitale CBD | 1 |
| Milimani Primary School | Milimani | 1 |
| St Theresa Boys | Bikeke Centre – Kitale – Eldoret Highway | 2 |
| St Theresa Boys | Bikeke Centre – Kitale – Eldoret Highway | 2 |
| Bikeke Primary School | Bikeke Centre – Kitale – Eldoret Highway | 2 |
| Lumuli Primary School | Lumuli centre located along Kitale – Eldoret Highway | 2 |
| Hill School Primary | Alakara - Kitale – Eldoret Highway | 2 |
| Namgoi Primary School | Namgoi Kitale – Eldoret Highway | 2 |
| St Michael Secondary School | Kwa Muthoni | 2 |
| St Joseph's Boys | Wamwini – Kitale Webuye Road | 2 |
| St Joseph's Boys | Wamwini – Kitale Webuye Road | 2 |
| Sirende Primary School | Sirende - Kitale – Eldoret Highway | 2 |
| Top Station Primary Schools | Kwa Muthoni | 2 |
| GK Prison | Kitale CBD | 3 |
| KCC | Kibomet | 1 |
| Public Health Department | CBD | 3 |
| Kitale County Hospital | Kitale CBD | 3 |
| Mt. Elgon Hospital | Kitale CBD | 3 |
| Bidii Health Centre | Bidii | 1 |
| Crystal Hospital | Milimani | 1 |
| St. Anne Hospital | Milimani | 1 |
| Galilee Hospital | Milimani | 1 |

## Table 8-15: Pre-Mitigation Impact Assessment

| **Impact** | **Community Safety and Environment Health** | | | | |
|---|---|---|---|---|---|
| Nature of Impact | Negative | Positive | Neutral | | |
| | Project activities interaction with community | | | | |
| Type of Impact | Direct | Indirect | Induced | | |
| | Impact that result from a direct interaction between the Project (i.e. increased plant and equipment traffic) and the local population along the sewer lines and at WWTPs. | | | | |
| Duration of Impact | Temporal | Short term | Long term | Permanent | |
| | The increased traffic effect and risks to injuries is temporary as construction activities will take place in a sequential manner during the length of the construction period | | | | |
| Impact Extent | Local | Regional | International | | |
| | The impact will be limited to the footprint of the project and immediate surrounds. | | | | |
| Impact scale | The impact is considered as small (local) scale. | | | | |
| Frequency | Frequency is occasional or one time at each construction site over the duration of the Construction Phase. | | | | |
| Likelihood | Inevitable | | | | |
| Impact magnitude | Positive | Negligible | Small | Medium | Large |
| | Based on the above the impact magnitude is considered negligible to small. | | | | |
| Resource / receptor sensitivity | Low | Medium | High | | |
| | The sensitivity of the receptors (local population near construction sites and road users including vehicle users, pedestrians and cyclists) is considered medium. | | | | |
| Impact significance | Negligible | Minor | Moderate | Major | |
| | Considering the magnitude and sensitivity are medium, the impact on the community safety during construction activities is moderate | | | | |

**c) Mitigation**

Contractor will develop and monitor implementation of a Community Health and Safety Management Plan (C-HSMP). The plan will include the following;

- An *Emergency Response Plans (ERPs)* in cooperation with local emergency authorities and hospitals.
- *Worker Code of Conduct* including guidelines on worker –community interactions and will provide training on the worker code of conduct to all employees including contractors and subcontractors and truck drivers as part of the induction process.
- Provide a *Community Grievance Mechanism*.
- *Traffic Management Plan* covering aspects such as vehicle safety, driver and passenger behaviour, use of drugs and alcohol, operating hours, rest periods, community education on traffic safety and accident reporting and investigations.
- Specific Construction Environment and Social Management Plan (C-ESMP) which included among others; *Health, Hygiene and Safety Plan, Labour Management Plan and Gender-based Violence Action Plan*

The Contractor will provide primary health care and first aid at construction camp sites to avoid pressure on local healthcare infrastructures.

**d) Residual Impact**

The significance of the residual impacts on community health and safety after the implementation of mitigation measures is presented in **Table 8-16** below.

**Table 8-16: Residual Impact Significance**

| Impact | Significance (Pre-mitigation) | Residual Impact Significance (Post-mitigation) |
|---|---|---|
| Community Safety (Road Accidents, Site Trespass, | Moderate | Minor |
| Environmental Health (Noise and Air) | Moderate | Minor |
| Interaction with Project Workforce | Moderate | Minor |

### 8.3.7 Worker Health and Safety and Workers Management

**a) Potential Impacts**

Workers' rights including occupational health and safety need to be considered to avoid accidents and injuries, loss of man-hours, labour abuses and to ensure fair treatment, remuneration and working conditions.

The Project could potentially lead to workforce-related social and health issues throughout the life cycle of the Project if worker management and rights do not meet Kenyan law or international best practice.

**Table 8-17** on **Page 8-19** presents the potentially significant impacts associated with occupational health and safety and worker management during the construction and

operation phases. The potential for occupational health and safety incidents throughout the life cycle of the project is higher during construction phase.

**Table 8-17: Potential Impacts Health and Safety of Workers**

| Construction Phase | Operation Phase |
|---|---|
| Impacts on workers' health and safety, from road accidents, slip, trip and falls during trench excavations and inconsistent use of PPEs. | Impacts on workers' health and safety during operation and maintenance sewers and from occupational hazards such as contamination and the exposure to harmful gases such as methane and hydrogen sulphide. |
| Impacts on workers' rights from violations of labour laws in respect to enforcement of health and safety measures by the employer such as the use of appropriate PPEs | Impacts on worker's rights from lack of enforcement of health and safety measures by the employer such as the use of appropriate PPEs during maintenance of the sewer lines. |

### b) Baseline Conditions

Kitale municipality has adequate number of health institutions that can provide medical services to workers in the event of emergency on site. The main government hospitals are Kitale County Hospital and Mt. Elgon Hospital.

### c) Impact Assessment

#### i) Worker's Health and Safety and Labour Rights

Typical activities for the proposed construction works include clearance of the Right of Way (RoW) in vegetated areas, earthworks, pipe laying, installation of pipe and other ancillaries.

Considering that construction is identified as one of the sectors of employment (formal and informal), the locally hired workforce may have some experience in traditional/basic construction activities. However, work practices and consideration for health and safety may fall short of international standards and best practice, such as the inadequate use of Personal Protective Equipment (PPE), which increases the severity of hazards to which the workforce are exposed.

Equipment and worker transport along the access roads to various construction sites may also result in road accidents in the absence of a proper traffic management plan or if traffic safety rules are not enforced. The poor conditions of the existing roads may also increase the risk of accidents. Pre mitigation Impact Assessment is presented in **Table 8-18** on **Page 8-20**.

**Table 8-18: Pre-Mitigation Impact Assessment**

| **Impact** | **Workers Health and Safety and Rights during Construction** | | | |
|---|---|---|---|---|
| Nature of Impact | Negative | Positive | Neutral | |
| | Poor planning, non-compliance with health and safety best practice and labour rights can result in injuries or fatalities | | | |
| Type of Impact | Direct | Indirect | Induced | |
| | Impact that result from a direct interaction between the Project activities which include clearance of the RoW in vegetated areas, earthworks, pipe laying, installation of pipe and other ancillaries | | | |
| Duration of Impact | Temporal | Short term | Long term | Permanent |
| | Injuries and fatalities could have permanent impacts on workers and their families. | | | |
| Impact Extent | Local | Regional | International | |
| | The workforce will be primarily contracted from within the Project Area | | | |
| Impact scale | As mentioned above the workers will be working in various construction sites simultaneously. The impact scale is therefore medium. | | | |
| Frequency | The frequency is minimal as the workforce and drivers are expected to be trained and the employer is expected to enforce the use of PPEs and health and safety measures. | | | |
| Likelihood | Inevitable | | | |
| Impact magnitude | Positive | Negligible | Small | Medium | Large |
| | Based on the parameters above, and considering the embedded measures in place the magnitude is medium | | | |
| Resource / receptor sensitivity | Low | Medium | High | |
| | The sensitivity of the receptors (workforce) is considered medium as some workers may not be aware of their rights. | | | |
| Impact significance | Negligible | Minor | Moderate | Major |
| | Since the magnitude is considered medium and sensitivity is medium, the impact on workers' health and safety during construction activities is of moderate significance | | | |

### ii) Mitigation Measures

The following mitigation measures will be implemented during the construction phase to reduce any impacts on workers' health and safety and labour rights.

- Contractor will develop a Human Resources Policy, which will outline worker rights to be included in all contracts including restrictions on working hours in line with applicable International Labour Organization (ILO) standards, compensation including consideration of overtime, holidays etc. Contractor will require its contractors and subcontractors to put in place policies in line with national legislation and applicable International Legislation and contractor Code of Conduct and Policies.
- Contractor will prohibit the use of alcohol or drugs, which could adversely affect the ability the employee to perform the work safely or adversely affect the health and safety of other employees, community members or the environment.
- Contractor and self-employed contractors will assess the Health and Safety risks related with the tasks to be performed during the construction phase.
- Pre-employment medical assessments will be put in place as a workforce risk management tool to screen individuals for risk factors that may limit their ability to perform a job safely and effectively. Expected benefits of conducting a pre-employment medical assessments include a safer working environment,

reduction in workplace injuries, minimised downtime, matching the capacity of the employee with the role, and overall recruitment cost and risk reduction.

- Contractor will ensure that training on health and safety measures is provided to all construction workers prior to starting to work on the Project and that supervisors have adequate experience to deliver on their responsibilities.
- Contractor will implement regular health and safety checks and audits of workers, contractors and subcontractors and implementing sanctions in case of breaches of national standards and the Project's specific standards. Such audits to include workplace Health and Safety; worker contracts, working hours, pay and conditions; housing and food standards.
- Contractor will establish a procedure for the recording and analysis of incidents and lessons learned such that additional actions can be implemented to avoid or minimize occupational health and safety risks.
- Contractor will ensure that facilities and work sites are designed and maintained such that robust barriers are in place to prevent accidents.
- Contractor will ensure that its Code of Conduct is followed to regulate the performance and behaviour of all workers, including provision for disciplinary action for anti-social behaviour and non-compliance with health and safety regulations such as lack of use of PPE.
- Contractor will ensure that adequate clean water, adequate food and access to medical care is provided to all workers on the worksite and at accommodation.
- Contractor will develop and implement a *Traffic Management Plan* covering aspects such as vehicle safety, driver and passenger behaviour, use of drugs and alcohol, operating hours, rest periods, community education on traffic safety and accident reporting and investigations.
- Contractor will develop a *Waste Management Plan* for the construction phase with clear guidelines for the safe storage and disposal of hazardous waste and handling of hazardous materials.

#### d) Residual Impacts

With the implementation of mitigation measures the remaining impact significance is considered minor significance. Residual Impact Significance is presented in **Table 8-19**.

**Table 8-19: Residual Impact Significance**

| Impact | Significance (Pre-mitigation) | Residual Impact Significance (Post-mitigation) |
|---|---|---|
| Worker health and safety and labour rights | Moderate | Minor |
| Worker health and safety and labour rights | Moderate | Minor |

### 8.3.8 Land Acquisition and Resettlement

The proposed sewers are designed to be laid within existing road reserves and wayleaves owned by the relevant Road Authorities i.e. Kenya Urban Roads Authority (KURA), Kenya Rural Roads Authority (KeRRA) or Kenya National Highways Authority (KeNHA) including

Trans Nzoia County Government. Trunk sewers will also be laid along river riparian under custody of Water Resources Authority (WRA).

From RAP report, the Project will physically and economically impact 248 PAPs in both Rafiki Sewerage System (Lot 1) and Sirende Sewerage System (Lot 2) Projects. Rafiki Sewerage System Project will physically and economically impact 100 PAPs comprising of 28 female PAPs and 72 male PAPs in Matisi Location.1 PAP in Grassland (Rafiki) will transfer 119 acres required for establishment of Waste Water Treatment Plant (WWTP) while 28 PAPs will transfer a cumulative of 5.09 acres as easement for the sewers.

Sirende Sewerage System Project will physically and economically impact 148 PAPs comprising of 30 female PAPs and 118 male PAPs in Bidii, Milimani, Naisambu and Sirende Locations. 1 PAP in Sirende (Eldoret Express Bus Company Limited) will transfer 173acres required for establishment of Waste Water Treatment Plant (WWTP) while 103 PAPs will transfer a cumulative of 20.96 acres as easement for the sewers

**a) Land Requirement at New Sirende Site**

The site is located at the banks of Koitobos River East of Sirende Centre in Drainage Area 1 which is sparsely populated. The proposed site is located in a private agricultural land which must be acquired for construction of Wastewater Stabilization Ponds (approx. 70 Ha) for treatment of the projected wastewater flow of 5,600 $m^3$/d for medium term (2035) and 8,400 $m^3$/d for long term (2045)

**b) Land Requirement at New Rafiki Site**

The site is located at the banks of Katalele River at its confluence with Kukureze River. The site is located within Drainage Area 3 in a sparsely populated area at the proposed Municipality Boundary.

All the wastewater from Drainage Area 3 can gravitate to the proposed site. It is designated as public land in the proposed Land Use Plan and has an area of approximately 48 ha. However, the County Government has not yet acquired the land. The land requires acquisition for construction of wastewater stabilization ponds (approx. 40 Ha is required).

Resettlement Action Plan (RAP) that identifies and provides mitigation impacts Project impacts with regards to land acquisition and disruption of people crops, trees and structures has been prepared.

## Table 8-20: Summary of Environment and Social Impacts Severity

| Environmental / Social Variable and Receptors | Project Activities / Impacts | Impact Type | Severity Rating | |
|---|---|---|---|---|
| | | | Before Mitigation | After Mitigation |
| Impact on Water Resources (Koitobos and Katalele rivers and associated streams) | • Earthworks such as excavation and backfilling could result to loosening of soils that are eventually washed down through storm water channels into rivers, this ultimately results to increased sedimentation of the rivers.<br>• Water from rivers will be abstracted for Project activities such as dust control and cement batching.<br>• Un-serviced plant and equipment on site could result to oil spills and fuels leaks that contaminate water resources affecting ultimately affecting aquatic organism<br>• At operation stage, there might be direct interaction of water resources and raw sewerage from blocked overflowing un-maintained manholes | Direct | Minor | Negligible |
| Impact on Vegetation Cover | • Minimal interference with vegetation within proposed sewer wayleaves including isolated marshlands and protected man-made Lessos forest<br>• Potential interference with privately owned Kitale Nature reserve located within Koitobos drainages basin at Kapenguria road river crossing | Direct | Minor | Negligible |
| Impacts on Soil Resources | • Project activities will interfere with the soil structure exposing the soils to agents of erosion such as wind and water. If not properly restored or managed, such soils may erode and wash into nearby surface water bodies.<br>• Soil contamination as a result of oil spills and fuel leaks from un-serviced plant and equipment on site | Direct | Minor | Negligible |
| Impact on Air Quality | Project activities that have potential to impact air quality include, emissions of air pollutants from temporary diesel generators, construction equipment, and vehicles and dust generated from construction activities and traffic movement<br><br>The following would be expected during construction.<br>• Emissions of oxides of nitrogen ($NO_2$ in particular) mainly from construction-related vehicles (and to a lesser degree from construction generators and other hydrocarbon powered equipment)<br>• Dust and particulate matter (as $PM_{10}$) created by construction-related vehicle traffic on unpaved roads and construction activities<br><br>Once the proposed works are built and operational and all construction sites reinstated, no significant effects on air quality will be anticipated. | Direct | Moderate | Negligible |
| Noise and Vibration Impacts | Potential noise impacts may arise as a result of the construction activities associated with the construction of the sewer lines.<br><br>Construction activities and equipment are not expected to result in significant levels of vibration. Equipment that might high levels of vibration (such as impact piling or vibratory compaction) will not be used | Direct | Minor | Negligible |

| Environmental / Social Variable and Receptors | Project Activities / Impacts | Impact Type | Severity Rating | |
|---|---|---|---|---|
| | | | Before Mitigation | After Mitigation |
| Impacts on Flora and Vegetation Cover | According to data from the survey carried out during the assessment, the vegetation cover within all the settlement has been largely modified to give room for anthropogenic activities. There are not protected vegetation cover within the settlement that is considered a fragile ecosystem, sensitive to changes to its components. However, stripping of vegetation cover will be on isolated cases only limited to exotic species of trees and boundary hedges. | Direct | Minor | Negligible |
| Community Health and Safety | The presence of the Project could affect the health, safety and wellbeing of the communities living within the Project Area. Increased project-related traffic, civil works for site preparation including site clearance and excavation work for sewer pipes, change to the environment due to increased noise, decreased air quality, inappropriate waste handling or disposal, and accidental leaks and spills, and the presence of the Project workforce all present potential hazards for the health and safety of local communities | Direct | Moderate | Minor |
| Workers Health and Safety | Workers' rights including occupational health and safety need to be considered to avoid accidents and injuries, loss of man-hours, labour abuses and to ensure fair treatment, remuneration and working conditions. These issues should be considered not only for those who are directly employed on the Project. The Project could potentially lead to workforce-related social and health issues throughout the life cycle of the Project if worker management and rights do not meet Kenyan law or international best practice. | Direct | Moderate | Minor |
| Land Acquisition and Resettlement Impacts | The proposed sewer lines are designed to be laid within existing road reserves and wayleaves owned by the relevant Road Authorities i.e. Kenya Urban Roads Authority (KURA), Kenya Rural Roads Authority (KeRRA) or Kenya National Highways Authority (KeNHA) including Trans Nzoia County Government.<br><br>In addition, the trunk sewers will be laid along river riparian under custody of Water Resources Authority (WRA).<br><br>From RAP report, the Project will physically and economically impact 248 PAPs in both Rafiki Sewerage System (Lot 1) and Sirende Sewerage System (Lot 2) Projects. Rafiki Sewerage System Project will physically and economically impact 100 PAPs comprising of 28 female PAPs and 72 male PAPs in Matisi Location.1 PAP in Grassland (Rafiki) will transfer 119 acres required for establishment of Waste Water Treatment Plant (WWTP) while 28 PAPs will transfer a cumulative of 5.09 acres as easement for the sewers.<br><br>Sirende Sewerage System Project will physically and economically impact 148 PAPs comprising of 30 female PAPs and 118 male PAPs in Bidii, Milimani, Naisambu and Sirende Locations. 1 PAP in Sirende (Eldoret Express Bus Company Limited) will transfer 173acres required for establishment of Waste Water Treatment Plant (WWTP) while 103 PAPs will transfer a cumulative of 20.96 acres as easement for the sewers | Direct | Moderate | Minor |

## 8.4 Negative Impacts during Operation Phase

Environment and social Impacts during operation phase of the proposed Kitale Sewerage Project is presented in **sub sections below**

### 8.4.1 Water Pollution by Raw Sewerage

The main rivers at a risk of pollution are katalele and Koitobos that drain Kitale town to the East and West. Poorly maintained and designed sewers can lead to spillage of raw sewage particularly at manholes and burst areas into the environment which eventually seeps in water sources. These can cause outbreaks of water borne related diseases like cholera and typhoid.

**Mitigation Measures**

- NZOWASCO will ensure proper and periodic maintenance of sewers and treatment plants
- NZOWASCO will activate a community watch group for information sharing on the status of the sewers
- Regular cleaning of grit chambers and sewers to remove grease, grit, and other debris that may lead to sewer backups
- Development of an inventory of system components, with information including age, construction materials, and drainage areas served
- 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 sewer 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
- Regular inspection of the system to ensure performance is maintained at high levels
- Blockages should be detected and promptly replaced
- Regular monitoring and sampling of the wastewater at influent and effluent points as well as in the receiving water bodies
- Communities living within the river basins where the trunk sewers will be constructed should be enlightened on dangers of using raw sewerage to irrigate farmlands.

### 8.4.2 Odour Menace

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 solid handling facilities as well as the sludge drying beds. The most frequently reported symptoms attributed to odours from treatment plants include headache, nausea, hoarseness, cough, nasal congestion, palpitations shortness of breath, stress, drowsiness, alterations in mood, and eye, nose, and throat irritation. Hydrogen Sulphide ($H_2S$) is the most prevalent gas associated with domestic wastewater collection and treatment.

The conditions leading to Hydrogen Sulphide formation usually favour the production of other odorous gases such as ammonia which may have considerably higher undetectable 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.

**Mitigation to odour menace from WWTP**

- NZOWASCO will ensure appropriate covering/ventilation of the pre-treatment unit
- NZOWASCO will ensure appropriate handling and removal of grit/grease
- NZOWASCO will ensure scum is appropriately disposed off or properly stabilized
- NZOWASCO will 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
- Repairing dilapidated roofs of the sludge drying beds to ensure quick drying of sludge and appropriate disposal to reduce odour emanating from wet sludge.

### 8.4.3 Risks Associated with Sludge from the WWTP

Wastewater Treatment Plants often require sludge removal overtime in order to guarantee efficient operation of the plant. However, if sludge is not management properly it can pose significant health hazards to workers, community and water quality from the de-sludging exercise.

Also, if sludge on site is not properly managed, it leads to significant land and soil contamination at the disposal site and eventually pollution water resources when leachate from the sludge flows into water resources. Therefore, mitigation measures for sludge associated risks are presented below.

**Mitigation Measures**

- NZOWASCO will dry sludge on the drying beds before disposing it off
- Dried sludge could be used to make briquettes as a charcoal substitute or be sold to farmers as fertilizers
- Excess sludge can be disposed in a designated landfill which shall only be for disposing dry odorless sludge.
- Preparation and enforcement of operational guidelines for sludge management by Trans-Nzoia County Government

### 8.4.4 Solid Wastes Impacts at WWTP Screens

Wastewater trunk and secondary sewers are often used illegally as dumping sites at open manholes. Therefore, solid wastes which include plastic bottles, wood, cloths and debris are often screened and disposed off at screening chambers at inlet works of the Wastewater Treatment Plant (WWTP).

Such solid wastes should be properly handled and disposed off appropriately as

provided by the waste Management Regulations of (2006). This ESIA provides measures that will be enforced by Water and Sanitation Company (NZOWASCO) during Project operation.

**Mitigation Measures**

- NZOWASCO will develop a comprehensive Waste Management Plan (WMP) for management of solid wastes from screen chambers
- NZOWASCO will employ personnel who will be in charge of maintaining hygiene and cleanliness of the WWTP including removal of solid wastes from screen chambers
- Properly labelled and strategically placed waste disposal containers shall be provided at all places within the WWTP
- Solid wastes once removed from screens shall be collected and disposed appropriately as required by waste Management Regulations of (2006) and Trans Nzoia County Government by laws.

### 8.4.5 Invasion the WWTP by Birds and Reptiles.

There is a possibility of birds' attraction to the sewage treatment plants arising from proliferation of insects and aquatic flora suitable as birds' food. Certain species and population of birds at Wastewater treatment plant could become a safety risk to aviation sector; however, no flight corridor was identified within the vicinity. Certain animals including crocodiles and hippos 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 wastewater 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 river waters to support life (low oxygen levels and toxic conditions).

**Mitigation Measures**

- The wastewater treatment plants should be protected from wildlife encroachments by providing secure barriers to keep off the animals from interfering with the plant operations and safety
- In the event of larger wildlife e.g. hippos, NZOWASCO will ensure appropriate consultations with the Kenya Wildlife Services (KWS) on appropriate management actions.
- The quality of the effluent discharged into the river will be an important parameter on the regional control of the river eutrophication that attracts insects that reptiles feed on

# CHAPTER 9: ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN (ESMMP)

## 9.1 Purpose and Objectives of ESMMP

The specific objectives of the ESMMP are to:

- Serve as a commitment and reference for the Contractor to implement the ESMMP including conditions of approval from NEMA
- Serve as a guiding document for the environmental and social monitoring activities for the supervising consultant, contractor and the client management including requisite progress reports
- Provide detailed specifications for the management and mitigation of activities that have the potential to impact negatively on the environment.
- Provide instructions to relevant Project personnel regarding procedures for protecting the environment and minimizing environmental effects, thereby supporting the Project goal of minimal or zero incidents.
- Document environmental concerns and appropriate protection measures, while ensuring that corrective actions are completed in a timely manner.

## 9.2 Auditing of ESMMP

The Project Executing Agency and the Contractor shall conduct regular audits to the ESMMP to ensure that the system is operating effectively. The audit shall check that a procedure is in place to ensure that:

- The ESMMP being used is up to date
- Variations to the ESMMP, non-compliance and corrective action are documented
- Appropriate environmental training of personnel is undertaken
- Emergency procedures are in place and effectively communicated to personnel
- A register of major incidents (spills, injuries, complaints) is in place and other documentation related to the ESMMP.
- Ensure that appropriate corrective and preventive action is taken by the Contractor once instructions have been issued

## 9.3 Management Responsibility of ESMMP

In order to ensure the sound development and effective implementation of the ESMMP, it will be necessary to identify and define the responsibilities and authority of the various persons and Organizations that will be involved in the project. The following entities should be involved in the implementation of this ESMMP:

- Nzoia Water and Sewerage Company
- Contractor
- Design Consultant;
- County Government of Trans-Nzoia.

**Tables 9-1** to **9-4** on **Page 9-3 to 9-12** present the ESMMP for the proposed Kitale Sewerage Project during construction, operation and decommissioning phases respectively.

## 9.4 Grievance Redress Mechanism

The contractor will employ a Community Liaison Officer and or sociologist who will be responsible for collating written complaints and co-coordinating responses to all complaints. Both verbal and written complaints are to be entered into a Grievance Complaint Log as addressed

When receiving a complaint all employees shall refer the complainant to the Community Liaison Officer (CLO) or the resident engineer. The person receiving a complaint shall ensure that the Grievance Complaint Log is completed. The form shall then be forwarded to the Community Liaison Officer who will assign it a number. The Community Liaison Officer shall ensure that all actions are made to close out the complaint.

Information on proposed corrective action sent to complainant (if appropriate); the date the complaint was closed out; and Date response sent to complainant. All complaints shall be responded to in writing, though a verbal response will be provided as well if this is more appropriate in the circumstances (e.g., where the complainant cannot read). All complaints must be responded to within two weeks of being received, even if the response is just a summary of what is planned and when it is likely to be implemented. Further correspondence should be given once the complaint is closed out.

The CLO through the contractor will be responsible for providing CRVWWDA and LVNWWDA with a monthly report detailing the level of complaints and any outstanding issues to be addressed. Monthly reports will include analysis of the type of complaints, levels of complaints and action taken to reduce complaints. The CLO shall file all documentation related to complaints in a file in his office.

Detailed Grievance Redress Mechanism (GRM) is presented as **Appendix 3.**

**Table 9-1: Permits and Approval Compliance Management Monitoring Plan**

| Activity | Associated Impacts | Impact Levels | Management Actions | Target Areas & Responsibilities | Monitoring Indicator | Provisional Budget |
|---|---|---|---|---|---|---|
| **Permits and Licenses** | Delay in implementation of the Project due to objections and stop orders | Low | ▪ The Contractor shall ensure that all pertinent permits, certificates and licenses have been obtained prior to any activities commencing on site and are strictly enforced/ adhered to<br>▪ Obtain the license in **Department of Occupational Health and Safety Registration (DOSH).**<br>▪ Acquire Environment Licenses for camp sites, burrow pits, cement batching plants, quarries from **NEMA**<br>▪ Reach out to Water Resources Authority **(WRA)** for the necessary approvals<br>▪ Obtain Approval of Plans from **Trans Nzoia County Government Physical Planning Department** for any structures on site<br>▪ Acquire Permits from **Public Health Department (Trans Nzoia County)** of sanitation facilities installed on site<br>▪ The Contractor shall maintain a database of all pertinent permits and licenses required for the contract as a whole and for pertinent activities for the duration of the contract | All the Project components<br><br>Responsibility<br>CRVWWDA/LVNWWDA & Contractor | Approvals / permits issued | ~KShs.1M |
| | | | | | **Total** | **~KShs.1M** |

## Table 9-2: Environment Management and Social Management and Monitoring Plan

| Risk | Anticipated Impact | Mitigation | Responsibility | Monitoring parameter | Budget |
|---|---|---|---|---|---|
| Impacts on Water Resource | • Earthworks such as excavation and backfilling could result to loosening of soils that are eventually washed down through storm water channels and into receiving rivers, this ultimately results to increased sedimentation of the rivers.<br>• Water from rivers will be abstracted for Project activities such as dust control and cement batching.<br>• Un-serviced plant and equipment on site could result to oil spills and fuels leaks that contaminate water resources ultimately affecting aquatic organism<br>• At operation stage, there might be direct interaction of water resources and raw sewerage from blocked overflowing un-maintained manholes | • Discharge of Grey water or uncontrolled discharges from the site/working areas (including wash down areas) to adjacent rivers shall not be permitted<br>• Water containing pollutants such as cements, concrete, lime, chemicals and fuels shall be discharged into a conservancy tank for planned removal from site<br>• Works that are likely to generate silt-laden runoff such excavations will be undertaken preferentially during the drier months of the year; December-March<br>• The drainage system will be developed to prevent silt-laden runoff from entering surface water drains and streams without treatment (e.g. earth bunds, silt fences, straw bales, or proprietary treatment) under any circumstances<br>• Where possible an 8m buffer strip of existing vegetation will be maintained along the affected rivers such as River Koitobos and River Katalele<br>• Earth stockpiles will be seeded as soon as possible, covered with geotextile mats or surrounded by a bund to minimise the risk of sediment-rich runoff<br>• Tools and plant will be cleaned in designated areas within the site where runoff can be isolated for treatment before discharge to the river<br>• Debris and other material will be prevented from entering watercourses; Construction sites (such as settlement lagoons or other temporary attenuation) to be used during construction if necessary; Diversion of minor watercourses will be carefully managed to prevent suspension of silt (or contamination by other pollutants)<br>• Discharge into watercourses and water bodies will only be carried out under consent of the relevant governing bodies such as WRMA | • Contractor<br>• Water Service Provider (WSP) | • State of storm water drainage channels within Kitale town adjacent to the sewer lines<br>• Quality of water flowing within rivers Katalele and Koitobos Rivers. | Preliminary Sum of Ksh 1 Million to be allowed for water pollution control |

| Risk | Anticipated Impact | Mitigation | Responsibility | Monitoring parameter | Budget |
|---|---|---|---|---|---|
| Impacts on Soil Resource | • The interaction will interfere with the soil structure exposing the soils to agents of erosion such as wind and water. If not properly restored or managed, such soils may erode and wash into nearby surface water bodies.<br>• Soil contamination as a result of oil spills and fuel leaks from un-serviced plant and equipment on site. | • Vegetation clearing and topsoil disturbance will be minimised where possible<br>• Contouring temporary and permanent access roads / laydown areas to minimise surface water runoff and erosion<br>• Sheet and rill erosion of soil shall be prevented where necessary through the use of sandbags, diversion berms, culverts, or other physical means<br>• Topsoil shall be stockpiled separately from subsoil. Stockpiles shall not exceed 2 m height, shall be located away from drainage lines, shall be protected from rain and wind erosion, and shall not be contaminated.<br>• Wherever possible construction work will take place during the dry season.<br>• Topsoil shall be evenly spread across the cleared areas when reinstated.<br>• Accelerated erosion from storm events during construction shall be minimised through managing storm water runoff (e.g. velocity control measures).<br>• Soil backfilled into excavations shall be replaced in the order of removal in order to preserve the soil profile.<br>• Mulch generated from indigenous cleared vegetation shall be spread across exposed soils after construction<br>• At construction stage, the contractor will prepare Specific Construction Environment and Social Management Plan (C-ESMP) which included among other; Soil and Sedimentation Control Plan, Spoil Management Control Plan and Waste Management Plan. | Contractor | • Status of soil resources within the project area<br>• State of storm water drainage channels within Kitale town adjacent to the proposed works<br>• Quality of water flowing within rivers Katalele and Koitobos Rivers. | Preliminary Sum of Ksh 1 Million to be allowed for soil erosion control |
| Impacts on vegetation cover | According to data from the survey carried out for the ESIA, the vegetation cover within all the drainage area has been largely modified to give room for anthropogenic activities. stripping of vegetation cover will be on isolated cases only limited to | • Compensatory planting of trees i.e. plants at least twice the number of trees, about 900 in total either on farmers' land or in public land within the project area.<br>• The local community should be given a chance to harvest the targeted vegetation if they so wish.<br>• Areas to be cleared shall be identified and demarcated before hand<br>• Avoidance of impacts should be prioritised, however, if | Contractor | • Status of sewer alignments with regards to vegetation cover.<br>• Number of trees replanted as compensatory trees | Preliminary Sum of Ksh 500,000 to allowed for procurement and planting of compensatory tree seedling |

| Risk | Anticipated Impact | Mitigation | Responsibility | Monitoring parameter | Budget |
|---|---|---|---|---|---|
| | exotic species of trees and food crops | not possible then compulsory planting of trees that will be cut by the contractor during construction of works should be done<br>• Clearing of vegetation will be carried out during construction of works if deemed necessary<br>• Staged vegetation clearance is also recommended so as not to clear the entire corridor all at once.<br>• The use of existing cleared or disturbed areas for the Contractor's Camp, stockpiling of materials etc. shall be encouraged.<br>• Whenever possible, all damaged areas shall be reinstated and rehabilitated upon completion of the contract to as near pre-construction conditions as possible<br>• Reinstatement of temporary construction sites and pioneer camps (if needed) should be done as swiftly as possible and always with suitable native grasses and other plants | | • Status of reinstatement of completed sites | |
| Impacts on Air Quality | • Emissions of oxides of nitrogen (NO2 in particular) mainly from construction-related vehicles (and to a lesser degree from construction generators and other hydrocarbon powered equipment); and<br>• Dust and particulate matter (as PM10) created by construction-related vehicle traffic on unpaved roads. | **As general measures for all locations:**<br>• Developing a Dust Management Plan (DMP)<br>• Recording all dust and air quality complaints, identifying cause(s), taking appropriate measures<br>• Liaising with local communities to forewarn of potentially dusty activities<br>• Close monitoring of dusty activities, noting that this may be daily visual inspections, or passive/active monitoring as parameter<br>• Performing regular inspections to ensure compliance with the Dust Management Plan<br>• Planning potentially dusty activities so that these are located as far from receptors as feasible<br>• Erecting solid screens if feasible around stockpiles and concrete batching<br>• Avoiding run off of mud and water and maintaining drains in a clean state<br>• Removing dusty materials from construction sites as soon as possible if not being re-used. re-used materials | Contractor | • Compliance level Dust Management Plan<br>• Services reports of plant and equipment<br>• Air quality monitoring report findings<br>• Number of complaints from community related to dust menace | Preliminary Sum of Ksh 1 Million to be allowed for air pollution control |

| Risk | Anticipated Impact | Mitigation | Responsibility | Monitoring parameter | Budget |
|---|---|---|---|---|---|
| | | should be covered or vegetated if possible<br>• Imposing speed limits on haul routes and in construction compounds to reduce dust generation<br>• Minimizing drop heights when loading stockpiles or transferring materials<br>• Avoid waste or vegetation burning.<br><br>**For traffic on unpaved roads:**<br>• Watering shall be done to attenuate dust near sensitive receptors. The duration and frequency shall be set out in the Dust Management Plan and will consider water availability and any stakeholder grievances<br><br>**For earthworks**<br>• Revegetation of exposed areas if feasible<br>• Revegetation or covering stockpiles if feasible<br>• Exposure of the minimum area required for the works, and undertake; and exposure on a staged basis to minimise dust blow. | | | |
| Noise and Vibrations Impacts | Potential noise impacts may arise as a result of the construction activities mainly from Plant and Equipment. At the wastewater treatment plants, vibratory compaction is expected in works execution. | • Siting noisy plant and equipment as far away as possible from human settlement, and use of barriers (e.g. site huts, acoustic sheds or partitions) to reduce the level of construction noise wherever practicable<br>• Where practicable noisy equipment will be orientated to face away from the nearest Human settlement and other receptors<br>• Works expected to generate significant noise will be executed during the day<br>• Alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electric-controlled units, will be used, where practical<br>• Where practical, stationary equipment will be located in an acoustically treated enclosure<br>• For machines with fitted enclosures, doors and door seals will be checked to ensure they are in good working order and that the doors close properly against the seals | Contractor | Serviced plant and equipment to manufacturers specification | Preliminary Sum of Ksh 1 Million to be allowed for noise and exercise vibration control |

| Risk | Anticipated Impact | Mitigation | Responsibility | Monitoring parameter | Budget |
|---|---|---|---|---|---|
| | | • Throttle settings of plant and equipment will be minimized or turned off when not in use<br>• Equipment will be regularly inspected and maintained to ensure it is in good working condition. Additionally, mufflers, fittings and silencers will be routinely checked as recommended by the manufacturers. | | | |
| Community Health Safety and Security Impacts | • Increased project-related traffic<br>• Air pollution from construction related activities<br>• Noise pollution<br>• Improper handling and disposal of waste<br>• Accidental oil spills and leaks<br>• Presence of the project workforce in the community | • Contractor will develop and monitor the implementation of a Community Health and Safety Management Plan (CHSMP)<br>• Contractor will develop Emergency Response Plans (ERPs) in cooperation with local emergency authorities and hospitals.<br>• Contractor will extend the Worker Code of Conduct to include guidelines on worker –community interactions and will provide training on the worker code of conduct to all employees including contractors and subcontractors and truck drivers as part of the induction process.<br>• Contractor will provide primary health care and first aid at construction camp sites to avoid pressure on local healthcare infrastructures.<br>• Contractor will implement a Community Grievance Mechanism.<br>• Contractor will develop and implement a Traffic Management Plan covering aspects such as vehicle safety, driver and passenger behaviour, use of drugs and alcohol, operating hours, rest periods, community education on traffic safety and accident reporting and investigations. | • Contractor<br>• WSP | • Number of incidences recorded on site and within communities<br>• Community satisfactory reports with regards to health and safety<br>• Reported and addressed grievances on site and from communities | Preliminary Sum of Ksh 1 million to allowed for addressing Community health and security impacts |
| Worker Health and Safety and Workers Management impacts | Workers' rights including occupational health and safety need to be considered to avoid accidents and injuries, loss of man-hours, labour abuses and to ensure fair treatment, remuneration and working conditions. | • Contractor will develop a Human Resources Policy, which will outline worker rights to be included in all contracts including restrictions on working hours in line with applicable ILO standards, compensation including consideration of overtime, holidays etc. contractor will require its contractors and subcontractors to put in place policies in line with national legislation and applicable international legislation and contractor Code | Contractor | • Number of incidences recorded on site and within workers<br>• Workers satisfactory reports with regards to health | Preliminary Sum of Ksh 2 million to allowed for addressing Workers health and |

| Risk | Anticipated Impact | Mitigation | Responsibility | Monitoring parameter | Budget |
|---|---|---|---|---|---|
| | The Project could potentially lead to workforce-related social and health issues throughout the life cycle of the Project if worker management and rights do not meet Kenyan law or international best practice. | of Conduct and Policies.<br>• Contractor will develop a Human Resources Policy, which will outline worker rights to be included in all contracts including restrictions on working hours in line with applicable International Labour Organization (ILO) standards, compensation including consideration of overtime, holidays etc. Contractor will require its contractors and subcontractors to put in place policies in line with national legislation and applicable International Legislation and contractor Code of Conduct and Policies.<br>• Contractor will prohibit the use of alcohol or drugs, which could adversely affect the ability the employee to perform the work safely or adversely affect the health and safety of other employees, community members or the environment.<br>• Contractor and self-employed contractors will assess the Health and Safety risks related with the tasks to be performed during the construction phase.<br>• Pre-employment medical assessments will be put in place as a workforce risk management tool to screen individuals for risk factors that may limit their ability to perform a job safely and effectively. Expected benefits of conducting a pre-employment medical assessments include a safer working environment, reduction in workplace injuries, minimised downtime, matching the capacity of the employee with the role, and overall recruitment cost and risk reduction.<br>• Contractor will ensure that training on health and safety measures is provided to all construction workers prior to starting to work on the Project and that supervisors have adequate experience to deliver on their responsibilities.<br>• Contractor will implement regular health and safety checks and audits of workers, contractors and subcontractors and implementing sanctions in case of breaches of national standards and the Project's | | and safety<br>• Reported and addressed grievances on site and from workers | security impacts |

| Risk | Anticipated Impact | Mitigation | Responsibility | Monitoring parameter | Budget |
|---|---|---|---|---|---|
| | | specific standards. Such audits to include workplace Health and Safety; worker contracts, working hours, pay and conditions; housing and food standards.<br>• Contractor will establish a procedure for the recording and analysis of incidents and lessons learned such that additional actions can be implemented to avoid or minimize occupational health and safety risks.<br>• Contractor will ensure that facilities and work sites are designed and maintained such that robust barriers are in place to prevent accidents.<br>• Contractor will ensure that its Code of Conduct is followed to regulate the performance and behaviour of all workers, including provision for disciplinary action for anti-social behaviour and non-compliance with health and safety regulations such as lack of use of PPE.<br>• Contractor will ensure that adequate clean water, adequate food and access to medical care is provided to all workers on the worksite and at accommodation.<br>• Contractor will develop and implement a Traffic Management Plan covering aspects such as vehicle safety, driver and passenger behaviour, use of drugs and alcohol, operating hours, rest periods, community education on traffic safety and accident reporting and investigations.<br>• Contractor will develop a Waste Management Plan for the construction phase with clear guidelines for the safe storage and disposal of hazardous waste and handling of hazardous materials. | | | |
| | | | **Total Budget for Implementing the ESMP** | | **Kshs 7.5 M** |

## Table 9-3: Operational Phase: Environmental and Social Management and Monitoring Plan

| Issue | Action required | Responsibility | Provisional Budget |
|---|---|---|---|
| **Pollution of Water Resources by raw sewage from blocked Sewer pipes and Manholes.** | • NZOWASCO will ensure proper and periodic maintenance of sewers and treatment plants<br>• NZOWASCO will activate a community watch group for information sharing on the status of the sewers<br>• Regular cleaning of grit chambers and sewers to remove grease, grit, and other debris that may lead to sewer backups<br>• Development of an inventory of system components, with information including age, construction materials, and drainage areas served<br>• 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 sewer system<br>• Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent build-up of solids and hydrogen sulphide generation<br>• Regular inspection of the system to ensure performance is maintained at high levels<br>• Blockages should be detected and promptly replaced<br>• Communities living within the river basins where the trunk sewers will be constructed should be enlightened on dangers of using raw sewerage to irrigate farmlands. | • Nzoia Water and Sewerage Company<br>• Trans-Nzoia County Government | To be established at Operation Phase and included in the operation of the Project |
| **Odour Menace from Wastewater Treatment Works** | • NZOWASCO will ensure appropriate covering/ventilation of the pre-treatment unit<br>• NZOWASCO will ensure appropriate handling and removal of grit/grease<br>• NZOWASCO will ensure scum is appropriately disposed off or properly stabilized<br>• NZOWASCO will ensure that the pond series have adequate water flow and aeration to reduce the potential of odour formation<br>• The perimeter of the proposed site should be vegetated with trees and plants of varying heights thereby forming windbreaker and reduce dispersion of odour<br>• Repairing of dilapidated the roofs of the sludge drying beds to ensure quick drying of sludge and appropriate disposal to reduce odour emanating from wet sludge.<br>• | • Nzoia Water Services Company<br>• Trans-Nzoia County Government | To be established at Operation Phase and included in the operation of the Project |

| Issue | Action required | Responsibility | Provisional Budget |
|---|---|---|---|
| **Risks Associated with Sludge from the WWTP** | • NZOWASCO will dry sludge on the drying beds before disposing it off<br>• Dried sludge could be used to make briquettes as a charcoal substitute or be sold to farmers as fertilizers<br>• Excess sludge can be disposed in a designated landfill which shall only be for disposing dry odourless sludge.<br>• Preparation and enforcement of operational guidelines for sludge management by Trans Nzoia County Government | • Nzoia Water and Sewerage Company<br>• Trans-Nzoia County Government | To be established at Operation Phase and included in the operation of the Project |
| **Solid Wastes Impacts at WWTP Screens** | • NZOWASCO will develop a comprehensive Waste Management Plan (WMP) for management of solid wastes from screen chambers<br>• NZOWASCO will employ personnel who will be in charge of maintaining hygiene and cleanliness of the WWTP including removal of solid wastes from screen chambers<br>• Properly labelled and strategically placed waste disposal containers shall be provided at all places within the WWTP<br>• Solid wastes once removed from screens shall be collected and disposed off appropriately as required by waste Management Regulations of (2006) and Trans Nzoia County Government by laws. | • Nzoia Water and Sewerage Company<br>• Trans-Nzoia County Government | To be established at Operation Phase and included in the operation of the Project |
| **Inversion of Birds and Reptiles to the WWTP** | • The sewage treatment plants should be protected from wildlife encroachments by providing secure barriers to keep off the animals from interfering with the plant operations and safety<br>• In the event of larger wildlife e.g. hippos, NZOWASCO will ensure appropriate consultations with the Kenya Wildlife Services (KWS) on appropriate management actions.<br>• The quality of effluent discharged into the river will be an important parameter on the regional control of the river eutrophication that attracts insects that reptiles feed on | • Nzoia Water and Sewerage Company<br>• Trans-Nzoia County Government | To be established at Operation Phase and included in the operation of the Project |

## 9.49.5 General Decommissioning Flow Chart

The Project has been designed to operate effectively for over 20 years. In the event that the infrastructure will be required to be overhauled, then steps should be considered in order to undertake the procedure in a structured manner with minimum impact to both human and natural environment as illustrated in **Table 9-4**.

**Table 9-4: Decommissioning Flow Chart**

| Stage | Action | Actor |
|---|---|---|
| **Step 1** | **Initiation**<br>• Development of an Objective Worksheet and checklist incorporating references, legal and policies<br>• Undertake decommissioning audit | **Proponent then** |
| **Step 2** | **Prepare Road Map for Decommissioning Design**<br>• Conduct design review to validate elements of the design and ensure design features are incorporated in the decommissioning design<br>• Public consultations | **Proponent then** |
| **Step 3** | **Prepare and Award Contract**<br>• Prepare a contract that incorporates validated Project information and award to a contractor as per the Procurement rules | **Proponent then** |
| **Step 4** | **Execute Decommission Works**<br>• Implement design elements and criteria on the Project in accordance with specifications and drawings<br>• Inspect during decommissioning and at Project completion to ensure that all design elements are implemented according to design specifications | **Contractor** |
| **Step 5** | **Commissioning Environmental Management Plan** | **Contractor** |
| **Step 6** | **Non-Conformance, Corrective/Preventive Action**<br>• Determine root cause<br>• Propose corrective measures<br>• Propose future preventive measures | **Contractor** |

## 9.59.6 Decommissioning Guide for Machinjoni/Matisi and Bidii WWTPs

These guidelines provide information on Decommissioning and Rehabilitation Plan (DRP) preparation and Reporting for Machinjoni/Matisi and Bidii Waste Water Treatment Plants in Kitale that are planned to be decommissioned.

In compliance with EMCA 1999 Cap 387 and Water Quality Regulation 2006 Part III, a DRP is usually required by NEMA prior to decommissioning the WWTP. At the time of decommission, separate DRP will be prepared separately for Matisi and Bidii WWTP.

### ~~9.5.1~~9.6.1 Preparation of Decommissioning and Rehabilitation Plan (DRP)

**Key principles**

The DRP must outline the actions that will be taken to ensure the following:

a) Avoidance of environmental harm during decommissioning;
b) Land uses allowable under the relevant zoning are not prejudiced or likely to be prejudiced by residual pollution or potential pollutants on the land;
c) That all waste material and products are managed and disposed of appropriately; and
d) The land is not causing or likely to cause off-site environmental harm.

**Information required**

The DRP must include:

a) An action plan with tasks to be completed and timeframes for each task.
b) A site plan which identifies all structures to be removed (and retained) and all land to be rehabilitated.
c) Who is responsible for undertaking the work (including site contact details)
d) Who is responsible for determining the work is completed to a satisfactory level (including site contact details); and
e) How environmental impacts associated with decommissioning tasks will be managed.

**DRP Tasks**

Where alternative approaches exist for undertaking DRP tasks, justification for the selected option should be provided based on the objectives of the decommissioning and proposed future land uses. As a minimum, the DRP should consider the parameters shown in **Table 1.5**.

**Table 9-5: DRP Minimum Tasks**

| Parameter | Assessment Details |
|---|---|
| Soil, surface water and Ground Water Assessment and Remediation (Environment Site Assessment (ESA) process) | The DRP must specify responsibilities and timelines associated with undertaking an environmental site assessment (ESA). The ESA must:<br>• Be undertaken in accordance with the EMCA 1999 Cap 387 and EIA/ EA Regulation 2003 (Assessment of Site Contamination)<br>• Describe the pollutant(s) concerned;<br>• Describe the full spatial extent and magnitude of the pollutant(s) concerned;<br>• Assess the level of human health and ecological risk associated with the pollutant(s); and<br>• Describe the current management and recommendations for further management (including remediation) of the identified pollutant or pollutants and the time frames within which these management actions will be implemented. If no management |

| | |
|---|---|
| | action is considered necessary, this must be stated with a reason for why further action is not considered necessary. |
| **Waste management** | All waste issues must be documented in the DRP, along with the preferred management approach. When decommissioning a wastewater treatment plant there will be a range of waste issues requiring management (e.g. residual sludge, liquid wastes including chemicals, contaminated soil). Management recommendations within the DRP should reflect the requirements of relevant environmental regulations, guidelines or other rules.<br><br>There may be other waste issues which are more challenging to manage and require discussion with the NEMA. |
| **Infrastructure decommissioning** | Details of proposed infrastructure decommissioning must be provided in the DRP. Before decommissioning any infrastructure, the relevant planning authority should be consulted in this case Trans Nzoia County Government and, if necessary, planning approval obtained. |
| **Landscape and revegetation** | Details of the following must be provided in the DRP:<br>• Top soiling and planting of the site with native, locally sourced plants or grasses; and /or<br>• Grading, levelling and re-contouring to ensure no voids or uneven surfaces; and<br>• Rendering the site safe for future land use. |
| **Managing decommissioning, remediation and rehabilitation works** | The DRP should outline what steps will be undertaken to mitigate environmental impacts arising from decommissioning, remediation and rehabilitation works. Consideration should be given to the following:<br>• Water quality: prevention of soil or sediment entrainment in surface runoff;<br>• Air quality: prevention of impacts arising from dust and odour;<br>• Noise: prevention of impacts arising from machinery or other works. |
| **Other Considerations** | Other relevant issues which need to be considered in the context of decommissioning include, but are not necessarily limited to:<br>• Site history;<br>• Heritage considerations, including heritage buildings or sites for special consideration;<br>• Occupational Health and Safety and Public Health requirements |

### ~~9.5.2~~9.6.2 DRP Submission

The person responsible for the preparation of the DRP will be required to contact officers within NEMA Trans Nzoia County Offices for guidance in developing the Decommissioning and Rehabilitation Plan. A draft DRP should be submitted to the County Director of Environment (CDE), NEMA for review before finalising.

### ~~9.5.3~~9.6.3 Post Decommissioning and Rehabilitation Reporting

Once the land has been rehabilitated to a standard appropriate for the future land use, a Final Report signed by the Managing Director Nzoia Water and Sanitation Company (NZOWASCO) must be submitted to NEMA for review and approval. This final report must include:

- Details of works that were completed, outlining any deviations from the agreed DRP;
- Any supporting reports such as the ESA; and
- Details of any ongoing management strategies such as monitoring.

# CHAPTER 10: CONCLUSION AND RECOMMENDATIONS

## 10.1 Conclusion

The Environment and Social Impact Assessment detailed specific baseline information of the 3Nr. drainage areas with a specific focus on the potential impacts likely to be inflicted on natural and human environment due to the proposed sanitation works.

A summary of the finding is detailed below:

(i) The Project is proposed to be implemented within human settlements where anthropogenic activities has led to clearing of natural vegetation to provide land for housing and farming. Therefore, no direct interaction of the Project activities with natural sensitive ecosystems at the time of construction will occur.

(ii) There exist 3Nr man-made forest blocks within Kitale municipality namely Block 6, KCC and Agricultural Society of Kenya (ASK) forest. However, proposed trunk and secondary sewers will not directly interact / traverse the forests. The Project Executing Agency (PEA) will seek wayleave permits from Kenya forest services in the event that sewer works are to be undertaken within the forests

(iii) Trunk sewer along Koitobos river basin will traverse through the privately owned land belonging to Kitale Nature Reserves. The ESIA provides that appropriate permit from National Museums of Kenya will be acquired by the PEA before the construction.

(iv) Kitale Municipality is divided into 3 main drainage areas with most of the area draining into River Koitobos. River Koitobos flows to the Southeast and forms the current Northern boundary of Kitale Municipality. Machinjoni River Basin is an urban river basin whose source is at the center of Kitale Municipality. The baseline Biological Oxygen Demand (BoD) of the rivers was collected during the ESIA, at Project operational stage, the baseline BoD will be a critical parameter during monitoring of river pollution.

(v) The New Sirende Site is located at the banks of Koitobos River East of Sirende Centre in Drainage Area 1. The area is sparsely populated. The proposed site is located in a private agricultural land which must be acquired for construction of Wastewater Stabilization Ponds (approx. 70 Ha) for treatment of the projected wastewater flow of 5,600 $m^3$/d for medium term (2035) and 8,400 $m^3$/d for long term (2045).

(vi) The New Rafiki Site is located at the banks of Katalele River at its confluence with Kukureze River. The site is located within Drainage Area 3 in a sparsely populated area at the proposed Municipality Boundary. The land requires acquisition for construction of wastewater stabilization ponds (approx. 48 Ha is required) for treatment of the projected wastewater flow of 4,600 $m^3$/d for medium term (2035) and 6,900 $m^3$/d long term (2045)

(vii) The proposed sewers are designed to be laid within existing road reserves and wayleaves owned by the relevant Road Authorities i.e. Kenya Urban Roads

Authority (KURA), Kenya Rural Roads Authority (KeRRA) or Kenya National Highways Authority (KeNHA) including Trans Nzoia County Government Trunk sewers will also be laid along river riparian under custody of Water Resources Authority (WRA However, specific Resettlement Action Plan (RAP) has been prepared for potential impacts on private assets as a result of demolition (loss) of structures/household assets to provide space for laying of sewers within build up estates such as Mitume, Matisi, Kipsongo among others. Crops and woodlots belonging to private individuals along the main trunk sewers that flows along Koitobos and Katalele rivers might be affected.

(viii) The cost of implementing the Environment and Social Management Plan (ESMP) is provides as **Kshs 7.5 million.**

## 10.2 Recommendations

The **Bid Documents** prepared for the Project incorporates the Environment, Social Health and Safety Provisions discussed under **Chapter 8** (Environment and Social Impact Assessment and Mitigation Measures). The Project Contract Document include provisions for the contractor preparing and implementing Construction Environment and Social Management Plan (C-EMSP), annexes to the C-EMSP will include but not limited to:

- ✓ *Soil and Sedimentation Control Plan*
- ✓ *Decommissioning and Rehabilitation Plan for Matisi and Bidii WWTPs as illustrated in section 9.5*
- ✓ *Spoil Management Control Plan*
- ✓ *Health, Hygiene and Safety Plan*
- ✓ *Labour Management Plan*
- ✓ *Child Protection Strategy*
- ✓ Gender-based Violence Action Plan
- ✓ *Waste Management Plan*
- ✓ *Contractors Code of Conduct*
- ✓ *Gender Inclusivity Strategy*
- ✓ *HIV/Aid Prevention Strategy*

At Project implementation stage, the Contractor will report to the Project management team comprising of the Consultant and the Project proponent on a monthly basis on how ESHS provision detailed in this ESIA are addressed at each Project Site. In addition, the contractor will hire 2Nr Environment Health and Safety Managers under the contract.

At Project completion stage, within the defects liability Period, NZOWASCO will initiate an Initial Environment and Social Audit for the Project as required by EIA/EA Audit regulation of the year 2003 and subsequent annual self-audits. The audit will develop an Environment and Social Audit Action Plan (ESAAP) that will be used to track Project Environment and Social Compliance during Project implementation stage.