

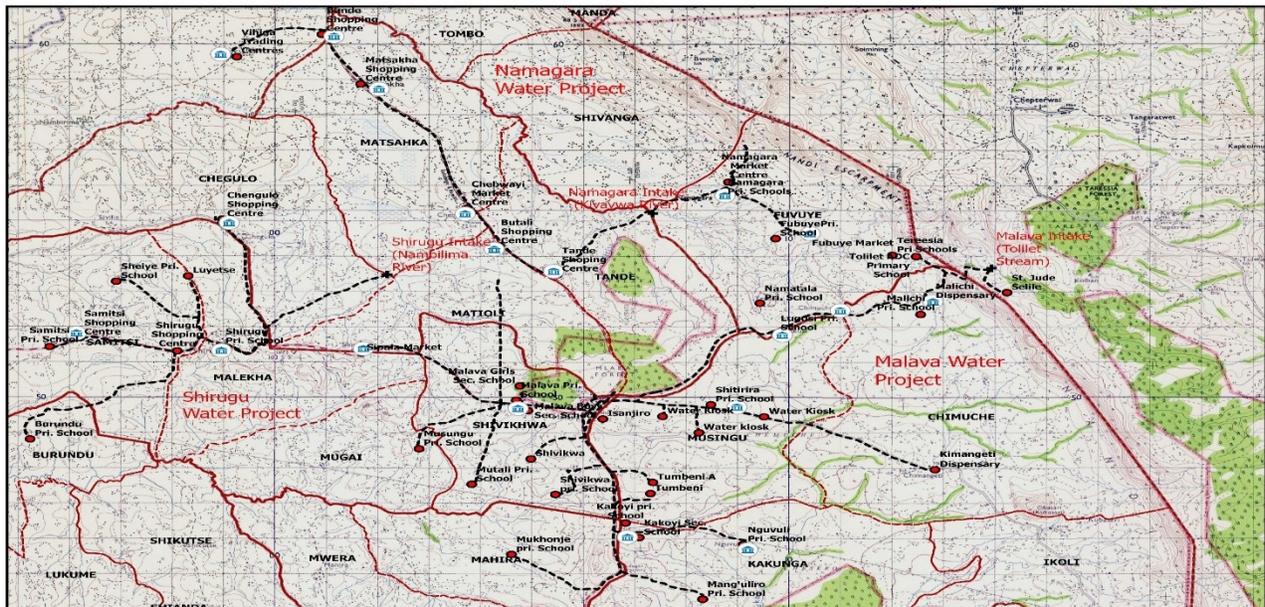


REPUBLIC OF KENYA
Ministry of Water Sanitation and
Irrigation



LAKE VICTORIA NORTH
WATER WORKS DEVELOPMENT
AGENCY

**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FINAL REPORT FOR
WATER AND SANITATION PROJECTS FOR THE TOWNS IN MALAVA
CONSTITUENCY KAKAMEGA COUNTY**



FINAL ESIA REPORT
CONTRACT No.: LVNWWDA/CONS/MALAVA/2020 -2021

PREPARED BY DR. DAN ADINO
SOCIAL SAFEGUARDS EXPERT

BATCH ASSOCIATES LIMITED

Suite A4 Machera Court,
Komo Lane, off Wood Avenue Kilimani
P. O Box 24103-00100, Nairobi, Kenya
Tel: +254 (0) 20 2621168,
Fax: +254 (0) 20 2018176,
Cell: +254 (0)721467213 /+254 (0)736451752
E-mail: hndugah@batchassociates.co.ke
Website: www.batchassociates.co.ke

**Lake Victoria North Water Works
Development Agency**
**Kefinco Hse, off Kakamega-Kisumu
Road**
P.O Box 673-50100
KAKAMEGA
Email: info@lvnwwda.go.ke
**Phone: 056 2030795, 056 2031552 and
020 7608130**

November 2021

CONTENTS

CONTENTS.....	i
LIST OF TABLES.....	IV
LIST OF FIGURES.....	VI
EXECUTIVE SUMMARY.....	VII
1. INTRODUCTION.....	1
1.1 Overview of Lake Victoria North Water Works Development Agency.....	1
1.2 The project.....	1
1.3 Objectives of the Assignment.....	1
1.4 ESIA Rationale.....	2
1.5 Objectives of the ESIA.....	2
1.5.1 ESIA methodology.....	2
1.5.2 Scoping.....	2
1.5.3 Literature review.....	2
1.5.4 Baseline data collection.....	3
1.5.6 Identification, prediction and determination of environmental impacts.....	3
1.5.6.1 Event Magnitude.....	3
1.6 Stakeholder consultations.....	4
1.7 Project Area description.....	4
1.8 Proposed water Supply.....	5
1.8.1 Malava Town water supply Project.....	5
1.8.2 Namagara water supply scheme.....	6
1.8.3 Shirugu Water supply Scheme.....	6
1.9 Scope of this report.....	6
2. BACKGROUND INFORMATION.....	7
2.1 Climate.....	7
2.2 Topography.....	7
2.3 Geology and Soils.....	8
2.4 Land use.....	8
2.5 Water Resources.....	8
2.5.1 Hydrogeology.....	8
2.6 Water Supply situation.....	9
2.6.1 Existing Malava Water supply.....	9
2.7 Socio-Economic Aspects.....	9
2.7.1 Population.....	9
2.7.2 Social Infrastructure.....	10
3. WATER DEMAND STUDY.....	11
3.1 Delineation of the Project Supply Area.....	11
3.1.1 Project Supply area.....	11
3.2 Project horizon, Design Period, and Population Projection.....	12

3.2.1 Population Projection.....	13
3.2.2 Institutional Population.....	15
3.3 Water Demand Estimation.....	19
3.3.1 Water demand Categories.....	19
3.3.2 Water Consumption Rates.....	20
3.3.4 Service level.....	22
3.3.4.2 Estimated Water Demands.....	22
4. DESIGN OF PROPOSED WATER SUPPLY SYSTEM.....	24
4.1 The Scheme Layout.....	24
4.2 Intake and raw water mains.....	24
4.2.1 Malava Town Water Scheme:.....	24
4.2.2 Namagara Water Scheme:.....	24
4.2.3 Shirugu Water Scheme:.....	24
4.3 Design of Water Treatment Plants.....	24
4.3.1 Design Capacities.....	24
4.3.2 Inlet Works and Chemical Mixing.....	25
4.3.3 Malava Water Supply Treatment Works.....	26
4.3.4 Namagara Water Supply.....	31
4.4 Chemical Preparation and dosing.....	37
4.5 Storage.....	40
4.6 Distribution System.....	41
4.6.1 Malava Distribution System.....	41
4.6.2 Hydraulic Modelling.....	41
4.6.3 Community Water Kiosks.....	43
4.7 Project Ancillary works.....	45
4.7.1 Access and service roads.....	45
4.7.2 Auxiliary buildings and other works.....	45
4.7.3 Pump House.....	46
4.7.4 Fence.....	46
4.7.5 Electricity Supply.....	46
4.7.6 Utility Water.....	46
4.8 Environmental baseline conditions.....	47
4.8.1 The bio-physical environment.....	47
4.9 Socioeconomic environment.....	49
ii. Land use, livelihoods and local economy.....	49
4.9 .1 Regional challenges.....	50
5. POLICY LEGAL AND REGULATORY FRAMEWORK.....	55
5.1 Policy Framework.....	55
5.2 Legal Framework.....	56
5.3 Institutional Framework.....	69

6. STAKEHOLDER CONSULTATIONS.....	69
6.1 Introduction.....	69
6.2 Benefits of public consultation.....	69
6.4 Community Introductory meetings with PAPs.....	69
6.5 Community Concerns.....	69
6.6 Consultations findings.....	69
6.7 Expected community benefits.....	69
6.8 Conclusion.....	69
7. PREDICTION AND EVALUATION OF IMPACTS.....	69
7.1 Impact Categories.....	69
7.1.1 Impacts Emanating from the proposed project.....	69
7.1.2 Impacts during Operation & Maintenance.....	69
8. ENVIRONMENTAL AND SOCIAL MITIGATION AND MANAGEMENT PLAN (ESMMP).....	69
8.1 Possible Enhancement Measures.....	69
8.2 Mitigation Measures.....	69
8.3 CONCLUSIONS AND RECOMMENDATIONS.....	69
ANNEXES.....	69

LIST OF TABLES

Table 1: Summary of impacts of relocation impacts.....	x
Table 2: Summary of impacts.....	xi
Table 3: Malava Water project, Supply area.....	11
Table 4: Population figures for the past two population and housing census.....	13
Table 5: Projected Rural Population.....	14
Table 6: The project area population for the general supply area and the cluster towns.....	15
Table 7: Population of Day Primary School.....	15
Table 8: Population of Secondary Boarding Schools.....	16
Table 9: Project Population of Secondary Day Schools.....	17
Table 10: Projected Population of Boarding Primary Schools.....	17
Table 11: Projected Population of Tertiary Institutions.....	17
Table 12: Project Capacity of Hospitals/Health centers.....	17
Table 13: Project Number of Commercial establishments.....	18
Table 14: Criteria for classification of land potential in rural areas.....	20
Table 15: Water consumption rates for rural areas.....	20
Table 16: Water consumption rates for rural areas.....	21
Table 17: Consumption Rates for Institutional and commercial use.....	21
Table 18: The Percentage of individuals and non-individuals connections.....	22
Table 19: Total Water Demand.....	22
Table 20: Projected Scheme Water Demand.....	23
Table 21: Projected Water Demand by Category.....	23
Table 22: Malava Treatment Works Design Capacity.....	25
Table 23: Namagara Treatment Works Design Capacity.....	25
Table 24: Shirugu Treatment Works Design Capacity.....	25
Table 25: WTP Inlet NTU Design Parameters.....	26
Table 26: Pipe and Regulation Valve Design Parameters.....	27
Table 27: Flocculation.....	28
Table 28: Sedimentation.....	29
Table 29: Pipe and Regulation Valve Design Parameters.....	32
Table 30: Flocculation.....	34
Table 31: Sedimentation.....	34
Table 32: Storage capacity required for chemicals.....	37
Table 33: Schedule of storage reservoir for Malava Water Project.....	40
Table 34: Schedule of storage reservoir for Namagara Water Project.....	40
Table 35: Schedule of storage reservoir for Shirugu Water Project.....	41
Table 36: Schedule of Malava town Water supply pipeline.....	41
Table 37: Schedule of Namagara Pipelines.....	42
Table 38: Schedule of Butere Pipelines.....	43
Table 39: Schedule of Kiosks for Malava Water Project.....	44
Table 40: Schedule of Kiosks for Namagara Water Project.....	44
Table 41: Schedule of Kiosks for Shirugu Water Project.....	45
Table 42: Percentage distribution of Households by main source of drinking water.....	52
Table 43: Identified stakeholders in Kakamega County Government.....	69
Table 44: Identified stakeholders in Nandi County Government.....	69
Table 45: Other water Sector stakeholders in the project area.....	69

Table 46: Stakeholder analysis.....69
Table 47: Schedule of community Introductory and Sensitization Meeting in locations.....69
Table 48: Summary of community’s concerns.....69

LIST OF FIGURES

Figure 1: Project Area Location.....5
Figure 2: General Project Area Map.....12
Figure 3: General Coverage of Malava Town Water Supply Project.....14

EXECUTIVE SUMMARY

Project background

The Government of Kenya (GoK) wishes to fund the cost of construction of water supply and sanitation projects for the Towns Malava constituency in Kakamega county. The proposed three water supply schemes were proposed to provide enhanced water services in Malava Town, and its environs and the market centres of Namagara, Tande, Butali, Chebwayi, Matsakha, Chegulo and Samitsi in Malava Constituency. Beside the domestic water supply to the general and market centres, the water supply scheme will also supply water to education and health institution within the project area. Malava is one of the 15 medium sized towns whose water supply and sanitation systems were identified for expansion under the Social Pillar of Kenya Vision 2030. The Market Centres of Namagara, Tande, Butali, Chebwayi, Matsakha, Chegulo and Samitsi are also to be included in this expansion.

Current Situation

The existing source of water supply for Malava is a protected spring. The existing intake was constructed in 1956 and comprises 2 protected spring intakes which discharge into a common sump. The water is chlorinated (the only treatment provided) in the pump house before being pumped to an elevated tank in the town. From earlier records, the average output from the springs is 220m³/day. The water is supplied mainly to the town centre and institutions as well as the local Catholic Mission.

The treated water is pumped to an elevated (10m high) steel tank of capacity 21m³. The tank is located within the compound of Sunrise Junior Academy. This tank receives water from the spring via a 100mm diameter rising main and in turn feeds another 24m³ plastic tank in the town centre once it is full.

The population of project area has increased significantly over the last 20 years and is projected to increase even further due to rapid growth. The current water production from existing Malava Town water supply is 250m³/d from the two low yielding boreholes.

Proposed Water Supply System

To adequately meet the project goals project objectives, three independent and localised water supply schemes are proposed to cover the Project area comprising Malava Town and the additional market centres of Namagara, Tande, Butali, Chebwayi, Matsakha, Chegulo and Samitsi in Malava Constituency, three separate water supply schemes are proposed:

- a) Malava Town Water Supply Scheme based on an intake from Kivaywa River near its source at Tolilet stream on Nandi Escarpment
- b) Namagara Water Supply Scheme based on abstraction from Kivaywa River near Namagara Market
- c) Shirugu Water Supply Scheme based on abstraction from Nambilima River

Malava Town water supply Project

Malava town water will abstract water through a concrete weir constructed on Tolilet stream, a tributary of River Kivaywa on the Nandi Escarpments at a location defined by the coordinates N53,660m, E713,850m at an altitude of 1824masl. The scheme will supply water to Malava town and its environs and to areas along its 42km distribution pipelines. The estimated ultimate water demand is 2,873m³/day. Raw water will be treated using a conventional water treatment located

approximately 350m from the intake works. The location of the water treatment plant is chosen communities along the treated water transmission piping to Malava town can abstract from the water supply by gravity. Water will be supplied to Tolilet area of Nandi County. The system will also supply water to market centers of Malichi, Chemuche, Lugusi, Shiritira, Malanga and Samitsi. Besides individual connection ad institution and commercial centres, water will also be drawn and 40. community water points.

Namagara water supply scheme

The intake works for Namagara water projects is located at coordinates points N55, 275m, E707, 350m and altitude of 1523masl at the crossing of Kivaywa River by Namagara-Tande Road. Water will be treated using a conventional treatment works close to the intake. The scheme water design demand is 2,621m³/day, treated water will then be pumped to a high-level tank above Namagara centre form distribution by gravity. The scheme will supply water to Febuye and Teressia sub-locations and additional market centers comprising of Namagara Tande, Butali, Chebwayi, Matsakha and Bande along the Malava Webuye road. A total of 18No. community water points are opposed along the distribution pipelines. The total length of distribution network is 21.5km.

Shirugu Water Supply Scheme

The proposed Shirugu water supply scheme, with a demand capacity of approximately 1,088m³/day will have its intake located on Nambilima river. Raw water will be treated at the intake site using a compact water treatment system. Treated water will then be pumped to a high-level water tank located at Shirugu school through a 3.0km long rising main and treated using 2No. by 600m³/day composite water treatment system. The scheme will provide to markets and institutions located in Burundu, Samitsi, Luyetse, Sheiywe and Chengulo areas and will complement the existing water supply system. Water will be distributed by use of a distribution network comprising 19.5km of pipelines and 12No. community water points along the distribution pipelines.

ESIA Rationale

The Environmental Management and Coordination Act (EMCA) 1999 provides for the completion of an Environmental and Social Impact Assessment (ESIA) and the preparation and submission of a Project Report before undertaking a project of the proposed nature. Batch Associates was commissioned by LVNWWDA to carry out an ESIA of the proposed project and submit an ESIA Report for review and approval by the National Environment Management Authority (NEMA).

The overall aim and purpose of the ESIA was to assess environmental and social impacts that are likely to arise from implementation of the proposed water supply schemes. Specific objectives of the ESIA were to:

- Collect and analyze baseline environmental and socioeconomic data in the study area;
- Identify and assess potential environmental impacts in the design, construction and operation of the proposed schemes;
- Liaise with interested and affected parties in the area in order to seek their views on pertinent issues related to the proposed schemes;
- Identify mitigation measures for the actual and potential adverse impacts; and
- Develop environmental and social management plans suitable for the proposed

works, activities and anticipated environmental impacts.

Study approach

The ESIA was carried out in line with the provisions of the Environmental Management and Coordination Act, 1999, the Environmental (Impact Assessment and Audit) Regulations 2003, as well as international guidelines on environmental and social impact management. A scoping exercise was carried out to identify gaps in information and determine the range of issues to be addressed in the ESIA. The key methods that were used to gather information in the ESIA study included desktop studies, field surveys and stakeholders' consultations. A systematic approach was used to identify and evaluate significant impacts of the proposed project based on project activity event magnitude and receptor sensitivity. Mitigation measures were then proposed to address the adverse impacts identified.

Stakeholder Consultations

Various methods were applied in stakeholder consultations including interviews, administration of questionnaires and stakeholder/community meetings. Outcomes of these consultations revealed that from the community's perspective, the schemes were a worthwhile investment that would solve the problem of lack of access to safe drinking water in the area.

Prediction and evaluation of impacts and mitigation measures

Potential impacts of construction, operation and decommissioning the water supply schemes were identified and their significance evaluated. In determination of impact significance, event magnitude (extent/scale, frequency, duration, and intensity) and receptor sensitivity (presence and resilience) were considered.

Significance was either categorized as Negligible, Minor, Moderate or Major.

SUMMARY OF IMPACTS

Project Resettlement Impacts

The assessment identified that no Project Affected Person (PAP) will be completely displaced from their households because of the project activities, this is because the three water Schemes will be constructed on land belonging to individual PAPs which will be acquired through a willing buyer willing seller arrangement with LVNWWDA.

The schemes will involve impacts on land, productive assets, and livelihoods through temporary use of land for construction purposes, permanent acquisition of land for intake works and treatment works, imposition of rights to construct and operate a pipeline under existing ownership for the pipeline alignment and imposition of restrictions on land use adjoining the pipelines. Land and related livelihood impacts of the water supply scheme will include: temporary loss of use of cultivated land, with resultant loss of income for owners/users for the construction period, permanent loss of land and the related income to the intake works and treatment works, impairment of livelihoods in areas adjacent to the pipeline that are affected by restrictions on use, loss of trees/perennial crops in the 5 meter construction corridor and loss of annual / seasonal crops in-ground at the time land is occupied for construction.

The water pipelines will be constructed within river riparian and within road reserves, however, the RAP has documented cases of easement to be acquired from private individuals in cases where

there is no wayleave. A 5m width construction corridor for the pipeline ROW (this is temporary and only for the construction period); and Land for the construction camp(s), materials, and equipment storage.

This RAP identified a total of 15 PAPs owning 18 acres of land and other assets through which the water infrastructures will be constructed.

Table 1: Summary of impacts of relocation impacts

Number of parcels	Number of PAPs	Land sizes to be acquired (Acres)
North Kabras/Malava/71	1	4.3
North Kabras/Malava/ 396	1	0.8
North Kabras/Malava/ 707	1	2.4
South Kabras/Chemuche/2961	1	0.3
South Kabras/Samitsi/1596	1	0.025
Nandi/Kaptich/67	1	0.245
Nandi/Kaptich/69	1	0.0468
Nandi/Kaptich/ 72	1	0.208
Nandi/Kaptich/73	1	0.7
Nandi/Kaptich/73	1	4.3
Nandi/ Soimining/412	1	0.12
Total	11	13.4448

Summary of environmental and social impacts

The Table below summaries the impacts identified, their significance, and mitigation measures proposed.

Table 2: Summary of impacts

Aspect	Impact	Significance	Mitigation Measure
Environmental Impacts			
Air Quality	Nuisance and health effects on humans from dust exhaust gases	Moderate	<ul style="list-style-type: none"> • Maintenance of equipment and machinery to by regular servicing to maintain efficiency in combustion and reduce carbon emissions;
	Stunted growth of crops and natural vegetation from dust deposition	Moderate	<ul style="list-style-type: none"> • Use environmentally friendly fuels such as low sulphur diesel; • minimize idling of machinery; • ensure no burning of waste on sites/non-designated areas; • Sprinkling of all active construction areas as and when necessary; • Control of construction vehicle speeds by imposition of speed limits; • Rehabilitation of disturbed areas once completed; • Use of tarpaulins to cover trucks carting away spoil using public roads; • Proper planning in transportation of spoil to ensure that the number of trips done or the number of vehicles used is as minimum as possible; and • Provision of appropriate Personnel Protective Equipment such as dust masks to site workers.
Visual and	Visual disturbance effects on humans from disturbed sites, opened views and	Moderate	<ul style="list-style-type: none"> • Reinstatement in accordance with the project’s reinstatement specification; • Avoidance of the removal of

landscape	construction plant and machinery		<ul style="list-style-type: none"> existing mature trees which form important visual focal points; and Replacement of any removed trees during the reinstatement phase using indigenous species of local provenance.
	Adverse impacts on natural vegetation from	Moderate	
	clearance and topsoil removal		
Ecology	Damage/Loss of natural vegetation from bush clearing or pollution	Minor	<ul style="list-style-type: none"> Development and implementation of a Reinstatement Plan; Ensure that as much as possible, only the trench line is stripped of vegetation; Faunal species encountered during construction works should not be killed or injured; and Development and implementation of pollution prevention plans and emergency response plans.
	Avoidance, death and/or injury of fauna from human acts	Minor	
Soil Resources	Soil loss resulting from erosion and carting to spoil	Major	<ul style="list-style-type: none"> Trench back-fill material to be compacted to a similar value to the original surrounding soils to avoid subsidence as a consequence of rain water channelling; Implementation of a project specific Reinstatement Plan which includes mitigation for impacts to soils; and Implementation of spillage prevention and control measures for hazardous materials in use and storage at sites.
	Soil contamination from pollution incidences	Major	
Energy Resources	Depletion of fossil fuel resources	Minor	<ul style="list-style-type: none"> Minimize idling of machinery; Avoid overloading of trucks and machinery; and Regularly service vehicles, plant and machinery.

Water Resources	Pollution of water resources from sediments and other contaminants	Moderate	<ul style="list-style-type: none"> • Establish measures to control erosion of river bank and bed at crossings; • Seek an abstraction licenses from WRMA and adhere to the conditions of the license; • Careful discharge of hydrotest water to avoid erosion and deposition of sediments into watercourses; • Cooperate with WRMA in implementing the catchment abstraction management strategy to allow for adjustments/variation in licensing conditions which may be necessary following resource assessments; and • Recycling of filter backwash water.
	Reduced ecological sustainability of the river from interruption of river flow	Moderate	
	Increased water demand and potential over abstraction of Tolilet, Kivaywa and Nambirima Rivers	Major	
	Potential pollution from sludge and backwash wastewater	Moderate	
Waste	Environmental pollution and creation of health and safety hazards	Major	<ul style="list-style-type: none"> • Land-fill spoils as much as possible within the sites or identified fill areas;
	from poor management of wastes		<ul style="list-style-type: none"> • Felled trees, shrubs and stumps can be isolated for collection by locals as firewood; • Organic wastes can be composted on site; • Provide pit latrines at the camp(s) and construction sites for use by workers; • Vehicle maintenance to be done off- site (at the construction camp's garage/workshop or commercial garage) and wastes (used oil, oily rags, cans and used parts) disposed in a designated area; • Ensure that construction materials left over at the end of construction are used elsewhere rather than their disposal; • Put in place measures to ensure

			<p>that construction material requirements are carefully budgeted and to ensure that the amount of construction materials left on site after construction is kept minimal;</p> <ul style="list-style-type: none"> • Avoid mixing of excess concrete if possible, and discard excess concrete in a designated area away from water courses; • Washing of concrete coated vehicles or equipment to be done off-site or in a designated wash area a minimum of 50 feet away from drainage channels; • Runoff from the on-site concrete wash area to be contained in a temporary pit where the concrete can set; • The temporary pit to be lined with plastic or clay to prevent seepage of the wash water into the ground. The wash water should be allowed to evaporate or collected along with all concrete debris in a concrete washout system bin; and • To the extent possible, hydrotest water should be discharged into the next section of the pipeline to be tested.
Noise and Vibrations	Vibrations and noise nuisance to the community	Moderate	<ul style="list-style-type: none"> • Portable hoods to be installed to shield compressors and other small stationary equipment where necessary; • Pumps, generators and other mobile equipment to be sited as far as practicable from housing and other noise sensitive locations;

			<ul style="list-style-type: none"> • The contractor to endeavor to use equipment installed with noise abatement devices as much as practicable; • Idling time on trucks and other noisy equipment to be limited to a minimum; and • Personal protective equipment such as ear muffs will be provided to workers at the sites as necessary.
Cultural Heritage and archaeology	Damage and/or destruction of cultural artefacts	Moderate	<ul style="list-style-type: none"> • Determine appropriate action in consultation with the National Museums of Kenya if areas of archaeological significance are revealed at any of the project sites; • For any encounters along the pipeline route, considerations should be made to alter the alignment of the pipeline to avoid damage to the feature; and • Where the pipeline cannot be sensibly moved, significant sites may need to be excavated and recorded prior to construction activities continuing in the area.
Occupational/public health and safety	Exposure of workers and the general public to health and safety	Major	<ul style="list-style-type: none"> • Provision of all workers on site with the necessary Personal Protective Equipment, and ensuring a safe and healthy environment for the construction workers; • Workers accidents during construction can be mitigated by enforcing adherence to safety procedures and preparing contingency plans for accident response. In addition, safety education and training should be emphasized;

	hazards		<ul style="list-style-type: none">• The Contractor should have qualified first aid personnel among the workers and maintain fully stocked first aid kits at the sites;• Hazards and accidents involving the public should be minimized by controlling access to the construction sites. This should be done by cordoning off the construction sites and posting warning signs in hazard prone areas;• To reduce hazards exposure to the public such as open trenches, the Contractor should endeavour to lay pipes and backfill as soon as possible; and• The Contractor should ensure that workers have access to sanitary
--	---------	--	--

			facilities at the sites and provide potable water.
Traffic	Nuisance and increased safety hazards to other road users from construction traffic and works	Moderate	<ul style="list-style-type: none"> • Development and implementation of a traffic management plan.
Natural Resources	Environmental degradation at materials sites	Moderate	<ul style="list-style-type: none"> • Contractor to source construction materials such as sand, aggregate and masonry stones from approved quarries and mining sites which have undergone satisfactory environmental impact assessment and are licensed according to the regulations.
Socioeconomic Impacts			
Access to clean water	Increased access to clean water	Major (positive)	
Impacts on existing water usage of Tolilet, Kivaywa and Nambirima Rivers	Over abstraction of Tolilet, Kivaywa and Nambirima Rivers leading to social unrest	Major	<ul style="list-style-type: none"> • Cooperate with WRMA in implementing the catchment abstraction management strategy to allow for adjustments/variation in licensing conditions which may be necessary following resource assessments; and • Recycling of filter backwash water.
Employment and business opportunities	Increased employment and business opportunities	Moderate (positive)	
Land acquisition	Loss of land and livelihoods for affected people	Moderate	<ul style="list-style-type: none"> • Cash compensation based on market value of land or provide with option of replacement land within the village if available of equivalent size and quality; • Cash compensation to be provided for lost agricultural productivity during the construction period; and

			<ul style="list-style-type: none">• Reinstatement of land to a least the condition it was in prior to construction.
--	--	--	---

Conclusion

Although potential adverse impacts were identified in the construction and operation of the proposed water supply schemes, various opportunities were also identified for the mitigation of these impacts. It is considered that with good construction, environmental and social practices and procedures, the project has potential to enhance benefits while avoiding environmental degradation. The requirements identified for the contractor in this Report will ensure environmental protection, health and safety of the workers and the general public and social acceptance of the proposed project. An environmental audit of each scheme is recommended upon completion of the construction works to corroborate the implementation of the proposed mitigation measures. Any unforeseen project impacts shall be identified and addressed through annual environmental audits.

1.0 INTRODUCTION

1.1 Overview of Lake Victoria North Water Works Development Agency

The Lake Victoria North Water Works Development Agency (LVNWWDA) is one of the nine Regional Water Works Agencies that were created as part of reforms in the water sector by clause 65 of the Water Act, 2016. LVNWWDA was established through a Legal Notice No. 28 of 26th April 2019 to provide efficient and economical water and sanitation services in its area of jurisdiction consisting of the whole of the former Western Province (Bungoma, Busia, Kakamega and Vihiga Counties) and parts of the former Rift Valley Province (Trans-Nzoia, and Nandi Counties). The Agency is supervised by the Ministry of Water, Sanitation and Irrigation which is responsible for policy direction in the Water sector and the Inspectorate of State Corporations Advisory Committee which is responsible for enforcing the State Corporations Act Cap 446 of the Laws of Kenya. The total coverage of the area of jurisdiction is 6.9 Km² with an estimated population of 7.0 million people

Section 68 of the Water Act, 2016 assigns the following functions to LVNWWDA:

- (a) Undertake the development, maintenance and management of the national public water works.
- (b) Operate and provide the services of a Water Service Provider for a water works until responsibility for operation and maintenance of the waterworks are handed over to an appointed Water Service Provider.
- (c) Provide water services where the Water Services Regulatory Board orders the transfer of the water services function from a defaulting water service provider to another licensee.
- (d) Provide technical services and capacity building to County Governments and Water Service Providers within its area of jurisdiction.
- (e) Provide technical support to the Cabinet Secretary in the discharge his functions under the Constitution of Kenya, 2010 and the Water Act, 2016.

LVNWWDA is committed to contributing to the achievement of the above goal by proactively soliciting for finance and involving private actors in water and sanitation service provision and ensuring efficient and effective management of resources placed at its disposal.

1.2 The project

The Government of Kenya (GoK) wishes to fund the cost of construction of water supply and sanitation projects for the Towns Malava constituency in Kakamega county. The proposed three water supply schemes were proposed to provide enhanced water services in Malava Town and the market centres of Namagara, Tande, Butali, Chebwayi, Matsakha, Chegulo and Samitsi in Malava Constituency.

1.3 Objectives of the Assignment

The objective of the assignment is to review existing documents, carry out feasibility study, detailed design and preparation of tender documents of the proposed Bukura-Butere-Khwisero water supply projects. In addition, the Consultant is expected to undertake the Environmental and Social Impact Assessment (ESIA) and prepare the Re-settlement Action Plan (RAP) for the project.

1.4 ESIA Rationale

The Environmental Management and Coordination Act (EMCA) 1999 provides for the preparation and submission of a Project Report before undertaking a project of the proposed nature. This Project Report has been prepared to comply with Section 58 of the EMCA, 1999 and the Amendment Act 2015, Legal Notice No 150 on the Act, Part 2 Section 7 of the Environmental (Impact Assessment and Audit) Regulations, 2003, Legal Notice 101, and other relevant regulations.

1.5 Objectives of the ESIA

The overall aim and purpose of the study was to assess environmental and social impacts that are likely to arise from implementation of the proposed water supply scheme. Specific objectives of the ESIA study were to:

- Collect and analyze baseline environmental and socioeconomic data in the study area;
- Identify and assess potential environmental impacts in the design, construction and operation of the proposed scheme;
- Liaise with interested and affected parties in the area in order to seek their views on pertinent issues related to the proposed scheme;
- Identify mitigation measures for the actual and potential adverse impacts; and
- Develop environmental and social management plans suitable for the proposed works, activities and anticipated environmental impacts.

1.5.1 ESIA methodology

The ESIA was carried out in line with the provisions of the Environmental Management and Coordination Act, 1999, the Environmental (Impact Assessment and Audit) Regulations 2003, as well as international guidelines on environmental and social impact management.

1.5.2 Scoping

A scoping exercise was carried out to determine the range of issues to be addressed in the ESIA, the significant issues that would need detailed study and those that were not significant. Determination of the boundaries of the ESIA in terms of the geographical extent and timing was also done.

1.5.3 Literature review

The Consultant reviewed literature related to the proposed project and the project area. These included feasibility studies and design reports for the proposed water supply schemes, and other studies on physiography, geology, hydrogeology, water resources and socio-economics of the project area. Both local and international legislation, policies and procedures in social and environmental management were also reviewed.

1.5.4 Baseline data collection

Baseline data was collected on the proposed project sites and the immediate neighborhood. The data collected was on aspects such as: topography; local flora and fauna; soils and geology; existing and past activities including human settlements; local surface and ground water resources; ambient air quality and noise levels (qualitative); waste management practices; and natural resources and cultural heritage aspects of the project areas.

1.5.6 Identification, prediction and determination of environmental impacts

A systematic approach was used to rank identified impacts according to their significance determined by consideration of project activity **event magnitude** and **receptor sensitivity**. The expected significance of environmental impacts were assessed taking into account:

1.5.6.1 Event Magnitude

This is determined based on the following parameters:

- **Extent** – the size of the area across which the effect of the activity extends;
- **Duration** – the length of time over which the effect of the activity occurs;
- **Frequency** – how often the activity occurs; and
- **Intensity** of the impact – concentration of an emission or discharge with respect to standards of acceptability that include applicable legislation and international guidance, its toxicity or potential for bioaccumulation, and its likely persistence in the environment, and degree and/or permanence of disturbance or physical impact

Receptor Sensitivity determined by:

Presence – whether biological species present are unique, threatened, protected or not vulnerable and are present during a period of high sensitivity (e.g. breeding, spawning or nesting). For human receptors, whether they are permanently present to uncommon in the area of impact and for physical features whether those present are highly valued or of limited or no value. For physical receptors/features, whether they are national or international value (e.g. state protected monument), local or regional value and is sensitive to disturbance or none of the above; and

Resilience – how vulnerable people and/or species and/or features are to the change or

disturbance associated with the environmental interaction with reference to existing baseline conditions and trends (such as trends in ecological abundance/diversity/status, ambient air quality etc.) and their capacity to absorb or adapt to the change. For physical receptors/features, highly vulnerable, undergoes moderate but sustainable change which stabilizes under constant presence of impact source or unaffected or marginally affected.

Socio-economic impacts were also assessed taking into account event magnitude and receptor sensitivity. However, a more qualitative approach was applied, which considers how significant the change would be on social, economic and cultural dynamics, the potential for governmental and stakeholder intervention, the value of the receptor (on a local, regional, national or international scale) and the resilience of the receptor to change or adapt to a given change.

Impact significance was assessed taking into account existing control measures that are incorporated into the project design.

Sets of criteria were defined for both impact magnitude and receptor sensitivity and these were then combined in an appraisal matrix to identify relative degrees of impact significance. The matrix was accompanied by ancillary definitions of the resulting final significance categories.

1.6 Stakeholder consultations

Stakeholder consultations were carried out in order to: inform project stakeholders of the proposed project; to explain the likely impacts (positive/negative) of implementing the project; and to obtain views, concerns, comments and suggestions from interested and affected parties regarding the proposed project.

Three categories of stakeholders were identified. These included:

- a) **Internal Project Stakeholders:** These were the project ‘insiders’ who worked closely with the Consultant to ensure successful execution of the EIA study. They provided the Consultant with the project brief, information on the project area and on other stakeholders.
- b) **The Local Community:** These were the key stakeholders important in the mapping of impacts and their magnitude/significance. Information from these stakeholders was gathered through questionnaires administered to a sample of the neighboring population and through public meetings organized at Matunda, Moi’s Bridge and Kachibora.
- c) **Key Informants:** These were the key stakeholders who the Consultant selected on the basis of their knowledge of the goings-on in project host communities, as well as their knowledge of the proposed project. They included County Government officials, Project area MCAs, Chiefs and community elders, and Water Resource Users

Associations (WRUAs). A key informant guide was used to gather information from these stakeholders.

1.7 Project Area description

The project is located in Kakamega County, Western Kenya, approximately 360 kms from Nairobi. Malava Town is located about 20km to the North – East of Kakamega Town. It is the headquarters of Kakamega North Sub-County and borders Nandi North Sub-County to the East, Lugari Sub-County to the North, Navakholo Sub-County to the West and Kakamega East Sub-County to the East. The project area covers parts of three Divisions of Kakamega North Sub-County namely: Kabras Central, Kabras East and Kabras North Divisions. The area boards Nandi North Sub-County to the East, Lugari Sub-County to the North, Navakholo Sub-County to the West and Kakamega East Sub County to the South.

Agriculture is the main economic practice in the County with sugarcane, maize, bean, cassava, finger millet and sorghum farming being the main crops grown in the areas. The average rainfall received in the County lies between 2214.1mm and 1280.1 mm per year. Figure 1:1 below shows the general project area location in the republic of Kenya.



Figure

1: Project Area Location.

1.8 Proposed water Supply

1.8.1 Malava Town water supply Project

Malava town water will get its water from concrete weir constructed on Tolilet stream, a tributary of River Kivaywa on the Nandi Escarpments at a location defined by the coordinates N53,660m, E713,850m at an altitude of 1824masl. The scheme will supply water to Malava town and its environs and to communities along its 8.0km transmission line. The estimated demand is 3,556m³/day. Raw water will be treated using a conventional water treatment located approximately 350m from the intake works. The location of the water treatment plant is chosen communities along the treated water transmission piping to Malava town can abstract from the water supply by gravity. Water will be supplied to Tolilet area of Nandi County.

1.8.2 Namagara water supply scheme

The intake works for Namagara water projects is located at coordinates points N55, 275m, E707, 350m and altitude of 1523masl. This intake point is at the crossing of Kivaywa River by Namagara-Tande Road. Water will be treated using a conventional treatment works close to the intake. The

treated water will then be pumped to a high-level tank above Namagara centre from distribution by gravity. The scheme will supply water to Namagara market centre and sections of Febuye and Teressia sublocations. The supply will be extended to supply market centres of Tande, Butali, Chebwayi, Matsakha and Bande along the Malava Webuye road.

1.8.3 Shirugu Water supply Scheme

The proposed Shirugu water supply scheme, with a design capacity of approximately 1,200m³/day will have its intake located on Nambilima river. Raw water will be treated at the intake site using a compact water treatment system. Treated water will then be pumped to a high-level water tank located at Shirugu school through a 3.0km long rising main. The scheme will provide to markets and institutions located in Burundu, Samitsi, Luyetse, Seeiywe and Chengulo areas and will complement the existing water supply system.

1.9 Scope of this report

This report has been prepared on the basis of reviewed previous studies by the Client, data collected in the study area, relevant field visits, and investigations in the study area and analysis of data by the Consultant's project team. The report covers the following main aspects:

- General background information on the project area
- Existing conditions of water supply infrastructure
- Population and water demand estimation and projections.
- Water Resources study
- Review of the Socio economic and Environmental impact study.
- Review of the Resettlement Action Plan.
- Project cost estimates and implementation plan
- Conclusion and recommendations

2.0 BACKGROUND INFORMATION

Malava Town is in Kakamega County, about 20km to the North – East of Kakamega Town. It is the headquarters of Kakamega North Sub-County and borders Nandi North Sub-County to the East, Lugari Sub-County to the North, Navakholo Sub-County to the West and Kakamega East Sub-County to the East. The project area covers parts of three Divisions of Kakamega North Sub-County namely: Kabras Central, Kabras East and Kabras North Divisions. The area borders Nandi North Sub-County to the East, Lugari Sub-County to the North, Navakholo Sub-County to the West and Kakamega East Sub County to the South.

2.1 Climate

Climate is largely dependent on the geographical position on the earth's surface. The main factors that control climate of any place are latitude, altitude, direction and character of prevailing winds, the distance from the sea or any sizeable waterbody, and topography. Vegetation cover is also important but is normally a result of other factors already noted. The low-pressure belt which shifts with the apparent movement of the overhead sun, the intertropical convergence zone (ITCZ), is the main factor and cause of seasons in Africa. It is the major line of convergence of winds leading to the creation of rain and drought generating air flows.

The project area has two rain seasons, the short and the long rains. The long rains start in March and end in June with a peak in the month of May. The short rains commence in the month of July and end in the month of September with a peak in the month of August. The dry months are December, January, and February. Generally, rainfall varies from 1,000mm to 2,400mm per annum.

2.2 Topography

The topography of the project area has varying altitude ranging from 1,250 m to 2,000 masl. In General, the region can be divided into three major physiographic units (Huddleston, 1954):

- The Nandi Scarp and the highlands to the east of it.
- The general only slightly undulating peneplain, occupying the northern, central and western portions of the area; and
- The southern hill belts. The study area falls wholly with the undulating peneplain characterized by a gradient of about 5m per kilometre with the land generally sloping to the south-west.

The Nandi escarpment, where the intake and the treatment works locations are proposed, forms a prominent feature on the Eastern part of the project area bordering the Nandi North sub-County and has an altitude varying between 1600m to 2000m above sea level. Several tributaries flowing into the Nzoia river arise from the Nandi escarpment and forests at the county boundaries.

2.3 Geology and Soils

The project area lies on that Lake Victoria Basin which was formed during the middle Pleistocene by earth movements. The geology is formed on rocks of the Kavirondo and Nyanzian age. These underlying rocks include basalt, phonolites and ancient gneisses which are nerved with gold-bearing quartz veins. The rocks from the Nyanzian System are made up of acidic to basic volcanic lavas with minor tuff. Fertile clay-loam soils develop out of rock systems which predominantly are of granite. These soils belong to the latosols, more precisely to the ferrisols they are well drained, very deep, reddish brown to yellowish red with a humic topsoil. Soils of granitic origin are known as fertile and thus support large numbers of forest.

2.4 Land use

Agriculture is the main economic practice in the project area with sugarcane, maize, bean, cassava, finger millet and sorghum farming being the main crops grown in the areas. The average rainfall received in the County lies between 2214.1mm and 1280.1 mm per year.

2.5 Water Resources

Nzoia river is the main drainage system in the larger Kakamega county. Though the drainage system is mature, the major rivers and tributaries show evidence of rejuvenation in the form of waterfalls, rapids and rock-bars, with intervening stretches of papyrus choked swamps, while broad, gently sloping divides often drop sharply to the newly incised modern stream valleys. This rejuvenation has probably been caused by renewal of movement involving general uplift along the Nandi fault in fairly recent times, which has also tilted the present peneplain surfaces to their present slope towards the south-west.

Kivaywa and Namagara are the two main rivers within the project are, all originating from Nandi escarpment. The FSR states that these rivers have minimum flows of 1300m³/h, respectively.

2.5.1 Hydrogeology

Kakamega county is underlain by rocks of Precambrian age. These rocks are of volcanic, sedimentary and plutonic in origin. The main rocks include the Kavirondian and Nyanzian groups of rocks which have been invaded by regional granitoid batholiths, diorites and giant quartz veins. These are masked in places by Pleistocene deposits that include soils and laterite. Three different hydrogeologic zones covers the in the project. These are:

- Aquifers in Nyanzian Volcanics.
- Aquifers in the Kavirondian sediments
- Aquifers in the intrusive rocks.

Groundwater potential in the project area is fairly good. There are several wells, springs and boreholes in the area. Water point distribution are scattered over the project area and forms a major source for drinking water for the people. Majority of the springs have low yielding. Those with fairly high yielding are scattered and distance apart. The springs will require electricity to pump water to storage tanks which may disadvantage the users given the ever-increasing cost of electricity.

2.6 Water Supply situation

2.6.1 Existing Malava Water supply

The existing source of water supply for Malava is a protected spring. The existing intake was constructed in 1956 and comprises 2 protected spring intakes which discharge into a common sump. The water is chlorinated (the only treatment provided) in the pump house before being pumped to

an elevated tank in the town. Two staff houses are located on higher ground about 30m before the intake and pump house.

From earlier records, the average output from the springs is 220m/day. The water is supplied mainly to the town centre and institutions as well as the local Catholic Mission.

The treated water is pumped to an elevated (10m high) steel tank is of capacity 21m. The tank is located within the compound of Sunrise Junior Academy. This tank receives water from the spring via a 100mm diameter rising main and in turn feeds another 24m³ plastic tank in the town centre once it is full.

2.7 Socio-Economic Aspects

2.7.1 Population

Census data published by the Central Bureau of Statistics, Ministry of Planning have been collected for 2019 shows that the project areas had an overall population of 25,470 people form 22,471 in 2009 spread over 43km² and 5,858 households. The project area population by location is presented in the Table below.

Table 2-1 General Area Population

Location	Sublocation	2009	2019	2009-2019 Growth Rate (%)
Township	Isanjiro	1954	2185	1.12
Township	Malanga	4204	4481	0.64
Township	Shivikhwa	2305	2970	2.57
Chemuche	Musingu	1706	2074	1.97
Chemuche	Tumbeni	2695	2809	0.42
Shivanga	Teresia	4157	5747	3.29
Shivanga	Fuvuye	5450	5204	-0.46
Total		22471	25470	1.26

2.7.2 Social Infrastructure

Kakamega County, situated in the Western Province (Kenya), employs most of its inhabitants within the agricultural sector (GoK 2002), with most of them being small-scale farmers. In fact, 80% of the population live in rural areas, and 62% of all households generate their income from agriculture. At the same time the district suffers from demographic pressure with an annual population growth rate of about 2.5%. This fact, combined with the district's poverty rate of 52%, shows the importance of exploring ways to facilitate secure incomes for households and one of them is to reduce time spent by women to fetch water for domestic use thus investing such time in income generating activities.

3.0 WATER DEMAND STUDY

3.1 Delineation of the Project Supply Area

The project supply area was delineated during the earlier studies carried out by the Client (*Howard Humphreys (East Africa) Limited, Feasibility Study Report-Malava Water Supply Project, October 2015*), studies for the area maps based on the Term of Reference for the detailed design and further discussions with the Client and stakeholders. This design review has therefore relied on the earlier concept used to delineate the project area.

3.1.1 Project Supply area

The proposed Water and Sanitation Project for the towns In Malava Constituency Kakamega County will provide enhanced water services in Malava Town and the market centres of Namagara, Tande, Butali, Chebwayi, Matsakha, Chegulo and Samitsi in Malava Constituency. The project will also provide water to schools, commercial establishments, and institution with the project area. in the immediate vicinity of the project area. The earlier studies proposed three independent water supply schemes. To achieve this goal, the project was conceived to comprise three separate water supply schemes. projects has The three proposed water supply projects are broadly described as below. The area to supplied by the three water supply schemes are summarised in the table below, Figure 3.1 shows the map of the project supply area.

Table 3: Malava Water project, Supply area

General population (sublocation)	Towns/Public Institutions	Learning Institution
Isanjiro	Malichi	Malichi primary School,
Malanga	Chemuche	Namatala Pri. Schiool
Shivikhwa	Lukusi	Lukusi, Sec. School
Musingu	Shiritiri	Bridge International School
Tumbeni	Malava	St. teresia Malava polytechnic
Teresia	Malanga	Shitirira Pri. School
Fuvuye	Shipala	Malav Pri., Malava Boys High and Malva Girls Schools
	Malichi dispensary	Kakoi Pri. And Secondary Schools
	Malava subcounty Hospital	St. Marks Pri. School,
		Nguvuluni, Tumbeni, Mangúliro and makhonje Pri. schools
General population (sublocation)	Towns/Public Institutions	Learning Institution
	Namagara	Namagara Pri. school
	Febuye	Fuvuye Pri. school
	Tande	
	Chebwai	
	Matsakha	

	Bande	
	Vihiga Trading centre	

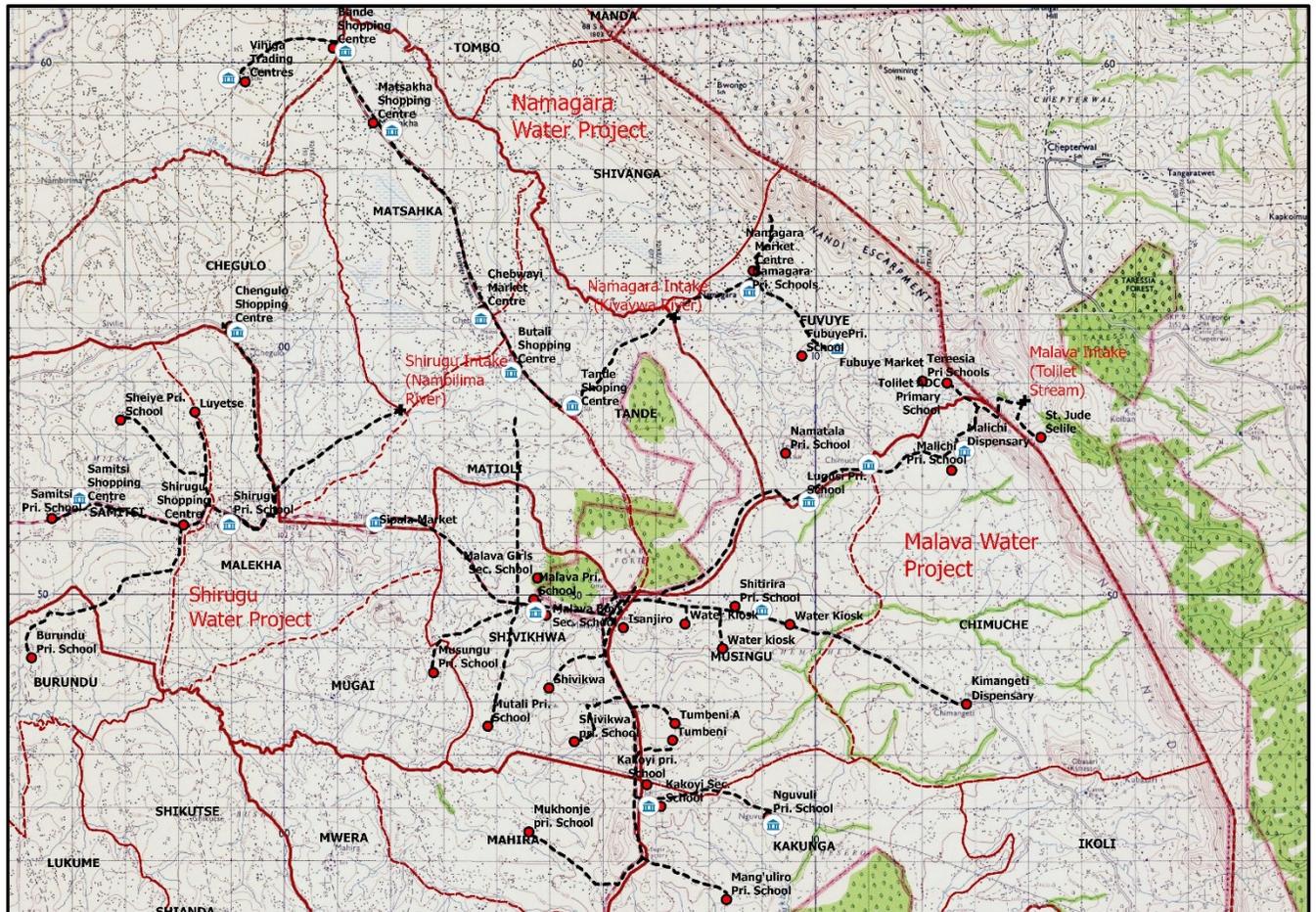


Figure 2: General Project Area Map.

3.2 Project horizon, Design Period, and Population Projection

The project water demand estimation was based on 20 years design period as recommended by the Practice Manual for Water Supply Services in Kenya, 2005. The design horizon adopted in the project feasibility studies of 2040 is revised to 2044 to reflect the expected project completion time. The population projections will be based on the present, initial, future and ultimate periods as follows;

- Present Year 2021
- Initial Year 2024 (End of Construction)
- Future Year 2034
- Ultimate Year 2044

3.2.1 Population Projection

The feasibility study uses a population growth rate of 2.5% to project the 2009 project area population to the various project periods. Th 2.5% was established from the 2018-2022 Kakamega County integrated development plan. A review of the 2009-2019 intercensal growth factor indicate a lower average project growth rate at 1.26%. The table below shows population figures for the past two population and housing census.

Table 4: Population figures for the past two population and housing census

Location	Sublocation	Population		2009-2019 Growth Rate (%)
		2009	2019	
Township	Isanjiro	1954	2185	1.12
	Malanga	4204	4481	0.64
	Shivikhwa	2305	2970	2.57
Chemuche	Musingu	1706	2074	1.97
	Tumbeni	2695	2809	0.42
Shivanga	Teresia	4157	5747	3.29
	Fuvuye	5450	5204	-0.46
Total		22471	25470	(Average) 1.26

The evaluation of the 2019 population census results indicates a fairly high population growth rate for the Malava township sublocations of Shivikhwa and Musingu at 2.57 and 1.97 respectively. The rural sublocations shows low population growth factors of 0.42-1.12% except the two sublocations of Teresia and Fuvuye which shows unreasonable disparity through the combined location growth factor is 1.32%. However, a uniform growth factor of 2.5% is adopted to cushion the project against unforeseen population variations. Error: Reference source not found shows the general coverage of Malava Town Water Supply Project

Population projection is assumed to follow geometrical growth progression based on the following formula. A population growth factor of 2.5% estimated from the 2009 to 2019 inter-census results using the formula below was used.

$$P = P_0(1+r)^n$$

Where;

P – Projected population after n years

P₀ – Population during the reference year

r – Population growth factor

n – Projection period

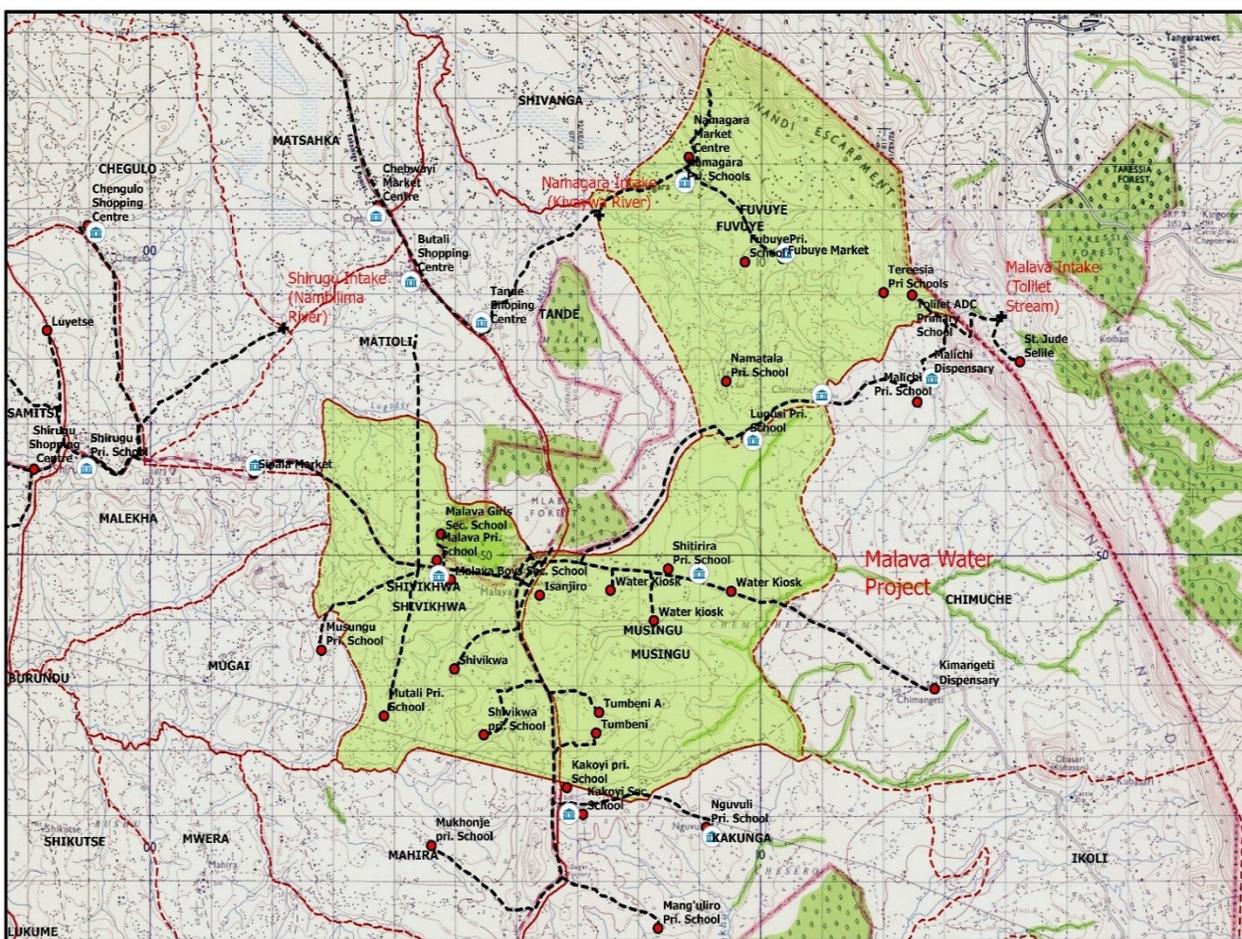


Figure 3: General Coverage of Malava Town Water Supply Project

The projected rural area population of the project areas is presented in table 5. The population in township and the sublocations in Chemuche will be supplied from the Malava Water project while the Shivanga area will be supplied from Namagara water project.

Table 5: Projected Rural Population

Location	Sublocation	Project Population				
		2019	2021	2024	2034	2044
Township	Isanjiro	2,185	2,296	2,472	3,165	4,051
	Malanga	4,481	4,708	5,070	6,490	8,308
	Shivikhwa	2,970	3,120	3,360	4,301	5,506
Chemuche	Musingu	2,074	2,179	2,347	3,004	3,845
	Tumbeni	2,809	2,951	3,178	4,068	5,208
Shivanga	Teresia	5,747	6,038	6,502	8,323	10,655
	Fuvuye	5,204	5,467	5,888	7,537	9,648
Total		25,470	26,759	28,817	36,888	47,221

Table 6: The project area population for the general supply area and the cluster towns

Name of Market/ Business Centre		Year			
		2021	2024	2034	2044
1	Matsakha	4,748	5,113	6,545	8,378
2	Chebwayi	3,254	3,504	4,485	5,742
3	Tande	5,246	5,649	7,231	9,257
4	Butali	5,036	5,423	6,942	8,886
5	Samitsi	5,843	6,292	8,054	10,310
6	Shipala	1,699	1,829	2,342	2,998
7	Sheywe	4,790	5,158	6,603	8,452
Total Population		30,616	32,968	42,202	54,023

3.2.2 Institutional Population

The population for learning institutions were projected from earlier enrolment figures from the Ministry of Education, Malava Sub-County office of Kakamega County. The projected numbers followed the growth rate or the general population. Information on health facilities in the project area was also obtained from Ministry of Health, office in Malava Sub-County office and projected to the project periods.

In considering the institution to be supplied by the project, the earlier concept taken in the earlier feasibility study of including institution with 1.km of the pipelines was adopted. The figures below show the projected populations.

Table 7: Population of Day Primary School

Name of Primary School		Year			
		2021	2024	2034	2044
1	Malichi Primary School	464	500	639	819
2	Lugusi Primary School	785	845	1,082	1,385
3	Namatala Primary School	910	980	1,254	1,606
4	Febuye Primary School	706	760	973	1,246
5	Teresia Primary School	581	626	801	1,025
6	Isanjiro Primary School	596	642	822	1,052
7	Bridge International School	406	437	560	716
8	Malava Primary School	539	581	743	952
9	St Marks Academy	278	300	384	491
10	Shivikhwa Primary School	279	301	385	493
11	Tumbeni Primary School	517	557	713	913
12	Wavoka Primary School	387	417	534	684
13	Matioli Primary School	428	461	590	755
14	Manyonje Primary School	924	995	1,274	1,631
15	Greenview Academy	209	225	288	368

Name of Primary School		Year			
		2021	2024	2034	2044
16	Star Academy	278	300	384	491
17	Sir Berring Academy	130	140	179	229
18	St. Teresa Isanjiro	255	275	303	388
19	Burundu primary School	386	416	532	681
20	Mavusi Pri School	610	657	841	1,076
21	Sheywe Primary School	598	644	824	1,055
22	Chengulo primary School	575	619	793	1,015
23	Tande primary School	617	664	851	1,089
24	Cheptuli primary School	379	408	522	669
25	Luyese primary School	550	592	758	971
26	Shirugu Primary School	576	620	794	1,016
27	Shirugu primary School	585	630	806	1,032
28	Namanja Primary School	930	1,002	1,282	1,641
29	Namagara Primary School	638	687	879	1,126
30	Matsakhala Primary School	367	395	506	648
31	Shipala Primary School	387	417	533	683
32	Manguliro Primary School	586	631	808	1,034
33	Nguvuluni Primary School	505	544	696	891
34	Musungu Primary School	297	320	409	524
35	Litali Primary School	421	453	580	743
Total Population		8,672	9,758	12,440	15,925

Table 8: Population of Secondary Boarding Schools

Name of School		Year			
		2021	2024	2034	2044
1	Malava Girls	496	535	684	876
2	Malava Boys	670	722	924	1,183
3	Kakoi	411	442	566	724
4	Samitsi Secondary School	460	495	634	812
5	Samitsi Girls Secondary School	429	462	591	757
Total Population		2,466	2,656	3,399	4,352

Table 9: Project Population of Secondary Day Schools

Name of School		Year			
		2021	2024	2034	2044
1	Namanja Secondary School	383	412	528	675
2	St. Monica Namatala	104	112	144	184
3	Lugusi Secondary School	571	614	787	1,007
4	Shivanga Secondary School	193	207	265	340
5	Chengulo Secondary School	210	226	289	371
6	Namagara Secondary School	750	808	1,034	1,323
7	Namanja Secondary School	410	442	565	723
8	Tande Secondary School	287	309	396	506
Total Population		2,908	3,130	4,008	5,129

Table 10: Projected Population of Boarding Primary Schools

Name of School		Year			
		2021	2024	2034	2044
1	Shitirira Primary School	800	862	1,103	1,412
2	Isanjiro Primary School	596	642	822	1,052
3	Malava Primary School	180	194	248	317
Total		1,576	1,698	2,173	2,781

Table 11: Projected Population of Tertiary Institutions

		2021	2024	2034	2044
1	Sunrise ECD College	50	54	69	88
2	Malava Complex TTC	200	215	276	353
3	Isanjiro Polytechnic	354	381	488	625
Total		604	650	833	1,066

Table 12: Project Capacity of Hospitals/Health centers

1	Name of Dispensary	2021		2024	2034	2044
		Inpatient	Outpatient			
1	Kimangeti Dispensary	42		45	58	74
2	Malava Sub County Hospital	70	0	75	96	123
	Malava Sub County Hospital	0	70	75	96	123
3	Malichi Dispensary	10		109	139	178
Total				304	389	498

Table 13: Project Number of Commercial establishments

Town/market centre	Year			
	2021	2024	2034	2044
Malichi				
Shops	12	12	16	20
Bars	1	1	2	2
Hotels	3	4	5	6
Butcheries	1	1	2	2
Posho mill	2	2	3	4
Chemuche				
Shops	13	14	18	23
Bars	2	2	3	4
Hotels	5	5	6	8
Butcheries	1	1	2	2
Posho mill	3	4	5	6
Lukasi				
Shops	13	14	18	23
Bars	1	1	2	2
Hotels	3	4	5	6
Butcheries	1	1	2	2
Posho mill	3	4	5	6
Shiritira				
Shops	8	9	11	14
Bars	1	1	2	2
Hotels	3	4	5	6
Butcheries	1	1	2	2
Posho mill	5	5	6	8
Malava				
Shops	245	264	337	432
Bars	13	14	18	23
Hotels	19	20	26	33
Butcheries	14	15	19	25
Posho mill	2	2	3	4
Malanga				
Shops	17	19	24	31
Bars	3	4	5	6
Hotels	5	5	6	8
Butcheries	2	2	3	4

Town/market centre	Year			
	2021	2024	2034	2044
Posho mill	3	4	5	6
Shops	307	331	424	542
Bars	22	24	30	39
Hotels	38	41	53	68
Butcheries	21	22	29	37
Posho mill	20	21	27	35
Total	408	439	563	721

3.3 Water Demand Estimation

The Previous study estimated water demand for the proposed water schemes based on the projected population and water consumption rates derived from the Design Guidelines for water supply services in Kenya, 2015. The estimated demand comprised of domestic, commercial, and institutional water demand for the delineated project area and some institutions along the transmission pipelines. In the estimation the water demands, Malava Township was taken as Urban Medium Class Housing while Chemuche, Shivanga and population along the transmission pipeline was considered to be Rural Medium Class Housing. According to the design guidelines and based on classification based on rainfall, the rural areas should be classified as high potential rural area. The estimated water demands are for Malava town water scheme is summarised in the table below.

3.3.1 Water demand Categories

The projects target to provide domestic water project that will cater for domestic water supply for both institutional and residential household needs. Estimation of water demand for the various categories of water demand will be based on the following assumption.

- Domestic water demand was estimated on the basis on the projected general project area populations
- Estimation for water consumption for educational institutions and cluster towns was based on actual school enrolment and projected growth where that information

The project area is generally rural and water demand will be considered purely as a rural demand. In projecting the water demand for rural populations, the Ministry of Water and Irrigation- Practice Manual for Water Supply Services in Kenya, 2005 is used as the main guideline because it provides a consistent framework that has been employed in design of rural water supply schemes. The main components to be considered in deriving the domestic water demands include:

1. Land potential: Rural areas are normally classified by land potential to obtain an estimate of agricultural productivity and hence rural income levels and per capita water demand. The land potential is classified according to the annual rainfall as

shown in Table 14 below. High and low values of land potential represent high and low water demand values. The project area is classified as high potential rural area.

Table 14: Criteria for classification of land potential in rural areas

Classification	Rainfall
Low potential	Annual rainfall less than 500mm
Medium potential	Annual rainfall between 500 to 1000mm
High potential	Annual rainfall more than 1000mm

2. Rate of connections - The manual also specifies guidelines for estimating the rate of installation of connections and ratio between individual connection (IC) users, and users who rely on communal watering points (CWP). The distinction is important because IC users are expected to have a higher level of per capita water consumption than CWP users.
3. Per capita Demand. This component of demand is related to land potential and type of connection. The rates presented in the Design Manual are as shown in the table below and will be used in demand computation in the project area.

3.3.2 Water Consumption Rates

Water consumption rates are categorised according to the type of housing and service types. The project supply areas are classified into average housing within the townships and medium rural setup for the peri-urban and rural areas. The proportion of Individual and communal connection for the corresponding design periods are discussed above. Table 5.4 and Table 5.5 shows the domestic, commercial and institutional water consumption rates adopted from WHO Report No. 4 and revised by Practice Manual Practice Manual for Water Supply Services Water Supply Services in Kenya (MoWI, 2005). It is assumed that consumers with individual connections in the rural areas will water their cattle from the piped water supply unless there are reliable alternative sources of water. Consumers without individual connections will retain traditional sources of water for watering the cattle.

Table 15: Water consumption rates for rural areas

Type of connection	Land potentials		
	High potential	Medium potential	Low potential
Individual connection	40	50	60
Communal watering point	10	15	20

Urban water consumption rates are categorised according to the class of housing. It assumed that high class housing units will be equipped with various water use facilities that increase use of water

will low class units will have basic requirements for water use and, in some cases, use shared facilities. The table below provides that recommended water consumption rate.

Table 16: Water consumption rates for rural areas

Urban Water Demand (l/c/day)	Housing Type		
	High Class Housing	Medium Class Housing	Low Class Housing
Individual connection	250	150	75
Communal watering point			20

Table 17: Consumption Rates for Institutional and commercial use

Category	Rate (litres/day)
Administration offices, per person	25
Hospitals, high class, per person	400 min
Hospital, medium class, per person	200
Hospital, low class, per person	100
Dispensaries, low class, per person	50
Day school, per person	25
Hotels, high class, per bed	600
Hotels, medium class, per bed	300
Day school, per person	25
Boarding school, per person	75
Offices, per person	25

Further to considering domestic demand, allowance will be made for other categories like commercial, industrial and institution water consumption in the rural areas.

3.3.4 Service level

3.3.4.1 Water Services

The services types for the supply areas are modified to conform to the current supply status. The percentage of individual and non-individual connections are thus adopted as presented in the table below.

Table 18: The Percentage of individuals and non-individuals connections

Consumer Category	IC%			NC %		
	Initial	Future	Ultimate	Initial	Future	Ultimate
High Potential Rural Areas	20	40	80	80	60	20
Urban Areas (High and Medium Class Housing)	100	100	100	0	0	0
Urban Areas (Low Class Housing)	5	10	20	95	90	80

Further to considering domestic demand, allowance will be made for other categories like commercial, industrial and institutional water consumption in the rural areas.

3.3.4.2 Estimated Water Demands

The estimated water demand based on the guidelines disused above are summarized in the table below.

Table 19: Total Water Demand

Demand Category/Description	Total Water Demand (m ³ /Day)			
	2021	2024	2034	2044
DOMESTIC				
Urban Medium Potential Housing	1,012	1,090	1,396	1,787
Rural Medium Potential Housing	1,223	1,317	2,184	4,072
Livestock Unit				
Subtotal	2,236	2,407	3,580	5,858
INSITITUTIONAL				
Educational				
Secondary School, Boarding	123	133	170	218
Secondary School, Day	7	8	10	13
Primary Schools, Boarding	79	85	109	139
Primary Schools, Day	88	95	122	156
Tertiary Colleges	30	33	42	53
Subtotal	328	353	452	579

Demand Category/Description	Total Water Demand (m ³ /Day)			
	2021	2024	2034	2044
Health				
General Hospitals outpatients	11	11	15	19
General Hospitals inpatients	14	15	19	25
Subtotal	25	26	34	43
	353	380	486	622
COMMERCIAL				
Bars	11	12	15	20
Shops, Butcheries and Posho mills	35	37	48	61
Low class Hotels	11	12	16	20
Subtotal	57	62	79	101
Total Water demand	2,646	2,849	4,145	6,582

Table 20: Projected Scheme Water Demand

Water Supply Scheme	Total Water Demand (m ³ /day)			
	2021	2024	2034	2044
Namagara Water project	805	867	1,422	2,621
Malava Water project	1,480	1,593	2,108	2,873
Shirugu Water project	361	389	615	1,088
Total Water demand	2,646	2,849	4,145	6,582

Table 21: Projected Water Demand by Category

Water Demand Category	Total Water Demand (m ³ /Day)			
	2021	2024	2034	2044
Domestic Water Demand	2,236	2,407	3,580	5,858
Institutional Demand	353	380	486	622
Commercial Water Demand	57	62	79	101
Total Water demand	2,646	2,849	4,145	6,582

4. DESIGN OF PROPOSED WATER SUPPLY SYSTEM

4.1 The Scheme Layout

The three water supply networks will supply water to the Malava town and its environs, Shirugu Town and its environs and Namagara areas including towns along Malava Webuye road between Tande to Matsakhala. The supply areas will be including area along the pipes (at least one kilometre either side) and education, medical and commercial establishment in close vicinity on the pipeline routes. The layout comprises the transmission mains, distribution systems for the three supply schemes and towns and water storage system. The project layout map is presented in the book of drawings.

4.2 Intake and raw water mains

The proposed intake works will comprise gravity concrete weirs across the river valleys. The offtake works will comprise side channel gravity chambers installed with sufficient screens and flow controls. The location of the intake and raw water mainlines are described below. The proposed intakes will be a concrete weir as indicated below:

4.2.1 Malava Town Water Scheme:

The Malava town water supply system intake is located on Tolilet streams in Nandi County, a tributary of the larger Kivaywa river. The intake is located at UTM (WGS64) coordinates N53,354m, E714,007m at an altitude of approximately 1808masl. The intake weir is approximately 15.0 wide by 1.5m deep.

4.2.2 Namagara Water Scheme:

The intake for the Namagara water supply is located on Kivaywa river at UTM Coordinates N55, 275m, E707,350m at an altitude of 1523masl.

4.2.3 Shirugu Water Scheme:

The Shirugu water system will be located on river Coordinates N53,165m, E702,2292m at an altitude of a 1496masl.

4.3 Design of Water Treatment Plants

4.3.1 Design Capacities

The water treatment plant is designed to the ultimate system demands in and will be implemented in two phases. Three lines of treatment works is proposed to cater for the ultimate demand, two lines to be constructed in phase I and additional line Phase II. The treatment works capacity incorporate 25% allowance for Unaccounted for water and 2.5% and 2.0% for losses and treatments works respectively.

Table 22: Malava Treatment Works Design Capacity

Description	2030 (m ³ /Day)	2040 (m ³ /Day)
Total Average Water Demand	2,108	2,873
Add 25% UfW	527	718
2.5% Technological losses	66	90
2% Treatment Works Usage	53	72
Treatment Works Design Capacity	2,753	3,753

Table 23: Namagara Treatment Works Design Capacity

Description	2030 (m ³ /Day)	2040 (m ³ /Day)
Total Average Water Demand	1,422	2,621
Add 25% UfW	356	655
2.5% Technological losses	44	82
2% Treatment Works Usage	36	66
Treatment Works Design Capacity	1,858	3,424

Table 24: Shirugu Treatment Works Design Capacity

Description	2030 (m ³ /Day)	2040 (m ³ /Day)
Total Average Water Demand	615	1,088
Add 25% UfW	154	272
2.5% Technological losses	19	34
2% Treatment Works Usage	15	27
Treatment Works Design Capacity	804	1,421

4.3.2 Inlet Works and Chemical Mixing

(a) Inlet turbidity

Inlet turbidity is regularly updated at WTP level for all inlet lines. Should turbidity reach the maximum allowable (high turbidity), plant inlet flow will be reduced following a pre-defined protocol. Should the plant be closed, a minimum flow will nevertheless be maintained to update the turbidity monitoring.

Table 25: WTP Inlet NTU Design Parameters

Parameter	Data	Unit
Nominal min. turbidity	10	NTU
Peak turbidity	100	NTU

(b) Distribution chamber

The distribution chamber will be composed by 2 chambers in series, the first chamber will collect the water from the inlet pipe and send it on 3 “in parallel” V-notch weirs for equal flow distribution between the 3 process lines. Up-flow velocity is limited at 0.1 m/s in the first chamber. The second chamber will collect the water from the V-notch weirs and for transmission to the WTP lines via 3 distribution channels.

(c) Chemical feeding and rapid mixing

The inlet of each WTP line is made of another weir followed by a hydraulic jump for flow measurement and rapid mixing of the different chemicals.

The chemical feeding system for coagulant and pH modifier is described below. The addition of chemicals at the weir (rapid mixing unit) is done by a perforated PVC pipe.

(d) Chemical feeding

An attempt has been made to design a simple and reliable chemical feeding system.

The use of two kinds of chemical substances is foreseen a coagulant and a pH modifier - both in a solid form.

Tanks for chemical feeding will be designed based on a batch preparation and the dosing is purely by gravity. A double tank system is provided for the coagulant and the pH modifier.

The type of chemicals, the degree of concentration of the chemical solutions, the dosage rates, etc., will depend on the quality of the water to be treated. The optimal selection of these parameters is calculated in a next chapter.

4.3.3 Malava Water Supply Treatment Works

Water is supplied to the treatment unit through a 200 mm diameter raw water main pipe. The inlet chamber is connected to a chamber through sharp-crested triangular weirs (V-notch weirs). Flow distribution between the treatment lines (2/3) will be through a rectangular gate. The inlet pipe will be fitting with the following accessories.

- Shutoff valve
- Regulating valve.
- Turbidity (NTU) meter.

Regulation of the inlet flow will be controlled according to the raw water turbidity. Recommended maximum velocity is 3 m/s for DN 400 valves. Velocity below 1.5 m/s will be considered at WTP inlet level.

Table 26: Pipe and Regulation Valve Design Parameters

Parameter	Malava	Unit
Nominal flow	31.9	lps
Flow per line	15.9	lps
Max flow per line	14.5	lps
Inlet pipe diameter	200	mm
Nominal velocity	1.18	m/s

(e) Coagulation

The addition and mixing of the coagulant and the pH corrector are done directly in the weir followed by the hydraulic jump connecting to the flocculators and creating good mixing conditions. A velocity gradient not lower than 500 s^{-1} is maintained for rapid mixing.

A gradient of less than 100 s^{-1} should be maintained in the interconnection between the rapid mixing and the flocculation units. The coagulation fittings include.

- Hydraulic mixing chamber – hydraulic jump type, including grate, ladders and I beams.
- Washout facilities to ease O&M – drainage facilities shall be installed at inlet chamber.
- 1 isolation sluice gates at the outlet of the hydraulic mixing chamber, upstream the flocculator
- Inlet chamber - L 2.5 x W 0.45 x H 0.6 m.
- Weir - 0.45m wide.
- Hydraulic jump with a slope of 1:2.
- Injection of chemicals will be as follows:
 - o Aluminium sulphate.
 - o Sodium carbonate.
- The inlet chamber will be equipped with DN 100 washout valves for O&M.

(f) Flocculation

Flocculation is carried out hydraulically in a horizontal flow unit formed by channels whose walls are made of thin precast concrete or fibre-cement or PVC sheets. The design will make sure to maintain the same velocity gradient both in the “straight” portions of the channels and in the “curves”, improving the efficiency of the reactor.

To obtain the desired velocity gradient, the separation between the baffles will be calculated.

Each flocculator (3) is divided into three compartments (3° to allow easy distribution and eventually regulation of the velocity gradient.

Design parameters and calculation notes

2 flocculation lines to be provided in phase, additional unit in phase II.

- The flocculation chambers have the following characteristics:
- Water height of approximately 0.35 meters
- Retention time for average flow is minutes and 17.5minutes
- Characteristics of the mixing process are:
 - o 54 and 57 sec⁻¹ velocity gradients in chambers
 - o Sufficient velocities (0.21m/s and 0.53m/s) in the channel and the baffles to avoid sedimentation phenomenon in the flocculation tank.
- Injection of chemicals will be as follows: PAC or Polymer at the inlet of chambers 1.
- Drainage facilities to ease O&M – drainage facilities shall be installed at the 3 flocculation chambers. Outlet to be drained into the drainage system.
- Skimmer facilities for manual skimming of the flocculator at the outlet of the third flocculation chamber.
- 1 x 3 isolation gates at the outlet of the flocculation chambers – manually operated.
- Flexible hose pipe to be installed including water supply for the maintenance of the flash mixing and flocculation basins.

An interconnection channel is provided between the flocculation and the sedimentation units.

- 1 x 3 “in series” hydraulic slow mixing chambers with baffles.
- 1 x 4 isolation sluice gates to isolate the flocculation compartments from the downstream sedimentation tanks
- Surface of each chamber = 65.16 m².
- Total surface area = 195.47 m².

Table 27: Flocculation

(Length of Channels) =		10.86	m
Number of Channels (baffles) =		20.00	Nr
Thickness of Baffle walls =		0.15	m
Width of Tank =		8.85	m
Depth of Flow =		0.35	m
Width of channel =		0.30	m
Head lost =		0.30	m
Slope of tank bottom =	1:	25	

(g) Sedimentation

The basin is divided into three sections, namely, inlet, settling and outlet zones. The design criteria for the basins are as follows:

Table 28: Sedimentation

Parameter	Data nominal	Unit
Length	18.0	m
Surface Loading	1	m ³ /m ² /m
Detention Time	3.75	hrs
Velocity at entry	0.5	m/s
Length/Width Ration	4/1	m/m
Depth of Tank	2.7	m
Total Volume	215.1	m ³
Sludge Volume	54	m ³

Sludge storage in the tank will depend on a number of unknown factors such as coagulant dose, turbidity of water, removal of sludge from tank etc. Typical sludge yield from alum is 0.5m³/kg of sludge of 8 g/l of suspended solids and 0.5m³/kg yield form from alum per day.

(h) Filtration

(i) Design parameters and calculation notes

Decanted water from the settled water channel enters each of the filters via a DN200 diameter pipe fitted with gate valve. A chequered plate flooring walkway is provided from which the gate valves are operated. The DN200 discharges into an inlet channel provided for each filter. The inlet channel has 80mm orifices at the base spaced at 200mm centres to allow for an even distribution of water across the filter width. The filter media provided consists of a 750mm deep sand bed supported on 550mm deep layer of graded gravel.

Filtration will serve to reduce inlet turbidity of the raw water to < 1 NTU as per recommendations. Different situations have been modelled in the introduction chapter.

A general overflow is provided at the inlet of the filtration plant, outlet of the sedimentation units. Filtration parameters including filtration velocities are summarized in the table below:

When one filter has to be maintained, it is recommended to reduce the nominal flow of the WTP not to increase velocities above acceptable values, certainly during backwash procedure.

To obtain the best result, the sand layer will be immediately placed on the filter bottom slab. The slab will be equipped with filtering nozzles. The conventional supporting layers (four types of gravel) and prefabricated A-shaped beams false bottom will not be required.

The water inlet to the filters is controlled by a butterfly valve 200 mm diameter leading directly in the backwash channel. The interior walls of the filter also serve as a spillway for the outflow of backwash water, and at the same time form the clear water channel.

The filter backwash system is composed of a limited storage capacity determined by the position of the outlet control weir. Back-wash water is directly provided from the existing elevated backwash tank.

The backwash water is collected in a trough located in the lateral part of the filter box and is controlled by a manually operated butterfly valve.

In the event that raw water quality is relatively good (turbidity <15 NTU), it may be feasible to provide direct down-flow filtration, as the only treatment process. Where this can be justified, then it is possible to use only the filter units of this water treatment plant.

(j) Sand characteristics

The filtration layer will be composed by a layer of sand of 0.85 mm effective size and a 1.4 uniformity coefficient.

The layer of sand will be installed directly on the support slab. A 25 nozzles /m² system will guarantee flow distribution during filtration and backwash processes.

The loss of filtration material is estimated at 2% for the sand during the initial operation of the plant.

The height of water above the sand is 1.75m after backwash, and possible head loss through the filter before backwash is 0.6 m, with a total height of 2.35m. Filter compartments are deep to allow the backwash process by the other filters in filtration, entirely by gravity.

Other design details are proposed in the table in annex.

(k) Backwash characteristics

The sequence for backwash is as follows:

- Closing of the clarified inlet valve.
- Lowering of the outlet water level - +/- 10 minutes (part of the filtration process).
- Opening of the backwash outlet valve
- Water backwash during 20 minutes at 50m³/m²/h, entirely by gravity.
- Progressive reestablishment of filtration water level when closing the BW outlet valve and reopening the inlet valve.

Filter bed characteristics during filtration and backwash process are proposed in the table in annex.

(l) Filtration process efficiency

Detailed calculation of the filtration efficiency has already been discussed and is detailed in the main WTP table in annex.

Surface loading rate is estimated at 960 g/m² for the proposed deep bed filter. This has been estimated considering the process equations and similar experiences.

Different situations have been modelled from low to maximum allowable turbidity with filtration cycle varying from 24 hours to even 96 hours.

Quantity of water required for BW and process efficiency are calculated accordingly.

(m) Filter Details

- 3No, rapid – variable flow – variable level – single layer – deep bed sand filter, including grate, ladders and I beams.
- Filter system including filter false floor – nozzles – filter bed type – grain size – layer thickness – backwash facilities – water only.
- Installation of actuated valves
- 3 water inlet valves.
- 3 backwash outlet valves.
- 3 manually operated washout valves.

(n) Sludge Drying Beds

2No. Sludge Drying Beds, 10.3x19.9 x 1.25m deep - with a total area of 200m², are provided for sludge from the sedimentation tanks. The sludge drying beds consist of slotted pre-cast concrete slabs laid on an 80mm thick layer of sand (size 1 -3mm) below which is an 80mm layer of size 10 - 15mm gravel. Underneath the sand and gravel are large stones (size 20mm - 35mm, minimum 200mm thick) surrounding an open-jointed pre-cast concrete pipe, laid to falls, for collecting the filtrate. Sludge from one sedimentation tank at a time, after it has reached 25% of the tank volume, is applied on to the sludge drying basins via a 225/300mm diameter pre-cast concrete pipe which discharges into a 500x450 concrete channel that distributes the sludge into the beds. Dried sludge is to be removed from the bed before the sludge from the next sedimentation tank is applied; a ramp is provided for access (e.g., using a wheel barrow) to the beds for this purpose. The filtrate from sludge percolates through the media and is collected in the open-jointed pipe and discharged into the river. An overflow manhole is provided at the end of the inlet channel to the sludge drying beds. Details of the sludge drying beds are given as:

4.3.4 Namagara Water Supply

(a) Treatment works Location

The treatment works for Namagara water project is located next to the pumped intake works. Water will be pumped to the inlets chamber using a low lift submersible pump located at the intake sump. Treated water collected in the clear water tank will be pumped to a high-level tank located approximately 4.5km away for distribution by gravity.

(b) Inlet system

Water is supplied to the treatment unit through a 200 mm diameter raw water main pipe. The inlet chamber is connected to a chamber through sharp-crested triangular weirs (V-notch weirs). Flow distribution between the treatment lines (2/3) will be through a rectangular gate. The inlet pipe will be fitting with the following accessories.

- Shutoff valve

- Regulating valve.
- Turbidity (NTU) meter.
- V_notch

Regulation of the inlet flow will be controlled according to the raw water turbidity values. Recommended maximum velocity is 3 m/s for DN 400 valves. Velocity below 1.5 m/s will be considered at WTP inlet level.

Table 29: Pipe and Regulation Valve Design Parameters

Parameter	Namagara	Unit
Nominal flow	18.6	lps
Flow per line	9.29	lps
Inlet pipe diameter	200	mm
Nominal velocity	1.18	m/s

(c) Coagulation

The addition and mixing of the coagulant and the pH corrector are done directly in the weir followed by the hydraulic jump connecting to the flocculators and creating good mixing conditions. A velocity gradient not lower than 500 s⁻¹ is maintained for rapid mixing.

A gradient of less than 100 s⁻¹ should be maintained in the interconnection between the rapid mixing and the flocculation units. The coagulation fittings include.

- Hydraulic mixing chamber – hydraulic jump type, including grate, ladders and I beams.
- Washout facilities to ease O&M – drainage facilities shall be installed at inlet chamber.
- 1 isolation sluice gates at the outlet of the hydraulic mixing chamber, upstream the flocculator
- Inlet chamber - L 5.0 x W 1.0 x H 1.0 m.
- Weir - 0.600m wide.
- Hydraulic jump with a slope of 1:2.
- Injection of chemicals will be as follows:
 - o Aluminium sulphate.
 - o Sodium carbonate.
- The inlet chamber will be equipped with DN 100 washout valves for O&M.

(d) Flocculation

Flocculation is carried out hydraulically in a horizontal flow unit formed by channels whose walls are made of thin precast concrete or fibre-cement or PVC sheets. The design will make sure to maintain the same velocity gradient both in the “straight” portions of the channels and in the “curves”, improving the efficiency of the reactor.

To obtain the desired velocity gradient, the separation between the baffles will be calculated.

Each flocculator (3) is divided into three compartments (3° to allow easy distribution and eventually regulation of the velocity gradient.

Design parameters and calculation notes

2 flocculation lines to be provided in phase, additional unit in phase II.

- The flocculation chambers have the following characteristics:
- Water height of approximately 0.35 meters
- Retention time for average flow is minutes and 17.5minutes
- Characteristics of the mixing process are:
 - o 54 and 57 sec⁻¹ velocity gradients in chambers
 - o Sufficient velocities (0.21m/s and 0.53m/s) in the channel and the baffles to avoid sedimentation phenomenon in the flocculation tank.
- Drainage facilities to ease O&M – drainage facilities shall be installed at the 3 flocculation chambers. Outlet to be drained into the drainage system.
- Skimmer facilities for manual skimming of the flocculator at the outlet of the third flocculation chamber.
- 1 x 3 isolation gates at the outlet of the flocculation chambers – manually operated.
- Flexible hose pipe to be installed including water supply for the maintenance of the flash mixing and flocculation basins.

An interconnection channel is provided between the flocculation and the sedimentation units.

- 1 x 3 “in series” hydraulic slow mixing chambers with baffles.
- 1 x 4 isolation sluice gates to isolate the flocculation compartments from the downstream sedimentation tanks
- Surface of each chamber = 55.06 m².
- Total surface area = 165.17 m².

Table 30: Flocculation

(Length of Channels) =		9.18	m
Number of Channels (baffles) =		20.00	
Thickness of Baffle walls =		0.15	m
Width of Tank =		8.85	m
Depth of Flow =		0.33	m
Width of channel =		0.30	m
Head lost =		0.33	m
Slope of tank bottom =	1:	25	

(e) Sedimentation

The basin is divided into three sections, namely, inlet, settling and outlet zones. The design criteria for the basins are as follows:

Table 31: Sedimentation

Parameter	Data nominal	Unit
Length	16	m
Surface Loading	1	m ³ /m ² /m
Detention Time	3.75	hrs
Velocity at entry	0.5	m/s
Length/Width Ration	4/1	m/m
Depth of Tank	2.4	m
Total Volume	153.4	m ³
Sludge Volume	38.3	m ³

Sludge storage in the tank will depend on a number of unknown factors such as coagulant dose, turbidity of water, removal of sludge from tank etc. Typical sludge yield from alum is 0.5m³/kg of sludge of 8 g/l of suspended solids and 0.5m³/kg yield form from alum per day.

(f) Filtration

(o) Design parameters and calculation notes

Decanted water from the settled water channel enters each of the filters via a DN200 diameter pipe fitted with gate valve. A chequered plate flooring walkway is provided from which the gate valves are operated. The DN200 discharges into an inlet channel provided for each filter. The

inlet channel has 80mm orifices at the base spaced at 200mm centres to allow for an even distribution of water across the filter width. The filter media provided consists of a 750mm deep sand bed supported on 550mm deep layer of graded gravel.

Filtration will serve to reduce inlet turbidity of the raw water to < 1 NTU as per recommendations. Different situations have been modelled in the introduction chapter.

A general overflow is provided at the inlet of the filtration plant, outlet of the sedimentation units. Filtration parameters including filtration velocities are summarized in the table below:

When one filter has to be maintained, it is recommended to reduce the nominal flow of the WTP not to increase velocities above acceptable values, certainly during backwash procedure.

To obtain the best result, the sand layer will be immediately placed on the filter bottom slab. The slab will be equipped with filtering nozzles. The conventional supporting layers (four types of gravel) and prefabricated A-shaped beams false bottom will not be required.

The water inlet to the filters is controlled by a butterfly valve 200 mm diameter leading directly in the backwash channel. The interior walls of the filter also serve as a spillway for the outflow of backwash water, and at the same time form the clear water channel.

The filter backwash system is composed of a limited storage capacity determined by the position of the outlet control weir. Back-wash water is directly provided from the existing elevated backwash tank.

The backwash water is collected in a trough located in the lateral part of the filter box and is controlled by a manually operated butterfly valve.

In the event that raw water quality is relatively good (turbidity < 15 NTU), it may be feasible to provide direct down-flow filtration, as the only treatment process. Where this can be justified, then it is possible to use only the filter units of this water treatment plant.

(p) Sand characteristics

The filtration layer will be composed by a layer of sand of 0.85 mm effective size and a 1.4 uniformity coefficient.

The layer of sand will be installed directly on the support slab. A 25 nozzles /m² system will guarantee flow distribution during filtration and backwash processes.

The loss of filtration material is estimated at 2% for the sand during the initial operation of the plant.

The height of water above the sand is 1.75m after backwash, and possible head loss through the filter before backwash is 0.6 m, with a total height of 2.35m. Filter compartments are deep to allow the backwash process by the other filters in filtration, entirely by gravity.

Other design details are proposed in the table in annex.

(q) Backwash characteristics

The sequence for backwash is as follows:

- Closing of the clarified inlet valve.
- Lowering of the outlet water level - +/- 10 minutes (part of the filtration process).
- Opening of the backwash outlet valve
- Water backwash during 20 minutes at $50\text{m}^3/\text{m}^2/\text{h}$, entirely by gravity.
- Progressive reestablishment of filtration water level when closing the BW outlet valve and reopening the inlet valve.

Filter bed characteristics during filtration and backwash process are proposed in the table in annex.

(r) Filtration process efficiency

Detailed calculation of the filtration efficiency has already been discussed and is detailed in the main WTP table in annex.

Surface loading rate is estimated at $960\text{ g}/\text{m}^2$ for the proposed deep bed filter. This has been estimated considering the process equations and similar experiences.

Different situations have been modelled from low to maximum allowable turbidity with filtration cycle varying from 24 hours to even 96 hours.

Quantity of water required for BW and process efficiency are calculated accordingly.

(s) Filter Details

- 3No, rapid – variable flow – variable level – single layer – deep bed sand filter, including grate, ladders and I beams.
- Filter system including filter false floor – nozzles – filter bed type – grain size – layer thickness – backwash facilities – water only.
- Installation of actuated valves
- 3 water inlet valves.
- 3 backwash outlet valves.
- 3 manually operated washout valves.

(t) Sludge Drying Beds

2No. Sludge Drying Beds, $10.3 \times 19.9 \times 1.25\text{m}$ deep - with a total area of 200m^2 , are provided for sludge from the sedimentation tanks. The sludge drying beds consist of slotted pre-cast concrete slabs laid on an 80mm thick layer of sand (size 1 -3mm) below which is an 80mm layer of size 10 - 15mm gravel. Underneath the sand and gravel are large stones (size 20mm - 35mm, minimum 200mm thick) surrounding an open-jointed pre-cast concrete pipe, laid to falls, for

collecting the filtrate. Sludge from one sedimentation tank at a time, after it has reached 25% of the tank volume, is applied on to the sludge drying basins via a 225/300mm diameter pre-cast concrete pipe which discharges into a 500x450 concrete channel that distributes the sludge into the beds. Dried sludge is to be removed from the bed before the sludge from the next sedimentation tank is applied; a ramp is provided for access (e.g., using a wheelbarrow) to the beds for this purpose. The filtrate from sludge percolates through the media and is collected in the open-jointed pipe and discharged into the river. An overflow manhole is provided at the end of the inlet channel to the sludge drying beds. Details of the sludge drying beds are given as:

4.4 Chemical Preparation and dosing

- a. Aluminium sulphate preparation and dosing.
 - 2 mixing tanks including pipes and, and calibration units.
 - level control devices in the preparation tanks
 - 2 mixer units.
- b. Sodium carbonate preparation and dosing
 - 2 mixing tanks including piping, fitting and calibration units.
 - level control devices in the preparation tanks
 - 2 mixer units.
- c. PAC and Polymer preparation and dosing
 - Installation of 2 PE preparation tanks – pipes and fitting – calibration units. New units will be used for Cationic (coagulant) / Non-ionic (Filter aid) polymer and PAC preparation / dosage and injection.
 - Installation of 4 level control devices in the preparation tanks
 - 2 new mixer units.
 - Injection pipelines
- d. Chlorine preparation and dosing
 - Mixing tanks including pipes and fitting and calibration units.
 - level control devices in the preparation tanks
 - Mixer units.
- e. Chemicals storage facilities
 - Extension of the existing dosage room including lighting and ventilation.
 - Extension of the existing storage room including lighting and ventilation.

a) Disinfection

Considering the direct correlation existing between turbidity and the presence of microorganisms, the need for precautions in the disinfection stage of treatment is foreseen. Therefore, a chlorine contact chamber has been incorporated with a retention time of 20 minutes and adequate hydraulic conditions (velocity gradient and baffled chamber) to guarantee the bacteriological quality of the treated water.

Disinfection is accomplished by post-chlorination with calcium hypochlorite, using the existing dosing units made off two tanks for batch preparation followed by the gravity dosing.

b) Process by-products

Water used for the backwash of the filters will be recycled at the inlet of the plant (pre-sedimentation tank). Storage and pumping facilities will be provided.

c) Design of storage facilities

A new storage room will be constructed considering min. storage capacity for each chemical. Capacity for the different chemicals is presented in the table below.

Storage capacity is designed based on the nominal flow of the WTP and the average chemical consumption.

Separate storage area will be provided for PAC with an anti-explosive extractor.

Table 32: Storage capacity required for chemicals

Chemical	Storage capacity
Aluminium Sulphate	3 months
Sodium Carbonate	3 months
PAC	1 month
Polymer	2 months
Chlorine (pre & post)	1 month

(u) Design of dosing lines

Chemical Injection lines for all chemicals have been standardized to DN 40 to allow easy O&M in case of clogging.

Pressure lines have been designed to minimize head losses but guarantee a minimum of velocity. P&ID are proposed in another volume - drawings.

For the Polymer/Pac, inline dilution facility is proposed. A dilution factor from 5 g/l to a 0.5 g/l is proposed to reduce the viscosity of the fluid and avoid clogging of the lines.

(v) Clear Water Tank

750m³ capacity Treated water tank is proposed at the treatment water tank to provide to our storage. The tank will also double as the sump for the pumping system.

(w) WTP Layout

The layout of the WTP extension is presented in the book of drawings. Topographical levels of the different structures will be presented in detailed during the detailed designs. The process is operated by gravity within the proposed structure, changes in the inlet flow to the max capacity have been considered as it has a direct impact on the hydraulic profile of the WTP.

4.5 Storage

To provide for fluctuations in consumer demand during the day (e.g., the hourly peak flow) and to cater for emergency demand during outages, storage reservoirs will be required. The practice manual for water supply in Kenya, 2015 recommends 12hour demand. The service reservoirs are therefore sized so that the storage capacity will be sufficient to cover a minimum of the water consumption without refilling and to balance the difference between the consumption and supply of water. 1500m³, 750m³ and 500m³ storage is provide for Malava, Namagara and Shirugu systems respectively. The location of the reservoirs is indicated in the Error: Reference source not found below. The storage tanks will also act as brake pressure tanks in hydraulic.

Table 33: Schedule of storage reservoir for Malava Water Project

Location of Reservoir	Capacity (m ³)
Water treatment Works	1000
Break pressure tank @ chainage	250
Main Storage Tank at Malava	1500
Total	2750

Table 34: Schedule of storage reservoir for Namagara Water Project

Location of Reservoir	Capacity (m ³)
Water treatment Works	500
High Level storage	1000
Tande	100
Chebwayi	100
Matsakha	100
Total	1800

Table 35: Schedule of storage reservoir for Shirugu Water Project

Location of Reservoir	Capacity (m ³)
Water treatment Works	500
High Level storage	500
Chengulo	100
Total	600

4.6 Distribution System

4.6.1 Malava Distribution System

Transmission to the project area will be mainly by gravity, except for a distribution line to St. Jude Selile primary school located at an area above the treatment works site. The mainline

Several connections will be installed to supply cluster shopping centres and areas along the mainline. The transmission design flows and pipeline lengths for are summarised below.

To regulate static pressures along the pipelines, several tanks are proposed along the pipelines which will act both as break pressure and half day storage tanks.

4.6.2 Hydraulic Modelling

The network was modelled using **WaterGems** computer modelling software. The network has been sized for the ultimate demand for the year 2044 peak day demand. **PE** pipelines has been used for the pipelines; the pipes will be joined by butt welding.

The minimum residual nodal pressure at peak hour demand should be 10 m head, whilst the maximum pressure in the network should not exceed 60 m, and only in isolated cases 90 m head. All distribution pipework will be to PN 10 (100 m head). The schedule of the mainline pipeline summarised in Error: Reference source not found below.

Table 36: Schedule of Malava town Water supply pipeline

Distribution Line Notation	Description	Length (m)
Raw Water Gravity	400mm HDPE PN10	183.8
	200mm HDPE PN10	192.0
		375.8
Gravity Main	200mm HDPE PN10	804.0
	250mm HDPE PN10	7,780.9
		8,584.9
Malava Town Main Line	280mm HDPE PN10	1,508.8
	200mm HDPE PN10	641.5
	160mm HDPE PN10	2,826.8
	110mm HDPE PN10	1,166.4
		6,143.5
Malanga Pipeline	110mm HDPE PN10	1,440.8
	90mm HDPE PN10	1,144.5
		2,585.3
St June Selile (Pumped Line)	40mm HDPE PN16	408.2
	40mm HDPE PN12	248.4
	40mm HDPE PN10	650.1
		1,306.7
Matioli Line	50mm HDPE PN10	3,582.7
Lutali Line	40mm HDPE PN10	2,387.0
Musungu Line	40mm HDPE PN10	2,221.4
Nguvuluni Line	40mm HDPE PN10	2,654.6
Shivikwa 1 Line	75mm HDPE PN10	1,698.2
Shivikwa 2 Line	75mm HDPE PN10	2,654.6
Tumbeli Line	40mm HDPE PN10	997.5

Distribution Line Notation	Description	Length (m)
Manguliro Line	40mm HDPE PN10	1,851.7
Mukhonje Line	40mm HDPE PN10	2,723.9
Shiritini Line	63mm HDPE PN10	997.5
Malava Distribution Line A	63mm HDPE PN10	402.0
Malava Distribution Line B	63mm HDPE PN10	876.2
Malava Distribution Line C	75mm HDPE PN10	1,397.0
Malichi Line	40mm HDPE PN10	700.2
Additional; Lines	40mm HDPE PN10	5,000.0
Total Length of Pipelines		49,140.8

Table 37: Schedule of Namagara Pipelines

Distribution Line Notation	Description	Length (m)
Rising Main	280mm HDPE PN10	2,911.0
Gravity Main	315mm HDPE PN10	2,202.5
	315mm HDPE PN12.5	2,100.8
	315mm HDPE PN10	12,328.7
		16,632.0
Fevuye	160mm HDPE PN10	2,176.4
Additional; Lines	63mm HDPE PN10	2,500.0
Total		24,219.4

Table 38: Schedule of Butere Pipelines

Distribution Line Notation	Description	Length (m)
Rising Main	225mm HDPE PN12.5	378
	225mm HDPE PN10	4,037
		4,415
Samitsi Line	160mm HDPE PN10	3,709
Burundu Line	50mm HDPE PN10	4,482
Luyetse	110mm HDPE PN10	568
	40mm HDPE PN10	1,199
		1,768
Sheiywe	110mm HDPE PN10	2,016
Chengulo	63mm HDPE PN10	4,958
Additional Lines	63mm HDPE PN10	2,500
Total		23,848

4.6.3 Community Water Kiosks

Community Water kiosks are proposed along the distribution network to ensure access to water by the community which are not connected at home. The water points are sited so that the maximum walking distance for 90% of the water users is approximately 0.5km. However, the number of water users per water point should be in the range of 250-750m. The design encompasses appropriate and low-cost technology for construction, operation, and management. The kiosks will be provided with a gate valve and a water meter in valve chamber. The water kiosks will also be provided with a storage tank to ensure reliability and to cushion the user against pump failures. Multiple water taps will be provided at each kiosk to reduce waiting time at water kiosk. The kiosk will be fitted with a plastic water storage at the roof slab for storage and avoid drawing water directly from the transmission mainline. The Kiosks will be located at all market centres and rural schools to allow drawing of water by the local community. Where the distances to schools and market centers are far apart, the water kiosk will be located according to the criteria above. Proposed number of water kiosks for the satellite towns are presented in the table below. It is however we recommend that towns with projected population of more than 5,000 and that will require more than 10 water kiosks should have a distribution system.

Table 39: Schedule of Kiosks for Malava Water Project

LOCATION	Proposed No. of Kiosks	Comments
Tolilet	1	Water Kiosks
Malichi	1	Water Kiosks
Chemuche	1	Water Kiosks
Lukusi	1	Water kiosks
Shitirira	1	Water Kiosks
Musingu Area	5	Water Kiosks
Isanjiro	1	Water Kiosks
Shivikwa	2	Water Kiosks
Malanga	1	Water Kiosks
Tumbeni	2	Water Kiosks
Malava Town	4	Water Kiosks
Kakoyi	1	Water Kiosks
Nguvuluni	2	Water Kiosks
Manguliro	1	Water Kiosks

LOCATION	Proposed No. of Kiosks	Comments
Mukhonje	2	Water Kiosks
Musungu	1	Water Kiosks
Shipala	1	Water Kiosks
Matiolo Line	2	Water Kiosks
Along pipelines	10	Water Kiosks
Total Number	40	

Table 40: Schedule of Kiosks for Namagara Water Project

LOCATION	Proposed No. of Kiosks	Comments
Namagara	1	Water Kiosks
Febuye	1	Water Kiosks
Tande	1	Water Kiosks
Butali	2	Water kiosks
Chebwayi	2	Water Kiosks
Matsakhala	2	Water Kiosks
Bande	1	Water Kiosks
Vihiga	2	Water Kiosks
Along pipelines	6	Water Kiosks
Total Number	18	

Table 41: Schedule of Kiosks for Shirugu Water Project

LOCATION	Proposed No. of Kiosks	Comments
Shirugu	2	Water Kiosks
Samitsi	2	Water Kiosks
Burundu	1	Water Kiosks
Sheiywe	1	Water kiosks
Luyetse	1	Water Kiosks
Chengulo	1	Water Kiosks
Along pipelines	4	Water Kiosks
Total Number	12	

4.7 Project Ancillary works

4.7.1 Access and service roads

Most of the project pipelines and storage tanks are located along the main roads. Access to the three treatment works sites will as no new access new road will therefore be required.

4.7.2 Auxiliary buildings and other works

The ancillary components of the projects within the treatment plant compounds will staff housing, fencing, guard house, parking bay, storm drainage, wastewater storage, water supply and any other work that will be incidental at site. Separate fencing will be provided to isolate the staff hounds from the general compound.

It is anticipated that to run the new treatment works efficiently the following staff will be required at each of the treatment site and for the distribution network:

- 1 No. Operator in charge
- 1 No. Deputy Operator in charge
- 5 No. Attendants (for 8 hour shifts over 7 days)
- 1 No. Zonal officer (meter reader/ plumber)

4.7.3 Pump House

The pumping equipment together with the air blower room, workshop and store will be housed in one building. The building will be from masonry or block work.

Two number backwash pump sets will be installed. They will pump from the clear water reservoir to the 12m high elevated tank. Each pump will have a capacity of 185 m³/h at 25 m head and one unit will be operational, whilst the other is standby. The pump capacity will be big enough to wash each filter once daily during daylight.

4.7.4 Fence

A chain link fence with concrete posts and struts will be installed around the treatment plant facilities. Two entrance gates are to be provided for entering the treatment works form the main road, one 6 m wide for vehicles and one 1 m wide for pedestrians. A further 1m wide gate will also be installed for entering the works from the staff quarters.

4.7.5 Electricity Supply

The KPLC line supplying the existing water treatment works will be extended to the new treatment works to run the backwash pumps, air blowers and site/ building lighting.

4.7.6 Utility Water

Utility water is required for several purposes, including preparation of dosing chemicals, cleaning, fire protection and the supply of drinking water to the operator's buildings. Utility water will be provided from the elevated reservoir on site. Standpipes on either side of the treatment units will be provided to facilitate cleaning.

4.8 Environmental baseline conditions

4.8.1 The bio-physical environment

i. Topography

The topography of the project area ranges from 1,834m asl at the proposed intake works for Malava Water Supply in Tolilet – Nandi County, to 1,478m asl along the Shirugu – Chegulo - Matsakha Line at the Namagara River crossing.

ii. Geology and soils

The project area on the Nandi Escarpment is underlain by soils developed on undifferentiated Basement system Rocks (predominantly gneisses). These are well-drained deep, red to yellowish red friable sandy clay (ferralsol-chromic ACRISOLS). Towards Malava, the soils are developed on granites and are well drained, deep, yellowish red to brown, friable clay loam, with an acid humic topsoil (humic CAMBISOLS; with humic ACRISOLS). Areas covered by the Shirugu and Namagara water schemes also have soils developed on granites and are well drained, deep to very deep, brown to dark brown, friable, sandy clay to clay (ferralsol-orthic ACRISOLS) (Sombroek, Braun, & van der Pouw, 1982).

iii. Hydrology, hydrogeology and water resources

Malava sub-county lays in the Nzoia river basin where rivers and streams draining the area mainly form a dendritic drainage pattern as they join up and flow into Nzoia River west and south-westwards. While most rivers mainly originate from the Nandi Escarpment North East of Malava town, a few originate from Malava Forest. The forest is generally on a higher altitude than the surrounding lands and is nearly dome shaped resulting in the area having a nearly radial drainage pattern.. Tande and Makwabuye streams exit forest to the West and join up to form Nambirima River. Several tributaries of Lusumu River originate just outside of the forest to the South West while Matiti (Lugusi) River exits to the North (Malava Community Forest Association, 2015).

The aquifers in this area occur in the basement system of rocks at the contact between the weathered and the fresh basement rocks. Groundwater quality in the area is good for human consumption. The analysis reports of the boreholes in Malava area have shown that all the parameters are in good concentrations for domestic use (Namwamba, 2012)

The Nzoia River and its spring water resources, are the major communal water supply for domestic use and animal requirements. The demand for water is generally increasing due to population growth and economic development. On the other hand, these water resources are increasingly being degraded due to unplanned settlements and lack of collaborative rehabilitation and management. Stream flow during seasonal low- flow periods has decreased in many areas due to greater degradation of the catchments. In addition, studies have established that most springs normally expected to have clean water are now contaminated with thermo-tolerant coliform bacteria. These may soon result into outbreaks of water-borne diseases and adversely affect the communities' livelihoods (Simiyu, Adams & Esipila, 2008).

iv. Climatic conditions

Climate records for Malava town and its environs are not available. However, those for Kakamega and Webuye towns (both within a radius of <25kms and at relatively similar altitude) are available and can be used to deduce the climate of Malava.

Kakamega and Webuye's climate is classified as tropical. Rainfall is significant most months of the year, and the short dry season has little effect. According to Köppen and Geiger, Kakamega Climate is classified as Af, while that of Webuye is classified as Am. The temperatures average 20.3 °C and 20.4°C while the average annual rainfall is 1691 mm and 1971 for Webuye and Kakamega respectively. Precipitation is lowest in January, while most of it falls in May for both towns. (Source: <http://en.climate-data.org>)

v. Flora and fauna

The project area is mainly an agricultural area intensively cultivated with sugarcane and other food crops such as maize and beans. Sugarcane however dominates the land cover and is interspersed by woodlots of such trees as *Eucalyptus sp* *Croton sp*. *Grevillea robusta* and *Psidium guajava*.

At the proposed intake and treatment plant site in Tolilet for the Malava water scheme, the vegetation found here includes herbaceous plants (mainly grasses), trees and shrubs such as *Calodendron capense*, *Eucalyptus sp*, *Pavonia kilimandscharica*, *Erythrina abyssinica*, *Psidium guajava*, *Maesa lanceolata*, *Spathodea campanulata*, *Cuppressus lucitanica* and *Ximenia americana*. Sections of the site have also been cultivated with sugarcane and other food crops, while vegetation on the riparian area proposed for the intake works had been cleared by burning in readiness for cultivation.

Along the proposed pipeline route from Tolilet, dominant vegetation includes *Lantana camara*, various grass species, and live hedges. The pipeline also passes along the road abutting the southeastern edge of Malava Forest. The forest which is a biodiversity hotspot is part of the Kakamega Forest Ecosystem.

Biodiversity of the forest is closely related to that of the larger Kakamega forest both in species richness and composition, even though it has relatively low species abundance due to its small size and past disturbance. The forest's flora is characteristic of mixed young regenerating forest and strands of plantation forest.

Originally, the forest was dominated by *Olea capensis*, *Diospyros abyssinica*, *Maesopsis eminii* and *Prunus africana* which are characteristic of a primary forest. These are still present although only in small patches of the forest to the South West area adjacent to Malava Girls, to the East of the Malava-Webuye road.

In other sites, the four dominant species are not abundant and have been replaced by *Antiaris toxicaria*, *Croton megalocarpus* and *Funtumia africana* which are classified as climax species in the early stages of succession, an indicator of past disturbances. The high abundance of fast growing species like *Croton megalocarpus*, *Funtumia africana*, *Polyscias fulva* and *Trilepisium madagascariense* in most parts of its natural forest is further evidence of the forest being a regenerating secondary forest following previous disturbance. Project activities will however not interfere with the forest boundaries.

At the proposed treatment plant site in Lunyu village for the Namagara water scheme, a significant portion of the site is cultivated with sugarcane. Trees and shrubs also found on the site include *Ficus thonningii*, *Cupressus lusitanica*, *Psidium guajava*, *Eucalyptus sp*, *Grevillea robusta*, *Acacia sp*, *Cissampelos mucronata*, *Searsia natalensis*, *Vernonia amygdalina*, and *Lantana camara*. At the proposed intake site on the banks of Kivaywa River, some of the trees and shrubs found here include *Eucalyptus sp*, *Ficus lutea*, *Psidium guajava* and *Acanthus pubescens*. Along the proposed pipeline route, common vegetation includes *Psidium guajava* and other live hedges.

At the proposed treatment plant site next to Friends Church, Shirugu, part of the land is cultivated with sugarcane. Other vegetation found here includes *Croton sp*, *Senna sp*, *Psidium guajava*, *Eucalyptus sp* among other shrubbery. At the proposed intake site on the banks of Nambirima River, the vegetation found here includes *Psidium guajava*, *Eucalyptus sp* *Lantana camara* among other shrubbery.

Apart from that in Malava Forest, much of the fauna found in the project area is domesticated animals such as cows, sheep, and goats. Avian fauna found in the area includes birds such as chicken, swallows, weavers, starlings etc. Birds' species are mostly distributed on the basis of microhabitats. Thus, pockets with woodlots/dense vegetation and high plant diversity such as riverine areas are also likely to have higher birds' species composition.

4.9 Socioeconomic environment

i. Population

According to the Kenya Population and Housing Census (2009) Report, the Project area which is in Kakamega North (Malava Sub County) had a population of 205,166 in 40,635 households. The population density was 480 people per square kilometer.

ii. Land use, livelihoods and local economy

Rural livelihoods in the project area are predominantly based on agriculture, as reflected by its contribution to income generation, food security, and employment. More than 80% of the rural population depend directly or indirectly on agriculture for their livelihood, and most of the small-scale industries found in the region are also agriculture-based.

Agriculture alone accounts for over 62% of the household income. The sector is a primary source of income for 47.9% of the population and is a secondary source for 18.5%

Although the region has a favorable climate that supports various crops and most of its people depend on agriculture for their livelihood, overall its agricultural situation is negative, being often marred by low productivity, land degradation, and slow or stagnant growth. Farmers too often do not have access to the resources they need to make the most of agriculture (Wondimu, 2008)

4.9 .1 Regional challenges

i. Declining household landholding sizes

The rapid growth of population that has occurred in the region over the past few decades has been accompanied by a surge in the number of farm households. This rapid growth of population and consequent increase in the number of farm households has brought at least two major changes to the agricultural landscape. The average size of household landholdings has declined from 1.5 hectares in 1969 to 0.7 hectares in 2006, due to land fragmentation through inheritance, for an average family size of 4.8 persons per household, and soil fertility has continuously deteriorated due to exhaustion.

As land holdings become smaller, households are frequently forced to use and skip or shorten fallow periods so that they can produce enough to meet their ever-increasing food and income needs. In addition, the heavy rainfall the area receives makes the soil susceptible to erosion. Land exhaustion and soil erosion, coupled with inadequate soil improvement measures, have led to increased soil infertility and ultimately to low yields (Wondimu, 2008).

ii. Cash crops vs. food crop production

A vast majority of the households in the region depend on such cash crops as sugarcane as their main source of in-come. The introduction of sugarcane to the area in 1970s and 1980s has prompted a gradual shift from the cultivation of such traditional food crops as millet, sorghum, and maize to sugarcane, because farmers were able to earn a better income from the cultivation

of the new crops. Consequently, food production went down as farmers put greater emphasis on cash crop production and allocated all their land to sugarcane farming.

This overemphasis on cash crop production, combined with falling prices and declining terms of trade for cash crops, has brought challenges to these rural households. In addition, the price of the farm inputs supplied by sugarcane companies on credit has often been kept high, and delays have occurred in both harvesting the product and in payment. Many small-scale farmers have therefore been forced to venture into other activities, usually casual wage-labor in the plantations and urban centers, as a no food-no income situation has prevailed (Wondimu, 2008).

iii. Infrastructure and access to services

Infrastructure is the backbone upon which most development activities flourish. It plays a key role in facilitating development through the expansion of livelihood options and contributes to poverty reduction by enabling access to a range of socioeconomic services and creating new jobs.

However, the services and facilities that are required for the diversification of livelihoods in the region are lagging behind required levels. Although three out of four people live in rural areas, access to services remains mainly restricted to the urban centers, and most of the rural areas are under-served in terms of basic social and economic services. For example, most of the road networks are composed of dry-weather roads and are in poor condition.

The availability, quality and affordability of basic social services, particularly education and health, present a challenge for the rural households. In some areas where schools and health-care centres exist, the quality of the services is below standard, whereas in areas where the quality of the services is better, most of the households are unable to pay. Access to these basic social services determines the livelihood status of the households, as poverty is linked to poor health and lack of education, and vice versa. However, the government policy of free primary education for all has enabled most children in the region to access primary education.

iv. High and rising poverty Levels

According to the Kenya Integrated Household Budget Survey (KIHBS) 2005/06, Malava constituency had a poverty rate of 48.4%. The First County Integrated Development Plan (CIDP) for Kakamega (2013 – 2017) for Kakamega advances that the overall poverty level in the County stands at 51.3%.

The causes of high poverty levels include poor farming methods, overdependence on one cash crop such as sugarcane, poor quality livestock, overdependence on rain fed agriculture, high population density, poor infrastructure, inaccessibility to quality health, low level of entrepreneurial skills, inadequate capital to invest in high yielding areas, high HIV and AIDS prevalence rate, increasing number of orphans and vulnerable children due to HIV and AIDS.

Other effects of HIV and AIDS include the disease burden resulting from the cost of treatment for HIV and AIDS and loss of productivity (County Government of Kakamega, 2013).

v. Household social amenities

The KIHBS 2005/06 survey revealed that most of the people in Kakamega lived in their own homes mainly constructed from mud/wood with corrugated iron sheet roofing. The main sources of water for these households were rivers/ponds, streams, and unprotected dug wells/springs wells/springs. The table below shows the distribution of households by the main source of drinking water in Kakamega (KNBS, 2006).

Table 42: Percentage distribution of Households by main source of drinking water

Water source	% of the households
Piped into dwelling	2.0
Piped into plot/yard	3.7
Public tap	0.2
Borehole with pump	3.9
Protected dug well	2.8
Protected spring	18.2
Rain Water collection	0.1
Unprotected dug well/spring	26.1
River/ponds streams	38.7
Tanker – truck/ vendor	2.0

According to the CIDP (2013), access to quality water remains a challenge with only 29.5% of the County population with access to portable water while only 5.9% have access to piped water.

The CIDP acknowledges that the level of the county’s household access to portable water is still very low as compared to the UN standards that require each person is entitled to between 20-50 liters of water a day.

With only a small fraction of households connected to piped water, springs are the main source of water providing for 41.6% of households in the County. About 53.1% of the existing springs are unprotected. This exposes people to the risk of contracting various water borne diseases. The rest of the County populace depends on water sourced from boreholes, shallow wells and roof catchments. About 44.2% of the households take between 5-14 minutes to fetch water - a chore considered for women and children. The terrain to the water points makes these water sources inaccessible.

The CIDP proposes to increase by twofold the percentage of the county’s population with access to clean and safe water by 2017, i.e. 49% with access to portable water and 11.8% with access to

piped water. A strategy that has been put forward in the CIDP to ensure access to quality water supply is to construct water treatment plants at various designated centres and joint school-community water projects. Rainwater harvesting and storage by individual persons and institutions is also proposed as well as a combined effort between water and housing subsectors focusing on ensuring that upcoming county structures have the element of water harvesting and storage in their design. Protection and fencing of natural and pure sources of water, and increase in the number of well-managed boreholes at strategic positions for community use in the County is also proposed (County Government of Kakamega, 2013).

The CIDP of 2013 estimated that Kakamega County has 88.0% of the population using pit latrines as the main waste disposal type, 1.9% of the population use flush toilet while 5.9% use VIP Latrines - a trend that is generally reflected in the major towns in the County.

vi. Issues in urban settlements

The Kakamega CIDP (2013) cites the following issues as emerging in urban settlements of which Malava Town and its environs are amongst:

- Indiscriminate solid waste disposal;
- Urban sprawl/ Unplanned settlements;
- Inadequate water supply;
- Pollution (land, air, and water);
- Poor waste water disposal;
- Encroachment on restricted areas e.g. road reserves, riparian reserves or environmentally fragile land; and
- Inadequate sanitation facilities e.g. public toilets, waste receptors, waste disposal sites.

The general strategies proposed for addressing the above problems revolve around planning of the urban centres, upgrading of water supply systems, development of sewage systems, enforcement of by – laws by county government, and provision of sanitation facilities (County Government of Kakamega, 2013).

vii. Catchment/watershed degradation

The Nzoia River watershed is exposed to several environmental problems such as land degradation and deforestation. The extensive clearing of vegetation and increased rainfall intensity has caused soil erosion leading to high sedimentation in rivers (Okoth-Ogendo & Ojwang, 1995). Most of the watershed has been deforested and is continuously under crop production. 60% of the land in this area is arable and mostly under cultivation. The few remaining forested areas are Mt Elgon and Cherangany forests - which are currently being heavily deforested, and the steep sloping escarpments - originally Government trust land - are quickly being de-vegetated due to charcoal burning and illegal farming. This has led to high soil erosion and transport of sediments, which impacts on the livelihoods of the lake basin

communities. Erosion along the River's banks has resulted in a noticeable large plume of sediments entering Lake Victoria and the production of an extensive algal bloom. The significant impact of sedimentation is siltation of shallow unconfined spring aquifers and eventual drying up of springs.

Catchment degradation due to increased population, urbanization and climate changes have led to contamination of the spring water sources. It is not uncommon to find spring water contaminated with thermo-tolerant coliform bacteria, in both developed and undeveloped springs (Simiyu & Adams, 2009). In other incidences, some springs have dried up or have shifted their outlets immediately after development denying the local communities their normal access to water (Simiyu, Ngetich, & Esipila, 2009).

The greatest vulnerabilities are likely to be in unmanaged water systems and systems that are currently stressed or poorly and unsustainably managed due to inadequate watershed governance that has been worsened by conflicts among riparian communities. Land cover changes are likely to change the natural ecology and water resources. Exogenous factors such as climate change, drought and floods will also impact the already serious water resource and pollution problems.

Environmental degradation is leading to interference and the disappearance of some small wetlands. Ground water recharge would also decrease under this scenario, with lowering of water tables and a reduction in borehole and spring yields. Climate change is likely to exacerbate the current pressures on the limited surface and ground water resources in the area (Simiyu, Adams, & Esipila, 2008).

5. POLICY LEGAL AND REGULATORY FRAMEWORK

5.1 Policy Framework

The Kenya Government's Environmental Policy aims at integrating Environmental Aspects into National Development Plans. The broad Objectives of the National Environmental Policy include:

- i. Optimal use of natural land and water resources in improving the quality of Human Environment;
- ii. Sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations;
- iii. Integration of Environmental Conservation and Economic Activities into the process of sustainable development;
- iv. Meeting national goals and international obligations by conserving bio-diversity, arresting desertification, mitigating effects of disasters, protecting the ozone layer and maintaining an ecological balance on earth.

Kenya has approximately 77 statutes which relate to Environmental concerns. Most of these statutes are sector specific, covering issues such as public health, soil erosion, protected areas, endangered species, water rights and water quality, air quality, noise and vibration, cultural, historical, scientific and archaeological site, land use, resettlement, etc. Previously, Environmental Management Activities were implemented through a variety of instruments such as policy statements and sectorial laws and also through permits and licenses. For example, the Physical Planning Act of 1996 empowers local authorities to request existing facilities to conduct environmental assessments, while under the Local Government Act of 1998, it is an offence to emit smoke, fumes or dust which may be a source of danger, discomfort or annoyance. With the enactment of the Environmental Management and Co-ordination Bill in December 1999, the institutional framework for environmental management was strengthened. The Environmental Management and Co-ordination Act (EMCA) of 1999 provided for the establishment of a National Environment Management Authority (NEMA), which became operational in July 2002, with the statutory mandate to co-ordinate all environmental activities.

5.2 Legal Framework

The Environmental Management and Co-Ordination Act

The Environmental Management and Co-ordination Act (EMCA) received Presidential assent on 6 January 2000 and was gazetted on 14 January 2000.

The Main Objective of the Act is to:

- i. Provide guidelines for the establishment of an appropriate legal and institutional framework for the management of the Environment in Kenya;
- ii. Provide a framework legislation for over 77 statutes in Kenya that contain environmental provisions;
- iii. Provide guidelines for Environmental Impact Assessment, Environmental Audit and Monitoring, Environmental Quality Standards and Environmental Protection Orders.

The Second Schedule to the Act specifies the projects for which an EIA or environmental audit must be carried out. According to EMCA, Section 58, all Projects listed in the Second Schedule of EMCA must submit a Project Report to NEMA. Flood control schemes are listed in No. 4 Dams, rivers and water resources.

The Environmental (Impact Assessment and Audit) Regulations, 2003, provide the basis for procedures for carrying out Environmental Impact Assessments (EIAs) and Environmental Audits (EAs).

In 2001, the Government established the administrative structures to Implement EMCA. The main administrative structures are described in Section 4.3.

The Environment Management and Coordination Act (EMCA) 1999 and Its Tools

The most pertinent and overriding statute that will be evoked is the Environmental Management and Coordination Act (EMCA 1999) was enacted in 2000 to harmonize environmental legislation previously scattered among 77 national laws. As the principal environmental legislation in Kenya, EMCA sets the legal framework for environmental management basically as follows:

Requirement for Environmental Impact Assessments for all new projects

Section 58 of the Environmental Law requires that an Environmental Impact Assessment (EIA) study precede all development activities proposed to be implemented in Kenya. The Act further requires that EIA studies so designed, be executed in accordance with the Guidelines for Conduct of EIAs and Environmental Audits (Kenya Gazette Supplement No. 56 of 13th June 2003) as published by the National Environmental Management Authority (NEMA). It is for this reason that CWSB instructed the consultant to carry out an environmental and social impact assessment on the project. CWSB ensures that for all proposed projects an environmental and social impact assessment is carried out

Requirement for Annual Environmental Audits

In order to mitigate and control environmental damage from ongoing projects, Sections 68 and 69 of the EMCA require that all ongoing projects be subjected to annual environmental audits as further expounded in Regulation 35 (1) and (2) of Legal Notice 101 of June 2003. CWSB is committed in ensuring environmental safeguard and requires consultants to submit quarterly and annual environmental audit reports for all on-going projects.

The Environmental Impact Assessment is guided by the Environmental Management and Co-ordination Act, 1999 through the National Environment Management Authority (NEMA) The preparation of the EIA study and subsequent approval procedures are set out in the EIA Study, legal notice 101 of 2003.

According to the regulations, an EIA study should incorporate but not limited to the following: -

- i. The proposed location of the project
- ii. The objective of the project
- iii. The technology, procedures and process to be used in the implementation of the project.
- iv. The materials to be used in the construction and implementation of the project.
- v. The products and by-products and waste generated by the project. The environmental effects of the project including the socio-cultural impacts, effects and direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated.
- vi. A concise description of national environmental legislative and regulatory framework, baseline information and any other information related to the project.
- vii. A description of the potentially affected environment.
- viii. Alternative technologies and processes available and reasons for preferring the chosen technology and processes.
- ix. An analysis of alternatives including project sites, design and technologies and reasons for preferring the proposed site, design and technologies.

- x. An Environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, time frame and responsibility to implement the measures.
- xi. The provision of an action plan for the prevention and management of foreseeable accidents and hazardous activities in the cause of carrying out activities.
- xii. The measures to prevent health hazards and to ensure security in the working environment for the employees and for the management of emergencies.
- xiii. An identification of gaps in the knowledge and uncertainties which were encountered in compiling the information.
- xiv. An economic and social analysis of the project.
- xv. An indication of whether the environment of any other state is likely to be affected and the available alternative and mitigating measures.

Environmental Impact Assessment and Audit Regulation 2003 (Legal Notice 101 of 2003)

Environmental Impact Assessment is a tool for environmental conservation and has been identified as a key component in on-going project execution. Section 58 of the Environmental Management and Coordination Act (EMCA) Number 8 of 1999, Second Schedule 9(I), and Environmental (Impact Assessment and Audit) Regulation 2003, stipulate that both new and old projects must undergo Environmental Impact Assessment and Audits. This is necessary as many forms of developmental activities cause damage to the environment and hence the greatest challenge today is to maintain sustainable development without interfering with the environment. There are many environmental problems and challenges in Kenya today among them land degradation, water management and environmental pollution. This is aggravated by lack of awareness and inadequate information amongst the public on the consequences of their interaction with the environment. According to Kenya Subsidiary Legislation, 2003 part V of the EIA and EA regulation, provides for environment Audit and monitoring. The policy recommends the need for enhanced reuse/recycling of residues including waste water and use of non-waste technologies. It recommends participation of stakeholders in the management of wastes within their localities. It encourages better planning in both urban and rural areas and provision of basic needs such as water, drainage and waste disposal facilities.

The Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2013 (Gazette Notice No. 13211 of 2013)

Pursuant to regulation 48 of the Environmental (Impact Assessment and Audit) Regulations, 2003, as read with paragraph 4 of the fifth schedule thereof. The Environmental Impact Assessment fees payable has been reviewed as follows:

0.1% of the total cost of the project to a minimum of KSh.10, 000 with no upper capping.

Water Quality Regulations (2006)

Water Quality Regulations apply to water used for domestic, industrial, agricultural, and recreational purposes; water used for fisheries and wildlife purposes, and water used for any other purposes. Different standards apply to different modes of usage. These regulations provide for the protection of lakes, rivers, streams, springs, wells and other water sources.

Everyone is required to refrain from any actions, which directly or indirectly cause water pollution, whether or not the water resource was polluted before the enactment of the Environmental Management and Coordination Act (EMCA) gazetted in 1999. It is an offence to contravene the provisions of these regulations with a fine not exceeding five hundred thousand shillings.

According to these regulations, “Every person shall refrain from any action which directly or indirectly causes, or may cause immediate or subsequent water pollution, and it shall be immaterial whether or not the water resource was polluted before the enactment of the Act”.

The Environmental Management and Coordination (waste management) Regulation, 2006

The Waste Management Regulations are meant to streamline the handling, transportation and disposal of various types of waste. The aim of the Waste Management Regulations is to protect human health and the environment. The regulations place emphasis on waste minimization, cleaner production and segregation of waste at source.

The regulation requires licensing of transporters of wastes and operators of disposal site (sections 7 and 10 respectively). In section 14 (1) every trade or industrial undertaking is obliged to install anti-pollution equipment for the treatment of waste emanating from such trade or industrial undertaking. The Developer shall ensure that the garbage collector contracted has a valid license from the National Environment Management Authority (NEMA).

EMCA (Noise and Excessive Vibration Pollution Control) Regulations, 2009

These Regulations determine that no person or activity shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise that annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. In determining whether noise is loud, unreasonable, unnecessary or unusual, the following factors may be considered:

- i. Time of the day;
- ii. Proximity to residential area;
- iii. Whether the noise is recurrent, intermittent or constant;
- iv. The level and intensity of the noise;

- v. Whether the noise has been enhanced in level or range by any type of electronic or mechanical means; and,
- vi. Whether the noise is subject to be controlled without unreasonable effort or expense to the person making the noise.

These regulations also relate noise to its vibration effects and seek to ensure no harmful vibrations are caused by controlling the level of noise. Any person(s) intending to undertake activities in which noise is suspected to be injurious or endangers the comfort, repose, health or safety of others and the environment must make an application to NEMA and acquire a license subject to payment of requisite fees and meeting the license conditions. Failure to comply with these regulations attracts a fine of KES 350,000 or 18 months jail term or both.

Draft Environmental Management and Coordination (Air Quality) Regulations, 2008

The objective of these Regulations is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. The general prohibitions state that no person shall cause the emission of air pollutants listed under First Schedule (Priority air pollutants) to exceed the ambient air quality levels as required stipulated under the provisions of the Seventh Schedule (Emission limits for controlled and non-controlled facilities) and Second Schedule (Ambient air quality tolerance limits)

Environmental Impact Assessment and Audit Regulation 2003 (Legal Notice 101 of 2003)

Environmental Impact Assessment is a tool for environmental conservation and has been identified as a key component in on-going project execution. Section 58 of the Environmental Management and Coordination Act (EMCA) Number 8 of 1999, Second Schedule 9(i), and Environmental (Impact Assessment and Audit) Regulation 2003, stipulate that both new and old projects must undergo Environmental Impact Assessment and Audits. This is necessary as many forms of developmental activities cause damage to the environment and hence the greatest challenge today is to maintain sustainable development without interfering with the environment. There are many environmental problems and challenges in Kenya today among them land degradation, water management and environmental pollution. This is aggravated by lack of awareness and inadequate information amongst the public on the consequences of their interaction with the environment. According to Kenya Subsidiary Legislation, 2003 part V of the EIA and EA regulation, provides for environment Audit and monitoring. The policy recommends the need for enhanced reuse/recycling of residues including waste water and use of non-waste technologies. It recommends participation of stakeholders in the management of wastes within their localities. It encourages better planning in both urban and rural areas and provision of basic needs such as water, drainage and waste disposal facilities.

The Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2013 (Gazette Notice No. 13211 of 2013)

Pursuant to regulation 48 of the Environmental (Impact Assessment and Audit) Regulations, 2003, as read with paragraph 4 of the fifth schedule thereof. The Environmental Impact Assessment fees payable has been reviewed as follows:

0.1% of the total cost of the project to a minimum of KSh.10, 000 with no upper capping.

The Occupational Safety and Health Act, 2007

This is an Act of Parliament to provide for the safety, health and welfare of all workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes.

It applies to all workplaces where any person is at work, whether temporarily or permanently. The purpose of this Act is to:

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

The Occupational Safety and Health Act 2007 (OSHA 2007) revokes the Factories and Other Places of Work Cap.514. However sections of the Factories and Other Places of Work that are not inconsistent with those of OSHA 2007 remain applicable.

The scope of OSHA 2007 has been expanded to cover all workplaces including offices, schools, academic institutions and plantations. It establishes codes of practices to be approved and issued by the Director, Directorate of Occupational Health and Safety (DOHS) for practical guidance of the various provisions of the Act. Other parameters within the Act include:

- i. Duties of employers, owners or occupiers of workplace;
- ii. Establishment of safety and health committees;
- iii. Annual safety and health audit of workplaces;
- iv. Safety and Health obligations for persons who may come to premises for work and are not employees of that particular workplace;

- v. Reporting of any accident, dangerous occurrence or occupational poisoning caused in the workplace to the area Occupational Health and Safety Office. These incidents should be entered in the General Register. In case of a fatal accident information to the area Safety and Health Office should be within 24 hrs. and a written notice to the same within 7 days;
 - vi. The duties of manufactures, designers, importers and suppliers to ensure that all articles and substances for use at workplace are safe and will not cause injury to health and the environment;
 - vii. Duties of self-employed persons;
 - viii. Duties of employed persons;
 - ix. Prohibition of interference or misuse any appliance, convenience or any other facility provided to secure Safety, Health and Welfare at work by any person (occupier, self-employed person or employed);
 - x. The administration of the Act is the responsibility of a Director and other appointed and gazetted officials (Occupational Health and Safety Officers);
- The establishment of National Council for Occupational Safety and Health to assist the Director to discharge his duties and those that may be required by the Minister;

The registration of all workplaces by the Director DOHS forming the basis of his work statistics;

Machinery safety to include:

- i. Safe use of machinery, plant and equipment;
- ii. Prime makers and transmission machines;
- iii. The maintenance, construction of fencing safeguards;
- iv. The statutory requirements of various machines, plants and equipment (hoists and lifts, chains and ropes, cranes, steam receivers and containers, air receivers, cylinders for compressed liquefied and dissolve gases and refrigeration plants).

Chemical safety including:

- i. Handling, transportation and disposal of chemicals and other hazardous substances;
- ii. Importance of Materials Safety Data Sheets (MSDS);
- iii. Labelling and marking of chemical substances;
- iv. Classification of hazardous chemicals and substances;
- v. Establishment and adoption of exposure limits on hazardous substances in a workplace;
- vi. Control of air pollution, noise and vibrations;
- vii. Redeployment on medical advice.
- viii. Health, safety and welfare special provision including;
- ix. Permit to Work systems;
- x. Work processes that are likely to harm persons below eighteen (18) years;

- xi. Supervision of apprentices and indentured learners;
- xii. Training and supervision of inexperienced workers;
- xiii. Medical surveillance.

Penalties, offences and legal proceedings including:

- i. The upward adjustments of all fines imposed in the event of failure to comply with provisions of the Act;
- ii. The need to investigate and prosecute the real offender otherwise all those who fail to comply with any provisions of this Act that have been legally imposed on him/her shall be prosecuted.
- iii. The establishment of the safety and Health fund and Safety and Health regulations and procedures thereof.
- iv. The establishment of provisions as to the conduct of business and affairs of the National Council for Safety and Health under Third Schedule.

The Public Health Act (Cap. 242)

Part IX Section 8 & 9 of the Act states that no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Any noxious matter or waste water flowing or discharged into a water course is deemed as a nuisance. Part XII Section 136 states that all collections of water, sewage, rubbish, refuse and other fluids which permits or facilitates the breeding or multiplication of pests shall be deemed nuisances The Act addresses matters of sanitation, hygiene and general environmental health and safety.

Water Act, 2002

This is an Act of Parliament to provide for the management, conservation, use and control of water resources and for the acquisition and regulation of rights to use water; to provide for the regulation and management of water supply and sewerage services; to repeal the Water Act (cap 372) and certain provisions of the Local Government Act; and for related purposes.

Part II of the Act deals with ownership and control of water. Every water resource is vested in the State and subject to rights of user granted by or under the Act. The Minister in charge has control over every water resource.

Part III of the Act defines the powers of the Water Resources Management Authority (WRMA).

The Water Act 2002 also provides the basis for the following:

- i. Formulation of a National Water Resources Management Strategy;
- ii. Classification of water resources and resource quality objectives;
- iii. Determination of water reserves;
- iv. Designation of catchment areas;
- v. Formulation of a catchment management strategy;
- vi. Declaration of protected catchment areas national monitoring of and Information on water resource management;
- vii. Definition of state schemes and community projects.

Part IV of the Water Act defines the other regulatory bodies and modalities as follows:

- i. Water Services Regulatory Board;
- ii. Water Services Strategy;
- iii. Water Services Board and Water Service Providers;
- iv. Provision of water services;
- v. Powers and duties of licenses of water services provided. Section 94 of the Act states that:

No person shall or throw or convey, or cause or permit to be thrown or conveyed, any rubbish, dirt, refuse, effluent, trade waste or other offensive or unwholesome matter or thing into or near to any water resource in such manner as to cause, or likely to cause, pollution of the water resource.

Other Sections of the Act are as outlined below:

Part V - Financial Provisions;

Part VI - General and Supplementary: has a provision for the Water appeal Board, Entry on to land, miscellaneous, repeals, savings and transitional provisions.

The Second Schedule of the Water Act outlines conditions relating to construction works.

Lakes and Rivers Act

This Act (Cap 409, rev 1983) makes provisions for the protection of birds and other wildlife in or on lakes and rivers.'

The Territorial Waters Act

This is an Act of parliament to make provision for the delimitation of the territorial waters of Kenya and for purposes incidental thereto.

The Continental Shell Act

This is an Act of Parliament that vests rights in the Government in respect of the natural resources of the continental shelf, and to provide to matters incidental thereto and connected therewith.

It gives specifications for Kenyan courts on handling of acts, omissions, questions and disputes that occur within the area of the continental shelf.

The regulation would be relevant to disposal of sewage into the ocean through fall out points.

The Maritime Zones Act

An act of parliament to consolidate the law relating to the territorial waters and continental shelf of Kenya; to provide for the establishment and delimitation of the exclusive economic zone of Kenya; to provide for the exploration, exploitation, conservation and management of the resources of the maritime zones and for connected purposes.

The regulation would be relevant to disposal of sewage into the ocean through fall out points.

The HIV and Aids Prevention and Control Act

This Act commenced in March of 2009. It is an Act of Parliament to provide measures for the prevention, management and control of HIV and AIDS, to provide for the protection and promotion of public health and for the appropriate treatment, counseling, support and care of persons infected or at risk of HIV and AIDS infection, and for connected purposes.

The object and purpose of this Act is to-

- i. Promote public awareness about the causes, modes of transmission, consequences, means of prevention and control of HIV and AIDS;
- ii. Extend to every person suspected or known to be infected with HIV and AIDS full protection of his human rights and civil liberties by-
- iii. Prohibiting compulsory HIV testing save as provided in this Act;
- iv. Guaranteeing the right to privacy of the individual;
- v. Outlawing discrimination in all its forms and subtleties against persons with or persons perceived or suspected of having HIV and AIDS;
- vi. Ensuring the provision of basic health care and social services for persons infected with HIV and AIDS;
- vii. Promote utmost safety and universal precautions in practices and procedures that carry the risk of HIV transmission; and

viii. Positively address and seek to eradicate conditions that aggravate the spread of HIV infection. In this Act, unless the context otherwise requires-

"Acquired Immune Deficiency Syndrome (AIDS)" means a condition characterized by a combination of signs and symptoms, resulting from depletion of the immune system caused by infection with the Human Immuno- Deficiency Virus (HIV);

"anonymous testing" means an HIV testing procedure whereby the person being tested does not reveal his true identity but instead, an identifying number or symbol is used which allows the testing centre and the tested person to match the test results with the identifying number or symbol;

"Human Immunodeficiency Virus (HIV)" means the virus which causes AIDS;

"Person with HIV and AIDS" means a person whose HIV test indicates, directly or indirectly, that he is infected with HIV and AIDS;

"Positive", in relation to the result of an HIV test, means a result which shows that the person who is tested is infected with HIV or which shows evidence of such infection;

"Post exposure prophylaxis" means the administration of one or a combination of anti-retroviral drugs after probable exposure to HIV, for the purpose of preventing transmission;

"post-test counselling" refers to the process of providing a person who submitted themselves for an HIV test with risk-reduction information and emotional support at the time the test result is released;

"pre-test counselling" means the process of providing a person, before such person undergoes an HIV test, with information on the biomedical aspects of HIV and AIDS and emotional support with respect to the psychological implications of undergoing an HIV test;

"self-testing" in relation to HIV infection, means a prescribed test or series of tests carried out entirely by a person on self without the involvement of another person, which determine whether a person is infected with HIV;

"Testing centre" means a testing centre approved by the Minister under section 16; Part II of the Act stipulates as follows:

(1) The Government shall promote public awareness about the causes, modes of transmission, consequences, means of prevention and control of HIV and AIDS through a comprehensive nationwide educational and information campaign conducted by the Government through its various Ministries, Departments, authorities and other agencies.

The educational and information campaign referred to in subsection (1) shall-

- i. Employ scientifically proven approaches;
- ii. Focus on the family as the basic social unit;
- iii. Encourage testing of individuals; and be carried out in schools and other institutions of learning, all prisons, remand homes and other places of confinement, amongst the disciplined forces, at all places of work and in all communities throughout Kenya.

In Part IV - Testing, Screening and Access Health Care Services, it states as follows:-

13. (1) Subject to this Act, no person shall compel another to undergo an HIV test. without prejudice to the generality of subsection (1), no person shall compel another to undergo an HIV test as a precondition to, or for continued enjoyment of-

- i. Employment;
- ii. Marriage;
- iii. Admission into any educational institution;
- iv. Entry into or travel out of the country; or
- v. The provision of healthcare, insurance cover or any other service.

Notwithstanding the provisions of subsection (1), a person charged with an offence of a sexual nature under the Sexual Offences Act, 2006 may be compelled to undergo an HIV test.

A person who contravenes any of the provisions of this section commits an offence.

(1) No person shall carry out an HIV test except in a testing center approved by the Minister under this section or in the manner specified under paragraph (d) of subsection (4).

No person shall carry out an HIV test unless such person is a healthcare provider approved by the Minister for that purpose.

No person shall provide pre-test or post-test counseling for the purposes of section 17 unless such person is approved by the Minister under this section.

(1) Every testing center shall provide pre-test and post-test counseling to a person undergoing an HIV test and any other person likely to be affected by the results of such test.

The results of an HIV test shall be confidential and shall only be released-

- To the tested person;
- In the case of a child, to a parent or legal guardian of such child;

Provided that where any such child consents to an HIV test directly under section 14(1)(b), the results thereof shall be released to the child; or

In the case of a person with a disability which, in the opinion of the medical practitioner undertaking the test, renders him incapable of comprehending such result to-

- i. The guardian of that person;
- ii. A partner of that person;
- iii. A parent of that person; or
- iv. An adult offspring of that person

In Part V – Confidentiality,

No person shall record, collect, transmit or store records, information or forms in respect of HIV tests or related medical assessments of another person otherwise than in accordance with the privacy guidelines prescribed under this section.

(1) No person shall disclose any information concerning the result of an HIV test or any related assessments to any other person except-

With the written consent of that person;

If that person has died, with the written consent of that person's partner, personal representative, administrator or executor;

If that person is a child, with the written consent of a parent or legal guardian of that child:

Part VI - Transmission of HIV (1)

A person who is and is aware of being infected with HIV or is carrying and is aware of carrying the HIV virus shall-

- i. Take all reasonable measures and precautions to prevent the transmission of HIV to others; and
- ii. Inform, in advance, any sexual contact or person with whom needles are shared of that fact.

A person who is and is aware of being infected with HIV or who is carrying and is aware of carrying HIV shall not, knowingly and recklessly, place another person at risk of becoming infected with HIV unless that other person knew that fact and voluntarily accepted the risk of being infected.

A person who contravenes the provisions of subsections (1) or (2) commits an offence and shall be liable upon conviction to a fine not exceeding five hundred thousand shillings or to imprisonment for a term not exceeding seven years, or to both such fine and imprisonment.

A person referred to in subsection (1) or (2) may request any medical practitioner or any person approved by the Minister under section 16 to inform and counsel a sexual contact of the HIV status of that person.

A request under subsection (4) shall be in the prescribed form.

Part VIII - Discriminatory Acts and Policies

(1) Subject to subsection (2), no person shall be-

- i. Denied access to any employment for which he is qualified; or
- ii. Transferred, denied promotion or have his employment terminated, on the ground only of his actual, perceived or suspected HIV status.

Subsection (1) shall not apply in any case where an employer can prove, on application to the Tribunal that the requirements of the employment in question are that a person be in a particular state of health or medical or clinical condition.

(1) A person's freedom of abode, lodging, or travel, within or outside Kenya shall not be denied or restricted on the grounds only of the person's actual, perceived or suspected HIV status.

No person shall be quarantined, placed in isolation, refused lawful entry or deported from Kenya on the grounds only of the person's actual, perceived or suspected HIV status.

No person shall be denied the right to seek an elective or other public office on the grounds only of the person's actual, perceived or suspected HIV status.

(1) Subject to this Act, no person shall be compelled to undergo a HIV test or to disclose his HIV status for the purpose only of gaining access to any credit or loan services, medical, accident or life insurance or the extension or continuation of any such services.

Notwithstanding the provisions of subsection (1), an insurer, re-insurer or health maintenance organization shall, in the case of life and healthcare service insurance cover, devise a reasonable limit of cover for which a proposer shall not be required to disclose his or her HIV status.

Where a proposer seeks a cover exceeding the no test limit prescribed under subsection (2) the insurer, reinsurer or health maintenance organization may, subject to this Act, require the proposer to undergo an HIV test.

The Land Act, No. 6 Of 2012

Under section 19. (1) The Commission shall make rules and regulations for the sustainable conservation of land based natural resources.

Without limiting what the Commission may prescribe under subsection (1), the rules and regulations may contain;

- i. Measures to protect critical ecosystems and habitats;
- ii. Incentives for communities and individuals to invest in income generating natural resource conservation programs;
- iii. Measures to facilitate the access, use and co- management of forests, water and other resources by communities who have customary rights to these resources;
- iv. Procedures for the registration of natural resources in an appropriate register;
- v. Procedures on the involvement of stakeholders in the management and utilization of land- based natural resources; and
- vi. Measures to ensure benefit sharing to the affected communities.

Land registration under land act, 2012

Under section 5 (1) of the land act, 2012 there shall be the following forms of land tenure-

- i. Freehold;
- ii. Leasehold;
- iii. Such forms of partial interest as may be defined under this Act and other law, including but not limited to easements; and
- iv. Customary land rights, where consistent with the Constitution.

There shall be equal recognition and enforcement of land rights arising under all tenure systems and non-discrimination in ownership of, and access to land under all tenure systems.

Title to land may be acquired through;

Allocation;

- i. Land adjudication process;
- ii. Compulsory acquisition;
- iii. Prescription;
- iv. Settlement programs;
- v. Transmissions;
- vi. Transfers;
- vii. long term leases exceeding twenty one years created out of private land; or
- viii. Any other manner prescribed in an Act of Parliament.

Under section 8 (a), the Land Commission shall identify public land, prepare and keep a database of all public land, which shall be geo-referenced and authenticated by the statutory body responsible for survey;

May require the land to be used for specified purposes and subject to such conditions, covenants, encumbrances or reservations as are specified in the relevant order or other instrument.

Section 9 (1) states that any land may be converted from one category to another in accordance with the provisions of this Act or any other written law.

Without prejudice to the generality of subsection (1);

Public land may be converted to private land by alienation;

Subject to public needs or in the interest of defense, public safety, public order, public morality, public health, or land use planning, public land may be converted to community land;

Private land may be converted to public land by;

Compulsory acquisition;

Reversion of leasehold interest to Government after the expiry of a lease; and

Transfers; or
o Surrender.

Community land may be converted to either private or public land in accordance with the law relating to community land enacted pursuant to Article 63(5) of the Constitution.

Any substantial transaction involving the conversion of public land to private land shall require approval by the National Assembly or county assembly as the case may be.

Way leaves under land act, 2012

Subject to and in accordance with section 143 (1) and section 146, the Commission may, create a right of way which shall be known as public right of way.

144.(1) Unless the Commission is proposing on its own motion to create a way leave, an application, for the creation of a wayleave, shall be made by any State department, or the county government, or public authority or corporate body, to the Commission.

An application shall be made in the prescribed form and shall be accompanied by any prescribed information or other information that the Commission may, in writing require the applicant to supply and the Commission shall not begin the process of creating a wayleave until all prescribed or required information has been submitted to it.

In order to enable a proposed wayleave to be created by the Commission of its own motion to comply with the provisions of this section, the Commission shall complete an application form as if it were applying to create a wayleave and references to "the applicant" in this Sub-part in relation to an application to create a wayleave shall be taken to apply as well to the Commission.

The applicant shall serve a notice on:

- i. All persons occupying land over which the proposed wayleave is to be created, including persons occupying land in accordance with customary pastoral rights;
- ii. The county government in whose area of jurisdiction land over which the proposed wayleave is to be created is located;
- iii. All persons in actual occupation of land in an urban and per-urban area over which the proposed wayleave is to be created; and
- iv. Any other interested person.

The Commission shall publish the application along the route of the proposed wayleave calculated to bring the application clearly and in a comprehensible manner to the notice of all persons using land over which the proposed wayleave is likely to be created.

A county government, an association, or any group of persons may make an application to the commission for a communal right of way on accordance to section 145 (1).

Land acquisition under land acts 2012

Under section 110 (1) of Land Acts 2012 Land may be acquired compulsorily under this Part if the Commission certifies, in writing, that the land is required for public purposes or in the public interest as related to and necessary for fulfillment of the stated public purpose.

Part 2 of this section states that if, after land has been compulsorily acquired the public purpose or interest justifying the compulsory acquisition fails or ceases, the Commission may offer the original owners or their successors in title pre-emptive rights to re-acquire the land, upon restitution to the acquiring authority the full amount paid as compensation.

Section 111 (1) states that if land is acquired compulsorily under this Act, just compensation shall be paid promptly in full to all persons whose interests in the land have been determined. The commission shall make rules to regulate the assessment of just compensation.

Likewise where land is acquired compulsorily, full compensation shall be paid promptly to all persons affected in accordance to section 113 (1). (2) Subject to Article 40 (2) of the Constitution and section 122 and 128 of this Act, an award-

Shall be final and conclusive evidence of-

- a. The size of the land to be acquired;
- b. The value, in the opinion of the Commission, of the land;
- c. The amount of the compensation payable, whether the persons interested in the land have or have not appeared at the inquiry; and
- d. Shall not be invalidated by reason only of a discrepancy which may thereafter be found to exist between the area specified in the award and the actual area of the land.

Section 124 of the Act allows for the temporary acquisition of land for public purpose or public interest; or for, the possession of the land is necessary in the interests of defense, public safety, public order, public morality, public health, urban and planning, or the development or utilization of any property in such manner as to promote the public benefit; for utilization in promotion of the public good for periods not exceeding 5 years. At the expiry of the period, the Commissioner of Land shall vacate the land and undertake to restore the land to the conditions it was before as per section 125. The compensation to be paid under section 120 shall be limited to the damage done to trees, plants, growing crops and permanent improvements on the land, together with a periodical sum for diminution in the profits of the land and of adjoining land by reason of that use.

(1) Subject to the provisions of this section, compensation shall be payable to any person for the use of land, of which the person is in lawful or actual occupation, as a communal right of way and, with respect to a wayleave, in addition to any compensation for the use of land for any damage suffered in respect of trees crops and buildings as shall, in cases of private land, be based on the value of the land as determined by a qualified valuer.

Compensation relating to a wayleave or communal right of way shall not be paid to a public body unless there is a demonstrable interference of the use of the land by that public body.

Damage caused as a result of the creation of a wayleave shall include any preliminary work undertaken in connection with surveying or determining the route of that wayleave,

The County Governments Act, 2012

This is 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

According to section 103 the objectives of county planning shall be to;

- i. Protect the historical and cultural heritage, artefacts and sites within the county; and
- ii. Make reservations for public security and other critical national infrastructure and other utilities and services;
- iii. work towards the achievement and maintenance of a tree cover of at least ten per cent of the land area of Kenya as provided in Article 69 of the Constitution; and
- iv. Develop the human resource capacity of the county.

Under section 104, (1) a county government shall plan for the county and no public funds shall be appropriated outside a planning framework developed by the county executive committee and approved by the county assembly.

The county planning framework shall integrate economic, physical, social, environmental and spatial planning.

The county government shall designate county departments, cities and urban areas, sub-counties and Wards as planning authorities of the county.

To promote public participation, non-state actors shall be incorporated in the planning processes by all authorities.

Under section 111, (1) for each city and municipality there shall be; the

- i. City or municipal land use plans;
- ii. City or municipal building and zoning plans;
- iii. City or urban area building and zoning plans;
- iv. Location of recreational areas and public facilities.

A city or municipal plans shall be the instrument for development facilitation and development control within the respective city or municipality.

(3) A city or municipal plan shall, within a particular city or municipality, provide for;

- i. Functions and principles of land use and building plans;
- ii. Location of various types of infrastructure within the city or municipality;
- iii. Development control in the city or municipality within the national housing and building code framework.

City or municipal land use and building plans shall be binding on all public entities and private citizens operating within the particular city or municipality.

City or municipal land use and building plans shall be the regulatory instruments for guiding and facilitating development within the particular city or municipality.

Each city or municipal land use and building plan shall be reviewed every five years and the revisions approved by the respective county assemblies.

Under section 115, (1) Public participation in the county planning processes shall be mandatory and be facilitated through;

Provision to the public of clear and unambiguous information on any matter under consideration in the planning process, including;

- i. clear strategic environmental assessments;
- ii. Clear environmental impact assessment reports;
- iii. Expected development outcomes; and
- iv. Development options and their cost implications.

Each county assembly shall develop laws and regulations giving effect to the requirement for effective citizen participation in development planning and performance management within the county and such laws and guidelines shall adhere to minimum national requirements.

The Physical Planning Act (CAP 286) 2010

Under the Physical Planning Act, physical development activities are supposed to be carried out according to the physical plans. The Act provides for the preparation and implementation of

physical development plans and for related purposes. It gives provisions for the development of local physical development plan for guiding and coordinating development of infrastructure facilities and services within the area of authority of County, municipal and town council and for specific control of the use and development of land.

Accordingly the processes of physical planning involve two stages; the plan making stage and the development control stage. The former involves drawing up the actual plan to indicate the various activities and zones whereas the later involves the process of determining applications by developers to carry out specific development activities. Section 36 states “if in connection with a development application a local authority is of the opinion that proposals for industrial location, dumping site, sewerage treatment, quarries or any other development activity will have injurious impact on the environment, the applicant shall be required to submit together with the application an environment impact assessment report”.

The site layout plan appended to this report shows the route of the entire project route. The proponent shall secure all mandatory approvals and permits as required by the law.

The Public Health Act (CAP. 242)

Part IX Section 8 & 9 of the Act states that no person/ institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Any noxious matter or waste water flowing or discharged into a water course is deemed as a nuisance. Part XII Section 136 states that all collections of water, sewage, rubbish, refuse and other fluids which permits or facilitates the breeding or multiplication of pests shall be deemed nuisances. The Act addresses matters of sanitation, hygiene and general environmental health and safety.

The Act places responsibility for protection of water supplies from any pollution dangerous to health on the local authorities. The Act empowers the Minister for Health to make rules and impose on local authorities and others, the duty of enforcing such rules.

The Constitution of Kenya 2010

Environmental obligations and rights

Article 42 states that every person has the right to a clean and healthy environment, which includes the right; (a) to have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69; and

(b) To have obligations relating to the environment fulfilled under Article 70.

Section 43 (d) every person has the right to clean and safe water in adequate quantities;
Under Article 69 (1) The State shall:

- i. Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;

- ii. Work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya;
- iii. Protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities;
- iv. Encourage public participation in the management, protection and conservation of the environment;
- v. Protect genetic resources and biological diversity;
- vi. Establish systems of environmental impact assessment, environmental audit and monitoring of the environment;
- vii. Eliminate processes and activities that are likely to endanger the environment; and
- viii. Utilize the environment and natural resources for the benefit of the people of Kenya.

Every person has a duty to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.

(1) If a person alleges that a right to a clean and healthy environment recognized and protected under Article 42 has been, is being or is likely to be, denied, violated, infringed or threatened, the person may apply to a court for redress in addition to any other legal remedies that are available in respect to the same matter.

On application under clause (1), the court may make any order, or give any directions, it considers appropriate

- i. To prevent, stop or discontinue any act or omission that is harmful to the environment;
- ii. To compel any public officer to take measures to prevent or discontinue any act or omission that is harmful to the environment; or
- iii. To provide compensation for any victim of a violation of the right to a clean and healthy environment.

For the purposes of this Article, an applicant does not have to demonstrate that any person has incurred loss or suffered injury.

Classification of land

Under Article 61 (1) all land in Kenya belongs to the people of Kenya collectively as a nation, as communities and as individuals.

(2) Land in Kenya is classified as public, community or private.

(1) Public land is land which at the effective date was alienated government land as defined by an Act of Parliament in force at the effective date;

- i. Land lawfully held, used or occupied by any State organ, except any such land that is occupied by the State organ as lessee under a private lease;
- ii. Land transferred to the State by way of sale, reversion or surrender;
- iii. Land in respect of which no individual or community ownership can be established by any legal process;
- iv. Land in respect of which no heir can be identified by any legal process
- v. All minerals and mineral oils as defined by law;

government forests other than forests to which Article 63 (2)(d) (i) applies, government game reserves, water catchment areas, national parks, government animal sanctuaries, and specially protected areas;

- i. All roads and thoroughfares provided for by an Act of Parliament;
- ii. All rivers, lakes and other water bodies as defined by an act of parliament;
- iii. The territorial sea, the exclusive economic zone and the sea bed;
- iv. The continental shelf;
- v. All land between the high and low water marks;
- vi. Any land not classified as private or community land under this Constitution; and
- vii. Any other land declared to be public land by an Act of Parliament; (i) in force at the effective date; or (ii) enacted after the effective date.

Public land shall not be disposed of or otherwise used except in terms of an Act of Parliament specifying the nature and terms of that disposal or use.

Section 63 (1) Community land shall vest in and be held by communities identified on the basis of ethnicity, culture or similar community of interest.

Any unregistered community land shall be held in trust by county governments on behalf of the communities for which it is held.

Community land shall not be disposed of or otherwise used except in terms of legislation specifying the nature and extent of the rights of members of each community individually and collectively.

Private land consists of;

- i. Registered land held by any person under any freehold tenure;
- ii. Land held by any person under leasehold tenure; and
- iii. Any other land declared private land under an Act of Parliament.

National Legal Provisions on Gender

Gender issues in the country are institutionalized through:

- a. The current newly enacted Constitution;
- b. Vision 2030 Flagship projects;
- c. The Presidential Directive of 2006 on 30% women's' appointments to all positions of leadership employment and promotions;
- d. The National Gender Policy 2000;
- e. Sessional Paper No.2 of 2006;
- f. Gender Department in the Ministry for Gender Children and Social Development;

The National Commission on Gender and Development enacted through an Act of Parliament in 2003 is mandated to Monitor Government Implementation of its Commitments to Women's Rights and Gender issues

Employment Act, No. 11 of 2007: the Act prohibits discrimination in access to employment and in employment security on the basis of sex, among others:

- a. Guarantees equality of opportunity in employment
- b. Provides for equal pay for work of equal value

- c. Prohibits sexual harassment which the law defines to include use of language, whether written or spoken, of a sexual nature

A National Framework on Gender-based Violence. The government through the National Commission on Gender and Development has developed a National Framework on Gender Based Violence (February 2009) to form that basis of investigation of instances of sexual violence and strengthen coordination of responses to stem the vice

- i. Launch of same on 09.11.2019 by Minister for Gender, children and social development
- ii. The Sexual Offences Bill
- iii. FGM Policy being developed

National Gender and Development Policy (2000)

The National Gender and Development Policy provide a framework for advancement of women and an approach that would lead to greater efficiency in resource allocation and utilization to ensure empowerment of women.

The National Policy on Gender and Development is consistent with the Government's efforts of spurring economic growth and thereby reducing poverty and unemployment, by considering the needs and aspirations of all Kenyan men, women, boys and girls across economic, social and cultural lines. The policy is also consistent with the Government's commitment to implementing the National Plan of Action based on the Beijing Platform for Action (PFA).

The overall objective of the Gender and Development Policy is to facilitate the mainstreaming of the needs and concerns of men and women in all areas in the development process in the country.

The Policy's concerns cover the following critical areas:

- a. The Economy;-To enable men and women to have equal access to economic and employment opportunities.
- b. Poverty and Sustainable Livelihoods; - To remove obstacles to women's access to and control over productive assets, wealth and economic opportunities, shelter, safe drinking water, and promote measures for conserving the environment.

- c. Law; - To guarantee Kenyan men and women equality before the law, as provided for in the Constitution and under the obligations of the Kenyan State in international law.
- d. Political Participation and Decision- Making; - To enhance gender parity in political participation and decision - making
- e. Education and Training; - To enhance and sustain measures to eliminate gender disparities in access, retention, transition and performance in education for both boys and girls
- f. Health and Population; - To achieve the highest attainable standard of health for both men and women through addressing gender inequalities pertaining to access and use of basic health services and facilities at an affordable cost.
- g. The Media; - To increase the participation of women in the media and communications sector and promote gender sensitive portrayal of both men and women in the media
- h. Policy Implementation Framework and Resource Mobilization- empowering both men and women to be equal partners in development- It focuses on the elimination of existing disparities between the two genders. It also advocates for an affirmative action to address gender disparities.

The New Constitution of August 2010 on Gender

In the New Constitution, Chapter Four—The Bill of Rights,

Section 21 (3) All State organs and all public officers have the duty to address the needs of vulnerable groups within society, including women, older members of society, persons with disabilities, children, youth, members of minority or marginalized communities, and members of particular ethnic, religious or cultural communities

Section 27 (3) Women and men have the right to equal treatment, including the right to equal opportunities in political, economic, cultural and social spheres.

Part 2 on the Composition and Membership of Parliament,

Section 97 (1) The National Assembly consists of, a) two hundred and ninety members, each elected by the registered voters of single member constituencies; (b) forty-seven women, each elected by the registered voters of the counties, each county constituting a single member constituency;

Section 98. (1) The Senate consists of— (a) forty-seven members each elected by the registered voters of the counties, each county constituting a single member constituency; (b) sixteen women members who shall be nominated by political parties according to their proportion of members of

the Senate elected under clause (a) in accordance with Article 90; (c) two members, being one man and one woman, representing the youth; (d) two members, being one man and one woman, representing persons with disabilities;

Section 100 Parliament shall enact legislation to promote the representation in Parliament of—

(a) Women;

Section 127 (1) There is established the Parliamentary Service Commission.

The Commission consists of—

- i. The Speaker of the National Assembly, as chairperson;
- ii. A vice-chairperson elected by the Commission from the members appointed under paragraph
- iii. Seven members appointed by Parliament from among its members of whom—
- iv. Four shall be nominated equally from both Houses by the party or coalition of parties forming the national government, of whom at least two shall be women;

In Chapter Thirteen, on the Public Service, Part 1—Values and Principles of Public Service

Section 232 (1) the values and principles of public service include—(i) affording adequate and equal opportunities for appointment, training and advancement, at all levels of the public service, of—

- a. Men and women;
- b. The members of all ethnic groups; and
- c. Persons with disabilities.

Section 232 (2) the values and principles of public service apply to public service in—

- i. All State organs in both levels of government; and
- ii. All State corporations

Parliament shall enact legislation to give full effect to this Article.

In the composition, appointment and terms of office, the new constitution says that the chairperson and vice-chairperson of a commission shall not be of the same gender.

In addition, clause (8) says that the State shall take legislative and other measures to implement the principle that not more than two-thirds of the members of elective or appointive bodies shall be of the same gender.

The new constitution provides for the elimination of gender discrimination in law, customs and practices related to land and property. Under Kenya's previous law, inheritance was governed by customary law, often preventing women from inheriting property from their parents or laying claim to joint assets when their husbands' died.

In summary, the New Constitution provides as follows-

- i. The New Kenyan Constitution ensures that women will be able to pass on citizen ship to their children regardless of whether or not they are married to Kenyans. Article 14 (1)
- ii. The New Kenyan Constitution provides that parties to a marriage will be entitled to equal rights at the time of marriage, during the marriage and at its dissolution. Article 45 (3)
- iii. The New Kenyan Constitution assures that parental responsibility shall be shared between parents regardless of marital status. Article 53 (1) (e).
- iv. The New Kenyan Constitution eliminates gender discrimination in relation to land and property and gives everyone including women the right to inheritance and unbiased access to land. Article 60 (1) (f).
- v. The New Kenyan Constitution provides for the enactment of legislation for the protection of matrimonial property with special interest on the matrimonial home during, and upon the termination of the marriage. Article 68 (c) (iii).
- vi. The New Kenyan Constitution maintains a one third requirement for either gender in elective bodies giving women of Kenya at least 1/3 minimum in elective public bodies. Article 81 (b).
- vii. The New Kenyan Constitution ensures that gender equality is maintained in political parties providing a basic requirement for political parties as amongst other to respect and promote gender equality. Article 91 (f)
- viii. The New Kenyan Constitution provides that Parliament shall formulate law to promote the representation of women, persons of disabilities, ethnic and other minorities and marginalized communities in Parliament. Article 100.

- ix. The New Kenyan Constitution ensures that women and men will have the right to equal treatment and opportunities in political, economic, cultural and social spheres without discrimination. Article 27 (3).
- x. The New Kenyan Constitution accords the right to health including reproductive health to all. Article 43 (1) (a).
- xi. The New Kenyan Constitution affords adequate and equal opportunities for appointment, training and advancement for women and men at all levels within the Public Service Commission. Article 232 (i).

The Sexual Offences Act (NO 3 of 2006)

Relevant Sections include: -

- i. Sexual offences relating to position of authority and persons in position of trust.
- ii. Sexual relationship which pre-date position of authority or trust.
- iii. Deliberate transmission of HIV or any other life threatening sexually transmitted disease.

Relevant Sectorial Legislation

While the EMCA supersedes all other environmental legislation, numerous other laws and regulations in addition to those described above influence the various aspects and activities of the Project, which include the following among others:

- a. Physical Planning Act (1996);
- b. Building Code (1997);
- c. Local Government Regulations (1963);
- d. Workmen's Compensation Act (rev.1988);
- e. Standards Act;
- f. Penal Code, Cap 63 (rev 1985);
- g. Use of Poisonous Substances Act, Cap 247 (rev 1983);

- h. Land Control Act Cap 302;
- i. Forestry Act Cap 385;
- j. Wildlife (Conservation and Management) Act Cap 376.

5.3 Institutional Framework

Institutions under the EMCA 1999

The National Environmental Council

The National Environmental Council (the Council) is responsible for policy formulation and directions for the purposes of the Act. The Council also sets national goals and objectives and determines policies and priorities for the protection of the environment.

The National Environmental Management Authority

The responsibility of the National Environmental Management Authority (NEMA) is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of government in the implementation of all policies relating to the environment.

In addition to NEMA, the Act provides for the establishment and enforcement of environmental quality standards to be set by a technical committee of NEMA known as the Standards and Enforcement Review Committee (SERC).

County and Sub County Environmental Committees

The county and sub county Environmental Committees also contribute to decentralized environmental management and enable the participation of local communities. These environmental committees consist of the following:

- a. Representatives from all the ministries;
- b. Representatives from local authorities within the province/district; Two farmers / pastoral representatives;
- c. Two representatives from NGO's involved in environmental management in the province/district;
- d. A representative of each regional development authority in the province/district.

Public Complaints Committee

EMCA also establishes a Public Complaints Committee, which provides the administrative mechanism for addressing environmental harm. The committee has the mandate to investigate

complaints relating to environmental damage and degradation. Its members include representatives from the Law Society of Kenya, NGO's and the business community.

Institutions under the Water Act 2002

The main functions of the Ministry of Water and Irrigation are to develop and formulate Water Resources Management Policy, Water and Sanitation Services Policy, Water Quality and Pollution Control Policy, Flood Control and Land Reclamation Policy, Waste Water Treatment and Disposal Policy, National Irrigation Policy and a policy on Water Schemes and Community Water Projects.

The relevant institutional framework for water and sanitation in Kenya was set up under the Water Act 2002. Institutions under this Act are presented in the following sections.

Water Resources Management Authority

The Water Act 2002 provides for a Water Resources Management Authority (WRMA) to manage water in an integrated way. WRMA is charged with responsibility for managing, regulating, protecting, apportioning and conserving water resources naturally, including Trans boundary waters.

Some of these powers and functions of WRMA include:

- a. Developing principles, guidelines and procedures for the allocation of water resources;
- b. Monitoring the national water resources management strategy;
- c. Receiving and determining applications for permits for water use;
- d. Monitoring and enforcing conditions attached to permits for water use;
- e. Regulating and protecting water resources quality from adverse impacts;
- f. Managing and protecting water catchments.
- g. WRMA may prosecute any offences arising under the Water Act.

Water Services Regulatory Board and Water Appeals Board

The Water Services Regulatory Board (WSRB) and Water Appeals Board (WAB) are independent institutions to regulate and deal with disputes respectively. The WSRB regulates the seven Water Services Boards in Kenya. The Water Appeals Board is established with the responsibility of hearing and determining appeals concerning a permit or license.

Regulatory Framework

Environmental Regulations

Environmental Impact Assessment and Audit Regulations

The Environmental Impact Assessment and Audit Regulations state in Regulation 3 that ".....the

Regulations shall apply to all policies, plans, programs, projects and activities specified in Part IV, Part V and the Second Schedule of the EMCA....."

Regulation 4(1) further states that:

"...no proponent shall implement a project:

Likely to have a negative environmental impact; or

For which an environmental impact assessment is required under the Act or these Regulations;

Unless an environmental impact assessment has been concluded and approved in accordance with these Regulations..."Where standards are yet to be established, the local authority standards or standards promulgated under sectorial legislation apply.

Environmental Management and Coordination, (Water Quality) Regulations 2006

These are described in Legal Notice No. 120 of the Kenya Gazette Supplement No.68 of September 2006. These Regulations apply to drinking water, water used for agricultural purposes, water used for recreational purposes, water used for fisheries and wildlife and water used for any other purposes. This includes the following:

- a. Protection of sources of water for domestic use;
- b. Water for industrial use and effluent discharge;
- c. Water for agricultural use.

These Regulations outline:

- i. Quality standards for sources of domestic water;
- ii. Quality monitoring for sources of domestic water;
- iii. Standards for effluent discharge into the environment;
- iv. Monitoring guide for discharge into the environment;
- v. Standards for effluent discharge into public sewers;

- vi. Monitoring for discharge of treated effluent into the environment.

Environmental Management and Coordination, (Waste Management) Regulations 2006

These rules are described in Legal Notice No. 121 of the Kenya Gazette Supplement No. 69 of September 2006. These Rules describe the following:

- i. Waste description;
- ii. Waste transportation;
- iii. Responsibility of waste transporters;
- iv. Waste disposal facility;
- v. Description and handling of industrial wastes;
- vi. Description and handling of hazardous and toxic wastes;
- vii. Description and handling of pesticides and toxic substances;
- viii. Description and handling of biomedical wastes;
- ix. Description and handling of radioactive substances;
- x. List of schedules on waste management.

Fossil Fuel Emission Control Regulations 2006

These regulations are described in Legal Notice No. 131 of the Kenya Gazette Supplement No. 74, October 2006. These regulations include internal combustion engine emission standards, emission inspections, the power of emission inspectors, fuel catalysts, licensing to treat fuel, cost of clearing pollution and partnerships to control fossil fuel emissions. The fossil fuels considered are petrol, diesel, fuel oils and kerosene.

Environmental Management and Coordination, (Conservation of Biological Diversity (BD) Regulations 2006)

These regulations are described in Legal Notice No. 160 of the Kenya Gazette Supplement No. 84 of December 2006. These Regulations apply to conservation of biodiversity which includes conservation of threatened species, inventory and monitoring of BD and protection of environmentally significant areas, access to genetic resources, benefit sharing and offences and penalties.

Occupational Health and Safety Regulations

The Occupational Health and Safety Act (OSHA) 2007 repealed the Factories and Other Places of Work Act. Anything done under the provisions of the Factories and Other Places of Work Act or the Minister under the provisions of Factories and Other Places of Work Act, including subsidiary legislation issued before the commencement of the OSHA 2007 shall be deemed to have been done under the provisions of this Act.

The Factories and Other Places of Work Act had over the years passed several subsidiary rules and regulations for effective implementation of the Act. All shall, as long as it is not inconsistent with OSHA 2007 remain in force until repealed or revoked by subsidiary legislation under the provisions of OSHA 2007 and shall for all purposes be deemed to have been made under this Act.

These regulations include:

- i. The Factories (Cellulose Solutions) Rules 1957;
- ii. The Factories (Wood Working Machinery) Rules 1959;
- iii. The Factories (Dock) Rules 1962;
- iv. The Factories (Eye Protection) Rules 1978
- v. The Factories (Electric Power) (Special) Rules 1978;
- vi. The Factories (Building Operations and Works of Engineering Construction) Rules 1984;
- vii. The Factories and Other Places of Work (Health & Safety Committees) Rules 2004;
- viii. The Factories and Other Places of Work (Medical Examination) Rules 2005;
- ix. The Factories and Other Places of Work (Noise Prevention and Control) Rules 2005.
- x. The Factories and Other Places of Work (Fire Risk Reduction) Rules 2007;
- xi. The Factories and Other Places of Work (Hazardous Substances) Rules 2007.

World Bank Environmental and Social Standards

Environmental and Social Standard 1. Assessment and Management of Environmental and Social Risks and Impacts

ESS1 sets out the Borrower's responsibilities for assessing, managing and monitoring environmental and social risks and impacts associated with each stage of a project supported by the Bank through Investment Project Financing, in order to achieve environmental and social outcomes consistent with the Environmental and Social Standards (ESSs).

The ESSs are designed to help Borrowers to manage the risks and impacts of a project, and improve their environmental and social performance, through a risk and outcomes based approach. The desired

outcomes for the project are described in the objectives of each ESS, followed by specific requirements to help Borrowers achieve these objectives through means that are appropriate to the nature and scale of the project and proportionate to the level of environmental and social risks and impacts.

Environmental and Social Standard 2. Labor and Working Conditions

ESS2 recognizes the importance of employment creation and income generation in the pursuit of poverty reduction and inclusive economic growth. Borrowers can promote sound worker-management relationships and enhance the development benefits of a project by treating workers in the project fairly and providing safe and healthy working conditions.

Objectives

- i. To promote safety and health at work.
- ii. To promote the fair treatment, nondiscrimination and equal opportunity of project workers.
- iii. To protect project workers, including vulnerable workers such as women, persons with disabilities, children (of working age, in accordance with this ESS) and migrant workers, contracted workers, community workers and primary supply workers, as appropriate.
- iv. To prevent the use of all forms of forced labor and child labor.¹
- v. To support the principles of freedom of association and collective bargaining of project workers in a manner consistent with national law.
- vi. To provide project workers with accessible means to raise workplace concerns.

Environmental and Social Standard 3. Resource Efficiency and Pollution Prevention and Management

ESS3 recognizes that economic activity and urbanization often generate pollution to air, water, and land, and consume finite resources that may threaten people, ecosystem services and the environment at the local, regional, and global levels. The current and projected atmospheric concentration of greenhouse gases (GHG) threatens the welfare of current and future generations. At the same time, more efficient and effective resource use, pollution prevention and GHG emission avoidance, and mitigation technologies and practices have become more accessible and achievable.

This ESS sets out the requirements to address resource efficiency and pollution¹ prevention and management² throughout the project life cycle consistent with GIIP.

Objectives

- i. To promote the sustainable use of resources, including energy, water and raw materials.
- ii. To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities.
- iii. To avoid or minimize project-related emissions of short and long-lived climate pollutants.³
- iv. To avoid or minimize generation of hazardous and non-hazardous waste.
- v. To minimize and manage the risks and impacts associated with pesticide use.

Environmental and Social Standard 4. Community Health and Safety

ESS4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. In addition, communities that are already subjected to impacts from climate change may also experience an acceleration or intensification of impacts due to project activities. ESS4 addresses the health, safety, and security risks and impacts on project-affected communities and the corresponding responsibility of Borrowers to avoid or minimize such risks and impacts, with particular attention to people who, because of their particular circumstances, may be vulnerable.

Objectives

- i. To anticipate and avoid adverse impacts on the health and safety of project-affected communities during the project life cycle from both routine and non-routine circumstances.
- ii. To promote quality and safety, and considerations relating to climate change, in the design and construction of infrastructure, including dams.
- iii. To avoid or minimize community exposure to project-related traffic and road safety risks, diseases and hazardous materials.
- iv. To have in place effective measures to address emergency events.
- v. To ensure that the safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the project-affected communities.

Environmental and Social Standard 5. Land Acquisition, Restrictions on Land Use and Involuntary Resettlement.

ESS5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons. Project-related land acquisition or restrictions on land use may cause physical displacement (relocation, loss of residential land or loss of shelter), economic displacement (loss of land, assets or access to assets, leading to loss of income sources or other means of livelihood), or both. The term “involuntary resettlement” refers to these impacts. Resettlement is considered involuntary when affected persons or communities do not have the right to refuse land acquisition or restrictions on land use that result in displacement.

Experience and research indicate that physical and economic displacement, if unmitigated, may give rise to severe economic, social and environmental risks: production systems may be

dismantled; people face impoverishment if their productive resources or other income sources are lost; people may be relocated to environments where their productive skills are less applicable and the competition for resources greater; community institutions and social networks may be weakened; kin groups may be dispersed; and cultural identity, traditional authority, and the potential for mutual help may be diminished or lost. For these reasons, involuntary resettlement should be avoided. Where involuntary resettlement is unavoidable, it will be minimized and appropriate measures to mitigate adverse impacts on displaced persons (and on host communities receiving displaced persons) will be carefully planned and implemented.

Objectives

- i. To avoid involuntary resettlement or, when unavoidable, minimize involuntary resettlement by exploring project design alternatives.
- ii. To avoid forced eviction.
- iii. To mitigate unavoidable adverse social and economic impacts from land acquisition or restrictions on land use by: (a) providing timely compensation for loss of assets at replacement cost⁶ and (b) assisting displaced persons in their efforts to improve, or at least restore, their livelihoods and living standards, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation whichever is higher.
- iv. To improve living conditions of poor or vulnerable persons who are physically displaced, through provision of adequate housing, access to services and facilities, and security of tenure.
- v. To conceive and execute resettlement activities as sustainable development programs, providing sufficient investment resources to enable displaced persons to benefit directly from the project, as the nature of the project may warrant.
- vi. To ensure that resettlement activities are planned and implemented with appropriate disclosure of information, meaningful consultation, and the informed participation of those affected.

Environmental and Social Standard 6. Biodiversity Conservation and Sustainable Management of Living Natural Resources

ESS6 recognizes that protecting and conserving biodiversity and sustainably managing living natural resources are fundamental to sustainable development. Biodiversity is defined as the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems. Biodiversity often underpins ecosystem services valued

by humans. Impacts on biodiversity can therefore often adversely affect the delivery of ecosystem services.

ESS6 recognizes the importance of maintaining core ecological functions of habitats, including forests, and the biodiversity they support. Habitat is defined as a terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the nonliving environment. All habitats support complexities of living organisms and vary in terms of species diversity, abundance and importance. This ESS also addresses sustainable management of primary production and harvesting of living natural resources. ESS6 recognizes the

need to consider the livelihood of project-affected parties, including Indigenous Peoples, whose access to, or use of, biodiversity or living natural resources may be affected by a project. The potential, positive role of project affected parties, including Indigenous Peoples, in biodiversity conservation and sustainable management of living natural resources is also considered.

Objectives

- i. To protect and conserve biodiversity and habitats.
- ii. To apply the mitigation hierarchy⁴ and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity.
- iii. To promote the sustainable management of living natural resources.
- iv. To support livelihoods of local communities, including Indigenous Peoples, and inclusive economic development, through the adoption of practices that integrate conservation needs and development priorities.

Environmental and Social Standard 7. Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities.

This ESS applies to a distinct social and cultural group identified in accordance with paragraphs 8 and 9 of this ESS. The terminology used for such groups varies from country to country, and often reflects national considerations. ESS7 uses the term “*Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities*,”¹ recognizing that groups identified under paragraphs 8 and 9 may be referred to in different countries by different terms. Such terms include “Sub-Saharan African historically underserved traditional local communities,” “indigenous ethnic minorities,” “aboriginals,” “hill tribes,” “vulnerable and marginalized groups,” “minority nationalities,” “scheduled tribes,” “first nations” or “tribal groups.” ESS7 applies to all such groups, providing they meet the criteria set out in paragraphs 8 and 9. For the purposes of this ESS, the term “Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities” includes all such alternative terminology.

Environmental and Social Standard 8. Cultural Heritage

ESS8 recognizes that cultural heritage provides continuity in tangible and intangible forms between the past, present and future. People identify with cultural heritage as a reflection and expression of their constantly evolving values, beliefs, knowledge and traditions. Cultural heritage, in its many manifestations, is important as a source of valuable scientific and historical information, as an economic and social asset for development, and as an integral part of people’s cultural identity and practice. ESS8 sets out measures designed to protect cultural heritage throughout the project life cycle. This ESS sets out general provisions on risks and impacts to cultural heritage from project activities. ESS7 sets out additional requirements for cultural heritage in the context of Indigenous Peoples. ESS6 recognizes the social and cultural values of biodiversity. Provisions on Stakeholder Engagement and Information Disclosure are set out in ESS10.

Objectives

- i. To protect cultural heritage from the adverse impacts of project activities and support its preservation.
- ii. To address cultural heritage as an integral aspect of sustainable development.

- iii. To promote meaningful consultation with stakeholders regarding cultural heritage.
- iv. To promote the equitable sharing of benefits from the use of cultural heritage.

Environmental and Social Standard 10. Stakeholder Engagement and Information Disclosure.

This ESS recognizes the importance of open and transparent engagement between the Borrower and project stakeholders as an essential element of good international practice. Effective stakeholder engagement can improve the environmental and social sustainability of projects, enhance project acceptance, and make a significant contribution to successful project design and implementation.

Stakeholder engagement is an inclusive process conducted throughout the project life cycle. Where properly designed and implemented, it supports the development of strong, constructive and responsive relationships that are important for successful management of a project's environmental and social risks. Stakeholder engagement is most effective when initiated at an early stage of the project development process, and is an integral part of early project decisions and the assessment, management and monitoring of the project's environmental and social risks and impacts. This ESS must be read in conjunction with ESS1. Requirements regarding engagement with workers are found in ESS2. Special provisions on emergency preparedness and response are covered in ESS2 and

ESS4. In the case of projects involving involuntary resettlement, Indigenous Peoples or cultural heritage, the Borrower will also apply the special disclosure and consultation requirements set out in ESS5, ESS7 and ESS8.

Objectives

- To establish a systematic approach to stakeholder engagement that will help Borrowers
 - i. identify stakeholders and build and maintain a constructive relationship with them, in particular project-affected parties.
 - ii. To assess the level of stakeholder interest and support for the project and to enable stakeholders' views to be taken into account in project design and environmental and social performance.
 - iii. To promote and provide means for effective and inclusive engagement with project-affected parties throughout the project life cycle on issues that could potentially affect them.
 - iv. To ensure that appropriate project information on environmental and social risks and impacts is disclosed to stakeholders in a timely, understandable, accessible and appropriate manner and format.

6. STAKEHOLDER CONSULTATIONS

6.1 Introduction

The need for public involvement in project development is enshrined in the Constitution of Kenya, 2010. This requirement is also provided for in the EMCA, 1999, the Environmental (Impact and Audit) Regulations, 2003, and is one of the guiding principles of the National Environment Policy, 2013.

Public participation ensures that communities and stakeholders are part and parcel of the proposed developments. It presupposes that the public has access to timely and accurate information on the environment and the proposed development(s), and therefore assures that the developments are sustainable and resources are also used sustainably. It has also been demonstrated successfully that projects that go through this process acquire a high level of acceptance and accrue benefits to a wider section of society.

Public consultation also forms a useful component for gathering, understanding and establishing likely impacts of projects, determining community and individual preferences and selecting alternatives.

6.2 Benefits of public consultation

Benefits to the developer

- i. The developer is likely to benefit from local knowledge;
- ii. Costs may be saved as key issues are identified by the public and studies are focused on key issues as opposed to a broad range of issues;
- iii. Measures to reduce adverse impacts and enhance benefits will be identified with stakeholders;
 - i. Relations with the communities in the vicinity of the development are likely to be improved;
 - ii. Delays in decision making may be reduced because of good participation early in the process;
- iii. The public are unlikely to raise objections to the project; and
- iv. The developer's image and reputation is likely to be enhanced.

Benefits to the public

- i. Capacity is built through people playing an active role during the process. The skills learnt can be used in other community projects;
- ii. Public rights are exercised and protected in participating; and
- iii. Inputs are likely to influence the form and nature of the development and is likely to lead to better development that takes society's needs into account.

Benefits to decision makers

- i. Public participation is likely to improve decisions since there is access to a broader range of perspectives and opinion on the proposed rehabilitation/augmentation;
- ii. The development is likely to be more sustainable as it takes people's needs and views into account; and

- iii. The legitimacy of project commencement and implementation is likely to be improved.

Public consultations in the project area

The Public consultation process involved visiting the project area and its environs. Project stakeholders were identified and consulted with the aim of informing them about the proposed water supply schemes, collect their views on anticipated positive and/or negative impacts, get recommendations on how the adverse impacts can be mitigated or avoided, and gather local knowledge that would be useful to the proposed project.

Objectives

The main objectives of the public consultation process were as follows:

- i. To inform stakeholders about the proposed water supply schemes;
- ii. To share with stakeholders, the impacts (positive and/or negative) that they should expect from the proposed schemes during construction and operation; and
- iii. To collect stakeholders' views, comments, concerns and local knowledge regarding the proposed schemes.

Engagement methodology

In order to complete this public consultations exercise, the Consultant implemented a systematic approach that consisted of a reconnaissance visit to the project area, review of relevant documentation, conducting interviews, administration of questionnaires to the project stakeholders and holding stakeholders' meetings.

Literature review

Prior to commencement of the assignment and throughout the assignment, the Consultant reviewed relevant information including the Feasibility Study and Detailed Design Reports for the proposed project, County Data Sheet for Kakamega, and the Population and Housing Census Report, 2019. This desktop review formed the basis on which subsequent field visits would be made and reports compiled.

Stakeholder identification

The Public consultation exercise commenced in 25th August with the Consultant's reconnaissance visit. The visit identified the following as the project stakeholders:

Community

- i. Residents of Tolilet –the community and beneficiaries at the Tolilet/Kivaywa River intake which is the proposed source of water for the Malava town and Namagara water supply schemes
- ii. Residents of Namagara centre and its environs – beneficiaries and the community that hosts the treatment works for the Namagara Water Supply Scheme;
- iii. Residents of Shirugu – the community that hosts the proposed intake and treatment works sites for the Shirugu Water Supply Scheme;
- iv. Residents of Samitsi, Burundu, Chegulo and Matsakha – beneficiaries and communities that will host communal water points for the Shirugu Water Supply Scheme

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

- v. Residents of Tande, Butali and Chebwai – beneficiaries and communities that will host communal water points for the Namagara

Kakamega County Government

Table 43: Identified stakeholders in Kakamega County Government

Position	Institution
The Governor	Kakamega County
County Minister of Environment, Water and Natural Resources	Ministry of Water, Environment, & Natural Resources
Minister for Agriculture, Livestock, Cooperatives and Fisheries.	Ministry of Agriculture, Livestock, Cooperatives and Fisheries.
County Director of Environment	NEMA, Kakamega County
Deputy County Commissioner	Malava Sub county
Position	Institution
County Director of Water	Kakamega County
County Lands Officer	Kakamega County
County Agricultural Officer	Kakamega County
County Social Affairs Officer	Kakamega County
County Chambers of Commerce Officer	Kakamega County
Member of County Assembly (MCA)	Malava
Ward Administrator	Malava
Sub county Administrator	Malava
Chief	Malava Township
Sub County Water Officer	Malava
The Governor	Kakamega County
County Minister of Environment, Water and Natural Resources	Ministry of Water, Environment, & Natural Resources

Nandi County Government

Table 44: Identified stakeholders in Nandi County Government

Position	Institution
The Chief Officer	Ministry of Environment, Energy, Water and Natural Resources
County Director - Water Affairs	Nandi County
County Director of Environment	NEMA, Nandi County
Chief Officer	Department of Lands , Housing & Physical Planning
Chief	Soiminei

Water Sector Stakeholders in the Project area

Table 45: Other water Sector stakeholders in the project area

Position	Institution
Regional Manager	Lake Victoria North Catchment-(WRMA)
Sub-Region Manager	WRMA Kipkarren-Upper Yala Sub-region
Water Resource Users Association	WRUA-Malava
Malava Water and Sanitation Project	Malava

6.3 Stakeholder Analysis

In this study, the ‘importance’ of a stakeholder is defined by whether the stakeholder is directly or indirectly affected by project activities. For instance, stakeholders directly affected by the proposed works are viewed as more ‘important’ as they are first-hand recipients of the concomitant impacts. The stakeholders are as analysed below:

Table 46: Stakeholder analysis

	Details				Impact Level	Directly Affected	Indirectly Affected
	Community	Government	Business	Other			
Residents of Tolilet/Cheptilil/Soiminei at the Nandi escarpment				<ul style="list-style-type: none"> Community living in the project area: some neighboring the proposed intake and treatment works sites and others neighboring part of the treated water main pipeline. Some of the land owners will be affected by the land acquisition process for the Intake/treatment works sites. 			
Residents of Namagara				<ul style="list-style-type: none"> Major beneficiaries of the proposed project 			

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

Residents of Shirugu	Community			<ul style="list-style-type: none"> Major beneficiaries of the proposed project. 	
Residents of Samitsi, Burundu, Chegulo and Matsakha				<ul style="list-style-type: none"> Areas that will benefit from the project's water supply as they will host the project's communal water kiosks. 	
Residents of Tand, Butali and Chebwai		Business	Other	<ul style="list-style-type: none"> Communities that will host some of the water storage tanks, and will be beneficiaries of the water project as well. 	
Kakamega County Government				<ul style="list-style-type: none"> The County Government of Kakamega hosts several technical stakeholders whose inputs will be sought on project components to be located in Kakamega County. Some of them include but are not limited to the following: Department of Water, Agriculture, Commerce and NEMA 	

	Details	Impact Level	Directly Affected	Indirectly Affected
Nandi County Government		<ul style="list-style-type: none"> The County Government of Nandi hosts several technical stakeholders whose inputs will be sought on project components to be located in Nandi County. Some of them include but are not limited to the following: Department of Water, Land and Natural Resources, and NEMA. 		

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

<p>WRMA Kipkarren-Upper Yala Sub-region</p>		<ul style="list-style-type: none"> • Government authority in charge of water resources management, and a key stakeholder as he manages part of the river where effluent discharge for the proposed project will happen. 	
<p>WRUA - Malava</p>		<ul style="list-style-type: none"> • Association that works with WRMA in its effort to manage and protect water resources in Malava. 	
<p>Malava Water and Sanitation Project</p>		<ul style="list-style-type: none"> • This is a stakeholder who currently supplies water to Malava Town. • The stakeholder was consulted on an information level touching on the current water situation in the area, and how the proposed project is expected to impact the affected communities. 	
<p>National Environment Management Authority-Kakamega, and Nandi Counties.</p>		<ul style="list-style-type: none"> • Government regulator on matters environment, and is therefore a key stakeholder in the project. 	

Stakeholder consultations

The stakeholders were consulted through the following methods:

Interviews

This method was applied in engaging various institutional stakeholders and community representatives. Stakeholders consulted through interviews included: The Deputy County Commissioner-Malava Sub County, Malava Sub county water officer, Malava Sub county administrator, area Chiefs and members of the community living in the project area. Convenience sampling was applied to select respondents for participation.

Stakeholders’ meetings

Effective resettlement action planning requires regular and thorough consultation with a wide range of project stakeholders drawn from the affected area. This wide consultation is intended to include individuals and groups who will be positively or adversely affected by the project. The stakeholders’ consultations are extremely important for successful implementation of the RAP.

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

Stakeholder and PAP consultation meetings were held within the Project area from 25th August 2021 to 3rd September 2021. The stakeholder and PAP Consultation meetings included the following:

- i) Courtesy calls and introductory meetings at the County Commissioner
- ii) Consultation meetings with affected PAPs

Courtesy to Deputy County Commissioner, Malava

The Consultant paid a courtesy call to Deputy County Commissioner, Malava and held a consultative meeting to brief Commissioner on the assignment and the activities to be undertaken. The meeting took place on 25th August 2021.

6.4 Community Introductory meetings with PAPs

Community Sensitization meeting were held in each of the Location affected by the project. During the introductory meetings, the RAP Consultant team was introduced by the host chiefs after which the Consultant gave a brief background of the Project and informed the participants that Batch Associates had been contracted by LVNWWDA to update the RAP for the tertiaries in Malava water supply project.

The Consultant outlined the activities that were to be undertaken during the field work as follows:

- (i) Determination and acquisition of the pipeline wayleave and intakes works and storage tanks
- (ii) Survey and marking of the infrastructure;
- (iii) Identification of Persons Affected by the project through census and Socioeconomic baseline survey of PAPs;
- (iv) Valuation of affected assets;
- (v) PAPs sensitization meetings;

The Consultant underscored the need for the community to co-operate with the Consultants’ Team, locally recruited enumerators and village elders during the data collection. In addition, the community was informed about the RAP coverage.

Table 47: Schedule of community Introductory and Sensitization Meeting in locations

Date	Location
1/9/2021	Samitsi
2/9/2021	Namagara
31/8/2021	Burundu
30/8/2021	Chegulo

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

27/8/2021	Chebwai
26/8/2021	Butali
26/8/2021	Tolilet
25/8/2021	Malava constituency CDF hall

6.5 Community Concerns

The project affected person (PAPs) were concerned that the project infrastructure is going to disturb the social relations and interactions. The project activities are going to impact, to some extent, communication and movement among the PAPs. There may be limited movement within communities and between communities and access to some social and public facilities. However, to mitigate these impacts, the project design has included footpaths, bridges and steps to ensure easy access between affected neighbourhoods and communities as well as continuous access to water for affected households and livestock. The best way to avoid accidents and improve safety of the locals is through public awareness and capacity building of the community members and safety measures. The focus should be on children. The detailed summary of PAPs’ concerns and responses are provided in below:

Community concerns expressed

- i. Unaffordable water charges during schemes’ operations;
- ii. Corruption in running of the schemes which can compromise the quality of service in water supply;
- iii. Potential conflicts with importation of labour while ignoring the local community;
- iv. Loss of income for borehole water vendors;
- v. Abstraction will cause reduced flows on Kivaywa and Nambirima Rivers;
- vi. Unequal distribution of water to both rich and poor in the project area;
- vii. Conflicts arising from disagreement on land acquisition for project components;
- viii. Risk of poisoning from water treatment chemicals especially if not handled properly;
- ix. Fears of the project stalling before completion like many others in the past;
- x. Cross-boundary issues between the Nandi and Kakamega counties if the community at the Nandi escarpment near the intake and treatment works does not benefit from the scheme;
- xi. Concerns over loss of the community cattle dip in Tolilet upstream of the intake site;
- xii. Potential conflict if communities at intake sites do not benefit from clean water supply;
- xiii. Project reliability may be questionable if water supply will be entirely dependent on electricity; and
- xiv. Vices like prostitution may creep in host villages during project construction with the influx of laborers.

Recommendations by affected communities

- i. Ensure proper management of the proposed schemes on completion i.e. engage people of integrity to ensure fair distribution of the water to the intended consumers;

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

- ii. Ensure water charges are affordable so that the targeted consumers can benefit;
- iii. Carry out civic education of the community to cultivate ownership and enhance sustainability;
- iv. Ensure there is no political interference on the schemes;
- v. Engage the host communities, and specifically the affected land owners so that they are well informed about the proposed schemes and compensation plans;
- vi. Ensure community involvement in management of the proposed schemes on completion;
- vii. NEMA should be involved in the entire life cycle of the schemes to assure residents of environmental protection in implementation;
- viii. Ensure reliable power supply to so as not interrupt water supply.

Table 48: Summary of community's concerns

Issue Raised	Response
What is the width of the pipeline?	5 meters
As construction starts locals youths and the area residents should be considered	70% of the unskilled labour force will be sourced from the project area as a requirement
Will be people whose lands are along the road be affected and will be compensation?	Existing road demarcations will be used-no plans for acquisition unless changes occur then those affected will be liable for compensation
Road reserve demarcations should be clearly stated and marked.	Prior to construction surveys will undertake the survey and mark the road reserve
What happens to the scenic tree to be destroyed along the road?	Compensation planting of tree will be undertaken along the road or at designated place by the County Government This will be done before construction works start
What would be done to ensure there would be no noise and air pollution from machines to be used by contractor? Concerned of the destruction of water and sewerage infrastructure installations along the road.	NEMA License issued to the contractor considers issues of noise and air pollution All stakeholders whose installations are within the road reserve work in close collaboration with LVNWWDA
How will compensation be done to affected lands without title deeds	-Anybody impacted by the project will qualify for fair and just compensation however the public should also strive to have legal ownership documents for their lands to avoid future tussles should they qualify for any compensation.
Hopeful that the water project will be finally constructed after many years of promises What are the correct road	-The government has already allocated funds in the budget and the construction of the project is assured after finalization of the project design and bid documents
Can people go on with developments outside the demarcated points?	Construction will be undertaken within the road reserve if need be then there will be acquisition with compensation
Adequate notice of vacation should be given to encroachers	The public have been made aware of the project and should therefore start willingly evacuate the road reserve other than

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

to avoid destruction of property	waiting for forceful demolitions
Local sourcing of construction materials should be considered to boost the local economy	The concerns will be reported to LVNWWDA
Applauded the organizers for involving the local administration who are key public mobilizers	The selected community committee should work with the contractor to ensure local youths are considered for employment Public participation is key and therefore the forum was very important in informing the public of the proposed project and collect their views and concerns
The project should consider incorporating solar power alongside hydropower for pumping water to cut the operation costs	The Concerns will be incorporated in the design
Securing the intake at Tolilet	The project should consider putting up houses for security personnel to be deployed by the government
Will people pay for water	The water service companies under the county government will install meters and people will pay according to consumption levels
Who will manage the project	LVNWWDA will manager key installations while the county government will manage distribution pipes.

6.6 Consultations findings

The following are the findings from consultations with specific stakeholders:

6.7 Expected community benefits

- i. Easy access to clean water for domestic consumption and supply to schools and hospitals in the area;
- ii. Reliable water supply to alleviate the problem when boreholes dry up during the dry season;
- iii. Job opportunities during construction and operation of the schemes;
- iv. Savings on time and effort currently used in search/drawing of water;
- v. A reduction in waterborne diseases in areas to be supplied with treated water;
- vi. Better health of communities from improved diet enabled by all-year farming of vegetables; and Rural development and improved sanitation catalyzed by the water schemes

6.8 Conclusion

- i. The stakeholders' consultation exercise established that the host community welcomes the proposed project. They perceive it as a worthwhile investment that will solve the challenge of access to safe drinking water in the project area.
- ii. Stakeholders anticipate both positive and negative impacts, and they reported not having a problem with project implementation as long as the negative impacts can be mitigated against.
- iii. Offering local residents jobs, ensuring just compensation for affected property/land owners, offering locals job opportunities and engaging the host communities during the lifespan of the proposed projects are key points that were emphasized by the respondents.

7. PREDICTION AND EVALUATION OF IMPACTS

7.1 Impact Categories

First the likely significance of the potential issues of concerns has been determined and ranked according to the following:

- a. Potential environmental impacts which are deemed to be highly significant and need thorough investigation in the ESIA
- b. Potential environmental impacts that are deemed to be moderately significant, and will require reasonable investigation in the ESIA
- c. Potential environmental impacts that are deemed unlikely to be significant, and will need to be listed, and addressed in some way, but which will not require detailed assessment in the ESIA.

Secondly, the following characteristics have been defined for each impact:

Nature:

Positive: applies to impacts that have a beneficial economic, environmental or social result, such as additional economic activity or enhancement of the existing environmental conditions.

Negative: applies to impacts that have a harmful or economical aspect associated with them such as economical cost, loss or degradation of environmental resources.

Effect:

Direct: applies to impacts which can be clearly and directly attributed to a particular impacting activity.

Indirect: applies to impacts which may be associated with or subsequent to a particular impacting activity, but which cannot be directly attributed to it.

Time Range:

Short Term: applies to impacts whose effects on the environment will disappear within a 1-year period, or within the construction phase.

Medium Term: applies to impacts whose effects on the environment will disappear within a 5-year period following the construction phase.

Long Term: applies to impacts whose effects on the environment will disappear in a period greater than 5 years following the construction phase.

Reversibility:

Reversible: applies to impacts whose significance will be reduced and disappear over time (either naturally or artificially), once the impacting activity ceases.

Irreversible: applies to impacts whose significance will not be reduced nor disappear over time (either naturally or artificially), once the impacting activity ceases.

7.1.1 Impacts Emanating from the proposed project

The impacts are identified at three stages: -

- a. Pre- construction/Planning Phase Impacts

- b. During construction and

- c. Post-construction (operation phase)

Planning Phase Impacts

This will mainly be the acquisition of land and the pipeline

These are commonly associated with acquisition land for the treatment works, storage tanks and pipeline reserves, and include involuntary relocation where resettlement or land acquisition is foreseen this affects three groups of people:

- a. People affected by the acquisition of land for the project;

- b. People affected by the temporary use of land for installation of the of the pipeline, and;

- c. People whose livelihood is impacted.

Mitigation measures

The pipeline runs along roads and footpaths, the extension of the lines will be located along footpaths and roads so as to minimise land acquisition. However, in the case of unavoidable land take, that land in question shall be acquired in accordance with the applicable law and the previously done Resettlement action plan report.

Project affected persons to be identified by type of loss through a detailed resettlement action plan.

The affected persons to be compensated for loss of houses and ancillary buildings, land, trees, livelihood productivity, and land improvements

LVNWWDA to agree with the local community on the form of compensation for loss of land, structures, trees, crops and livelihood (such as water provision etc.). Once the community is fully compensated the contractor may move to site

Temporarily used land will be returned to the original land user on completion of works. Short term severance impacts on land parcels will also occur during the construction phase of the project. On construction completion, access routes will be reinstated to their pre-project conditions for both people and animals.

The mitigation measures for social impacts are to ensure that the affected persons' livelihood is at least maintained after implementation of the project.

Project affected persons to be identified by type of loss through a detailed resettlement action plan.

The affected persons to be compensated for loss of houses and ancillary buildings, land, trees, livelihood productivity, and land improvements

LVNWWDA to agree with the local community on the form of compensation for loss of land, structures, trees, crops and livelihood (such as water provision etc.). Once the community is fully compensated the contractor may move to site

Construction Phase Impacts

Most of the potential environmental and social impacts associated with the construction phase will be negative and temporary, and can be mitigated with the use of standard environmental management procedures. The potential social impacts or nuisance will be those typically associated with construction activities involving vehicles, equipment, and workers. The predicted impacts include the following:

Traffic Congestion

Traffic congestion is anticipated from site related traffic from Contractor vehicles. This may interfere with socio-economic activities which majorly rely on the transport network affected by the construction activities. The proposed project would have minor, short term impacts on transportation, as the sewer mains are anticipated to be installed within the shoulder of existing roads.

Mitigation measures

The Contractor should provide temporary road signs or notices to indicate ongoing works;

The Contractor together with the Resident Engineer should Plan itineraries for site traffic on a daily basis and avoid peak traffic periods;

The Contractor should effect traffic controls and cleanliness to avoid congestion and truck accidents on roads;

The Resident Engineer has to ensure that transportation vehicles are operated during night-time and off-peak hours to avoid peak traffic. With proper vehicle operation control, adverse impacts on the environment and traffic by the transportation will be minimal;

The Resident Engineer and Contractor should choose traffic routes to reduce the impact in the neighborhood avoiding, as far as practical any sensitive areas;

- For the site traffic the Contractor has to ensure that they
- Only park in designated parking areas;
- Don't block pedestrian routes;
- Don't block traffic routes;
- Obey the speed limit

The resident Engineer has to ensure that the Contractor:
Introduces segregated pedestrian walkways;
Introduces speed limits;

Reduces the need for reversing vehicles, by introducing a one way system;
Uses a qualified BANKSMAN to control deliveries and reversing vehicles;
Designates loading/unloading areas.

Site Related Oil Spills

During construction, oil spills may result from construction site equipment and storage.

<p>Mitigation Measures</p> <p>The Contractor should ensure that the employees on site are aware of the company procedures for dealing with spills and leaks from oil storage tanks for the construction machinery through induction and safety training;</p> <ul style="list-style-type: none">• In case of spillage the Contractor should isolate the source of oil spill and contain the spillage using sandbags, sawdust, absorbent material and/or other materials approved by the Resident Engineer;• The Resident Engineer and the Contractor should ensure that there is always a supply of absorbent material such as saw dust on site during construction, readily available to absorb/breakdown spill from machinery or oil storage; All vehicles and equipment should be kept in good working order, serviced regularly and stored in an area approved by the Resident Engineer;• The Contractor should assemble and clearly list the relevant emergency telephone contact numbers for staff, and brief staff on the required procedures. <p>All vehicle works should be done in one place to avoid chances of spillage in different parts of the camp</p>
--

Soil-Related Impacts

All construction activities have some minor impacts on the soil. However, these are localised and restricted locally to the excavation of trenches for the water pipes. It is expected that these impacts are also short-lived during construction and mitigation measures are recommended. The key impacts will revolve around soil erosion, contamination, disturbance of the natural soil structure, piling of soil along public access routes, improper replacement of soil to its original position, mixing of layers and compaction thus reducing the ecological function of the soil.

Mitigation Measures

The valuable top soil containing organic material, nutrients as well as seeds and the soil fauna would be excavated separately and piled in an adequate manner for re-use.

In cases where it is identified that during construction there is a danger of increased run-off or erosion of trenches, temporary drainage channels or holding ponds can be employed

After completion of the construction works, immediate restoration spreading piled top soil and by sowing adequate grass cover and planting of trees will be followed, therefore the impact is temporary and reversible.

Plan emergency response measures in case of accidental oil spills.

Impact on Water Resources

Potential environmental impacts associated with water resources include sedimentation, foreign material spills, pollution slumping, disturbance to drainage and removal of vegetation. Vegetation and solid waste, if allowed to accumulate in water ways, may cause localized pooling and flooding.

Improper handling of construction wastes and increased waste water production may cause pollution of the Ocean. This may affect the oceanic eco-system including fish and other marine organisms.

Mitigation

Construction materials and other debris (lime, cement and fresh concrete, etc.) shall be prevented from entering waterways.

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

Ensure protection of the Ocean ecosystem by proper handling of cement during civil works. Examples of good practices while handling cement include:

- Cement mixing should be done in a designated area away at a safe distance from natural water courses;
- Sensitize workers and enable them to properly handle concrete spillages or waste cement.

Social - Economic Impacts

During construction the project will have clear benefits with regard to local employment opportunities. The project will additionally require various skills and services which may not be available on the local level but certainly on the regional level, e.g. masonry workers, plumbers, etc. for which appropriate personnel will be contracted.

The increase in employment will temporarily lead to an overall increase of income directly and indirectly (through increased demand of other local services). Consequently, farmers will also benefit from higher income levels as they sell their products. New businesses will grow such as food vending to construction workers

With availability of tap water there will be a possibility of increased investor interest in tourism related developments in the area and possible increase in property values for land with access to piped water.

In migration of people from different regions may lead to behavioral influences and this may increase the spread of diseases such as HIV/AIDS

<p>Mitigation</p> <p>Unskilled construction and skilled (if available) labor to be hired from the local population as far as possible to minimize on influx of foreigners into the community.</p> <p>Use of manual labor during trenching works where possible to ensure more employment of locals and hence ensure project support throughout the construction process.</p> <p>Sensitize workers and the surrounding community on awareness, prevention and management of HIV / AIDS through staff training, awareness campaigns, multimedia, and workshops or during community Barazas.</p>
--

Air Quality

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

Construction activities of bush clearing, materials delivery, trench excavation and construction traffic will generate a lot of noise and dust especially during the dry seasons. The area is predominantly dry thus dust is already a pre-existing problem.

Vehicular traffic to the proposed sites is expected to increase especially during delivery of raw materials. Vehicular traffic emissions will bring about air pollution by increasing the fossil fuel emissions into the atmosphere. The access roads are earth roads. Trucks with heavy loads will further damage these earth roads.

Mitigation:

Use protective clothing like helmets and dust masks on construction crew.

Construction sites and transportation routes will be water-sprayed on regularly up to three times a day, especially if these sites are near sensitive receptors, such as residential areas or institutions.

All the vehicles and construction machinery should be operated in compliance with relevant vehicle emission standards and with proper maintenance to minimize air pollution.

Digging of trenches should be done manually so as to avoid too many trucks and machines in the area. The use of manual labor will also benefit the community socio-economically.

Use of other dust palliative measures to reduce dust emissions

Construction Noise and vibration

Noise and vibration generated during construction by heavy construction machinery, such as excavators, bulldozers, concrete mixers, and transportation vehicles.

Generally, construction noise exceeding a noise level of 70 decibels (dB) has significant impacts on surrounding sensitive receptors within 50m of the construction site.

Mitigation:

Avoid night time construction when noise is loudest. Avoid night-time construction using heavy machinery, from 22:00 to 6:00 near residential areas.

No discretionary use of noisy machinery within 50 m of residential areas and near institutions such as schools

Good maintenance and proper operation of construction machinery to minimize noise generation.

Installation of temporary sound barriers if necessary.

Selection of transport routes for large vehicles to avoid residential areas.
Where possible, ensure non mechanized construction. This includes, employing locals during the trench excavation.

Biodiversity and Conservation Impacts

Removal of vegetation as well as trees will lead to loss of plants and animal habitat. The biodiversity affected includes insects such as butterflies and worms, small mammals, reptiles and birds. Water contamination with cement will cause it to be highly alkaline and toxic to plants and animals living in watercourses.

Mitigation:

Re-plant the indigenous vegetation as much as practical once work is completed. Spare the vegetation that must not necessarily be removed such as trees.

Minimize the amount of destruction caused by machinery by promoting non-mechanized methods of construction.

Ensure protection of the Coastal ecosystem by proper handling of cement during civil works.

Cement mixing should be done in a designated area away at a safe distance from natural water courses.

Spilled cement or concrete should be collected and disposed away from natural water ways or storm water drainage;

Sensitize workers and enable them to properly handle concrete spillages or waste cement.

Public Health, Safety & HIV & AIDS Impacts

Construction staff and the general public will be exposed to safety hazards arising from construction activities. The main pipeline is to be placed along major roads together with a distribution system along rural access roads and footpaths these roads have pedestrian and vehicular traffic and this may cause an increase in the number of accidents.

The project works will expose workers to occupational risks due to handling of heavy machinery, construction noise, electromechanical works etc.

Construction activities of bush clearing, materials delivery, trench excavation and concrete mixing and construction traffic will generate a lot of dust and this may affect the respiratory system.

The high temperatures in the area will expose the workers to difficult working conditions.

Construction sites may be a source of both liquid and solid wastes. If these wastes are not well disposed these sites may become a breeding ground for disease causing pests such as mosquitoes and rodents.

At the concrete mixing plant the exposure of human skin to cement may lead to damage of the skin.

In migration of people from different regions may lead to behavioural influences which may increase the spread of diseases such as HIV/AIDS. Improper handling of solid wastes produced during and civil works such as spoil from excavations, scrap metal, mortar, paper, masonry chips and left over food stuff present a public nuisance due to littering or smells from rotting. Open trenches during the project duration pose a risk to the general public as they access the different sides of the trenches.

Improved clean water supply to the area will lead to improved public health and quality of life through reduced risk of waterborne and water-related diseases; and increased public satisfaction.

Mitigation:

Ensure that all construction machines and equipment are in good working conditions to prevent occupational hazards.

Establish a Health and Safety Plan (HASP) for both civil and electromechanical work.

Appoint a trained health and safety team for the duration of the construction work. Use of dust masks while working in dusty environment to avoid respiratory related sicknesses.

Provide workers with appropriate personal protective equipment (PPE).

Provide workers with adequate drinking water and breaks.

Provide workers training on safety procedures and emergency response such as fire, oil and chemical spills, pipe bursts and other serious water loss risks.

Roads passing through population centers will be water sprayed to reduce dust. Sensitize workers and the surrounding communities on awareness, prevention and management of HIV/AIDS through staff training, awareness campaigns, multimedia and workshops or during community Barazas. Provide information, education and communication about safe uses of drinking water.

Work to minimize or altogether eliminate mosquito breeding sites. Provide appropriate human and solid waste disposal facilities

Provide crossing points along the trenches to allow people to maintain their normal activities, also cautionary signage should be provided along the trenches.

Provide clean toilets for workers

Conflict of due to Influx of Labour

The project will attract labour into the project area. Like any other project with significant recruitments, the behavior of workers on and off the site, such as the use of abusive and vulgar language, destruction to property, lack of respect to the locals, gender-based violence, and engagement in sexual relations with underage girls and married women are bound to happen. Thus, a potential source of conflict. The impact of conflicts because of influx of labour, though localized, temporary, reversible and noncumulative, can be severe in magnitude.

Mitigation:

Contractors should develop guidelines for behavioral conduct, including penalties (Workers' Code of Conduct). Casual labour jobs should be prioritized for Local Residents to reduce the influx levels. Workers must be sensitized on proper social behavior and conduct with regard to community norms prior to starting work; workers should be sensitized to avoid engaging in sexual relations with underage girls and married women; in case of misunderstandings between workers and the local community, local leadership should always be sought as a first priority in solving these issues; similarly, in liaison with local leaders, contractors should prepare local communities – psychologically and otherwise – for the newcomers; efforts be focused on instilling attitudes of tolerance, support and understanding towards the newcomers in the local communities. This shall be achieved by requiring Contractors bidding for construction works to develop and implement Contractor's ESMP which will among others have the following: a Labour-Influx Management Plan which will make provision for establishment of a separate Workers' Grievance Committee, Workers' Camp Management Plan, and so on. Community Grievance Redress Committees shall be established at different levels and mainly built on existing structures to increase their accessibility and acceptability by the Communities. These shall handle all project related complaints and be a bridge between the project and the host communities. It is also recommended that regular Monitoring by District Local Governments (Community Development Officers, Probation Officers, Gender Officers) and other related local institutions.

Service Delivery Impacts

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

The construction activities will cause disruption of services such as water supply and transportation within the project area. Where the water pipe crosses the road, excavation of trenches and laying down of the water pipes may cause disruption of transport within the project area. Trucks with heavy loads of construction materials may damage murrum roads during the construction process. The trucks may get stuck on bad road sections (sandy soil is difficult to negotiate through) and these may cause disruption of transport.

The current water storage facilities may not be enough to handle emergencies brought on by the interruption in water supply. Areas of special attention include the learning and health care institutions.

The completion of the water project will alleviate the water problem and ensure better management of water supply as water losses will be detected. Metering will allow better pricing of water resources and could contribute to better water use management by consumers. Improved clean water supply to the area, sanitation and hygiene for residents with access to tap water will lead to improved public health and quality of life through reduced risk of waterborne and water-related diseases; and increased public satisfaction within the project area. This will lead to population growth and informal settlements causing increased waste water production and increased demand for emergency water supply from existing reservoirs.

Mitigation:

Provide appropriate signage to warn motorists and other road users of the construction activities, diversion routes to ward off traffic accidents.

The contractor should communicate any intended disruption of the services to enable the people to prepare e.g. by having emergency water storage and provision facilities.

Areas being trenched to be temporarily cordoned off to avoid people and animals accidentally falling into open trenches.

In the event that delivery trucks damage parts of the road, repair the spots in consultation with the local authorities.

Provide adequate water storage facilities to ensure adequate supplies to meet the new demand.

Ensure proper maintenance of the water works

Use pipes of good quality materials

Gender Empowerment Impacts

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

There is need to promote gender equality in all aspects of economic development and more so in construction. Women roles in construction are mainly confined to supply of unskilled labour and vending of foodstuffs to the construction workers. Where available skilled women will be used.

The increase in the distribution of water to the inhabitants will immediately transform their ways of life, especially for women who are the first concerned when it comes to water supplies. Women who are the main economic players will have more time to spend on other economic activities.

Mitigation:
Ensure equitable distribution of employment opportunities between men and women
Provide toilets and bathrooms for both male and female workers on site

7.1.2 Impacts during Operation & Maintenance

During the operation of the constructed water supply project no substantial negative environmental and social impacts and risks are anticipated.

Socio - economic potential positive or beneficial impacts

Numerous socio-economic potential positive or beneficial impacts from successful implementation of the project will include:

- a. Better access to safe drinking water leading to improved standard of living; and changes in exposure to both communicable and non-communicable diseases;
- b. Improvements in domestic hygiene and a reduction in health risks that were associated with poor water quality or inadequate access to services, as a result of improvements in drinking water quality and its availability;
- c. The program will contribute to increase in local development and employment as the local population are likely to be employed during the construction phase and after construction due to water related investments;

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

- d. Increase in tourism in the area. The project area has many tourist attractions and destinations such as the hotels, as well as the Indian Ocean. The increase in water will allow for a more lucrative business opportunity in terms of hotels and tourist related activities.
- e. Promote a more sustainable use of water resources with improvements in the infrastructure to reduce losses and introduction of better metering and billing procedures to encourage more efficient use of water;
- f. A comprehensive metering program (of production and consumers) is expected to keep the on Non-Revenue Water (NRW- technical and commercial losses) at an acceptable level;
- g. Sanitation will also be promoted with its attendant improvement in the health of the people such as reduced incidence of water borne diseases.
- h. Improvements in metering and administrative billing procedures;
- i. The program is expected to contribute to poor communities well-being associated with improved services, stability, and health.
- j. Employment creation will be the key positive environment impact as operation and maintenance personnel will be required for the rest of the project life. The availability of water and easy access will trigger other developments and businesses.

Other potential impacts typically associated with operation and maintenance activities are such as:

Generation of both solid and liquid waste

The establishment of an adequate water distribution system will be mostly beneficial to the local community, however with the provision of water comes the increase in the generation of solid and liquid waste. MALAVA town and its environs currently have few sanitation sewerage facilities. Majority of the stakeholders within the project area, use septic tanks.

Water supply will lead to an increase in the generation of solid and liquid waste, and with the area's proximity to the ocean the risk of untreated sewage making its way into the ocean.

Mitigation measures:

Provide adequate waste disposal facilities. Ensure collection of all solid waste from generation points, safe transportation to a central point where they are sorted out and safely disposed according to type to protect the environmental resources.

Put in place adequate and efficient sanitary facilities for handling liquid waste especially waste water to protect the ocean from pollution.

Come up with regular trash collection system in the site areas so as to avoid accumulation of waste.

Leaks and burst

During the project duration there may be leaks and bursts caused by various reasons such as excessive pressures, illegal connections, among others

Mitigation measures:

A program of leak detection to be put in place to identify aging pipes for replacement to avoid major bursts and frequent repairs. In case of unavoidable major repairs, mitigation measures similar to those applied during construction to reduce the impacts of noise, dust, disturbance of flora and fauna.

Leaks and pipe bursts to be promptly repaired to avoid contamination of water resources especially shallow ground water.

Constant policing of network to check for illegal connections

Noise

Noise nuisance from vehicles and repair equipment. During O&M activities vehicles are required for inspection of pipelines to detect any leakage and repair equipment is required in case need arises and in the process of these activities undesirable noise will be generated.

Mitigation measures:

During normal operations the noise generated from vehicles has insignificant impact. However, during major repairs, the equipment used can generate unacceptable levels of noise and mitigation measures similar to those applied during construction to be used.

Impact on Water Resources

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

As mentioned earlier the generated solid and liquid waste from the project area will make itself through its natural water courses, including ground water, back to the Indian Ocean. Thus the entire water system and as a result the ecological system will be negatively affected.

Mitigation measures:

Wastewater will be channeled to the sewerage system if available or constructed septic tanks. Pit latrines can be used where sewerage system is not available or where construction of septic tank is not feasible.

All solid waste will be collected from generation points, safely transported to the central place where it is sorted out by type and then safely disposed according to type.

Socio - Economic Impacts

The expected improvements in metering and administrative billing procedures are likely to cause social and economic impact as this may result in higher water bills.

Mitigation measures:

The project is currently making use of the LVNWWDA approved rates and this impact is not foreseen

Impact on flora and fauna.

Impact associated with repair and replacement activities when there are leaks or bursts on pipelines will be loss of vegetation and disturbance flora and fauna.

Mitigation measures:

A program of leak detection to be put in place to identify aging pipes for replacement to avoid major bursts and frequent repairs. In case of unavoidable major repairs, mitigation measures similar to those applied during construction to reduce the impacts of disturbance of flora and fauna.

Leaks and pipe bursts to be promptly repaired to avoid contamination of water resources especially shallow ground water.

After the repair works the land to be levelled to allow vegetation regeneration.

Impacts during De-commissioning

De-commissioning of the Project is not envisaged. Project components however will be rehabilitated over time having served their useful life.

8. ENVIRONMENTAL AND SOCIAL MITIGATION AND MANAGEMENT PLAN (ESMMP)

By design, the potential positive impacts of the project can readily be optimised while the potential negative environmental and social impacts are mostly restricted to the planning and construction period. These are assessed and considered as minor to medium, being reversible and short-term and can be managed through well-defined mitigation and monitoring measures.

8.1 Possible Enhancement Measures

Possible enhancement measures of beneficial impacts would include the following:

- Construction should adhere to recommended best construction practices that make effective and economical use of locally available resources including materials, expertise and labour.
- Ensure that the poor and other vulnerable groups adjacent or along the pipeline route will be catered for by the project to safely satisfy their basic water needs in future.
- Ensure that social services provide education on appropriate hygienic conditions and water conservation, taking into consideration gender particular roles and responsibilities.
- Carrying out periodic assessment of different components of the water production, transmission and distribution system to initiate immediate rehabilitation whenever problems are identified to reduce system leakage and bursts losses.

8.2 Mitigation Measures

Mitigation measures for negative environmental impacts include the following:

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

- a. Construction site environmental and social management plans (C-ESMP), prepared by the contractor, will be required for all works. This plan will include a waste management plan for all activities during the construction period.
- b. All Contractors to develop & implement a Labour Influx Management Plan and Workers' Camp & Accommodation Management Plans as part of C-ESMP
- c. Air pollution due to dust when excavated material is stockpiled, should be limited by working in small sections so that the trenches are backfilled with excavated materials within shortest possible period.
- d. Avoid hampering drainage of surface water and plan for restoration measures after construction.
- e. Construction activities should be scheduled appropriately to reduce high noise levels particularly at night from noisy activities.
- f. Avoid areas sensitive to erosion.
- g. Avoid establishing temporary access roads along steep slopes
- h. At the end of construction works, level off the soils and facilitate vegetation regeneration.
- i. Minimize land clearing areas by employing mechanization only when necessary. Most of the work should be done by hand.
- j. Prevention of work place injuries during construction is taken care of by the contractors, e.g. by means of signs, signals, fencing, etc.
- k. Carry out specific Environmental Assessment and preparation of a hazardous material management plan for handling such materials that will be identified during the construction stage of the Project.
- l. Employ occupational Safety and Health measures as required by law.

Mitigation measures have already been discussed in Chapter 6. However, a brief summary is included in the Environmental and Social Mitigation and Management Plan (ESMMP) in Table 7-1: The Proposed Environmental and Social Mitigation and Management Plan (ESMMP). Also considered in this management and monitoring plan are the persons responsible for implementation.

The Proposed Environmental and Social Mitigation and Management Plan (ESMMP)

Environmental / Social Impact	Mitigation Action Plan	Responsibility
Land acquisition for laying of pipeline	The pipelines will be laid within the existing road reserves as much as possible. In case there is need for private land acquisition then compensation to done according to the prevailing market rates in the area.	LVNWWDA
Loss of structures	As a first step, the owners, type of structures and businesses are identified. The compensation will be done at replacement cost.	LVNWWDA
Loss of livelihoods	Loss of livelihoods to be valued and compensated to ensure that project affected persons (PAPs) continue with their normal lives(or better) as before	LVNWWDA

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

	the project	
Loss of flora and fauna	<p>Site clearance should be limited to the minimum area required for the execution of the works.</p> <p>The records of the number and tree species cut to be kept.</p> <p>Replanting of indigenous trees after the project is completed.</p> <p>Top soil should be stockpiled separately from the subsoil. After completion of works, the subsoil should be backfilled first then top soil should be restored on top to facilitate natural regeneration of those areas.</p>	<p>Contractor</p> <p>Supervisor – project</p> <p>Engineer to consult</p> <p>KFS on appropriate replanting seedlings</p> <p>Sub-County</p> <p>Environmental officer</p>
Air pollution	<p>Vehicles and other equipment emissions would be kept to a minimum by servicing and maintaining the equipment to manufacturer’s specification. In, addition the contractor to be encouraged to use</p>	<p>Contractor</p> <p>Supervising Engineer</p>

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

	<p>unleaded and low sulphur content petrol and diesel</p> <p>respectively for all equipment and vehicles</p>	
	<p>The Contractor should also make use of the readily available labour for carrying out construction activities.</p>	
Noise and Dust	<p>Use protective clothing like helmets and dust masks on construction crew.</p> <p>Avoid night time construction when noise is loudest. Avoid night-time construction using heavy machinery, from 22:00 to 6:00 near residential areas;</p> <p>No discretionary use of noisy machinery within 50m of residential areas;</p> <p>Good maintenance and proper operation of construction machinery to minimise noise generation;</p> <p>Installation of temporary sound barriers if necessary; and</p> <p>Construction sites and transportation routes will be water-sprayed on dry and windy days up to three</p>	<p>Contractor</p> <p>Supervising Engineer</p>

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

	<p>times a day, especially if these sites are near sensitive receptors, such as residential areas or institutions.</p>	
<p>Generation of solid and liquid waste</p>	<p>Provide adequate waste disposal facilities. Ensure collection of all solid waste from generation points, safe transportation to a central point where they are sorted out and safely disposed according to type to protect the environmental resources.</p> <p>Put in place adequate and efficient sanitary facilities for handling liquid waste especially waste water to protect the river from pollution.</p> <p>Wastewater from residential quarters and offices to be directed to constructed septic tanks for safe handling.</p> <p>Pit latrines can be used in areas where the other services are not available or feasible</p>	<p>Contractor</p> <p>Supervising Engineer</p> <p>LVNWWDA</p>
<p>Pollution of water resources</p>	<p>Ensure proper solid and liquid wastes disposal mainly from the construction camps and offices.</p>	<p>Contractor, Supervising</p>

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

	<p>Ensure proper measures are in place for collection and disposal of spilled oils and lubricants.</p>	<p>Engineer District Water Officer</p>
<p>Health and safety</p>	<p>Provision of Personal Protective Equipment (ear muffs, gloves, dust masks and helmets) for the construction crew</p> <p>Employ a safety and health officer on site.</p> <p>Provide First aid kit and appropriate procedures and safety measures</p> <p>Ensure that all construction machines and equipment are in good working conditions to prevent occupational hazards.</p> <p>Provide workers training on safety procedures and emergency response such as fire, oil and chemical spills, pipe bursts and other serious water loss risks.</p> <p>Sensitize workers and the surrounding communities on awareness, prevention and</p>	<p>Contractor Supervising Engineer LVNWWDA</p>

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

	<p>management of HIV/AIDS through staff training,</p> <p>awareness campaigns, multimedia and workshops</p> <p>or during community Barazas.</p> <p>Provide information, education and communication</p> <p>about safe uses of drinking water.</p> <p>Provide condom dispensers at appropriate</p> <p>locations coupled with awareness campaigns to</p> <p>workers and surrounding communities on</p> <p>HIV/AIDS throughout the construction period</p> <p>Provide enough toilets within the camp</p> <p>Work to minimize or altogether eliminate mosquito</p> <p>breeding sites.</p> <p>Provide appropriate human and solid waste</p> <p>disposal facilities</p> <p>In general comply with operating occupational</p> <p>health and safety law requirements</p>	
<p>Conflict due to influx of labour</p>	<p>All Contractors to develop & implement a Labour Influx Management Plan and Workers' Camp & Accommodation Management Plans as part of C-ESMP.</p> <p>All workers to sign employment contract including Code of Conduct.</p>	<p>LVNWWDA</p> <p>Contractor</p> <p>Supervising Engineer</p> <p>MALAVA County</p>

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

	<p>Establish a Grievance Committee for Workers</p> <p>Casual workers be employed from host community to reduce labour influx</p> <p>Sensitize workers on community based social behavior and conduct</p> <p>Sensitize workers to not engage in sexual relations with underage girls and married women</p> <p>Establish a Grievance Redress Committee to act as link between community and the project; local leadership should always be sought as a first priority in solving issues;</p> <p>prepare both local communities psychologically and the new comers;</p> <p>Efforts to be geared toward instilling attitudes of tolerance, support and understanding of labour immigrates by the local communities;</p> <p>Regular Monitoring by Local Government.</p>	
<p>Unaccounted For Water (UFW)</p>	<p>Ensure proper and accurate records on production and consumption are kept through metering to detect any UFW in the system. Have a leak detection program to identify aging pipes for replacement to control UFW. Any leakages and</p>	<p>LVNWWDA beneficiaries</p>

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

	<p>bursts to be repaired promptly. If these standards are met the tariffs are likely to be within affordable range.</p>	
Traffic Congestion	<p>Provide temporary road signs or notices to indicate ongoing works</p> <p>Plan itineraries for site traffic on a daily basis and avoid peak traffic periods;</p> <p>Effect traffic controls and cleanliness to avoid congestion and truck accidents on roads to ensure that transportation vehicles are operated during night-time and off-peak hours to avoid peak traffic.</p> <p>With proper vehicle operation control, adverse impacts on the environment and traffic by the transportation will be minimal;</p> <p>Choose traffic routes to reduce the impact in the neighborhood avoiding, as far as practical any sensitive areas;</p>	<p>The Contractor</p> <p>Supervising Engineer</p>
Gender balance	<p>Ensure equitable distribution of employment opportunities between men and women</p>	<p>The contractor</p> <p>The Supervising</p>

Environmental & Social Impact Assessment of the Proposed Malava Water Supply Schemes Volume I - Project Report

	<p>Provide toilets and bathrooms for both male and female workers on site</p>	<p>Engineer</p>
<p>Service Delivery</p>	<p>Provide appropriate signage to warn motorists and other road users of the construction activities, diversion routes to ward off traffic accidents.</p> <p>Communicate any intended disruption of the services to enable the people to prepare e.g. by having emergency water storage and provision facilities.</p> <p>Areas being trenched to be temporarily cordoned off to avoid people and animals accidentally falling into open trenches.</p> <p>In the event that delivery trucks damage parts of the road, repair the spots in consultation with the local authorities.</p> <p>Provide adequate water storage facilities to ensure adequate supplies to meet the new demand.</p> <p>Ensure proper maintenance of the water works</p> <p>Use pipes of good quality materials</p>	<p>The Contractor</p>

8.3 Conclusions and recommendations

An environmental and social impact assessment (ESIA) has been carried out for the proposed Malava water supply schemes, and an ESIA Project Report prepared outlining the potential positive and adverse impacts of the proposed schemes.

The Project Report has identified, assessed and presented mitigation measures for the anticipated adverse environmental impacts of the proposed schemes. Beneficial impacts identified in the assessment included: improved water supply/access to clean water for the population in the target areas; and the creation of employment and business opportunities in the construction stage of the water supply schemes.

Adverse impacts identified include displacement and/or disturbance of members of the community with potential loss of livelihoods, the potential increase in noise pollution, air pollution, soil and water resources pollution, and increased health and safety hazards during construction phase of the schemes. Increased demand on water resources and an increase in solid waste generation are some of the impacts anticipated during the operation phase of the schemes.

Mitigation measures proposed during construction include implementation of a resettlement action plan for the expected displacement/disturbance to communities, institution of noise management mechanisms on machinery at the sites, dust control around construction areas and stockpiles, soil and water pollution prevention through proper management of construction wastewater, storage and use of hazardous chemicals, and implementation of health and safety and traffic management plans.

During project operation, water resource conservation measures are proposed which include recycling of filter backwash wastewater, cooperation with WRMA in the implementation of the catchment abstraction management strategy and other water conservation measures for staff and facilities at the treatment plants.

From the foregoing, no adverse environmental impacts are anticipated that cannot be mitigated. An environmental audit of each scheme is recommended upon the completion of construction works to corroborate the implementation of the proposed mitigation measures. Any unforeseen project impacts shall be identified and addressed through annual environmental audits.

Annexes

Annex 1: Minutes of meetings

Annex 2: Attendant sheets

Annex 3: Photos