Ministry of Water, Sanitation and Irrigation

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED WATER PROJECT INTERVENTIONS IN OL KALOU

FINAL ESIA REPORT

16 December 2024

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DECLARATION

This EIA report was done in accordance with the requirements of the Environmental (Impact Assessment and Audit) Regulations, 2003, pursuant to the Environmental Management and Coordination Act (EMCA) 1999 and acceptable international standards.

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ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
DOSH	Directorate of Occupational Safety and Health
E&S	Environment and Social
EA	Environmental Audits
EIAs	Environmental Impact Assessments
EMCA	Environmental Management and Coordination Act
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GoK	Government of Kenya
HIV	Human Immunodeficiency Virus
KWS	Kenya Wildlife Service
MDGs	Millennium Development Goals
NECC	National Environmental Complaints Committee
NEMA	National Environment Management Authority
NET	National Environmental Tribunal
NGEC	National Gender and Equality Commission
OLWASCO	Ol Kalou Water and Sanitation Company
OP	Operational Policies
OSHA	Occupational Safety and Health Act
PAPs	Project Affected Persons
PPE	Personal Protective Equipment
PPP	Public Private Partnership
RAP	Resettlement Action Plan
SDGs	Sustainable Development Goals
SEP	Stakeholders Engagement Plan
SHE	Safety, Health and Environment
TOR	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change
WB	World Bank
WRA	Water Resource Authority

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EXECUTIVE SUMMARY

1. Introduction

In this section, we present general information that summarizes the findings of the Environmental and Social Impact Assessment (ESIA) for the proposed Ol Kalou Water and Sanitation Company (OLWASCO) Project. The objective of this study was to evaluate the environmental and social impacts that are likely to emanate from construction, operation and decommissioning phases of the proposed project. We have, as a way forward suggested ways of minimising the identified adverse impacts and optimizing the positive impacts.

2. Proposed Project

The Project Development Objective (PDO) is to improve water supply and sanitation services and improve the financial performance of OLWASCO. The proposed project involves the construction of an 8.3 km High-Density Polyethylene (HDPE) pipeline in Githunguri, Nyandarua County, Kenya. The primary objective is to provide a reliable and sustainable water supply to the residents and institutions in the Githunguri area. The project will leverage gravity flow from existing elevated tanks to minimize energy costs, ensuring a consistent water supply to approximately 2,500 residents, three institutions, and surrounding homesteads.

3. Objective of the Project

The general objective of this project is to improve the water supply services within Githunguri area for the benefit of residents of Ol Kalou town.

4. Scope of works

The project scope involves installing an 8.3 km HDPE pipeline (DN63mm is 7.4km and DN50mm is 0.9km) to provide a reliable water supply to the Githunguri area. This includes site clearance, trench excavation, and the construction of break-pressure tanks to manage water flow. The pipeline will connect to existing infrastructure, with all necessary plumbing, masonry, and support structures completed. Landscaping will restore the area post-construction. Additionally, a decommissioning plan ensures responsible disposal or repurposing of materials, followed by ecological restoration of the site.

5. Objective of ESIA study

The general objective of the ESIA investigations is to carry out a systematic examination of the present environmental situation within the project area to determine whether the proposed project will impact adversely on the physical and biological elements of the environment within the project area. This is in line with Section 58 (1) of EMCA 1999 that requires proponents to carry out ESIA on projects that appear in the Second Schedule of the Act.

6. Study methodology

The methodologies used in the study include identification, collection, and analysis of environmental baseline data; identification of impacts; analyses and evaluation of impacts; formulation of mitigation measures for significant negative impacts; development and analysis of project alternatives, and development of environmental/social management and monitoring plans.

7. Study findings

The study identified several critical issues that could impact the implementation of water project, including encroachment on road reserves and water pipeline wayleaves, and social conflicts. Additional challenges include illegal tapping, road crossings, service disruptions, damage to road infrastructure, drainage blockages, and risks to residents from construction traffic and sexually transmitted diseases. Environmental concerns such as solid waste generation, soil erosion, atmospheric pollution, and noise impacts were also noted, along with potential disruptions to water supply.

8. Public Consultation

Public participation in this project was achieved through consultation with the neighbouring community and with lead agencies including WRA; CECM Water; and Municipal Manager. This was done through direct interviews and questionnaire administration, and public barazas. It emerged from the stakeholders' consultation that the project is welcome in the area as they do not anticipate any negative impacts from its construction and operation.

9. Impact Assessment Criteria

The criteria applied in this study are based on industry standards for impact assessment, adopted for use in the assessment of the proposed project impacts. The purpose of impact assessment is to assign relative significance to predicted impacts associated with the project, and to determine the manner in which impacts are to be avoided, mitigated or managed. The rating of impacts assumes that standard construction and operating procedures present in the project description will be implemented. The impact assessment criteria include the spatial context of project impacts; temporal context; and reversibility, magnitude and significance of potential impacts of project construction and operation. The potentially significant environmental and social impacts have been identified based on the nature of the receiving environment, analysis of the proposed activities and analysis of the issues raised by stakeholders during public participation process.

10. Environmental and Social Impacts and mitigation Measures

Environmental and social impacts associated with construction and operation phases of the proposed project include the following:

Environmental and Social Impacts	Mitigation Measures
Disruption of business: The project will affect access to a kiosk situated along the pipeline route, potentially leading to revenue losses.	- Valuation of the affected business has been done and the WSP will compensate the PAP for loss of business and issue sufficient notice to the PAP before excavation. - Compensation of the affected individual will be undertaken as per World Bank OP 4.12 and Kenyan law. - Expedite restoration to minimize revenue loss.
Disruption of services: Construction may interfere with water supply.	- Schedule construction during off-peak hours, notify residents of interruptions. - Implement temporary water supply solutions. - Install sectional valves to minimize disruption.
Impact on public infrastructure: laying of the pipeline will be along the public roads, therefore, excavation works may block roads and interfere with road surfaces.	- Use excavated soil for backfilling and restore road surfaces to pre-excavation conditions. - Dispose of excess materials in approved sites.

Environmental and Social Impacts	Mitigation Measures
Blockage of drainage channels: the water pipeline will be laid along the road reserve therefore, it may disrupt surface runoff, leading to waterlogging and erosion.	- Work under dry conditions, if it is during the rainy season, unclog blocked drains. - Collaborate with county government of Nyandarua to upgrade drainage systems. - Re-route the pipeline to avoid flood-prone areas.
Accidents and injuries: Construction activities may increase the risk of accidents and injuries to workers and residents.	- Implement safety measures per the Occupational Health and Safety Act, 2007. - Provide proper training, PPE, and site access control.
community safety: Increased traffic and the presence of construction workers may lead to accidents.	- Enforce a strict code of conduct for drivers. - Enforce safety Measures at site e.g. signages, safety protocols etc.
Influx of workers	– Hiring unskilled construction and skilled (if available) labour from the local population as far as possible. – Prepare influx of workers plan.
Spread of HIV/AIDS and other STI	– Hiring unskilled construction and skilled (if available) labour from the local population as far as possible. – Sensitizing workers and the surrounding community on awareness, prevention and management of HIV / AIDS.
Solid waste generation: Construction will generate various solid wastes, which must be managed according to national laws.	- Require site clearance and waste management plans. - Use receptacles for waste sorting and recycling.
Soil erosion: Uncontrolled excavation and improper drainage may lead to soil erosion.	- Plan for proper drainage and implement restoration measures post-construction. - Encourage vegetation regeneration.

11. ESMP summary and implementation arrangements

The ESMP provided in chapter 8 provides the mitigations measures of the anticipated environment and social impacts, monitoring indicators, responsible party and the cost of mitigation measures. Key impacts and risks anticipated include: waste generation, clearance of vegetation, loss of biodiversity, air pollution, occupational health and safety risks, GBV, etc. The cost for the implementation of the ESMP shall be included in the overall design, construction supervision cost of the project. Most of the environmental cost which involves engineering design is embedded in the engineering costs. However, Ksh. 2,265,000 will be spent in the implementation of the mitigation measures and environmental management administration. These costs shall also cover environmental monitoring.

The ESMP shall be provided along with bidding documents. Compliance with the ESMP shall be clearly provided for in the contract documents. The Contractor shall prepare a C-ESMP to operationalize the ESIA findings and recommendations. Method statements will also be prepared and will be task-specific after undertaking specific risk assessments. In addition, the contractor will have a qualified fulltime EHS person to be based on site who will be responsible for the implementation of the ESMP. The contractor will be required to submit monthly progress reports on ESMP implementation during construction phase. Also, the contractor should submit incident reports, and any other as per the WB standards.

The Olkalou Water and Sewerage Company will be the implementing Agency of the project. The company has no capacity to supervise the implementation of the E&S activities but will rely on the outsourced personnel. It has no full time social and environmental safeguards staff to assist in the project. At the national level, WSTF will form a project implementation unit comprising of the E&S experts to oversee the project activities.

12. Conclusions and recommendations

The following are recommended with respect to the proposed Project.

(i) That strict adherence to the Environmental and Social Management Plan should be observed;

(ii) That any unforeseen impacts shall be immediately notified to the environmental assessor to ensure that they are immediately addressed and mitigated.

(iii) Project Construction works to commence after approval and issuance of the license.

(iv) The project contractor shall need to hold meetings with local communities before commencement of construction to firm up agreements of engagement.

1. INTRODUCTION

1.1. Background

The Ministry of Water, Sanitation and Irrigation (MoWS&I) is implementing Water and Sanitation Development Project (WSDP) with a credit from the International Development Association (IDA) that aims at improving water supply and sanitation services in selected regions in Kenya through the Water Service Providers (WSPs). The Project Development Objective (PDO) is to improve water supply and sanitation services in select Coastal and Northeastern regions in Kenya and improve the financial performance of Water Service Providers (WSPs) affected by the COVID-19 pandemic.

Following conclusion on allocation of grants to WSPs under the CLSG-1 program, WaterFund through the MoWS&I prepared documentation for the second phase of the CLSG program now referred to as CLSG-II program. The focus of CLSG-II is to support financial recovery of WSPs to pre-COVID levels or better. During this phase, only WSPs with potential to achieve financial recovery within a period of less than 12 months are eligible to receive the support.

A total of 31 WSPs with 77 interventions costing KES 2.198 billion have been pre-qualified to implement the CLSG II programme which is expected to start in February 2024 for implementation period of 12 months. 18 WSPs will have significant interventions and are clustered into four groups based on their location within the county.

This ESIA report has been prepared in compliance with the Terms of Reference (TOR) for the construction of 8.3Km HDPE pipeline in Githunguri area by Ol Kalou Water and Sanitation Company (OLWASCO).

1.2. Project objectives

The construction of the 8.3Km HDPE pipeline (DN63mm is 7.4km; DN50mm is 0.9km) in the Githunguri area by OLWASCO is a community-driven project aimed at addressing perennial water shortages and pollution issues. Initiated by the Githunguri community, the project seeks to improve access to potable water by laying a new pipeline network. This development is critical, given the inadequate and polluted existing water sources, which force residents to rely on distant and often unreliable supplies. The new pipeline will connect to existing infrastructure, including an operational borehole, rising main, and elevated plastic tanks with a total capacity of 20m³. The project's primary objective is to provide reliable, clean water to households and institutions within the Githunguri sub-location, thereby improving the quality of life for the local population.

1.3. Relevant SDGs

Sustainable Development Goal (SDG)	Goal Description	Relevance to the Project
SDG 6: Clean Water and Sanitation	Ensure availability and sustainable management of water and sanitation for all	The project improves access to safe, clean water in the Githunguri area, directly addressing water shortages and pollution, aligning with the goal of providing equitable access to safe drinking water.

Sustainable Development Goal (SDG)	Goal Description	Relevance to the Project
SDG 3: Good Health and Well-being	Ensure healthy lives and promote well-being for all at all ages	By providing clean water, the project helps reduce the risk of waterborne diseases, contributing to improved health and well-being for the Githunguri community.
SDG 11: Sustainable Cities and Communities	Make cities and human settlements inclusive, safe, resilient, and sustainable	The project promotes sustainable water infrastructure, enhancing the resilience of the community by providing reliable water access, reducing dependence on distant, unreliable sources.
SDG 9: Industry, Innovation, and Infrastructure	Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation	The new HDPE pipeline is a significant investment in reliable and resilient water infrastructure, supporting the economic development and well-being of the Githunguri community.
SDG 1: No Poverty	End poverty in all its forms everywhere	Access to clean water reduces the financial burden on households and frees up time for economic activities, contributing to poverty alleviation in the Githunguri area.
SDG 13: Climate Action	Take urgent action to combat climate change and its impacts	The project enhances water security and community resilience against climate-related water shortages, helping the community adapt to climate variability.
SDG 8: Decent Work and Economic Growth	Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all	Improved water access increases productivity and supports small-scale economic activities, such as agriculture, contributing to economic growth and stability in the region.

1.4. Objective of ESIA study

The principal objective of the study is to identify the potential positive and negative environmental & social impacts expected during the construction, operation and decommissioning phases of the proposed project with the aim of proposing the possible mitigation measures. The exercise was undertaken to ensure that current and future activities does not negatively impact the environment & social fabric of the project area including human health and safety, physical (land, water, plants, and animals) components and intricate relation between them. In case any of such impacts are inevitable, a mitigation plan for the same is proposed in the study. Thus, the subject environmental and social impact assessment study formulates environmental and social considerations in the planning, designing, implementation and decommissioning phases, so as to ensure sustainable development. The study has been undertaken in line with Kenyan legislations as well as World Bank

Guidelines. In this context, Environmental Social Impact Assessment (ESIA) Study of the proposed project is performed.

In brief, the specific objectives in carrying out the ESIA are as under:

i. To discuss elements of the propose project and policy & regulatory frameworks relevant to project

ii. Establish the social, economic and cultural make-up of the project area.

iii. Document the views of the community and other stakeholders in the project area.

iv. To identify elements of environment likely to be affected by the project and/or likely to cause adverse impacts to the project including natural and man-made environment.

v. Identify the potential social risks and how to mitigate them in the project area.

vi. To identify any potential losses or damage to flora, fauna and natural habitats.

vii. To identify the negative impacts and propose the provision of infrastructure or mitigation measures so as to minimize pollution, environmental disturbance and nuisance during construction and operation of the project.

viii. To specify environmental monitoring and audit requirements, if necessary, to ensure the implementation and the effectiveness of the environmental protection and pollution control measures adopted.

ix. Prepare an environmental impact assessment report compliant with the Environmental management and Coordination Act (1999) and detailing findings and recommendations.

1.5. Scope of this Report

The ESIA was carried out in compliance with the Government of Kenya's Environmental Management & Co-ordination Act of 1999 and the Environmental (Impact Assessment & Audit) Regulations, June 2003, World Bank Guidelines among other relevant laws, regulations, and guidelines. To meet the objectives stated in section 1.4 above, the consultant undertook the following tasks.

i Literature review: gathering environmental and social information pertaining to the project

ii Description of the baseline environment: collecting and presenting baseline information on the environmental characteristics of project and surrounding areas, e.g., climate, soils, geology, vegetation, fauna, valued environmental components, land use, human populations, socio-economics activities, cultural heritage, water supply and sanitation.

iii Detailed description of the proposed project: describing the proposed project, its geographic location, ecological, general layout of facilities including maps at appropriate scale where necessary

iv Legislative and Regulatory Framework: identifying and describing all pertinent regulations and standards governing environmental quality, solid and liquid waste management, health and safety, protection of sensitive areas, land use control at the national and local levels and ecological and socio-economic issues including compliance issues.

v Identification of potential Impacts: Analysis and description of all significant changes expected due to the proposed project
vi Occupational Health and Safety Concerns: Analysis and description of all occupational health and safety concerns likely to arise as a result of the construction of the proposed project
vii Public Participation: Consultations with the public on the positive and negative impacts of the proposed project
viii Mitigation Measures: Proposing feasible mitigation measures for the negative impacts that could result from the proposed project.
ix Environmental Management Plan: Developing an Environmental Management Plan to mitigate negative impacts:
x Monitoring Plan: Developing an Environmental Monitoring Plan
xi ESIA Report: Preparation and submission of an Environmental and Social Impact Report.

1.6. Methodology

In order to meet the study objectives, the first step was for the consultant to undertake desk study and preliminary site visit. Based on the site visit various considerations relevant to project that could influence the Environmental and Social Impact Assessment were identified. The stepwise activities as well as methodologies followed for this study is described below:

1.5.1. Desk Study

Various relevant documents were reviewed for a clear understanding of the terms of reference, environmental status of the project area, data on demographic trends, land use practices in the affected areas, development strategies and plans (local and national) as well as the policy, legal and institutional documents.

The team reviewed relevant literature including but not limited to the following reports:

- Design Report; to understand the project background, the preliminary designs and the implementation plan
- Hydrogeological survey report to understand the subsurface conditions and hydrogeology
- Secondary data through literature reviews to collect baseline information in the project area
- Relevant Legal, Policy and Regulatory documents with special emphasis to requirements under the EMCA, 1999, and the Environmental Impact Assessment and Audit Regulations, 2003
- World Bank's Environmental Health and Safety (EHS) Guidelines.

1.5.2. Understanding the project

The first step in environmental assessment of the proposed project was to understand the proposed site based on maps and, also analysing the direct and indirect environmental impacts, which are key in determining the scope and depth of the study.

1.5.3. Site Survey and Baseline Data Collection

Physical project site inspections and observations constituted the main baseline survey activities in August 2024. The team visited site inspecting the site characteristics to assess the existing baseline condition with respect to physical, biological and socio-economic environment.

1.5.4. Physical environment

The baseline data collection methodology applied for physical environment involved a combination of primary and secondary data collection methods ranging from direct observations & visual analysis to interaction with locals during field survey on various parameters such as land use & topography, water channels, natural drainage, flood flows, climate, air, and noise quality etc.

1.5.5. Physical Cultural Resources

Archaeological and Cultural Heritage impact assessment has been undertaken to identify and ensure the protection of archaeological and cultural heritage assets associated with the project sites to ensure that effective management and mitigation controls are in place. The assessment included a desktop review of any available documents and records associated with archaeological and cultural heritage resources within the project sites as well as field survey of project site.

1.5.6. Biodiversity Assessment

Both qualitative (desk-stop literature review) and quantitative (field sampling) methods were employed to assess biodiversity of the study area. The general biodiversity information gathered includes the following.

- Detailed lists of flora and fauna species (mammals, avifauna, reptiles and amphibians, fish and invertebrates) occurring in the project area.
- Fauna and flora Species of Conservation Concern (SCC) were identified based on the IUCN Red List of species i.e. Critically Endangered, Endangered, Vulnerable or Near Threatened.
- Other biodiversity value characterization criteria such as nationally threatened, nationally protected, restricted-range and endemic species, congregatory, migratory species as well as invasive species were also applied.
- Characterization of vegetation structure and habitat types i.e. modified, natural, critical

1.5.7. Data Evaluation and Analysis

Environmental assessment was carried out to identify potential impacts of the project on the environment, biodiversity and the community. The assessment was carried out in three main steps, as follows:

- Prediction of potential impacts

- Execution of specialized ecological studies on biodiversity and evaluation and assessment of the impacts in terms of their significance
- Identification/ proposing mitigation measures for minimizing the effects of the significant impacts.

After exclusion of the negligible impacts, the remaining aspects were assessed based on the following criteria:

- Magnitude of the impact.
- Duration: period of time that impact lasts.
- Mitigation measures: its availability whether integrated in the project design or implemented as management measures; and
- Residual impacts.

Where negative environmental impacts are expected, majority of them will be experienced during the construction phase. To help manage the potential negative impacts, mitigation measures are suggested, and the residual impact evaluated.

1.5.8. Public Consultations.

Public consultations were undertaken during the environment and social impact assessment study to document the social impacts to the project area and general community perceptions on the project. In general, the following steps were followed in carrying out the entire consultation and public participation process: -

- Identification of institutions and individuals interested in the process and compiling a database of the interested and affected parties
- Administration of questionnaires to different target groups and local community members within the proposed project site.

One-on-one interviews with government agencies, National government officials and other institutions in the project area were undertaken to assist in analysis of impacts to the community and institutions in the project area. These interviews were conducted to augment and confirm data and information obtained using the other tools and methodologies.

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2. PROJECT DESCRIPTION

2.1. Geographic, ecological, general layout

2.1.1. Geographic Description

The project is in Githunguri Sub Location, Passenga Location, Rurii Division in Nyandarua County, along the Gilgil-Nyahururu tarmac road (C77). The area is approximately 5km from Ol Kalou town, the county headquarters, and 7km from Rurii commercial center. The topography of the project area is undulating, with the highest point at 2563 meters above sea level, where the elevated tanks are situated. The area slopes steeply from this point towards Githunguri primary school and then gently towards the supply area boundary at the tarmac road. The soil in the area is well-drained black loamy soil, suitable for farming, and the region receives an average annual rainfall of around 1000mm.

The existing water infrastructure includes a borehole with a pumping system, a pump house, a masonry tank that leaks, a 3-inch diameter rising main, a 9-meter-high water tower, and two plastic water tanks of 10,000 liters each. There is also a scanty 1-inch diameter distribution pipeline connecting approximately 31 homesteads. Other water sources in the area include a polluted dam and shallow wells, with some residents relying on roof catchment water during the rainy season.



Figure 2- 1: *Location of Githunguri Borehole*



Figure 2- 2: *Elevated water Tanks*

2.1.2. Ecological Considerations

The project area is characterized by a highland climate, with cool temperatures ranging from 13°C at night to 18°C during the day. The proximity to the Aberdare ranges contributes to the cool weather. The area receives an average annual rainfall of approximately 1000 mm, primarily during the long rainy season from April to June, with lesser amounts between August and November. The soil in the region is primarily well-drained black loam, which is highly suitable for agriculture, a key economic activity in the area.

The surrounding environment includes human settlements, farmlands, and patches of natural vegetation. However, human activities such as deforestation and farming, particularly in the higher areas of Charagita, Nyairoko, and Rurii, have led to significant degradation of local

watersheds. This has resulted in reduced water flow in seasonal streams and dry valleys, which once played a crucial role in replenishing the local water supply.

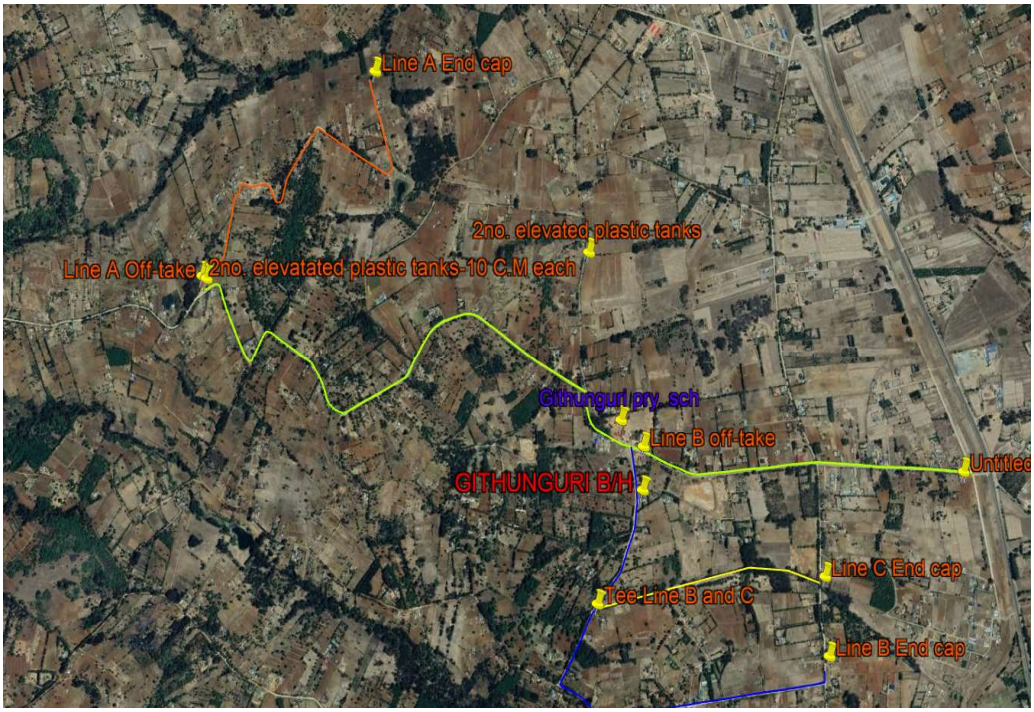
2.1.3. General Layout

The proposed 8.3 km HDPE pipeline will start from the existing elevated plastic tanks situated at the highest point in the project area, approximately 2563 meters above sea level (m.a.l.). The pipeline will follow the natural topography, descending from the elevated tanks and traversing the undulating terrain towards Githunguri Primary School. The layout is designed to take advantage of gravity flow, minimizing the need for pumping and reducing energy costs.

The pipeline will be installed primarily along existing road reserves, minimizing the impact on private land and agricultural activities. The route passes near key community institutions, including Githunguri Secondary School, Githunguri Primary School, and the local nursery school, ensuring these institutions have access to a reliable water supply.

The final segment of the pipeline will connect to the main distribution lines, ensuring that water reaches all intended households and institutions within the project area.

Figure 2- 3: Google Map showing Githunguri area proposed potable water networks



(1) Gravity distribution main (63mm dia, 3860m long) ……. Green in colour

(2) Line A (63mm dia. 1546m) …. Red in colour

(3) Line B (63mm dia, 2059m long) …. Blue in colour (4) Line C 50mm dia. 935m long……. Yellow in colour

2.2. Land required and its availability

The project requires a continuous land corridor for the installation of the 8.3Km pipeline, with an average width of approximately 1 meters for trenching, pipe laying, and maintenance

access. This translates to a total land requirement of approximately 8,300 square meters (0.83 hectares). The land requirements include:

- **Pipeline Corridor**: A 2-meter-wide strip of land along the 8.3Km route for trenching and pipe installation.

- **Staging Areas**: Temporary areas for storing materials, equipment, and pipe sections near the construction zones. These areas will be rehabilitated after construction.

The project route has been carefully planned to follow existing road reserve, hence, no land acquisition. This approach significantly minimizing both costs and potential conflicts with landowners.

Detailed Route Description:

- **Start Point (Elevated Tanks near Githunguri Primary School):** The pipeline starts at the elevated tanks located near Githunguri Primary School. This site has been selected due to its high elevation, which allows gravity-fed water distribution. The tanks are situated at an elevation of 2563 meters above sea level, providing sufficient pressure for the downstream network.

- **Section 1: Githunguri Primary School to Mugumo Water Project Intersection (0 – 2.3 Km):** The pipeline runs from the tanks towards the Mugumo Water Project intersection. This section follows a relatively steep descent, aligning with the existing road network to minimize land disturbance. The terrain here is undulating, with the pipeline route carefully chosen to avoid unnecessary land acquisition and to utilize the existing road reserve.

- **Section 2: Mugumo Water Project Intersection to Rurii Commercial Center (2.3 – 5.6 Km):** After the Mugumo Water Project intersection, the pipeline proceeds towards Rurii Commercial Center, crossing several minor streams and agricultural lands. The route in this section primarily follows existing easements and public roadways, reducing the impact on private land. This section is crucial as it connects several homesteads and small-scale farms to the water supply network.

- **Section 3: Rurii Commercial Center to Passenga Location Boundary (5.6 – 7.5 Km):** Beyond Rurii Commercial Center, the pipeline continues towards the boundary of Passenga Location. The terrain in this section becomes less steep, allowing for a more straightforward pipeline installation. The route runs parallel to the main road, which facilitates access for construction and future maintenance activities. The proximity to the road also minimizes the need for additional land acquisition.

- **Section 4: Passenga Location Boundary to Termination Point at Gilgil-Nyahururu Tarmac Road (7.5 – 8.3 Km):** The final section of the pipeline extends from the Passenga Location boundary to the termination point at the Gilgil-Nyahururu Tarmac Road. This section is relatively flat and passes through agricultural fields, where existing easements are utilized to avoid disruption to farming activities. The pipeline terminates at the main road, where it can be connected to future extensions or additional water supply infrastructure if needed.

2.3. Intervention design and construction processes

2.3.1. Intervention Design

Key Components of the Design:

a. Water Demand Analysis

The water demand for the Githunguri area is based on a population projection of 2,500 residents, with an estimated annual growth rate of 3.5%. The design period considers initial (2024), future (2034), and ultimate (2044) stages. The area also hosts three institutions with a combined population of approximately 540 students and staff. The total daily water demand for the ultimate design stage is projected to be 74.5 cubic meters per day.

b. Hydraulic Modeling and Pipe Sizing

The hydraulic design is based on serving 75% of the total water demand through the new pipeline. A 63mm diameter HDPE pipe is selected, with a designed flow rate of 1.4 liters per second over a 10-12 hour run time. The pipe's class is determined based on frictional losses, elevation differences, and the total head, ensuring the pipeline can withstand the required pressure. A break-pressure tank (BPT) will be installed at an optimal location near Githunguri Primary School to manage the pressure within safe limits.

2.3.2. Construction Process

The construction process will be executed in phases to ensure minimal disruption to the communities and institutions served by OLWASCO. The following steps outline the key activities involved:

Phase 1: Site Clearance, Excavation, Foundation Works, and Backfilling

The construction process will begin with site clearance along the proposed 8.3Km HDPE pipeline route. This will include the removal of vegetation, debris, and any existing structures that may obstruct construction. Following clearance, trench excavation will be carried out to the specified depth and width necessary to accommodate the HDPE pipes. Foundation work will involve preparing the trench bed with a sand layer or other suitable materials to ensure proper support and stability for the pipeline. Backfilling will be done using selected material, ensuring that the pipeline is adequately protected from potential external damage, such as soil movement or pressure from above.

Phase 2: Masonry, Concrete Work, and Related Activities

This phase encompasses the construction of essential masonry structures, including the housing for the break-pressure tank, which is a critical component to manage pressure fluctuations along the pipeline. Concrete work will include the installation of supports and anchor blocks at designated points to secure the pipeline, particularly in areas with uneven terrain or where the pipeline may be subject to stress. The concrete and masonry works will be executed with high precision to ensure long-term structural integrity and durability, considering the environmental conditions in Githunguri.

Phase 3: Plumbing

Plumbing activities will involve the careful installation of the HDPE pipes along the excavated trench, ensuring alignment and proper jointing techniques to maintain a leak-proof system. The pipeline will be connected to the existing OLWASCO water infrastructure, which may include connections to water storage tanks, booster stations, or other distribution networks. Additionally, the installation of valves, meters, and other necessary fittings will be carried out, with each section of the pipeline being pressure-tested for leaks and integrity before proceeding to the next segment.

Phase 4: Landscaping

Upon successful installation and testing of the pipeline, the site will be restored to its original or improved condition. Landscaping efforts will include replanting native vegetation, particularly in areas that were disturbed during excavation, and stabilizing the soil to prevent erosion. The goal is to minimize the visual and environmental impact of the construction, ensuring that the surrounding community and ecosystem are preserved.

Phase 5: Operational Phase

The pipeline will be commissioned, with water being pumped through the new HDPE pipeline to the intended distribution points. Monitoring systems will be implemented to track flow rates, pressure levels, and overall system performance. During this phase, local operators will receive training on the operation and maintenance of the pipeline system to ensure smooth and efficient management.

Phase 6: General Repairs and Maintenance of Water Supply A comprehensive maintenance plan will be put in place to ensure the long-term functionality and reliability of the water supply system. This plan will include regular inspections of the pipeline, prompt repair of any detected leaks or issues, and periodic flushing of the pipeline to prevent sediment build-up and blockages. Maintenance will also cover the servicing of valves, meters, and other critical components.

Phase 7: Water Quality Monitoring

Continuous monitoring of water quality will be integral to the operation of the pipeline. Regular sampling and testing for contaminants, including bacterial, chemical, and physical parameters, will be conducted to ensure compliance with the water quality standards for human consumption. Additionally, the maintenance of any necessary water treatment facilities, such as chlorination units, will be carried out to safeguard public health.

Phase 8: Decommissioning Phase

Upon decommissioning, the project components will be demolished and pipe uninstalled. This will produce a lot of solid waste, which are advisable to be reused for other construction works or if not reusable should be disposed of appropriately by a licensed waste handling company. All equipment including installations, pipework among others should be dismantled and removed from the site on decommissioning of the project. Priority will be given to reuse equipment in other projects. This will be achieved through resale of the equipment to other developers or contractors or donation of this equipment to schools, churches and charitable institutions. The contractors camp can also be donated to the water company to us as offices or store for pipes.

Once all the waste resulting from demolition and dismantling works is removed from the site, the site should be restored through replenishment of the topsoil and re-vegetation using indigenous plants and grass.

2.4. Natural resources (water and construction materials)

2.4.1. Water Requirement

The installation and operation activities of the proposed water networks will require high quantity of water. Water is a crucial resource for both the construction processes and the eventual water supply network operation. The project area relies on various water sources, including boreholes, shallow wells, roof catchments, and an earth dam. However, these sources are currently inadequate to meet the community's needs.

Existing Water Sources:

- **Mugumo Water Project**: The primary water source is the Mugumo borehole, with a test pumping yield of 4.5m³/day. However, this source is insufficient for the community's needs, as it also serves neighboring areas.
- **Shallow Wells**: Privately owned shallow wells are scattered throughout the area, but they suffer from contamination risks, limited water availability, and seasonal drying.
- **Roof Catchment**: Some residents collect rainwater, but the lack of adequate storage facilities and gutters limits the effectiveness of this source.
- **Earth Dam**: The dam provides water for livestock and construction but is not suitable for human consumption due to its turbidity and location at a significant distance from many residents.

Projected Water Demand:

The projected population growth in the Githunguri area is estimated at 3.5% per annum. By 2044, the population is expected to reach approximately 5,149 people. The total daily water demand for the area at the ultimate design stage is projected to be 74.5m³/day. This includes water for human consumption, livestock, and institutions.

Table 1: Projected Water Demand

Consumer	Initial (2024)	Future (2034)	Ultimate (2044)
Humans	29.8m³	47.5m³	66.1m³
Livestock	14.4m³	20.3m³	28.7m³
Institutions	2.3m³	3.2m³	4.6m³
Total	**46.5m³**	**71.0m³**	**99.4m³**

The existing water sources are inadequate to meet this demand, necessitating the construction of additional infrastructure and the enhancement of existing water supplies. The project will tap into the existing borehole, supplementing it with improved storage and distribution systems to ensure a reliable water supply.

2.4.2. Construction Materials Requirements

Several machines will be required for successful operation of the proposed project. Although hand tools will be increasingly used during construction of the pipeline, some sections e.g. the main pipeline will require minimal use of machinery. The number of equipment and machineries to be used will be confirmed at the start of construction works. Where destruction or interruption of business is realized use of machines will be avoided. The Table below gives a summary of equipment, and machines required for successful implementation of the project.

Table 2: Project equipment and facilities requirements

S. No	Equipment/ Facility	Purpose
1	Hand tools including jembes, Spades and mattocks	For use in the excavation of trenches
2	Excavators	Excavation works.
3	Loaders	For mobilization of excavator to site
4	Rollers	For compacting surfaces
5	Pick-up truck	For transportation of personnel to site
6	Drilling machines	For rock drilling
7	Butt fusion machine	For jointing of HDPE pipes
8	Portable toilet	For use by construction workers.

2.5. Labour requirements

Several personnel will be required at the project site to carry out various activities and functions associated with implementation of the proposed project. They include among others professional staff, operators, drillers, drivers and labourers. The number of personnel to be involved in the Works will however be determined at the commencement of project construction. The Table below gives a summary of personnel requirements for the proposed project. It is recommended that priority is given to the residents of Githunguri area when recruiting the personnel.

Table 3: Labour requirements for project operations

No	Trade	Responsibility
1	Inspectors of works	Overseeing the site operations and work instructions
2	Health and Safety Officer	Supervision of implementation of health and safety requirements during project implementation
3	Environmentalist	Supervision of implementation of environmental requirements during project implementation
4	Sociologist	Dealing with community liaison and grievances arising in the course of project implementation
6	Laborers	In charge of unskilled labour within construction sites
7	Drivers	In charge of driving vehicles and equipment used in construction sites
8	Plumbers	In charge of plumbing works within construction sites
9	Masons	In charge of masonry works
11	Excavator operator	In charge of operation of excavators within construction sites

No	Trade	Responsibility
12	Surveyors	In charge of survey and positioning of works
13	Truck drivers	In charge of driving Trucks within the construction sites
14	Security Officer	In charge of site security

2.6. Waste generated

2.6.1. Excavated Soil and Rock Debris

During trench excavation for laying the pipeline, a significant quantity of soil and rock debris is anticipated to be generated. This waste is a direct result of the excavation process necessary for the trench, where the pipeline will be installed. The estimated quantity of this debris is approximately 1,500 cubic meters, calculated based on the trench's depth, width, and length. To manage this waste, the excavated soil can be reused for backfilling the trenches once the pipeline installation is complete. However, any excess soil and unusable rock debris that cannot be reused will be transported to a designated disposal site. Care will be taken to ensure that the disposal process does not obstruct drainage paths or cause erosion in the surrounding environment.

2.6.2. HDPE Pipe Cuttings and Offcuts

The installation process of the pipeline will generate waste in the form of HDPE materials, specifically pipe cuttings and offcuts. This type of waste arises when pipes are cut to fit specific lengths or shapes required during installation. The estimated quantity of HDPE waste is approximately 100 kilograms, a figure derived from the length of the pipeline and the installation procedures. To manage this waste, smaller offcuts can be retained for future repair works or additional connections. Unusable HDPE materials should be collected and sent to recycling facilities to ensure they are processed in an environmentally responsible manner.

2.6.3. Packaging Waste

The transportation and storage of construction materials will involve the use of various packaging materials, including plastic wraps, cardboard boxes, and wooden pallets. These materials will generate packaging waste, with an estimated quantity of approximately 500 kilograms of mixed waste. To manage this waste effectively, recyclable materials such as cardboard, paper, and plastic should be segregated and sent to recycling centers. Wooden pallets, which are often robust and reusable, can be repurposed for future material transportation or other construction projects, thus minimizing waste.

2.6.4. Construction Material Waste

The construction process, particularly concrete works for structures such as valve chambers and thrust blocks, will produce waste from materials like cement, sand, and gravel. The estimated quantity of this mixed construction waste is around 200 kilograms. Effective management of this waste begins with careful planning and precise measurements to minimize excess material. Where feasible, excess materials can be reused on-site for other construction purposes. If reuse is not possible, the materials will be disposed of at approved construction waste disposal sites.

2.6.5. Hazardous Waste

During the project, small quantities of hazardous waste may be generated, primarily from equipment maintenance. This includes waste such as lubricants, oils, and chemical cleaners. Disposal of hazardous waste will be conducted through licensed waste management services, ensuring adherence to environmental regulations to prevent contamination of the environment.

2.6.6. Organic Waste

Vegetation and organic matter cleared from the pipeline route will contribute to organic waste generation. This waste, estimated to be around 200 cubic meters, results from the necessary clearing of vegetation to create a clear path for the pipeline. Organic waste management strategies include mulching, where the organic matter is shredded and used for erosion control or landscaping purposes. Additionally, if feasible, organic waste can be composted to produce soil conditioners, contributing to soil health and reducing the need for chemical fertilizers.

2.7. Applicable permitting process

A legal register listing all legislation and legal instruments relevant to the site has been prepared, indicating applicability to the site. In addition, permits and licenses that are required to be obtained by the project during construction and operation has been provided.

No.	Licenses/Permits	Legislation
1.	ESIA License for project	EMCA 1999
2.	Water extraction permit from water resource authority	Water Act 2016
3.	Workplace Registration License from DOSHS	OSHA 2007
4.	NEMA License to transport waste	EMCA 1999
5.	NEMA Noise Vibration Permit	EMCA 1999
6.	Plant and Equipment Inspection DOSHS	OSHA 2007
7.	Business/Trade permit: County Government of Nyandarua	

2.8. Project cost and BoQ

The total project cost for the installation of the bulk meters and associated accessories is Kenya shillings Ten Million Three hundred and Seventy-Nine Thousand Five hundred and Sixty (Ksh.10,379,560). The EIA processing fee payable to NEMA is 0.1% of the project cost which translates to KSh. 10,379.

(See appendix D: BoQ)

3. LEGISLATIVE, POLICY AND INSTITUTIONAL FRAMEWORK

Regulation 18 (1) (b) of the Environmental (Impact Assessment and Audit Regulations) 2003 require an environmental assessment study report to, among others; include a concise description of national environmental legislative and regulatory framework. This chapter presents a review of the current policy, legal and regulatory framework applicable to environmental management of the proposed water networks, both at local and international levels.

3.1. Applicable Nyandarua County Laws

No	Policy	Relevance	Applicability to The Project
1	Nyandarua County Natural Resources (Wetlands and Riparian Areas) Management Bill, 2024	The objective of the Bill is to promote the conservation and sustainable management of wetlands, water catchments, and riparian areas. It seeks to integrate the sustainable use of these resources into county and national development plans, ensuring they are utilized for ecological, socio-economic, and aesthetic purposes for the benefit of all citizens.	By providing clean and reliable water, it supports socio-economic development, helps prevent pollution, and minimizes the environmental degradation of sensitive ecosystems. The pipeline's implementation also fits into broader county and national resource management plans, contributing to the long-term sustainability of water catchments.

3.2. Applicable National policies, laws and regulations

Table 4 presents a summary of relevant policies that were analysed in this ESIA.

Table 4: Policy Framework Relevant to the Water Networks Project

No	Policy	Relevance	Applicability to the Project
1	National Environment Policy (NEP)2013	The Policy goal is towards a better quality of life for present and future generations through sustainable management and use of theenvironment and natural resources. The objective of the policy among others is to ensure sustainable management of the environment and natural resources, such as unique terrestrial and aquatic ecosystems, for national economic growth and improved livelihoods.	The proposed project will contribute to achievement of this policy's mission through provision of water after the construction of the Transmission and distribution Pipelines. This Project will lead to equitable distribution of water in Githunguri area.
3	The National Water Policy, 2021	The water policy proposes to mitigate the challenges and threats facing the water sector by ensuring that coordination and accelerated partnerships are mainstreamed in the management and provision of water resources. It also sets the goal of enhancing protection of watersheds and other catchment areas in the country.	The Water Pipeline Project will result into sustainable utilization of scarce water resources through equitable distribution.

No	Policy	Relevance	Applicability to the Project
4	The National Environmental Sanitation and Hygiene Policy-July 2007:	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 behaviour and practices begin with the individual.	The proposed water pipeline contributes towards achievement of this policy through provision of sustainable water for domestic use to residents of Githunguri.
5	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, among them Preserve, conserve, and protect available water resources and allocate it in a sustainable rational and economic way.	The proposed water networks project will result into sustainable utilization of scarce water resources through equitable distribution
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 / improvement of water infrastructure
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, socio-economic groups, planners and policy makers in water resource management (Kenya, 2010: 53).	Provision of Sustainable water to residents of Githunguri is a way of ensuring community resilience to climate change impacts. The Project will ensure that water resource is utilized in ways that recognize that it is a finite resource
8	Climate Change Policy Framework 2016	The Policy was developed to facilitate a coordinated, coherent and effective response to the local, National and global challenges and opportunities presented by climate change. An overarching mainstreaming approach has been adopted to ensure the integration of climate change considerations into development planning, budgeting and implementation in all sectors and at all levels of government. This Policy therefore aims to enhance adaptive capacity and build resilience to climate variability and change, while promoting a low carbon development pathway.	The proposed water pipelines is among the projects that align to provision above especially in fight against poverty and food security through provision of sustainable water to residents of Githunguri area.
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: Expanding and improving infrastructure and Safeguarding environment and natural resources among others. The proposed Project directly conforms to these provisions.

No	Policy	Relevance	Applicability to the Project
11	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.	The project will provide direct employment to the youth as required by the Policy.
12	National Gender and Development Policy, 2019	The goal of the policy is to "achieve gender equality and women's empowerment in national development so as to enhance participation of women and men, boys and girls, vulnerable and marginalized groups for the attainment of sustainable development". The policy sets, legislative and administrative measures to address the existing gaps in the realization of gender equality and women's empowerment	The policy will be important at the time of recruiting workers during Project implementation.
13	National policy for prevention and response to gender-based violence, 2014	The overall Goal of this National Policy is to accelerate efforts towards the elimination of all forms of GBV in Kenya. The Policy Goal is to be realized as laid out in the key objectives which seek to ensure; a coordinated approach in addressing GBV and effective programming; enhanced enforcement of laws and policies towards GBV prevention and response; increase in access to quality and comprehensive support services across sectors; and improved sustainability of GBV prevention and response interventions.	Provisions of this policy will be adhered to during project implementation phase.
14	The National Occupational Safety and Health Policy, 2012	The main objective of this policy is to establish National occupational safety and health systems and programmes geared towards the improvement of the work environment. The Policy seeks to reduce the number of work- related accidents and diseases, and equitably provide compensation and rehabilitation to those injured at work or who contract occupational diseases. It thus requires employers to ensure safety and health at workplace, establishment of safety and health committees at workplaces, conduct training on occupational safety and health and report accidents, diseases and other dangerous occurrences to relevant authorities	The contractor will be given a copy of the ESMP to develop Contractor-ESMP for compliance during construction including provision of PPE, erection of signages at critical points, sealing the pan construction area to avoid unauthorized entry and accidents.
	Sustainable Waste Management Policy, 2021	The policy aims to promote sustainable waste management through the application of waste hierarchy and circular economy principles. It seeks to improve the efficiency of waste management processes, including mapping, planning, and transportation.	The project will incorporate sustainable waste management practices by implementing waste hierarchy and circular economy principles. This includes reducing waste generation through efficient planning and design, reusing materials where possible, and recycling construction by-products.

3.3. Legal Framework

Applicable Acts of Parliament as summarized in **Table 5** were reviewed.

Table 5: Legal Framework Relevant to Water Infrastructure

Acts	Relevance	Applicability to the Project
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 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.	The proposed project will comply with all constitutional requirement of ensuring sound management of the environment by implementing the proposed environmental and social management plan. 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.
EMCA 1999	The Environmental Management and Coordination Act of 1999 (EMCA) 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. EMCA and its subsidiary legislations are enforced by the National Environment Management Authority (NEMA). Section 58, all projects listed in the Second Schedule of the Act must submit a study report to NEMA.	The water Project is classified under Medium-risk project in the Second Schedule of EMCA 1999, and thus requires an ESIA. By conducting this ESIA, the project therefore complies with the Act.
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 this Act to acquire land for projects, which are intended to benefit the general public. 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.	The water pipeline is designed to be layed along existing easements and road reserves. The Act will be useful in providing the legal framework for managing public land, facilitating the acquisition of private land for public benefit when necessary, and ensuring that affected landowners are fairly compensated during the implementation of the project.
Environment and Land Court Act, 2011	Article 162 of the constitution provides for the creation of specialized courts to handle all matters on land and the environment. Such a court will have the status and powers of a High Court in every respect. Article 159 on the principles of judicial authority, indicates that courts will endeavour to encourage application of alternative dispute resolution mechanisms, including traditional ones, so long as they are consistent with the constitution.	The Act will be useful in provision of guideline on resolving disputes that might arise related to land or environment.

Acts	Relevance	Applicability to the Project
	Section 20, of the Environment and Land Court Act, 2011 empowers the Environment and Land Court, on its own motion, or on application of the parties to a dispute, to direct the application of alternative dispute resolution (ADR), including traditional dispute resolution mechanisms.	
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.	The proposed water networks Project is envisaged to provide reliable water to residents of Githunguri area in line with the provisions of this Act.
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 hold and dispose of assets, and delegate functions, such as through sub-contracts and partnerships.	PART VIII of the Act provided for Citizen Participation principles which include timely access to information, data, documents, and other information relevant or related to policy formulation and implementation among others. Similarly, implementation of the proposed Pipeline Project will be done through sustained public participation as provided for by this Act.
Physical and Land Use Development Plan Act 2019	Part IV of the Act provides objectives of development control which are to ensure orderly physical and land use development, to ensure the proper execution and implementation of approved physical and land use development plan and to protect and conserve the environment. Further section 56 provides that Subject to the provisions of this Act, the Urban Areas and Cities Act, 2011, and the County Governments Act, 2012, the county governments shall have the power within their areas of jurisdiction to consider and approve all development applications and grant all development permissions among other roles.	As guided by this Act, the project proponent will seek requisite approvals from the Nyandarua County Director of Physical Planning prior to commencement of the works discussed in this report.
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 neighbouring community.	OSHA is enforced by the directorate of occupational safety and health services (DOSHS). Further, the project contractor will be expected to register the site as a workplace with DOSHS and engage the directorate in handling work related accidents.
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 as well as other measures such as provision of condoms among others.
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	To comply to provisions of this Act, the contractor will integrate Sexual Exploitation and Abuse (SEA) in job descriptions, employments

Acts	Relevance	Applicability to the Project
	focuses mainly on sexual offenses on minor (children).	contracts, performance appraisal systems, etc. Development of contract policies related to SEA, including whistle- blower protection and investigation and disciplinary procedures; training for all project management; management of coordination mechanism for case oversight, investigations and disciplinary procedures; supervision of dedicated SEA focal points in the project and trained community liaison officers among other measures.
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.	The contractor will undertake the below listed measures among others; The contractor will develop and implement a Children Protection Strategy that will ensure minors are protected against negative impacts associated by the Project including SEA. All contractor's staff must sign, committing themselves towards protecting children, which clearly defines what is and is not acceptable behaviour
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 especially during hiring of workers, the aim will be to ensure adequate representation of women in the Project.
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 if the project encounters such materials. Chance Find Procedures have been provided in this report. The provisions of the Act are mainly enforced by the National Museums of Kenya (NMK)
Energy Act 2019	PART VIII provided for energy efficiency and Conservation of energy resources, the Act provides that factories and buildings and energy appliances by types, quantities of energy use, or methods of energy utilization for purposes of energy efficiency and conservation, as provided by the act safe handling of	Requirements for dealing in energy handling including safety are enforced by the Energy and Petroleum Regulatory authority (EPRA). EPRA will be instrumental in licensing the bulk storage of

Acts	Relevance	Applicability to the Project
	petroleum used by plant and equipment on site will be emphasized	petroleum on site where necessary.
Traffic Act 2015	PART V of the Act provides driving and other offences relating to the use of vehicles on roads. The act provides explicit measures related to; Speed of motor vehicles, Penalties in relation to speed, driving under influence of drink, Driving on pavement, pedestrian walkway, Causing death by driving or obstruction, Reckless driving, Signals and signs to be obeyed, Condition of vehicles, Limitation of loads.	This Act will be cited in relation to construction phase on site. This act is enforced by the Traffic Police Department and the National Transport and Safety Authority (NTSA).
Public Health Act, CAP 242	This is an Act of Parliament which makes provision for good public sanitation and maintenance of health. Part III section 17-18 highlights on what the proponent should do in case of an outbreak of infectious diseases within the area. The infectious diseases apply to small pox, plague, cholera, typhus fever, acute poliomyelitis, rabies and many more as highlighted in this section. The Public Health Act makes provision for securing and maintaining health. For instance, the local authorities are supposed to take measures for preventing any pollution dangerous to health of any supply of water that the public uses for domestic purposes and purifying the sources that have been polluted. They are also supposed to take action against persons causing pollution to the water sources.	The contractor will be required to provide sanitary facilities and solid waste containers for use by construction workers on site during construction phase.
Climate Change Act 2016	The Act establishes a cooperation called National Climate Change Council whose responsibility among others is to advise the national and county governments on legislative, policy and other measures necessary for climate change response and attaining low carbon climate change resilient development. The act further provides that the Cabinet Secretary shall, in accordance with Article 10 of the Constitution and section 3 of this Act, and through public consultation, formulate a National Climate Change Action Plan (NCCAP) In formulating the National Climate Change Action Plan, the Cabinet Secretary shall be informed by social circumstances in particular, the likely impact of the action plans, strategies and policies on biodiversity and ecosystem services among other measures.	The proposed Project is among projects that align to provision of the National Climate Change Action Plan (NCCAP) efficient utilization and conservation of freshwater resources.
Penal code CAP 63	Chapter XVII on “Nuisances and offences against health and convenience” contained in the penal code strictly prohibits the release of foul air into the environment which affects the health of the persons. Section 191 of the penal code states that if any person that voluntarily corrupts or foils water for public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an offence.	Human and Solid (refuse) Waste disposal and other project related activities shall be carried out in such a manner as to conform to the provisions of the code.

Acts	Relevance	Applicability to the Project
The Standards Act Cap 496	This Act promotes the standardization of the specification of commodities and provides for the standardization of commodities and codes of practice to ensure public health and safety. It establishes the Kenya Bureau of Standards (KEBS) and defines its functions as related to promotion of standardization in industry and commerce; and Deciding or provision of facilities for the testing and calibration of precision instruments, gauges and scientific apparatus, for the determination of their degree of accuracy by comparison with standards approved by the Minister on the recommendation of the Council, and for the issue of certificates in regard thereto.	This means that the contractor under the supervision of the Engineer will ensure that all materials used on site adheres to the highest standards and do not pose any human health and safety risk.
The National Construction Authority Act, 2011	The Act provides for the establishment, powers and functions of the National Construction Authority (NCA). For accountability purposes, it requires all contractors to be registered and having valid annual practicing licenses. It also allows for public complaints against the contractor, which may trigger investigation by NCA into the conduct of such a contractor.	The proponent will only hire a licensed contractor to undertake the construction works. Complaints against the contractor will first be addressed through the project Grievance Redress Mechanism (GRM) and other measures only acting as a last resort.
Sustainable Waste Management Act, No. 31 of 2022.	The Act identifies the following objectives: sustainable waste management promotion; improving the health of all Kenyans by ensuring a clean and healthy environment; reduction of air, land, fresh water and marine pollution; ensuring the delivery of waste service; creating an enabling environment for employment in the green economy in waste management, recycling and recovery; circular economy practices promotion; mainstreaming resource efficiency principles in sustainable consumption; improving responsible public behaviour on waste and environment. The Act is based on the following principles: precautionary principle; polluter pays principle; payment for ecosystem services; zero waste principle.	The contractor will incorporate waste management strategies to handle construction debris and other waste products effectively.

3.4. Regulations and Rules

Applicable Regulations and Rules as summarized in **Table 6** were reviewed.

Table 6: Regulations and Polices

Regulation	Relevance	Applicability to the Project
The Environmental (Impact Assessment and Audit) Regulations, 2003	The regulation provides a framework under which Environment Impact Assessment for the Factory is prepared, Regulation 4(1) further states that: (a) "…no Proponent shall implement a project: likely to have a negative environmental impact. (b) for which an environmental impact assessment is required under the Act or these Regulations, unless an environmental impact assessment has been concluded and approved in accordance with these Regulations…"	Provisions of the regulations were applied during preparation of this report.

Regulation	Relevance	Applicability to the Project
Environmental Management and Coordination (Water Quality) Regulations, 2006	Regulation 9 of these regulations provides for water quality monitoring. It states that the "Authority in consultation with the relevant lead agency, shall maintain water quality monitoring for sources of domestic water at least twice every calendar year and such monitoring records shall be in the prescribed form as set out in the second schedule to these regulations". The regulations provide for sustainable management of water resources including prevention of water pollution and protection of water sources (lakes, rivers, streams,' springs, wells and other water sources). Construction of the dam provides for sustainable management of such water resources.	Provisions of the regulations were applied during preparation of this report.
(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 contractor will use provisions of this regulation to ensure that waste is handled, stored, transported and disposed as per this regulation.
Noise and Excessive Vibration Pollution (Control) Regulations, 2009	The Contractor will be required to ensure compliance with the above regulations to promote a healthy and safe working environment throughout the Construction Phase. This shall include regular inspection and maintenance of equipment and prohibition of unnecessary hooting by vehicles. The regulations provide for a maximum of 60 dBA during the day and 35 dBA during the night for a construction site.	Provisions of the regulations were applied during preparation of this report.
The Environmental Management and Coordination (Air Quality Regulations 2014)	These regulations provide a framework for management of plant and equipment emissions of hydrocarbons on site. The regulations require that all plant and equipment on site should be well serviced to manufacturers specifications to avoid air pollution, the regulation also require monitoring of baseline air quality within construction site and implementation of correction action where the standards are not complied to.	Water spray will be always used when working in dry areas to avoid risks associated with dust menace. Particulate matter (PM_{10}), equipment's will be operated as provided by manufacturers specification to eliminate cases of Oxides (SOx), Nitrogen Oxides (NOx) and Volatile Organic Compounds (VOC).
Fire Risk Reduction Rules, 2007	The rules require electrical equipment be installed in accordance with the respective hazardous area classification system, flammable materials are stored in appropriately designed receptacles, electrical equipment is inspected after six months by a competent person and the Proponent is required to keep records of such inspections, installation and maintenance of firefighting systems in workplaces, fire drills at least once a year, assembly points be marked, undertake annual fire safety audits etc.	The contractor will be required to store all flammable materials and liquids safely to avoid risk of fire.

Regulation	Relevance	Applicability to the Project
Medical Examination Rules, 2005	It requires workers on site to undergo regular medical examination to identify the symptoms of hazardous exposures on the body, especially those who handle food or food products. This is with a sole purpose of monitoring exposure for remedial action.	The contractor will institute and implement regular medical examinations for its staff at the facility. These will include COVID 19 temperature check-up and drug abuse (at least alcohol on daily basis).
Safety and Health Committee Rules of 2004	These rules require the proponent and contractor (once they employ a more than twenty persons) to establish a committee to address the health, safety and welfare of workers. The Proponent and by extension the contractor, are required to provide space for meetings for the committee, training of the S&H Committee, appoint a S&H management representative, as well as allowing all staff to attend these meetings with no risk of loss of earnings, opportunities for promotion or advancement. They should also make legislation on occupational safety and health available to the Committee.	The contractor will develop a clearly defined safety and health policy and bring it to the notice of all employees at the workplace. They are also required to implement and review the policy when need arises. If construction workers exceed 20, the contractor will facilitate the formation of a S&H Committee and its operations.
First-Aid Rules, 1977	Rule 7 of First-Aid Rules, 1977 require that (No person shall be placed in charge of a first aid unless he has received adequate training and holds a certificate of competence	The contractor will conduct first aiders' training for the first time and a refresher training Bi-annually.
Water Management Regulations, 2021	Matters covered by these Regulations include: prescription of water use activities; issue of approvals, permits and authorizations for water use and waterworks; guidelines on surface water, including declaration of a watercourse, wetlands, land reclamation, water use for irrigation and Works Associated for protection and control of fish; groundwater development, including borehole and issue of specific permits and authorizations; water quality monitoring and liquid waste disposal, including control of water pollution, water quality monitoring; inspection and controls concerning waterworks; water use charges, including penalties for misuse or for over-abstraction; roles and powers of water resource users associations and basin water resources committees; identification of protected and designated groundwater conservation areas; composition of reserve; categories of water sector professionals and contractors and issue of related permits and licences	The project will adhere to these Regulations by obtaining all necessary approvals, permits, and authorizations for water use and construction activities. It will comply with guidelines for surface and groundwater management, implement water quality monitoring and pollution control measures, and ensure regular inspections. The project will respect protected and designated areas, collaborate with local water resource associations, and employ licensed water sector professionals.
Extended Producer Responsibility Regulations 2022	Aims to extend the responsibility of producers over their products and packaging throughout their entire life cycle. The regulations also provide a framework for the establishment and operation of mandatory extended producer responsibility schemes and promote a collaborative approach to the management of products and associated wastes.	The contractor will ensure that materials used, including pipes and construction supplies, are managed in a way that minimizes environmental and health impacts. The project will focus on selecting recyclable and recoverable materials, managing hazardous substances carefully, and implementing cost-effective waste management strategies.

3.5. World Bank Operational Safeguard Policies

Applicable World Bank Safeguard Policies that are triggered by the project are summarized in **Table7.**

Table 7: World Bank Safeguard Policies

Safeguards Policies	Provision	Relevance to the Project
World Bank OP 4.01 on Environmental Assessment	Provides framework for WB environmental safeguard policies and describes project screening and categorization to determine level of environmental assessment required. For category A and B projects the policy requires public consultation and disclosure to be undertaken as part of the EA process. If indigenous people are found to be affected, in addition to consultation, it is necessary to prepare a plan to avoid or mitigate adverse impacts on such groups and ensure that they have access to project benefits to the extent that they wish to.	An Environmental and Social Impact Assessment of Proposed Project Components is required and therefore the need for this report.
World Bank OP 4.12 On Involuntary Resettlement	The policy provides that Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative Project designs. Where it is not feasible to avoid resettlement, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the persons displaced by the project to share in project benefits. Displaced persons should be meaningfully consulted and should have opportunities to participate in planning and implementing resettlement programs. Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levelsprevailing prior to the beginning of project implementation, whichever is higher	Triggered: 1PAP will be compensated for the loss of business.
World Bank OP 4.11on Physical CulturalResources	Provides for measures to protect cultural heritage from the adverse impacts of project activities and support its preservation;	Requires assessment for any physical cultural resources or requirespreparation of chance find procedures be prepared during implementations of Projects. Appended to this ESIA arechance find procedures to be adopted in the event such resources are encountered during Project construction phase.

3.6. World Bank Group Environmental Health and Safety Guidelines on Water and Sanitation

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry- specific examples of Good International

Industry Practice. When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards.

These industry sector EHS guidelines are designed to be used together with the General EHS Guidelines, which provides guidance to users on common EHS issues potentially applicable to all industry sectors.

The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs.

Application of the EHS Guidelines to existing facilities may involve the establishment of site -specific targets, with an appropriate timetable for achieving them.

Relevance to the Project

The EHS Guidelines for Water and Sanitation include information relevant to the operation and maintenance of:

i. Potable water treatment and distribution systems

ii. Collection of sewage in centralized systems or decentralized systems and treatment of collected sewage at centralized facilities.

The above discussed Guidelines/ Instruments, present Environmental Health issues concerned with Water Distribution and the necessary requirement to assure adequate capacity to supply the water demand.

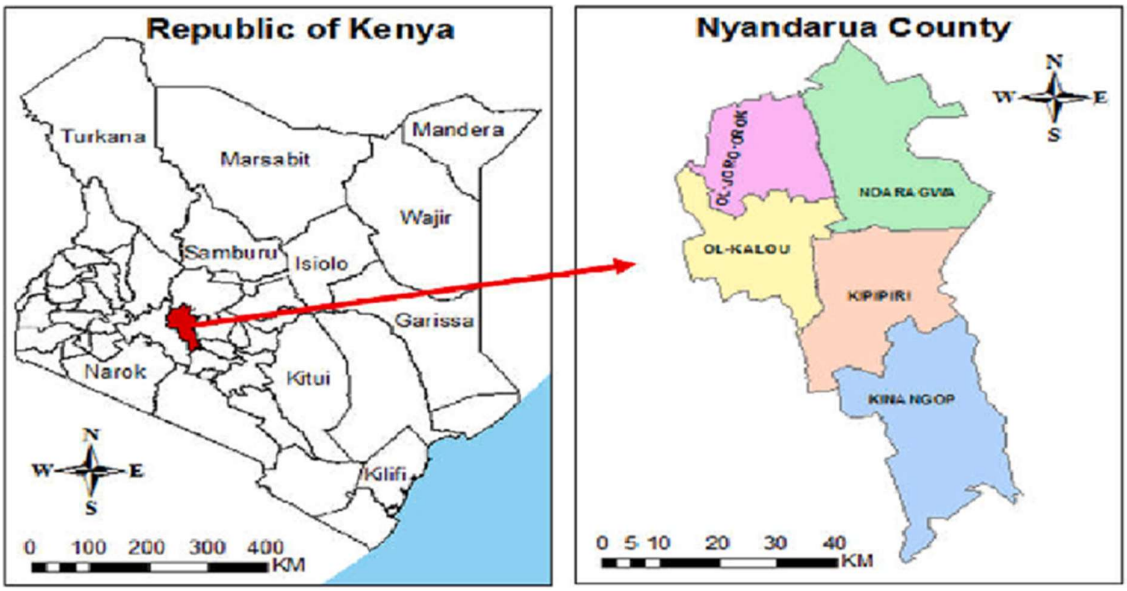
The most significant environmental issues associated with operation of water distribution systems include: Water system leaks, loss of pressure and water discharges. The design for the project has ensured these environment risks are mitigated.

4. BASELINE INFORMATION

4.1. Background

Nyandarua County is in the central region of Kenya and lies between latitude 0°8' North and 0°50' South and between Longitude 35° 13' East and 36°42' West. It borders Kiambu to the South, Murang'a to the Southeast, Nyeri to the East, Laikipia to the North, and Nakuru to the West. The County is privileged to have the equator passing through two points in O1'Joro'Orok (Gatimu) and Ndaragwa (Gwa-Kung'u) sub-counties. The area of the County is approximately 3245.1 Square Kilometres part of which is covered by the Aberdare Ranges. The map below shows the position of Nyandarua County

Figure 4- 1: Map of Nyandarua County



Nyandarua County headquarters are in Ol'Kalou town which is approximately 150 Kilometers Northwest of Nairobi. This town was the headquarter for the defunct Ol'Kalou town council which was the only elevated local authority in Nyandarua and had a small jurisdiction. Ol'Kalou was an underdeveloped urban centre with no tarmacked roads, parking lots, streetlights, sewerage system and few financial institutions, among other amenities found in other urban centres. However, the County is in a prime location with urban centres/towns surrounding it such as Nakuru, Gilgil, Nyahururu, Naivasha, Kiambu, Murang'a, Nyeri and Nairobi. To Nairobi, it is connected via (A2) to Mombasa, and Kisumu via (A12). This interconnectivity provides Ol'Kalou with an enviable opportunity to engage in trade and investments as it can be considered a hub within its environs. The County Government model of resource allocation and application will be inevitable in propelling its status to that of the neighbouring urban centres.

The mode of transport is predominantly via road with the road network and its interconnectivity to the neighbouring towns sufficient. The Ol'Kalou- Miharati-Engineer Road, class (B20) traverses the entire County of Nyandarua, from Dundori to Njabini. It connects to the Nakuru-Nairobi (A8) Highway via Dundori, Gilgil, Naivasha and Magumu points. The County is linked to Nyahururu and Gilgil by the (A4) road which then connects to the Nyahururu-Nyeri Road; class B2l. The C487 road connects Ol'Joro'Orok to Dundori through

Charagita centre. Road D1323 links Engineer and Naivasha facilitating movement from Nyandarua to Nakuru County. The airstrip in O1'Joro Orok Sub-County links the County to surrounding air transport facilities. The railway line connects the County to Nyahururu and Gilgil towns although the two are not operational.

The socio-economic mainstay in Nyandarua is Agriculture and related industries. The main agricultural produce includes Irish potatoes, cabbages, carrots, peas, floriculture, pyrethrum, sugar beet, cereals, poultry and dairy. This is due to the favourable climate and natural resources such as fertile soils. The high agricultural production has made Nyandarua County a top producer of Irish potatoes accounting for over a third of the national production and the second top producer nationally of milk in turn becoming a food basket and a strategic County in national food security. The sector employs about 69% of the population and contributes approximately 73% of household incomes. Other significant contributors to the County economy are general commerce including wholesaling and retailing, tourism-related activities as well as timber sector which in turn has created significant employment opportunities.

Due to its location in Central Kenya, the inhabitants are predominantly of Kikuyu origin and settled from Kiambu, Murang'a and Nyeri during and after the colonial era. The Kikuyu account for more than 95% of the County inhabitants with other tribes accounting for the remaining 5%. The other major inhabitants include Turkana, Gusii, Luo, and Luhya who settled there due to intermarriages and employment. These minority tribes are spread across the County evenly.

The County is also a member of the Central Region Economic Block (CeREB) comprising nine other member Counties namely Nakuru, Laikipia, Nyeri, Murang'a, Kiambu, Embu, Tharaka Nithi, Kirinyaga and Meru. These counties are relatively homogeneous in terms of economic activities with all of them engaging heavily in agriculture. Further, the inhabitants are predominantly Eastern Bantus. Other regional economic blocks in the country include Lake Region Economic Bloc (LREB), North Rift Economic Bloc (NOREB), Frontier Counties Development Council (FCDC), Jumuia Ya Kaunti Za Pwani, and Southeastern Kenya Economic Bloc.

4.2. Physical Environment

4.2.1. Physiographic Characteristics

The formation of the County was greatly influenced by volcanism and faulting that created the major landforms namely: The Great Rift Valley to the west and the Aberdare ranges to the east. The County's topography is characterized by a mix of plateaus and hilly areas.

At 3,999 metres above sea level, the Aberdare Ranges is the highest point in the County while the lowest parts include Lake Ol'Bolossat, Leshau and the northern part of Ndaragwa Central Ward, lower Kaimbaga, and the western parts of Kipipiri, Githioro and Murungaru Wards. The flat areas include Kinangop and Ol'Kalou/Ol'Joro Orok plateaus.

Over time, rock weathering has transformed the Aberdare Ranges, which dissects the slopes into shallow valleys and the gorges with deep and well-drained soils. As they approach Ol'Kalou and Kinangop plateaus, these valleys flatten with only a few gorges draining river water down the escarpment and onto the floor of the Rift Valley. Ol'Kalou Salient Plateau in the north and Kinangop Plateau to the south stretch north-south between the Aberdare ranges and a system of fault scarps which form the escarpment. Dundori Hills represent a high weathering resistant block of the scarp. The two plateaus extend to about 80 km from

north to south and about 40 km wide north of Ol'Kalou town. Gentle slopes intermitted by low hills flatten into marshlands and swamps. The rest of the land is well-drained and has fertile soils of volcanic origin. Soils in the Kinangop and Ol'Kalou plateaus are poorly drained clay loam. However, Ndaragwa, the northern part of Ol'Joro Orok and Ol'Kalou have well-drained clay loam with different crop production potential. The plateaus have the key settlement zones.

There are eight permanent rivers; Malewa, Ewaso Narok, Pesi, Turasha, Chania, Kiburu, Mkungi, and Kitiri. Lake Ol'Bolossat which is the largest water mass in the County is fed by streams and underground water seepage from the Aberdare and Dundori hills. Human activities and clearing of the catchment areas for settlement have affected its natural refilling system and its existence is threatened.

The Aberdare Ranges is one of the country's major water towers. Moreover, the Aberdare ecosystem constitutes a dense forest with several animal species including elephants, baboons, Columbus monkeys, tree and ground squirrels, porcupines, and many bird species. On the slopes of the Aberdare Ranges are also the Mau Mau caves in Geta and Kimathi. The ranges offer great potential for local and foreign tourism in the County as they border the Aberdare National Park to the east and can be developed as nature trails and for mountain climbing.

4.2.2. Ecological conditions

Some areas in the County are in the highland savannah zone, characterized by scattered trees with expansive grass cover. In elevated areas, tree cover increases forming thick forests with thick undergrowth. However, most of the natural vegetation has been cleared leading to environmental hazards such as environmental degradation which has claimed large portions of arable land. This has had some negative effects such as reduced rainfall, soil erosion, reduced soil fertility, poor health and reduced food production.

The County is categorized into seven agro-ecological zones (AEZs) namely:

- UH1 (North and South Kinangop), which receives relatively high rainfall
- UH2 (North Kinangop), which falls in the high rainfall zone
- UH3 (Ol Kolou, Kinganop)
- UH4 (Ol jor Orok, Kipipiri)
- LH3 (Ol Kalou), receiving a moderate amount of rainfall
- LH4 (Ndaragwa, Kipipiri), in dry, ranching zone
- LH5 (Ndaragwa), which is largely dry

The County has been greatly affected by climate change. This has led to emergent weather patterns which were hitherto unprecedented. Incidences of unpredictable weather patterns have become common in the last decade affecting negatively agriculture production as well as increasing health challenges associated with weather changes. Floods and droughts have become common occurrences lately.

The Climate has been observed to change in Nyandarua. Since 1981, the first wet season has experienced a moderate (1 ºC) increase in mean temperature and associated reduction in the crop cycle, and a slight tendency for increasing precipitation. The second wet season experienced a mild (~0.5 ºC) increase in temperature and no change in precipitation. Looking

to the future in the years 2021-2065, prolonged moisture stress is projected to occur across both seasons of the year analysed, whereas intense precipitation looks to change little.

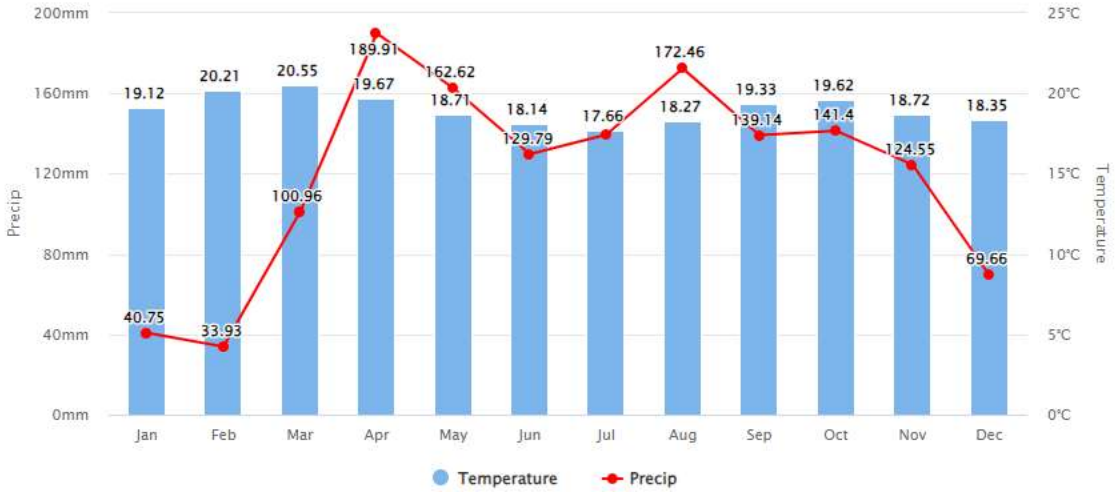
4.2.3. Climatic Conditions

The temperature in the County ranges between 12°C in July and 25°C in December. The County can, therefore, be considered to have a moderate temperature. High temperatures, which are low by the national average, are experienced between December and March with the lowest temperatures occurring in July. The highest temperature in December has a mean average of 25°C while the lowest in July has a mean average of 12°C. Variation of the temperature has adverse effects, especially on crop cultivation; when cold air during clear nights on the moorlands of the Aberdare Ranges flows down the Kinangop and Ol'Kalou Plateaus it causes night frost almost monthly.

Maximum rainfall of about 1700 mm is received during March and May which coincide with the wet season, (also known as the second season) and minimum rainfall of about 700 mm during September- December (coinciding with the dry season, also known as the first season). The rainfall decreases from East to West. Nyandarua County has had reliable rainfall which is generally well distributed throughout the year but is starting to be erratic due to climate change. The Aberdare Ranges and the Dundori Hills influence rainfall distribution in the area, with areas like Njabini and South Kinangop receiving higher amounts of rainfall while areas of Ndaragwa and Ol'Kalou receive comparatively low rainfall. In a typical year, the County experiences two rainy seasons: long rains from March to May with a maximum rainfall of 1700 mm and short rains from September to December with a maximum rainfall of 700 mm. The average annual rainfall of the County is 1500 mm. Nyandarua County has an average relative humidity of 71.5%.

The chart below shows the mean monthly temperature and precipitation of Nyandarua in recent years.

Figure 4- 2: Monthly temperature and precipitation of Nyandarua



4.2.4. Air Quality

As of August 26, 2024, the air quality in Nyandarua County, is classified as "Good," with an Air Quality Index (AQI) of 42. This indicates that the air quality is generally safe and poses minimal to no risk to public health. All individuals, including those in sensitive groups such as children, the elderly, and people with pre-existing respiratory conditions, can safely engage in outdoor activities.

The data shows that the concentration of PM2.5, or particulate matter smaller than 2.5 micrometers, is 10 μg/m³. These particles are small enough to penetrate deep into the lungs and enter the bloodstream, but the current levels are well within safe limits according to international standards. Despite this, it is important to maintain continuous monitoring to ensure that these levels remain low and do not pose a risk over time. Additionally, the concentration of PM10, or particulate matter smaller than 10 micrometers, is recorded at 14.7 μg/m³. PM10 includes particles such as dust, pollen, and mold spores, which can cause respiratory issues if they accumulate in higher concentrations. However, the current level in Nyandarua County is low and within safe limits, indicating that the air quality is not a cause for concern at this time.

The weather conditions in Nyandarua County also contribute to the good air quality. The temperature is a mild 18°C, which is generally comfortable for outdoor activities. Humidity levels are at 64%, which is moderate and likely aids in the dispersion of particulate matter, thereby helping to maintain good air quality. Additionally, the wind speed is 4 kph, indicating light winds that help disperse pollutants and prevent their accumulation in the area.

4.2.5. Assessment of climate risks

The project is susceptible to the impacts of climate change due to the increasing unpredictability of weather patterns in Nyandarua County. The county has experienced variations in rainfall and temperature over recent years, driven by climate change. These changes are likely to affect the water supply infrastructure and the overall effectiveness of the pipeline project.

The main climate risks associated with the project include:

- **Increased rainfall variability:** The county's historical rainfall patterns are becoming more erratic, affecting the water recharge rates and reliability of water sources such as boreholes and storage tanks.
- **Flooding during extreme rain events:** High rainfall amounts, especially during the long rains from March to May, may result in flooding that could damage infrastructure, including water pipelines, and overwhelm drainage systems.
- **Extended drought periods:** During dry seasons, the pipeline may experience increased demand due to water scarcity, straining both the infrastructure and the available water resources.
- **Temperature fluctuations:** Rising temperatures may increase evaporation rates from water storage systems and exacerbate water shortages during dry periods. Additionally, extreme cold conditions, such as frost, could potentially affect the pipeline materials and reduce their efficiency over time.

The **Climate Change Act, 2016** emphasizes the need for resilience and adaptation strategies in development projects, especially those concerning essential services like water supply. The Act provides a framework for mainstreaming climate change considerations into the design, construction, and operation of infrastructure projects to minimize vulnerability to climate impacts. Under this Act, the following provisions are relevant to the pipeline project:

- **Section 5 (c) on Climate Resilience:** The Act mandates the integration of climate risk assessments into all water infrastructure projects to ensure resilience to changing weather patterns. This includes evaluating how the pipeline will withstand increased rainfall intensity, prolonged dry periods, and temperature variations.
- **Section 8 (a) on Adaptation:** Projects must include adaptation measures that mitigate the impacts of climate change, such as flood-resistant infrastructure and drought mitigation strategies, ensuring the long-term sustainability of water resources.

Potential Impacts of Climate Change on the Project

1. Increased Rainfall and Flooding Erratic and extreme rainfall, especially during the long rainy season (March-May), poses a significant risk of flooding, which could damage the pipeline and related infrastructure. Flooding may also lead to soil erosion, destabilizing pipeline foundations and increasing maintenance costs. Moreover, high rainfall runoff could contaminate boreholes and storage tanks, leading to water quality issues for the residents who rely on this supply.

2. Drought and Water Scarcity Extended periods of drought, particularly during the dry season (September-December), will likely reduce water availability in the borehole and other water sources feeding into the pipeline. This may force OLWASCO to impose water rationing or find alternative water sources, straining the system's capacity. As droughts become more frequent and intense, it could challenge the ability of the system to meet demand, necessitating upgrades to storage capacity and distribution efficiency.

3. Temperature Extremes While temperatures in Nyandarua County are moderate, the potential increase in extreme temperature variations could lead to increased evaporation from storage tanks and reservoirs, reducing water availability. Additionally, extreme cold, including night frost, may affect the durability and performance of pipeline materials.

Climate Adaptation and Mitigation Measures

In line with the **Climate Act 2016**, the following measures are proposed to protect the infrastructure from climate risks:

1. Flood-Resistant Infrastructure Design To mitigate the impact of flooding, the pipeline should be constructed with appropriate materials that can withstand high levels of water pressure and soil saturation. The design should incorporate flood-resistant techniques, such as elevating pipelines in flood-prone areas or installing protective embankments to minimize flood exposure.

2. Erosion Control and Drainage Improvements Proper drainage systems should be established to divert excess runoff away from the pipeline during periods of heavy rainfall. Erosion control measures, such as terracing, gabion walls, or planting vegetation along

vulnerable sections of the pipeline, will help maintain soil stability and reduce the risk of infrastructure damage.

3. Enhanced Water Storage Capacity To address the risk of water scarcity during drought periods, increasing the storage capacity of water tanks should be considered. This includes expanding tank volume or constructing additional reservoirs. These measures would ensure continuous water availability during prolonged dry spells, alleviating the strain on the water supply system.

4. Water Conservation and Efficiency Measures The project should incorporate water conservation strategies, such as promoting water-efficient technologies at the household level and reducing leakage within the pipeline system. This will ensure that the available water is used efficiently, particularly during drought periods.

5. Temperature-Resistant Materials Given the potential impacts of temperature fluctuations on the pipeline, materials that are resistant to both high temperatures and frost should be selected for pipeline construction. High-density polyethylene (HDPE) is generally suitable, but additional protection or insulation may be necessary in sections exposed to extreme conditions.

Monitoring and Evaluation

A robust climate monitoring and evaluation system should be established to track climate-related risks, such as rainfall patterns, water levels, and temperature changes. This will enable OLWASCO and other stakeholders to adjust the operation of the pipeline and implement corrective measures in a timely manner. Continuous data collection will also help predict future climate trends, informing long-term adaptation planning.

4.2.6. Water Quality and Hydrology

Water Quality:

Practically all types of water, i.e. runoff water, groundwater and even rainwater, contain some dissolved salts and impurities. If certain elements are present in high concentrations, the application of the water for domestic use or any other purpose may be restricted. The groundwater quality in the project area is generally fair. However, this is naturally improved by frequent recharge due to a large catchment and frequent rainfall at the upper reaches of the Aberdares Ranges.

Table 8: Water quality parameters in parts per million (ppm).

BH No.	PH	COND	FE	MN	CA	MG	THARD	TALK	CL	F	SO4	PO4	TDS
C-45	8.4	350	0.1	0.01	20	12	98	204	11	1.2	3.5	0.01	210
C-10742	7.2	122.8	0.04		3.2			8	3		0.3		73.7
C-10801	7.3	390					10	220	7	1.4	17		234

The above tabulated water quality data shows that Water quality in Ol'Kalou and the surrounding areas is generally good and within the KBS, W.H.O. and E.C. guideline on drinking water ionic concentrations.

Hydrology:

The County has four major rivers Pesi, Malewa, EwasoNyiro and Turasha. Malewa flows from the Aberdare ranges into Naivasha in the south. Ewaso Nyiro drains from Bahati escarpment through Ol JoroOrok to Laikipia. Turasha flows downwards to Naivasha while Pesi flows northwards to Laikipia. Most small rivers are drying up and this adversely affects the livelihood of the people in the district and beyond.

Lake Ol Bolossat is the only large natural water mass in the district. It is fed by streams and underground water seepage from the Aberdares Geta forest and Dundori Hills. Human activities and clearing of the catchments areas for settlement has affected its natural refilling system and its existence is threatened.

The project area is marked by good prospects for sustainable groundwater development. The boreholes drilled in Ol Kalou area and its direct surroundings exclusively draw water from aquifers occurring within the Rumuruti Phonolites, and further north- also from the younger Losioli Phonolites. Although the primary porosity of these lava flows is generally low, water occurs in fissures and other forms of secondary pore space, such as embedded weathered horizons (so-called Old Land Surfaces, or OLS) and bedding planes.

The Ewaso Narok system consists of Rivers Ewaso Narok, Pesi and Mutura. There are swamps on each of these tributaries namely Ol' Bolossat, Ewaso Narok, Pesi and Suguta-Naibor, and mostly all these swamps have a high salt content possible due to high evaporation rate and partly to nature of sediments that constitute the area (Krhoda, 1992).

The water from the basin flows northwards through Thomson's Falls into the northern part of Ewaso Nyiro River. The Melawa River drains off Satima, its headwaters reaching up into the highest upland valleys. It plunges down the Sattima Escarpment onto the Ol' Bolossat plain through a magnificent steep-walled gorge, with walls nearly 3048 m high, the Malewa 'Ndogo' gorge. The river cuts a deep trench across the Ol' Bolossat plain passing very close to the south end of the lake and separated from it by a divide of very low relief, probably not more than 9 m. The river turns south and cuts another deep gorge, the lower Malewa gorge, along a fault line, to its confluence with the Turasha River just south of the Melawa Water Scheme Intake. Lake Ol' Bolossat it is perched on the divide between the Ewaso Narok drainage northwards towards the arid flats of the Northern Frontier Province (McCall, 1967). The faulting activity in the area resulted in a complex drainage system that separates major drainage basins. According to Mwaura (2006), the Lake is located in a hydrological cross border zone between the Rift Valley basins of Lake Naivasha, Lake Elementaita and Ewaso Ng'iro River Basin to the northeast and therefore suggests that a future hydrological linkage between Ewaso Ng'iro and Lake Naivasha basins is likely.

Lake Ol' Bolossat drainage system comprises of the springs and streams along the Satima escarpment, open water, Wellmont, Ol' Joro Orok and Ol' Bolossat swamps, Ewaso Narok river, the numerous springs along the upper reaches of Ewaso Narok river, and springs and streams on the western side of the catchment. The springs and streams from the Satima escarpment and to a lesser extent by streams that flow from the Ndundori hills on the western side recharge the lake. Most streams flow for a distance and then disappear underground recharging the lake as sub-surface flow. The main streams are Nduthi to the east, and Simba and Maji Chemka to the west. The system loses water through the continuous flow of Ewaso Narok River and evapotranspiration. (NEMA, 2007). The hydrology of Lake Ol' Bolossat is influenced by the effects of long-term and seasonal variations in climate and water inflow from

the surrounding highlands. The lake water level is highest during the rains, especially in July. Macharia (2011) reports an average depth of 2.0 m while Thenya et al., (2014) a maximum depth of 4 m.

4.2.7. Soil

The area is characterized by well drained black loamy soil best for farming embraced by the community members. No existence of quarries, the nearest being located in Ol-Kalou town. Kikuyu Red Loam and Black Cotton Soil are common names which have been used respectively to identify the well-drained red soils and the imperfectly drained dark coloured soils which occur in the area. Like most common names, they lack precision, but are more readily understood by a large audience than scientific names. The names are frequently used locally to convey respectively an image of a deep and well drained red soil which is ideal for coffee and or tea growing and an imperfectly drained dark soil which is ideal for cotton, sugarcane and rice growing.

Soils on young landscape or recently deposited pyroclastics and river sediments as occur in the area may be rich in plant nutrients and support a vigorous plant and animal community provided that water, sunlight and temperature are not limiting. But the soil nutrient supply is not limitless and with time, soluble nutrients are removed in crops and some find their way to ground and river waters. What remains on the landscape may be a soil that is stripped of its capacity to retain and supply the nutrients essential for plant growth. Formulation of sound soil management practices therefore depends on the understanding of the causes and effect relationship between the crop response and soil manipulation.

4.2.8. Geology and Hydrogeology

The geology along the route of the pipelines, intake, and water supply lines in the Project areas presents a diverse landscape influenced by the geological history of the area, particularly its location on the eastern edge of the East African Rift Valley. The intake site is situated in an area influenced by the Precambrian geological history of the region. The underlying geology likely consists of metamorphic rocks of the "Mozambiquian Basement," representing the ancient crust of Eastern Africa. These rocks may include schists, gneisses, and granites formed during the Precambrian era. The presence of metamorphic rocks suggests a stable geological foundation capable of providing reliable water sources.

The water supply line traverses a varied geological terrain characterized by volcanic formations and sedimentary deposits. Areas such as Ol'Kalou plateau may have poorly drained clay loams, indicating the presence of volcanic soils. In contrast, Ol'Kalou feature well-drained clay loams, likely associated with sedimentary deposits. The varying soil types along the water supply line route influence agricultural potential and groundwater recharge rates, affecting local communities' livelihoods and water availability.

In general, two aquifer types are present in the study area; those associated with fault and fracture features, those associated with weathered rocks usually encountered beneath the soil cover and the overlying compact or un-weathered rock. Faulting and fracturing associated with major movement of the earth's crust lead to formation of loose coarse material. This material fills up the faults and fractures and thus formation potential for storage of water. Aquifers located in the weathered volcanics are highly variable in terms of potential yield because the physical transmission of water within the aquifer is dependent upon the total clay fraction present.

4.2.9. Soil erosion, stability& Landslides

The county's landscape is inundated with steep slopes and mountains thus increasing susceptibility of the county to soil erosion and landslides especially during the rainy seasons.

4.2.10. Disasters and risks related to climate Change

The major climate hazards frequently experienced in Nyandarua County are drought - associated with moisture, heat stress and high temperatures - intense rain, and frost - associated with flooding in the lower regions and erosion in the sloppy areas.

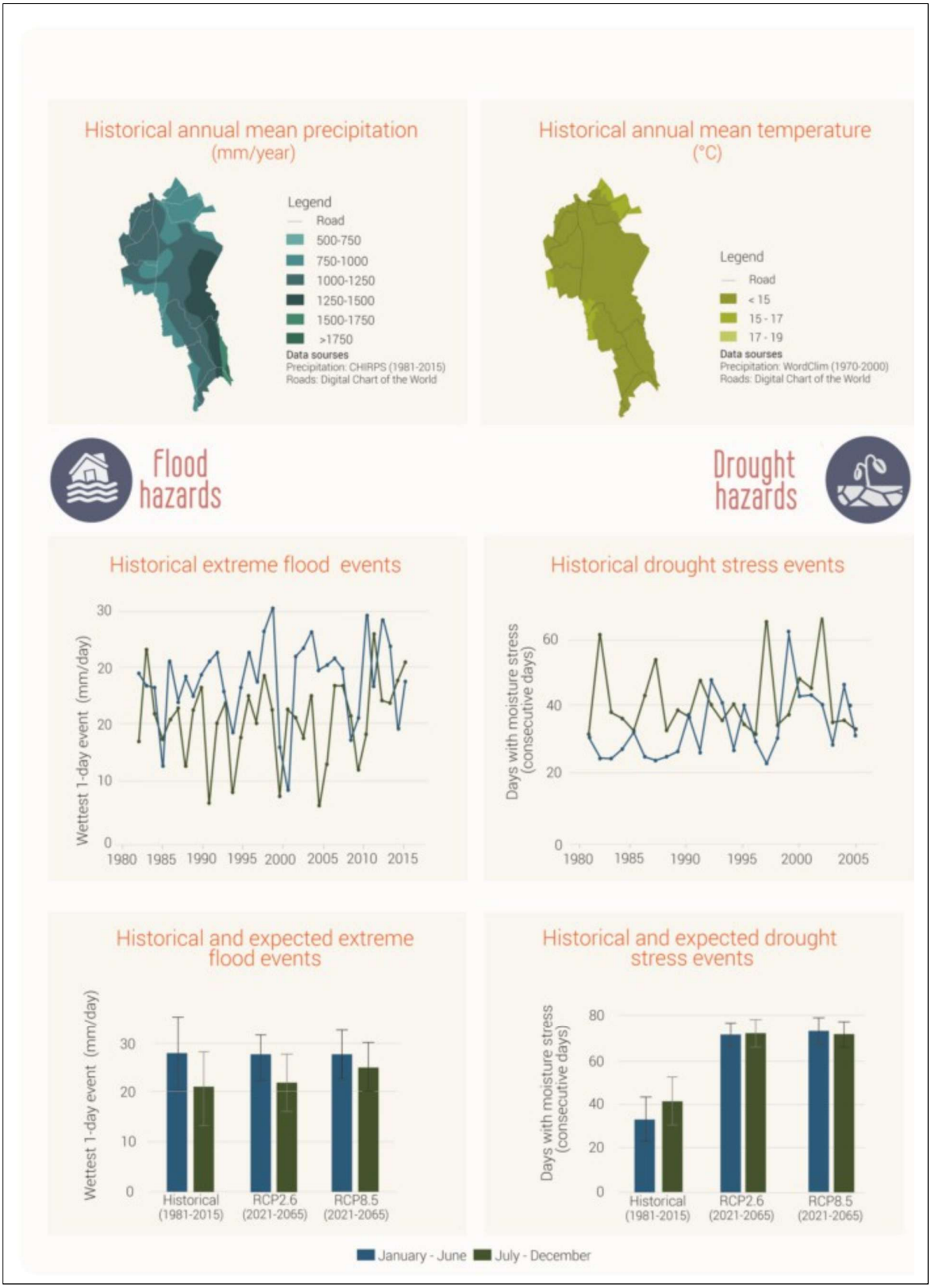


Table 9: Past and future impacts of climate hazards in Nyandarua

Source: International Center for Tropical Agriculture (CIAT)

4.3. Biological Environment

Key ecological receptors and other valued environmental components (VECs) occurring within the project influence area (i.e., along or near the water networks) such as key biodiversity areas, rivers, and wetlands along the water networks are outlined below.

4.3.1. Forest & other Protected Areas within the project AoI

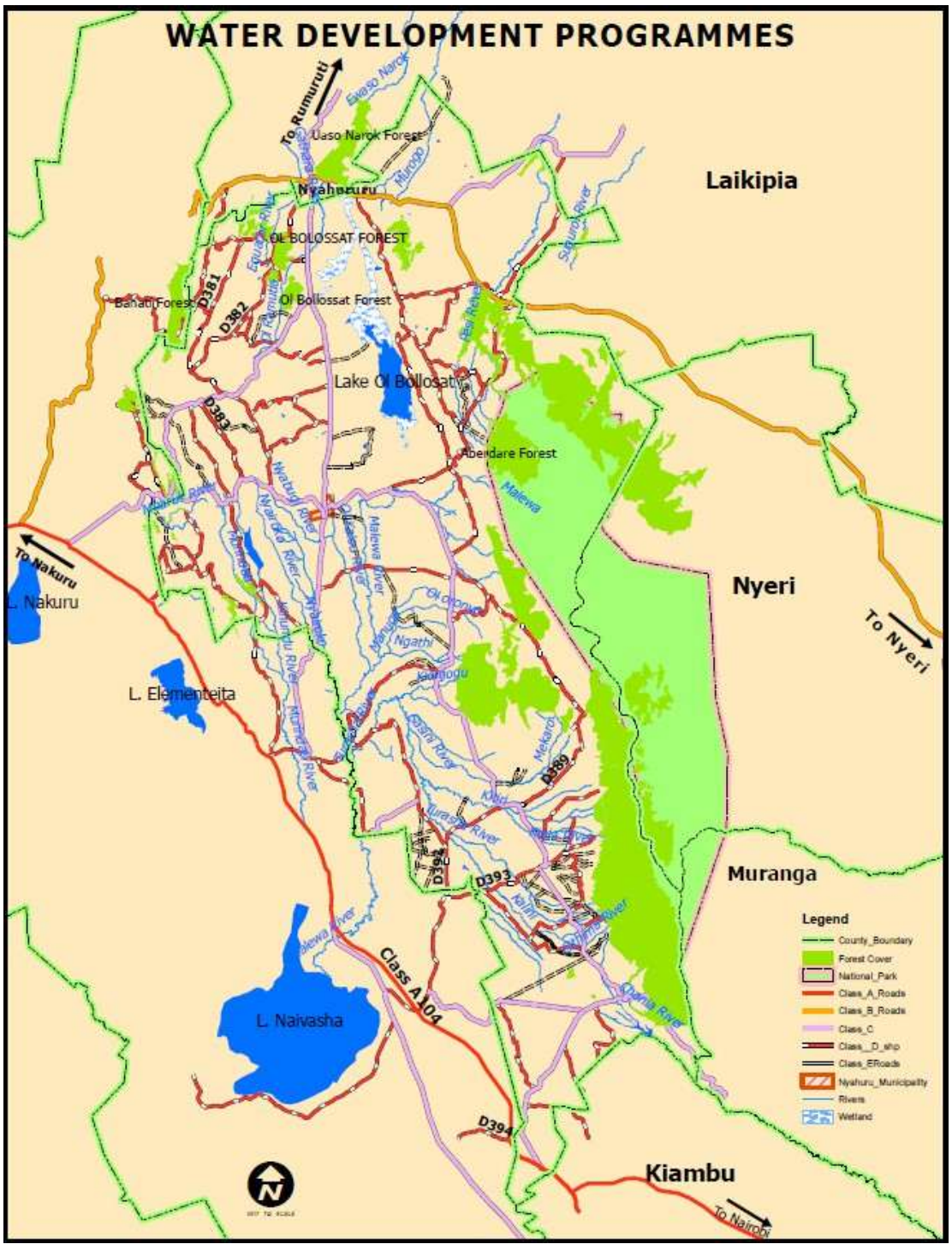
Based on the Nyandarua County CIDP, 2018-2022, the total gazetted forest area in the County is 49,916.2 km² which is concentrated in the western side of the Aberdare Ranges. The main forest areas include four forests, namely Ndaragwa (13,233.5 ha), Lake Ol'Bolosat (3,326.9 ha), Geta (19,884.3 ha), North Kinangop (6,811.5 ha) and South Kinangop (6,660 ha). The gazetted forest areas also include Lake Ol'Bolosat wetland which covers 33.3 sq. km. Out of the total gazetted forests, plantation type of forest covers 84.3 sq. km, natural forests area 21.2 sq. km, grassland 39.4 sq.km, bush land 84.35 sq.km and bamboo 77.01 sq.km. There are non-gazetted forests in the County namely Muruai, Kirima, Kaimbaga Extension, Mawingu, Salient and Malewa Tree Nursery as well as two presidential tree parks within Ol'Kalou urban centre.

The main forest products are livestock fodder (grass), timber, poles and fuel wood. These are both from gazetted and non-gazetted forests. As many households in the County use firewood and charcoal as cooking fuel, there is a need to explore more sustainable sources of energy in order to sustain and increase the County's forest cover.

4.3.2. Major rivers and wetlands within the project AoI

For OL kalou township lies western side of the Aberdare Mountain range the major rivers from Aberdare Forest are Athi and Tana, which flow into the India Ocean, Ewaso Nyiro that drains into Lorian Swamp and River Malewa that drains into Lake Naivasha. The ranges also have several tributaries, and higher up are bog markings that are the source of the rivers on the moorlands and afro-alpine. The Athi, Lake Naivasha, Tana and Ewaso Nyiro river basins have their source in Aberdare Forest Reserve. Rivers in SHAMATA drain the project area.

Figure 4- 3: Water Sources and Catchment Areas in Nyandarua County



4.3.3. Wildlife and bird migrations within Project AoI

The wildlife in the County is mainly found in the park, forests and at lake Ol'Bolosat. The Aberdare National Park has abundant wildlife which include elephants, hippopotamus, cheetahs, lions, leopards, monkeys, wild pigs, baboons, water bucks, Thompson's gazelles, zebras and hyenas. Lake Ol'Bolosat has hippopotamus in addition to a large population of bird species, in particular the Sharpe's long claw eagle, one of the threatened bird species, can also be found here. The County wildlife conservation areas include the Aberdare National Park and forest which covers an area of 767 km^2 and Lake Ol'Bolosat covering about 33 km^2. The gazettement of Lake Ol'Bolosat as a protected area is currently in progress. While the project site is not in immediate proximity to the major wildlife conservation areas, it is important to consider the potential indirect effects on wildlife and bird migrations due to its location near significant ecological zones.

4.4. Bio –Physical Environment

The area is rich in flora and fauna, with over 200 plant species, over 180 bird species and over 15 species of mammals. There are also species of fish, reptiles and amphibians as well as a vast number of invertebrates.

4.4.1. Terrestrial Flora

The proposed project site in Ol Kalou lies in a savannah zone, characterized by scattered trees with expansive grass cover. In elevated areas within the county, tree cover increases forming thick forests with thick undergrowth. However, most of the natural vegetation has been cleared leading to environmental hazards such as environmental degradation which has claimed large portions of arable land. The county has a rich variety of species of both indigenous and exotic trees including Jacaranda (jacaranda minosofolia), Grevillea (Brachylaena huilenis), Acacia Cypress, and Eucalyptus, among many others providing beautiful sceneries all over the county. A collection of these trees is found near the project site. The projects proponents – the Judiciary – will be required to replant any trees it may need to cut down to make way for the building but only with the approval of the Project Architect, the county governments department of environment and natural resources and the local NEMA office. However, it is being proposed that the project proponent takes cognizance of the importance of vegetation cover and attempts to preserve as many of the vegetation as possible, particularly those within the project's wayleave.



Figure 4- 4: Eucalyptus trees along the pipeline route



Figure 4- 5: Indigenous trees along the pipeline route



Figure 4- 6: Pine trees within the area

4.4.2. Terrestrial Fauna

The project area is home to an impressive diversity of bird species. Over 350 bird species have been recorded in this region, highlighting its ecological richness. Lake Ol' Bolossat is particularly notable for its avian diversity, with more than 100 species of waterbirds documented. These waterbirds, which include Afro-tropical ducks, geese, rails, gallinules, and coots, are essential indicators of environmental health and can signal early warnings of ecological changes. Notably, the lake serves as a critical site for Palearctic and Afrotropical migrants listed under the African-Eurasian Waterbird Agreement (AEWA) of the Bonn Convention on Migratory Species (CMS).

Significant bird species in the area include Sharpe's Longclaw (Macronyx sharpei), which is globally threatened and endemic to high-altitude grasslands in Kenya, and Jackson's Widowbird (Euplectes jacksoni), which is near-threatened and restricted to specific regions. The Long-tailed Widowbird (Euplectes progne), another regionally threatened species, and the Grey Crowned Crane (Balearica regulorum), which is endangered, are also present. A 2008 survey led to the designation of Lake Ol' Bolossat as Kenya's 61st Important Bird Area (IBA), documenting Sharpe's Longclaw and Jackson's Widowbird at notable densities. The most recent survey in January 2018 recorded 72 waterbird species with a total population of 14,423 individuals, reflecting the lake's continued importance as a habitat for diverse avian species.

The mammalian fauna in the area includes occasional sightings of leopards, which are known to attack livestock at night. Additionally, the Coypu Rat (Myocastor coypus), an invasive species, occupies the swamps and marshes and has no natural predators in the region.

4.4.3. Aquatic flora and fauna

Wetlands in the area play a crucial role for freshwater fish, providing essential breeding grounds in shallow waters and protection from predators due to thick vegetation. Lake Ol' Bolossat's aquatic environment supports several fish species, including tilapia and common carp. However, fishing is limited due to the proliferation of aquatic weeds, and the fish population in open waters is low due to high evaporation rates and water alkalinity. The dominant fish species in the lake is mudfish, which thrives under the lake's turbid conditions.

Fishing activities in the central parts of the lake are conducted on a small scale for both subsistence and commercial purposes. Nonetheless, production is hampered by aquatic weeds, and the overall fish population is constrained by high evaporation and water quality

issues. The mudfish population increases during the rainy season, as it is well-adapted to the lake's turbid conditions.

Habitat loss and degradation from water abstraction, vegetation removal for development, and agricultural activities have negatively impacted the fisheries. Despite these challenges, the mudfish remains a significant species due to its adaptability to the lake's conditions.

4.4.4. Relevant Biodiversity Treaties

1. Convention on Biological Diversity (CBD)

Kenya is a signatory to the Convention on Biological Diversity (CBD), which emphasizes the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from genetic resources. The Githunguri project operates within an area of rich biodiversity, including indigenous flora and fauna and important bird species. This places a direct responsibility on the project to ensure the conservation of ecosystems and prevent habitat destruction. Any negative impacts on local biodiversity, including forests, bird habitats, and water bodies, must be minimized through strategic environmental management plans, such as reforestation programs or wetland restoration, aligning with the CBD's objectives of ecosystem preservation.

2. The Paris Agreement (2015)

The Paris Agreement, a landmark treaty under the United Nations Framework Convention on Climate Change (UNFCCC), seeks to limit global warming and promote climate resilience. The water supply project's objectives to address water shortages and improve community access align with the broader goals of the Paris Agreement, particularly in enhancing climate adaptation mechanisms in vulnerable areas. Nyandarua County, where Githunguri is located, is affected by changing climate patterns that influence water availability. Therefore, the project must incorporate climate-resilient infrastructure, such as sustainable water management systems that reduce dependency on climate-sensitive water sources. Environmental considerations should include renewable energy solutions where possible and efforts to minimize greenhouse gas emissions during construction and operation.

3. Convention on the Conservation of Migratory Species (CMS)

The Convention on Migratory Species (CMS), also known as the Bonn Convention, aims to protect migratory species that cross international borders. Key species of concern within the project area include waterbirds such as the endangered Grey Crowned Crane and the globally threatened Sharpe’s Longclaw. The wetlands and rivers in the vicinity, particularly Lake Ol’ Bolossat, are critical habitats for these species. Therefore, the project must ensure that the construction and operation of the pipeline do not disrupt migration routes or degrade vital bird habitats. This could involve avoiding construction during critical breeding or migratory periods and establishing buffer zones around wetlands and rivers in line with the CMS requirements.

4. African-Eurasian Migratory Waterbird Agreement (AEWA)

The African-Eurasian Migratory Waterbird Agreement (AEWA) is a specialized treaty under the CMS that focuses on the conservation of migratory waterbirds and their habitats across Africa and Europe. The Githunguri project's proximity to Lake Ol’ Bolossat, an important habitat for waterbirds listed under AEWA, such as Afrotropical ducks and Palearctic migrants, increases its responsibility to ensure the protection of these species. Compliance with AEWA involves maintaining the integrity of waterbird habitats, preventing water pollution, and preserving wetland areas essential for the birds’ migration, feeding, and breeding.

5. African Convention on the Conservation of Nature and Natural Resources (Revised Version)

The African Convention on the Conservation of Nature and Natural Resources, a continental treaty, promotes the conservation of natural resources, including wildlife and ecosystems. The revised version of this convention advocates for the sustainable use of natural resources and emphasizes the need for environmental planning and assessment in development projects. As the Githunguri project involves laying water pipelines through areas rich in both terrestrial and aquatic biodiversity, it is essential that the project complies with the principles of this convention. This includes protecting endangered species like the Sharpe's Longclaw and ensuring that water bodies such as rivers and wetlands are not adversely impacted by pipeline construction activities. Furthermore, the African Convention calls for rehabilitation efforts to restore any degraded ecosystems, which would be applicable to areas affected by the project.

6. Ramsar Convention on Wetlands

Kenya is a signatory to the Ramsar Convention, which seeks to protect wetlands of international importance. Although the project does not directly interfere with a Ramsar site, the nearby Lake Ol' Bolossat, which is home to a variety of waterbirds, is an important ecological area that aligns with Ramsar's objectives. The construction of the pipeline must ensure that it does not disrupt local wetland ecosystems, particularly regarding water flow and quality. Adopting wetland conservation measures and implementing management plans that align with Ramsar principles can mitigate potential impacts, such as runoff or habitat disruption, from the construction process.

7. United Nations Framework Convention on Climate Change (UNFCCC)

Although not directly biodiversity-related, the UNFCCC addresses climate change impacts, which indirectly affect biodiversity. By focusing on reducing carbon footprints and promoting sustainable development, the Githunguri project can contribute to climate mitigation efforts. Ensuring that water supply infrastructure is resilient to climate variability aligns with the UNFCCC's goals of adaptation and minimizing long-term environmental degradation.

4.5. Socio-Economic and Cultural Environment

4.5.1. Demographic information

The Kenya National Population and Housing Census, 2019, stated that the county had a population of 638,289 persons of whom 315,022 (49.3 per cent) were male and 323,247 (50.6 per cent) were female. The County had a total number of 179,686 households with an average household size of 3.5 persons. The population density at the time was 194 persons per km2 . The population was projected to be 682,740 in 2022, and further extrapolated to be 721,112 in 2025 and 746,009 in 2027.

In 2019, Kinangop Sub-County had the highest number of households with a population of 205,280 persons whereas Ol'Joro Orok had the least number, with 97,965 persons. This implies that 32.16 per cent of the entire county population resides in Kinangop while 15.34 per cent reside in Ol Jor Orok. Table 4 provides the population at the time of the census in 2019 and its projections for the periods; 2022, 2025 and 2027 segregated by sex. The projections have factored in key demographic considerations such as fertility, mortality, birth and immigration rates.

Table 10: Population Projections (by Sub-County and Sex)

County/ Sub-County	2019			2022			2025			2027		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
Nyandarua	315,022	323,247	638,289	335,847	346,893	682,740	354,096	367,016	721,112	365,883	380,126	746,009
Kinangop	100,884	104,387	205,280	107,553	112,023	219,576	113,397	118,521	231,917	117,172	122,755	239,924
Kipipiri	46,113	47,740	93,855	49,161	51,232	100,391	51,833	54,204	106,033	53,558	56,140	109,694
Ol'Kalou	70,776	71,697	142,476	75,455	76,942	152,398	79,555	81,405	160,963	82,203	84,313	166,521
Ol'Joro Orok	48,752	49,209	97,965	51,975	52,809	104,787	54,799	55,872	110,677	56,623	57,868	114,498
Ndaragwa	48,497	50,214	98,713	51,703	53,887	105,587	54,512	57,013	111,522	56,327	59,050	115,372

Source: KNBS

Table 5: Population Projections by Age Cohort

Age Cohort	2019 (Census)			2022 (Projection)			2025 (Projection)			2027 (Projection)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
0-4	35,356	34,632	69,988	38,275	38,588	76,863	39,205	39,769	78,974	39,254	39,817	79,071
5-9	37,963	36,940	74,903	36,736	37,063	73,799	37,644	38,142	75,786	38,263	38,936	77,199
10-14	42,540	40,333	82,873	35,547	35,723	71,271	36,183	35,983	72,165	36,789	36,698	73,487
15-19	39,433	36,135	75,568	34,402	34,771	69,173	34,988	35,320	70,307	35,410	35,493	70,903
20-24	24,219	24,244	48,463	31,526	33,805	65,331	34,020	34,560	68,581	34,411	34,928	69,339
25-29	18,837	20,089	38,926	29,422	31,764	61,186	29,694	33,497	63,191	31,349	34,015	65,364
30-34	19,622	22,409	42,031	25,407	26,934	52,341	28,680	30,567	59,247	28,860	31,722	60,582
35-39	18,748	20,476	39,224	21,559	22,139	43,698	22,779	24,133	46,912	24,922	26,521	51,443
40-44	16,905	18,189	35,094	19,797	19,600	39,397	20,311	20,384	40,695	21,111	21,691	42,802
45-49	15,468	16,761	32,229	16,266	16,531	32,797	18,894	18,619	37,513	19,228	19,133	38,361
50-54	12,802	13,932	26,734	12,780	13,529	26,309	13,959	14,730	28,689	15,643	16,086	31,729
55-59	10,751	11,505	22,256	9,752	10,515	20,267	11,351	12,302	23,653	12,101	13,080	25,180
60-64	6,859	7,193	14,052	6,984	7,429	14,413	8,035	8,929	16,964	9,019	10,071	19,089

Age Cohort	2019 (Census)			2022 (Projection)			2025 (Projection)			2027 (Projection)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
65-69	5,368	5,951	11,319	5,024	5,256	10,280	5,653	6,082	11,734	6,283	7,022	13,306
70-74	4,334	5,344	9,678	4,211	4,425	8,636	3,984	4,352	8,336	4,349	4,860	9,209
75-79	2,485	4,229	6,714	3,343	3,586	6,929	3,595	3,978	7,573	3,471	3,933	7,404
80+	3,328	4,884	8,212	4,816	5,235	10,051	5,121	5,670	10,791	5,422	6,118	11,540
Total	**315,018**	**323,246**	**638,264**	**335,847**	**346,893**	**682,740**	**354,096**	**367,016**	**721,112**	**365,883**	**380,126**	**746,009**

4.5.2. Land-Use

Land is a very important resource in the County, being the mainstay of the County economy.

a. Land Ownership Categories/Classification

Land ownership in Nyandarua is largely private with most owners being small-scale farmers with a few large farms spread across the County. The average holding size per household is 3.5 ha. With the projected population growth and the predominant cultural practices on inheritance, the average acreage per household will continue to decrease due to subdivisions. Over 90% of the households owning land have their title deeds.

Table 11: Anticipated Functions (Urban Areas and Cities Act)

Town/Centre	Projected Population (2026)	Urban Area Status
Ol'Kalou	135,264	Municipality
Njabini	12,380	Town
Engineer	4,166	Town
Mairo-Inya	20,199	Town

According to common belief in the County, every man must own land. This belief has led to fragmentation of land into small uneconomical pieces where they grow maize and other staple crops. This has been observed particularly in South Kinangop where the original farm sizes have been getting smaller at an alarming rate.

Table 12: Mean Agricultural Land Holding per Sub-County

Sub-County	Average (Acres)
Ol'Kalou	1.80
Kipipiri	1.47
Ol'Joro Orok	1.69
Kinangop	1.73
Ndaragwa	1.69

b. Incidence of Landlessness

Squatters have been settled in various parts of Nyandarua County since the colonial era. Squatters are mainly located within the townships and trading centres which happen to be the colonial labour camps. Following the post-election violence of 2007, some internally displaced persons who moved into Nyandarua are yet to be resettled. 1.7.3 Settlement Patterns There are three major settlement patterns identified in the County; clustered settlements, dispersed settlements and linear/ribbon settlements.

- ***Clustered settlements:***

This type of settlement is found within the main urban centres. It is characterised by highly built-up areas with compact housing. The region has a high population density and the inter-house distance is usually small. Such areas include Ol'Kalou, Engineer, Njabini, Mairo-Inya as well as parts of Ol'Joro Orok and Ndaragwa. These towns are either economic centres or administrative areas with settlement density reducing towards the periphery.

- ***Dispersed settlements***

Mostly found in the rural hinterland of the County which is largely characterised by farming villages spread across the County. The built-up area is less compact, and the region has a low population density. Most of the rural settlements are influenced by availability of land, soil fertility, pastures, topography, climate and provision of basic services such as water, electricity and roads. Areas with this type of settlement include Shamata, Central, Charagita, Gathanji, Kanjuiri and Gathara Wards.

c. Type and Size of Land

The County can be categorised into two broad agricultural potential zones based on agro-ecological conditions: high potential zones (65 per cent) and low potential zones (35 per cent). The high potential zones include Kinangop, most of Ol'Kalou and Ol'Joro Orok Sub-Counties. The low potential zones include most parts of Ndaragwa and lower parts of Kipipiri Sub-Counties. The table below shows land use patterns in the County.

Table 13: Land Use Patterns

Land Use	Area (Km²)	% of Total Land Area
Area under forests	347	10.69%
Area under natural lakes	33	1.02%
Area under cultivation	1,587	48.90%
Area under natural pasture	276	8.50%
Area under rocks and swamps	148	4.56%
Roads, commercial centres, and schools	320	9.86%
Other areas	534.2	16.46%
Total Area	**3,245.2**	**100.00%**

Source: Department of Lands, Housing and Physical Planning

There is pressure to subdivide land including land in agricultural areas with high potential as a result of increased population growth in urban areas. A total of 55,500 ha has already been affected, thus reducing average farm holding. The average land holding has come down to 4 ha and 0.8 ha in low and high potential zones respectively. Available data indicates that the optimum land holdings are 8.9 ha and 2.0 ha, respectively in both zones. While 57 per cent of the land in the County is arable, only about 25 per cent is cultivated. In addition to size and fertility, other main challenges include urban sprawl which threatens agricultural land, inadequate service provision in urban settlements and unplanned growth of settlements.

Figure 4- 7: Map of Nyandarua County Land use

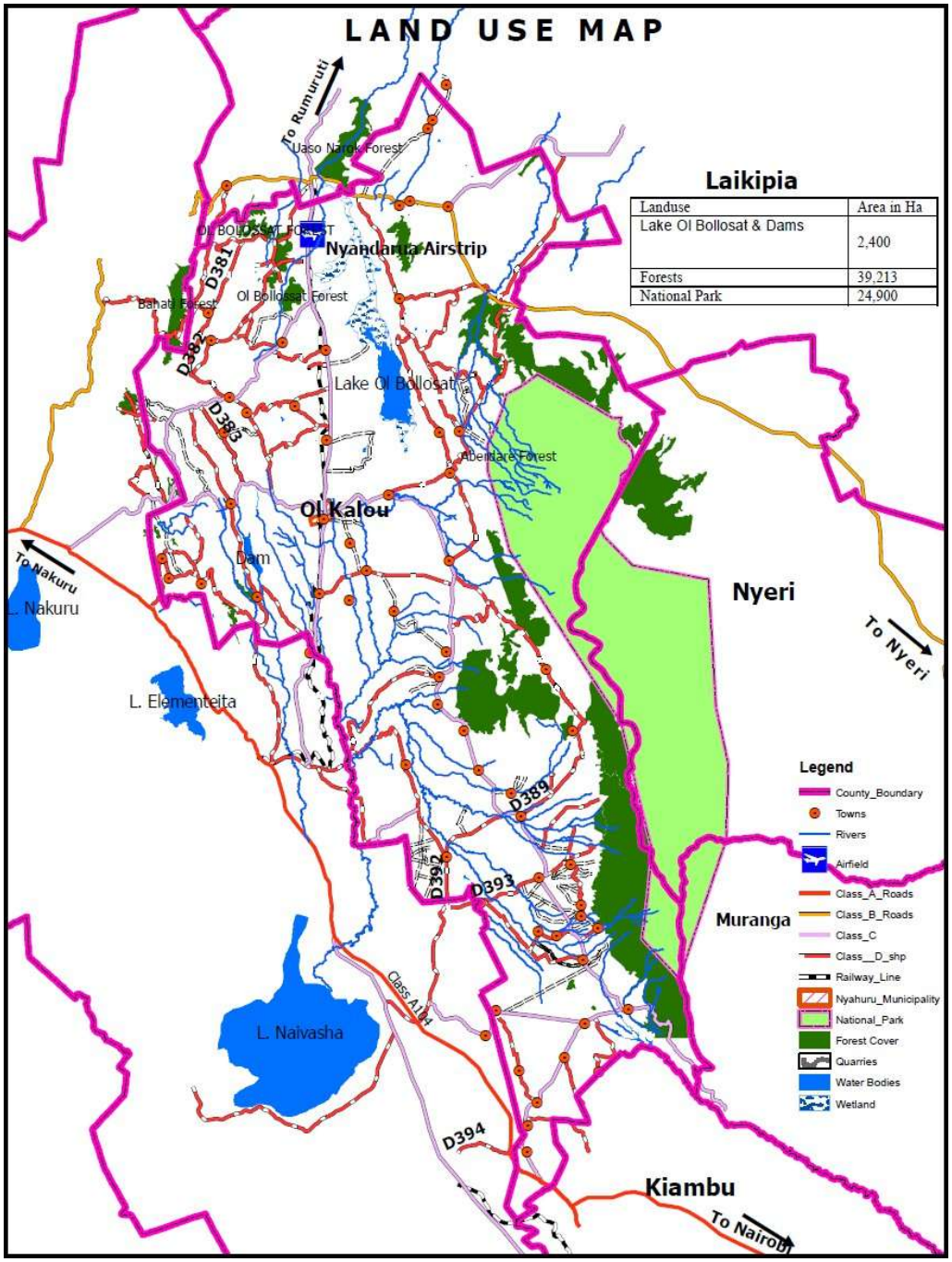




Figure 4- 8: Wheat farm in Ol'Kalou

4.5.3. Status of Existing Water Resource Management Programs

There are two registered water companies in the County, namely Nyandarua Water and Sanitation Company and the Ol'kalou Water and Sanitation Company, in addition there are several community managed water supply schemes. However, some areas in the County are not covered by these schemes and therefore remain unserved. The water supply schemes are unreliable requiring augmentation and rehabilitation to increase the number of households with access to piped water. About 46,400 households have access to piped water. Most of the households depend on water from shallow wells, dams, springs, roof catchment and rivers.

4.5.4. Community Structure

Understanding of a project area's socio-cultural composition is important as it provides insights into the best way to develop rapport with the local community, helps create an understanding of acceptable norms, locational distribution that may be ethnic based and "taboo" subjects to enhance inclusivity in identification and engagement of the stakeholders and general project acceptance. The population in Ol Kalou town largely constitutes the Kikuyu community although there are a few people from other communities. There are two caves along the Peri River that were being used by the Mau Mau freedom fighters during the fight for independence. These caves are linked to other caves along the routes used by the Mau Mau fighters across the area now covering the Aberdares Forest and the Aberdares National Park, as they moved from Nyeri to Nyandarua and other areas of Central Province. Ol Kalou is largely a Christian town. However, there are a two Muslims praying areas in Ol Kalou town.

4.5.5. Labour Force

Ol Kalou is one of the five constituencies in Nyandarua. It serves as the county headquarters. Nyandarua County located west of Aberdare ranges and 40 km east of Nakuru. The area is predominantly an agricultural zone. According to the Nyandarua County Integrated Development Plan 2023-2027, the county has a total labor force of 344,300 persons with 54.2% of this being male and 45.8% female. The number is however projected to be 378,999 in 2027. This labor force is engaged as wage earners, self-employed, in school or is unemployed. The bulk of this labor force is however semiskilled and unskilled and are mainly engaged in agricultural practices. Therefore, majority of the unskilled, semi-skilled and some of the skilled personnel will be locally sourced.

The technical professionals such as the contractor and the project manager are likely to be sourced from outside the area. Therefore, they would require temporary camps on site to house the some of the skilled workers. The level of specialization in the building sector is limited in terms of capacity and numbers. In fact, the county has a limited number of experts in the built environment industry. This can be attributed to the high level of academic qualifications required for these professions. Skilled professionals to be included in this project will include the following.

- Land Surveyor
- Geographical Information System Analyst
- Landscape Architect
- Architect
- Quantity Surveyor
- Civil Engineer
- Structural Engineer
- Geotechnical Engineer etc

However, most people involved in construction industry are the semi-skilled and unskilled labourers. The professionals are involved mainly in the inception and design stages of the project while the actual construction process is carried out by semi-skilled and unskilled labourers.

4.5.6. Gender

The largest proportion of the Nyandarua County population is in the rural areas with women constituting the majority. The main economic activity in Nyandarua County is agriculture where women particularly the youth form much of the on-farm work force. However, due to socio-cultural values, women in the rural areas generally own less than 1% of the total wealth.

To uplift the status of the women, various intervention programs have been initiated such as involvement of women in all development committees, increased access to credit (Women Enterprise Fund and Kenya Women Finance Trust). However, because most of the land ownership is in the hands of men, the impact of the programs has not been felt by most women as was planned thereby reducing access to credit by the larger women population.

It is against this backdrop of this gender parity that it will be important to address the issue of Gender inequality through efforts by the DBS of the Judiciary who will be expected to encourage the contractor to employ women at the site particularly the young women who may have the necessary skills. In order for the contractor to be able to successfully sensitize the workers on site, it will be crucial to acquire the services of NGOs, CBOs as well as the enlisting

the support of the department of Gender and Children to sensitize against gender inequality and other vices such as sexual harassment at the workplace.

4.5.7. Local Communities

Local communities in Nyandarua County is deeply rooted in traditional family and kinship systems, reflecting the county's strong emphasis on community cohesion and cultural continuity. Family is the cornerstone of social life in Nyandarua County. Typically, families are extended, including not just the nuclear family but also grandparents, uncles, aunts, and cousins, all living in proximity or within the same homestead. This extended family structure fosters a strong sense of belonging and mutual support. Decisions affecting the family, such as marriage, education, and inheritance, are often made collectively, with respect for the wisdom of the elders playing a crucial role.

Elders hold a revered position within the community, serving as custodians of culture, history, and moral guidance. They are often called upon to mediate disputes, provide counsel, and preside over important ceremonies and rituals. Their authority is rooted in their experience and knowledge of community traditions, and they play a pivotal role in ensuring that cultural practices are upheld across generations.

Clans are an integral aspect of the social fabric in Nyandarua County. Each clan comprises several extended families that trace their ancestry to a common forebear. Clans often have specific roles within the community, such as leadership, spiritual guidance, or the stewardship of communal resources like land and water. The clan system also functions as a mechanism for social control, with clan leaders overseeing the adherence to community norms and values. In many cases, clans are responsible for resolving conflicts and disputes within the community, employing traditional justice systems that prioritize reconciliation and the restoration of harmony.

Beyond the family and clan structures, community groups and networks play a significant role in the social organization of Nyandarua County. These groups, often formed around shared interests or goals, include women's groups, youth associations, and savings and credit cooperatives (SACCOs). Such groups provide a platform for collective action, enabling members to pool resources, share knowledge, and support each other in times of need. For instance, women's groups are instrumental in promoting economic empowerment, education, and health initiatives within the community.

4.5.8. Livelihoods, Income Sources, and Distribution of Goods and Services

The socio-economic mainstay in Nyandarua is Agriculture and related industries. The main agricultural produce includes Irish potatoes, cabbages, carrots, peas, floriculture, pyrethrum, sugar beet, cereals, poultry and dairy. The total acreage under food crops is 45,000ha while the employed population in the agricultural sector is more than 380,000 (72%). The County generally has 1 ranch, with an area covering of 300ha. This is due to the favourable climate and natural resources such as fertile soils.

The high agricultural production has made Nyandarua County a top producer of Irish Potatoes accounting for over a third of the national production and the second top producer nationally of Milk in turn becoming a food basket and a strategic county in national food security. The sector employs about 69% of the population and contributes approximately 73% of household incomes. It is estimated that about 5% of household income comes from rural self-employment, and 10% of the household income from urban-self-employment.

Other significant contributors to the county economy are general commerce including wholesaling and retailing as well as lumbering sector all which have created significant employment opportunities.

The County is also blessed with numerous tourism assets which includes Lake Ol bolosat, Mau Mau caves, happy valley homes, equatorial sites, and Aberdare ranges which if well tapped into would be major contributors to the County and national economic growth.

Nyandarua County is also endowed with natural resources that are utilised through mining of building materials such as stones, sand, gravel among others.



Figure 4- 9: Cattle farming



Figure 4- 10: Banana farming



Figure 4- 11: Sheep Rearing



Figure 4- 12: Maize Farming

4.5.9. Recreation

The county's natural beauty and rich biodiversity offer a variety of recreational opportunities, from scenic hikes to tranquil nature walks.

- **Aberdare National Park**

Aberdare National Park, established in 1950, is a prime destination for nature enthusiasts. The park protects the ancient Aberdare Ranges, stretching 160 km in length. Key attractions include the highest peaks, Ol Donyo Lesatima (3,999 meters) and Mt. Kinangop (3,906 meters). Visitors can explore the park's waterfalls, such as the Chania, Gura, and Karura Falls,

the latter featuring a dramatic drop of approximately 300 meters. The park is also home to a variety of wildlife, including elephants, rhinos, hyenas, buffaloes, and bushbucks.

- **Ndaragwa Nature Trail**

Located within the Ndaragwa Forest Station, the Ndaragwa Nature Trail offers a serene walking experience. Approximately 230 km from Nairobi, the trail provides scenic views of the lush forest and Ndaragwa town. A notable feature of the trail is the Ndaragwa waterfall, visible from a footbridge at the trail's end. This destination is ideal for peaceful nature walks and appreciating local flora and fauna.

- **Kinangop Plateau**

The Kinangop Plateau, situated between the Great Rift Valley and the Aberdare Ranges, is a stunning peneplain rising to about 2,400 meters above sea level. The gradual slope offers breathtaking views, especially from the plateau's edges. This location is perfect for visitors seeking panoramic vistas and a gentle hike across a unique geological formation.

- **Mt. Kipipiri**

Mt. Kipipiri, an isolated volcano in the northwestern Aberdares, stands at 3,349 meters. Approximately 130 km from Nairobi, it is renowned for its hiking trails. The summit hike, taking around 8 hours, traverses the picturesque Wanjohi Valley. The mountain is home to sykes and colobus monkeys, buffalos, and elephants, requiring guided tours for a safe hiking experience.

- **Sasumua Dam**

Located near Njabini Township and the Aberdare Ranges, Sasumua Dam is a scenic spot ideal for picnics and nature walks. The dam, set against the backdrop of the Aberdares, is surrounded by Sasumua Forest. Visitors can enjoy walking trails through the forest, making it a great location for outdoor relaxation and exploration.

- **Ol Donyo Satima**

Ol Donyo Satima, also known as Mt. Satima, is the highest peak in the Aberdare Ranges at 3,999 meters. It is a favorite among hikers for its scenic and relatively gentle trails. The mountain's name translates to 'mountain of the bull calf' in Maasai, reflecting its cultural significance. Hiking here offers breathtaking views and a rewarding outdoor experience.

- **Lake Ol Bolossat**

Lake Ol Bolossat, the only natural lake in central Kenya, spans about 44 square kilometers. Situated between the Aberdare Ranges and Dundori Ridge, the lake offers picturesque views and is a great spot for observing hippos, bird watching, and boat rides. Its serene environment makes it a hidden gem for nature lovers.

- **Rurimeria Hill**

Accessible via the Ndunyu Njeru gate in Kinangop, Rurimeria Hill is a historic site with dense forests and bamboo thickets. It holds cultural significance, often mentioned in stories of Dedan Kimathi, a Mau Mau hero. The hill is ideal for hiking and bird watching, providing both historical context and natural beauty.

The Mau Mau Caves, located within the Aberdare Forest, are historically significant as hideouts used by freedom fighters during the Mau Mau uprising. The hike to the caves passes through scenic areas with rivers, waterfalls, and dense forests, offering a blend of historical insight and natural exploration.

- **Elephant Hill**

Situated on the southern end of the Aberdare Ranges, Elephant Hill is part of the Aberdare Simbara. It features a more challenging hiking trail compared to Ol Donyo Satima, making it a popular choice for those seeking a strenuous adventure. The challenging terrain and rewarding views attract avid hikers.

4.5.10. Cultural Properties

Sites and monuments constitute the nation's immovable heritage. These sites and monuments, including the natural and cultural landscapes, historical and contemporary architecture, memorials, artworks and sculptures, are a testimony of our identities, shared aesthetical values and creative expressions. The conservation and appreciation of such sites and monuments promotes a stable society and ensures recognition and respect for the differences and cultural identities of distinct communities.

Overlooking the Aberdares, and just adjacent to the upcoming Ol'Kalou stadium, Ol'Kalou Arboretum is an iconic 87 acres of natural forest, with a few exotic trees here and there. Ideal for cultural, sporting and recreational activities, the Ol'Kalou Arboretum, situated at the heart of the county headquarters, has been host to several successful events in the recent past.

Tangible culture includes archaeological findings and cultural artefacts. The Government shall put in place mechanisms to promote, preserve, safeguard and disseminate traditional and contemporary knowledge on tangible culture. It shall promote programmes that contribute to the use of tangible cultural heritage as a means of wealth creation and employment. Intangible Culture is defined under the 2003 UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage as "the practices, representations, expressions, knowledge, skills as well as the instruments, objects, artefacts and cultural spaces associated therewith that communities, groups and, in, some cases, individuals recognise as part of their cultural heritage."

4.5.11. Education

The Ol kalou area boasts a comprehensive educational landscape with a total of 10 primary schools, including St. Joseph Primary School, AC Primary School, Kianda Primary School, Father Baldo Primary School, Southwest Primary School, Mumbi Primary School, Kiganjo Primary School, Huruma Primary School, Mureri Primary School, and Hospital Hill Primary School. Additionally, the area is served by 6 secondary schools, namely Highway Secondary School, Melenium Secondary School, Kiganjo Secondary School, Huruma Secondary School, Ol kalou High School, and Kieni Secondary School.

In terms of tertiary education, Ol kalou is home to two esteemed institutions: Ol kalou Vocational Training Center and Ol kalou Medical Training Institutions. These institutions contribute significantly to the educational landscape, providing diverse opportunities for learning and skill development in the community.

The majority (57%) of the residents have completed their education up to Secondary school level, twenty percent (20%) of the respondents had completed their education up to university level, fifteen (15%) of the respondents had reached Primary School while those who reached Technical Trainings and Pre-Primary had four percent (4%) each.

Nyandarua County literacy rate is 86.3%. This is the county population that can read. However, the proportion of the population that can write is 85.2% while the proportion that can read and write is 83.8 %. This implies that about 13.7% of the population cannot read and will be the target for adult education basic literacy programmes.

- **Pre-School Education (Early Childhood Development Education)**

The County currently has 929 Early Childhood Development and Education (ECDE) centres of which 496 are public and 433 are private. The enrolment stands at 33,953 where 20,216 are in public centres and 13,737 are in private centres. In this enrolment, 17,270 are boys while 16,683 are girls.

The enrolment is approximately 49.49% of the projected target population aged between 3 and 5 years. The Gross Enrolment Rate (GER) is 54.5% with that of boys being 55.6% and that of girls being 53.3%. The Net Enrolment Rate (NER) is 53% with that of boys being 54.2% and that of girls being 51.8%. This indicates that there are many children who are not enrolled in ECDE. There are 1317 ECDE teachers, indicating a general teacher pupil ratio of 1:26. There are 789 teachers in public centres and 528 teachers in private centres. The average age of attendance to ECDE is two years.

- **Primary Education**

The County has 507 primary schools of which 349 are public while 158 are private. The total enrolment is 151,165, where 128298 are in public primary schools and 22427 are in private schools. In this enrolment, 76,165 are boys while 75,000 are girls. The enrollment is 92.5% of the County population aged 6 and 13 years. The Gross Enrolment Rate (GER) in primary schools is 109.5% while the Net Enrolment Rate (NER) is 96.8%. The number of public primary school teachers is 3,942 with a pupil teacher ratio of 1:33. About 3% of children travel for less than one kilometre to school while 93% travel between 1.1 and 4.9Kms. 4% of the children travel for more than 5km to school.

- **Youth polytechnics**

The Youth polytechnics are basic technical education institutions intended to offer school leavers both from primary and secondary schools' opportunities to acquire education and training, knowledge and technical skills for gainful employment. Besides, they equip the youth with entrepreneurial skills based on appropriate technology enabling them to utilise locally available resources for further job creation.

The polytechnics in Nyandarua County include: Rurii Polytechnic, Ol'Kalou Polytechnic, Melangine Polytechnic, Ngorika, Mukeu polytechnic, Kinangop polytechnic, Njabini Polytechnic, Munyaka YP (Engineer), Nandarasi (under construction), Miharati Polytechnic, Kahoro Polytechnic, Lereshwa Polytechnic, Kangui Polytechnic, Ngano and Geta polytechnics are yet to be renovated, Leshau Polytechnic, Shauri Polytechnic, Shamata Polytechnic, Pesi Polytechnic, while Kanyagia and Karagoini polytechnics were renovated and ready for use. Mbuyu and Ol'Bolosat polytechnics (under construction) and Raichiri polytechnic was supplied with electricity.

- **Secondary Education**

There are 221 secondary schools: 167 public and 54 private. The average distance travelled to access a public secondary school facility within the County is 2.5 km. This is the longest in Ndaragwa, 3.3 km and shortest in Kipipiri, 2 km. Current total enrolment is 57,646, of which 51,599 are in public and 6,047 are private. The total number of secondary schools in the County is 219 of which 167 are public schools while 52 are private. The total enrolment stands at 60,021, comprising 53,974 in public schools and 6,047 in private schools. In this enrolment,

28,303 are boys while 31,718 are girls. This enrolment is 60.66% of the population aged 4–17 years. There are 1,656 teachers in public schools in the County giving a teacher/student ratio of 1:33. The dropout in secondary schools stands at 5.8%. Students travelling less than one kilometre to school account for 12%, with 54% travelling 1.1 to 4.9 km and 34% travelling for five kilometres and above. The transition from primary to secondary school is 21%, meaning that 79% either join tertiary institutions or they drop out of school after primary school education.

- **Tertiary Education**

The County has four technical training institutes, namely Nyandarua Institute of Science and Technology (NIST), Leshau, Kinangop, and Kipipiri Technical Training Institutes. In addition, there is the Aberdare Teacher Training College. The County also has Animal Health Industry Training Institute (AHITI) at Ol'Joro Orok. Lack of adequate tertiary institutions has negatively affected the transition to higher learning for skills development and upgrading from traditional to market driven courses. The sector needs close attention since the level of education is always proportional to the rate of development.

4.5.12. Health

There are currently 207 health facilities of which 73 of these are public health facilities. There is a county referral hospital; J.M. Memorial Hospital, a County hospital Engineer and one faith-based hospital N. Kinangop Catholic Hospital. The County has a total of 781 health personnel. The doctor population ratio is 1:35,750; nurse population ratio is 5:3 per 10,000 a staff population ratio of 11:10,000 (the WHO recommended ratio is 23:10,000). The bed capacity is 486.The average distance to the nearest public health facility is 3.7 Km; recommended 5 Km (WHO).

In some areas of the County, access is hindered by geographical barriers. The average distance to the nearest health centre is 3.2 km. In the County, 21 % of the households travel up to one kilometre to access health service, 78 % travel between 1.1 km and 4.9 km while those who travel above five kilometres account for 1 % of the population. Of major concern is that only 15% of the total population in Nyandarua County use mosquito bed nets. This needs to be improved through creating public awareness to the residents.

Health Access

There are 2 Government hospitals, 1 mission hospital, 26 health centres, 45 dispensaries, 7 mission dispensaries, 125 private clinics and 69 community units.

Morbidity:

The average morbidity rate for the County is 21.2 % with the male morbidity rate at 19.2 % and female morbidity rate at 23.4 %. The five most common diseases in order of prevalence in the county are shown in Table 1.2. Most of these diseases are bacterial infections that can be prevented through proper clothing, appropriate beddings, water treatment and hand washing.

Table 14: The five most common diseases in Nyandarua County

No.	Disease	No. of Cases
1	Other diseases of the respiratory system	362,028
2	Skin diseases	76,364
3	Diarrhea	39,991
4	Arthritis, joint pains, etc.	35,630
5	Pneumonia	34,504

Source: Nyandarua DHIS 2022

Prevalence of stunting and wasting in children under 5 years

Stunting (low height for age) is the chronic restriction of a child's potential growth. Twenty-nine per cent (29%) of children less than five years old in the County are stunted, three percentage points higher than the national average. On the other hand, 7% of the children are either underweight or overweight. The prevalence of wasting among the under-fives is 2%. The main causes of malnutrition in the County include poor maternal, infant and young child feeding and breast-feeding practices. Only 37.4 per cent of children aged 6 to 23 months receive adequate dietary diversity and meal frequency. Micronutrient deficiencies are widespread among the children. Maternal anaemia is also a major determinant of child growth. Only 6% of pregnant women receive the recommended 90 or more doses of iron/folate supplements.

Immunization Coverage

The immunisation coverage stands at 85.3% of the children in the entire County. There is, however, marked variation with some areas recording lower coverage. Some families do not take their children for immunisation due to religious beliefs or out of ignorance. This has led to prevalence of communicable diseases which could have been prevented. Immunisation can be improved through proper sensitisation to overcome the religious beliefs hampering immunization.

Maternal Health Care

Maternal health is linked with the survival of newborn babies. Provision of continuous care during pregnancy, labour and delivery and the postnatal period results in reduced maternal and neonatal morbidity and mortality. In antenatal care (ANC), 96.7 % of the pregnant mothers seek first antenatal care while 58% of pregnant mothers seek fourth antenatal care from a skilled provider while 3.3% do not seek ANC services at all (KDHS 2014). Regular antenatal care is helpful in identifying and preventing adverse pregnancy outcomes. In delivery, 86.1% of the mother deliver in health facilities while 12.8% deliver at home. Obstetric care from a health professional during delivery is recognised as critical in reducing maternal and neonatal mortality. 85.3% of the deliveries are conducted by a skilled provider.

Access to Family Planning Services/Contraceptive Prevalence

Access to family planning services in the County is widespread and is found in all health facilities. The contraceptive acceptance rate stands at 67%. The most commonly used contraceptives are male condoms, injectable contraceptives and pills. The remaining 33% represent the unmet need for family planning. Some women have not tried contraception because they fear side effects. Counselling about side effects and mass media communication can improve acceptance rate. Modern contraceptive use has increased with women education. The unmet need for contraceptive is highest in rural areas and among the poorest women. Men should also share the burden of family planning by accepting permanent or temporary family planning methods. Health education, sex education and family planning should be an integral part of school/college education.

The health facilities in Nyandarua County are inadequate with a strained workforce owing to big staff shortage; insufficient supply of essential drugs; inadequate modern equipment; poor road network to health facilities and lack of water supply in health facilities.

HIV and AIDS Prevalence Rates and Related Services

HIV prevalence in the County stands at 3%. HIV prevalence among women in the County is higher (4.4%) than that of men (1.6%). The County contributes 0.8% of the total number of people living with HIV in Kenya and is ranked 29th nationally. There are estimated 12,754 people living with HIV in the County with 10% being young people aged 15-24 years and 4% being children under the age of 15 years. Antiretroviral treatment coverage in the County is 92% but viral suppression is poor at 44%. Mother to Child transmission rates are 6.4% in the County against global target of 5%.

4.5.13. Waste Disposal

Solid Waste Management in Nyandarua is characterised by: Low implementation of environmental laws; Poor practices such as indiscriminate dumping and lack of waste segregation. The main waste include domestic, industrial and medical waste. To comply with National Solid Waste Management Strategy Standards, the County will need to zone off waste collection areas; ensure timely and regular collection of all wastes and provide waste collection facilities; ensure that collected waste is transported to designated sites for waste disposal; gazette a County dumpsite and accelerate the process of purchasing land for dumpsites in Ndunyu Njeru and Engineer Market and increase the number of garbage collection trucks.

Urban areas are the largest generators of liquid waste. However, all the urban areas in the County luck sewerage networks posing a risk of contamination and ill-health. The major sources of liquid waste are households, institutions, commercial establishments and light industries. The wastes mainly include blackwater, sullage and waste from industrial processes. Most of the households, 84.1%, rely on pit latrines for sewage disposal. A majority of the households, close to 74.2%, pour wastewater in their compounds.

4.5.14. Community Participation, Customs, and Norms

Community participation in Nyandarua County is deeply embedded in traditional structures and cultural values, forming the bedrock of social organization. One of the key avenues for participation is through Itũĩka meetings, which are formal community gatherings that play a central role in decision-making. These generational councils, traditionally composed of adult males and increasingly inclusive of women, deliberate on significant community issues, with their decisions binding for a generation. This participatory process is not just a civic duty but a reflection of the community's commitment to collective well-being.

Another important aspect of community participation is the practice of Gĩthoomo, a traditional system of communal labor that brings together community members to work on collective projects. Whether constructing homes (Mũthinga) or developing infrastructure, Gĩthoomo embodies the Agikuyu value of "Kuuma na Wendo" (love and solidarity). The spirit of collaboration and mutual assistance is further evident in the activities of Nyakĩna groups, which include women's associations (Mwethya wa Athenya) and youth groups (Gĩthũngũri). These groups are pivotal in driving economic and social development, often relying on traditional rotating credit schemes (Mwethya) to fund their projects, thereby promoting self-reliance and community empowerment.

The customs and traditions of Nyandarua County, grounded in the Gĩkũyũ Mwena, provide a framework for cultural continuity and social stability. Ihu Rĩa Anake, the rites of passage, are among the most significant cultural practices in the county. Circumcision, a key rite for boys,

is a deeply spiritual and communal event that marks the transition to adulthood. It is accompanied by teachings that instill values such as courage (Ngũvu) and integrity (Mwĩthemba), ensuring that the young men are prepared for their roles in society.

Marriage customs, particularly the process of Ruracio, are also central to the cultural identity of Nyandarua. Ruracio involves a series of rituals, including the symbolic Kũhanda Ithigi (planting of a ceremonial stick), which marks the formal union of two families. This practice underscores the importance of family and clan (Mĩhĩriga) ties, as marriage is viewed not just as a bond between individuals but as a union that strengthens the entire community. Additionally, cultural festivals, known as Mĩtũmi, play a crucial role in preserving and celebrating the county's heritage. Events such as Ituĩka (the generational handover) involve traditional dances (Ngoma cia Kĩama) and rituals, fostering a sense of continuity and reinforcing the values passed down from the elders (Athuri) to the younger generation.

Social norms in Nyandarua County, referred to as "Mũthingi wa Mwĩrĩri," dictate the acceptable behavior and expectations within the community. One of the most important norms is Gũtirĩa Athuri, which emphasizes the respect for elders. Elders are considered the custodians of cultural knowledge (Ithaka) and play a crucial role in conflict resolution (Gũkĩria mbaki) and communal decision-making (Itũĩka). Their opinions are highly valued, and they are seen as the moral and cultural anchors of the community.

Another key social norm is Mwĩrĩri wa Harĩra, the principle of collective responsibility. This norm reflects the belief that "Mũkũrũ a Mũrathi" (one's actions affect the whole community), promoting a culture of mutual support and accountability. This collective ethos is evident in the community's response to social and economic challenges, where individual success is viewed as beneficial to the entire community. However, traditional gender roles, known as Nja ya Mũhiki, remain influential in shaping social expectations. While men have traditionally held leadership positions, there is a growing recognition of the need for gender equality (Gĩkũyũ Mwena wa Mĩtũmi), with more women stepping into leadership roles and challenging the traditional confines of male dominance (Mũthaka).

4.5.15. Traditional Knowledge, Perception, and Aspiration

Traditional knowledge in Nyandarua County is deeply rooted in the practices and beliefs of the Agikuyu people. This knowledge encompasses various areas, including agriculture, medicine, environmental conservation, and social organization. In agriculture, the people of Nyandarua have long relied on traditional practices passed down through generations. These practices, such as crop rotation, intercropping, and the use of organic fertilizers, have sustained their farming activities for centuries. The cultivation of indigenous crops like yams, millet, and sorghum is particularly valued, as these crops are well-suited to the local climate and hold significant cultural importance.

The use of herbal medicine is widespread in Nyandarua County, with the community possessing a deep understanding of the medicinal properties of various plants and herbs found in the region. Traditional healers, known as "Muganga," play a vital role in healthcare, providing remedies for common ailments and offering spiritual guidance. Additionally, the community has developed intricate methods of environmental conservation, including the preservation of sacred forests and the protection of water sources. These practices are guided by a profound respect for nature and the belief that natural resources are a gift from their ancestors, which must be preserved for future generations.

While many community members value and uphold their cultural practices, there is a growing tension between traditional beliefs and the influences of modernization. Many people in Nyandarua take great pride in their cultural heritage and view traditional knowledge as a vital

part of their identity. This pride is evident in the continued practice of traditional ceremonies, festivals, and rituals, which serve as a means of preserving and transmitting cultural values to younger generations.

However, the younger generation is increasingly exposed to modern education, technology, and global culture, leading to a shift in perception. Some view traditional practices as outdated or irrelevant in the contemporary world, sparking debates within the community about the relevance of traditional knowledge amid rapid social and economic changes. Despite these challenges, there is a growing movement within the community to integrate traditional knowledge with modern practices. For example, some farmers are combining traditional farming techniques with modern agricultural innovations to improve crop yields and sustainability. Similarly, traditional healers are collaborating with modern healthcare providers to offer complementary medical services.

The aspirations of the people of Nyandarua County are shaped by a desire to balance the preservation of their cultural heritage with the need for social and economic development. Access to education is a key aspiration for many families in Nyandarua. The community recognizes the importance of education in providing opportunities for the younger generation to succeed in a rapidly changing world. There is a growing emphasis on ensuring that children receive both modern education and cultural education to maintain a strong connection to their roots.

In addition to education, the people of Nyandarua aspire to improve their livelihoods through economic development. This includes diversifying income sources, improving agricultural productivity, and accessing markets for their produce. The community is also exploring opportunities in eco-tourism, leveraging their rich cultural heritage and natural beauty to attract visitors and generate income. Despite the pressures of modernization, there is a strong commitment to preserving cultural traditions and knowledge. Community leaders and elders are actively involved in efforts to document and transmit traditional knowledge to future generations. There is also a growing interest in establishing cultural centers and museums to showcase the rich heritage of the Agikuyu people.

4.5.16. Social Amenities and Infrastructure

There are three main modes of transport in Nyandarua County, namely road, railway and air transport; road transport is by far the dominant mode.

Roads

Road transport is the primary mode of transportation in Nyandarua County, with a total road length of Approximately 3,400 kilometres. Earth roads account for 78% of the total road network, while bitumen roads constitute only about 7%, which indicates that there are challenges of mobility within the County.

Parking and terminal facilities

Nyandarua County has minimal designated parking spaces in all major urban centres. Parking in undesignated areas is common in rural areas, and the small urban centres. Most of the urban centres are served by terminal facilities. However, the level of utilisation is low due to lack of demand for transportation services. The table below is a summary of the existing terminal facilities. There are 7 major bus parks located in Ndaragwa, Mairo-Inya, Ol'Kalou, Miharati, Engineer, Njabini and Flyover that act as centres for transport and communication for the population and cargo and have a multiplier effect on development.

Railway transport

There is a 60 kms long metre gauge rail connecting Gilgil to Nyahururu that passes through the Nyandarua County with stations in Ol'Kalou and Ol'Joro Orok. Currently, the railway line, which was constructed in 1927, is in disuse and some of its infrastructure has been vandalised. It was constructed to transport milk, livestock, wool and cereals from Nyandarua and Laikipia to the rest of Kenya. The railway line collapsed due to the failure of KCC as the Nyahururu plant used to be the main client; increased tariffs and low turn-around period has diverted clients to use roads; and inbreeding of sheep resulted in a decline in wool production.

Energy Access

The gaps within counties in terms of access to electricity for lighting are enormous. In most counties (29 out of 47), the gap between the Ward with the most access to electricity and the least access is more than 40 percentage points. Just 1% of residents in Nyandarua County use liquefied petroleumgas (LPG), while 1% use paraffin, 78% use firewood and 19% use charcoal. The most common cooking fuel, therefore, is firewood. Kipipiri Constituency has the highest level of use of firewood at 86%. This is 12 percentage points above Kinangop Constituency, which has the lowest share at 74% and 8 percentage points below the County average. Geta Ward has the highest level of use of firewood in Nyandarua County at 85%.

Ol'Joro Orok and Kinangop constituencies have the highest level of charcoal use in Nyandarua County at 23% each. This is 11 percentage points above Kipipiri Constituency, which has the lowest share at 12%. Gatimu Ward has the highest level of charcoal use in Nyandarua County at 50%. A total of 11% of Nyandarua residents use electricity as their main source of lighting. A further 56% use lanterns and 26% use tin lamps. Less than 1% use fuel wood. The most common lighting source among male headed households is lanterns at 56% and the same holds for female headed households at 55%.

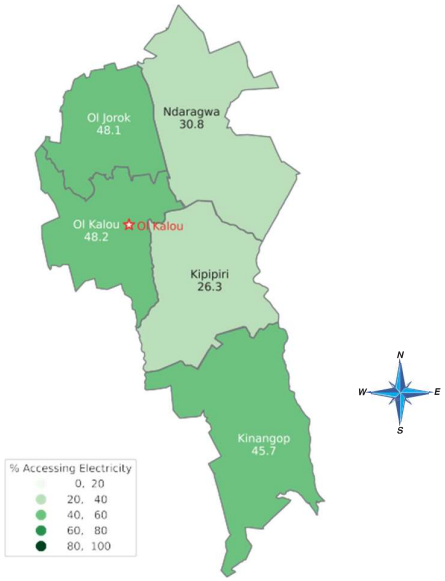
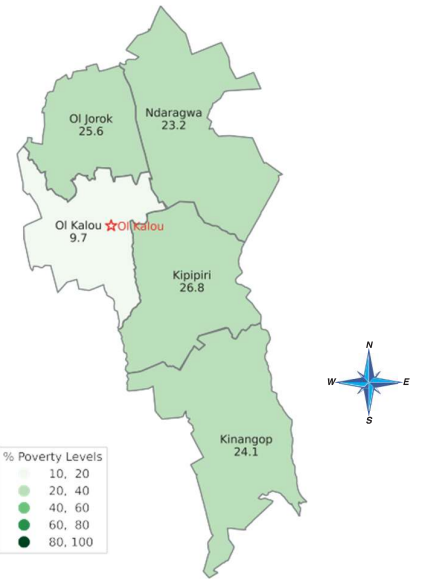
The tables below summarize the socio-economic status of Nyandarua County

Table 15: Socio-economic outcomes for Nyandarua County

Socio-economic outcomes				
Health				
Health outcomes	**2012/13**	**Rank**	**2019**	**Rank**
Child immunization (%)	70.3	16	86.9	36
People Living with HIV	13,700	32	12,754	29
Deliveries at health facility (%)	66.4	7	95.1	8
	2019		**Rank**	
Total Fertility Rate	3.4		24	
Infant Mortality Rate (Per 1,000 Live Births)	30.1		30	
Under five Mortality Rate (Per 1,000 Live Births)	46.5		29	
Maternal Mortality Rate (100,000 Live Births)	466		12	
	Male	**Rank**	**Female**	**Rank**
Life Expectancy at Birth (Years), 2019	58.0	28	63.2	28
Life Expectancy at 60 (Years), 2019	13.8	43	16.6	31
	2015/16		**Rank**	
Morbidity (sick/injured) (%)	16.2		31	
Health facilities (2020)	**Public**		**Private**	
No. of health facilities Level 5 / 6	0		0	
No. of health facilities Level 4	2		3	
No. of health facilities Level 3	24		6	

No. of health facilities Level 2	56		83	
Health infrastructure and Personnel	**2019**		**Rank**	
Bed density per 10,000 population	12		26	
Health-workers per 10,000 population	12		26	
Health Expenditure	**2019**		**Rank**	
Average out of pocket outpatient expenditure (Ksh.)	2,297		11	
Average out of pocket inpatient expenditure (Ksh.)	371		29	
Health Insurance	**2015/16**		**Rank**	
Insurance coverage (%)	18		22	
Education	**2009**	**Rank**	**2019**	**Rank**
Education Outcomes				
Population with primary education (%)	62	7	55.0	13
Population with secondary education (%)	22.4	16	26.5	14
Population with complete Primary or Higher education (%)			82.3	6
Pre-Primary School Net Enrolment Rate (%)			85.0	6
Primary School Net Enrolment Rate (%)			88.7	5
Secondary School Net Enrolment Rate (%)			61.6	5
	2009	**Rank**	**2015/16**	**Rank**
Literacy levels (%)	75.4	16	92	8
School Outcomes	**2009**	**Rank**	**2015/16**	**Rank**
Primary school net attendance rates (%)	90.3	6	89.5	14
Secondary school net attendance rates (%)	35.6	7	52	7
School Infrastructure, 2019				
No of schools	**Public**		**Private**	
ECDE centres	498		362	
Primary schools	350		138	
Secondary schools	170		41	
No. of teachers	**Public**		**Private**	
ECDE centres	789		537	
Primary schools	3,778		1,095	
Secondary schools	1970		542	
Pupils Teachers Ratio (PTR)	**Public**		**Private**	
ECDE centres	29		21	
Primary schools	31		20	
Secondary schools	32		8	
	2019		**Rank**	
Public Primary schools connected to electricity (%)	99.7		7	
Water & Sanitation	**2009**	**Rank**	**2019**	**Rank**
Households accessing safe drinking water (%)	59.3	18	77.6	6
Households accessing improved sanitation (%)	74.1	12	93.1	6
Energy	**2009**	**Rank**	**2019**	**Rank**
Households accessing electricity (%)	10.5	22	41.6	18
Roads	**2019**		**Rank**	
Rural Access Index (RAI)-%	88		11	
ICT	**2019**		**Rank**	
Population accessing internet (%)	12.7		15	
Population owning mobile phones (%)	55		9	

Table 3: Selected Social Services Access Rates and Poverty Levels by Constituency

Households with access to electricity 2019 (%)	Population Accessing Internet 2019 (%)
	
Households Accessing Safe Drinking Water 2019 (%)	**Poverty Levels 2019 (%)**
	

4.6. Resettlement Action Plan

The project will be implemented along the road reserve and no land acquisition is envisaged. One (1) PAP with a kiosk will be compensated due to temporary displacement as per World bank policy. Disturbance created by the project to land improvement and businesses are entitled to compensation.



A kiosk where the access will be affected during trenching of the pipeline route

5. PUBLIC CONSULTATION, PARTICIPATION AND STAKEHOLDER ENGAGEMENT

5.1. Introduction

This chapter describes the process, and activities related to public consultation and stakeholder engagement that were undertaken to ensure that the relevant stakeholders and the public / community are informed about the project and are involved in the identification of key issues and impacts of the proposed project. Stakeholders are defined as persons or groups who are directly or indirectly affected by a project as well as those who may have interests in a project and / or the ability to influence its outcome, either positively or negatively.

Stakeholder engagement and public consultation are an integral aspect of successful decision making in the ESIA process and implementation of projects, plans and programmes. It is central to all other aspects of environmental and social performance. It is the basis for building strong, constructive and responsive relationships that are essential for the successful management of a project's environmental and social impacts (IFC, 2012). The key focus of meaningful consultations is equity and inclusivity i.e. ensuring that all groups (including those that are disadvantaged or vulnerable) are embraced within the consultation process on equal terms, and that all groups are given the capacity to express their views with the knowledge that these views will be properly considered.

The process of engagement presupposes that the relevant stakeholders and other interested publics have access to timely and accurate information on the environment and the proposed development and are therefore able to offer informed views on the project. Stakeholder engagement presents a useful avenue for gathering, understanding and establishing likely impacts of projects, determining community and individual preferences and selecting alternatives. For the proposed potable water networks project, stakeholder engagement focused on diverse issues including disclosure of project information, communication on project scope, financiers and financing framework, construction and operation impacts, mitigation measures, project benefits and recommendations.

The objectives of stakeholder engagement were.

(a) Share project information.

(b) Obtain feedback from the stakeholders.

(c) Bring the stakeholders up to date on the progress of the project as well as next steps to be undertaken.

(d) Garner support for the project hence acquiring the social license /acceptability.

(e) Reduce possibility of conflict through early identification of contentious issues.

(f) Understand culturally sensitive information about the stakeholders.

5.2. Consultation method and approach used in ESIA

Stakeholder mapping and analysis was undertaken in order to determine the particular stakeholders in the project area of influence (individuals, groups, communities, institutions/ organizations, agencies etc.) that will be affected directly or indirectly, either positively or negatively by the proposed project; or those who can contribute to, or hinder its success, and

those with interests, have mandate over various issues related to the project. Overall, the critical guiding participation principles used are outlined below.

Table 16: Principles of Participation and how they were ensured in the ESIA process

Principle	How observed
Adaptive, communicative, meaningful and pro-active consultation	• Project information was shared in Swahili and English languages. In some cases where necessary translation was provided by a local person/ someone appointed by the community or the chief. Some questions were however asked in Kiswahili, local language or English. • Information provided was extensive, detailed and providing as much information as possible but mainly revolving around dissemination of fundamental project background, objectives, scope, description of the proposed alignment, administrative footprint, potential positive and negative lenders, compensation entitlements, safety. • Effort was put towards simplification of technical processes and concepts.
Accessibility	• The locations for consultation were convenient to the stakeholders – in their offices or places where they live in the community.
Inclusivity	• All the stakeholders – men, women, youth, leaders, vulnerable peoples, households etc. were involved.
Right to questions and responses	• In line with Article 33 of the Constitution, which states that public participation should respect the freedom of expression of the participants, the stakeholders were allowed to ask questions, share their views, make recommendations, seek clarifications, make comments about all aspects of the project. • All the questions, requests for clarifications, or additional information were responded to. • Time was dedicated to a question-response session in all the engagements.

Stakeholder engagement/participation was achieved through a variety of information and consultation methods. These were contextualized to the type of stakeholder and/or complexity of the information to be shared or collected. The consultation methods used were administration of a household questionnaire, key informant interviews, observation and secondary data.

Table 17: Consultation Methods

Stakeholder Type	Details of Stakeholders	Consultation Method
Community members in the project area individuals / groups institutions that may or not be direct beneficiaries but who consider or perceive their interests in the project and the process of its implementation in some way.	All community members: men, women, youth, vulnerable, PWDs, community leaders, businesspeople, religious leaders, traditional council of elders, village managers. • National Government County leaders e.g. Chiefs, Assistant Chiefs. • County Government Officers including Municipal Managers	• Environmental Impact Assessment questionnaire. • Face to face meetings. • One- on- One/ face to face meetings • Key Informant Interviews
Government Agencies	• Kenya Wildlife Service (KWS)	• Key informant interviews

Stakeholder Type	Details of Stakeholders	Consultation Method
	• NEMA • KURA/KERRA • CECM Water • CECM Roads • Water Resources Authority	• Face to face discussions • Questionnaire

Table 18: Key Stakeholders Consulted

Stakeholder	Relevance to the project components
National Environment Management Authority (NEMA)	Review ESIA reports and issue EIA Licence
Municipal manager	Implementer of County Projects. Therefore, liaison will be required for functions that fall under Nyandarua County.
CECM Water	manage water resources, ensuring clean and accessible water for residents.

5.3. Stakeholder Consultation and Engagement

5.3.1. Public community Consultations

Stakeholder consultations were conducted using semi-structured questionnaires, designed to identify key issues and concerns related to the Environmental and Social Impact Assessment (ESIA). Questionnaires were chosen as the primary data-gathering tool for this project due to the localized nature of the activities, which are concentrated along the water pipelines.

Public barazas (community meetings) were considered but were not held because there was lack of attendance when one was organized. Community mobilizers who were used to reach more people stated that the community's response indicated dissatisfaction with the current water shortage and a reluctance to participate in additional meetings without tangible results. Thus, the chosen method of using questionnaires allowed for targeted engagement with key stakeholders directly affected by the project.

The use of questionnaires allowed for targeted engagement with key stakeholders, including those most likely to experience or observe the effects of the project. Given the technical nature of the installations, it is unlikely that people outside of the immediate vicinity of the project area would be significantly impacted. Therefore, questionnaires were an appropriate method to collect detailed, site-specific feedback from stakeholders who were to be directly impacted by the project.

These questionnaires provided essential data for analyzing the project's impacts and informing strategies to promote best practices for mitigating negative effects. The primary objective of these interviews was to capture a broad range of perspectives, allowing for the identification of potential impacts and the development of mitigation strategies. Additionally, these consultations served to identify any other concerns that could lead to conflicts during project implementation.

The participants were selected through purposive sampling, a method chosen to ensure that the most relevant stakeholders were consulted. This technique focused on individuals directly

affected by or closely involved with the project, thereby ensuring the relevance and quality of the responses. Key stakeholders included local residents and small-scale business owners, whose proximity to the project areas made their feedback particularly valuable. These stakeholders were expected to offer critical insights into the project's social, environmental, and economic effects.

The consultation was conducted among neighborhoods which were beneficiaries of the project, including stakeholders along the project line i.e. Githunguri Primary and Secondary School, Kwa Iria stage, Kinyumba, Kimanja road, Njoru road, Wa Maria Road, Thenji road and Njoru road

A total of 70 people living and working in the surrounding neighbourhood were interviewed for the project EIA over a 2-day period. The people interviewed were primarily local residents and small-scale business owners living and working in the neighborhoods surrounding the project sites. The individuals were not specifically identified as Heads of Households. Instead, they were individuals found present at their homesteads who had the ability to respond to the questionnaires.

Although there are two schools along the project line, the EIA was undertaken during school holidays and as such no respondent was available at the school vicinity.

A sample size of 70 respondents along the 4 sections of the pipeline was selected to achieve data saturation. It was determined that after interviewing 70 individuals, there was a clear pattern of similar responses, indicating that the main concerns and issues had been adequately captured. By stopping at 70 respondents, the study avoided redundancy while ensuring that the key points of interest had been fully explored. This approach also balanced the need for thorough stakeholder engagement with time and resource constraints, making it both efficient and effective in gathering representative data.

The stakeholder consultations findings are detailed below, and samples of questionnaires administered are annexed in this report.

5.3.2. Concerns/Issues/Questions raised during the Stakeholder Engagement

In all the engagements several issues were raised. The issues ranged between questions, comments and recommendations. The issues were synthesized / summarized below.

Table 19: Issues Raised Matrix

No	Environmental and Social Impact Raised	Description of Issue
1.	Water Availability	The construction of the 8.3Km HDPE pipeline in the Githunguri area is anticipated to significantly enhance water availability throughout the year. This improved access to clean water will support domestic needs such as drinking, cooking, and cleaning, reducing the burden on families who previously had to travel long distances to collect water. Moreover, the consistent water supply will enable irrigation activities, fostering agricultural productivity. This is particularly beneficial for the youth, who can engage in farming as a source of income and employment, thereby empowering the community economically. The availability of water will also promote better hygiene and public health, reducing the prevalence of waterborne diseases.

No	Environmental and Social Impact Raised	Description of Issue
2.	Reduce Water Wastage	The project is expected to reduce water wastage significantly by replacing outdated infrastructure with a modern, well-designed system. The new HDPE pipeline will be less prone to leaks, and timely repairs will be facilitated by the project's improved monitoring and maintenance strategies. This reduction in water loss is crucial in conserving the limited water resources in the area, ensuring that more water is available for essential uses. Additionally, the higher quality materials used in the construction will extend the pipeline's lifespan, minimizing the frequency of repairs and further reducing wastage over time.
3.	Road Network Destruction	The installation of the water pipeline will likely cause significant disruption to the existing road network. This includes potential damage to road surfaces, making them uneven or impassable, and the complete blockage of some roads during construction activities. Such disruptions could lead to delays in transportation, affecting local businesses, commuters, and emergency services. The community is particularly concerned about the potential for prolonged road closures, which could isolate some areas and make access to essential services, such as healthcare and markets, more difficult. Furthermore, the noise, dust, and general disturbance caused by construction activities could exacerbate these inconveniences, leading to frustration among residents.
4.	Accidents	There is a heightened risk of accidents involving both motorists and pedestrians due to the construction activities associated with the project. The presence of open trenches, heavy machinery, and construction materials on or near the roads increases the danger for those who are unaware of the ongoing works. Livestock grazing near the construction sites may also be at risk, particularly in areas where fencing or other protective measures are inadequate. The community has expressed concern that without proper signage, barriers, and public awareness campaigns, the likelihood of accidents could be unacceptably high, leading to injuries or even fatalities.
5.	Loss of vegetation	The construction activities for the project will necessitate the clearing of vegetation. This may lead to a loss of biodiversity, disruption of local ecosystems, and potential soil erosion in the affected areas.
6.	Noise pollution	The use of heavy machinery and construction activities will generate significant noise, which could disturb local communities, wildlife, and workers on-site. Prolonged exposure to high noise levels may also result in hearing impairments and stress-related health issues.
7.	Dust pollution	Construction activities, particularly excavation, transportation of materials, and other ground disturbances, will generate dust, which may degrade air quality. This could lead to respiratory issues for workers and nearby residents, and negatively affect local flora and fauna.
8.	Insecurity	The construction phase could inadvertently increase insecurity in the area, particularly around the project sites. The presence of valuable

No	Environmental and Social Impact Raised	Description of Issue
		tools, machinery, and materials, combined with unguarded or poorly lit trenches, might attract criminal activities such as theft or vandalism. Furthermore, the disruption of the local landscape and the presence of temporary workers unfamiliar to the community could exacerbate feelings of unease among residents, especially after dark. The community is concerned that, without proper security measures, the project could contribute to a rise in crime, making the area less safe for residents, particularly women, children, and the elderly.
9.	Contamination of existing water supply	The construction process poses a risk of contaminating the existing water supply through the release of construction materials, chemicals, or debris. This could compromise the quality of water available to local communities and ecosystems, potentially leading to health risks and environmental degradation.
10	Borehole Drying Up	The community has expressed concern that the increased water extraction required to fill the new pipeline could lead to the depletion of local boreholes. Over-extraction from these boreholes, particularly during the dry season, could cause them to dry up, exacerbating water scarcity rather than alleviating it. The drying up of boreholes would not only affect domestic water supply but could also harm agricultural activities, leading to crop failures and loss of livestock, which are critical to the local economy. Residents fear that without careful management and monitoring, the project could inadvertently reduce the overall availability of water in the area, rather than increasing it as intended.
11	Internal Community Conflict	The implementation of the water project has the potential to trigger conflicts within the community, particularly if there is a perception of unequal benefit distribution or if certain groups feel excluded from decision-making processes. Disagreements could arise over the allocation of water resources, especially if the project results in reduced access for some households. There is also the risk of disputes between different community factions over the use of land, the prioritization of beneficiaries, or the hiring of local labour. These conflicts could delay the project or lead to its outright rejection by parts of the community, undermining its overall success. Effective and transparent communication, along with the early involvement of community leaders, will be essential to mitigate these risks.

5.4. Stakeholders' engagement during scoping phase

During the ground truthing process, project engaged relevant government authorities to brief them about the project.

5.4.1. Key informant interview with national government administration officers

The table below summarizes the key stakeholders consulted during the scoping phase.

Table 20: Details of Stakeholder Engagement / Consultation undertaken for proposed Pipeline

Date	Stakeholder	Venue	Key Points of Discussion and feedback
12/8/2024	CECM Water	Chief Officer's office	• Briefing on the proposed potable water networks. • The Chief Officer pledged to support the project. • The Chief Officer raised concern about intermittent adverse water supply effects on some areas. • He also raised concerned about trenches that might cause danger to residents and expects that precautions will be undertaken. • In addition, the Chief Officer suggested that to avoid the negative impacts, there should be signboards at the project site, campaign awareness, community/stakeholders sensitization, education and involvement be given priority. • He also suggested that the project activities should be timely and not prolonged.
12/8/2024	Municipal Manager, Ol Kalou County	Municipal Manager's office	• Briefing on the proposed potable water networks. • The Municipal Manager pledged to support the project. The project will create job opportunities within the locality and improve clean water supply. • He raised concern on expected water shortage • He requested for the community to be informed in time during implementation period. • He also suggested for timely completion of the project and prior notices to be given before the commencement of the project.
12/8/2024	WSPs (OLWASCO)	OLWASCO Offices	• The consultation with OLWASCO provided valuable insights into the project design and highlighted several challenges including Topographical Challenges, Soil Conditions, and Community Impact that will need to be managed during construction.

6. PROJECT ALTERNATIVES

6.1. Section Overview

The purpose of this section of the ESIA is to examine feasible alternatives to the project and, highlight the benefits of and general rationale for the project that need to be considered against any potential environmental cost. The general principle involved in identifying option(s) to the proposed development is to ensure that the option chosen, which indeed may be the 'non development' option, would result in optimal returns in social and environmental capital: In effect the option chosen should bode well not only for the developer, but also for the environment and stakeholders in the area. This section is a requirement of the National Environment Management Authority (NEMA), and is critical in consideration of the ideal development with minimal environmental disturbance.

6.2. The "No-action" alternative

The "No-Action" alternative would entail not proceeding with the proposed 8.3 km HDPE water pipeline project. This option would leave the current water supply situation unchanged, meaning that the community would continue to rely on the existing, insufficient, and unreliable water sources. Presently, the residents depend on a combination of a problematic borehole, a polluted dam, shallow wells, and roof catchment systems. This scenario would perpetuate the challenges of accessing clean, potable water, leading to continued water shortages and potential health risks associated with contaminated sources. Without this project, the community's water scarcity issues would remain unresolved, and the quality of life would not see the anticipated improvements in water reliability and accessibility.

6.3. Project Design

An alternative to the current project design could involve modifications to the pipeline specifications or materials used. Instead of the proposed 63 mm diameter HDPE pipes, the project could consider using larger diameter pipes to increase the flow rate and potentially reduce the need for pressure management along the pipeline. Additionally, incorporating advanced materials such as high-density polyethylene with enhanced durability or adopting a different pipeline design, such as a prefabricated pipeline with joint fittings, might improve long-term performance and reduce maintenance needs. Furthermore, integrating automated monitoring systems for real-time data on water flow and quality could enhance the efficiency and reliability of the water distribution network. This alternative design approach aims to address future demands more effectively and extend the service life of the infrastructure.

6.4. Location

An alternative location for the pipeline could involve adjusting the route to better align with existing infrastructure or to minimize environmental and social impacts. Instead of the current route that primarily follows existing roadways and utility corridors, the pipeline could be rerouted through less sensitive or more easily accessible areas, such as utilizing underdeveloped land or less utilized utility easements. This alternative might involve a more detailed assessment of potential impacts on local ecosystems and community areas. For instance, choosing a route that avoids crossing sensitive residential areas could reduce disruptions to local activities and potentially lower construction and maintenance costs. This

approach would require a thorough evaluation of the trade-offs between different routes, considering both the environmental and socio-economic implications.

6.5. Layout

Another alternative involves revising the layout of the pipeline within the selected route. The current layout follows a predominantly linear path with minimal deviation. An alternative layout might include variations in the pipeline alignment to better accommodate local topography, reduce construction challenges, and potentially lower costs. For example, the layout could be adjusted to avoid steep gradients that require more extensive excavation and stabilization, thereby reducing the risk of erosion or landslides. Additionally, reconfiguring the layout to integrate more efficient distribution points or to align with existing infrastructure such as roads and utilities could optimize the overall performance of the pipeline. This alternative would focus on improving operational efficiency and minimizing construction and long-term maintenance challenges.

6.6. Preferred Alternative

The Preferred Alternative is to modify the project design to incorporate larger diameter HDPE pipes and advanced materials, with an emphasis on integrating automated monitoring systems. This alternative is chosen due to its comprehensive benefits in enhancing the overall performance and reliability of the water supply infrastructure. The current proposal to use 63 mm diameter HDPE pipes is a solid starting point, but increasing the pipe diameter can significantly improve water flow rates, reduce the need for pressure management, and better accommodate future demand. By opting for larger diameter pipes, the system can handle higher volumes of water, reducing the likelihood of pressure drops and ensuring a more consistent supply to the community.

Additionally, utilizing advanced HDPE materials with enhanced durability will extend the lifespan of the pipeline, reducing the frequency and cost of maintenance. This is crucial in the context of the project's goal to provide a reliable and long-term water supply solution.

Incorporating automated monitoring systems for real-time data on water flow and quality will further enhance the project's effectiveness. These systems will allow for immediate detection and response to any issues, such as leaks or water quality problems, thereby improving the overall reliability and efficiency of the water distribution network.

This design alternative not only addresses the current water supply issues but also anticipates future needs and potential challenges, offering a forward-looking solution that ensures sustainability and resilience. By implementing these modifications, the project will better meet the community's needs, improve water quality and reliability, and provide a robust infrastructure capable of adapting to future demands.

7. PROJECT POTENTIAL ENVIRONMENTAL & SOCIAL IMPACTS AND MITIGATION MEASURES

7.1. Overview

This chapter presents the assessment of the issues likely to emanate from implementation of the proposed project and associated infrastructure. For each issue, the analysis is based on its nature, the predicted impact, extent, duration, intensity, probability, and the stakeholders and/or values affected. In accordance with best practice, the analysis includes issues relating to the project's environmental and social sustainability. For potential negative impacts judged to be significant and require mitigation, the analysis is followed by notes on mitigation options. Impacts and their possible mitigation are combined in this chapter for easy reference. As in most impact studies, the analyses focus on potential problems and their solutions.

7.2. Impact identification

7.2.1. Sources of impacts

The impacts associated with the proposed project will emanate from project inputs, activities and outputs. The project inputs that shall be potential sources of impacts include materials taken from local and external sources including sand and cement; skilled and unskilled workforce exerting indirect demand for water supply, sanitation, health services etc; and machinery used at the project site for various activities. The project activities that shall be potential sources of impacts include obtaining raw materials e.g. transportation of raw materials, machinery and labour to the site; site preparation and clearance; topsoil removal; demolition works (for structures located along project alignment areas); excavation works; disposal of excavated materials; backfilling works and compaction. Project outputs likely to lead to adverse impacts include solid wastes from construction and operation activities; emissions from the site (hydrocarbons, Carbon dioxide, and particulate matter); noise pollution from construction activities and hazardous waste (oil) spillage.

Table 21: Sources of impacts

Project Inputs	Project Activities	Project Outputs
• Materials taken from local and external sources • Skilled and unskilled workforce • Machinery used at the project site	• Transportation of raw materials • Transportation of machinery • Transportation of labour • Site clearance • Excavation works • Spoil and waste disposal • Backfilling and compaction	• Waste generated • Gaseous emissions from the site • Noise from site activities • Oil spills

7.2.2. Receptors of impacts

The anticipated negative impacts will be experienced on both the physical and human environments. Human environment likely to be affected by project activities include structures within project vicinity and alignment areas; residential premises within project vicinity; businesses within project vicinity and workers at the site. Natural environment likely to be affected by project activities include surface and ground water resources within the vicinity of the project and air quality within the project area.

Table 22: Receptors of impacts

Human Environment	Physical Environment
• Residential houses within project vicinity • Business premises within project vicinity • Academic institutions including schools • Workers at the site	• Surface water resources • Ground water resources • Plants and animals within project alignment area • Ecologically sensitive areas • Soil

7.2.3. Impact Assessment Criteria

The criteria applied in this study are based on industry standards for impact assessment, adopted for use in the assessment of the proposed project impacts. The purpose of impact assessment is to assign relative significance to predicted impacts associated with the project, and to determine the way impacts are to be avoided, mitigated or managed. The rating of impacts assumes that standard construction and operating procedures present in the project description will be implemented. The impact assessment criteria include the spatial context of project impacts; temporal context; and reversibility, magnitude and significance of potential impacts of project construction and operation. The potentially significant environmental and social impacts have been identified based on the nature of the receiving environment, analysis of the proposed activities and analysis of the issues raised by stakeholders during public participation process.

7.3. Impact Assessment Methodology

7.3.1. General

In the impact assessment stage of the ESIA, identified issues are analysed and expected impacts are defined. This analysis identifies the types of impact; predicts the magnitude, probability of occurrence and extent of the impact; and determines the overall significance of the impact.

7.3.2. Identification of environmental aspects and impacts

The outstanding environmental and social issues identified as having significance have been assessed using the following methodology.

(i) First, the issues identified were described considering the associated activity and the aspect of that activity that is likely to result into an impact.
(ii) The nature of the impact was then described.
(iii) Once this was undertaken, the significance of the impact was determined.

The following definitions have been used in identification of environmental and social impacts in this study:

(i) An activity

This is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or pieces of infrastructure that are possessed by an organisation.

(ii) An environmental aspect

This is an “element of an organisation’s activities, products and services which can interact with the environment”. The interaction of an aspect with the environment may result in an impact.

(iii) Environmental impacts

These are the consequences of these aspects on environmental resources or receptors of value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. Receptors can comprise, but are not limited to, people or human-made systems, such as residents, communities and social infrastructure, as well as components of the biophysical environment such as aquifers, flora and palaeontology. Impacts on the environment can lead to changes in existing conditions; the impacts can be direct, indirect or cumulative. Direct impacts refer to changes in environmental components that result from direct cause-effect consequences of interactions between the environment and project activities. Indirect impacts result from cause-effect consequences of interactions between the environment and direct impacts. Cumulative impacts refer to the accumulation of changes to the environment caused by human activities.

Aspects and impacts associated with the proposed development have been differentiated into construction and operation phases of the project.

7.3.3. Description of aspects and impacts

The accumulated knowledge and the findings of the environmental investigations form the basis for the prediction of impacts. Once a potential impact has been determined during screening and scoping process, it is necessary to identify which project activity will cause the impact, the probability of occurrence of the impact, and its magnitude and extent (spatial and temporal). This information is important for evaluating the significance of the impact, and for defining mitigation and monitoring strategies and has been used in this study. The aspects and impacts identified have been described based on the following criteria.

7.3.4. Spatial scope

The spatial scope for each aspect, receptor and impact has been defined. The geographical coverage (spatial scope) description has taken account of the following factors:

- The physical extent/distribution of the aspect, receptor and the anticipated impact; and
- The nature of the baseline environment within the area of impact.

The spatial scope of the impact has been rated on the following scale:

Activity specific	1	Area specific	2	Whole site	3	Regional/ neighbouring areas	4	National	5

7.3.5. Duration

Duration refers to the length of time that the aspect may cause a change either positively or negatively on the environment. The environmental assessment has distinguished between different time periods by assigning a rating to duration based on the following scale:

One day to one month	1	One month to one year	2	One year to ten years	3	Life of operation	4	Post closure	5

7.3.6. Severity

The severity of environmental aspect has been determined by the degree of change to the baseline environment, and has included consideration of the following factors:

(i) The reversibility of the impact.
(ii) The sensitivity of the receptor to the stressor.
(iii) The impact duration, its permanency and whether it increases or decreases with time.
(iv) Whether the aspect is controversial or would set a precedent; and
(v) The threat to environmental and health standards and objectives.

The following ratings have been used

Insignificant/ non-harmful	1	Small/ potentially harmful	2	Significant/ slightly harmful	3	Great/ harmful	4	Disastrous/ extremely harmful	5

7.3.7. Frequency of Activity

Frequency of activity has considered the repetitiveness of various project activities and how this may impact on the various receptors of the impacts. The following ratings have been used

Annually or less	1	6 monthly	2	Monthly	3	Weekly	4	Daily	5

7.3.8. Frequency of the impact

The frequency of the impact occurring refers to how often the aspect impacts or may impact either positively or negatively on the environment. After describing the frequency, the findings have been indicated on the following scale:

Almost never/ almost impossible	1	Very seldom/ highly unlikely	2	Infrequent/ unlikely/ seldom	3	Often/ regularly/ likely/ possible	4	Daily/highly likely/ definitely	5

7.4. Assessment of significance of impacts

7.4.1. General

The purpose of impact evaluation is to assign relative significance to predicted impacts associated with the project, and to determine the way impacts are to be avoided, mitigated or managed. The information presented above in terms of identifying and describing the aspects and impacts have been summarised in a tabular form and significance has been assigned with supporting rationale. Significance has been determined before and after mitigation, taking into consideration all the factors described above. A definition of a “significant impact" for the purposes of this study is: “An impact which, either in isolation or in combination with others, could, in the opinion of the specialist, have a material influence on the decision-making process, including the specification of mitigating measures.”

7.4.2. Significance determination

The environmental significance rating is an attempt to evaluate the importance of a particular impact, the consequence and likelihood of which has already been assessed by the relevant specialist. The description and assessment of the aspects and impacts undertaken

is presented in a consolidated table (Table 7.2) with the significance of the impact assigned using the process and matrix detailed below. The sum of the first three criteria (spatial scope, duration and severity) provides a collective score for the CONSEQUENCE of each impact. The sum of the last two criteria (frequency of activity and frequency of impact) determines the LIKELIHOOD of the impact occurring. The product of CONSEQUENCE and LIKELIHOOD leads to the assessment of the SIGNIFICANCE of the impact, shown in the significance matrix below.

Table 23: Significance Assessment Matrix

CONSEQUENCE (Severity + Spatial Scope + Duration)															
LIKELIHOOD (Frequency of activity + Frequency of impact	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 24: Positive and Negative Mitigation Ratings

Colour Code	Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
	Very high	126-150	Improve management current	Maintain current management
	High	101-125	Improve management current	Maintain current management
	Medium-high	76-100	Improve management current	Maintain current management
	Medium-low	51-75	Maintain management current	Improve current management
	Low	26-50	Maintain management current	Improve current management
	Very-low	1-25	Maintain management current	Improve current management

The model outcome is then assessed in terms of impact certainty and consideration of available information. Where a particular variable rationally requires weighting or an additional variable requires consideration, the model outcome is adjusted accordingly. Arguments for such adjustments are presented in the text and associated table.

Table 25: Framework for Assessing Environmental Impacts

Spatial Scope	Rating	Duration	Rating	Severity	Rating
Activity specific	1	One day to one month	1	Insignificant/ non-harmful	1
Area specific	2	One month to one year	2	Small/ potentially harmful	2
Whole site / plant	3	One year to ten years	3	Significant/ slightly harmful	3
Regional (neighbouring	4	Life of operation	4	Great/harmful	4

areas)					
National	5	Permanent	5	Disastrous/ extremely harmful	5

FREQUENCY OF ACTIVITY	RATING	FREQUENCY OF IMPACT	RATING
Annually or less	1	Almost never / almost impossible	1
6 monthly	2	Very seldom / highly unlikely	2
Monthly	3	Infrequent / unlikely / seldom	3
Weekly	4	Often / regularly / likely / possible	4
Daily	5	Daily / highly likely / definitely	5

SIGNIFICANCE OF IMPACT	TIMING
Very Low (1-25) Low (26-50) Medium -Low (51-75) Medium-High (76-100) High (101-125) Very High (126-150)	Pre-construction Construction Operation

7.5. Description of Feasible Alternatives

Although alternatives were investigated in detail during screening and scoping process, a review of the options based on the impact assessment have been undertaken in comparison with the preferred option.

7.6. Mitigation

Measures to avoid, reduce or manage impacts consistent with best practice have been proposed and the effectiveness of such measures assessed in terms of their ability to avoid, remove an impact entirely, render it insignificant or reduce its magnitude. In assessing the significance of the impact, natural and existing mitigation have been taken into account. Natural and existing mitigation measures are defined as natural conditions, conditions inherent in the project design and existing management measures that alleviate (control, moderate or curb) impacts. In addition, the significance of impacts has been assessed taking into account any mitigation measures that are proposed.

7.7. Existing environmental and social impacts

The Githunguri Water Project emerged from the persistent water challenges faced by the local community, which prompted them to come together with the common goal of addressing these issues. The existing water sources in the area, including the only operational borehole, a polluted dam, and a few shallow wells, have proven insufficient to meet the community's water needs. The borehole, while functional, has limited infrastructure, including a leaking masonry tank, a small rising main, and a scanty distribution network that only serves around 31 homesteads. Additionally, the area lacks reliable water sources, with many residents relying on roof catchments during the rainy season. The inadequacy of these water sources, combined with the challenges of accessing potable water, has driven the community to seek a more sustainable solution.

The proposed construction of an 8.3km HDPE pipeline by OLWASCO is a response to these pressing water issues. The project aims to ensure that potable water reaches the homes of

the Githunguri residents through the laying of a comprehensive pipe distribution network. The project area is strategically located along the Gilgil-Nyahururu tarmac road, near the West of Lake Olbolossat, and within proximity to Ol Kalou town, the county headquarters. Despite its advantageous location, the area's existing water infrastructure has been inadequate, with a rising main, a borehole, and elevated plastic tanks already in place, but the distribution network is yet to be completed.

The environmental and social impacts of the current water situation in Githunguri are significant. The area's topography, characterized by undulating terrain and steep slopes, presents challenges for water distribution. The soil in the region is predominantly well-drained black loamy soil, ideal for farming, which is the primary economic activity of the community. However, the area's water supply is insufficient to support agricultural activities and meet the daily needs of the residents. The climate in Githunguri is generally cool, with temperatures ranging between 13°C and 18°C, and the area receives an average annual rainfall of around 1000mm. Despite the rainfall, the lack of adequate water storage and distribution infrastructure has exacerbated the water scarcity problem.

Human settlements and the loss of tree cover in the higher areas surrounding Githunguri have led to the destruction of watersheds that once replenished the dry valleys and seasonal streams in the region. This environmental degradation has further strained the already limited water resources, making it difficult for residents to access clean and sufficient water. The economic activities in the area, primarily subsistence farming and dairy farming, are heavily dependent on water availability. The existing water sources, such as the Mugumo water project, individual shallow wells, roof catchment systems, and a small earth dam, are either insufficient or unreliable, leading to frequent water shortages.

The proposed pipeline project is expected to alleviate these environmental and social challenges by providing a reliable water supply to the Githunguri community. The project will not only address the water scarcity issue but also create job opportunities for the local population, particularly in the construction phase, where unskilled labor for trench excavation will be sourced from the community. Additionally, the project will save time for residents who currently spend significant amounts of time fetching water from distant sources, allowing them to engage in more productive activities, such as farming.

Issues noted within the project area that may adversely impact the proposed project implementation include the following:

7.8. Potential impacts and mitigation measures during construction phase

7.8.1. Disruption of business activities within the pipeline route

Impacts on socio-economic front associated with the proposed project have been looked at from the point of view of temporary disruption of business by project. The business will be affected temporarily during excavation works (kiosk that is located along the project alignment area but outside the wayleave) where the access will be affected. The disruptions of the business have the potential of leading to loss of revenue. During the assessment, the affected business was valued as per the law and details of the PAP is presented in Appendix B.



Figure 7- 1: Kiosk situated along the wayleave of the proposed pipeline route where access will be affected

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	3	2	4	5	4	9	9	81
	Whole site	One month to one year	Harmful	Daily	Likely			Medium-high
Mitigation Measures	• The affected business owner shall be compensated as per provisions of World Bank OP 4.12 and applicable Kenyan legislations. Appendix B contains the details of the PAP and compensation package. The compensation will cater for the loss of revenue only since no structure will be affected.							
With mitigation Measures	1	1	1	4	1	3	6	15
	Activity specific	One day to one month	Non harmful	Weekly	Almost impossible			Very Low

7.8.2. Disruption of services within the project alignment area

Given that the Githunguri water project is in a well-connected area with sufficient road networks and existing water supply infrastructure, the construction activities, including excavation and pipe laying, are likely to interfere with these services. For example:

1. **Water Supply**: The project aims to upgrade and expand the existing water distribution network. During the construction phase, especially when connecting new pipes to the existing system, there may be a need to temporarily shut down the water supply. This could affect the residents who rely on the borehole and other water sources, as well as institutions like schools within the project area.
2. **Transport**: The construction might require trenching along or across roads, particularly the Gilgil-Nyahururu tarmac road (Rd C77), which is a critical access route. This could lead to road closures or restrictions, impacting the movement of people and goods, and potentially disrupting daily activities such as travel to and from commercial centers or institutions.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance

Without Mitigation	3	2	4	5	3	9	8	72
	Whole site	One month to one year	Harmful	Daily	Infrequent			Medium - Low
Mitigation Measures	• Schedule construction activities during off-peak hours and notify consumers in advance about expected service interruptions. • Implement temporary water supply solutions, such as water tankers or auxiliary lines, to serve critical consumers during downtime. • Install sectional valves to isolate parts of the network during maintenance, reducing the number of affected consumers. • Micro-tunnelling of the C77 road to avoid disruption of transport. Provide alternative routes while trenching across the earth roads.							
With mitigation Measures	1	1	1	4	1	3	5	15
	Activity specific	One day to one month	Non harmful	Weekly	Almost impossible			Very Low

7.8.3. Impact on access roads

There are instances where the proposed project infrastructure will cross public roads thus affecting the structure and disrupting traffic flow. Access roads within the project area are likely to be temporarily blocked by excavated materials. Road surfaces may also be interfered with because of trenching works.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	3	2	4	5	2	9	7	63
	Whole site	One month to one year	Harmful	Daily	Very seldom			Medium-Low
Mitigation Measures	(i) All excavated soil shall be used for backfilling of trenched areas and site restoration. (ii) Damaged road surfaces shall be adequately restored to pre-excavation conditions. (iii) Excess spoil materials shall be disposed of in approved sites in compliance with existing laws, rules and regulations							
With mitigation Measures	1	2	1	4	2	3	6	18
	Activity specific	One day to one month	Non harmful	Weekly	Very seldom			Very Low



Figure 7- 2: Pipeline Road crossing at Kinyumba junction to take the right side of the road reserve



Figure 7- 3: Pipeline Road crossing at the branch towards Kimanja road to take the route towards Njoru road



Figure 7- 4: Pipeline Road crossing to elevated water tanks at the junction at Wa Maria road-Thenji road-Njoru road

7.8.4. Blockage of drainage channels

Drainage blockages due to temporary disruption of surface runoff because of the construction process will be experienced. Inadequate drainage could lead to waterlogging and erosion. Collaboration with the county government is necessary to implement proper drainage systems, which could delay the project if not addressed in a timely manner.

Significance of impact

Mitigation status	Spatial Extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	3	2	4	5	2	9	7	72
	Whole site	One month to one year	Harmful	Daily	Very seldom			Medium-Low
Mitigation Measures	(i) Working under dry weather conditions and/or unclogging all blocked storm water drainage channels shall be implemented during the rainy season. (ii) Collaborate with the Nyandarua County Government to upgrade drainage infrastructure along the route. (iii) Engage the community in clearing encroached areas and rehabilitating storm drains to improve water flow. (iv) Design the pipeline installation to avoid low-lying areas susceptible to flooding, incorporating proper drainage channels as part of the project.							
With mitigation Measures	1	1	1	4	2	3	6	18
	Activity specific	One day to one month	Non harmful	Weekly	Very seldom			Very Low



Figure 7- 5: Existing drainage at Kwa Iria Stage where the pipeline route is situated



Figure 7- 6: Existing drainage Near Githunguri Secondary school, where the pipeline will pass



Figure 7- 7: Swampy area due to overflowing drainage Near Githunguri Secondary school, along the pipeline route



Figure 7- 8: Existing drainage along the proposed pipeline route

7.8.5. Accidents and Injuries to workers and community

Activities associated with construction such as excavating of trenches, movement of construction vehicles, the use of equipment and the congregation of workers and staff on site increase the risk of injury. Construction activities will also result in access of the area by vehicles delivering materials to the site that may result in accidents/incidents. Work at the proposed site may involve hazards such as accidental falls into open trenches, slippery walkways, working at heights, exposure to energized circuits, and heavy equipment.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	3	2	4	5	4	9	9	81
	Whole site	One month to one year	Harmful	Daily	Likely			Medium-High
Mitigation Measures	• The Contractor shall conform to all the stipulations of the Occupational Health and Safety Act, 2007. The Act requires the designation of a Health and Safety representative when more than 20 employees are deployed.							

	• The contractor shall provide ample warning signs, guard rails, warning tape, etc., around open excavations, stacks of material, debris, etc. and shall be held liable for all claims because of neglect of such precautions and provisions. • Proper access control should be enforced to ensure that no unauthorised persons enter the site. • Material delivery vehicles should be under the control of competent personnel. Ensure that persons handling equipment and materials are suitably trained, supervised and adequately instructed. • Use of requisite Personal Protective Equipment (PPE) always during construction works • Maintain work areas to minimize slipping and tripping hazards. • Use proper techniques for trenching to avoid collapsing e.g. Benching, shoring etc. • When installing or repairing mains adjacent to roadways, implement procedures and traffic controls, such as establishment of work zones to separate workers from traffic and from equipment as much as possible; reduction of allowed vehicle speeds in work zones to 10km/hr; and use of high-visibility safety apparel for workers in the vicinity of traffic							
With mitigation Measures	1	2	1	5	1	4	6	24
	Activity specific	One month to one year	Non harmful	Daily	Almost impossible			Very Low

7.8.6. Social, health and safety risks to community

The community as well as workers are at risk from projects such as this project, particularly from construction traffic, and local women through sexually transmitted diseases. The project will generate substantial amount of traffic compared to the non-project situation. This traffic will be travelling on the public roads within the project area. Accidents could occur due to falling into open trenches, collapsing of trenches, excessive speeds, unsafe loading, poor road surfaces, poor vehicle maintenance, and unwary pedestrians, especially drunken men, and children.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	3	2	4	5	4	9	9	81
	Whole site	One month to one year	Harmful	Daily	Likely			Medium-high
Mitigation Measures	• Establish and enforce a strict code of conduct for all project drivers including outside suppliers delivering materials. The code should focus on safety, especially speed, and loading, especially banning all carriage of staff, workers and passengers except in seats. • Contractor to employ locals to avoid influx of workers to sites. • Sensitize the workers and community on STDs and HIV/AIDS • same-day excavation, pipelaying and backfilling to minimize risk; provision of access ramps across open trenches; priority backfilling at accesses • x							
With mitigation Measures	1	2	1	5	1	4	6	24
	Activity specific	One month to one year	Non harmful	Daily	Almost impossible			Very Low

7.8.7. Solid waste generation

Construction will result in the generation of various solid wastes, principally spoils from the excavation of chambers, trenches, surplus aggregates, metal scraps, plastics (wrappings and containers) and wood.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	2	2	2	5	3	6	8	48
	Regional	One month to one year	Potentially harmful	Six monthly	Likely			Medium to low
Mitigation Measures	• Express condition shall be put in the contract that before the contractor is issued with a completion certificate; he will clear the site of all debris and restore it to a state acceptable to the environmental consultant. • Construction site management plans will be required for all works. This plan will include a waste management plan for all activities during the construction period. • Bins/ receptacles shall be placed at appropriate locations within the site as collection centres to facilitate separation and sorting of the various types of wastes. • The contractor shall work hand in hand with private waste handlers and local council to facilitate sound waste management; and • The wastes shall be properly segregated and separated to encourage recycling of some useful waste materials.							
With mitigation Measures	1	1	1	5	1	3	6	18
	Activity specific	One month to one year	Non harmful	Daily	Almost impossible			Very Low

7.8.8. Soil erosion

Soil erosion may occur due to uncontrolled excavation of trenches during rainy seasons, from inadequacies in backfilling construction works and improper drainage of storm water. Excavation works will expose soil to agents of erosion leading to soil erosion problems. Occurrence of the impact will be short term and will be restricted to construction phase of the project. Implementation of mitigation measures can reduce the impact to significance of low to negligible.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	3	3	2	5	4	8	9	72
	Whole site	One year to ten years	Potentially harmful	Six monthly	Likely			Medium-Low
Mitigation Measures	• Avoid hampering drainage of surface water and plan for restoration measures after construction. • At the end of construction works, level off the soils and facilitate vegetation regeneration.							
With mitigation Measures	1	1	1	5	1	3	6	18
	Activity specific	One day to one month	Non harmful	Daily	Almost impossible			Very Low

7.8.9. Atmospheric Pollution

The expected air pollutants from the proposed project will include dust, particulate matter and gaseous emissions from construction materials. Dust will be generated from the excavations. Particulate matter will be generated by dry construction materials including sand, cement, gravel, murram, etc. Smoke, hydrocarbons and nitrogenous gases will be emitted from machinery exhausts. These will be expected to increase slightly and will be localized hence expected to be experienced within 30m radius of the project. Air pollution is expected to be a low-key impact during the construction period.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	4	2	3	5	3	9	8	72
	Regional	One month to one year	Harmful	Daily	Infrequent			Medium- Low
Mitigation Measures	• Impose speed limits (10 km/h in all areas within the site boundaries). • Damping down of access roads, stockpiles and cleared areas must take place to minimize dust pollution. • Ensure that no refuse wastes are burnt on the premises or surroundings. Refuse wastes should be removed by an official contractor and dumped at an approved site in compliance with local laws and regulations. More significantly, an Integrated Solid Waste Management system is encouraged. • Proper rehabilitation and restoration of disturbed areas is required in order to minimize bare patches. • Vehicles to be used during the construction phase are to be kept in good working condition and should not be the source of excessive fumes. • Transported materials must be done in such a manner that they do not fly or fall off the vehicle by covering or wetting friable materials. • Sprinkle water before undertaking very dusty operations to reduce dust pollution. • Dust and air pollution due to dust when excavated material is stock piled, should be limited by means of wetting (particularly dry season), covering with foil or working in small sections so that the trenches are backfilled with excavated soil within shortest possible period (maximum 2 days).							
With mitigation Measures	1	1	1	3	1	3	4	12
	Activity specific	One day to one month	Non harmful	Monthly	Almost impossible			Very Low

7.8.10. Water supply disruption

Disruption of water supply due to shutting off valves during construction works may lead to service disruption in some service areas during construction period. Flushing of the system may also lead to temporary water supply disruption during operation phase although this will be of negligible impact significance.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	4	2	2	5	4	8	9	72
	Regional	One month to one year	Potentially harmful	Daily	Likely			Medium-Low
Mitigation Measures	• Give warning to consumers so that they can store water that can last them within the period of disruption • Ensure that water services are restored within 24 hours and keep records of restoration as evidence.							
With mitigation Measures	2	1	1	4	1	4	5	20
	Area specific	One day to one month	Non harmful	Weekly	Almost impossible			Very Low

7.8.11. Sexual exploitation and abuse of community members by project workers

This impact refers to sexual exploitation and abuse committed by Project staff against communities, and represents a risk at all stages of the Project, especially when employees and community members are not clear about prohibitions against SEA in the Project. The project will experience the influx of people who will be seeking employment during construction phase, therefore, SEA will be a critical aspect to be monitored.

Mitigation:

- Develop and implement and SEA action plan with an accountability and Response Framework as part of the C-ESMP. The SEA action plan will follow guidance on the World Bank's Good Practice Note for Addressing Gender-based Violence in Investment Project Financing involving Major Civil Works (Sept 2018).
- The SEA action plan will include how the project will ensure necessary steps are in place for:
  - ✓ *Prevention of SEA*: including Code of Conducts (CoC) and ongoing sensitization of staff on responsibilities related to the COC and consequences of non-compliance;
  - ✓ *Response to SEA*: including survivor-centered multi-sectoral referral and assistance to complainants; staff reporting mechanisms; written procedures related to case oversight, investigation and disciplinary procedures at the project level
  - ✓ *Engagement with the community*: including development of confidential community-based complaints mechanisms discrete from the standard GRM; mainstreaming of PSEA awareness-raising in all community engagement activities; IEC materials; regular community outreach to women and girls about social risks and their PSEA-related rights;
  - ✓ *Management and Coordination*: including integration of SEA in job descriptions, employments contracts, performance appraisal systems, etc.; development of contract policies related to SEA, including whistleblower protection; training for all project management; management of coordination mechanism for case oversight, investigations and disciplinary procedures; supervision of dedicated

Prevention of Sexual Exploitation and Abuse (PSEA) focal points and trained community liaison officers.

7.8.12. Gender-based violence at the community level:

GBV constitutes acts of gross misconduct and are therefore grounds for sanctions, penalties and/or termination of employment. This impact refers to gender-based violence at the community level that women and girls may experience as a result of Project implementation. This includes, for example, an increase in intimate partner violence (IPV) when compensation schemes that share funds equally among husband and wife at the household level do not provide adequate sensitization and safety measures to reduce potential for increased tensions due to females receiving funds. This also refers to other GBV-related risks incurred as a result of project implementation that do not adequately consult women and adolescent girls in the community about safety and security issues related to the delivery of water services.

Mitigation:

- Develop and implement provisions that ensure that gender-based violence at the community level is not triggered by the Project, including:
  - ✓ effective and on-going community engagement and consultation, particularly with women and girls;
  - ✓ review of specific project components that are known to heighten GBV risk at the community level, e.g. employment schemes for women; delivery of supplies; etc.
  - ✓ Specific plan for mitigating these known risks, e.g. sensitization around gender-equitable approaches to employment; supply services; etc
- Ensure adequate referral mechanisms are in place if a case of GBV at the community level is reported related to project implementation.

7.8.13. Violation of children rights by contractor and labour force on site:

Violence against Children (VAW) is defined as physical, sexual, emotional and/or psychological harm, neglect or negligent treatment of minor children (i.e. under the age of 18), including exposure to such harm, that results in actual or potential harm to the child's health, survival, development or dignity in the context of a relationship of responsibility, trust or power. This includes using children for profit, labor, sexual gratification, or some other personal or financial advantage. This also includes other activities such as using computers, mobile phones, video and digital cameras or any other medium to exploit or harass children or to access child pornography.

The Children Act of Kenya prohibits contractors from "employing children in a manner that is economically exploitative, hazardous, and detrimental to the child's education, harmful to the child's health or physical, mental, spiritual, moral, or social development. The possibility of contractor children abuse is through hiring of child labour, also labour force on site might abuse children within the Project area through sexual advance that could lead to early pregnancies and school dropout including exposure to communicable diseases such as HIV and AIDS. It is also important to be vigilant towards potential sexual exploitation of children, especially young girls. The contractor should adopt a 'Child Protection Code of Conduct'; that all staff of the contractor must sign, committing themselves towards protecting children, which clearly defines what is and is not acceptable behaviour. That notwithstanding, the contractor should take responsibility if any of the suppliers and subcontractors contravene this law.

The contractor will undertake the below listed mitigation measures.

Mitigation:

- Develop and implement a Children Protection Strategy that will ensures minors are protected against negative impacts associated by the Project.
- All staff of the contractor must sign, committing themselves towards protecting children, which clearly defines what is and is not acceptable behavior
- Children under the age of 18 years shall not be hired on site as provided by Child Rights Act (Amendment Bill) 2014.

7.8.14. Spread of HIV/AIDS, STIs and other communicable diseases

The project will bring together groups of people, such as workers, community members, or visitors, which can lead to increased social interactions and mobility, contributing to the spread of HIV/AIDS and STIs. Economic development may also encourage behaviors associated with higher risk, such as multiple sexual partnerships. Migrant workers could introduce new infections or increase the transmission rates of existing diseases, while women and young girls may be more vulnerable due to gender inequalities and transactional relationships.

Mitigation Measures:

- Carry out periodic HIV/AIDS awareness training for workers and the beneficiary community.
- Distribution of condoms to workers and beneficiary communities, especially the CIGs.
- Carryout voluntary HIV/AIDS testing for workers and community members.
- If tested positive, further guidance will be offered and directed to the nearest public hospital to receive free antiretroviral (ARVs) drugs and other services.
- The project team should use the services of contracted GBV/SEAH service providers to undertake community outreach activities.
- Hire local workers where possible to minimize the extent of any influx.
- All workers shall sign CoC/ contract that has provisions on GBV/SEAH.

Impact Criteria	Spread of HIV/AIDS, STIs, and Other Communicable Diseases
Impact Nature	Health-related, social, and cultural impacts
Impact Type	Negative impact
Impact Severity	High – the spread of communicable diseases can lead to significant morbidity and mortality
Impact Duration	Long-term – may persist for years or even decades if not addressed
Impact Extent	Local to regional – affects the immediate project area and potentially surrounding areas
Likelihood of Occurrence	High – given the increased social interactions, migration, and possible gaps in health systems
Potential for Irreplaceable Loss of Resource	Moderate to high – the loss of health and well-being can have long-lasting effects on the community's development
Impact Magnitude	Large – can significantly affect the overall health of the community and hinder project success

Impact Significance	Very high – can affect community stability, project outcomes, and public health in the region

7.8.15. Workers/ Labour Influx Impacts

The project will attract an influx of workers and laborers to the area, which could lead to increased pressure on local resources such as housing, water, and food supply, potentially resulting in higher costs for community members. This influx may also strain local infrastructure, including transportation and healthcare services, as the population temporarily grows. Additionally, there may be social tensions between local residents and the incoming workforce, especially if there is perceived inequity in job opportunities or access to benefits. The potential for increased incidences of crime and conflicts may arise, as well as concerns about the impacts of a transient labor force on the local culture and social dynamics.

Impact Criteria	Workers/ Labour Influx Impacts
Impact Nature	Social and economic strain
Impact Type	Negative
Impact Severity	Moderate to High
Impact Duration	Temporary to Medium-term
Impact Extent	Localized to project area, but could spill over into surrounding communities
Likelihood of Occurrence	Likely
Potential for Irreplaceable Loss of Resource	Low to Moderate (depends on resource strain)
Impact Magnitude	Moderate to High
Impact Significance	High due to potential for social unrest and resource scarcity

Mitigation measures:

- Ensure that locally available labour force is given priority during recruitment. Especially for casual and unskilled positions.
- Providing accommodation for workers in camps if the workforce is large

7.9. Potential impacts and mitigation measures during operation phase

7.9.1. Water system leaks and loss of pressure

Water system leaks can reduce the pressure of the water system compromising its integrity and ability to protect water quality (by allowing contaminated water to leak into the system) and increasing the demands on the source water supply and the quantity of chemicals. Leaks in the distribution system can result from improper installation or maintenance, inadequate corrosion protection, stress from traffic and vibrations and overloading among other factors.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	4	2	4	5	3	10	8	80
	Regional	One month to one year	Harmful	Daily	Infrequent			Medium-High
Mitigation Measures	• Ensure construction meets applicable standards and industry practices; • Conduct regular inspection and maintenance; • Implement a leak detection and repair program (including records of past leaks and unaccounted- for water to identify potential problem areas);							
With mitigation Measures	2	1	1	5	1	4	6	24
	Area specific	One day to one month	Non harmful	Daily	Almost impossible			Very Low

7.9.2. Water Discharges

Water lines may be periodically flushed to remove accumulated sediments or other impurities that have accumulated in the pipe. Flushing is performed by isolating sections of the distribution system and opening flushing valves or, more commonly, fire hydrants to cause a large volume of flow to pass through the isolated pipeline and suspend the settled sediment. The major environmental aspect of water pipe flushing is the discharge of flushed water, which may be high in suspended solids and other contaminants that can harm surface water bodies.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	3	1	2	2	2	6	4	24
	Regional	One day to one month	Potentially harmful	Six monthly	Highly unlikely			Very low
Mitigation Measures	• Where possible, flushed water should be carried in bowsers for discharge • Discharge the flush water into a separate storm system with storm water management measures such as a detention pond, where solids can settle, and residual chlorine consumed before the water is discharged; • Where water is flushed into the environment, erosion should be minimised during flushing by avoiding discharge into areas that are susceptible to erosion and spreading the flow to reduce flow velocities.							
With mitigation Measures	2	1	1	2	1	4	3	12
	Area specific	One day to one month	Non harmful	Six monthly	Almost impossible			Very Low

7.9.3. Deficiencies in water distribution system

The water distribution system is a critical component in delivery of safe potable water. Even if water is effectively treated to remove contaminants and destroy pathogens, waterborne diseases outbreaks can occur because of deficiencies in the water distribution system. Exposure of water to pathogens from storage facilities and from external sources may lead to long term impacts whose effects will be experienced regionally. The severity of the impacts will be high without mitigation measures.

Significance of impact

Mitigation status	Spatial extent	Duration	Severity	Frequency of activity	Frequency of Impact	Consequence	Likelihood	Significance
Without Mitigation	4	2	4	5	4	10	9	90
	Regional	One month to one year	Harmful	Daily	Likely			Medium - High
Mitigation Measures	(i) Construct, operate, and manage the water distribution system in accordance with applicable national requirements and internationally accepted standards. (ii) Construct and maintain the distribution system so that it acts as a barrier and prevents external contamination from entering the water system by: • Inspecting storage facilities regularly and rehabilitating or replacing storage facilities when needed. This may include draining and removing sediments, applying rust proofing, and repairing structures • Ensuring that all installation, repair, replacement, and rehabilitation work conforms to requirements for sanitary protection and materials quality • Testing material, soil, and water quality and implementing best practices to prevent corrosion, such as cathodic protection (iii) Maintain adequate water pressure and flow throughout the system by: • Implementing a leak detection and repair program • Reducing residence time in pipes • Maintaining positive residual pressure of at least 20 pounds per square inch (psi) • Monitoring hydraulic parameters, such as inflows, outflows, and water levels in all storage tanks, discharge flows and pressures for pumps, flows and/or pressure for regulating valves, and pressure at critical points, and using system modelling to assess the hydraulic integrity of the system (iv) Prevent introduction of contamination from the distribution system itself by: • Minimizing microbial growth and biofilm development (e.g. by ensuring adequate residual disinfection levels). Collect samples from several locations throughout the distribution system, including the farthest point, and test for both free and combined chlorine residual to ensure that adequate chlorine residual is maintained • Using construction materials that do not contribute to release undesirable metals and other substance or interact with residual disinfectants							
With mitigation Measures	2	1	1	5	1	4	6	24
	Area specific	One day to one month	Non harmful	Daily	Almost impossible			Very Low

7.9.4. Additional Waste water

Ol Kalou's sewerage system currently comprises a Sewage Treatment Plant (STP) with a designed capacity of 3300 m³/day. This facility includes various components such as inlet works, three anaerobic ponds, one facultative pond, two maturation ponds, and one sludge lagoon. In addition, the system features a public ablution block and a sewer network that extends for 36.7 km, encompassing combined trunks and secondary sewers around Ol Kalou.

Recent infrastructural upgrades include a new water treatment plant with a capacity of 2000 m³/day and a corresponding water supply network of 10 km. Additionally, a new sewerage treatment plant has been established with a capacity of 3300 m³/day, accompanied by a 38 km wastewater network. These developments are intended to enhance the water supply and wastewater management capabilities in the area.

Impact of Additional Water Supply

The additional water supply is expected to result in a corresponding increase in wastewater volume. Typically, the volume of wastewater generated is approximately equal to the volume of water supplied. Thus, the additional could lead to a similar increase in wastewater. Given that the existing STP has a design capacity of 3300 m^3/day, this increase would significantly exceed its capacity, potentially compromising the efficiency of wastewater treatment and risking system failures.

Moreover, the current sewer network, which spans 36.7 km, would need to accommodate this increased flow. The additional volume could surpass the designed hydraulic capacity of the sewer pipes, leading to potential issues such as blockages, overflows, and increased maintenance requirements. There is also a risk of system overflows or backflows if the sewer network cannot handle the added pressure.

Mitigation Measures

To address the increased wastewater load, several measures are recommended. First, the STP's capacity should be upgraded to manage the additional wastewater. This may involve expanding the treatment facility or enhancing existing processes to ensure it can handle the increased volume effectively.

Additionally, a detailed assessment of the existing sewer network is necessary to evaluate its ability to manage the higher flow rates. Upgrading the sewer network might be required to prevent potential overloads and ensure efficient operation. Implementing a robust monitoring system to track infrastructure performance and developing comprehensive maintenance plans will help address any issues arising from the increased load and maintain effective wastewater treatment.

7.10. Climate change and vulnerability assessment

Climate Change Act of 2016 is an Act of parliament to provide for a regulatory framework for enhanced response to climate change, to provide for mechanism and measures to achieve low carbon climate development and for connected purposes. The purpose of climate risk vulnerability assessment (CRVA) is to understand the climate and assess climate change threats to the proposed development to assess adaptation measures that are proposed in the design; to determine to what extent the performance and design of the project is vulnerable to climate change, and to recommend measures that will improve the climate resilience of the proposed project.

Climate change have been observed in Kenya. These include general warming, reduced amount of intense rainfall during the rainy season, and more intense and frequent rainfall during the rest of the year (Government of Kenya, 2010). Other literature also reports changes in the climate of Kenya, such as severe or prolonged drought (UNICEF, 2010), desertification (Plan Kenya, 2013), and changing rainfall patterns (de Wit & Stankiewicz, 2006; UNICEF, 2010). A report by Chaocheva (2016) observed a slight and insignificant increase in precipitation in Nakuru county and a more significant increase in minimum temperature, while National Climate Change Response Strategy (NCCRS, 2010) state that climate change in Kenya is *"already unmistakable and intensifying at an alarming rate with evident countrywide temperature increases and rainfall irregularities and intensification"*.

Climate change affects the four components of food security - food availability, food accessibility, food utilization and food system stability - in various direct and indirect ways. As

a result of climate change, there will be increased frequency and intensity of extreme weather events like droughts and floods, which will lead to losses of productive assets, personal possessions and even life. This has already been observed but will intensify in the future if efforts are not raised to stop global warming. For instance, due to droughts, the country's famine cycles have reduced from 20 years (1964-1984) to 12 years (1984-1996), to two years (2004-2006) and to yearly (2007/2008/2009), necessitating the Government's distribution of 528,341.77 metric tonnes of assorted foodstuffs. Extreme climatic variations coupled with improper land use including deforestation have resulted into Kenya reporting successive seasons of crop failure, increasing the country's food insecurity.

Climate change can impact the availability and quality of both surface and groundwater and affect agricultural production and associated ecosystems. Increasing variability of rainfall can influence the flow of water in surface systems and the rates of recharge and discharge from aquifers. Currently, main water sources in the county are groundwater. The potential effects of climate change on groundwater will be much on shallow aquifers.

Risk Impacts Identified:

- Reduced water availability due to decreased rainfall or prolonged droughts.
- Degradation of water quality from higher temperatures and altered flow patterns.
- Infrastructure stress and potential damage from extreme weather events.

Adaptation Strategies:

- Upgrade and design water infrastructure to be more resilient to extreme weather.
- Implement water conservation measures and diversify water sources (e.g., rainwater harvesting, recycled water).
- Establish robust monitoring systems and early warning mechanisms for rapid response.
- Enhance community engagement and capacity building to ensure local preparedness.

7.11. Cumulative Impacts

Environmental Topic	Potential Cumulative Impacts	Mitigation Measures
Noise and Dust	The construction of the pipeline, combined with ongoing activities such as repairs and upgrades to existing infrastructure, may lead to elevated levels of noise and dust. Cumulative impacts from concurrent construction projects in the area could exacerbate these issues.	Implement strict dust control measures (e.g., water spraying) and noise reduction practices (e.g., use of quieter machinery). Schedule construction activities to minimize overlap with other major projects.
Water Supply and Wastewater Generation	Increasing the water supply capacity through the new pipeline may lead to a proportional rise in wastewater generation. This can strain existing wastewater treatment facilities and impact local water bodies if not managed	Upgrade wastewater treatment facilities to handle increased capacity. Develop a comprehensive wastewater management plan in collaboration with other projects to

	properly. Existing and future projects may exacerbate these impacts.	ensure effective handling of increased wastewater.
Competition for Water Resources	Enhanced water supply from the new pipeline may intensify competition for water resources, especially if other developments in the region also increase water demand. This can lead to conflicts between different users and projects.	Coordinate with other water management initiatives to align water resource allocations. Implement water conservation measures and promote efficient use of water across all sectors.
Competition for Use of Existing Services and Infrastructure	The new pipeline might increase demand for existing services and infrastructure, such as roads and energy, leading to potential strain and competition with other projects or community needs.	Assess and plan for the cumulative demand on services and infrastructure. Collaborate with local authorities and stakeholders to optimize service provision and infrastructure upgrades.
Cumulative Environmental and Social Effects	The combined effects of the pipeline construction and other ongoing or planned projects might lead to significant cumulative impacts, such as enhanced environmental degradation and social disruptions.	Conduct a comprehensive cumulative impact assessment considering all concurrent projects. Implement adaptive management strategies to mitigate negative effects and enhance positive outcomes. Regularly review and adjust mitigation measures as needed.
Future Infrastructure Upgrades	Existing pipelines and infrastructure may require future upgrades due to the increased load from the new pipeline, which could lead to additional disturbances and impacts during repair and enhancement activities.	Plan and budget for future infrastructure upgrades in advance. Coordinate repair schedules with ongoing projects to minimize disruptions and optimize resource use.

8. ENVIRONMENTAL & SOCIAL MANAGEMENT AND MONITORING PLAN

8.1. Introduction

The purpose of developing an Environmental and Social Management Plan (ESMP) for the proposed project is to initiate a mechanism for implementing mitigation measures for the potential negative environmental impacts and monitor the efficiency of these mitigation measures based on relevant environmental indicators. The ESMP identifies certain roles and responsibilities for different stakeholders for implementation, supervision and monitoring.

The objectives of the ESMP are:

- To provide evidence of practical and achievable plans for the management of the proposed project.
- To provide the Proponent and the relevant Lead Agencies with a framework to confirm compliance with relevant laws and regulations.
- To provide community with evidence of the management of the project in an environmentally acceptable manner.

Conversely, Environmental monitoring provides feedback about the actual environmental impacts of a project. Monitoring results help judge the success of mitigation measures in protecting the environment. They are also used to ensure compliance with environmental standards, and to facilitate any needed project design or operational changes. A monitoring plan, backed up by powers to ensure corrective action when the monitoring results show it necessary, is a proven way to ensure effective implementation of mitigation measures. By tracking a project ‘s actual impacts, monitoring reduces the environmental risks associated with that project, and allows for project modifications to be made where required.

8.2. Management Responsibilities

The WSP confirmed to the consultant that they lack capacity to implement ESMP, therefore, to implement the management plan, it is recommended that the WSP hires E&S expert to oversee environment and management aspects e.g. pollution control, water loss control and equity access, management of sanitation and hygiene measures throughout the project area. The E&S expert would also be expected to co-ordinate and monitor environmental management during construction and provide monitoring schedules during operations. The expert will be stationed at project site in Githunguri. Other recommended participants could include the respective Nyandarua County Environmental Officers, and Water Officers.

8.3. Environmental Management Guidelines

Upon completion and commissioning of the water project, it will be necessary to establish appropriate operational guidelines on environmental conservation and social linkages to enable the operations’ management to identify critical environmental and social issues and institute appropriate actions towards minimizing associated conflicts. Basically, the guidelines should cover among other areas environmental management progammes, standard operation procedures, compliance monitoring schedule and environmental audit schedules as required by law. Social harmony of the facilities and associated component will be achieved through collaborations with the stakeholders.

8.4. Environmental Education and Awareness Raising

The staff and the beneficiaries will need to understand the basic environmental, water use, principles associated with the project. In this regard, therefore, the following steps will need to be considered.

(i) Creation of liaisons on all matters related to environment, utilization of water,
(ii) Encourage contribution of improvement ideas from the beneficiaries on specific issues related to the management of the facilities, water accessibility, water availability, sharing, etc. say through a questionnaires or direct interactions,
(iii) Establish initiatives that would instil a sense of ownership of the facilities to all beneficiaries

8.5. Decommissioning Process

Due to the long-term life of the intervention facilities and related components, a decommissioning audit will be undertaken before the process for any of the components commences, following a notice to decommission. The decommissioning process will be guided by a comprehensive decommissioning plan developed through the decommissioning audit process. However, the following features will need to be decommissioned upon completion of the works.

(i) Contractor's camp and installations that will need to be removed without compromising on the safety and general welfare of the immediate residents. Special care to be given to associated wastes and dust emitted in the process,
(ii) Materials stores that will comprise fresh materials and used items. Each category will be moved safely out of site ensuring minimal or no impacts to the related environment and social setting,
(iii) Wastes and debris holding sites will be cleared with maximum re-use of the debris either on surfacing the passageways or other grounds such as schools and church compounds.

8.6. Environmental & Social Management Plan (ESMP)

Table 26:ESMP

E&S impacts	Mitigation measures	Responsibility	Parameters to Monitor	Monitoring Means	Frequency of Monitoring	Estimated Annual Cost (Kshs)
Construction phase						
Encroachment of wayleave	Engage with local authorities to address encroachments; identify and document affected areas; coordinate with property owners for resolution.	Project Manager	Encroachment extent; Road reserve boundaries	Site inspections; GPS mapping	Monthly	50,000
Disruption of business activities	Inform affected property owner; compensation for temporary loss of business provided; coordinate alternative access; set up a communication plan to address concerns.	Social Liaison Officer	Business disruptions; Compensation status	Surveys; Stakeholder feedback	Weekly	5,000 (includes compensation cost for 1PAP)
Impact on Public Infrastructure	Plan construction activities to minimize impact; implement traffic management plans; coordinate with local authorities for road closures and detours.	Traffic Manager	Road closures; Traffic flow; Infrastructure damage	Traffic reports; Public feedback	Daily	100,000

E&S impacts	Mitigation measures	Responsibility	Parameters to Monitor	Monitoring Means	Frequency of Monitoring	Estimated Annual Cost (Kshs)
Blockage of Drainage Channels	Implement temporary drainage solutions; coordinate with local authorities for long-term drainage planning; regularly clear construction debris.	Environmental Officer	Drainage flow; Blockage occurrences	Site inspections; Drainage reports	Daily	250,000
Accidents and Injuries to Workers and community	Implement safety protocols; provide training and personal protective equipment (PPE); conduct regular safety audits; establish emergency response plans.	Health & Safety Officer	Accident rates; Safety compliance	Safety audits; Incident reports	Weekly	400,000
Health and safety Risks to community	Implement traffic control measures; conduct community awareness programs; address local health concerns proactively.	Community Liaison Officer	Traffic incidents; Health complaints	Incident reports; Community feedback	Monthly	50,000
Soil Erosion	Implement erosion control measures; stabilize excavated areas; use silt fences and proper backfilling techniques.	Environmental Engineer	Soil erosion extent; Effectiveness of control measures	Site inspections; Erosion reports	Weekly	30,000
Water Supply Disruption	Schedule construction activities to minimize	Project Manager	Water supply continuity;	Service reports; Public feedback	Weekly	100,000

E&S impacts	Mitigation measures	Responsibility	Parameters to Monitor	Monitoring Means	Frequency of Monitoring	Estimated Annual Cost (Kshs)
	service interruptions; notify residents in advance; provide temporary water sources if needed.		Notification effectiveness			
Influx of workers	– Hiring unskilled construction and skilled (if available) labour from the local population as far as possible. Prepare influx of workers plan.	Contractor	No. of local people employed	Inspection	During construction	20,000
Spread of HIV/AIDS and other STI	– Hiring unskilled construction and skilled (if available) labour from the local population as far as possible. Sensitizing workers and the surrounding community on awareness, prevention and management of HIV / AIDS.	Contractor	HIV/AIDS awareness activities	Periodic reports	During construction	50,000
Sexual exploitation and abuse of community members by project workers	Develop and implement SEA action plan with an Accountability and Response Framework as part of the C-ESMP. The SEA action plan will follow guidance on the World Bank's Good Practice Note	Proponent contractor	No. of Complaints	Periodic reports	During construction	20,000

E&S impacts	Mitigation measures	Responsibility	Parameters to Monitor	Monitoring Means	Frequency of Monitoring	Estimated Annual Cost (Kshs)
	for Addressing Gender-based Violence in Investment Project Financing involving Major Civil Works (Sept 2018). Engagement with the community					
Gender-based violence	The contractor will implement provisions that ensure that gender-based violence at the community level is not triggered by the Project.	Proponent Contractor	No. of Complaint	Periodic reports	During construction	20,000
Violation of children rights by contractor and labour force on site	• Develop and implement a Children Protection Strategy that will ensures minors are protected against negative impacts associated by the Project. • All staff of the contractor must sign, committing themselves towards protecting children, which clearly defines what is and is	Proponent Contractor	No. of Complaint	Periodic reports	During construction	20,000

E&S impacts	Mitigation measures	Responsibility	Parameters to Monitor	Monitoring Means	Frequency of Monitoring	Estimated Annual Cost (Kshs)
	not acceptable behaviour • Children under the age of 18 years shall not be hired on site as provided by Child Rights Act (Amendment Bill) 2014. The work at site will be for authorized personnel only. This will control any child interacting or accessing the site.					
Operation phase						
Water System Leaks and Loss of Pressure	Conduct regular inspections and maintenance; ensure proper installation; monitor pressure levels and leak reports.	Maintenance Team	Leak occurrences; Pressure levels	Inspection reports; Pressure gauges	Daily	400,000
Water Discharges	Implement measures to control discharge quality; use settling tanks or filtration; ensure proper disposal of flushed water.	Environmental Officer	Water quality; Discharge volumes	Water quality tests; Discharge records	After each flushing event	250,000

E&S impacts	Mitigation measures	Responsibility	Parameters to Monitor	Monitoring Means	Frequency of Monitoring	Estimated Annual Cost (Kshs)
Deficiencies in Water Distribution System	Regularly monitor water quality; inspect distribution system integrity; address deficiencies promptly.	Quality Control Officer	Water quality; System integrity	Inspection reports; Water quality tests	Weekly	500,000

8.7. Environmental & Social Monitoring

The management of environment and social impacts and consequences of every proposed project is a regular, all purpose and continuous activity, which commences from the beginning of the project and the initial plan of its establishment, and until termination of the project life and thereafter. The performance of this management rests on an appropriate administrative structure, known as the environmental & social management unit, which is a section of the management and operation aggregate of the plan. Outlooks and the principals of environmental conservations must proceed in all the various angles of management.

The objectives of this plan are to render suitable methods and perform effective measures of acceptable costs, in order to reduce the destructive impacts arising from the establishment and operation of the proposed project in regards the regional environment and its accordance with the standard and desirable conditions, in rendering monitoring and control plans, public participation and environmental training. Hence, in this chapter, in addition to rendering the plan for each monitoring index, by specifying the responsible or relative organizations and estimating the organizational and implementation requirements, conditions for the execution of environmental plan are alleviated.

8.8. Internal Monitoring

Though most of the mitigation measures will be implemented by the Construction contractor as per contract condition, the overall responsibility related supervision and monitoring of ESMP implementation and compliance of HSE requirement lies with project proponent. The evaluation of compliance of ESMP implementation and HSE management will be guided by Construction ESMP (CESMP) to be prepared by the contractor based on site specific conditions before start of construction and approved by Project proponent. The CESMP shall comprise of relevant sub-plans such as Erosion control and site restoration, biodiversity protection, Air Quality, Noise & Vibration, Waste Management, Traffic Management apart from Health & Safety Plan and emergency preparedness plan in line with mitigation measures suggested in ESIA.

The objective of internal monitoring and audit will be:

- To identify gaps in implementation of the ESMP by the contractor
- Ensure compliance to legal requirements provided in EMCA 1999
- Guide the contractor's management of HSE requirements from time to time where unforeseen impacts are encountered

The proponent will continue the monitoring process during the operation and decommissioning phases of the projects ensuring that the minimum allowable Environmental parameters are maintained. These parameters include,

1. **Workforce Training**

The contractor shall provide induction of workers to ensure they are adequately trained on HSE management on top of the specific skills required for their job description. The proponent should monitor induction training and toolbox talks records regularly. The contractor shall also train site specific HSE supervisors to enforce the trainings.

2. **Monitoring of Accidents Prevention/ Health Management**

The Proponent will procure services of an independent environmental, health and safety (HSE) consultant to undertake frequent audits on the contractor during project implementation. The consultant will undertake regular site inspection visits (frequency shall be agreed upon with Contractor) to monitor how the contractor is managing his work force and activities with regard to accident prevention and health management.

The contractor's safety manager on the other hand shall ensure that appropriate safety signage and personal protective equipment is always availed to the construction workers.

Indicators that will be used in evaluation of accident prevention and health risks management includes.

- Provision of adequate personal protective equipment to workers at all phases of the project
- Presence of displayed safety warning signs and markings at active sites and on tower structures on completion
- Adequate human waste disposal and sanitation facilities are present at active sites
- Community awareness on safety risks associated with the project
- Compiled records of actual accidents/ incidences that have been encountered
- Report health cases that are related to the project

3. **Soil Erosion and Conservation Monitoring**

Construction activities such excavations and transportation of construction materials within the project areas may lead to loosen soil structure thereby resulting in erosion. The contractor will be responsible for ensuring that appropriate soil conservation and erosion prevention measures are practiced throughout the construction phase.

4. **Noise Levels Monitoring**

Emission of noise is expected during the construction phase. Major sources of noise will be from machinery such as excavators. However, the noise levels may not be an issue as emission is site specific and low Regular monitoring of these noise levels by the Contractor should be conducted to ensure that they recommended limits are not exceeded. Consultation with the PAPs will aid in establishing the extent of this impact

5. **Air Quality Protection**

Dust and emissions from machinery should be monitored by the contractor and adequate measures employed in ensuring air quality. This will include watering down of active sites/ roads and other areas generating the dust or maintenance of machinery with excessive smoke emissions. In addition, where excessive wind is observed, dust generating activities can be halted for some time.

6. **Solid and Liquid Waste Management Monitoring**

Monitoring of waste generated at both the site and workers campsite during the construction phase shall be done by the contractor's HSE manager. He will ensure that;

- Records of the type and waste amounts generated at the sites is kept

- Adequate and separate waste management facilities are provided at each site. The equipment shall be such that it aids in waste segregation
- All generated waste is bound to the specific sites boundary and littering of the environment is discouraged
- Human waste disposal facilities are provided at each site
- Collected waste is properly disposed away from site at dumping sites approved by the local county government

7. Biodiversity monitoring
    - Monitor invasive species as they appear for timely control and physical removal

8.9. External Monitoring

The Kenyan government's environment management body NEMA shall issue approval for the implementation of the proposed project. Moreover, it shall ensure that the provided mitigation measures are implemented in implementation of the project. NEMA shall offer oversight of the implementing bodies through review of monitoring reports. The proponent shall therefore provide the agency with annual progress reports on environment, health and safety management

8.10. Environmental Audits (EA)

Environmental audits during all phases of the project implementation are key in ensuring full compliance to ESMP requirements. The goal of EA will be to establish if the proponent is complying with environmental requirements and enforcing the existing legislation. The purpose of EA is to determine the extent to which the activities and programs conform to the approved environmental management plan. The Consultant recommends that an independent consultant will be sourced to oversee environmental management throughout the construction phase and during the operational phase and decommissioning phase. He will provide Environmental audits in line with NEMA's requirement.

8.11. Grievance Management/Redress Mechanism

A Grievance Redress Mechanism GRM has been established to receive and facilitate resolution of complainants (project affected people, local community and workers) concerns and grievances regarding the project's performance during the construction, operation and decommissioning phases of the project. The mechanism should be able to address the concerns and complaints in a timely fashion by using an easy to understand, transparent and effective grievance redress process that is readily accessible to all segments of the project area population including workers and community members.

This GRM has been developed with the intention of providing an effective tool for early identification, evaluation and resolving of grievances during the full cycle of the project. The range of issues that are likely to arise requiring this process include:

- Unfair or biased job allocations.
- Poor management of construction activities.
- Compensation payment for services rendered or damages to property,
- Failure to fulfil commitments.
- Interference with public utilities.

- Accidents due to inappropriate planning of vehicle movement.
- Conflicts between migrant workers and local communities.
- Disturbance due to excessive noise or other nuisance during construction or operation.
- Unfair treatment of workers or unsafe working conditions.
- Issues related to Gender (GBV, SEA and VAC).
- Any other issues related to environment, health and safety issues

Since the range of issues is diverse, the GRM should be comprehensive enough to tackle complaints without any costs and also provide privacy to complainants especially gender issues.

An effective GRM should have the following:

- Identification of personnel (Grievance Officer who will be receiving and recording grievances at the site level);
- Process of evaluating grievances and determining which process to follow;
- Process of making decisions on providing resolutions.
- Notification procedures.
- Timeframes within which issues are to be resolved.
- Procedure for escalation of issues that cannot be resolved at the site level;

Publicizing of the GRM

The developed GRM should be publicized to ensure that all stakeholders (workers, community members, contractor, project management etc) are aware of the existence of the GRM and how it shall be used to resolve grievances.

Grievance Redress Committee (GRC) and Meeting Calendar

The GRC

The developer shall facilitate the formation of a two-tier Grievance Redress Committee (GRC) both at village level and project level. This committee shall comprise of the following representatives:

Level 1

- Affected persons
- Location Chief
- A Representative from the Community (Male and Female)
- Community liaison officer

Level 2

- Project manager/GRC officer
- Community liaison officer
- EHS Officer;
- Contractor EHS representative

GRC Meeting Calendar

The GRC shall roll out its meeting calendar to the stakeholders so that they are aware of when to expect their issues resolved. It should endeavour to meet as often as possible so that grievances do not remain unresolved for a long period. Other than the issues that the GRC Officer will be able to provide immediate solution when the complainants come lodge their complaints, the registered complaints will take between 21-45 days for resolution. It is

therefore suggested that the GRC meets monthly or as dictated by any registered urgent grievance. In case complainant/ appellant is not satisfied with the decision of GRC they can approach court of law for resolution.

Special Representatives in the Committee

The proponent to consider having special representatives in the grievance committee (Female Members) who can deliberate and resolve grievances touching on gender issues like sexual harassment, rape etc). This will help in safeguarding privacy of victims of rape and sexual harassment. It will also provide confidence to victims to come forth and register their complaints no matter how personal.

The Committee shall have the following functions:

- To keep a live register of all grievances lodged by complainants.
- To provide support to affected communities on issues arising from environmental or social impacts.
- To record grievances of the affected community by categorizing and prioritizing them, and providing solutions within a stipulated time period.
- To report to the aggrieved parties regularly and in a timely fashion, developments regarding their grievances and decisions of the GRC.
- To escalate any unresolved issues to the management in a timely fashion so that solutions are reached in good time.

Training Workshop

The project proponent shall hold a training workshop for stakeholders (workers and community members) to educate and sensitise them regarding the operations of the GRM. This training shall be carried out before rolling it out so that the team is ready to receive and resolve grievances immediately stakeholders get to know of its existence.

Receiving and Recording of Grievances

The Grievance Officer (Proponent E & S Officer) shall receive anonymously record the grievance in a grievance form and assess the type of grievance.

If it is an issue that can be resolved immediately then a solution shall be provided by the Grievance Officer. If it requires deliberation of the GRC then the Grievance Officer shall indicate the timeframe when the complainant should expect the issues to be resolved.

The Grievance form that shall be used to record grievances shall contain the following information:

- Unique Serial number of the complaint.
- Date of receipt of the complaint.
- Particulars of the complainant (Name, Address, Contact details);
- Nature of Complaint (Subject of the complaint, Brief description of the complaint, where the issue occurred and when, suggestion on what the complainant wants done).

GRC Reports

The GRC shall prepare detailed monthly reports that shall be submitted to the management. The reports shall contain the following among other issues:

- The grievances recorded during the reporting period
- The resolutions provided to the complainants
- The period taken to resolve the issue

- The response received from the complainant after receiving feedback from the GRC
- Escalated Grievances and the timeframe taken to provide solution from the management
- Classification and Analysis of the grievances for lessons learnt and improvement of project operations
- Minutes of all the meetings of the GRC.

8.12. Framework for Implementation of the ESMP

The Contractor will be expected to address all aspects of the construction activities in compliance with all laws and regulations, approvals, licenses and permits which are applicable to the proposed project. The Contractor shall ensure that he is familiar with the ESMP for the project. He shall prepare the work plan and strategy considering the relevant provisions of the ESMP. The prepared Management plans shall be reviewed and approved by Environment and Social Safeguards Officer of the project implementor.

The Contractor will also be expected to evaluate the construction activities/components and prepare appropriate project Construction Environment and Social Management Plan including:

1) Waste Management Plan.
2) Biodiversity Management Plan
3) Hazardous Waste and Materials Management Plan.
4) Occupational Safety and Health Management Plan (OSHMP)'
5) Traffic Management Plan.
6) Water Management Plan
7) Community Engagement Plan.
8) Child Protection Strategy.
9) Workers Code of Conduct.
10) Labour Recruitment and Migrant Labour Management Plan.
11) Grievance Redress Mechanism.
12) Prevention and Protection Against GBV and Sexual Exploitation.

8.13. Institutional Framework for implementation of ESMP

<u>Project Proponent Obligations & Responsibilities</u>

Project proponent will maintain a monitoring and oversight capability by hiring E&S personnel to ensure that the contractor and its subcontractors are fulfilling their E&S obligations. Responsibility for implementing the environmental and social mitigation and monitoring actions included in the ESMP will be passed on to contractor and its constructors.

Contractor upon issue of the 'notice to proceed' (NTP).

Proponent will:

- ensure that contracts with contractor and its sub-contractors are consistent with the components of the ESMP that are within their scope of responsibility and have the capacity to fulfil these requirements.
- review CESMP, including standard environmental and social protection procedures prior to starting construction; and

- maintain oversight of their ESMP performance. A monitoring process to track the contractor's compliance with the approved CESMP will be implemented during construction phase and the results reported.

Contractor Obligation and responsibilities

During the construction phase, responsibility for many of the environmental and social mitigation and monitoring actions will be passed on to the construction contractors. In these situations, Proponent will maintain a monitoring and oversight capability to ensure that contractors are fulfilling their obligations.

Contractor and their sub-contractors will prepare a CESMP, which will include:

- Sub plans for environmental management in line with the project ESMP as well as the mitigation measures proposed in the project EIA and any conditions imposed by NEMA to the potable water networks project.
- Site specific plans to apply in the field, including EHS Plan, emergency response and contingency plans, as appropriate; and
- proposed mitigation programme for identified sensitive areas (i.e. Impala Sanctuary Park).

8.14. Organization Roles and Responsibilities

The Contractor will be expected to engage the following safeguards officers on a full-time basis for the period of the project.

- EHS Expert (Environmentalist);
- CLO (Community Liaison Officer – Community Representative).

Before commencement of construction process, the Contractor will be expected to show familiarity with the methodology on the implementation of Environmental and Social Safeguards.

The above officers will have the responsibility of assisting the Contractor to comply with the safeguard’s requirements. Among other duties, the safeguards officers will be responsible for carrying out roles as listed in Table below.

The Safeguards Team will be reporting to the Project Manager/Supervisor on Safeguards achievements, issues and challenges on regular basis.

Table 27: Roles of Safeguards Officers Engaged by the Contractor

Title/Designation	Duties/Roles
EHS Officer	• Assist the Contractor to Develop CESMPs • Supervision of Health and Safety and implementation of Toolbox Talks • Implement Environmental Safeguards in the project to protect people and the environment • Ensure timely approvals and permits, wherever required • Coordinate environmental compliance in the project • Oversight waste management • Ensure environmental information reaches team leaders • Carry out surveillance on safety issues and safety training • Interface between the Contractor and the workers and Community • Support on social safeguards and helps mobilize and organize Community and other stakeholder meetings. • Record incidences taking place during construction work and liaises with the Project Supervisor to address the emerging issues. • Record Grievances • Assist the Grievance/EHS Officers with communicating safeguards issues to the community • Attend Grievance Redress Committee (GRC) Meetings • Preparation of Environmental, Health and Safety Reports

8.15. Training, Education and Competency

Site Supervisor shall ensure that every employee/worker (direct or contractual) is aware of the EHS risks associated with the work being carried out at the site and is trained and competent in the relevant work practices and maintenance procedures. Training needs shall be identified and executed to ensure all staff are provided with adequate safety training for all levels of employees. The safety training should provide staff with the knowledge and skills necessary for organizing and managing occupational safety and health programmes. The team leaders with leadership skills and knowledge to lead should be supported to implement and apply occupational safety and health activities. Workers with the knowledge, skills and right attitudes should be encouraged/supported to enable them to work safely.

Areas that could be considered for training of various cadres of workers are:

- HSE Policy and how it applies to the workplace.
- Hazards/Risks and Emergency Response Procedures.
- Importance of Safety Induction and Toolbox Talks.
- Appropriate use of Personal Protective Equipment (PPE).

The above inductions and trainings will improve on competency of the workers and lower incidence of injury and improvement on working safely.

8.16. Assessment and Improvement

It is noted that often projects collect data on environment, safety and social aspects of the project however this data is never evaluated for improvement on the implementation of the ESMP. Data on injury incidences should periodically analysed considering source of injury, frequency of occurrence and whether any safety measures were overlooked so that improvements can be made on lessons learnt.

8.17. Incident Management

All incidences occurring within the project shall be managed through the incident management procedure that has been put in place and conforms with DOSHS. Every team that is carrying out a task must have a person appointed to be in charge. The officer in charge shall be familiar with all incident management protocols All the procedures for different occurrences shall be documented using appropriate forms as guided by DOSHS. Team leaders shall be sensitized on the use of the forms and the required protocols of reporting incidences and timeframe in which all incidences must be reported. The incident reporting forms must always be within reach of the team leader or EHS Officer.

8.18. Reporting

It should be ensured that provisions for reporting incidents, accidents and dangerous occurrences during construction are promptly done using prescribed forms obtainable from the local Occupational Health and Safety Office (OHSO). The team leader or Officer in charge of a Task Team shall be inducted on the reporting protocols and requirements. The training or induction shall include:

- Procedure of making a report on incidences.
- The protocol to be followed and reporting hierarchy.
- How the forms should be filled (without errors or omissions);
- Reporting timeframe.

8.19. Management Review

The project Environmental and social Management and Incident reports shall be prepared and submitted on a monthly basis. Review by management shall be done on a quarterly basis and feedback given to the safeguard's teams.

8.20. Liaison and Communication to Stakeholders

A Stakeholder Engagement Plan has been prepared to guide the process of engaging with stakeholders. The Stakeholder Engagement Plan is a crucial component of the Social Management Plans that will be implemented. Regular transparent communication between the project and the community and other stakeholders and vice versa is critical in building a good understanding between the parties involved. This good understanding shall be very important in managing unexpected situations that might arise during project implementation. The Stakeholder Engagement Plan includes some community liaison measures for the operation phase as well.

9. CONCLUSION AND RECOMMENDATIONS

9.1. Conclusions

The Project will directly contribute in achieving vision 2030 through increased water supply. It will improve the economic development in Kenya through the availability of good quality water supply and creation of employment.

The Project's impact on the physical environment will be manageable, mostly short-term construction-related impacts, which will be mitigated. The report has outlined mitigation measures in the ESMP matrix in chapter 8 to be implemented during the various project phases.

Given that the Environmental Assessment undertaken under this Project, and considering the Project's strong economic justification, the Project satisfactorily meets environmental protection requirements provided that the mitigation, monitoring, and reporting plans are carried out.

The environmental, and social Impact Assessment (ESIA) of the proposed project has been conducted in accordance with national legislative requirement, county by-laws; World Bank Operational Policies; and World Bank Group/IFC EHS guidelines. The ESIA study has been carried out based on the site visit, baseline environmental and social condition survey including, stakeholder consultation, analysis of the possible project intervention. The experts identified and evaluated potential environmental impacts associated with all aspects of the proposed project.

The key potential environmental impacts due to the project construction as established by the ESIA study are some losses of vegetation, air and noise pollution, moderate loss of habitat for some mammals, insects and amphibians, solid waste generation and disposal, increase in traffic and occupational health and safety. The economic opportunities in terms of local employment and provision of services during construction and operation phases are assessed as positive impacts. During the operation of the proposed project, the key issues related to the environment has been identified from the ESIA study are ecological, visual impact and occupational health and safety.

The Environmental and Social Management Plan (ESMP) has described mitigation measures for impacts specific to the project activities and discuss implementation mechanism for recommended mitigation measures along with a monitoring plan. Implementation of the ESMP will help the developer to comply with the national regulatory framework as well as to meet World Bank Operational Policies.

9.2. Recommendations

The following are also recommended with respect to the proposed Project.

- That strict adherence to the Environmental Management Plans should be observed.
- That any unforeseen impacts shall be immediately notified to the environmental assessor to ensure that they are immediately addressed and mitigated.
- Project Construction works to commence after approval and issuance of the license.

- The project contractor shall need to hold meetings with local communities before commencement of construction to firm up agreements of engagement.

APPENDICES

Appendix A- Sample of Responses from Questionnaires

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED LAYING OF 8.3KM HDPE PIPELINE IN GITHUNGURI AREA

QUESTIONNAIRE

PART A: INTRODUCTION

The Ministry of Water, Sanitation, and Irrigation (MoWS&I) is implementing the Water and Sanitation Development Project (WSDP) aimed at improving water supply, sanitation services, and the financial performance of Water Service Providers (WSPs). Ol'Kalou Water and Sanitation Company proposes to carry out laying of 8.3km HDPE pipeline in Githunguri area. In accordance with the Environmental Management and Coordination Act (EMCA) 1999, it is a requirement to undertake an Environmental and Social Impact Assessment (ESIA) for new projects.

Kindly, give us information you know concerning the proposed project's impacts and mitigation measures.

PART B: RESPONDENTS' DETAILS

Name of Organization	WECCNR DEPT.	Tel No.:	0720868861
Respondent's Name:	FRANCIS M KIBUIKA	Designation:	C.O WATER
Email Address:	franciskibuika@gmail.c	Date:	12/8/24

PART C: EIA STUDY QUESTIONS

1) Are you aware of the proposed project? 1. Yes ☑ 2. No. ☐

2) How do you think the proposed project will affect your operations/activities?

Will not affect adversely but some areas will go without water intermittently

3) What impacts do you anticipate from the construction of the proposed project?

Trenches may cause danger to residents expect precautions to be undertaken

4) Suggest ways through which the negative impacts can be avoided, reduced or mitigated

Ensure Sign boards available, Community Sensitization timely activities (not prolonged)

5) Do you support the proposed project? (tick) 1. Yes ☑ 2. No. ☐

If NO, kindly give reasons for your objections.

Signature .....

Official Stamp

CHIEF OFFICER
WATER AND SANITATION
Date: 12/08/2024
NYANDARUA COUNTY
P.O. Box 701-20303,OL-KALOU

For any Enquiry or Clarification Please Contact:
Vitalis Too – Lead expert Tel. No: +254 720 283 797

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED LAYING OF 8.3KM HDPE PIPELINE IN GITHUNGURI AREA

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Kindly, give us information you know concerning the proposed project's impacts and mitigation measures.

PART B: RESPONDENTS' DETAILS

Name of Organization	Ol Kalou Municipality	Tel No.:	0724293354
Respondent's Name:	Eric Lagoo	Designation:	MANAGER
Email Address:	lgoeric@gmail.com	Date:	12/08/2024

PART C: EIA STUDY QUESTIONS

1) Are you aware of the proposed project? 1. Yes ☑ 2. No. ☐

2) How do you think the proposed project will affect your operations/activities?

Provision of sufficient water.

3) What impacts do you anticipate from the construction of the proposed project?

- ~~Hate Shatage~~
- Job Creation within the locality.
- Improved/Sufficient clean water supply.

4) Suggest ways through which the negative impacts can be avoided, reduced or mitigated

- Timely completion of the project.
- Give prior notices before commencement of the project

5) Do you support the proposed project? (**tick**) 1. Yes ☑ 2. No. ☐
If NO, kindly give reasons for your objections.

Signature ....

MUNICIPAL MANAGER
OL KALOU MUNICIPALITY
LAIKIPIA COUNTY
Official Stamp

For any Enquiry or Clarification Please Contact:
Vitalis Too – Lead expert Tel. No: +254 720 283 797

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED CONSTRUCTION OF 8.3KM HDPE PIPELINE IN GITHUNGURI AREA

QUESTIONNAIRE

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The consultant (Mr. David Moindi, assisted by Dr. Vitalis Too and the team) has been commissioned by Water Sector Trust Fund (WSTF) to carry out an Environmental Impact Assessment (EIA) study for Construction of 8.3Km HDPE pipeline in Githunguri area.

Kindly, give us information you know concerning the proposed project's impacts and mitigation measures.

1. **Details of the respondent**

   Name of respondent: Bernard Wachira Organization: _____

   Phone No. 0713522007 ID No. 32468292 Designation: _____

2. **Do you support the proposed project?** YES ☑ / NO ☐ **(tick one)**

   Do you have any reasons for your answer above? Please state

   + to reduce water wastages
   Better supply of water to whole community.

3. **Please state any positive/negative environmental and social impacts caused by the proposed project.**

   (a) Positive Impacts

   * Job creation
   * Sufficient water supply.

   (b) Negative Impacts

   * During the project insufficient / Poor road network

   (c) What would you propose as measures to mitigate the above negative impacts?

   * OLEWAS CO should reduce the Monthly standing charges.

4. **Give any relevant additional comments**

   .....

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P.O Box 990-00200, Nairobi
Tel: 0720283797

(Signature)

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Kindly, give us information you know concerning the proposed project's impacts and mitigation measures.

1. **Details of the respondent**

   Name of respondent: Eric Kamanja Organization: _____

   Phone No. 0756151895 9 ID No. 37387071 Designation: Githunguri

2. **Do you support the proposed project?** YES ☑ /NO ☐ **(tick one)**

   Do you have any reasons for your answer above? Please state

   Availability of clean and enough water

3. **Please state any positive/negative environmental and social impacts caused by the proposed project.**

   (a) *Positive Impacts*

   Job Creation
   Adequate water Supply

   (b) *Negative Impacts*

   Insecurity due to the unprotected trenches

   (c) What would you propose as measures to mitigate the above negative impacts?

   The project to take the Shortest time possible

4. **Give any relevant additional comments**

   The Project to be a Success

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Kindly, give us information you know concerning the proposed project's impacts and mitigation measures.

1. **Details of the respondent**

   Name of respondent: Joseph Kuria Organization: _____

   Phone No. 0710237781 ID No. 23001158 Designation: _____

2. **Do you support the proposed project? YES ☑/NO ☐ (tick one)**

   Do you have any reasons for your answer above? Please state

   It will help in minimising water shortage during dry seasons.

3. **Please state any positive/negative environmental and social impacts caused by the proposed project.**

   (a) *Positive Impacts*

   It will create job opportunity thus minimising cases of crime.

   (b) *Negative impacts*

   They might occur internal conflicts among the community members.

   (c) *What would you propose as measures to mitigate the above negative impacts?*

   Use of sign boards.

4. **Give any relevant additional comments**

   The project is an important to the community

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Kindly, give us information you know concerning the proposed project's impacts and mitigation measures.

1. **Details of the respondent**

   Name of respondent: Jane Njenga Organization: _____

   Phone No. 0715770884D ID No. 26713840 Designation: _____

2. **Do you support the proposed project? YES ☑ /NO ☐ (tick one)**

   Do you have any reasons for your answer above? Please state

   improvement of the way of farming

3. **Please state any positive/negative environmental and social impacts caused by the proposed project.**

   (a) Positive Impacts

   increase in farm inputs. farmers will be able to farm even in dry season.

   (b) Negative impacts

   ~~lack~~ insecurities in the pumps

   (c) What would you propose as measures to mitigate the above negative impacts?

   the setting of a security guards to protect the site

4. **Give any relevant additional comments**

   it will create employement to the youths

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(Signature) _____

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Kindly, give us information you know concerning the proposed project's impacts and mitigation measures.

1. **Details of the respondent**

   Name of respondent: John Muingu Organization: Kenfegra

   Phone No. 0703969203 ID No. 39307436 Designation: member

2. **Do you support the proposed project?** YES ☑ /NO ☐ **(tick one)**

   Do you have any reasons for your answer above? Please state

   It is going to help the community to improve in their way of farming

3. **Please state any positive/negative environmental and social impacts caused by the proposed project.**

   (a) *Positive Impacts*

   When there is enough water supply there will be enough capital and from the farm produce

   (b) *Negative impacts*

   It might lead to drying out of the dairy

   (c) *What would you propose as measures to mitigate the above negative impacts?*

   Ensuring all the instrument used are of high quality for efficiency

4. **Give any relevant additional comments**

   The youths should also be involved in the project to avoid unemployment

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Kindly, give us information you know concerning the proposed project's impacts and mitigation measures.

1. **Details of the respondent**

   Name of respondent: Joseph Nthiangu Kimuthia Organization: _____

   Phone No. 0755591457 ID No. 23871881 Designation: Githunguri

2. **Do you support the proposed project?** YES ☑ /NO ☐ **(tick one)**

   Do you have any reasons for your answer above? Please state

   .....

   .....

3. **Please state any positive/negative environmental and social impacts caused by the proposed project.**

   (a) Positive Impacts

   Water availability all seasons.

   .....

   (b) Negative Impacts

   Destruction of road network during the Construction

   (c) What would you propose as measures to mitigate the above negative impacts?

   Filling of all the sections during the Construction

4. **Give any relevant additional comments**

   .....

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P.O Box 990-00200, Nairobi
Tel: 0720283797

(Signature)

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED CONSTRUCTION OF 8.3KM HDPE PIPELINE IN GITHUNGURI AREA

QUESTIONNAIRE

INTRODUCTION

The Ministry of Water, Sanitation and Irrigation (MoWS&I) is implementing Water and Sanitation Development Project (WSDP) that aims at improving water supply and sanitation services and the financial performance of Water Service Providers (WSPs) affected by the COVID-19 pandemic.

The consultant (Mr. David Moindi, assisted by Dr. Vitalis Too and the team) has been commissioned by Water Sector Trust Fund (WSTF) to carry out an Environmental Impact Assessment (EIA) study for Construction of 8.3Km HDPE pipeline in Githunguri area.

Kindly, give us information you know concerning the proposed project's impacts and mitigation measures.

1. **Details of the respondent**

   Name of respondent: TABITHA NJOKI MUTHEE Organization: FARMER

   Phone No. 0725 07 0944 ID No. 5559445 Designation: Githunguri

2. **Do you support the proposed project?** YES ☑ /NO ☐ **(tick one)**

   Do you have any reasons for your answer above? Please state

   This project will help in dry seasons using water for irrigation and domestic purposes

3. **Please state any positive/negative environmental and social impacts caused by the proposed project.**

   (a) Positive Impacts

   It will lead to employment of youth

   (b) Negative impacts

   It may cause Road damages.

   (c) What would you propose as measures to mitigate the above negative impacts?

   Ensuring safety during work time by use of sign posts.

4. **Give any relevant additional comments**

Name & Address of the Expert
Vitalis Too
P.O Box 990-00200, Nairobi
Tel: 0720283797

(Signature)

Appendix B: Affected PAP

Appendix C-List of Respondents interviewed

QUESTIONNAIRE RESPONDENTS LIST

CONSTRUCTION OF 8.3KM HDPE PIPELINE IN GITHUNGURI AREA

S/No.	NAME	PHONE NUMBER	SIGNATURE
1.	Tabitha Wanjiku	0705326563	Tabitha
2.	Sarah waithira	0710113474	
3.	Jane Muthoni	0724346850	
4.	Joseph ndiragu	0707220330	
5.	Josphat Okello	0728354480	
6.	Harisson mwangi	0721354484	
7.	Daniel ngure	0727439204	
8.	Mikah mathoni	0726464755	
9.	Peter thiongo Mundia	0702709730	
10.	Charles kamau	0711518959	

QUESTIONNAIRE RESPONDENTS LIST

CONSTRUCTION OF 8.3KM HDPE PIPELINE IN GITHUNGURI AREA

S/No.	NAME	PHONE NUMBER	SIGNATURE
1.	Geoffrey Karanje M.	0728964054	
2.	Samuel Nyamu	0726955262	
3.	Bernard Wadura	0713522007	
4.	Monica Wangeci	0717905504	
5.	EDITH WANJIKU	0715772064	
6.	Grace Wanjiku	0701630653	
7.	John Ndungu	0796116558	
8.	Sarah Nyakoa	0742148681	
9.	Josphine Wambui	0704018889	
10.	Antony Mwangi	0759104675	

QUESTIONNAIRE RESPONDENTS LIST

CONSTRUCTION OF 8.3KM HDPE PIPELINE IN GITHUNGURI AREA

S/No.	NAME	PHONE NUMBER	SIGNATURE
1.	Newton mwangi	0769027740	
2.	Daniel Kariuki	0792327110	
3.	MARGARET WAMUGURU	0723415713	
4.	Jane muthoni	0703957700	
5.	BETH NYAWIRA	0723291915	
6.	WILSON MWANGI	0798978905	
7.	Peter Kiarie	0708716190	
8.	Nancy Wanjiru	0742620955	
9.	Stephen Kambo	0703633905	
10.	Kevin Mwangangi	0718600130	

QUESTIONNAIRE RESPONDENTS LIST

CONSTRUCTION OF 8.3KM HDPE PIPELINE IN GITHUNGURI AREA

S/No.	NAME	PHONE NUMBER	SIGNATURE
1.	Samuel Maina	0734878831	
2.	John Nderu	0703964203	
3.	Valentino Nderu	0791020138	
4.	Damaris Muthoni	0	
5.	Moses Mukoma	0724240750	
6.	Stephen Mwangi	0794776897	
7.	John Ngugi	0725156636	
8.	Faith Njeri	0718143207	
9.	Christine Wanjiru	0710356833	
10.			

QUESTIONNAIRE RESPONDENTS LIST

CONSTRUCTION OF 8.3KM HDPE PIPELINE IN GITHUNGURI AREA

S/No.	NAME	PHONE NUMBER	SIGNATURE
1.	TABITHA NJOKI MUTHEE	0725 070944	
2.	Edwin Mwangi Wangui	0716263168	
3.	FREDRICK GITHINJI KAMAU	0729522775	
4.	MARY WAMBUI GITHINJI	0740341322	
5.	Jacinta Nyokabi	0722874837	
6.	James Ngugi Njonge	0725680211	
7.	Susan Njoki Ndichu	0758828860	
8.	Mercy Njoki	0729053479	
9.	JOYCE CHEPKEMOI	0722881980	
10.	Joseph Ndwanga Kimutai	0758591457	

QUESTIONNAIRE RESPONDENTS LIST

CONSTRUCTION OF 8.3KM HDPE PIPELINE IN GITHUNGURI AREA

S/No.	NAME	PHONE NUMBER	SIGNATURE
1.	Eric Kamanja	0711518959	
2.	Grace Wambui	0790199243	
3.	Newton Mwangi	0769027740	
4.	Samuel Kamau	0745736073	
5.			
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8.			
9.			
10.			

QUESTIONNAIRE RESPONDENTS LIST

CONSTRUCTION OF 8.3KM HDPE PIPELINE IN GITHUNGURI AREA

S/No.	NAME	PHONE NUMBER	SIGNATURE
1.	Peter Thuku	0711968977	PETER
2.	~~Rachel~~ Racheal Wanjiku	0711975474	
3.	JO		
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Appendix D-BoQ



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