

REPUBLIC OF KENYA



CENTRAL RIFT VALLEY WATER WORKS DEVELOPMENT AGENCY

**CONSULTANCY SERVICES FOR PREPARATION OF TENDER
DOCUMENTS FOR DESIGN & BUILD WORKS AND
SUPERVISION OF NANDI HILLS, KILGORIS AND
LOLGORIAN WATER SUPPLY AND SANITATION PROJECTS**

KILGORIS AND LOLGORIAN WATER SUPPLY AND SANITATION PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

REPORT

JUNE 2020

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I hereby certify that the particulars given in this report are correct and true to the best of my knowledge.

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) STUDY REPORT

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LIST OF ACRONYMS

AfDB	African Development Bank
AIDS	Acquired Immuno Deficiency Syndrome
ARAP	Abbreviated Resettlement Action Plan
AWWA	American Water Works Association
BOD	Biological Oxygen Demand
CBO's	Community Based Organizations
CDP	County Development plan
COD	Chemical Oxygen Demand
CRVWWDA	Central Rift Valley Water Works Development Agency
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Co-ordination Act
ESIA	Environmental & Social Impact Assessment
ESMMP	Environmental & Social Management and Monitoring Plan
ESMoP	Environmental and Social Monitoring Plan
ESMP	Environmental & Social Management Plan
GHG	Green House Gases
HASP	Health and Safety Plan
HDPE	High Density Polyethylene
HIV	Human Immuno-Deficiency Virus
IUCN	International Union for Conservation of Nature & Natural Resources
JICA	Japan International Cooperation Agency
KFS	Kenya Forest Service
KNBS	Kenya National Bureau of Standards
LVSWSB	Lake Victoria South Water Services Board
LVSWWDA	Lake Victoria South Water Works Development Agency
MAM	March-April-May
MDGs	Millennium Development Goals
NARWASCO	Narok Water and Sanitation Company
NASCOP	National AIDS and STIs Control Programme
NCA	National Construction Authority
NEMA	National Environmental Management Authority
NGOs	Non-Governmental Organizations
O&M	Operation & Maintenance
OD	Operational Directives
OND	October-November-December
OS	Operational Safeguards
OSHA	Occupational Safety and Health Act
PAP	Project Affected Persons
PPE	Personal Protective Equipment
RoW	Right of Way
SDG	Sustainable Development Goals
SS	Suspended Solids
STD	Sexually Transmitted Diseases
STI	Sexually Transmitted Infections
TS	Total Solids
UNFCCC	United Nations Convention on Climate Change
uPVC	Unplasticized Polyvinyl Chloride
USAID	United States Agency for International Development
WHO	World Health Organization
WIBA	Work Injury Benefits Act
WRA	Water Resources Authority
WRUA	Water resource Users Association
WTP	Water Treatment Plant

EXECUTIVE SUMMARY

Project Background and Justification

The Government of Kenya (GoK) has received financing from the African Development Bank (AfDB) under the Kenya Sustainable Water Supply and Sanitation Programme. Part of the proceeds has been allocated for payment for the preparation of tender documents for the Design & Build and supervision of works for Nandi Hills, Kilgoris and Lolgorian Water Supply and Sanitation projects. The Central Rift Valley Water Works Development Agency (CRVWWDA), formerly Rift Valley Water Services Board (RVWSB), is the implementing agency.

GIBB Africa Ltd was commissioned by CRVWWDA to review and update the existing designs including the Environmental and Social Impact Assessment (ESIA) finalized in 2016. The design works have been clustered into two: Lot 1 (Nandi Hills Water Supply and Sanitation) and Lot 2 (Kilgoris and Lolgorian Water Supply and Sanitation Project). This Report only covers ESIA for Lot 2. This project is categorized as high risk under schedule 2 of the Environmental Management and coordination Act, 1999 that requires the preparation of an Environmental Impact Assessment (ESIA) Study Report for submission to, and approval by NEMA. In order to meet the NEMA guidelines, and study objectives as per the Terms of Reference, the study team carried out desktop studies, site visit and, public consultations relevant to the project.

The existing water supply schemes for Kilgoris and Lolgorian were constructed in the 1980s and 1960s respectively. The existing water supply capacity cannot meet the current and future population demand, therefore requiring augmentation to spur economic growth and avoid the cycle of water rationing. The following issues give justification for rehabilitation and augmentation of the water supply system in Kilgoris and Lolgorian:

- The existing Kilgoris water supply system with an intake from Enkare Oo Nkituak River (also known as Langata Ngima) is dilapidated and with a current inefficient daily production of 300m³/day against a design capacity of 480m³/day.
- The water abstraction from Langata Ngima River is inadequate therefore leading to frequent water shortages and rationing;
- The supply in Kilgoris town and its environs is characterized by breakdowns, leakages and rationing that leaves the residents with no water supply for weeks and sometimes months;
- Lolgorian town currently relies on only one borehole of an average safe yield of 63m³/day while the current demand is 434m³/day;
- The existing distribution network in Lolgorian is old and dilapidated and does not cover most of the town areas; and
- At the projected population for the year 2040, the current supplies in the two towns are not adequate to meet the future demand, let alone the current demand.

Consequently, the final Detailed Designs for the Kilgoris and Lolgorian Water Supply System (2019) has incorporated designs that are to improve water supply in the two towns that also meet the World Health Organization's 2006 Guidelines for Drinking Water Quality and Kenya Drinking Water Quality Standards KS-1996.

Project Description

The project's objectives are to deliver a supply of potable water to Kilgoris and Lolgorian (Narok County) within a planning horizon of Year 2040 for a population of 32,298 persons in Kilgoris and 8,804 persons in Lolgorian. The projected total water demands (m³/day) for year 2040 are: Kilgoris (2,425) and Lolgorian (1,095).

As per the final Detailed Design Report (2019), a new water supply system has been proposed with the following components:

- An intake at Mogor River with a throughput capacity of 1,800 m³/day;

- A raw water pump system with three pumps (two duty and one standby) each with a capacity of 50 m³/hr against 40 m head;
- A raw water rising main, steel pipeline (1000 m long) that shall deliver the raw water to a proposed water treatment plant with a throughput capacity of 1800m³/day;
- Water treatment system comprising maze hydraulic mixing flocculation basin, chemical aided sedimentation basins, rapid sand filters and contact tank;
- Clear water pump station: having three pumps (two to be duty and a standby, each with a discharge capacity of 45m³/hr and head of 190m) and 225kVA standby generator;
- A rising main, 9500 m long cement lined steel pipe, that shall deliver clear water to an underground storage with a capacity of 500 m³;
- HDPE gravity mains that shall transmit water to Kilgoris (7 km long) and Lolgorian (28km long) towns and their environs at flows of 1068 and 732m³/day respectively; and
- The proposed minimum pipe to be used for transmission and distribution mains that are 900 and 600mm, respectively.

The GPS locations of the new facilities to be constructed are shown in the table below;

Point and status	UTM Coordinates (Zone 36S)	
	East	North
Mogor Intake and treatment plant (<i>new construction</i>)	714316	9877796
Reservoir tank (<i>new construction</i>)	740,445.28	15,454.26

The estimated cost for the project is KES 1,067,866,980.00 (inclusive of VAT) within an implementation period estimated to be 24 months with additional 12 months for defects notification.

Considering the projected demand, additional civil works against the proposed new project will include:

- Rehabilitation of the existing Kilgoris water supply system with an intake from Langata Ngima with a current inefficient daily production of 300m³/day (against a design capacity of 480m³/day); and
- Rehabilitation of borehole (1 No.) and drilling new boreholes (3 No.) to supply Lolgorian with a total capacity of 280m³/day.

Analysis of Project Alternatives

Water sources assessed to determine the feasible option of water sources for Kilgoris and Lolgorian were Poroko Stream, Olondome River (Lolgorian) and Mogor River. Poroko River contributes about 60% flow to Langata Ngima; therefore, further abstraction will interfere with stream flow as well as negatively affect the existing Kilgoris Water Supply. Olondome River was abandoned due to existing pollution from gold mining activities upstream. Mogor intake was considered optimal with a minimum recorded flow of 0.022m³/sec (1,900.8m³/day). The pipeline alignment has been chosen to maximise use of existing public road reserve as feasible.

Policy, Legal and Regulatory Framework

The key legal framework for the project environmental management are the Constitution of Kenya 2010, the Environmental Management and Coordination Act (EMCA) of 1999 as amended in 2015, the Lands Act 2012, the Water Act 2016, Public Health Act, physical Planning Act, Occupational Safety and Health Act (OSHA) 2007 and their related regulatory frameworks. In addition, the study made reference to the African Development Bank's (AfDB) Operational Safeguards (OS).

Baseline Environmental Conditions

The rainfall amount and regime in the project area is influenced by the passage of Inter-Tropical Convergence Zone (ITCZ) giving rise to a bi-modal rainfall pattern. The breezes from Lake Victoria add to the moisture levels. Hailstorms are occasionally reported in the West and the highlands north of Transmara West Sub-County in Narok County. Long rains are experienced between February and June reaching its peak in April, while the short rains are experienced between August and November. Kilgoris town and its immediate environs receive a mean annual rainfall of 721.6mm.

Transmara West Sub-County in Narok County enjoys medium temperatures ranging from 14.8°C to 20.3°C. The highest temperatures occur in February and the lowest in June/July. Other than the urban core of Kilgoris and Lolgorian, other project areas are mainly rural in character with farmlands and associated homesteads. Other than farmland vegetation cover, there are no significant vegetation to form wildlife habitats. The town areas are built up environments so the vegetation cover is low with most of patches comprising of naturally growing grass, shrubs and trees.

The flora along the river bank at the intake site consists mainly of the following species:

- Accacia associations
- Morning glory, *Ipomoea sp*
- *Ricinus communis* (a weedy/colonial Species)
- Senna, *Senna didymobotrya*
- *Commiphora sp*

Ipomoea sagittata and *Senna didymobotrya* are listed as Vulnerable and Least Concern as per the IUCN list of Threatened species. None of the identified flora is listed as endangered or vulnerable in the Wildlife Conservation and Management Act, 2013.

In general, the habitat classification transitioned from natural habitat in the intake area (the riparian zone), WTP (adjacent to the riparian) and sections of the raw water rising mains pipelines to modified habitats in the settlements and road reserve where the storage tanks, pump stations, and transmission pipeline networks are proposed.

Wildlife is limited to the occasionally free ranging grazers from the nearby Maasai Mara Game reserve, about 30 km away from the project area. During field studies, zebras were observed to be grazing outside the homesteads together with the other domestic animals.

River Mogor, from which the water is proposed to be abstracted, is relatively undisturbed by agricultural activities. Water sampling and analysis revealed that the river water was within the NEMA, KEBS and WHO standards for sources of domestic water except for colour (400 mgPt/l), turbidity (242 N.T.U) and *E. coli* (10/100 ml), which were far above the KEBS and WHO allowable limits of 15 mgPt/l, 5 N.T.U, and 0/100ml, respectively.

As informed by the WRA officers, the local community are mainly pastoralists who do not engage in farming and so the riparian areas are well preserved. However, in the upstream areas, the catchment is facing threats of distraction for sugarcane plantations. The riparian is also being reclaimed. The water reservoirs are under threat of drying up if no proper catchment protection and conservation measures are put in place. Examples of the aquatic life found in River Mogor include: Catfish, Tilapia, *Barbus sp*, *Carps sp*, and, *Haplochromis sp*. None of these are listed as protected species under the IUCN red list of Threatened species or in the Wildlife Conservation and Management Act, 2013.

Community and Stakeholder Engagement

This Report makes reference to consultations made in 2016, 2018 and 2019. In 2016, the initial ESIA consultations involved local community and Senior Superintendents (Water Engineers) within the project area.

In 2018 design reviews necessitated consultations that involved two public meetings and five

key informant interviews. Key informants included CRVWWDA and LVSWWDA, Narok Water and Sewerage Company Ltd, NEMA, WRA and local area chiefs. Additional consultations were done in 2019 prompted by further design reviews. Stakeholders consulted included:

- Local community through three public meetings,
- Eight Key informants through key informant interviews as follows: WRA Sub Regional Manager (Lake Victoria South Catchment Sub-Region); County Director of Environment (Narok); Sub County Officers on Environment; Water; Fisheries, Livestock and Agriculture (Transmara West); and KFS Officer (Transmara East and West).

In summary, the main issues from the consultations were:

- To ensure the future sustainability of the river, the river catchment should be conserved through catchment protection programmes;
- During construction and operation, locals should be given first priority in terms of employment;
- In the case where there is land acquisition, land owners should be adequately compensated before commencement of the project;
- The community would like to benefit from the project as well therefore the project should provide alternative sources of water for the community members who live within the project area but are not direct beneficiaries;
- The project should avoid conflict with other users by ensuring there is water for the downstream users; and
- During construction and operation, the abstraction point and the water treatment plant should be fenced off to ensure that there are no fatal accidents involving the local area residents or their cattle.

The project was unanimously accepted and welcomed by the locals knowing that their water needs had been factored within the project through the provision of various water points for the community.

Impact Assessment

The main positive impacts during construction phase will be creation of business opportunities for local suppliers and employment opportunities for local community. During operation, improved access to water services for the local community will be the main positive impact of the project. Moreover, other cascading benefits from the project include enhanced public health and sanitation, improved welfare of women who usually bear the most burden in terms of looking for water on behalf of their families.

The envisaged negative impacts and their mitigation measures are presented in the summary Environmental and Social Management Plan (ESMP) below:

Summary ESMP of the Kilgoris Lolgorian water supply and sanitation project

Environmental and social impact	Mitigation measures	Cost (KES)
Construction Phase		
Soil erosion and disposal of excavated soil	<ul style="list-style-type: none"> • Excavated soil will be used in the proposed project sites for development of impounding structures, re-spreading in areas to be landscaped to enhance aesthetics along the wayleave area and the development of access roads; and • Works program should be in line with Kilgoris and Lolgorian weather pattern so as to avoid such works during rainy seasons; 	No additional costs to the BoQ
Soil and river water contamination	<ul style="list-style-type: none"> • Plan emergency response measures in case of accidental spills of hydrocarbons, cement and any foreign materials; 	43,000 (for 1.2m high sand bags along 200m of River Mogor bank)

	<ul style="list-style-type: none"> • Maintenance of construction equipment to be done on designated purpose-built surfaces; • Placing of sand bags along drainage channels and the river bank to prevent siltation of the river; • Any on site/camp storage areas for fuels, oils or other liquid chemicals would be sited away from surface water drains, and on impermeable base. 	Mitigation measures to be included in contractor's contract document
Loss of productive land and assets	<ul style="list-style-type: none"> • An Abbreviated RAP study shall be undertaken prior to commencement of the project in order to compensate the project affected persons. 	Cost to be captured in the Abbreviated RAP report
Loss of flora and habitat for avifauna	<ul style="list-style-type: none"> • Construction zone limits should be identified and physically marked, to avoid or minimize unnecessary damage of existing vegetation • Where clearance of vegetation is unavoidable, incorporate landscaping with local tree species and plants approved by KFS. 	163,000 (Landscaping at 15,900/- per ha for ~ 10.2 ha to be cleared of vegetation)
Noise and vibrations pollution	<ul style="list-style-type: none"> • Noise levels at the construction site boundary should be kept within acceptable limits of 60 dB(A) during the day and 35 dB(A) during the night as stipulated in the EMCA (Noise & Excessive Vibration Pollution) (Control) Regulations, 2009; • Workers to use ear plugs for noisy operations; • Regular maintenance of equipment; and • Noisy operation to be scheduled outside school learning hours. 	50,000 (Ear muffs for approx. 50 workers) Mitigation guidelines to be included in the contractor's contract document
Air pollution by dust and greenhouse gases	<ul style="list-style-type: none"> • Stabilize unpaved access roads, parking areas and staging areas at construction sites by soil compacting, and regular sprinkling of water to reduce on dust; • Minimizing number of motorised vehicles in use and number of trips through a traffic management plan; • Construction vehicles should adhere to speed limits within construction roads to prevent raising dust. 	3,000 per day (for sprinkling water from a 5,000 L water bowser to reduce dust)
Spread of HIV / AIDS and STI related diseases	<ul style="list-style-type: none"> • Awareness campaigns on HIV/AIDS and STIs; • Provision of condoms to the workforce; and • As much as possible, unskilled labour to be recruited from the project area. 	No additional cost (4,000,000 as per BoQ, Bill No. 1)
Solid and liquid/sewage waste disposal	<ul style="list-style-type: none"> • Contractor to put in place well labelled solid waste segregation bins and ensure final disposal of the waste stream at designated dump sites • Provision of appropriate sanitation facilities for use by workers. and • Sale of waste such as cartons and cement bags to waste paper recyclers. 	130,000 (5 garbage bins of 1100 L capacity) + 10,000 p.m for solid waste collection 600,000 (10 High Density Polyethelene portable toilets @ 60,000) + 20,000 p.m. for exhaustor services
Occupational and public health and safety	<ul style="list-style-type: none"> • Contractor to implement requirements of Occupational Safety and Health Act 2007 including provision of personal protective equipment (PPE), and carrying out frequent toolbox talks and safety trainings for workers. 	1,824,000
Security	<ul style="list-style-type: none"> • The project site should be enclosed using suitable walls with 24-hour security guards to beef-up security and to control movement in and out of the site. 	No additional cost (captured in BoQ)
Employment opportunities	<ul style="list-style-type: none"> • The contractor should as much as possible hire the local unskilled labour • At end of construction phase, the contractor should notify the employees in advance on the project closure date and adequately compensate them; and • Dismissal procedures to be compliant with 	Mitigation guidelines to be included in the contractor's contract document

	Employment Act, 2007;	
Noise and air pollution from decommissioning of the contractor's camp	<ul style="list-style-type: none"> • Schedule noisy activities during the day time period; • Use silencers on machines where possible; • Maintenance of machinery so as to reduce noise; • Practice dust management techniques, including watering down during drier period; • Set up dust barriers/ screens at strategic locations; • Provide and enforce the appropriate use of PPE against dust. 	As a per decommissioning plan to be independently prepared by the contractor and agreed by the client and supervising consultant
Operation Phase		
Contamination of the water source	<ul style="list-style-type: none"> • Continuous monitoring of water treatment effluent to ensure adherence to the EMCA (Water Quality) Regulations, 2006 and EMCA (Waste Management) Regulations, 2006; • Notification of downstream community in case of unprecedented overflow of wastes from water treatment sludge lagoons. A communication protocol should be developed for this. 	• 1,200,000 per year (for quarterly water sampling and analysis of the source river water)
Noise pollution	<ul style="list-style-type: none"> • Suitable mounting is done at the installation stage incorporating noise and vibration abatement; and • Generators to be equipped with standard noise attenuation features including silencers or lagging materials or specially designed acoustic enclosures; 	• No additional cost
Air pollution from operation of generators	<ul style="list-style-type: none"> • Regular inspection and maintenance of installed generators according to manufacturer's specifications; • Regular servicing of generators; and • Proper ventilation of generator room(s) to safeguard health and safety of operation and maintenance staff. 	• No additional cost
Occupational safety and health risks (i.e. exposure to chemicals and electricity hazards) on staff that will be working at the water treatment plant	<ul style="list-style-type: none"> • Provision of appropriate personal protective equipment (PPEs) for the operation & maintenance staff including safety glasses, hard hats, safety shoes, insulating (rubber) gloves with leather protectors, insulating sleeves, and flame-resistant clothing. • Scheduled staff training on handling of hazardous chemicals, tool box talks, and general health and safety training as per Occupational Safety & Health Act, 2007 	• 144,000 yearly (supposing 7 staff i.e. operations, maintenance, supervision, clerical, laboratory, yard work)

The monitoring plan for the implementation of the ESMP revolves around three fronts, namely:

- Physical environment
 - Noise and air quality of the project site;
 - Surface water quality at intakes and receiving waters;
 - Solid and liquid waste management;
- Biological environment
 - Rehabilitation of work sites (landscaping);
- Social-economic environment
 - Implementation of the resettlement action plan;
 - Occupational and community health and safety, including HIV/AIDS and STIs awareness campaigns; and
 - Efficiency at water treatment works once operational

The proponents, CRVWWDA and LVSWWDA are staffed by environmental experts who will oversee the mainstreaming environmental and social sustainability of the project, supervising ESMP implementation by the contractor and responsible for monitoring during project's operation. For closer supervision of the construction ESMP, the supervision consultant shall also be required to have an environmentalist to oversee ESMP implementation by the contractor and periodically report to the CRVWWDA.

Conclusion

The development of the proposed water supply project for Kilgoris and Lolgorian is necessary as its implementation will significantly improve access to clean water by the beneficiaries. The current water supply available for the town is far from adequate to meet the existing demand. Therefore, this project will lead to overall improved level of sanitation and health as a result reduced occurrence of water and sanitation related diseases for both towns.

The envisaged loss of land has been minimised by the design as much as possible by ensuring that the proposed project pipeline shall be aligned within the existing road reserve as much as is feasible.

This being a water abstraction project, it is important that the water abstracted does not significantly affect community and ecological functions of the river downstream the intake site. The minimum flow recorded for Mogor River is in the range of 2,592 m³/day. A design flow of 1,100 m³/day has conservatively been considered, which is lower than the minimum ever recorded flow for Mogor River. This will ensure that the project does not interfere with the ecological functions and flow requirements for the river. As informed by WRA, there are no current recorded/licensed downstream users.

In conclusion, the Project should comply with all local laws and regulations, which seek to ensure that the construction work does not adversely affect the environment and social resources. Any adverse impacts that may arise will be mitigated on an on-going basis through the ESMP proposed in this report. At the operation phase, the monitoring plan shall ensure the project complies with the best environmental practices.

Given the identified threats to the catchment of the target river and close link between sustainable river water supply and the catchment area status, it is also recommended that CRVWWDA liaises with other government agencies including Kenya Forest Service (KFS) and NEMA as well as local riparian communities in promoting catchment conservation measures.

1 INTRODUCTION

1.1 Project Background

The Government of Kenya (GoK) has received financing from the African Development Bank (AfDB) under the Kenya Sustainable Water Supply and Sanitation Programme. Part of the proceeds have been intended for the preparation of tender documents for the Design & Build and supervision of works for Nandi Hills, Kilgoris and Lolgorian Water Supply and Sanitation projects to enhance supply systems and augment water supply in the three towns. The project towns have been clustered into two: Lot1-Nandi Hills Water Supply and Sanitation; and Lot 2 - Kilgoris and Lolgorian Water Supply and Sanitation Project. This Report only covers Lot 2. Central Rift Valley Water Works Development Agency (CRVWWDA) (formerly Rift Valley Water Services Board) on behalf of Lake Victoria South Water Works Development Agency (LVSWWDA) (formerly Lake Victoria South Water Services Board), is the implementing agency responsible for the designs including ESIA reports.

The existing water supply schemes for Kilgoris and Lolgorian were constructed in the 1980s and 1960s, respectively. The design capacity for the 1980s water supply for Kilgoris is 480m³/day but currently the average daily water production is around 300m³/day which is insufficient compared to the total water demand of about 841 m³/day. Lolgorian town is currently served by boreholes (2 No.) drilled within the town, after the 1960s surface water from Olondome River was abandoned due to existence of heavy metals from nearby gold mine industry. The rationale of the project is founded on the realization that water supply to the two towns urgently requires rehabilitation and augmentation to spur economic growth and avoid the cycle of rationing:

- In Kilgoris, the current water services coverage is estimated at 42.86 percent since the current production is estimated at 300m³/day against a demand of about 700m³/day;
- In Lolgorian town, the current water services coverage is estimated at 1.4 percent since the current production is estimated at 6m³/day against a demand of about 434m³/day;

The service objectives are to deliver a supply of potable water complying with the World Health Organization's 2006 Guidelines for Drinking Water Quality and Kenya Drinking Water Quality Standards KS-1996 as follows:

- Water supply 24 hours per day, seven days per week;
- Water supply at a minimum pressure of 15m in all areas;
- Water supply at a minimum pressure of 10m and a maximum of 25m at communal water points;
- Water treatment to meet WHO guidelines.

In 2017, GIBB Africa Ltd. was commissioned by Central Rift Valley Water Works Development Agency (CRVWWDA) on behalf of Lake Victoria South Water Works Development Agency (LVSWWDA) to review and update existing designs (including ESIA) finalized in 2016. The existing ESIA project report for the Kilgoris - Lolgorian Water Supply System was prepared by CAS Consultants Ltd. and completed in May 2016. Following review of the existing ESIA report and designs, the following new project components were identified which had not been considered in the previous ESIA studies:

- Identification of a new site for water intake (Mogor River);
- Identification of a new site for the new water storage tank;
- Identification of alignment for the proposed rising main to the New water storage tank.

Moreover, supplemental studies have been carried out as part of updating the ESIA. This ESIA Study Report has been prepared in accordance with the Environmental Management and Coordination Act 1999 and (Amendment) Act, 2015. The Second Schedule of the Act categorises the nature of this project under the High-risk. It is therefore a requirement by National Environmental Management Authority (NEMA) as per the Environmental (Impact Assessment and Audit) (amendment) regulations 2019 that such projects undergo an ESIA Study and the study report submitted to NEMA for review and approval before implementation of the project.

1.2 Objectives of the ESIA Study

The main objectives of this ESIA Study are to update the existing (2016) ESIA Report through:

- Review and update of all potential significant adverse environmental and social impacts of the proposed project and recommend measures for mitigation measures given that there were some design changes to the preliminary design against which the initial ESIA was conducted;
 - Undertake supplemental studies and update of baseline data on the bio-physical and socio-economic environment within the project area to inform both the impact assessment, proposed mitigation measures and plans and eventually to inform the monitoring and evaluation program through-out the project cycle;
 - Preparation of an ESIA Study Report in compliance with the Environmental Management and Coordination (EMCA) (Amendment) Act, 2015 and its regulations including the Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2016; and
 - Apply for renewal (variation) of existing EIA license with NEMA in liaison with client.
-

1.3 Project location

1.3.1 Kilgoris Town and its Environs

The project area is in Narok County, Kenya which is situated in the southern part of the Great Rift Valley. Narok borders the Republic of Tanzania to the South, Migori and Kisii Counties to the west, Bomet and Nakuru counties to the North and Kajiado County to the East. It lies between latitudes 0° 27' and 20 7'South and Longitudes 34° 35' and 360 East. It covers an area of 17,921km² with a population of 850,920 people. The project area lies in Transmara west sub-county, Kilgoris Constituency and in Kilgoris town. The town is located west of Narok town and south-east of Kisii town. It is the headquarters of Transmara west sub-county. The town's geographical coordinates are 1° 0' 0" South, 34° 53' 0" East at an elevation of about 1780m above sea level. The project area, covering the distribution network in Kilgoris town, is located in Lepulosi sub-location in Ololchani location.

1.3.2 Lolgorian Town and its Environs

Lolgorian town (Lolgorian division) is located in Kilgoris Constituency, Trans Mara West Sub-County in Narok County, Kenya. The town is situated in the Rift Valley, and its geographical coordinates are 1° 14' 0" South, 34° 48' 0" East. The town is located on sloping terrain with a peak at Kilima Pesa at an altitude 1,616masl to Olondome River at 1,587masl.

Lolgorian is linked to Kilgoris through an all-weather gravel road, a distance of about 31km. The project area where the distribution network is proposed to be laid is located in Moyoi location.

The main facilities to be constructed are located in the coordinates shown below:

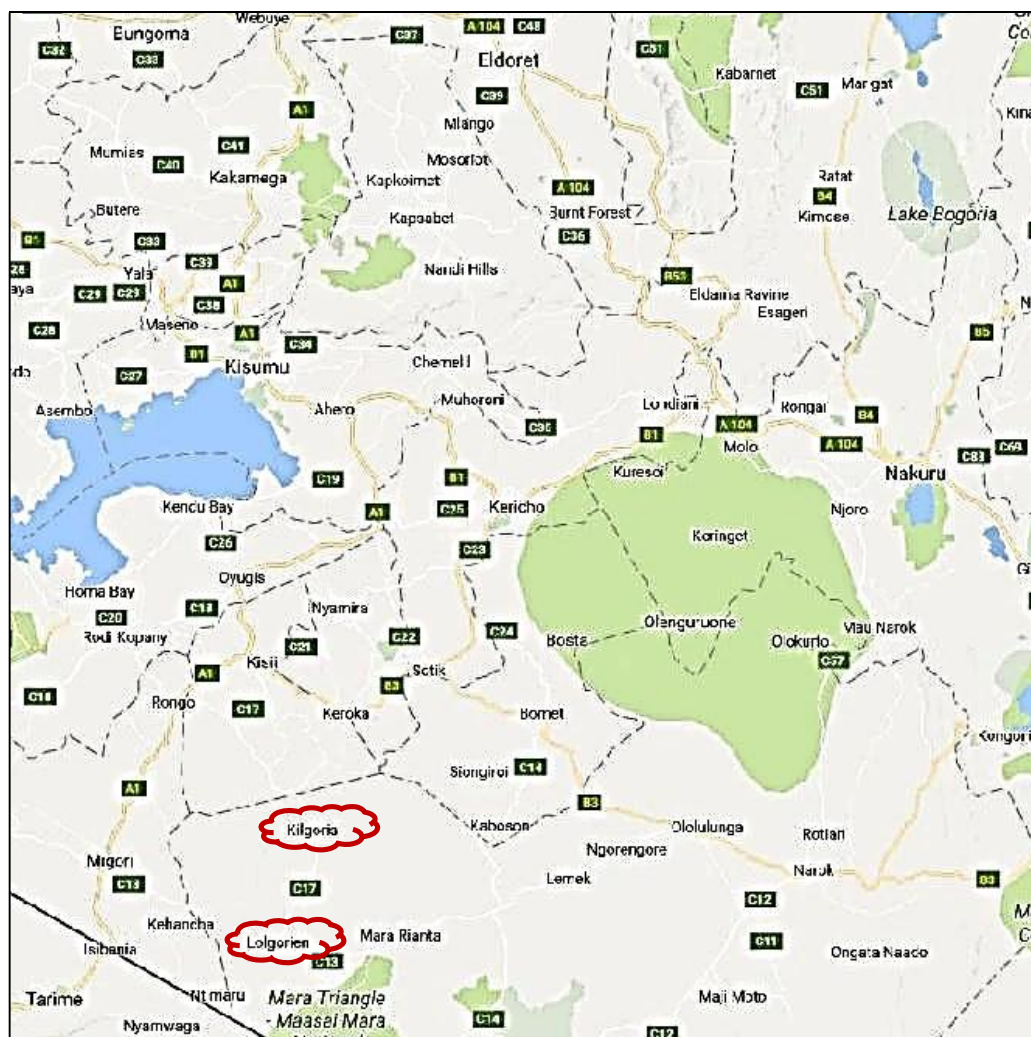
Main Facilities	UTM Coordinates	
	East	North
Intake at Mogor River and water treatment plant	714316	9877796
Reservoir next to Intimigom Primary School	710119	9884726

The project covers two towns both found in Transmara west Sub-County. The project components are located in different administrative units within the subcounty. The summary is tabulated as follows:

Project component	Sublocation	Location
Intake	Esoit Naibor	Olomisimis
Raw water rising mains	Olomisimis	
Treatment plant	Olosentu	
Treated water rising mains to the reservoir at Intimigom Primary School	Olosentu	
Treated water mains to Kilgoris town	Olomisimis	
	Olborsoito	
Treated water mains to Lolgorian town	Olosentu	Oololchani
Distribution network in Kilgoris town	Lepolosi and Nakuiyan	
Distribution network in Lolgorian town	Lolgorian	

The locations of the project towns are as presented in Figure 1-1 below

Figure 1-1: Location of Kilgoris and Lolgorian



1.4 Project Justification

1.4.1 Existing Water Supply System in Kilgoris Town and its Environs

The water supply for Kilgoris town is managed by Narok Water and Sanitation Company (NARWASCO). The existing Water Supply scheme in Kilgoris was constructed in the 1980s. The system serves Kilgoris Town with an area of about 10.8km² with a total network length of about 12km long. Surface water is the main source for Kilgoris Town.

The existing water supply facilities comprise of the following:

- An intake on Enkare oo Nkituak River (also known as Langata Ngima) is as shown in photo plate 2-1 below;
- Pump house that houses 3 No. raw water pumps. The reported pump capacity is 16m³/hr against a head of 20m. Originally the pumps were operated on two duty and one standby basis. However, over the years due to wear and tear and lack of regular maintenance or replacement, one of the pumps is not operational. The supply now relies on only one pump, which if operated for 20 hours would deliver only 320m³/day of raw water to the treatment Plant thus affecting water supply to the town;
- From the treatment units, water is lifted via a uPVC pipe of DN 100mm over a distance of 1.6 km to a storage tank
- DN 100 mm raw water pipeline, 75 m long;
- 50m³ treated water pump sump;
- Distribution network pipes range in size from DN 50 mm to DN 150 mm of uPVC
- Kilgoris main reservoir storage is located along the C17 Road at an elevation of 1850masl, about 300m from Kilgoris Boys Secondary School. The reservoir comprises of the three interconnected masonry tanks with a total volume of 300 m³ (capacities are 225m³, 50m³ and 25m³) at different elevations. Currently only the 225m³ is operational.
- Kilgoris lacks a faecal sludge management system. Traditional pit latrines serve majority of households majority (80%) but a few residents use septic tanks.
- High lift pump house that houses 3 no. pumps. Originally three pumps with a duty of 17m³/hr against a head of 160 m had been installed to operate on two duty and one standby basis. However, these pumps are old and dilapidated and were abandoned. Another pump was procured with a duty of 45 m³/hr against a head of 204.8 m, which is different from the original pumps, that is now being used to pump water to the storage tanks in town;
- DN 100mm uPVC rising main to the storage tank spanning 1.6 km from the Treatment Plant.



Photo-plate 1-1: Intake on Langata Ngima River



Photo-plate 1-2: Raw Water Pumps



Photo-plate 1-3: Existing Conventional Treatment Plant



Photo-plate 1-4: Configuration of the existing high lift vertical mounted pumps

1.4.2 Challenges facing the Existing Water Supply Situation at Kilgoris Town

The current intake site for Kilgoris water supply is at *Langata Ngima* River (also known as *Enkare oo Nkituak* or *Enkangatue*). The water is directed to a conventional treatment works with a design capacity of 480 m³/day but currently, the average daily water production is around 300m³/day. This is due to inefficient equipment since out of the three high lift pump sets of 17m³/hour, only two are in operational and one is dismantled. Since the current yield of 300m³/day from the existing treatment plant is not enough to meet the current water demand of 841m³/day, it is important to implement the necessary improvement works at the treatment plant so as to meet its targeted capacity of 480m³/day.

From engineering perspective, the following challenges are facing the existing water supply system:

- Some of the infrastructure facilities are dilapidated and the whole system has inadequate capacity to meet the current and future water demand;
- The existing water abstraction from river *Langata Ngima* is inadequate;
- Consumer connections on the rising main that affect the pumping system. The working point for a fixed speed pump would shift from its optimal point (BEP) to non-efficient working points due to variations in demand in the distribution system and therefore result in power wastage. Pumping to a reservoir ensures that this scenario does not occur as the pump would be working to a constant head and therefore flow;
- Poor repairs on the old rising main, i.e. low pressure rated uPVC pipes are normally installed leading to frequent bursts;
- Siltation problem at the existing intake was observed which is mainly caused by poor protection of the catchment area;
- Pump houses are in a bad state and would require rehabilitation;
- The available storage in the system is inadequate. Therefore, additional storage reservoirs would be required for the current planning period;
- The Diesel generator is completely rundown and will require a replacement; and
- There is much need for a billing system for the water provider to generate the much-needed revenues for economic viability of the water supply.

1.4.3 Existing Water Supply System in Lolgorian Town

The first water supply system for Lolgorian town was constructed in the 1960s. The water source was surface water from Olondome River which has since been abandoned due to heavy metals pollution caused by the gold mining operations at Kilimapesa.

The current water source for Lolgorian town is groundwater. The water supply system of the town consists of two boreholes and two masonry storage tanks with capacities of 25 m³ and 180 m³. Although the boreholes were developed by Lake Victoria South Water Works Development Agency (LVSWDA), one of the boreholes is located in private land and as at the time of preparing this report, the borehole was being operated privately and remained contentious.

The public borehole which is operated by NARWASCO has a depth of 68m with 150mm diameter casing and has a yield of about 3.5 m³/hr. Water is pumped from this borehole to the 25 m³ tank through a DN 50mm GI pipe from where it is distributed by gravity to the town. Apart from a few individual connections on the gravity main, water is mainly drawn by the residents at water kiosks located in the town. The overall system was intended to serve a population of 3,383 in year 2015. The current production is however insufficient to meet the current demand.

From the observations made during the study field visits, there was intermittent piped water supply to Lolgorian town due to lack of financing to fuel the generator that runs the borehole pump. The pump is only operated when an individual person in need of the service provides fuel for the generator. As a result of this situation, averagely the borehole is only operated once a week.

Figure 1-2: Existing Borehole and Generator Room



Within the town, Transmara Hospital has its own borehole that supplies water for hospital operations. During the site visit the study team interviewed the operating staff and was informed that the borehole had a depth of 54m and an estimated discharge of 8m³/hr.

1.4.4 Challenges facing the Existing Water Supply and Facilities at Lolgorian

From engineering perspective, the following challenges are facing the existing water supply system:

- Inadequate water supply to the town that currently relies on only one borehole of an average safe yield of 63m³/day) while the current demand is 434m³/day;
- Old and dilapidated pipe network, which does not cover most of the town areas;
- Lack of funding for operating the borehole, especially supply of fuel for the generator;
- Lack of institutional capacity to operate and maintain the water supply system; and
- One of the existing boreholes is located in a private compound and thus restricting access for public use.

In view of the above, the existing water supply system requires not only rehabilitation but also expansion since it is unable to meet the current water demand, hence the need for the project.

From existing reports, the other problems affecting water supply at Lolgorian Town are summarised as follows:

- There is no identified Water Service Provider who operates the Supply;
- Inadequate water supply facilities compared to the water requirements in the town;
- During the dry season the yield from the one borehole serving the town reduces drastically;
- The little water that may be supplied is not metered as there are no meters and people are charged flat rate;

- The existing distribution system, which comprises of GI and uPVC pipes of sizes ranging from DN 37.5 to DN 125 mm, is old and dilapidated thus causing water losses due to leakages; and
- Due to lack of water, the residents have resorted to fetching water from traditional sources especially shallow wells located in the town, which are unsafe, especially during rainfall.

1.4.5 Existing Waste Water Treatment Facilities for Kilgoris and Lolgorian towns

- Kilgoris and Lolgorian towns lack faecal sludge management systems. Traditional pit latrines serve majority of households (80%) but a few residents use septic tanks.

The current sanitation systems are faced with the following problems:

- There is no waste disposal point in the town; the town residents normally hire vehicles for collecting waste when toilets are full or use other methods like abandoning the toilets when full;
- No cesspit emptier vehicle in the Town (Kilgoris –Lolgorian);
- The Pit latrines have the potential to pollute the shallow individual wells which are sunk close to the latrines. The wells are a major source of water for Lolgorian town residents.

1.5 Study Methodology

In order to meet the study objectives, the study team carried out desktop studies and field studies which included field observations, baseline data collection (though consultation with key informants) and, public participation relevant to project. These activities were as follows:

1.5.1 Desktop study

The Environmental team has reviewed various specialised study reports prepared under this project. The Reports include the following:

- County Statistical Abstract - Narok County (2015) prepared by Kenya National Bureau of Statistics (KNBS);
- Environmental and social Impact Assessment Project Report for detailed design for Augmentation of existing Water Supplies in the towns of Kilgoris-Lolgorian, Narok County, prepared by CAS Consultants Ltd., dated May 2016;
- Exploring Kenya's Inequality: *Pulling Apart or Pooling Together?* Prepared for the Narok County in 2013 by Kenya National Bureau of Statistics (KNBS) and Society for International Development (SID);
- Final Conceptual Design Report for Kilgoris Town prepared by GIBB Africa Dated November 2018;
- Final Conceptual Design Report for Lolgorian Town prepared by GIBB Africa Dated November 2018;
- Final Pre-feasibility/Identification Report, prepared by WEMA Consult (T) Ltd for the USAID, dated September 2015.
- Layout map showing the present water supply and distribution pipework, including that installed in 2016;
- Narok County Integrated Development Plan (2013 – 2017), prepared by the County Government of Narok;
- Preliminary Design Report for Rehabilitation and Augmentation of Existing Water Supply in Kilgoris Town, dated June 2016, prepared by Director, Water, Sewerage and Sanitation Development in the Ministry of Water and Irrigation;
- Preliminary Design Report for Rehabilitation and Augmentation of Existing Water Supply in Lolgorian Town, dated 06/6/2016, prepared by Director,
- The 2009 and 2019 Kenya Population and Housing Census Report from Kenya

- National Bureau of Statistics;
- Revised conceptual design report for Kilgoris town, prepared by GIBB Africa, July 2018;
- Revised conceptual design report for Lolgorian town, prepared by GIBB Africa, July 2018;
- Site layout plans;
- Final detailed design Report for Kilgoris and Lolgorian Water supply and sanitation project, prepared by GIBB Africa, December 2019; and
- Various legal documents pertinent to the project.

1.5.2 Field Study

A reconnaissance field visit to the towns was carried out on 15 November 2017. The field visit was led by the District Water Officer who briefed the ESIA team on the status of the water supply system. A field study was conducted from 4 June 2018 to 8 June 2018 to evaluate the types, mode of action and magnitude of the specific projected effects and impacts, both favourable and detrimental to the physical, biological and socio-economic environment. Additional field work was conducted between 25 February and 8 March 2019 following revision of design (intake and transmission line) after completion of the original draft ESIA report. The activities carried out during this field work included:

- Field inspections;
- Public participation;
- River water sampling and analysis; and
- Baseline data collection.

The study tools applied during the field study are:

- Field observations;
- Public meetings; and
- Key informant interviews.

(a) Field Observations

During the field study, a site survey was conducted along the proposed site and its environs and involved the following:

- Participatory transect walks with key informants from the project area;
- Site observations including photographs to record and document existing site conditions.

A participatory site appreciation was also conducted with Mr Mutinda who is the Sub County Water Officer; Mr OleNgeto who is the Ward Administrator for Olomisimis, Mr Kirua who is the area Assistant Chief of Olesentu Sub-location in Olomisimis Location, and an area village elder. Those same officers provided secondary data utilised in the baseline profile as key informants to this report.

Site observations were done in order to appreciate the site in relation to the project as well as to make observations on what potential environmental and social impacts could arise given the proposed project's activities against the backdrop of the proposed project site and environs. The specific areas of observation were: Flora, fauna, socioeconomic activities, water use etc.

Based on the site visit and discussions held with the project team, observations relevant to the project and which could influence the ESIA were identified.

(b) Public Participation Meetings

The main purpose of the public meetings undertaken during the ESIA study was to disclose the proposed project and document the perceived Environmental and Social impacts in the project area and general attitude towards the project based on the proposed project components.

The methodology used for undertaking the public meetings was:

- A site appreciation of the general project area and site-specific location of the proposed project to identify the primary stakeholders to be consulted within the primary project zone of influence;
- Establishing contacts with the local area Chief and his assistants through the area Ward Administrators in order to schedule dates and venues for public meetings; and
- Holding public meetings with the members of the community within the project area of influence.

Public meetings had been held with the stakeholders in 2016 and 2018. The meetings held in 2016 were conducted as part of the initial ESIA Study. The stakeholders consulted during that time were as follows:

- Host community residents of Oloolchani location where the proposed new borehole and rising mains will be located;
- Host community residents of Logorian location where the proposed new borehole and rising mains will be located;
- Project site landowners; and
- Residents from surrounding location where the proposed new Water storage reservoir will be situated.

Additional public meetings held during the Conceptual design phase

Based on the revised design following studies conducted by GIBB Engineers, additional meetings were held at Oloolchani and Logorian locations in 2018. These additional public meetings were held in order to disclose the project to the community as well as to obtain the views of the community members on the proposed project.

Four Additional public meetings were held in the project area in 2019 to inform stakeholders the revised project designs. They are as presented in the Table 1-1 below:

Table 1-1 Schedule of Public Meetings

Target Community	Location of the Meeting	No. of Attendees	Dates
Area residents of Olosentu Sublocation in Olomisimis Location where the proposed intake, raw water transmission line and water treatment works are proposed to be located.	Munge Shopping Centre in Olosentu Sublocation.	41	26/02/2019
Area residents of Olomisimis Location living around Intimigom Primary School where the proposed reservoir tank in proposed to be located.	Intimigom Primary School in Olomisimis Sublocation	14	26/02/2019
Area residents of Olchamba and Siryan Villages in Olesentu sublocations in Olomisimis Location living along the proposed location for the transmission line to Logorian Town.	Olesentu Centre in Olomisimis Location	31	28/02/2019

These public consultations were documented and the records of consultation are presented within this report. See appendix 4. The records include the date and location of the consultation meetings, list of attendees and their contact addresses and finally summarized minutes. These records are supported by photographs. Notice for the meeting including the venue and the time were communicated to the public and other concerned parties two weeks prior to the meeting.

(c) River Water Sampling and Analysis

Water sampling and analysis of Mogor River and Enkare oo Nkituak River (also known as Langata Ngima) was coordinated by the water Resources Authority (WRA) through collection of grab samples from the rivers at selected points. Water parameters analyses based on NEMA, KEBS and WHO quality standards for domestic water were:

- PH
- Colour (Mg/Pt/l)
- Turbidity (N.T.U)
- Conductivity (25°C) (µS/cm)
- Calcium (mg/l)
- Magnesium (mg/l)
- Total hardness (mgCaCO3/l)
- Total Alkalinity (mgCaCO3/l)
- Chloride (mg/l)
- Fluoride (mg/l)
- Nitrate (mgNO3/l)
- Nitrite (mgNO2/l)
- Orthophosphates(mg/l)
- Total Dissolved Solids (mg/l)
- Ammonium (mg/l)
- Sulphates (mg/l)
- Iron (mg/l)
- Manganese (mg/l)
- Total coliforms (No./100 ml)
- E. coli (No./100 ml)
- Bilhazia (No./100 ml)

(d) Key Informant Interviews

Key Informant Interviews (KII's) were undertaken with County and Sub County government agencies and other institutions in the project area from Narok County as well as the constituent sub County of Transmara West. The KII's were undertaken to assist in identifying baseline conditions and in analysis of potential impacts to the community and institutions in the project area.

Additional ten Key Informant Interviews were undertaken to inform the revised design. The key stakeholders consulted included some of the stakeholders earlier consulted as well as additional new ones who were available during the study period as presented in the Table 1-2 below.

Table 1-2 Schedule of Key Informant Interviews

Title of Key Informant	role	Location	Date of interview
Water Resource Authority (WRA) - Lake Victoria South Catchment Sub-Regional Manager in charge of the water catchment for Kilgoris and Lolgorian towns	Water resource allocation and management To give feedback regarding the proposed abstraction from Mogor river.	Kisii	18/02/2018

Title of Key Informant	role	Location	Date of interview
Subcounty Water Officer for Transmara West Subcounty	To give feedback regarding the existing water situation in the project area	Kilgoris	19/02/2019
National Government Surveyor in charge of Transmara East/ West Subcounty	To give feedback concerning land adjudication, division and tenure.	Kilgoris	20/02/2019
Subcounty Administrator for Transmara West Sub County	To give feedback regarding the administrative units covered in the project area.	Kilgoris	20/02/2019
County Director of Environment-Narok County	In charge of matters environment in the County	Narok	22/02/2019
Transmara West Sub County officer in the Ministry of Agriculture, Livestock and Fisheries	To give feedback on agriculture activities in the area.	Kilgoris	27/02/2019
Transmara west Sub County Environmental officer	In charge of environmental matters within Transmara West Sub County.	Kilgoris	27/02/2019
Transmara West Sub County Fisheries Officer	To give feedback concerning the aquatic ecology of the river Mogor.	Kilgoris	27/02/2019
KFS Officer for Transmara East and West Subcounty	To give feedback on the catchment protection strategies currently being employed.	Kilgoris	28/02/2019
Deputy County Commissioners for Transmara West Sub County	Local administration	Kilgoris	26/02/2018

The agenda for all these meetings was to;

- Present the revised engineering designs to the stakeholders;
- Obtain views from the stakeholders on their concerns on environmental and socio-economic impacts of the proposed project; and
- Discuss the role of each stakeholder on the proposed project.

(e) **Assessment of Project Impacts**

An environmental impact is any change to the existing condition of the environment caused by human activity or an external influence. Impacts may be:

- Direct or indirect

Direct impacts result from a proposed action and manifest at the present time and place; while indirect impacts are caused by action that manifest at later time or occur remotely from source and are foreseeable.
- Cumulative

Impacts are termed cumulative when they add incrementally to existing impacts. In the case of the project, potential environmental impacts would arise during the construction and the operations phases of the project and at both stages positive and negative impacts would occur.

Moreover, impacts also vary with:

- Duration, that is long-term or short-term;
- Extent of their effect that is in wide-spread or local; and

- Are positive (beneficial) or negative (adverse).

(i) Impact Significance

The purpose of this ESIA Report is to identify the significant impacts related to the project or activity under consideration and then to determine the appropriate means to avoid or mitigate those which are negative.

Significant impacts are defined, not necessarily in order of importance, as being those which:

- Are subject to legislative control;
- Relate to protected areas or to historically and culturally important areas;
- Are of public concern and importance;
- Are determined as such by technically competent specialists;
- Trigger subsequent secondary impacts;
- Elevate the risk to life threatening circumstances; and
- Affect sensitive environmental factors and parameters.

(ii) Impact Identification

In this study, impacts were predicted and evaluated using acceptable standard methods of impact prediction and evaluation. Constant reference to project activities was made and scores were assigned in an assessment table in order to make an objective assessment of how each of the project activities would impact on a particular environmental and social medium. The significance of impacts is subjective, but the value judgments required were best arrived at by use of several approaches to establish the potential impacts from the proposed project activities.

(f) Preparation of an ESMP and ESMoP

The Environmental and Social Management Plan (ESMP) was developed to demonstrate how site-specific concerns and mitigation measures are to be addressed during construction and operation of the proposed project development activities. The ESMP has been developed with project knowledge and information available to date. The impacts originating from the project road development (construction, operation and decommissioning phases) have been identified. To ensure that the negative environmental impacts can be controlled and mitigated effectively, a thorough scientific management and monitoring plan has been prepared. This will ensure that all the targets are achieved and that the environmental responsibilities and obligations of ESIA are met during project implementation. As a progressive approach, components of the ESMP may require updating throughout the initiation and scheduling of plans for the project.

The Environmental and Social Monitoring Plan (ESMoP) is prepared with an objective of monitoring to ensure that mitigation measures in the ESMP are implemented and that they are effective. Environmental and social monitoring also enables response to new and developing issues of concern.

1.5.3 Constraints and Limitations

This report presents information that is generally consistent with the data and information gathered through various sources and approaches mentioned above.

Some of the project's infrastructure is located in remote areas with no existing accesses and across long distances, in some instances the ESIA team had to trespass private land in search of the proposed sites. However, through engagement of local administration, the area residents from those locations were identified and invited to attend the public meeting.

1.6 Structure of the Report

This report has been prepared under the following sections and chapters:

Executive

Summary: This section presents a brief of the water and sanitation project, summary of the significant findings, expected environmental and social impacts, and recommendations and conclusions from public participation and stakeholder consultations.

Chapter 1: **Introduction:** This chapter gives description of the project background, Project objectives, scope of the report, project location and justification, objectives of the ESIA Study, study methodology and the structure of the report.

Chapter 2: **Project Description:** This chapter gives a description of the status of the project in the project cycle, specifically during construction, operation and decommissioning.

Chapter 3 **Policy, Legal, and Regulatory Framework:** This chapter outlines the overview of legislative framework, regulatory, international guidelines and conventions relevant to this project.

Chapter 4: **Description of the Baseline Environment:** This chapter gives description of the environmental setting of proposed project and surrounding areas, e.g., climate, soils, geology, hydrogeology, flora, fauna, land use, human populations, socio-economic and cultural heritage.

Chapter 5: **Analysis of Project Alternatives:** This chapter gives a description of the project details of the proposed project, alternative options, designs and implementation strategies.

Chapter 6: **Stakeholder Consultation and Public Participation:** This chapter gives description of the objectives, methods used and summary of results of the public consultation activities.

Chapter 7: **Identification and Assessment of Potential Impacts:** This chapter presents the analysis of beneficial and adverse impacts of the project on the biophysical and human (social, cultural and economic) environments. The analysis covers anticipated impacts during the construction, operation phases and decommissioning phases and also describes the enhancement and mitigation measures proposed to enhance benefits or prevent, minimize, mitigate or compensate for adverse impacts.

Chapter 8: **Environmental and Social Management Plan:** This chapter presents the preliminary Environmental and Social Management and Monitoring Plan prepared for the project.

Chapter 9: **Conclusion:** The conclusion briefly presents the environmental and social acceptability of the project, taking into account the impacts and measures identified during the assessment process.

Appendices: This section presents supplementary documents to the report including records of consultations and results of river water analysis.

2 PROJECT DESCRIPTION

2.1 General Layout of the Proposed Water Supply and Sanitation System

The proposed water supply system targets to meet the projected water demand for both Kilgoris and Lolgorian towns. To achieve the desired water supply, the conceptual design considered new water source to supplement existing water supply from Langata Ngima River (for Kilgoris) and Boreholes (for Lolgorian). This ESIA is based on detailed Engineering designs for developing a new water supply network with an intake at Mogor River (with a throughput capacity of 1,800 m³/day), a sump, water treatment works and reservoir tank. From the reservoir tank (a 500m³ tank at Intimigom Primary School, Olomisimis Location), the water will be pumped to distributions tanks at Kilgoris and Lolgorian towns. Therefore, water from Mogor intake will be shared by both Kilgoris and Lolgorian towns.

Considering the projected water demands for Kilgoris and Lolgorian, there are other engineering works that have been proposed to augment the water supply of the designed project. However, they will not be implemented under the current project and therefore, this ESIA Report does not cover the works. These include:

- Rehabilitation of the existing water supply system at Kilgoris that has an intake from Langata Ngima River. The treatment works has a design capacity of 480m³/day but current daily production averages only 300m³/day. This system will only serve Kilgoris town and its environs as supplement water supply from Mogor Intake.
- Rehabilitation of borehole (1 No.) and drilling new boreholes (3 No.) at Lolgorian to augment water supply at the Lolgorian town. The boreholes will have a capacity of 280m³/day. The proposed boreholes will require independent ESIA undertaken as per legal requirements.

2.2 Projected Water Demand

2.2.1 Kilgoris Town

Water demand projections were generated from extrapolation of population growth up to the year 2040 at 3.9% growth rate, using the last population census figures for the year 2009. Further, the population growth data was differentiated into core-urban and peri-urban based on Town data (presented in Table 3 of the 2009 Kenya Population and Housing Census Report [Population Distribution by Sex in Urban Centres and Status of Centre]). The resulting population projections made are presented in Table 2-1 and Table 2-2 below.

Table 2-1: Previous population projections for Kilgoris Town

Sub-county	Division	Location	Sub-location	Year 2009 Pop	Adapted Growth rate (%)	Projected Population			
						Initial, 2015	Short-term 2020	Long-term, 2025	Ultimate 2035
Trans Mara	Kilgoris	Ololchani	Lepolosi	8,673	3.9	10,890	13,165	15,914	23,257
			Nakuinyan	3,363	3.9	4,223	5,105	6,171	9,018
				12,036	3.9	15,113	18,269	22,085	32,275

Source: (Final Conceptual Design Report for Kilgoris town: November 2018)

Table 2-2: Revised population projections for Kilgoris Town

Type Settlement	of	2009 (census)	Current 2017	Initial Year 2020	Year 2025	Future Year 2030	Year 2035	Ultimate Year 2040
Core-Urban		9,865	12,411	15,027	18,195	22,030	26,675	32,298
Peri-Urban		0	0	0	0	0	0	0
Total		9,865	12,411	15,027	18,195	22,030	26,675	32,298

Source: Final detailed design for Kilgoris and Lolgorian water supply and sanitation project, 2019

The revised population projections were then used to generate water demand projections for the design of the proposed project as presented in Table 2-3 below.

Table 2-3: Total water demand for Kilgoris town

	Net Water Demand, m ³ /day			
	2017	Initial, 2020	Future 2030	Ultimate 2040
Domestic Water Demand	551	667	1,084	1,744
Commercial water demand	86	104	152	223
Institutional water demand	159	192	282	413
Livestock Water Demand	45	45	45	45
Total Water Demand, m³/day	841	1,008	1,563	2,425

Source: Final detailed design for Kilgoris and Lolgorian water supply and sanitation project, 2019

2.2.2 Lolgorian Town

Similar to Kilgoris Town, the water demand projection for the Lolgorian town was extrapolated from the population growth figures presented in Table 3 of the 2009 Kenya Population and Housing Census Report (Population Distribution by Sex in Urban Centres and Status of Centre). The resulting population projections made are presented in Table 2-4 and Table 2-5 below.

Table 2-4: Revised population projections for Lolgorian Town

Type Settlement	of	2009 (census)	Current 2017	Initial Year 2020	Year 2025	Future Year 2030	Year 2035	Ultimate Year 2040
Core – urban		2,689*	3,652	4,096	4,773	6005	7,271	8,804
Peri-urban		-	-	-	-	-	-	-
Total		2,689	3,652	4,096	4,773	6005	7,271	8,804

* 2009 Kenya Population and Housing Census Report (Population Distribution by Sex in Urban Centres and Status of Centre)

Table 2-5: Total water demand for Lolgorian town

DESIGN DEMAND	Net Water Demand, m ³ /day			
	2017	Initial, 2020	Future 2030	Ultimate 2040
Domestic Water Demand	366	411	628	959
Commercial water demand	40	45	70	96
Institutional water demand	20	22	24	30
Livestock Water Demand	10	10	10	10
Total Water Demand, m³/day	436	488	732	1,095

Source: Final detailed design for Kilgoris and Lolgorian water supply and sanitation project, 2019

2.3 Quantity and Quality Standards for the Water Supply

The system is designed to supply potable water complying with the World Health Organization's 2006 Guidelines for Drinking Water Quality and Kenya Drinking Water Quality Standards KS-1996 as follows:

- Water supply 24 hours per day, seven days per week;
- Water supply at a minimum pressure of 15m in all areas;
- Water supply at a minimum pressure of 10m and a maximum of 25m at communal water points;
- Water treatment to meet WHO guidelines.

The treated water shall meet the guide values as presented in Table 2-6 below which is a requirement by National Environmental Management Authority (NEMA) of Kenya.

Table 2-6: Total Water Quality Guidelines

Parameter	Guide Value (max allowable)
pH	6.5 – 8.5
Suspended solids	30 (mg/L)
Nitrate-NO ₃	10 (mg/L)
Ammonia –NH ₃	0.5 (mg/L)
Nitrite –NO ₂	3 (mg/L)
Total Dissolved Solids	1200 (mg/L)
Scientific name (<i>E.coli</i>)	Nil/100 ml
Fluoride	1.5 (mg/L)
Phenols	Nil (mg/L)
Arsenic	0.01 (mg/L)
Cadmium	0.01 (mg/L)
Lead	0.05 (mg/L)
Selenium	0.01 (mg/L)
Copper	0.05 (mg/L)
Zinc	1.5 (mg/L)
Alkyl benzyl sulphonates	0.5 (mg/L)
Permanganate value (PV)	1.0 (mg/L)

Nil means less than limit of detection using prescribed sampling and analytical methods and equipment as determined by the Authority.

Source: EMCA water quality regulations, 2006: Water quality standards for domestic water sources

2.4 Water Intake and Treatment Works

2.4.1 Mogor River Intake

(a) Weir

The proposed intake site is upstream of the bridge on C17 (Kilgoris – Lolgorian) Road at UTM coordinates 714316 E, 9877796 N (Zone 36S) at an approximate altitude of about 1700 m. The intake will comprise of a diversion weir, intake chamber, sluice gates, scour pipe and other appurtenances. The weir shall be designed to divert 0.023m³/sec. The proposed intake weir shall be constructed of concrete with an

approximate length of 30 m and height of 2.5 m. In addition, the weir will be provided with scour facilities, intake box screens, guard rails where required, control valves etc.

From the intake chamber, a DN 200 steel pipe, PN 10 of approximate length of 100 m is proposed to the new raw water sump to be constructed next to the new raw water pump house, fixed with silt trap strainer.

(b) Raw Water Pump system

The raw water from the intake chamber expected to be provided with three pumps sized to operate as two duty and one standby each with a capacity of 50 m³/hr against 40 m head. The work for the raw water pump house shall include but not limited to the following:

- Design and built Provision of raw water pump house with sump;
- Design and supply raw water pump and DN 200 mm steel pipe and fittings; and
- Design and Installation of pump complete including all electrical and mechanical works.

The preliminary design sizing of the raw water pumps is as follows;

- | | | |
|-----------------|---|----------------------|
| • Discharge (Q) | = | 50m ³ /hr |
| • Head | = | 40m |
| • Operation hrs | = | 20hrs |

(c) Raw Water Rising Main

This will entail installation of DN 150 steel pipe, PN10 of approximate length of 1000 m from raw water pump station up to the treatment plant.

2.4.2 Mogor Water Treatment Plant

(a) Water Treatment Plant (WTP)

The proposed water treatment plant has a throughput capacity of 1800m³/day. The proposed treatment plant shall be provided with all units including mixing chamber flocculation and sedimentation/clarifier, rapid sand filter with water wash, chemical building etc.

Other associated compound works shall include:

- GSB blocks paved access roads (Length 1200m & Width 4000m);
- PCC walkways (Length 200 m & Width1500mm);
- Drainage works based on site drainage configurations;
- Street lighting (spacing 40 m and lux 20);
- Landscaping and other miscellaneous works; and
- Fencing (Length 630 m) and gate.

The area of land required to put up the facility and the associated compound works is 2.5 acres. Currently, the land at the proposed WTP site is under private ownership.

(b) Clear Water Pump Station

The proposed pumping station shall accommodate three pumps: two to be duty and a standby. A separate generator room shall be constructed to house 225kVA standby generator. The preliminary sizing of the pumps is as follows:

- | | | |
|-----------------|---|----------------------|
| • Discharge (Q) | = | 45m ³ /hr |
| • Total head | = | 190 |
| • Operation hrs | = | 20 |

A reinforced concrete clear water tank ground reservoir (with capacity of 150m³) shall be provided at the clear water pump station.

(c) Rising Mains

The rising main shall transmit water from the proposed Mogor WTP to the proposed 500m³ service tank located at Coordinate 710119 E, 9884726 N (Intimigom Primary School) at an elevation of approximately 1885 m asl, and has the following provisional sizing:

- Assumed pumping hours = 20hrs
- Water quantity = 1800 m³/day
- Design flow = 90 m³/hr
- Length of line = 9500 m
- Pipe material = Cement lined steel
- Static head = 155m
- Optimal pipe size = 200 mm
- Pipe rating = PN 20

The proposed alignment is to be laid within the existing road's Right of Way. The road belongs to the County Government of Narok and has a width of 12 meters. The land parcels bordering the road are under private ownership. In some sections of the road, the fences bordering the parcels of land seem to have encroached into the ROW and depending on the exact location of the alignment, they may have to be cleared.

(d) Gravity mains

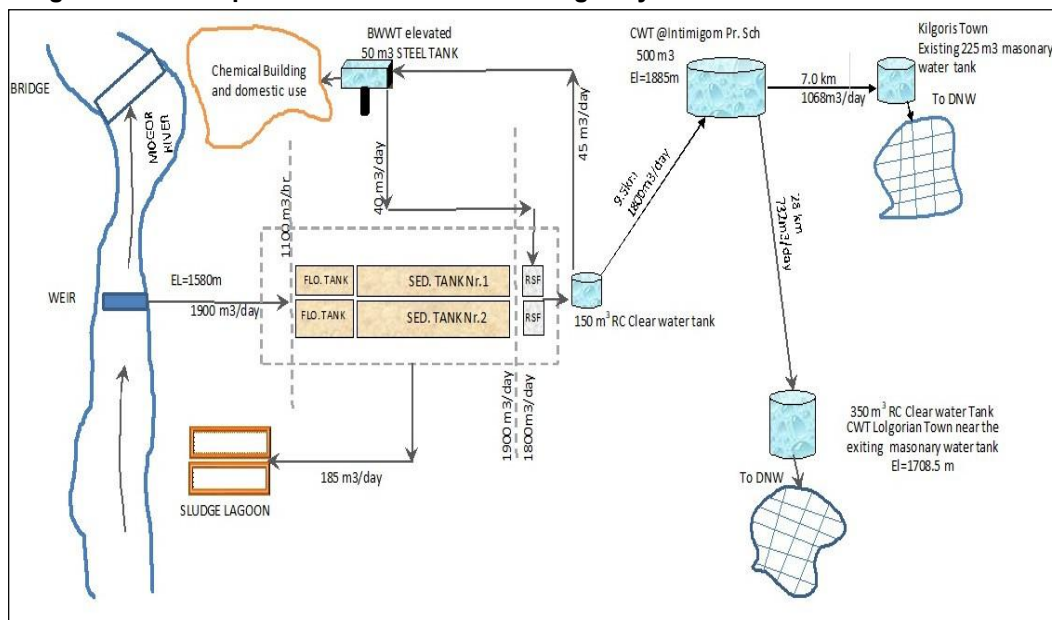
The gravity main shall transmit water from the proposed 500 m³ ground tank at Intimigom Primary School (coordinate 710119 E, 9884726 N) to Kilgoris and Lolgorian Towns. See Table 2-7.

Table 2-7: Gravity Mains

	Kilgoris	Lolgorian
Flows	1068 m ³ /day	732 m ³ /day
Total Length of line	7 km	28 km
Optimal pipe size	DN 130 mm (OD 160mm)	DN 150mm (OD 160)
Pipe pressure rating	PN 6.3 – PN 16	PN 6.3 – PN 16
Material	HDPE	HDPE

A layout of the entire system is attached as Appendix 1 of this report. In addition, a schematic for the proposed Mogor water supply system is presented in Figure 2-1 overleaf.

Figure 2-1: Simple Mass Balance of New Mogor System



2.5 Water Treatment System

The proposed full treatment works will be sized for the following:

- Maze hydraulic mixing flocculation basin;
- Chemical aided sedimentation basins;
- Rapid sand filters; and
- Contact tank.

The following chemicals were considered to be used:

- Aluminium sulphate for coagulation;
- Chlorine solution for disinfection; and
- Soda ash for pH correction.

The water treatment plant was designed with two parallel independent units capable of providing 50% operational capacity in the event that one unit is being de-sludged or is under maintenance.

As discussed in the subsections, the design took the following into consideration;

2.5.1 Flocculation

The proposed hydraulic chemical mixing shall be achieved by providing several 90° direction changes and flow velocity variation along the flocculation tanks. The velocity variation will be achieved by means of constricted slot openings at the end of the constructed parallel flow channels.

The flocculation basins are designed to satisfy the flowing criteria;

Retention time	15 minutes
Channel flow velocity	0.1 m/sec
Free board	0.5 m

Velocity through the channel slots shall vary as follows:

Velocity in First 2/3 of slots 0.5 – 0.6 m/sec
Velocity in Last 1/3 of slots 0.3 – 0.4 m/sec

2.5.2 Sedimentation

The inlet to the sedimentation tanks is designed to provide uniform distribution of influent. Entry to the tanks shall be through weep holes openings evenly distributed along the wall between the flocculation and the sedimentation basins.

The sedimentation unit was designed to provide a basic retention time of three hours and an additional 25% capacity for sludge storage.

2.5.3 Filtration

The proposed filtration process shall comprise of rapid sand filter units. The filters will have layers of supporting gravel and the sand, which will be of quartz material. Settled water from the sedimentation tanks shall enter the filters through a 600 mm wide common distribution channel structured to allow isolation of each filter unit using penstocks. The details of the filter media are as presented in Table 2-8.

Table 2-8: Supporting gravel

Layer (from bottom)	Thickness	Gravel size
First layer	15 cm	2 - 2.8 mm
Second layer	10 cm	5.6-8 mm
Third layer	10 cm	16-23 mm
Forth layer	20 cm	38-54 mm

The proposed sand properties are:

Quartz sand filter

Layer thickness 800 mm
Effective size 0.8 mm
Uniformity coefficient 1.5

The filter loading rate shall be 8m³/m²/hr. The filter sand will be placed on supporting gravel on false slabs fitted with filter nozzles of size less than 2mm openings which will transmit the filter water below the filter media. Under drain collector channels will direct the clear water to the pipe connecting to the clear water tank.

2.5.4 Backwash system

The backwash system will comprise of an elevated sectional steel tank with capacity to back wash 1-No. filter unit at a time. Air blowers will not be included in the backwash system. The backwash rate shall be taken as a minimum of 50m³/m²/hr while the washing period shall be taken as 8 minutes.

Filter drain system

During filter wash, water will enter the filter via the under-drainage system at a rate of about 0.23m³/s and will expand the sand by about 20%. Backwash water will be collected and directed to the collection channel leading to the pipe directing the water to the sludge lagoons.

2.5.5 Chemical Dosing

Gravity dosing systems which have the long-term advantage of low operational cost and less quality control measures have been proposed for all chemical dosing.

2.6 Water Transmission and Distribution

2.6.1 Lolgorian Town

(a) Pipeline Alignment

Pipelines within the planned urban areas shall be laid in road reserves. Pipelines crossing private land outside the planned urban area boundaries shall follow the property boundary.

Pipelines shall be laid in straight lines between changes in gradient and slopes shall be no less than 0.5% for diameters of <200mm and 0.2% for larger diameters.

Proposed minimum pipe covers to be used are as follows:

- Transmission mains : 900 mm
- Distribution mains : 600 mm
- Road crossing : 1,200 mm

The width of the pipe trench would generally be pipe OD + 400 mm for pipes DN100 - DN300 with a minimum of 600mm. Larger pipes, the minimum trench width will be OD+600 mm to allow for working around the pipe.

(b) Hydraulic Design of Transmission and Gravity Mains

For transmission mains maximum velocities will be limited to the following:

- 3.0 m/s for gravity mains;
- 2.0 m/s for pumped mains.

For gravity systems, the hydraulic calculations carried out considering the design pressure and maximum design pressure as defined in BS EN 805:2000.

(c) Pump Stations

Pumping stations are still at conceptual design stage but pumping systems will be fixed speed pumps. There will be at least 33% standby pumping capacity. Consideration for location and development of the pumping stations will depend on:

- Land availability;
- Power availability;
- Flooding possibility;
- Accessibility;
- Design discharge and Head requirement.

The design flows for pump installations are:

- The average day demand on source at the planning horizon for raw water pumps;
- The average day demand on storage at the planning horizon for treated water pumps delivering to a service reservoir;
- The peak hourly flow for pumps transferring water from a service reservoir to a water tower.

Standby power generation will be provided to ensure at least 100% capacity operation. These will be equipped with automatic mains failure units.

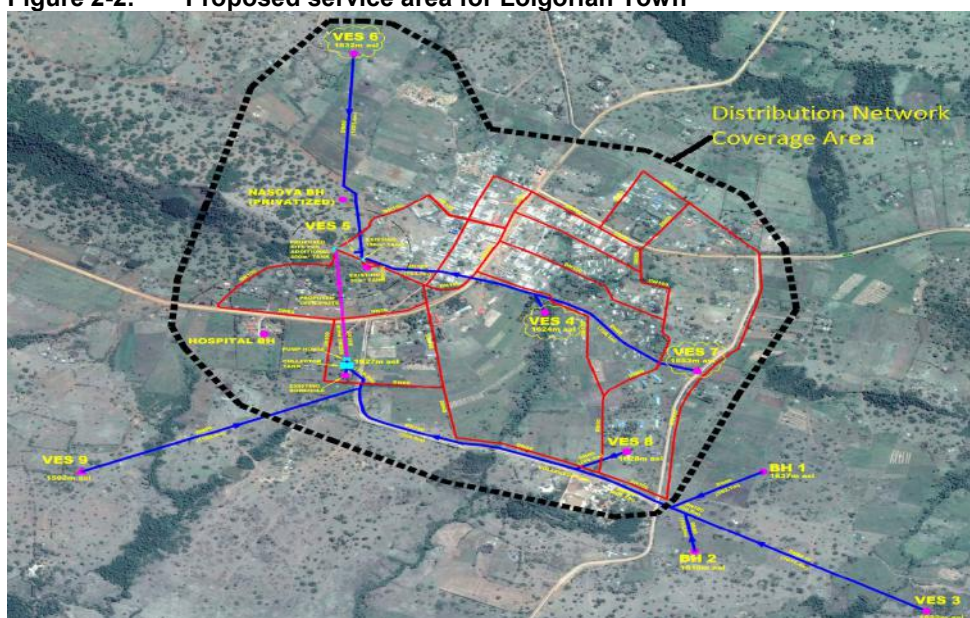
All pumping systems shall be designed for working period of 20 hours per day.

The design pressure and maximum design pressure as defined in BS EN 805:2000 will be calculated.

(d) Clear Water Distribution Network (Lolgorian)

The total clear water that can be shared and distributed after Mogor Treatment Plant (1,000 m³/day) and then augmented with borehole water of around 1,280 m³/day can sufficiently serve up to the year 2040. Depending on the total number of beneficiaries of this project reaching up to 8,804 (year 2040 population), this demand can be met. The layout of the service area is presented in Figure 2-2 below.

Figure 2-2: Proposed service area for Lolgorian Town



Accordingly, the proposed distribution system is expected to comprise of the following pipes:

- DN 200 mm HDPE, PN 10 pipes, estimated length 150 m
- DN 150 mm HDPE, PN 10 pipes, estimated length 1,300 m
- DN 100 mm HDPE, PN 10 pipes, estimated length 5,200 m
- DN 80 mm HDPE, PN 10 pipes, estimated length 3,850 m
- DN 50 mm HDPE, PN 10 pipes, estimated length 2,500 m

Regarding service storage tank the plan was to increase the existing capacity to 400 m³. The plan has been updated and will include the following:

- Construction of one new reinforced concrete tank with a capacity of 350 m³ near the existing clear water tank at about 1708 masl.
- It is planned to construct three (3) water kiosks at locations to be confirmed during implementation after consultation with local communities and the Client.

2.6.2 Kilgoris Town

(a) Rising mains to Kilgoris Town Storage Tanks

Installation of an additional new DN 150mm PN 25 cement lined steel rising main 1,650 m from clear water pump station to the main storage tank.

(b) Distribution storage

A new service water tank of RC 350 m³ capacity will be constructed at a much higher elevation than the existing tanks but within the same general area. The tank's compound will be provided with a Fence (minimum length 90 m) with gate.

With the above measures, the total service storage will be 625 m³, which is equivalent to about 12 hours supply at a production capacity of 1,250m³/day.

(c) Distribution system

(i) Distribution network

For the new distribution system, a full pipeline hydraulic modelling is to be done to reach to sizeable quantity of pipes and sizes. The new distribution pipe network sizes will range from 50mm to 160mm; the diameter and pipe classes will depend entirely on the hydraulic modelling.

Preliminary sizing of the proposed distribution network was carried out by the Consultant and the resulting pipe sizes are indicated in Table 2-9 below.

Table 2-9: Distribution pipeline system

OUTER DIAMETER(mm)	PIPE LENGTH(m)	PIPE MATERIAL	Pressure Class
180	2,000	HDPE	PN10
140	2,900	HDPE	PN10
125	4,300	HDPE	PN10
90	5,000	HDPE	PN10
63	6,200	HDPE	PN10

Maps showing the distribution networks in both Kilgoris and Lolgorian have been attached as Appendix 1 of this report.

(ii) Communal water points

To serve some of the communities within the project area, four (4) No. communal water points will be provided to meet the community water needs. The locations of these water kiosks will be identified in consultation with the local residents, and will be chosen bearing in mind the close proximity to the people they intend to serve.

The amount of water dispensed by the kiosks will vary depending on the number of residents in that area. Water meters will be installed at each of the water kiosks.

2.7 Additional Structures and Facilities Associated with the Project

- Construction of four (4) no. ablution blocks in Kilgoris Town is proposed. The locations will be confirmed after consultation with the Client and other stakeholders, but it will be based on ease of access, ground topography for proper drainage, gender preference and environmental considerations.
- Design and Build One Water Service Office 4m x 15m;

- Provision, installation of service connections pipe and fitting, distribution meters within the network system and supply of operation and maintenance tools;
- Provide for 8 No Motorbike in accordance with the specification for operation of the Water Supply service office;
- Purchase of 2 No. Four Wheel Drive Vehicle of capacity not exceeding 3000cc;
- An operation and maintenance building to house the chemical mixing and dosing units, the operation and maintenance staff, the water testing laboratory and the water treatment chemical stores has been proposed to be detailed and constructed depending on the site-specific requirements.

A general layout of the proposed buildings to be provided are attached as Appendix 1 of this report.

2.8 Project Design Standards

The design of water supply facilities shall be prepared using, but not limited to, the following design standards:

- Ministry of Water and Irrigation Practise Manual for Water Supply Services in Kenya, October 2005;
- WHO Guidelines for Drinking-Water Quality, 2006;
- Distribution Network Analysis for Water Utilities, AWWA Manual M32;
- BS EN 805:2000: Water supply – Requirements for systems and components outside buildings;
- BS EN 1507:1999: Water supply – Requirements for systems and components for the storage of water;
- CEN EN 12201-3 Plastics piping systems for water supply - Polyethylene (PE)
- EN 1295 Part 1: B 1.1.2 for pipe design;
- EN 545 for ductile iron pipes;
- BS 534, EN 10224, EN 10311 and AWWA M11 for steel pipes;
- BS 2782, BS 3505, BSCP 312, EN 921 for PVCU;
- BS 3284, EN 12201 for HDPE pipes;
- BSI BS EN 1452-5 Plastics Piping Systems for Water Supply – Unplasticized Polyvinyl Chloride (PVC-U) - Part 5: Fitness for Purpose of the System BS 8010, EN 1610 and BSCP 2010 or their equal for general pipework and installation as they are relevant to the prevailing conditions;
- Environmental Management and Co-ordination (Water Quality) Regulations, 2006.
- Other National and International accepted standards.

2.9 Proposed Project Activities

During the implementation phase of the proposed water supply and sanitation improvement works, there are different activities which will be undertaken at different stages of the project. These phases including construction phase, operation phase and the decommissioning phase.

The major activities associated with the proposed project will include but not limited to the following:

- Site clearance to pave way for excavations;
- Establishment of construction camps;
- Recruitment of the labour force; and
- Construction of water weir;
- Construction of a borehole;
- Excavations to pave way for pipe trenches;

- Rehabilitation of the existing treatment plant;
- Construction of storage tanks;
- Water abstraction procedures; and
- Piping procedures among others.

Likely wastes to be generated by the project activities have been presented in Table 2-10, below.

Table 2-10: Major Project Activities

Project phase	Major Activities	Waste Type generated
Construction	Site clearance	Vegetation including tea bushes and trees, top soil. Debris, rubble, concrete, earth, timber, mixed site clearance material
	Establishment of construction camps	
	Excavation	<ul style="list-style-type: none"> • Spoil, • Fill Material (Assorted spoil from previous civil projects nearby. Contains rocks of various sizes and soil, debris of pipes and other inert rubbish such as plastic. Not suitable for re-use on site or other projects.) • Clean sediments • Contaminated sediments
	Demolition	
	Rehabilitation of the existing treatment plant;	
	Construction of water weir and storage tanks	
	General site activities	<ul style="list-style-type: none"> • Spoil.
	Reinstatement of the land to its original state	
Decommissioning	Partial decommission and rehabilitation during the design life	<ul style="list-style-type: none"> • Spoil, • Fill Material (Assorted spoil from previous civil projects nearby. Contains rocks of various sizes and soil, debris of pipes and other inert rubbish such as plastic. Not suitable for re-use on site or other projects.) • Clean sediments • Contaminated sediments

2.10 Project Cost Estimates

The project implementation period is estimated to be 24 months with additional 12 months for defect notification. Below is a table showing the BoQ estimates exclusive of contingencies and Value Added Tax (VAT).

Table 2-11: Bill of Quantities (BoQ) Estimates

Item No.	Description	Amount (KES)
1	Preliminary and General Items	150,523,486.55
2	Intake works	37,514,900.00
3	Raw water pump house	17,138,500.00
4	Raw water rising main	12,641,535.00
5	Treatment works	23,646,409.00
6	200m ³ clear water contact tank	13,466,100.00
7	Clear water pump house	19,882,620.00
8	Clear water rising main	86,789,625.00
9	500m ³ clear water tank (Intimigom Primary School)	21,917,032.50
10	Gravity main to Kilgoris	45,085,065.00
11	Gravity main to Lolgorian	199,302,000.00

12	50m3 break pressure tank	3,833,490.00
13	200m3 clear water storage tank (Lolgorian)	11,906,100.00
14	200m3 clear water storage tank (Kilgoris)	11,936,600.00
15	Distribution network	106,553,505.00
16	Electro-mechanical works	36,245,150.00
17	Ablution blocks (4 No.)	18,384,632.29
18	Buildings	20,119,592.50
19	Total	836,886,342.83

3 POLICY LEGAL AND REGULATORY FRAMEWORK

3.1 General Overview

Regulation 18 (1) (b) of the Environmental (Impact Assessment and Audit) Regulations, 2003 requires an environmental impact assessment report to, among others; include a concise description of national environmental legislative and regulatory framework. This Chapter presents a review of the current policy, legal and regulatory framework applicable to environmental management of the proposed water supply project for Kilgoris and Lolgorian towns.

3.2 Policy Framework

3.2.1 National Environmental Policy, 2014

The National Environmental Policy is an outcome of the Sessional Paper No. 10 of 2014. The overall goal of the policy is better quality of life for present and future generations through sustainable management and use of the environment and natural resources. One of the objectives of the policy is to promote and support research and capacity development as well use of innovative environmental management tools such as Environmental Impact Assessments (EIAs) and Environmental Audits that is necessary to ensure environmental quality and resource productivity on long term basis.

The policy among other important objectives calls for promotion of domestication, coordination and maximization of benefits from Strategic Multilateral Environmental Agreements (MEAs). The policy further calls for integration of environmental concerns into development policies, plans and activities.

The National Environmental Policy proposes a broad range of measures and actions responding to key environmental issues and challenges. It seeks to provide the framework for an integrated approach to planning and sustainable management of natural resources in the country. It recognises the various vulnerable ecosystems and proposes various policy measures not only to mainstream sound environmental management practices in all sectors of society throughout the country but also recommends strong institutional and governance measures to support the achievement of the desired objectives and goal.

Relevance

The policy requires that projects such as this one, which are likely to have significant environmental and social impacts should be undertaken with sound environmental management plan. Thus, this ESIA report has been prepared as a tool for promoting environmental sustainability.

3.2.2 National Land Policy, 2009

In section 3.2, land policy is linked to constitutional reforms. Regulation of property rights is vested in the government by the constitution with powers to regulate how private land is used in order to protect the public interest.

Section 3.6, under land issues requiring special intervention, asserts that “Land rights of minority communities shall be protected through a law to be passed specifically to secure their rights as individuals and groups and recognition of their resource management systems to ensure sustainability.” It further states, “Land rights of vulnerable groups (namely subsistence farmers, pastoralists, hunters and gatherers, agricultural labourers, unskilled workers, unemployed youth, persons with disabilities, persons living with HIV and AIDS, orphans, slum

and street dwellers and the aged.) shall be addressed by creating a system for identifying, monitoring and assessment, resettling them, facilitating their participation in decision making over land and land based resources, and protecting their land rights”.

The policy in section 3.4.3.4 promotes Environmental Management and Audit as land management tools and encourages public participation in the process.

Relevance

Any wayleave or land acquisition required for the laying of the proposed project infrastructure will trigger this policy regulation. The proposed route for the rising mains is along an existing road but verification must first be done to ascertain that no private land will be affected. In the case that private land is affected, the proponent will be required to adhere to the principles in the land policy and follow the rightful procedure in the acquisition of these lands. This includes compensating the respective ascertained owners of the land parcels.

3.2.3 Kenya’s Vision 2030

Kenya Vision 2030 is the current national development blueprint for the period from 2008 to 2030. It was developed following on the successful implementation of the Economic Recovery Strategy of Wealth and Employment Creation which saw the country’s economy back on the path to rapid growth since 2002.

The Vision 2030 is based on 3 key pillars; Economic Pillar, Social Pillar, and Political Pillar. The economic, social and political pillars of Kenya Vision 2030 are anchored on the following foundations: macroeconomic stability; continuity in governance reforms; enhanced equity and wealth creation opportunities for the poor; infrastructure; energy; science, technology and innovation, land reform; human resources development; security and public-sector reforms.

The objective of the vision 2030 is to “transform Kenya into a middle-income country with a consistent annual growth of 10% by the year 2030”. One of these aims is to make Kenya to be a nation that has a clean, secure and sustainable environment by 2030. This will be achieved through promoting environmental conservation for better support of the economic pillar flagship projects.

Relevance

Kenya’s transformation in to a middle-income country will be achieved by bringing and improving basic infrastructure and services namely: water and sanitation facilities, roads, street lights, storm water drains and footpaths among others. This project aims at improving water supply to Kilgoris and Lolgorian town.

3.2.4 The National Biodiversity Strategy, 2007

The overall objective of the National Biodiversity Strategy and Action Plan (NBSAP) is to address the national and international undertakings elaborated in Article 6 of the Convention on Biological Diversity (CBD). It is a national framework of action to ensure that the present rate of biodiversity loss is reversed and the present levels of biological resources are maintained at sustainable levels for posterity.

The general objectives of the strategy are to conserve Kenya’s biodiversity to sustainably use its components; to fairly and equitably share the benefits arising from the utilization of biological resources among the stakeholders; and to enhance technical and scientific cooperation nationally and internationally, including the exchange of information in support of biological conservation.

Relevance

Activities during the construction of the new project infrastructure including the rising mains and, WTP and distribution network are bound to impact negatively on the flora around the area. As such, during construction, the contractor will be required to reinstate the environment to its original state. This will be in order to reverse the loss of biodiversity or to maintain the levels of biological resources at sustainable levels for posterity.

3.2.5 Sustainable Development Goals (SDGs)

The SDGs provide a framework for the entire international community to work together towards a common end making sure that human development reaches everyone, everywhere. If these goals are achieved, world poverty will be cut by half, tens of millions of lives will be saved, and billions more people will have the opportunity to benefit from the global economy.

Up to 2015, the development agenda was centred on the Millennium Development Goals (MDGs), which were officially established following the Millennium Summit of the United Nations in 2000. The MDGs were supposed to be achieved by 2015, so a further process was needed to agree and develop development goals from 2015-2030. Discussion on the post-2015 framework for international development began well in advance. On 19 July 2014, the UN General Assembly's Open Working Group on Sustainable Development Goals (SDGs) forwarded a proposal for the SDGs to the Assembly.

The proposal contained 17 goals with 169 targets covering a broad range of sustainable development issues. Goal number 6 in the SDGs ensures availability and sustainable management of water and sanitation for all". Some of the targets of this goal include:

- Achieving universal and equitable access to safe and affordable drinking water for all by 2030;
- Protection and restoration of water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes by 2020;
- expanding international cooperation and capacity-building support to developing countries in water and sanitation related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies; and
- Support and strengthen the participation of local communities in improving water and sanitation management.

Relevance

The proposed project aims at achieving some of the mentioned targets for the SDG goal no 6. In the long run, this moves the country towards the goal of ensuring availability and sustainable management of water and sanitation for all is addressed through this proposed water supply project.

The SDG goal number 6 on ensuring healthy lives and promoting the well-being for all at all ages and access to water and sanitation for all can be achieved by this project through reduction of sanitation related diseases which will increase life expectancy and reduce some of the common killers associated with child and maternal mortality.

3.3 Legal Framework

3.3.1 The Constitution of Kenya

Article 42 of Bill of Rights of the Kenyan Constitution provides that every Kenyan has a right to a clean and healthy environment, which includes the right to have the environment protected for the benefit of present and future generations through legislation and other measures.

Under Chapter 5 (Land and Environment), Part I is devoted to land. It requires that land be used and managed in 'a manner that is equitable, efficient, productive and sustainable, and in accordance with the following principles:

- Equitable access to land;
- Security of land rights;
- Sustainable and productive management of land resources;
- Transparent and cost-effective administration of land; and
- Sound conservation and protection of ecological sensitive areas.

In Part II of Chapter 5 of the Constitution (Environment and Natural Resources), (I) the State clearly undertakes to carry out the following:

- Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;
- Work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya;
- Protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities;
- Encourage public participation in the management, protection and conservation of the environment;
- Protect genetic resources and biological diversity;
- Establish systems of environmental impact assessment, environmental audit and monitoring of the environment;
- Eliminate processes and activities that are likely to endanger the environment; and
- Utilize the environment and natural resources for the benefit of the people of Kenya.

According to Article 69 (2) "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.

Chapter 5 on Land and Environment emphasizes on the following:

- Land use and management shall by law benefit local communities
- Community land is protected from encroachment by State.
- Law shall protect Rivers, forests and water bodies.
- Equitable access to land.
- All lawful land rights are secured; only someone who has stolen land needs to worry.
- County governments will manage land in trust of the people in accordance with the Proposed Constitution.

Relevance

The constitution of Kenya provides for sound management and sustainable development of all of Kenya's projects, both public and private investments. It also calls for the duty given to the project proponent, in this case CRVWWDA is to cooperate with State organs and other persons to protect and conserve the environment as mentioned in Part II.

3.3.2 The Environmental Management and Coordination Act (EMCA)

The EMCA 1999 and The Environmental management and Co-ordination (Amendment) Act, 2015 provide the main legal and institutional framework under which the environment in general is to be managed. EMCA is implemented by the guiding principle that every person has a right to a clean and healthy environment and can seek redress through the High Court if this right has been, is likely to be or is being contravened.

Section 58 of the Act makes it a mandatory requirement for an EIA study to be carried out by proponents intending to implement projects specified in the Second Schedule of the Act. Such projects have a potential of causing significant impacts on the environment. Similarly, section 68 of the same Act requires operators of existing projects or undertakings to carry out Environmental Audits (EA) in order to determine the level of conformance with statements made during the EIA study. The proponent is required to submit the EIA and EA reports to NEMA for review and necessary action.

Relevance

This project has been categorised under Medium Risk Projects in the Second Schedule of the Environmental Management and Coordination (Amendment) Act 2015, which requires for the preparation of an ESIA project report prior to its implementation.

The following regulations under EMCA are also relevant to the proposed project;

(a) Environmental (Impact Assessment and Audit Regulations) 2003 and (Amendment) Regulations, 2016 & 2019

The EIA and Audit Regulations state in Regulation 3 that “the regulations should apply to all policies, plans, programmes, projects and activities specified in Part IV, Part V and the Second Schedule of the Act. Part II of the Regulations indicates the procedures to be taken during preparation, submission and approval of the full study report

Relevance

This report has been compiled in compliance with the above regulations. CRVWWDA will also be expected to carry out Environmental audit of the project during the construction stage and annually thereafter the completion of the project. The project is expected to obtain EIA License from NEMA before commencement.

(b) The Environmental Management and Co-ordination (Water Quality) Regulations, 2006.

The Regulations provides for sustainable management of water resources including prevention of water pollution and protection of water sources (lakes, rivers, streams, springs, wells and other water sources). It is an offence under Regulation No. 4 (2), for any person to throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution.

Regulation No. 11 further makes it an offence for any person to discharge or apply any poison, toxic, noxious or obstructing matter, radioactive waste or other pollutants or permit the dumping or discharge of such matter into the aquatic environment unless such discharge, poison, toxic, noxious or obstructing matter, radioactive waste or pollutant complies with the standards for effluent discharge into the environment.

Relevance

During the construction, operation and maintenance phases of the project, there may be waste water and other liquid waste generated from oil spills, machine cleaning and vehicles among other sources. Rivers Mogor and Enkaare oo Nkituak are the primary receptors for such waste due to run off, the contractor should therefore comply to all the requirements of this regulation.

(c) The Environmental Management and Co-ordination (Waste Management) Regulations, 2006

This regulation was published in the Kenya Gazette Supplement No. 69, Legislative Supplement No. 37, and Legal Notice No. 121 of 29th September, 2006. The

regulations provide details on management (handling, storage, transportation, treatment and disposal) of various waste streams including:

- Domestic waste;
- Industrial waste;
- Hazardous and toxic waste;
- Pesticides and toxic substances;
- Biomedical wastes; and
- Radioactive waste.

Regulation No. 4 (1) makes it an offence for any person to dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle.

Regulation 5 (1) provides categories of cleaner production methods that should be adopted by waste generators in order to minimize the amount of waste generated and they include:

- i. Improvement of production process through
 - Conserving raw materials and energy;
 - Eliminating the use of toxic raw materials and wastes; and
 - Reducing toxic emissions and wastes.
- ii. Monitoring the product cycle from beginning to end by
 - Identifying and eliminating potential negative impacts of the product;
 - Enabling the recovery and re-use of the product where possible, and
 - Reclamation and recycling; and
 - Incorporating environmental concerns in the design and disposal of a product.

Regulation 6 requires waste generators to segregate waste by separating hazardous waste from non-hazardous waste for appropriate disposal. Regulation 15 prohibits any industry from discharging or disposing of any untreated waste in any state into the environment. Regulation 17 (1) makes it an offence for any person to engage in any activity likely to generate any hazardous waste without a valid Environmental Impact Assessment license issued by NEMA.

Relevance

The proposed project, during construction phase will generate wastes such as soil debris, cement bags, plastic containers, vehicles spare parts, stripped off vegetation and any other waste which will need to be disposed as per the guidelines in the regulations.

(d) The Environmental Management and Coordination Act (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009

These regulations were published as legal Notice No. 61 being a subsidiary legislation to the Environmental Management and Co-ordination Act, 1999. The regulations provide information on the following:

- Prohibition of excessive noise and vibration beyond defined thresholds;
- Provisions relating to noise from certain sources;
- Provisions relating to licensing procedures for certain activities with a potential of emitting excessive noise and/or vibrations; and
- Noise and excessive vibrations mapping.

According to regulation 3 (1), no person shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment.

The First and Second Schedule stipulate the Maximum Permissible Intrusive Noise Levels and Maximum Permissible Levels for Construction Sites respectively.

Regulation 4 prohibits any person to (a) make or cause to be made excessive vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment; or (b) cause to be made excessive vibrations which exceed 0.5 centimetres per second beyond any source property boundary or 30 metres from any moving source.

Relevance

Noise and vibrations are expected during the construction phase of the project when excavation is ongoing as well as during operation when the generators are operating. The contractor /sub-contractor for civil works will be required to ensure compliance with the above regulations in order to promote a healthy and safe working environment throughout the construction phase. This shall include regular inspection and maintenance of equipment and prohibition of unnecessary hooting of vehicles.

(e) Environmental Management and Coordination (Air Quality) Regulations, 2014

These Regulations cover air quality standards that are requisite to protect human health and allow an adequate margin of safety. These Regulations specify priority air pollutants, mobile and stationary sources as well as stipulates emission standards.

Relevance

The emissions generated from construction activities (such as running vehicle and equipment engines) have the potential of polluting the immediate atmospheric environment. Vegetation clearing, earthworks and bulk delivery of construction material, if unmanaged may result in generation of dust. Thus, need for strict adherence to these Regulations and standards therein in preventing possible pollutants and managing sources.

(f) Wetlands, riverbanks, lakeshores and sea shore management regulations, 2009

This regulation covers special measure for protection of river banks including; prevention of soil erosion, siltation and water pollution Its objectives are among others:

- To facilitate the sustainable utilization and conservation of resources on river banks;
- To promote the integration of sustainable use of resources in riverbanks; and
- To prevent siltation of rivers and lakes and control pollution or and other activities likely to degrade the environment.

Relevance

This project involves abstracting water from a river. This may have an impact on the aquatic life as a result of either the abstraction or pollution of the water through effluent discharge from the WTP. The proposed activities must be in line with the stipulated regulations.

3.3.3 Water Act, 2016

The Water Act No. 43 of 2016 was assented to on 20th September 2016 and repealed the Water Act 2002. The enactment of this law aimed at aligning national water management and

water services provision with the requirements of the Constitution of Kenya 2010 particularly on the clauses devolving water and sanitation services to the county governments.

The Water Act 2016 provides for the management, conservation, use and control of water resources and for acquisition and regulation of rights to use water; to provide for the regulation and management of water supply and sewerage services.

Section 11(l) establishes the Water Resources Authority (WRA) whose function in section 12 (d) include; to receive water permit applications for water abstraction, water use and recharge and determine, issue, vary water permits; and enforce the conditions of those permits.

Section 143 of the Act makes it an offence an offence to obstruct, interfere with, divert or obstruct water from any watercourse or any water resource, or negligently allow any such obstruction, interference, diversion or abstraction. It also prohibits anyone to 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 water resource in such a manner as to cause, or be likely to cause, pollution of the water resource.

According to the Water Resources management Rules (2007), Fifth schedule Part A Water use activities that require approval by authority (d) Diversion of a water course, ANY PERSON shall obtain approval from the Authority to undertake the activity: In addition Part II-approval, authorisation and permits (2) no water works approval, authorization and permit shall be issued or renewed for the purposes of supplying water for domestic, public, commercial or industrial use within the limits of supply of a water service provider without the applicant having received consent of the licensed water service provider for the area.

Relevance

The Kilgoris town and Lolgorian town water supply project will abstract water from Rivers Mogor and Enkaare oo Nkituak as well as draw water from boreholes. Before abstraction of water, there must be approval, authorization and issuance of a permit. The proponent shall therefore apply for an abstraction permit from WRA in line with this law.

3.3.4 The Water Resource Management Rules, 2006

The water Resource Management Rules, 2006 give guidelines on the use of water resources. The Rules are presented in thirteen (13) parts, some of the relevant ones are presented below:

- Part II provides applicants with the process on application and approval for permits depending on types of water resource use.
- Part III gives the guidelines on surface water including release and use of stored water.
- Part V gives rules on monitoring of water quality monitoring and effluent discharge including: control of water pollution, water quality requirements, effluent discharge control plan and authorising effluent discharge applications,
- Part VIII which gives guidelines on the various water use charges/incentives that includes water resource conservation charge; penalty for over- abstraction; and incentive for flood water storage
- Part IX which gives guidelines on Conservation of Riparian and Catchment Areas
- Part X which gives guidelines on Catchment Management Strategies

Some of the pertinent Schedules accompanying the Rules includes

The Fourth Schedule which gives Guidelines for Effluent Discharge into surface water resources

The Seventh Schedule which gives guidance on Protection and Conservation of Riparian and Catchment Areas.

Relevance

The proposed project will involve water abstraction, treatment and distribution then CRVWWDA is required will require to obtain requisite permits from WRA, maintain the required monitoring data and participate in catchment activities as per the Rules

3.3.5 The Lands Act, 2012 No. 6 of 2012

Part II Section 8 provides guidelines on management of public land by National Land Commission (NLC) on behalf of both National and County Governments. This law in Section 8(b) stipulates that the Commission shall evaluate all parcels of public land based on land capability classification, land resources mapping consideration, overall potential for use, and resource evaluation data for land use planning.

Section 8(d) stipulates that the Commission may require the land to be used for specified purposes subject to such conditions, covenants, encumbrances or reservations as are specified in the relevant order or other instrument. In managing public land, the Commission is further required in Section 10(1) to prescribe guidelines for the management of public land by all public agencies, statutory bodies and state corporations in actual occupation or use.

In these guidelines, management priorities and operational principles for the management of public land resources for identified uses shall be stated. This in essence means that the Commission shall take appropriate action to maintain public land. As well the Commission shall identify ecologically sensitive areas that are within public lands and demarcate or take any other justified action on those areas and act to prevent environmental degradation and climate change.

Section 9 (d) it states that 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. (3) 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.

Section 110 (1) of the Act provides that land may be acquired compulsorily 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 fulfilment of the stated public purpose.

In such an acquisition, this Act, in section 111(1) provides that just compensation shall be paid promptly in full to all persons whose interests in the land have been determined. The procedure for land acquisition is laid out in Part VIII of the Act.

Relevance

This part of the law seeks to preserve and direct management of fragile public land held by the various public bodies for sustainable development. CRVWWDA and the contractor will therefore be required to ensure protection of any sensitive habitats and endangered species that have been identified.

The Land Act is also a significance reference point during land acquisition for the project facilities.

3.3.6 Climate Change Act, 2016

This is an Act of Parliament to provide for a regulatory framework for enhanced response to climate change, to provide for mechanism and measures to achieve low carbon climate development, and for connected purposes.

One of the main goal of this act is to enhance energy conservation, efficiency and use of renewable energy in industrial, commercial, transport, domestic and other uses;

Relevance

The vehicles and machines to be used during construction, as well as the generators to be used during operation, may contribute to additional GHG emissions.

3.3.7 The Public Health Act (Cap. 242)

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

(a) The Public Health (Drainage and Latrine) Rules

Rule 85 provides that every owner or occupier of every workshop, workplace or other premises where persons are employed shall provide proper and sufficient latrines for use by employees.

Rule 87 requires every contractor, builder or other person employing workmen for the demolition, construction, reconstruction or alteration of any building or other work in any way connected with building to provide in approved position sufficient and convenient temporary latrines for use by such workmen.

Rule 91 provides that no person shall construct a latrine in connection with a building other than a water closet or a urinal, where any part of the site of such building is within 200 feet of a sewer belonging to the local authority which is at a suitable level, and where there is sufficient water supply.

Relevance

The contractor for civil works will be required to construct toilets for use by workers and visitors to the site during the construction phase of the proposed project. Sufficient latrines will also be required should there be any staff quarters within the site. During operation, the project is expected not to cause any public nuisance to the public.

3.3.8 The County Governments Act, 2012

The County Governments Act of 2012 repealed the Local Government Act.

Section 110 (2) provides for a spatial development framework for the county that indicates;

- Where public and private land development and infrastructure investment should take place;
- Desired patterns of land use within the county,
- address the spatial construction or reconstruction of the county;
- Sets out basic guidelines for a land use management system in the county taking into account any guidelines, regulations or laws as provided under Article 67 (2) of the Constitution;
- contains a strategic assessment of the environmental impact of the spatial development framework;
- Identify programs and projects for the development of land within the county

Section 114 of this act, sub sections (1) and (2) require that a project of national significance in a County be preceded by mandatory public hearings for approval. In addition, Section 115, sub section (1) Public participation in the county planning processes shall be mandatory and be facilitated through the mechanism stated under this section.

Relevance

The proposed development should be in line with the county spatial development framework in section 110 (2) as well as allow for public participation prior to implementation. This ESIA provides a platform for public participation. CRVWWDA should work in liaison with County Government of Narok to ensure compliance with land use requirements within the County.

3.3.9 Physical Planning Act, 2019

This is the main Act that governs land planning and all proposed developments must be approved by the respective local authority and certificate of compliance issued accordingly.

Under the Act, the director of physical planning advises the commissioner of lands on land alienation issues that fall under Lands Act. The director also advises the commissioner of lands and local authorities on land use, sub-division and or amalgamation of land; prepares regional and local physical development plans.

At the County level, the Act has established the County Physical and Land Use Planning Consultative Forum chaired by the County Executive Committee Member responsible for matters related to physical and land use planning. One of the major functions of the Consultative Forum is to determine development applications for change of user or sub-division of land that could have significant impact on adjacent land and or breach registered conditions in a given title deed; and also, industrial location which could have negative impact on the environment and adjoining land.

Relevance

CRVWWDA will be required to discuss its development plans with the Narok County Physical Planning Officers and seek the requisite approvals. For control of future development around the site, the County government shall enforce this law to ensure compatible land uses only.

Similarly, any temporary contractor's facilities like camps will require development approval from the Narok County government.

3.3.10 Urban Areas and Cities (Amendment) Act, 2019

This is an Act of Parliament that gives effect to article 184 of the Constitution, to provide for:

- the classification, governance and management of Urban Areas and Cities;
- the criteria of establishing urban areas; and
- the principle of governance and participation of residents and the related purposes.

Section V of the Act on Integrated Development Planning requires that every city and municipality established under this act shall operate within the framework of integrated development planning.

The second schedule of the Act outlines the rights and participation by residents in affairs of their city or Urban areas.

Relevance

As water supply is a problem in the project area, the project through this ESIA study collected views of the residents and incorporate them in the designs where feasible, to solve the water shortage problem.

3.3.11 Forest Conservation and Management Act, 2016

Various legislative forest reforms have taken place over the years that culminated in the repeal of the Forest Act 385, the enactment of the Forest Act, 2005 which established the Kenya Forest Service as a Semi-autonomous State Corporation in 2007, and the now newly formed Forest Conservation and Management Act, 2016 (FCM Act, 2016).

The main purpose of the Act is to give effect to Article 69 of the Constitution of Kenya with regard to forest resources; provides for the development and sustainable management, including conservation and rational utilization of all forest resources for the socio-economic development of the country and other connected purposes.

Relevance

The water intake site is abounding with different tree species which should be protected and not be cut down beyond the project site boundaries as guided by this Act. Sustainable river catchment management is also guided by this act.

3.3.12 Employment Act

This is an Act of parliament that applies to all employees employed by any employer under a contract of service. The Act came in operation in June 2008. Employment of children in the following forms is prohibited in the following sections of the Act:

53. *(1) notwithstanding any provision of any written law, no person shall employ a child in any activity which constitutes worst form of child labour.*

56. *(1) No person shall employ a child who has not attained the age of thirteen years whether gainfully or otherwise in any undertaking.*

(2) A child of between thirteen years of age and sixteen years of age may be employed to perform light work which is

(a) Not likely to be harmful to the child's health or development; and

(b) Not such as to prejudice the child's attendance at school, his participation in vocational orientation or training programmes approved by Minister for labour or his capacity to benefit from the instructions received.

Relevance

CRVWWDA and the contractor will need to understand all the requirements of the Act during employment such as ensuring that employees are of the right age, entitlement to leave, protection from discrimination and sexual harassment among others.

3.3.13 Work Injury Benefits Act (WIBA)

It is an Act of Parliament to provide for compensation to workmen for injuries suffered in the course of their employment. It outlines the following:

- Employer's liability for compensation for death or incapacity resulting from accident;
- Compensation in fatal cases;
- Compensation in case of permanent partial incapacity;
- Compensation in case of temporary incapacity;
- Persons entitled to compensation and methods of calculating the earnings;
- No compensation shall be payable under this Act in respect of any incapacity or death resulting from a deliberate self-injury; and
- Notice of an accident, causing injury to a workman, of such a nature as would entitle him for compensation shall be given in the prescribed form to the director.

Relevance

The contractor and CRVWWDA will be required to comply with all the provisions of the Act throughout the project cycle such as insuring workers against potential hazards. They will also be required to accord injured persons their dues in terms of shouldering the medical expenses or compensation of the families should there be loss of life.

3.3.14 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:

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

Section 44. (1) Before any person occupies or uses any premises as a workplace, he shall apply for the registration of the premises.

Section 95. Every occupier shall provide and maintain so as to be readily accessible, a first-aid box or cupboard of the prescribed standard.

The Occupational Safety and Health Act 2007 (OSHA 2007) Kenya Gazette Supplement No. 111 (Acts No.15) dated October 26, 2007 revokes the Factories and Other Places of Work Cap.514.

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

Relevance

The contractor and CRVWWDA will be required to comply with all the provisions of the Act throughout the project cycle such as registering the construction site as place of work, management of hazards, forming health and safety committees and reporting all the accidents and near misses and provision of First-Aid kits as necessary.

3.3.15 Environment and Land Court Act, 2012

The Court is established under section 4 of the Environment and Land Court Act No. 19 of 2011. It has the jurisdiction to hear any other dispute relating to environment and land. The jurisdiction of the court is provided under section 13 of the Act. The Court has original and appellate jurisdiction to hear and determine all disputes in accordance with Article 162(2)(b) of the Constitution and with the provisions of the Act or any other written law relating to environment and land. The court is also empowered to hear cases relating to public, private and community land and contracts, choses in action or other instruments granting any enforceable interests in land.

Relevance

In matters relating to land and environmental disputes that may arise between the project and the local community or county government during requisite private land acquisition and environmental management for the development or local material sites, the court has powers to deal with such disputes relating to land administration and management. Nonetheless, alternative grievance resolution mechanisms are also encouraged.

3.3.16 Wildlife Conservation and Management Act, 2013

The act established the Kenya Wildlife Service (KWS). The main objective of this service is to ensure that wildlife is managed and conserved so as to yield to the Nation in general and to individual areas in particular, optimum returns in terms of cultural, aesthetic and scientific gains as well as such economic gains as are incidental to proper wildlife management and conservation. It also lists nationally protected species as well as those classified as invasive.

Relevance

Contractor shall be responsible for conserving any indigenous flora encountered within the project area. They shall ensure when the land is being reinstated back to its original condition, the indigenous trees are replanted for their conservation and that the activities do not encourage spread of invasive species.

3.3.17 The Penal Code, Cap 63

Section 191 of the Penal Code makes it an offence for any person or institution that voluntarily corrupts, or foils water for public springs or reservoirs rendering it less fit for its ordinary use. Similarly, section 192 prohibits making the atmosphere in any place noxious to health of persons/institution in dwellings or business premises in the neighbourhood or those passing along a public way.

In addition, section 193 states: Any person who makes loud noises or offensive or unwholesome smells in a place so as to annoy any considerable number of persons in the exercise of their common rights commits an offence and is liable to be punished as for a common nuisance.

Relevance

The contractor and proponent will be required to ensure strict adherence to the Environmental Management Plan throughout the project cycle in order to mitigate any possible negative impact associated with dust, noise, and effluent discharge that might likely affect the public.

3.3.18 National Construction Authority Act, 2011

This Act establishes the National Construction Authority (NCA), meant to oversee the construction industry and coordinate its development. The authority is meant to promote quality assurance of the construction industry; accredit and register contractors as well as accredit and certify skilled construction workers and construction site supervisors.

During project implementation, the appointed contractor and conduct of construction works will be required to meet registration and approval requirements with NCA.

3.3.19 Energy Act, 2019

The Act establishes Energy and Petroleum Regulatory Authority (EPRA) whose functions include regulating transportation and storage of petroleum and petroleum products. Further, Clause 11 of the Act, vests EPRA with responsibility of issuing / revoking licences and permits in the energy sector.

Relevance

The current project proposes to have powerline connection as well as install of diesel generators at pump stations. Therefore, will require to comply with the Energy Act by permits for handling & storage of generator fuel. Further, the project shall engage an EPRA approved electrician to do the electrical connection for the project.

3.3.20 The Kenya Roads Act, 2007

The Act establishes and vests responsibilities to Authorities (KeNHA, KURA and KeRRA) to manage road reserves by controlling and access to road reserves for development.

Relevance

Sections of the alignment of the pipeline network is proposed to follow existing road reserve in the rural and urban settings (part of C17 [Kilgoris – Kisii Road] and C13 [Migori – Lolgorien

Road]) at an approximate length of about 50km. Therefore, CRVWWDA will have to register a request for approval to utilize the way leave from Kenya Rural Roads Authority (KeRRA).

3.3.21 HIV/AIDS Prevention and Control Act

The Act provides 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, counselling, support. The Act require HIV/AIDS education at the workplace. Therefore, the Client being a Government institution will ensure that the EPC Contractor includes in the construction program, the HIV/AIDS awareness and counselling for staff. Prevalence to HIV/AIDS among such staff has been associated with:

- Attraction of sex workers into project areas targeting earnings of workers, especially migrants / mobile workers temporarily separated from their families;
- Sexual behaviours among young adult workers in the sexually active age group. Most of the semi-skilled / unskilled work require physically abled workers who are mainly in this age. Others may be driven into this behaviour due to peer pressure.
- Stress induced by work or living conditions.
- Lack of awareness (due to remoteness of the project area) or access to health services.

Relevance

In anticipation of the HIV/AIDS epidemic, the Contractor's BoQ should have bill items to facilitate HIV/AIDS awareness programme and monitoring.

3.4 Regulatory Framework

In 2001, the Government established the administrative structures to implement the Environmental Management and Co-ordination Act 1999. The main administrative structures are described in the following sections.

3.4.1 County Environment Committee

The County Environment Committee is responsible for environmental management at the County level through preparation of County environment action plans for consideration and adoption by the respective County Assemblies.

Relevance

CRVWWDA should ensure that the project abides by the set county environment action plan for Narok County.

3.4.2 Central Rift Valley Water Works Development Agency (RVWWDA)

Central Rift Valley Water Works Development Agency (CRVWWDA) (formerly Rift Valley Water Services Board) is one of the eight Water Services Boards established by the Government of Kenya (GoK) as part of the reforms in the water sector. Narok County is one of the areas under the jurisdiction of CRVWWDA. CRVWWDA operates under the Water Act 2016 that aligns water sector to the Constitution of Kenya. One of the core functions of RVWWDA is to undertake development, maintenance and management of national public water works.

In regards to this project, the CRVWWDA will be highly important in setting standards for compliance with the Environment and Social Management Plan (ESMP) produced in this Report.

3.4.3 County Government of Narok

The Fourth Schedule of the Constitution of Kenya 2010 Part 2 (3) provides for devolved environmental functions to be undertaken by the County Governments and includes; control of air pollution, noise pollution, and other public nuisances.

In addition to development approvals, the county government has some jurisdiction of environmental management including waste management, drainage, noise permit issuance, and enforcing public health act.

3.4.4 The National Environment Management Authority (NEMA)

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 the Cabinet Secretary in consultation with the Authority, which will govern the discharge, limits to the environment by the proposed project.

Relevance

NEMA must approve the project before implementation and also participates in subsequent stages of construction environmental management and annual audits review.

3.4.5 Water Resource Authority (WRA)

WRA is responsible for regulation of water resources issues such as water allocation, source protection and conservation, water quality management and pollution control and international waters. Its roles and responsibilities are as follows:

- Planning, management, protection and conservation of water resources;
- Planning, allocation, apportionment, assessment and monitoring of water resources;
- Issuance of water permits;
- Water rights and enforcement of permit conditions;
- Regulation of conservation and abstraction structures;
- Catchment's and water quality management;
- Regulation and control of water use; and
- Coordination of the Integrated Water Resource Management (IWRM) Plan.

Relevance

There are both surface and underground water in the project area. The contractor will therefore need to consult WRA for the best source of water for construction. They will also be required to apply for a permit to abstract water as well as adhere to the rules and regulations stipulated by WRA.

The WRA is responsible for protection, conservation and management of the riparian areas. It is their mandate to ensure that there are WRUAs in place to actively manage the water resource.

3.4.6 Directorate of Occupational Safety and Health Services (DOSHS)

It is responsible for the implementation of the Occupational Safety and Health Act (OSHA), 2007 and associated regulations. Construction site must be registered with the Directorate as a work site both during the construction (by the contractor) and during operation (by NARWASCO).

Relevance

The contractor should liaise with this authority and register the site as a work place before the commencement of the construction works.

3.4.7 National Construction Authority (NCA)

NCA envisions to create "...a well-coordinated and developed construction industry for sustainable socio-economic development."

The functions of NCA include:

- To promote and stimulate the development of the construction industry to enable it to meet development aspirations of Kenya;
- To register and regulate the performance of local and foreign contractors and accredit skilled construction workers and site supervisors;
- To encourage the standardization and improvement of construction techniques and materials;
- To promote quality assurance and develop and publish a code of conduct for the construction industry.

Source: NCA website (<http://www.nca.go.ke>)

The authority controls registration of various contractors and issues registered ones with licenses. This ensures works are done by qualified contractors, giving associated safety assurance. At construction stage of the water supply project, the assigned contractor shall be required to be duly registered with NCA as a Civil Engineering- Works Contractor.

3.5 International Guidelines

The African Development Bank's environmental policy framework is strongly anchored in the concept of sustainable development. This concept defines sustainability as *"development that meets the needs of the present without compromising the needs of the future"*.

The AfDB's Operational Safeguards (OS) include:

OS 1: Environmental and Social Assessment. This OS governs the process of determining a project 's environmental and social category and the resulting Environmental and Social Assessment requirements. The requirements cover the scope of application, categorization, use of Strategic Environmental and Social Assessment (SESA) and Environmental and Social Impact Assessment (ESIA) where appropriate, Environmental and Social Management Plans, climate-change vulnerability, public consultation, community impacts, treatment of vulnerable groups, including indigenous peoples, and grievance procedures.

Relevance

Implementation of the project is required to take place within AfDB policy framework on the best practices when it comes to ensuring that the project does not destabilize the riverine aquatic ecosystem, affect downstream users or degrade the environment.

OS 2: Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation. This OS consolidates the Bank policy on involuntary resettlement and incorporates a number of refinements designed to improve their operational effectiveness. In particular, the OS embraces comprehensive and forward-looking notions of livelihood and assets, to account for their social and cultural dimensions, as well as their economic ones. It also adopts a progressive understanding of community and common property that emphasizes the crucial need to maintain social cohesion, community structures and the social inter-linkages that common property provides.

Relevance

The project may trigger the acquisition of private land for construction of the proposed project infrastructure including the water treatment plant and the rising mains. In the case that this is triggered, the acquisition should be done on a willing buyer and willing seller basis. As such, the OS 2 should be applied through consulting affected persons to ensure that they receive a commensurate compensation to package of their loss of land and other assets therein that will restore their livelihood and living standards, income earning capacity and production levels.

OS 3: Biodiversity, renewable resources and Ecosystem Services. This OS translates the policy commitments in the Bank policy on integrated water resources management into operational requirements and also reflects the objectives of the Convention on Biological Diversity to preserve biological diversity and promote the sustainable use of natural resources. It reflects the importance of biodiversity in the African continent and the value to the population of key ecosystems. Its content has benefited from recent joint work among the MDBs to improve their approach to assessing how the potential impacts of projects on different types of habitats can be avoided, minimized or offset.

Relevance

During the construction phase of the project, the contractor may have to clear vegetation in order to excavate. The vegetation in the project area lies in predominantly modified habitats (in the settlements, road reserve and urbanized environments) but pockets of natural bushes and thickets (around the intake and sections of the pipeline network) also exist to characterise natural habitats. The vegetation in the project area is mainly native and should be conserved. Precaution is thus required in line with this standard to ensure biodiversity is preserved.

OS 4: Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials and Resource Efficiency. This OS covers the range of key pollution, waste and hazardous materials impacts for which there are agreed international conventions as well as comprehensive industry-specific standards that are followed by other MDBs and financial institutions that have adopted the Equator Principles. It also introduces a GHG emission threshold for projects to trigger a detailed analysis of feasible reduction or offset measures and reporting on emission levels. Borrowers or clients are required to consider measures to improve resource efficiency.

Relevance

The contractor will be required to observe the above convention in all its operations throughout the project cycle in reducing emission of Greenhouse Gasses and proper management of the in treatment of the effluent before being released into the environment.

OS 5: Labour Conditions, Health and Safety. This OS aligns the Bank requirements for its borrowers or clients with the range of ILO conventions concerning workers' conditions, rights - and protection from abuse or exploitation. It covers working conditions, workers' organizations, avoidance of child or forced labour and occupational health and safety.

Relevance

The contractor will need to abide by all the provisions of the standard in maintaining safe working environment for the employees, in addition to this, the contractor will have to establish as health and safety policy to be approved the DOSHS that will guide the construction activities.

4 DESCRIPTION OF THE BASELINE ENVIRONMENT

4.1 Physical Environment

4.1.1 Climate

(i) Rainfall

The rainfall amount and regime are influenced by the passage of inter-Tropical Convergence Zone (ITCZ) giving rise to a bi-modal rainfall pattern. The breezes from Lake Victoria add to the moisture levels. Hailstorms are occasionally reported in the West and the highlands north of Transmara West Sub-County in Narok County.

Rainfall is bimodal. The long rains in the study area are experienced between February and June reaching its peak in April, while the short rains are experienced between August and November. The areas which receive a lot of rainfall are the highland West and North of Kilgoris Ward. Kilgoris and Lolgorian receive a mean annual rainfall of 721.6mm.

(ii) Temperature

With regard to temperature, the Transmara West Sub-County in Narok County enjoys medium temperatures ranging from 14.8°C to 20.3°C. The highest temperatures occur in February and the lowest in June/July. This range of temperature is as a result of the influence of the high altitude in the sub-county. Other modifying factors are cool winds blowing from Lake Victoria mainly from the month of August and November and also between February and April.

The annual Evaporation is estimated at 1585mm with a minimum of 100mm in June and maximum of 259mm during January.

4.1.2 Topography

The topography of Trans Mara West Sub-County comprises of two major categories, the highlands which lie between 2200 and 2500m above the sea level and the plateau which rise from 1500 to 2200m above the sea level.

The highlands consist of the Osupuko, Kapune, Meguara and Shankoe Hills in Pirrar and Kilgoris Ward and Keiyan and Nkararu Hills in Keiyan Ward.

The plateau covers the eastern part in Kiridoni Ward, and the southern part in Lolgorian Ward. Parts of Maasai Mara, Murgan, Soit in Kirindoni Ward, Masurura in Keiyan ward, Kerinkan, Olopikidogoe, Angata Barikoi and Lolgorian Ward also form part of the plateau.

The terrain both on the highlands and on the plateau, permit agricultural and livestock activities. Crop production is concentrated on the highlands while livestock development takes place on the lower grounds on the plateau.

4.1.3 Geology

Kilgoris Town is underlain by granites which is a type of intrusion. This is a hard rock mostly metamorphic in nature. The Kilgoris granites intrude gneisses of the Basement system and underlie Siria Plateau west of the Mara River. These are exposed west of Siria escarpment. These rocks are deeply weathered, sometimes faulted and fractured.

Meanwhile, Lolgorian is located in a narrow zone of gold mineralization which runs through it in general East-South-Easterly direction. This zone lies mainly in the valley of the Migori (Mogor) River and is conveniently called the Migori Gold Belt. The belt is situated about 16km

north of the Kenya-Tanzania boundary, to which it is parallel. Its width can be taken as about 4.8km and its length from near Karunga on Lake Victoria to the place East of Lolgorian where it finally disappears beneath younger lavas, is a little more than 80km. Throughout this length, it is remarkably straight and regular.

4.1.4 Hydrology

(a) General

Mara River originates from the Eastern Mau forest and drains the low altitude eastern section and flows to Tanzania. The Migori river which almost bisects Transmara sub-county into two flows in a south westerly direction from south west Mau joining Gucha river in Migori County to flow and empty into Lake Victoria. There are many small streams and rivers which drain into Migori (Mogor) River. The land on both sides of Migori River is a plateau. The altitude rises from 1524 m asl along the Mara River to about 1950 m asl around Kilgoris to 2073 masl. on the hill tops. Topography is gentle to flat in the plains but rather steep on some hills.

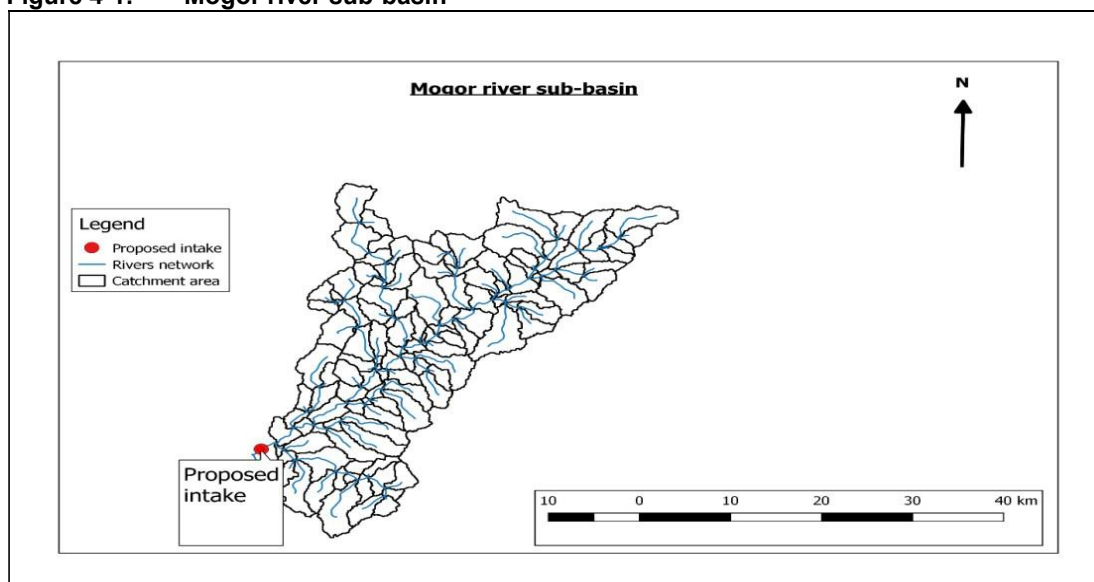
The main water sources in use by both livestock and people are rivers, pans, dams and taps. During periods of severe drought, the few existing catchment pools are not in use since they dry up. This forces the pastoralists to walk long distances in search of water for their pasture.

The project proposed to develop intake from Mogor River. Mogor River drains an average area of 1009 sq.km, commanded by proposed intake and 1287.92 sq.km commanded by the flow gauging station IKC 03. The river originates from the Mau complex, flows to Lake Victoria and is about 9 km from Migori town. The catchment area contributes a lot to the river flows in terms of sediment loading, river morphology and transpiration which especially result from land-use/land-cover changes in the catchment. General characteristics of the sub-basin are summarized in Table 4-1. The sub-basin is as shown in Figure 4-1.

Table 4-1: General characteristics of river Mogor sub-basin

Description	Characteristics/parameter
Catchment area	1009 km ²
General slope	0.037
Longest flow path	67 km
Time of concentration	12.23 hrs
Land-use/Land-cover	Peri-urban, shrubs, grasslands and farmlands

Figure 4-1: Mogor river sub-basin



(b) Stream flow analysis

According to a quick hydrology assessment report under the current study, the daily stream flow records for Mogor River was obtained from the Water Resources Authority (WRA) for the river gauging station 1KC 03. The record shows that the lowest flow of 1900.8m³/day (0.022m³/s) has ever been recorded.

Some of the hydrological indicators for the river are as follows:

Minimum Flow Analysis

Figure 4-2: Minimum flows of Mogor River

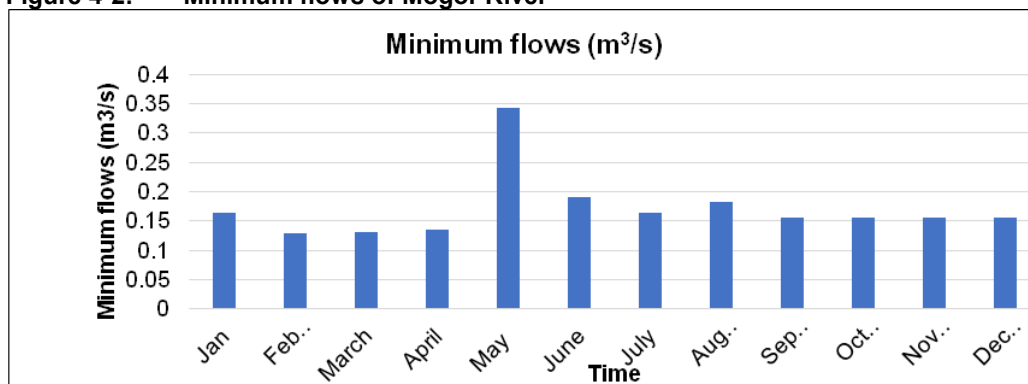
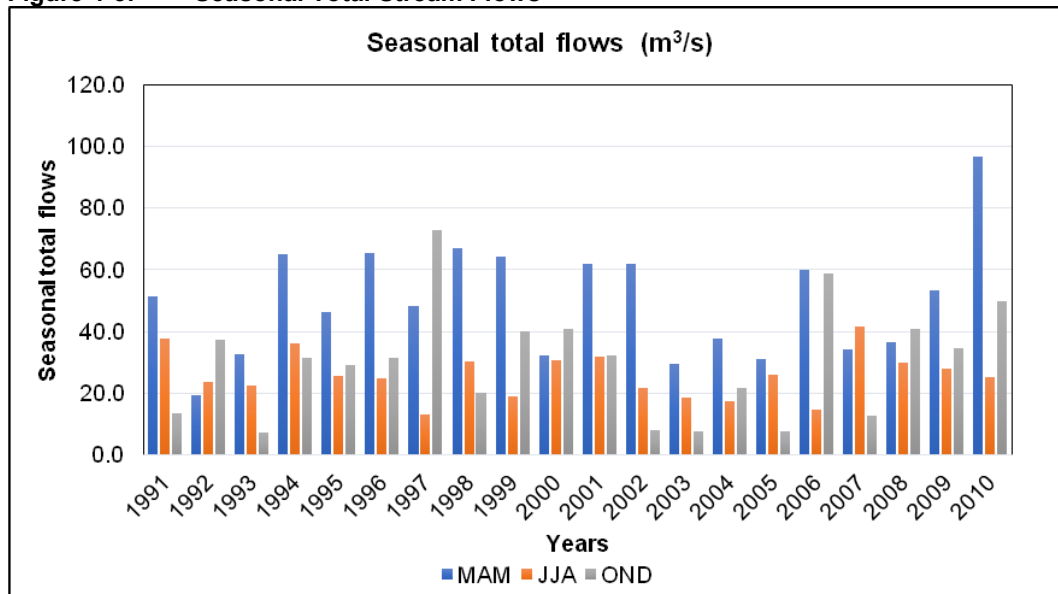


Figure 4-2 above shows the minimum flows for twelve months over 62 years' time period. February to April is a low flow season while May is the wettest month. For the months of August to December, the minimum flows are almost constant.

Seasonal Stream Flow Analysis

The Maximum stream flow was recorded in 1997 and it shows high variability between 2002 and 2010. See Figure 4-3. The minimum daily flow is comparatively constant. Therefore, low flows are reliable and sustainable over time and this assures availability of the proposed water supply.

Figure 4-3: Seasonal Total Stream Flows



The river is flowing in all seasons and March April and May (MAM) season presents the highest flows while the October, November and December (OND) season is characterized with low flows from which the supply is based. This marks the recession period before the hydrological year begins again. The lowest flow of OND flow of 7.1m³/s was recorded in 1993 while the maximum MAM was recorded in 2010.

The above analysis was based on hydrology data sourced from WRA and JICA by the previous consultant (CAS Consultants Ltd.). Table 4-2 and Table 4-3 below show that WRA data gives higher flow than that of JICA. Thus, the results from WRA need to be carefully analysed in the future. At the conceptual design stage, it was recommended to consider stream flow result based on data from JICA into the final detailed designs.

Table 4-2: Summary of Flow at the River Gauging Station

Parameter	Stream flow (m ³ /s) (WRA)	Stream flow (m ³ /s) (JICA)
Q90	0.159478	0.060
Q95	0.143948	0.0567
Q96	0.140842	0.0511
Q98	0.1346	0.04667

Table 4-3: Adjusted at the Proposed Site.

Parameter	Stream flow (m ³ /s) (WRA)	Stream flow (m ³ /s) (JICA)
Q90	0.12492	0.04701
Q95	0.1128	0.0444
Q96	0.1104	0.0400
Q98	0.1055	0.03656

As shown above, it was found out that the minimum flow recorded for Mogor River is in the range of 2,592m³/day. A design flow of 1,100m³/day has conservatively been considered to meet the expected demand for Logorian for year 2040, which is lower than the minimum ever recorded flow for Mogor.

From the consultations with the WRA officer, he pointed out that there are no other abstractors on Mogor River.

(c) Water quality

Water sampling and analysis through the Water Resources Authority (WRA) was conducted to obtain baseline conditions of Langata Ngima River and Mogor River. Table 4-4 gives a summary of the river water analysis.

Langata Ngima River

The sampled river was within NEMA's water quality limits for domestic water sources, as well as KEBS and WHO standards except for the parameters of colour, turbidity, Nitrates and *E. coli*. The colour of the water at 350 mgPt/l, and turbidity at 40 N.T.U (nephelometric turbidity unit) far above the KEBS and WHO allowable limits of 15 mgPt/l and 5 N.T.U, respectively. Even though turbidity and colour could not have direct health effects, water with high colour of turbidity can be regarded by consumers as aesthetically non-pleasing, hence unsafe. Colour in water is usually due to the presence of coloured organic matter associated with the humus fraction of soil. From the water analysis, the colour and turbidity disparity could be attributed to soil sediments from the hilly country side that erode into the river from the catchment area. Agroforestry should be encouraged by the county's agriculture department, water and environment department so as to reduce soil sediment loading of the river channel that contributes to high turbidity and colour.

Nitrate levels was slightly high, 10.1 mgNO₃/l above the 10.0 mgNO₃/l allowable limit by NEMA. However, as per KEBS and WHO standards, the nitrate level was within the 44 mgNO₃/l limit. Nitrates are frequently present due to sewage contamination or agricultural runoff. The fact that majority of the population in the project area use pit latrines for sewage disposal is an indicator of the source of nitrate pollution of the river, which is supported by the

recorded presence of 9/100 ml of *E. coli* in the tested water sample. In addition, crop farming evident in the project area that use nitrogen-rich fertilizers is another potential source of the river pollution. The best management of Nitrate pollution of the river would be by protecting the source water from contamination.

Table 4-4: Water quality analysis of rivers Langata Ngima and Mogor

Quality Parameters	PH	Colour (Mgpt/l)	Turbidity (N.T.U)	Conductivity (25oC) (μS/cm)	Fluoride (mg/l)	Nitrates (mgNO ₃ /l)	Nitrites (mgNO ₂ /l)	Total Dissolved Solids (mg/l)	Ammonium (mg/l)	Total Coliform (No./100 ml)	E. coli (No./100 ml)	Chlorides (mg/l)	Sulphate (mg/l)	Calcium (mg/l)	Magnesium (mg/l)	Total Hardness (mmCaCO ₃ /l)	Total alkalinity (mmCaCO ₃ /l)	Iron (mg/l)	Manganese (mg/l)
River / stream	NEMA maximum allowable limits for sources of domestic water																		
	6.5-8.5	-	-	-	1.5	10	0.5	1200	-	-	Nil	-	-	-	-	-	-	-	-
	KEBS (KS 459-1:2007) Standards																		
	6.5-8.5	15	5	-	1.5	44	0.003	1000	0		Nil	250	400	150	100	300	-	-	-
	WHO Standards (maximum allowable limits)																		
	6.5-8.5	15	5	2500	1.5	44	0.1	1500	0		Nil	10	450	100	100	500	500	0.3	0.5
Observed results of samples collected (2019)																			
Langata Ngima	7.4	350	40	145	0	10.1	0.04	72	0	17	9	9	12	12	2.4	40	58	0.06	0
Mogor river	7.2	400	242	175	0	6.6	0.08	88	0	25	10	13	20	21	4	48	72	0.16	0

Mogor River

Just like Langata Ngima River, Mogor River was within the NEMA water quality limits for sources of domestic water, as well as KEBS and WHO standards, except for the colour, turbidity and *E. coli* parameters. The colour of the water was at 400 mgPt/l with turbidity at 242 N.T.U, both of which were far above the KEBS and WHO allowable limits of 15 mgPt/l and 5 N.T.U, respectively. The high turbidity and colour of Mogor River compared to Langata Ngima could be attributed to the sediment loading from the catchment area which has seen major land use change from forest to farming and settlement.

Mogor River was slightly more infested by *E. coli* than Langata Ngima where *E.coli* concentration was identified at 10/100 ml compared to 9/100ml. The poor sewage disposal in the project area could be attributed to this water quality parameter, in addition to livestock defecation in the river banks while grazing.

4.2 Biological Environment

4.2.1 Flora

The county has an estimated 724Km² of gazetted forest, 930 Km² of non gazetted forest and 480 Km² of county council trust forest. The total area under forest cover represents 11.9 per cent of the total county surface area. In addition, Maasai Mara game reserve covers approximately 1,510 Km². Of this area 1,000 Km² is in Narok South sub county while 510 Km² of game reserve is in Transmara West sub county and is famously referred to as Mara Triangle. The vegetation cover of these forests is mainly natural trees in the highland areas and shrubs and grasslands in the lowlands.

Forests in the Transmara west are important wildlife sanctuaries and form a crucial dispersal zone for the Maasai Mara National Reserve. The Maasai traditional land use pattern allowed maintenance of rangeland production potential and was compatible with wildlife use of the area. Compatibility of land use with wildlife is particularly important in the eastern portion of Transmara because it borders the Maasai Mara National Reserve and has historically been an important dry season forage source for wildlife during drought in the Serengeti.

Unfortunately, Transmara has experienced unprecedented shift in pastoralism as the major form of land use to crop production. Unlike in the past when most of the cultivation was by non-Maasai cultivators, most Maasai have now ventured into small as well as large scale farming. Land renting to farmers from outside Transmara on a short-term basis (usually one year) is also very common. There are several underlying reasons for the apparent "rush" in forest clearing. Two obvious ones are:

- The inevitable shift by the Maasai (especially the elite group) from a predominantly pastoral lifestyle to a cash-oriented economy and land is seen as the resource that has hitherto remained
- The ongoing land unexploited and should now be fully tapped to achieve this demarcation process where land owned by group ranches is being subdivided among the members. In most cases, this has not been without controversy and forest clearing by individuals is often one way of legitimizing ownership.

Forest disturbances in the Sub-county can be attributed to the following main causes:

- Charcoal burning: A flourishing charcoal business across Transmara-Kisii border is also a major factor contributing to depletion of forest resources in parts of Transmara East and West Sub-counties.
- Extraction of pole size trees for fencing and house construction: An increasing number of Transmara residents are fencing their farms and posts are obtained locally from nearby forests. In absence of the prime cedar posts, other alternative species such as *Olea africana* and *Euclea divinorum* are used. There is considerable commercial incentive to exploit pole size trees for money and their demand is currently very high. Large chunks of forests have also been cleared for crop production.
- Clearing for settlement: In some areas where land adjudication and demarcation is taking place there is spontaneous mushrooming of human settlements. This is particularly the case where membership of a group ranch is controversial. Most individuals believe that the only way to assert ownership rights is to clear the forest and settle there or put the land under crop production even when it is evident that crop harvest is unlikely due to high wildlife concentration in the area. Part of the solution to halting forest destruction therefore, lies in addressing the problems of land tenure.

During the field study, it was observed that tree felling had occurred on the land parcels adjacent to the river bank in the project area in Kilgoris. It was reported that the deforestation

had taken place in the recent past. The soil is therefore loose and exposed to agents of erosion leading to high siltation in the river.

Private land owners have taken to planting of blue gum trees (*Eucalyptus Spp*) along the river bank. This worsens the already existing issue of low flow in the river. In Lolgorian, there were some tree plantations as well as naturally occurring indigenous trees.

Flora along the proposed project footprint

The proposed intake site and raw water transmission line are located on a parcel of land next to the river. The flora along the river bank at the intake site consists of mainly the following:

- *Accacia* associations
- *Ipomea sp*
- *Ricinus communis* (a weedy/colonial Species)
- *Senna didymobotrya*
- *Commiphora sp*

As per the IUCN red list of Threatened Species, *Ipomoea sagittata* is listed as vulnerable while *Senna didymobotrya* is listed as least concern. Species of *Commiphora* such as *Commiphora wightii* and *Commiphora stocksiana* are listed as critically endangered and endangered, respectively. None of the identified flora are listed in the sixth schedule of the Wildlife Conservation and Management Act, 2013 as being endangered, critically endangered or vulnerable.

Plate 4-1 Vegetation cover as was observed along the river bank adjacent to the treatment plant



It was observed that vegetation at the proposed site for the water treatment plant was varying from the surrounding. This was due to changes induced by water ponding allowing wetland vegetation (including papyrus reeds) to thrive.

Vegetation within the proposed booster tank site consisted of shrubs, trees and grass cover. Vegetation along the rising mains consisted of planted live fences that consist of shrubs intermittent with trees. In some sections the fence line shrubs formed a row of impenetrable thickets.

From the booster tank to the main storage tanks in Lolgorian and Kilgoris towns, the lines run within the existing road ROW hence there is no vegetation here. However, the surrounding environment consists of fences bordering woodlots and undeveloped land with grass cover interspersed with shrubs and trees.

The town areas are built up environments so the vegetation cover is low with most of patches comprising of naturally growing grass, shrubs and trees.

Based in AFDB OS 3, the habitat classification transitioned from natural habitats in the intake area (the riparian zone), WTP (adjacent to the riparian) and sections of the raw water rising mains pipelines to modified habitats in the settlements and road reserve where the storage tanks, pump stations, and transmission pipeline networks are proposed.

4.2.2 Fauna

There are about 95 species of mammals, amphibians and reptiles and over 420 bird species recorded in the Maasai Mara game reserve. The main wild animals in the park are the big five (buffalo, elephant, leopard, lion, and rhino). Other game include Wildebeests, Hippopotamus, Cheetah, Impala, Topi, Coke's hartebeest, giraffe, Roan antelope, Zebras, Spotted hyenas, waterbucks, Thompson's and Grants gazelles. The main birdlife includes the vulture, marabou stork, secretary bird, hornbill, crowned crane, ostrich, long crested eagle, and pygmy falcon. Nowhere in Africa is wildlife more abundant than in Maasai Mara Game Reserve.

Maasais are pastoralists who keep domestic animals such as cows, sheep, and donkeys. The project area is in close proximity (about 30km) to the Mara (triangle) game reserve. The wild animals freely roam into the human settlements where they interact with the domestic animals. During the field study we observed zebras freely feeding together with the cows and sheep. Although we did not observe this, it was reported that other wild animals like elephants, and giraffes frequently crossed the human settlements.

The project area in Lolgorian is however about 10km (direct distance) from the boundary of the Maasai Mara Game Reserve to the south east. It is thus not expected to directly interact with the protected area.

Examples of the aquatic life found in River Mogor include: Catfish, Tilapia, *Barbus* sp, *Carp* sp, and, *Haplochromis* sp,

4.3 Socio Economic Environment

4.3.1 Land Area and Administration

Narok County is divided into four administrative Sub-Counties. The sub- counties are further sub divided into 16 divisions, 92 locations and 182 sub locations. According to the records from the County Commissioner's Office, the County had 169,220 households in the year 2013. The county has six constituencies namely; Kilgoris, Emurua Dikirr, Narok North, Narok East, Narok South and Narok West; and 30 electoral wards. The project area lies in Transmara West sub-county within Kilgoris central and Kimindet Constituencies. See Table 4-5, below.

Table 4-5: Administrative and Political units

Sub county	Area in Km ²	Divisions	Locations	Sublocations	No. of Households
Transmara West	2,583.9	6	32	67	35,825
Transmara East	275.4	2	6	12	15,098
Narok south	10,412.1	5	28	52	62,412
Narok North	4,663.7	3	26	51	55,885
Total	17,935.1	16	92	182	169,220

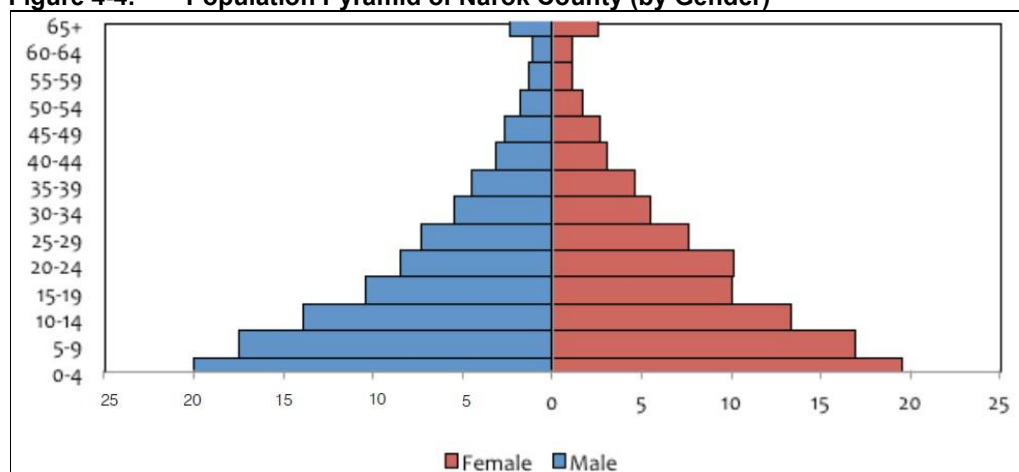
Source: County Commissioners office, 2013

4.3.2 Population

Based on 2009 National Census, Narok County has a total population of 850,920 with a population density of 47 persons per square kilometre (KNBS 2009). However, the 2019 Population and Housing Census show that the population increased to 1,157,873. More than 90% of the settlement is rural with only 6.9% comprising urban population. The Masai are considered the most dominant population in the county. The distribution of population shows that the county has a relatively young population at 53% below the age of 14 years. The county has a greater population growth rate than the national figure standing at 3.9 % compared to the national figure of 2.2%.

The population of Kilgoris Township stood at 9,865 in the year 2009, which is currently at 10,845 as per the 2019 census by KNBS. Lolgorian town had a total population of 2,689 people (2009 census) which currently stands at 6,053 as per the 2019 census. A population structure pyramid (by Gender) for Narok County is presented in Figure 4-4 below.

Figure 4-4: Population Pyramid of Narok County (by Gender)



Source: KNBS and SID, 2013

4.3.3 Ethnic groups

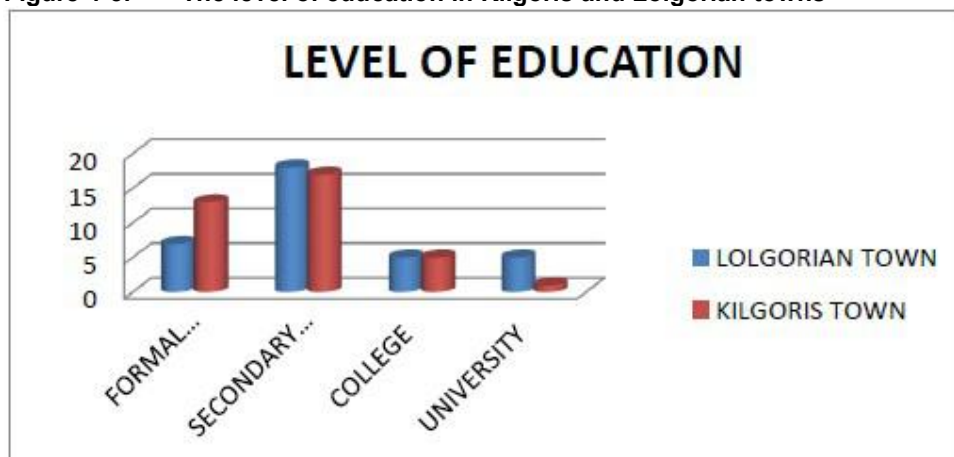
There is a unique characteristic in the settlement patterns, where majority of the urban population in Kilgoris town are from areas outside Narok County, i.e. the Kikuyu, Kalenjin, Luo, Gusii and the Kuria communities from the neighbouring Bomet, Nakuru, Migori and Kisii counties. These are mostly traders, farmers or professionals. Most ethnic Maasai live in the rural areas and only travel to the urban areas for business, administrative issues or social events.

4.3.4 Education

Narok county has a pupil teacher ratio of 33:1 and 496 primary schools with an enrolment of 175,409 pupils with 83% boys' and 73% girls' enrolment rates. The county has 61 secondary schools and a total enrolment of 13,852 students with a 20% and 15% boys' and girls' enrolment rate respectively. The affiliated youth polytechnics are a total of 8 and only one University College (Maasai Mara). In Kilgoris constituency (where Kilgoris town and Lolgorian fall under), there are 274 pre-schools, 154 primaries, 23 Secondary, 6 polytechnics and 3 tertiary colleges.

From the social survey conducted by CAS Consultants Ltd. in 2016, it was established that about 77% of the town population has reached secondary school as their highest level of education. The remaining 14% has been to college and only 9% has been to the university. This means that the community has the basic life skills to make a living.

Figure 4-5: The level of education in Kilgoris and Lolgorian towns



Source: Socioeconomic survey, CAS Consultants Ltd. 2016

There are a number of schools within the project area. See Table 4-6, below.

Table 4-6: Schools in the project area

School	Location along the project footprint
Munge Primary School	Found along the raw water rising mains
Intimigom Primary School	At the reservoir tank site
Olosayiet Primary School	Along the transmission line to Kilgoris
Mutenkwar Primary School	Along the Transmission line to Lolgorian
Mutenkwar Secondary School	
Olosentu Primary School	
Olpisiai Primary School	
Olmotonyi Primary School	
St Lucia Primary School (private School)	

4.3.5 Health

The county has one of the highest doctor-population ratios in the country at 1:100,953 as well as an equally high mortality rate of 60 per 1000 which is above national mortality rate of 12 per 1000 births. Though these figures are true for all regions from the former Rift Valley province during the 2009 National Census, medical practitioners in the county confirm that the figures are a true reflection if not lower than the actual figures. The main district hospitals in Narok and Transmara have a combined 187 bed capacity serving the total population. In Kilgoris constituency, there is one district hospital (Kilgoris town), one a sub-district hospital (Lolgorian town), one mission hospital and 13 health centres.

According to the socio-economic survey conducted by CAS Consultants Ltd. in 2016, it was evident that the community living in these two towns have been in one time or the other suffered from sanitation related diseases. For both Kilgoris and Lolgorian, a cumulative 91% of the residents have been treated for Malaria, diarrhoea, stomach issues, eye infection and respiratory challenges. All these diseases in one way or the other are associated to water and sanitation. This indicates strongly about the challenges faced due to lack of sufficient water to facilitate good sanitation practices.

4.3.6 Agriculture

Agriculture is largely practiced in the areas surrounding the town and is the main economic activity. This sector is comprised of crop and livestock production. Livestock rearing is dominant in the lowlands with Zebu being the main breed of cow reared; grade cows are more prominent in the highland areas adjacent to the town. There are two milk processing Plants with KCC being the major one. This is indicative of the milk production capacity within the area.

Some of the crops grown include barley, tea, sugarcane, maize and wheat. Tea is primarily grown in the tea belt around the Maasai Mau forest as a buffer zone to discourage encroachment into the forest while wheat is the main crop grown in large scale farms on the flat lowlands with farms averaging 8000 hectares. There has been sub-division of land into uneconomic units in some parts of the county while some large-scale farms remain unutilized.

Other main crops grown in the county are maize, beans, Irish potatoes and horticultural crops. These crops are grown under rain fed, micro-sprinklers and drip irrigation. Maize and wheat are the highest income earning cash crops in the county. The project area also has a National Cereals and Produce board depot located centrally within the town.

The project area lies within both urban and rural sections. The project area that lies within the rural area is dominated by the pastoral Maasai community. During the field study, we observed livestock including cows, goats and sheep being herded in search of pasture and water.

Photo plate 4-4 below shows cows drinking water beside the road



Photoplate 4-5 below showing a young herdsboy herding cattle.



During the field survey there was observation of crop farming along the river bank. The crops observed included maize, beans, and a variety of vegetables including kales and African Nightshade (managu).

Photo plate 4-6 below shows some of the crops observed to be planted along the river bank



4.3.7 Trading

Kilgoris Town is robust with trading activities with a number of retailers and wholesalers operating in businesses ranging from general stores, small hotels, eateries, hair salons, petrol stations and informal industries. Lolgorian is an upcoming centre currently serving as markets for farm produces but has the potential for the establishing banking and insurance services.

Although charcoal burning is illegal, there was evidence of charcoal burning and transportation within the area which suggests trade in charcoal. From feedback on the ground, it was reported that because of the fragmentation of land as a result of change of land tenure from group ranches to private land, there has been an increase in deforestation as people cut down trees and clear the land in order to build their houses to settle in. This has reportedly increased the charcoal burning as it is a quick and profitable way of getting rid of the felled trees.

Photo plate 4-6 below shows traders transporting the illegal charcoal on motorbikes; to be sold in the neighbouring counties.



4.3.8 Transport

Though Narok County is strategically placed, the road network is poor compared to the national standards. The County has a road network of approximately 2,798 km, (260 km bitumen, 840km gravel surface and 1,698 km earthen), connecting the various administrative areas of the County, including Lolgorian. Lolgorian is accessible from Narok through the C13 Road that connects to the Migori Isebania tarmacked road and also the C17 Road from Kilgoris Town.

There is a tarmac that runs from Nyangusu in Kisii County, ends in the middle of Kilgoris Town. Much of the road network within the town is in poor condition (with potholes and gullies).

The road used to access the intake site, WTP rising mains and reservoir tank at Intimigom Primary School is a County road. It runs from the junction with C13 all the way to the riverbank next to Munge Primary School.

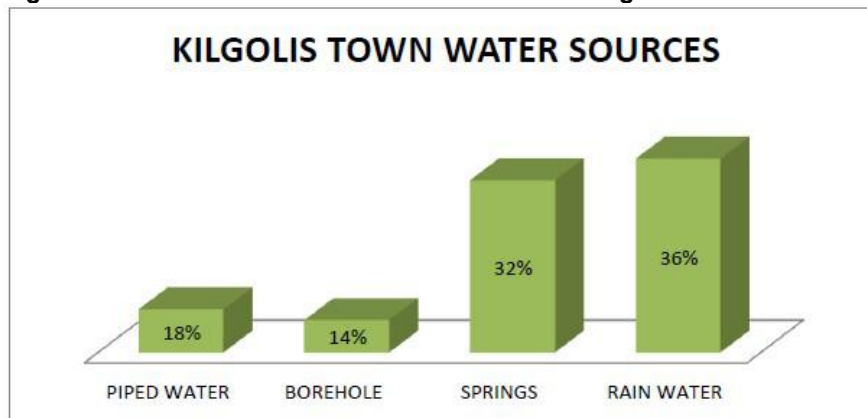
4.3.9 Water supply and sanitation

Kilgoris town

From the survey done in 2016, it was evident that most people are depended on the springs and collecting rain water as their water source for daily use; an indication that the existing water supply network does not adequately serve the population of the town.

The supply in Kilgoris town is characterized by breakdowns, leakages and rationing that leaves the residents with no water supply for weeks and sometimes months. As a result, some people have sunk shallow wells as well to help cater for their daily water needs. Mostly, the people obtain/buy water from multiple sources as the resource becomes available at any particular time.

Figure 4-6: Common sources of water for the Kilgoris town community



Source: Socioeconomic survey, CAS Consultants Ltd. 2016

The existing sanitation system in Kilgoris depends mainly on the onsite sanitation systems. The major excreta disposal system in the area is through pit latrines of varying quality while few residents use septic tanks. The absence of a faecal sludge management system is a major problem. There is no wastes disposal point in the town; the town residents normally hire vehicles for collecting wastewater when toilets are full or use other methods like abandon the toilets when full. The main solid waste disposal mechanism identified was through landfilling.

Lolgorian town

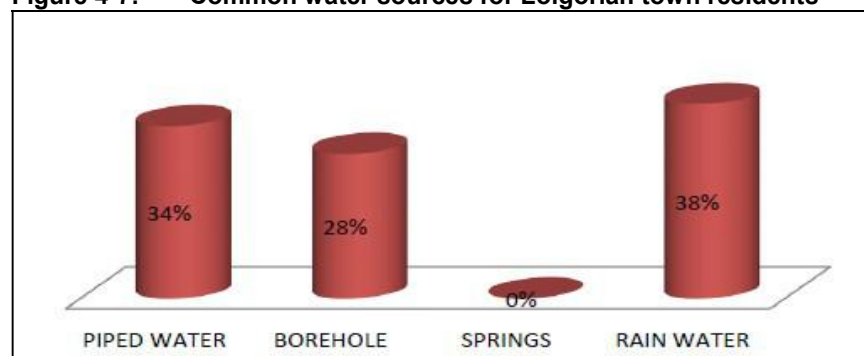
In Lolgorian, the water supply schemes were constructed in 1960s. The Scheme is responsible for the overall operation and management of water supply in Lolgorian Division. Area of responsibility has a total population of 14,773 people. Surface and Groundwater are the main sources of water in Lolgorian Division. However, in 1960s the surface water from Olondome River was abandoned due to the existence of heavy metal from nearby gold mine industry. Currently, Lolgorian town is served by water from a borehole, which is drilled within the town. There are two boreholes; one of them privately owned despite being constructed by Government. The water system is mainly dispensed through water kiosks and there are few customers connected directly to the pipelines. Water is abstracted from boreholes through suction pipe of 50 mm, then water is lifted using pump with the capacity of 20m³/hr via rising main of 50mm to the storage tank with the capacity 25m³. Thereafter, it is gravitated to consumers and Water Kiosk.

The preliminary data indicates that the yield produced by the existing borehole which is under government control is very small (Approx 3.5m³/hr) and is insufficient to the current demand of 600m³/day in the division. There are two storage tanks with a total capacity of 205m³. However, only one tank with 25m³ is operational, the other tank with the capacity of 180m³ is not operational because it was meant to receive water from the borehole (Approx 4m³/hr) which is now privately owned. The two boreholes were designed to produce 60m³/day which is insufficient to the current water demand of 600m³/day within the Division.

Currently, Lolgorian Water Supply System is almost dormant. It is only operated when someone is in need of water and provides fuel for the generator to acquire this service. As a result of this situation, on average, the Water supply system is only operated once per week. There are no springs in Lolgorian and therefore the alternative water source is rain water that is collected and stored during the rainy season.

For the project area, the present service area of Lolgorian water supply has a population of 2,689 people which is equivalent to 18 % of the entire population. Despite the unreliability of the water sources, we established that about 62% of the town residents depend on the very erratic water sources. As a result, they use them interchangeably. They collect and store rain water during the wet seasons. There are no springs in this area. The Figure 4-7 below shows the residents water sources.

Figure 4-7: Common water sources for Lolgorian town residents



Source: Survey by CAS Consultants Ltd, 2016

4.3.10 Energy

The electricity connection rate for the county is 5.9% far below the national figure of 22.7%. Parts of the county still do not have connection to the mobile telephony networks.

Biomass fuel is the main source of cooking energy.

(a) Cooking Fuel

In Kilgoris Town, the percent use of different cooking fuels was as follows: Electricity (0.1), Paraffin (1.7), LPG (0.3), Biogas (0.3), Firewood (84.8), Charcoal (12.7), Solar (0.1) and other (0.1) (**source: KNBS and SID, 2013**).

In Lolgorian, the percent use of different cooking fuels was as follows: Electricity (0.1), Paraffin (0.9), LPG (0.1), Biogas (0.1), Firewood (82.5), Charcoal (16.1), Solar (0.0), and Other (0.2) (**source: KNBS and SID, 2013**).

(b) Lighting Fuel

Estimated percent (%) use of the different lighting fuels at household level in Kilgoris Town was as follows: Electricity (2.9), Pressure Lamp (0.4), Lantern (20.9), Tin Lamp (71.3), Gas Lamp (0.8), Fuelwood (0.3), Solar (1.7) and Other (1.7) (**source: KNBS and SID, 2013**).

Estimated percent (%) use of the different lighting fuels at household level in Lolgorian was as follows: Electricity (0.2), Pressure Lamp (0.3), Lantern (18.5), Tin Lamp (77.8), Gas Lamp (0.3), Fuelwood (1.4), Solar (1.0) and Other (0.4) (**source: KNBS and SID, 2013**).

4.3.11 Mining

Mining activities in Narok County include gold mining in Lolgorian and Kilimapesa in Transmara west Sub-County. Gold mining activities have been ongoing in Lolgorian since the discovery of gold deposits. Goldplat, one of the world's biggest gold companies (also listed at the London Stock Exchange) was awarded the lease to exploit the large gold deposits in the Lolgorian area. The mineral output is at 285 kilograms per year, worth about shillings 1.5 billion.

Other quarry and mining activities in Narok County include sand, ballast and building stones. There are about 10 (No.) quarry sites in Narok County. (**Source: Narok County CIDP 2013-2017**).

4.3.12 Tourism

Masai Mara Game Reserve falls within Narok County and straddles across the Kenya – Tanzania border to the south west. Across the border into Tanzania the Game Reserve is known as Serengeti. Wildlife present in the Game Reserve include Elephants, Lions, Cheetahs, Buffaloes, Antelopes, Hyenas, Rhinos, Leopards, Wildebeest and all kind of birds among others. The Game Reserve attracts both local and international tourists visiting for recreation and sport. Maasai Mara Game Reserve and the Mara Triangle have neighbouring group ranches and conservancies. The reserves host several Hotels, tented camps, airstrips and balloon safaris. The reserve has highly contributed to the economic standards of the county through employment in the hotel industry, game ranging, revenue collection, beadwork, curio shops and cultural practices in the Manyattas among others.

4.3.13 Financial institutions

Financial institutions in the County include Banks such as Barclays, Chase, Equity, KCB and numerous other providers but in the form of banking agents. Microfinance institutions include Kenya women Finance Trust (KWFT), Agricultural Finance Cooperation (AFC) etc. M-pesa and other mobile money transfer services are also present in the project area.

4.3.14 Commercial Infrastructure

The building and construction industry is not well developed despite the promising potential the area has as a possible stop over to Maasai Mara. Currently, Kilgoris town boasts of just one modern building, the "Kilgoris Business Centre" which hosts several offices, including Kenya Power, the National Hospital Insurance Fund, Juhudi Kenya, Good Hope Kenya, Mwalimu Sacco, Maasai Mara University, Lenamo Springs Hotel and the State Counsel's office. Definitely, there is much need for infrastructural investments in Kilgoris as this would go into improving its stature as Narok's second largest urban centre.

4.3.15 Land tenure system in the project area

Previously, land tenure in the area was under group ranches. This has since changed over time as the land has been subdivided and allocated to private owners.

The land tenure system in the project area is under both private and public land ownership. The area along which the intake, raw water rising mains and treatment plant are proposed to be laid is under private ownership. The treated water transmission pipes as well as the distributions pipes are proposed to be laid within the existing road reserve which is public land. The reservoir tanks will be situated in both private and public land.

5 ANALYSIS OF PROJECT ALTERNATIVES

5.1 No Project Alternative

The No Action option assumes a status quo of the existing water supply condition for both Lolgorian and Kilgoris towns. From a social perspective, this is undesirable considering the present water demand has exceeded the existing supply system and resulted in a cycle of water rationing as indicated in Section 1.1 of this report.

Without the project, the environmental situation will neither improve nor will it necessarily deteriorate. Development of the project on the other hand will improve water provision to the communities in the two towns. The no-project option will however lead to the following (general) major negative and long-term impacts:

- The targeted populations (area residents and business communities) will continue to face acute water shortage and rationing;
- Increased exposure to health risks (water borne diseases);
- Stagnating growth of the towns (especially Lolgorian) and Narok county at large due to lack of attractiveness to would be investors;
- Environmental health problems due to poor sanitation; and
- There will be loss of productivity and reduced ability to create wealth.

This scenario is thus not acceptable on either social or environmental grounds.

5.2 Alternative Water Sources

5.2.1 Surface Water Intake Sources

The following water sources were assessed to determine the feasible option of water sources for Kilgoris and Lolgorian towns:

- Poroko Stream;
- Olondome River (Lolgorian);
- Mogor River

(a) Poroko Stream

Poroko stream is a tributary of *Enkare oo Nkituak* Langata Ngima River that discharges into it above the existing intake. Poroko stream contributes about 60% of the flow of Langata Ngima River which is abstracted at existing water supply intake for Kilgoris Town. This was considered as a potential source of water. The dry flow is estimated as 3.5litres/sec. (302.4m³/day). Therefore, further abstraction will interfere with stream flow as well as negatively affect the existing Kilgoris Town Water Supply.

(b) Olondome River

Olondome River, which is located near Lolgorian Town, used to be the main source of water for the town. The river was abandoned due to pollution from gold mining activities located upstream of the town. This potential source was thus dropped.

(c) Mogor River

Compared to other alternative intake rivers, Mogor River has a relatively sustainable water flow with a minimum recorded flow of 0.022m³/sec (1,900.8m³/day). The water abstracted from Mogor River will serve both Kilgoris and Lolgorian towns.

Since the planning horizon for the project spans up to Year 2040, CRVWWDA plans to rehabilitate the existing Kilgoris water supply project whose intake is at Langata Gima River (current daily production averages only 300m³/day will be raised to 480m³/day) and drill additional boreholes to supply water to Lolgorian Town. These additional water sources will augment the water supply of Mogor River intake. The total clear water that can be shared and distributed after Mogor Treatment Plant (1,000m³/day) and Developing 3 No. New boreholes and one existing borehole (280m³/day) will be around 1,280m³/day which can sufficiently serve up to the year 2040. Thus, the total number of beneficiaries of this project can reach up to 8,804 (year 2040 population), which can cover the demand up to year 2040.

Nonetheless, water supply from Mogor River intake will require pumping over distances – Kilgoris town (about 23km) and Lolgorian town (about 9km).

5.2.2 Groundwater Source

The conceptual design report has indicated that boreholes in Kilgoris Town have estimated yields of 3.5m³/hr with drilled depths up to 65m. The report has recommended exploring the possibility of supplementing the water supply with groundwater by drilling at least 10 boreholes whose tentative sites shall be confirmed after hydrogeological studies have been undertaken during implementation stage.

This option was dropped after it was established from the hydrological studies that the it was not viable. This was corroborated by the Water officer for Kilgoris Town during the Key informant interviews and reported as follows:

- The viability of the boreholes was not good.
- The quality of water from the boreholes is poor and not fit for consumption. Salinity is high. Low discharge from boreholes which in turn cannot serve big quantities. (the demand is high and therefore cannot be sustained by the low discharge.
- Most of the borehole would be very deep.

5.3 Alternative power sources

Alternative power supplies available are connection to the national grid, installation of diesel-powered generators and solar power.

Solar power supply has been considered for Lolgorian town due to high power costs (associated with persistent use of diesel generator) as pointed out during consultations. Connection to the national grid and installation of generators in these sites will only be for standby power.

In Mogor / Migori River System Solar pump may apply for the Raw Water Pump.

5.4 Conclusion

From the analysis, the Mogor river intake was the optimal option. Solar power supply will be the main source of power to bring down the operation cost.

6 STAKEHOLDER CONSULTATION AND PUBLIC PARTICIPATION

6.1 General

Public consultation is useful for gathering environmental data, understanding likely impacts, determining community and individual preferences, selecting project alternatives, and designing viable and sustainable mitigation plans.

The Constitution of Kenya (2010) makes Consultation and Public Participation (CPP) a central part of governance. CPP is also a mandatory procedure as stipulated by EMCA 1999 Section 58, on ESIA for achieving the fundamental principles of sustainable development.

Public consultation in the ESIA process is undertaken during the project design, implementation, and initial operation. The aim is to disseminate information to interested and affected parties (stakeholders), solicit their views, and consult on sensitive issues.

Inadequate public consultation can result in significant information gaps, which could mislead environmental planners undertaking an environmental assessment. Lack of attention to communication and consultation processes can generate individual, community, or regional opposition to a project. This can ultimately be a cause of substantial delays, increased costs, and unsatisfactory compromise solutions, which could have been avoided through earlier consultation.

Participation is a process through which different stakeholders influence and share their views regarding development initiatives and the decisions and resources that affect them.

6.1.1 Objectives of the Public consultation program

The overall objective of the consultations process was to disseminate project information to the project effected people and members of the community and to provide a feedback mechanism from these stakeholders to inform the environmental and social assessment of the project with feedback to be incorporated in the overall project planning and management processes. The specific objectives of the consultations were:

- Comply with EMCA's regulations on public consultation of primary and secondary stakeholders to obtain their views and concerns on expected impacts of the project both socially and environmentally;
 - Provide clear and accurate information about the project to the public;
 - Obtain the main concerns and perceptions of the population and their representatives regarding the project;
 - Obtain opinions and suggestions directly from the affected communities on their preferred mitigation measures;
 - To reduce conflict through the early identification of contentious issues; and
 - Identify local stakeholders with whom further dialogue can be continued in subsequent stages of the project.
-

6.2 Consultation and Feedback at Feasibility Study Stage in 2016

In April 2016, public meetings were held in Kilgoris town at the Church of God and Lolgorian at the Market Centre having been conducted by CAS Consultants Ltd. Engineers culminating in an ESIA report which is the subject of current update. The meetings were organised through the local chiefs and his assistants and had an attendance of 21 and 30 public members respectively. See Figure 6-1, below.

Figure 6-1: Public meetings at Lolgorian and Kilgoris respectively



In addition, a total of 46 household questionnaires at Kilgoris and 36 household questionnaires at Lolgorian were filled for rapid socioeconomic survey and the results incorporated in the baseline analysis.

Records of the consultations held with stakeholders in 2016 are attached in Appendix 3 of this report. Matters that arose from the consultations include:

Water shortages

There was a unanimous agreement that water shortage is a challenge experienced in the two towns. Therefore, proposed project was a welcomed relief and the community desired the project commences soonest. However, there was a concern raised about projects of similar nature promised by area politicians that have yet to materialise.

Awareness of the project

Some of the residents present at the barazas indicated that they were not previously aware of the project but appreciated the platform that allowed them such information. They also requested more meetings during the implementation of the project in order to give them access to the project progress information.

Empowerment of women and children

The community members informed the EIA team that women and children will be the greatest beneficiaries of the project as they are the ones tasked with the duty of fetching water. Consequently, reduced time spent in search for water will be dedicated for other constructive activities. Additionally, the danger posed to women and children during the search for water will greatly reduce. They proceeded to request that water be availed not only to households but to institutions such as schools, health centres and dispensaries and for watering their livestock too.

Trunk pipe laying

Community expressed willingness to cooperate in providing routing for pipe laying routes.

Water Kiosks

During the consultations, the community explained that they lacked the financial ability for water connections to household level. They further requested the Water Companies (Kilgoris and Lolgorian) to intervene by setting up additional water kiosks especially in the market area and town.

Employment opportunities

The communities requested that those responsible for the project implementation ensure that first priority is given to the local residents in the recruitment of local labour. They requested that employment opportunities available during the entire project life be availed to the qualified residents.

Remuneration

The Contractors should be advised not to underpay local people who will be employed on casual basis.

Future information flow

To avert unnecessary conflicts, there is need for prompt communication to all stakeholders. This could be through the use of the local administration and other such fora. Any information or clarification about stakeholders' position on project need to be promptly availed to any interested party.

About the proposed project

There was high acceptance of the proposed project. This was after a clear explanation that the project was not politically motivated and was entirely set to benefit the residents of the towns. However, the consultant pointed out that the project would have the political goodwill and support from the national government. The local administration indicated that it and the entire community would support the project as long as it promoted development in the area. The community has no objections for the project since there are similar projects in other parts of the country that have benefitted the residents.

In addition, the fact that access to water and decent sanitation is a right enshrined in Constitution of Kenya increases support for the proposal. The community thus embraces the project which will go a long way in making this right a reality.

6.3 Consultation and Feedback following Design Review

Following the update of project conceptual design, the following stakeholders were identified and key informant interviews held with them during the initial site visit as indicated in Table 6-1 below. Notes of the meetings held with them are attached in Appendix 4 to this report.

Table 6-1: Stakeholders consulted during the site visits

Stakeholder category	Interest	Date of Consultation
Primary Stakeholders	Project Proponent	Lake Victoria South Water Works Development Agency and Central Rift Valley Water Works Development Agency
	Project Affected Persons from Oloolchani location (Kilgoris Town)	New alignments that will require private land acquisition for their installations (Storage tanks and raw water and rising mains). These community members shall have direct benefit from the water supply or interaction with the project during both construction and operation phases.

Stakeholder category	Interest		Date of Consultation
	Members of the community in Moyoi location in Lolgorian	Community members residing near the transmission line and the new storage tanks.	7 June 2018
Secondary Stakeholders	Narok Water and Sewerage Company Ltd.	Technical Manager	23 February 2018
		Commercial Manager	23 February 2018
		Kilgoris and Lolgorian Area Managers	21 and 22 February 2018
	NEMA County officer	Narok County	23 February 2018
	WRA	WRA Regional Office (In charge of the intake sources i.e. Mogor and <i>Enkare oo Nkituak</i> Rivers.)	06 June 2018
	Local Administration	Chiefs in charge Oloolchani location.	08 June 2018

Typically, the agenda for the consultations were:

- Presentation of the proposed project;
- Obtaining from the respondents their environmental and socio-economic concerns, and perceptions as well as suggestions/comments regarding the proposed project.

6.3.1 Summary of Issues arising from the Key Informants/Institutional Stakeholders

The issue response matrix in table 6-2 overleaf summarises the issues raised by various stakeholders and how they have been incorporated in the ESIA study and the Conceptual design development.

Table 6-2 Issue Response Matrix from conceptual design consultations with Key informants

Stakeholder consulted	Issue	Preliminary feedback	Incorporation into design and ESIA Report
NARWASCO Technical manager	Pollution river due to farming activities upstream	It was reported that a lot of farming activities are going on upstream which causes siltation and pollution from pesticides and fertilisers to the River (<i>Enkare oo Nkituak</i>) that affects the water quality and yields.	It was agreed that WRA representatives will be engaged to ensure the River Riparian is well monitored and maintained to avoid the siltation incidences along the Riparian.
NARWASCO area Manager	Drying of the river	From the site visit, Eucalyptus tree planting is ongoing around the riparian. These trees have been known to consume a lot of water and they threaten the quantities of water in the river/will lead to drying up of the river. The locals reap richly from the trees by harvesting selling them for various timber work uses. The locals prefer the eucalyptus trees due to its fast maturity rate hence bringing in frequent income from sales.	It was recommended that WRA officers be requested to work in hand with Narok Water and Sewerage Company Ltd in order to conserve river riparian vegetation and maintain water flows. WRA catchment conservation program should sensitize community on likely impact of human activities along the (<i>Enkare oo Nkituak</i>) River Riparian.
NARWASCO Area Manager, NARWASCO Technical Manager and NARWASCO Commercial Manager	High power cost from the current energy source	The officers requested if the designs could incorporate solar panels as alternative sources of energy due to the high-power costs that they are currently experiencing to pump water.	The Engineer confirmed that the same has been considered and incorporated in the designs for the Kilgoris Project. Solar panels have been considered for Lolgorian town as indicated in the conceptual designs.
	Employment opportunities for the locals.	Employment opportunities that will be attracted by the project should benefit the locals.	In both Lolgorian and Kilgoris, the locals shall be given first priority when it comes to employment opportunities. Only skilled labour shall be outsourced where need be.
	Security for the facilities	Lack of security fence and walls around their facilities.	Fencing and security will be provided for key installations such as the treatment plants and the tanks.
NARWASCO Commercial Manager	Adequate public participation	Need for adequate public participation during the project study stage in order to incorporate the views from the community about the project in the designs.	One public meeting was conducted to inform the local area residents of the project and their role in the project.
Deputy Subcounty Water officer - Transmara West	Maximising on water sources	The number of boreholes should be increased to maximize on water sources for the town.	The project designs considered the possibility of augmenting supply by combining river water abstraction and boreholes. The designs proposed a total of 9 No boreholes in Lolgorian to augment water from the Mogor River abstraction. ESIA's for the boreholes will be undertaken separately.

Stakeholder consulted	Issue	Preliminary feedback	Incorporation into design and ESIA Report
	Lack of waste water treatment systems in both Kilgoris and Lolgorian.	Absence of sewerage system in the county may lead to pollution of the water supply infrastructure	The project has catered for ablution blocks as described in Section 2.3.6 of this report. In addition, recommendation will be made for Narok Water and Sewerage Company Ltd to consider feasibility study for design and development of waste water sewer systems. (Kilgoris and Lolgorian).
WRA regional Officer (In charge of the intake sources i.e. Mogor and <i>Enkare oo Nkituak</i> Rivers.)	Acceptable distance	For the proposed new boreholes in the two towns, the distance should be at least 100m from an existing borehole or surface water	ESIA for the boreholes shall be undertaken separately.
	Maintenance of the riparian	The WRA for Kilgoris is responsible for creating and equipping the Water Resource Users Associations (WRUAs) with the capacity to manage the water resource on their behalf. There is a WRUA in Kilgoris town. They are in charge of demarcating the riparian land (6 m away from the water source) as well as sensitizing the water users on the importance of conservation of the riparian. The riparian acts as a buffer between the cultivated land and the water source. When the riparian is maintained, the chemicals washed off from the crops will seep into the ground before reaching the water.	It was recommended that WRA officers be requested to work in hand with Narok Water and Sewerage Company Ltd in order to conserve river riparian vegetation and maintain water flows. WRA catchment conservation program should sensitize community on likely impact of human activities along the (Mogor and <i>Enkare oo Nkituak</i>) River Riparian.
	Planting of Eucalyptus (blue gum trees) along the riparian	In Kisii County, there is a bylaw that all the eucalyptus trees to be uprooted from the riparian. Once functional, the WRUA members will sensitize the community on uprooting the eucalyptus and advised to plant the water friendly trees e.g. <i>Grevillea</i> in both Lolgorian and Kilgoris towns.	Through WRUAs, the residents whose land touches the riverbed should be sensitized about the environmental impact of their activities and capacity built on riparian and catchment protection measures.
	Application for permit to drill boreholes	The water company running the water supply for Kilgoris is in Narok town. Application to drill the boreholes in Kilgoris should be done from the Sub regional office in Kisii. On application, among the requirements are comments by the WRA on their opinion of how the project will affect the water resource.	This project does not include drilling of boreholes in Kilgoris town as it is not a viable option. However, the application for permits shall apply when carrying out separate ESIA's for boreholes in Lolgorian.

6.3.2 Public meeting in 2018

Additional comments were obtained from the public meetings conducted during the project report preparation phase. They have been summarised in the issue response matrix in Table 6-3 and **Table 6-4** below and detailed records presented in Appendix 4.

Table 6-3: Issue response matrix for the public meeting in Kilgoris Town in 8 June 2018

Issue	Comment	Response
Lack of water distribution to the location along which the rising mains passes leading to illegal connections of water to the rising mains	The area residents complained that they had suffered from inadequate water supply. They resided along the rising mains and yet had no connection of a water distribution line to their location. This has led to illegal water connection to the rising mains. People currently rely on water from rain, springs and rivers.	The design will consider adding a water distribution line to serve area residents of Oloolchani location. Nonetheless, illegal water connections were prohibited.
High demand and low supply of water	It was reported that they had previously been relying on water connections from the rising mains. It was also reported that the population of the town had risen in the recent past and that the demand on these connections had gone high. There are a lot more water connections (illegal taps) which has led to reduction of pressure with which the water flows. This means that the water is simply not enough for the area residents.	<p><u>Recommendation from the community</u></p> <p>The residents requested for two official distribution lines from the new storage tank to serve the area residents of Poroko location (on the hill side) and Olotarin location (below the hill. This is in order to prevent conflict in the community over the resource.</p>
	Consider increasing the water distribution coverage to include the whole of Kilgoris town since the jurisdiction of the town is wider than what was considered in the proposed project.	
Long distance from water sources	It was reported that since there is no water source nearby, the residents are forced to travel for long distances to get water for their animals and domestic use	<p><u>Recommendation from the community</u></p> <p>The residents proposed that boreholes be drilled within their locality.</p>
Alternate water sources for the area residents	It was reported that water flow was not high enough even during the rainy season. The water from the river alone is not adequate to supply water to the entire town. Other alternative abstraction sources should therefore be considered.	<p><u>Recommendation from the community</u></p> <p>There are some springs which if protected could help supply the residents with water. It could be tapped and troughs put along the stream for use by animals.</p>
	A resident asked if the water from Mogor River could be used to supply Kilgoris town with water.	
Farming along the riparian	Residents living along the river are farming on the riparian	Through WRUAs, the residents whose land touches

Issue	Comment	Response
	areas up until the river bank. This is leading to high siltation as the soil is washed away into the river. The siltation is so high that the water levels have significantly reduced.	the riverbed should be sensitized about the environmental impact of their activities and capacity built on riparian and catchment protection measures.
Drying of the river	<p>Some of the residents have planted blue gum trees along the riparian yet this is prohibited. This tree species is known for its high uptake water leading to drying of the river. As it is the water on the river is significantly reduced.</p> <p>The Chief reported that previous efforts by his office to uproot the eucalyptus trees were ineffective as there were different opinions on how to handle the issue.</p>	<p><u>Recommendation from the community</u></p> <p>There should be a unanimous agreement and joint effort by the Agricultural Officers, WRA, NEMA, and KFS on how to effectively tackle the issue of the blue gum trees planted on river banks.</p> <p>Currently, no clear way forward.</p>
Land acquisition	Since the proposed new rising mains is proposed to pass through Ololchani location will the owners of the affected land be compensated?	The rising mains is proposed to pass along the designated road reserve. In case of wayleave acquisition, the affected land owners will be compensated for any property damages. The pipeline will be aligned along the fence as far as feasible.
Downstream water use	There are downstream users who depend on the water source for the domestic consumption as well as to feed their animals. Therefore, when planning for water abstraction they should be considered.	Leave water for downstream users who are also pastoralist. The proposed abstraction amount has considered the downstream water users likely to be affected by the project. The amount proposed to be abstracted is lower than the minimum flow of the river therefore allowing for water flow downstream.

Table 6-4: Issue response matrix for the public meeting in Lolgorian Town on 7 June 2018

Issue	Questions/ Comments/ Issues	Responses
Location of project and boreholes	<ul style="list-style-type: none"> Is the project for the town only or for the environs? Where will the water be tapped from along the river Mogor? Where will the boreholes be located? What consideration was done in determining the location of the said boreholes? Do the proposed boreholes have to be within town? 	Layout map was used to show the project overall foot print.
Collection, treatment, and distribution.	<ul style="list-style-type: none"> After treatment the water goes to a collection point, will the water be distributed through gravity or electric pump? After the collection tank does the water go to the individual homes or do the residents have to go collect the water? From Mogor River where will the water be treated? Will the water benefit the community? where will the pipeline pass? 	<p>The water will be distributed through gravity.</p> <p>After the distribution network has been laid, the residents can then apply for connection to their premises.</p> <p>Area residents from these locations should be provided with water since they are within the project area</p>
Working, Maintenance and access to boreholes.	<ul style="list-style-type: none"> The residents say the existing pipelines of water hardly ever work. What measures will be in place to ensure they work? The three existing boreholes do not work consistently, one borehole is located at the hospital, the 2nd is at KWS and the 3rd one was dug by National Water Conservation & Pipeline Corporation (NWCP) through LVSWWDA. The owner of the farm/land is now claiming it is his own private borehole. The challenge facing the KWS & hospital borehole is it's powered using diesel. It should be done using electricity for continuity. The proposed boreholes should be dug on public utility land that has been verified. The proposed new boreholes should be balanced to cater for areas where they do not have water. The communities downstream should be considered to avoid conflict especially during dry season they require water for their livestock. The project should therefore consider having a separate watering pan for the animals. 	<p>With the introduction of water abstraction from Mogor river to supply the town, the reliance on borehole water by area residents will be reduced.</p> <p>The volume of water to be abstracted is predetermined in consideration of downstream people. The other proposed boreholes will cater for the water supply needs for the community outside the distribution network.</p> <p>The proposed new boreholes will be solar powered.</p> <p>The proposed abstraction has considered and allowed for adequate reserve flow.</p>
Conservation	<ul style="list-style-type: none"> The locals asked to be provided with tree seedlings for planting to enhance water availability in the river 	Considered in ESMP

6.4 Additional Consultation and Feedback Following Design Review in 2019

Following further design review that propose abstraction of water for both towns from Mogor River, three additional public meetings and key informant interviews were held as presented in Table 6-6 and 6-7 respectively. The main aim of the additional consultation was to update the stakeholders of the new arrangement and also to reach out to newly affected persons.

6.4.1 Issues arising from the additional stakeholder interviews and public consultation in 2019

The issue response matrix in Table 6-6: Community Concerns Raised in 2019⁵ and Table 6-5: Issue response matrix from Key Informant Consultation conducted in 2019⁶ below summarise the issues raised by various stakeholders and how they have been incorporated in the ESIA study and the Conceptual design development.

Table 6-5: Issue response matrix from Key Informant Consultation conducted in 2019

Stakeholder	Issue	Comment and suggestions	Response and Incorporation into the Design and ESIA Report
County Director of environment-Narok County	Public awareness	Ensure you conduct public participation to inform the public of the proposed project.	Public awareness is a requirement in the ESIA process. Additional public meetings were conducted to inform area residents within the project footprint who had not been earlier consulted.
	Disturbance of cultural sites	Ensure there are no cultural sites (both individual or public being affected).	There were no identified cultural sites along the project area. If any is identified during the construction phase, chance find procedures (developed by NMK) shall be applied to handle sites.
	Avoidance of disruption by the proposed design	To avoid redesigning, ensure the access road has been planned and has an existing road reserve. If the pipes are laid without establishing where reserve is it could later be affected when the road is being constructed.	This has been factored in the design as much as possible. The pipes are proposed to be laid along the existing road reserve.
	Provision of water for the host community	The design should include provisions for water kiosks and water troughs for the community and their animals. The designs should cater for both cows and goats (lower troughs for goats and higher troughs for cows).	This shall be proposed for inclusion during in the detailed design phase.
	Provision of sanitation facilities for the community	Where the kiosks are there should be toilets, but far away from the water source/points.	The scope of works for this contract does not include Provision of sanitation facilities. However, this shall be captured in the report as a recommendation.
	Compensation	Be clear on compensation issues. Replant trees that have been cleared during construction	During the public meetings held in the project area, the area residents were informed of land acquisition as an anticipated impact during construction. They were informed that in case of acquisition, the affected people would be compensated.
	Conflict over cut trees	Once trees are cut provide a conflict resolution mechanism as the community members may lay claim to the trees.	This shall be addressed during the RAP studies. Any affected trees shall be inventoried and owners identified.
	Disturbance of wildlife	Ensure wildlife habitats are not disturbed.	It was established that the project area was within human settlement areas and minimal disturbance on wildlife habitats.

Stakeholder	Issue	Comment and suggestions	Response and Incorporation into the Design and ESIA Report
	Catchment protection	There should be corporate social responsibility projects for the catchment e.g starting a tree nursery (helping the community start afforestation works). KFS in conjunction with chiefs should ensure that no trees are cut by community members.	This is proposed as a mitigation measure within the report.
National Government Surveyor in charge of Transmara East/ West Sub County	Availability of land to lay the water pipes.	The Lolgorian road connects Kehancha Maasai Mara, Kirindoni. It's a national road (belonging to the national government) The road reserve is 40m wide (for Kenha roads)	The pipes are proposed to be laid within the existing road reserve therefore minimizing the need for land acquisition,
Water Resource Authority (WRA)- Lake Victoria South Catchment Sub-Regional Manager in charge of the water catchment for Kilgoris and Lolgorian towns	Impact of abstraction on the required environmental flow	Q. 95 is the bare minimum for the environmental Flow and should be observed at all times. This is the flow available in the river 95% of the time that the measurements are taken. The officer pointed out that there are no other abstracters on Mogor river.	This was factored in the design. From hydrological analysis, it was found out that the minimum flow recorded for Mogor River is in the range of 2,592 m ³ /day. A design flow of 1,100 m ³ /day has conservatively been considered, which is lower than the minimum ever recorded flow for Mogor.
	Catchment degradation	The challenge on major river is degradation. Deforestation and charcoal burning and overstocking or grazing animals upstream and loading to the degradation of the catchment.	Catchment protection has been proposed as a mitigation measure within the report.
	Flow of the river	The flows of the river are yet to be confirmed by WRA The hydrological reports must be submitted to WRA and a staff member from WRA sent to the site to confirm or verify the flows in the river. The WRA hydrologist will then write his independent report to verify whether the river is able to sustain the amount of water applied to be abstracted Also, when submitting the application for construction of works the consultant should ensure that the hydrological studies are conducted by a gazetted Hydrologist.	WRA permit shall be applied for based on the detailed design. The report shall propose that submission of the application for construction of works to be done by a gazetted hydrologist.

Stakeholder	Issue	Comment and suggestions	Response and Incorporation into the Design and ESIA Report
Sub County Environmental Officer for Transmara West Sub County	Volume of water for abstraction.	The peak season / volume of water is more frequent than the minimum volume	This was factored in the design. From hydrological analysis, it was found out that the minimum flow recorded for Mogor River is in the range of 2,592 m ³ /day. A design flow of 1,100 m ³ /day has conservatively been considered, which is lower than the minimum ever recorded flow for Mogor.
	Flooding	The rainy season is bimodal. It is during this season that flash flooding is likely to occur. The project should therefore maximize water abstraction during the rainy season and only topping up during the dry seasons.	The conceptual design has not proposed water storage before water treatment. It has however proposed a weir that will hold only the daily required abstraction.
	Change in land use and its impact on the catchment.	Sugar plantation is going on in Keyian which is an extension of the Awendo belt. The belt is generally on the lower western side of the county (downstream of the river towards Lake Victoria. Currently there is no sugarcane but there may be in the future (potential). The soils are favorable in Kilgoris but not in Lolgorian.	Catchment protection is proposed as a mitigation measure in this report.
		The Kipsigis are farmers, once the land has been subdivided; intense agriculture is likely to occur.	
		When land tenure was under group ranches, the forests were intact. This has since changed when the land was subdivided. As the land is cleared the easiest way to dispose of the wood is to make charcoal. The charcoal is in high demand in Kisii, Bomet, Kericho, Kisumu and Nairobi.	
	Water user conflict	Is the abstraction site a cattle-crossing corridor or a cattle-drinking point or a lagoon whereby water collects during the low seasons? If this is so, it will immediately bring conflict with the water users if we try to secure that point.	This shall be accurately verified at the detailed design phase of the project. The site for the weir should be chosen to avoid any conflict.
	Land acquisition	Land acquisition has to be done for the WTP. Acquire the land after consulting with the land owner to avoid conflict. Lay the pipes in the road's RoW to minimize acquisition impacts. When the pipes are laid along the road reserve the fences along the road may be affected/demolished. The community members through the chiefs should be sensitised and the relocations enforced.	A resettlement action plan (RAP) shall be prepared for the affected people during the detailed design phase of the project. By design, the water pipes are proposed to be laid along the existing road reserves as far as is feasible.

Stakeholder	Issue	Comment and suggestions	Response and Incorporation into the Design and ESIA Report
	Protection of the water source.	To reduce reliance on Mogor river, the client should have water points for the community to benefit from.	This has been catered for in the design.
	Need for a proper reticulation and established sewerage system	Change in lifestyle as people (beneficiaries) will start using water for showers and flushing toilets. There is therefore need for a well-functioning water sewerage system.	This has been proposed as a mitigation within this report
	Inadequate water supply for Kilgoris and Lolgorian.	The existing water sources should be protected and centralized in terms of collection so as to serve a wider population than what is currently proposed. This is because more people in Kilgoris still need water.	This has been proposed as a mitigation within this report
Sub County Water Officer-Transmara West	Poor viability of the previously proposed boreholes	<p>Quantity of the water from the borehole is low and not good for consumption. Salinity is high</p> <p>Low discharge from boreholes which cannot meet high demand.</p> <p>Most of the boreholes would be very deep The proposal to have River Mogor serve both Lolgorian and Kilgoris is welcome for the following reasons:</p> <ul style="list-style-type: none"> • It is clean • There are no extreme fluctuations • Currently the area around the river is sparsely populated as there are very few settlements. 	This has been considered in the Analysis of Alternatives for water sources.
Sub County Fisheries officer-Transmara West	Competing water users	Aquatic life depends on that ecosystem. The life of the organisms is threatened when water resource is scarce and they are competing for the water, space, oxygen.	This will be considered when deciding on the abstract amount and downstream release.
	Interference with riparian regulatory functions	When water volumes are low, the riparian vegetation dies off therefore interferes with their regulatory functions. The fish depending on the water are affected by the high increased nutrient load. The pH and acidity for aquatic organisms is affected.	
	Water resource management (quality and quantity)	During surface runoff, oil from generators and serviced machines may end up in the water body and affect the lives of aquatic organisms. The oil causes the slime on the fish's body to wear off having the fishes prone to infections.	

Stakeholder	Issue	Comment and suggestions	Response and Incorporation into the Design and ESIA Report
		Introduction of foreign organisms and plants to the aquatic ecosystem could lead to extinction of the native organisms. The new organisms could be harmful to both human health and aquatic life. Examples of the aquatic life found in River Mogor include: Catfish, Tilapia, <i>Barbus</i> sp, <i>Carp</i> sp, and, <i>Haplochromis</i> sp,	
		Upstream, the catchment is being destroyed for sugar plantation. The riparian is also being reclaimed. The water reservoirs are under threat of drying up.	
		Community is pastoralist but may in the future change to agricultural farming. They may need irrigation water.	
		The water addition will trigger growth of the town. Need for waste water treatment.	
		Raise the volume of water first before abstraction. Rehabilitation of the catchment/protect the catchment.	
		Breeding grounds may be affected.	
		Training, sensitization and capacity building on protection of the catchment.	
	Awareness programs on catchment conservation	Sensitize the community living along the rivers on how to conserve the catchment.	<p>The ESMP in this report has included the mitigation measures to address these issues. The following catchment protection and conservation measures have been proposed in the ESMP as follows:</p> <ul style="list-style-type: none"> Liaison with WRA to demarcate the riparian area as well as to sensitize people (through WRUAs) about farming and undertaking other proscribed activities along the riparian areas that may contribute to river sedimentation; and Equipping the community with appropriate resources like seedlings to plant trees along the riparian; <p>The design has catered for treatment of the waste water from the water treatment plant before its release back into the river.</p>
		Rehabilitation of the riverine vegetation and swamps along the river in order to protect the breeding grounds for aquatic organisms in general.	
		Uproot the trees that drain water from the river especially at the river catchments.	
		At the treatment plant, construct a manmade wetland where the waste water from the plant is released into for filtration before release into the main river.	
		Have bio-indicators at the points where the treated waste water is released into the water.	
		Community to be encouraged to conserve the water, to use alternative sources of water e.g water pans, water tanks, underground storage tanks, rooftop water harvesting. Reduce pressure on the river.	

Stakeholder	Issue	Comment and suggestions	Response and Incorporation into the Design and ESIA Report
Subcounty Officers for Livestock and Agriculture	Water availability during the dry seasons.	When its windy and very hot the rivers and streams dry up. During severe drought the levels of water in the river dry up completely. This was the case in the 2015 drought. The project should therefore consider having a water reserve (dam) during the overflow seasons so that the water can be conserved for use when the river is dry.	The proposed design has not included provision of dams, however, there shall be a weir at the abstraction point. Only the required amount shall be abstracted while ensuring that there is water being released for downstream users. The downstream release is envisaged to meet the environmental requirements and this rationale was factored in the design.
	Water user conflict	There may be conflict over the available water during the dry seasons – when the river dries up. Animals/livestock that need water may be in conflict with water being abstracted for the project.	From hydrological analysis, it was found out that the minimum flow recorded for Mogor River is in the range of 2,592 m ³ /day. A design flow of 1,100 m ³ /day has conservatively been considered, which is lower than the minimum ever recorded flow for Mogor. It is therefore not expected that there will be conflict with the water users downstream. However, the project shall propose that for the current project, there be water rationing during the dry seasons in order to minimize over abstraction on the limited water resource.
	Potential vandalism of infrastructure.	Water from Oliotoktok – Machakos project pumped water without serving the community along the water pipes. The community ended up vandalizing the pipes.	The surrounding community shall be provided with separate watering points that have been considered within the project. Consultations with the members of the community (especially the women) shall be held to determine the best suitable locations for the watering points.
	Community empowerment and capacity building	There should also be committees to run and maintain the boreholes and watering points. The committee can decide together with the community, the reticulation aspect. This bring in the aspect of capacity building for the committee who would run the boreholes.	
		The impact of agriculture is negligible as there is barely and crop agriculture. Land is being leased to farmers. This may lead to clearing of land. There should be awareness creation for the community as they are leasing the land. They should be taught conservation.	

Stakeholder	Issue	Comment and suggestions	Response and Incorporation into the Design and ESIA Report
	Catchment protection and conservation.	In the past Migor river never used to dry up even during the dry seasons. The Chapalungu forest, which is the source, has been cleared. The riverine vegetation has been cleared. The tributaries should be conserved and restored.	This report has proposed catchment protection and conservation measures to ensure sustainability of the project in the future. The proposed project is limited to primarily cater for the populations within the towns and not the rural populations. In future other options for abstraction of water should be explored in order to serve a wider population.
	Destruction of the wetlands.	The wetlands have been destroyed and so there is no retention. When it rains, there are instances of flash flooding leading to destruction and loss of lives (14 lives were lost during recent flash floods).	
	Future increase in demand for water.	The town is expanding beyond the town plan. There is need to overhaul the whole line to include the new settlements and not just the existing town.	
		To ease demand on water to towns consider protecting the springs of water within the town and the outskirts to be used by the community Roof catchment policy should be reintroduced and enforced in the town for more water.	
KFS officer for Transmara East and West.	Capacity building	There are no ongoing efforts to conserve the forest along the riparian. The KFS for now only offer advisory service to the community but not the actual conservation. Trees planting is organized by NAROK KFS who purchase and supply the seedlings then the community members plant the trees. There needs to be capacity building for the sub county offices in order to maintain nurseries. When the ban on polythene bags was implemented, many nurseries in Narok county stopped functioning since they did not have alternative to the polythene bags that they used to plant seedlings.	This report has proposed catchment protection and conservation measures to ensure sustainability of the project in the future.
	Destruction of infrastructure.	When the pipes are being laid trees will be felled during clearance of the site. The animals and birds living in those trees will be displaced after clearing is done, bamboo can be planted along the river to conserve the water.	

Table 6-6: Community Concerns Raised in 2019

Issue	Comment
Water for the surrounding community	Piped water should be made available for the community members living around the project footprint. It should not only be limited to the members on the community living within Lolgorian and Kilgoris towns only.
Access of the water by communities living near the pipes.	The community members wanted to know whether the members living along the areas where the pipelines are proposed to pass would benefit directly. They were informed that this is not possible but that the design has allowed for various water points for the members of the community.
Management of the water points	Water is a sensitive issue in the community. There should be a proper system in place for managing the common community water points to avoid conflicts.
Job opportunities for the member of the host community	When hiring manpower for the project, priority should be given to the community members. Community members requested that equal job opportunities be given to all the members who are willing and able to work including the women and old men. Women are requesting for lighter jobs that are not require heavy lifting etc.
Compensation for land acquisition	Before construction, there should be compensation given to the land owners whose land will be acquired to construct the project infrastructure including the intake, water treatment plant as well as the storage tanks.
Community to benefit from the project as well.	The community living along the proposed project area are in need of water for their cattle and for human consumption as well. They were not pleased to learn that the water from the river cannot be channelled to their houses as it is meant to benefit residents of Kilgoris and Lolgorian towns. However, they welcomed the project as long as they can benefit as a community. They proposed that a cattle watering trough and water point for human consumption be located at Munge, Lelishuani, Nganayio, Olmanic, Olpisiai, Olesentu, and Olchamba village in Olomismis location
	There are centers and schools along the road that also need water. Currently schools use rain harvested water which is not reliable all year long. The community members requested to be assisted with water points for the members of the community as well as the animals. The project should consider drilling a borehole a very 2km is possible.
Safety for Community members and their cattle	During construction, there should be measures put in place to ensure the water/abstraction point and treatment works is protected to avoid accidents and fatalities by animals and people.
Water catchment protection	There was a concern as to whether the water in River Mogor would run out as it did in Langata Ngima river. The measures to ensure that this does not happen have been covered in this report.
Conflict with other water users downstream of the project	Water is what has led to the people settling in the area regardless of the hardships they have faced. Therefore, if project considers other water users and doesn't abstract all the water, it is welcome.
Suggestion of location for the contractor's camp.	In case the contractor needs a work station to be situated between Kilgoris and Lolgorian, Olesentu is central.

6.5 Future Consultations

After collection of public views on the proposed water supply and sanitation development, the Proponent will be required to set the ground for future consultations with key stakeholders and the general public with respect to identification of location of the 4 No. ablution blocks proposed in the town. The following methods could be used to gather information from and continuously engage the various community members and other stakeholder groups:

- Key Informant Interviews;
- Focus Group Discussions (FGDs);
- Public meetings (*barazas*); and
- Roundtable meetings.

CRVWWDA and LVSWWDA should maintain consultation records including attendance registers, signed minutes, sample photographs for meetings, mails etc.

Upon mobilisation of the contractor, project publicity signboards should be erected at strategic locations to make the local community aware of what works are going on.

The contractor should also have a mechanism of receiving and addressing any concerns/complaints from the immediate local communities during the construction process.

To avert unnecessary conflicts with the community, there should be prompt communication to all stakeholders. Any information or clarification about stakeholders' position on project need to be promptly availed to any interested party. This could be through the use of the local administration and other such fora.

6.5.1 Public availability of documents

Subject to the existing legal framework, relevant approved project reports and licensing documents should be made available (at designated public offices and the project website) for public inspection/access on request.

We propose that the ESIA report findings be disclosed to the public through the Narok County NEMA office and the Deputy County Commissioners offices. Any comments raised by the public should be communicated to CRVWWDA/LVSWWDA through NEMA.

In addition, the ESMP to be publicized by NEMA upon completion of the ESIA studies, the final ESMP adopted for construction phase should also be made available to the public. Its availability should be publicized electronically through the Proponent and/or Contractor's website. Hard copies should be deposited at the contractor's camp site(s) and at the Deputy County Commissioners office for inspection.

6.5.2 Notification on forthcoming works

Prior to the commencement of construction, the Proponent and Contractor should mobilize and, in liaison with other stakeholders, facilitate consultation with the local community among other stakeholders including project affected persons (PAPs) in addition to those already identified in this report.

The Proponent and Contractor should continuously consult adjacent property owners with respect to project activities affecting their properties/environment and mitigation measures and, where necessary, jointly fine tune the proposed ESMP actions.

6.5.3 Publicity signages

Prior to the commencement of construction, the contractor should erect publicity signages detailing the nature of forthcoming water works at various strategic locations including the

treatment works site, reservoir sites, and at intervals along the distribution lines. The Publicity signage should be as required and approved by the Ministry of Transport, Infrastructure Housing Urban Development and Public works as well as National Construction Authority (NCA), and the by-laws of Narok County.

6.5.4 Localised notifications

For any working front, the Proponent in conjunction with the contractor will post notifications of forthcoming works, especially the disruptive ones. In addition, localized notifications should be made for:

- Job opportunities available;
- Any traffic disruptions or controls or changes to abutting property access; and
- Any irregular/hazardous work practices such as excessively noisy works.

7 IDENTIFICATION AND ASSESSMENT OF POTENTIAL IMPACTS

7.1 General

The purpose of the Environmental and Social Impact Assessment (ESIA) of the project is to improve decision making and to ensure that the project progresses using a sustainable approach. The ESIA identifies ways of improving the project environmentally and socially by preventing, minimising, mitigating, or compensating for adverse impacts. These measures will help to avoid potentially costly remedial measures. In order to alleviate negative impacts emanating from the implementation of the project, relevant mitigation measures have also been proposed in this chapter.

The impacts are divided into three phases namely construction; operation and decommissioning phases. The impacts of construction phase are related to activities carried out during project construction and they directly affect the communities living in the area in which the project is undertaken. The operational phase impacts are related to the impacts of the operation of the water supply project. The closure and decommissioning phases impacts have also been anticipated and considered in this report.

The Study team undertook a qualitative analysis and evaluation of potential environmental, socio-economic and occupational health and safety impacts. The analysis considered the nature of the impacts in terms of their probability of occurrence, spatial coverage, duration of occurrence, reversibility of impacts, and magnitude.

7.2 Positive Impacts during Construction Phase

7.2.1 Employment Opportunities

The project is estimated to employ a large number of people working with the contractor several workers including casual labourers, masons, electricians and plumbers are expected to work on the site for a period of at least 24 months. Also, semi-skilled and unskilled labour and formal employees are also expected to obtain gainful employment during the period of construction.

During the construction phase, there will be job opportunities for both skilled and unskilled labour. The skilled workers will include:

- Engineers (Supervising Engineering team);
- Environmentalists;
- Civil works contractors;
- Contractor's staff (managerial, skilled and unskilled labour force)
- Administrators.
- Artisans; and
- Construction monitoring personnel from the various Government agencies

Employment will lead to increased incomes for those employed. Creation of job opportunities will improve financial security hence improved living standards.

Enhancement measures

The client should coordinate with the appointed contractor to ensure that the local population is prioritised when it comes to employment opportunities (especially unskilled labour) during the construction phase. During the public participation meeting held in Olomisimis, the community members requested to be given first priority when employing both the skilled and

non-skilled workers. Consideration for employment should be given for both men and women and people of all age groups who are able to work.

The contractor shall be required to have a documented HR Policy in line with Kenyan labour laws and relevant ILO standards.

7.2.2 Injection of Money into the Local Economy

A large sum of the Project money shall be released into the local economy due to the construction activities. It is envisaged that during construction a large number of downstream activities shall take place including but not limited to the following:

- Payments for skilled and unskilled labour;
- Purchases of construction materials from local suppliers; and
- Payments for local provisions including fuel, foods and accommodation

Enhancement measures

As suggested during the public participation meeting held in Olomisimis, in case the contractor needs to set up a camp or work station between Kilgoris and Logorian, they should consider setting up in Olosentu village which is the central point.

7.2.3 Cultural Integration

During construction phase it is anticipated that few skilled personnel will be sourced from outside the project area of varied cultures. It is expected that there will be cultural exchange which will lead to adoption of new ways of life, such as: Changes in ways of clothing; Social Interactions between the new members and existing members of the community; and introduction of new beneficial ideas.

7.3 Negative Impacts during Construction Phase

7.3.1 Loss of Land

According to the proposed detailed design, the proposed intake is situated on riparian land that is within private property. The raw water transmission line and water treatment works are proposed to be located on private property as well. During the public meetings, the owners of the affected parcels of land were identified for further consultation regarding the land take.

The treated water will be transmitted to the reservoir tank that is proposed to be located in Intimigom Primary School. The transmission pipes shall be laid within the existing road reserve. From observation made during the field survey, there is some encroachment onto the existing Right of Way (ROW) by live fences that mark the boundaries of property.

The rising mains as well as the distribution lines are proposed to be laid along the existing road reserves. These are not expected to require land acquisition. The land owner, on whose land the new storage tank is proposed to be situated, has been consulted by the client and is in agreement in as far as acquisition of that land is concerned.

The breakdown of the required land is as follows:

Project component	Estimated land requirement
Intake works (weir and sump)	0.5 acres
Water Treatment Plant area (accommodating future expansion)	2.5 acres

Mitigation measures

Following completion of detailed design, an abbreviated RAP study shall be undertaken and implemented prior to commencement of the project in order to compensate the project affected persons (PAPs).

7.3.2 Soil-Related Impacts

Soil related impacts are likely to occur during construction activities. The impacts will be localised on trenches for the pipes, or the construction site of Intakes, Water Treatment Works, Reservoirs, etc. The impacts are:

- disturbance of the natural soil structure;
- mixing of different soil layers; and
- compaction thus reducing the ecological function of soil in the respective areas.

Nonetheless, most of the pipeline infrastructure will be laid in areas with already disturbed soil structures and functions i.e. along unpaved roads within the town. Soils within farmland where pipes will be laid through e.g. Raw Water Main and Treated Water Main will be affected. Trenches opened during the laying of pipes shall be backfilled and the surfaces restored to acceptable standards.

In sloping areas, where the pipes will be laid, there will be an increased risk of soil erosion, particularly during the rainy season, due to removal of vegetation. Proper landscaping and revegetation/grassing shall be done to reinstate and mitigate soil loss.

Disposal of Cut-to-Spoil

Excess material after backfilling excavated trenches will require proper disposal. Where necessary, the contractor will have to consult the local NEMA offices and the County Government to advise on the appropriate and available landfills for disposal of the generated cut-to-spoil material.

Mitigation

- Adopting the minimize (excavation of materials) and reuse principles for generated soil material. Options for reuse of generated soil material within the project include the development of impounding structures, re-spreading in areas to be landscaped to enhance aesthetics along the wayleave area and the development of access roads; and
- The valuable top soil containing organic material, nutrients as well as seeds and the soil fauna should be excavated separately and piled in an appropriate manner for reuse. The top soil shall be spread over the disturbed/excavated area in order to improve the conditions for redevelopment of a vegetation cover during the restoration process. This will apply particularly in farmland areas which are likely to be under cultivation use after the construction works. In these areas, majority of the pipelines, where applicable, will be laid along the fences. Areas adjacent to the construction sites will not be disturbed and care will be taken to minimize the area of impairment by storage of construction material (gravel and sand) and pipes.

Soil contamination

Contamination of soil is more likely to happen during the construction phase. The sites where the construction machinery is stored/parked/serviced are likely to be contaminated because of leakage or spillage of fuel and lubricants. Refuse and solid waste from construction and human activities can also contaminate the soil. Contamination of soil during construction might be a major long-term residual negative impact. Unwarranted disposal of construction spoil and debris will add to soil contamination. This contamination is likely to be carried over to water bodies in case of dumping being done near water body locations.

Mitigation

- Plan emergency response measures in case of accidental oil spills;
- Maintenance and servicing of construction equipment and vehicles shall be done only on designated purpose-built surfaces to avoid contamination of soil;
- Ensure that all construction equipment and vehicles are serviced off site at licensed garages;
- Any contaminated soil should be handled properly as hazardous waste and removed from site for safe disposal; and
- All spoils should be disposed off appropriately and the site shall be fully cleaned prior to hand over as a way of minimizing soil contamination.

Soil erosion at the proposed WTP

The proposed Kilgoris and Lolgorian WTP is located next to Mogor River which has been proposed as the water source. Construction activities are likely to cause soil erosion resulting to sediments ending up in the river causing more siltation. The construction will also require removal of vegetation. The situation will persist until landscaping through planting cover vegetation is done.

Mitigation

- Improvising embankments as protection measure along drainage channels and the river bank to trap soil particles before they end up into the river.
- Minimize and restrict construction disturbance/excavations within the project footprint by clear demarcation;
- Program of Works for Kilgoris and Lolgorian should be prepared in line with Narok weather pattern so as to avoid such works during adverse weather conditions especially excessive rains.

7.3.3 Changes on Surface Water Quality

River Mogor, the source from which the water is proposed to be abstracted, is relatively undisturbed by agricultural activities. As informed by the WRA officers the local community are mainly pastoralists who don't engage in farming and so the riparian areas are well preserved. During the construction of the proposed intake works at Mogor river, the water quality of the river may deteriorate in terms of increased turbidity levels due to increased sediments build up. Depending on the type of suspended material, this effect will continue over a short stretch of the River downstream of the Intake. The River will also be diverted temporarily depending on the local topography during construction/expansion of the Intake. However, these impacts are locally restricted, temporary and reversible and are thus of minor significance.

For both towns, there will be increased wastewater production from the construction site and this may cause pollution of the water resources. The liquid waste water may be through surface runoff that contains oils that have spilt from machines, and fuel storage areas in the construction camps. Water contamination with cement from the construction site can make it to be highly alkaline and toxic to fish, plants and animals living in watercourses. Cement particles entering a watercourse can clog fishes' gills and also destroy their spawning grounds.

Mitigation

- Reclaim and maintenance of the riparian land (through plant trees) by involving WRA and WRUAs;
- Monitoring of effluent discharged into environment and in particular changes in water quality downstream. Any discharged effluents must adhere to the Environmental Management and Coordination (Waste Management) regulation, 2006.
- Regular inspection on the operational condition of construction equipment and machinery (especially leaks of oils, fuel, hydraulics), refuelling protocols (at safe

location away from water, availability of spill kits and knowledge of their use, and emergency spill procedures);

- Any on site/camp storage areas for fuels, oils or other liquid chemicals shall be sited away from surface water drains. The base shall be impermeable limiting any seepage to the ground and also not draining directly into the surface water drains. Where practicable, drainage from storage compounds shall be passed through oil interceptors prior to discharge;
- Apply standard best practice site sediment control procedures to minimise sediment in site drainage waters returning to the river;
- Ensure all staff and workers are fully aware of the limits to the site for each activity, Standard Operating Procedures, and emergency procedures;
- River diversion works should be timed such that downstream users are not exposed to abrupt sedimentation. This should be communicated beforehand.
- Spilled cement or concrete should be collected and disposed away from natural water ways or storm water drainage; and
- Sensitisation of workers on proper handling of concrete spillages or waste cement.

7.3.4 Vegetation Clearing and Disturbance

In general, construction activities require clearance of natural vegetation. However, this will be to a low extent, as most of the construction activities will take place within the town area, along roads and along the hedges of farmlands.

From the site visits and discussion with key informants (KFS), it is inferred that there are no noticeable habitats or wild or endangered animal habitats at the vicinity of the project area

Mitigation

- Vegetation clearing shall minimize felling of maturing trees;
- Vegetation clearing should be selective and restricted to the project footprint. If cutting of trees is unavoidable, replanting to restore cover and with native tree species is recommended; and
- Monitor the project area of recolonization by invasive/weedy species, especially in excavated or disturbed areas. Such species should be weeded out.

7.3.5 Noise pollution

Construction of the proposed Project will most likely result in noise emissions as a result of the machines that will be used during excavation and construction vehicles delivering materials to site. During the construction phase of the WTP, noise generating activities will include earthworks, mixing, casting and material movement. It is expected the noise levels to be within acceptable limits. Noise can be a nuisance to the local community if construction works begin too early in the day and continues into the night.

The distribution lines are mainly in the town centre with dense settlements and commercial activities thus the noise air pollution impacts and may be a serious nuisance. However, the project should operate within the standards set in the NEMA noise regulations.

Mitigation measures

- Avoid night time construction when noise is loudest;
- Sensitive noise should be identified and avoided, where possible;
- Alternative methods should be optimised in areas where earthmoving equipment are likely to result in excessive noise and dust;
- Provide PPE (hearing protection) to persons operating within or visiting identified high noise areas;
- The noise emission characteristics should be considered during selection and mobilization of construction equipment;

- In order to meet noise level requirements, the works equipment should be equipped with standard noise attenuation features. Machines that exceed acceptable noise limits should be equipped with silencers or lagging materials or specially designed acoustic enclosures and sensitive receptors like schools and hospitals;
- Inform local residents when construction activities are likely to generate excessive noise in order to minimize disruption to local residents; and
- Sensitize truck drivers and plant operators to switch off engines while offloading materials; to avoid gunning vehicle engines or hooting especially when passing through sensitive areas such as schools, churches, residential areas and hospitals.

7.3.6 Air pollution

Air pollution can degrade the environmental quality around settlements and could impact on public health. Dust will be emitted during excavation and related earthworks. Air borne particulate matter pollution is likely to occur during the route clearance, excavation and transportation of materials on site. This is likely to affect site workers, in extreme situations leading to respiratory problems. Air pollution by exhaust of the vehicles used to transport the materials is a further negative impact usually closely related to the construction area. All these impacts are temporary and limited to those areas where machines are used. Manual trench excavation will generate much lower amounts of dust.

Urban areas are typically more densely populated than the rural areas therefore the impact of air pollution will be greater felt in the towns. In addition to the dense population, the distribution networks are within the town centres while the transmission lines are within the rural settlements, this means that the receptor for dust is increased within the towns as compared to the rural settlement while there will be little effect of noise and air pollution in the rural settlements.

The project should therefore operate within the standards set in the NEMA noise regulations and air quality standards.

Mitigation measures

- Limiting the number of motorised vehicles on use and number of trips through planning.
- Use predetermined tracks;
- Wet all active construction areas as and when necessary to lower dust;
- Compact, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites;
- Construction vehicles should adhere to speed limits within construction roads; and
- Machinery and vehicles to use approved fuels and be regularly serviced to reduce associated emissions.

7.3.7 HIV and AIDS

The overall HIV prevalence is 5% which makes the county to be ranked 28th in Kenya. The HIV burden is more among women whose prevalence is 7.1% compared to 4.3% among men.

Women and girls are more vulnerable to HIV infection which is attributed to lack of access to information and education services necessary to safeguard sexual and reproductive health, protection of human rights (Source: *Narok County Profile 2014*).

The number of adults living with HIV is 25,700 while the number of children living with HIV in the county is 3,325 (NASCOP, 2014). In terms of new HIV cases, Narok County is categorized among the medium burden counties with estimated annual new infections of 2,025 and 82 among adults and children respectively (NASCOP, 2014).

The influx of people (from other parts of the country) seeking employment opportunities during construction has potential of increasing infection rates. The spread of AIDS and other sexually transmitted diseases (STDs) can be linked to the construction activities and the resultant

opening-up of new regions/developments. Although there are no empirical data to support this theory as far as Kenya is concerned, it is believed that migrant populations with different social behaviour and background are likely to contribute to higher transmission rates of these diseases.

Labour camps bring a temporary influx of people in an area. This may stimulate business in the Project area and also propagate the spread of sexually transmitted diseases such as HIV/AIDS due to sexual interactions between the project workforce and the local community.

Researchers have indicated that HIV prevalence rates are higher among spouses who stay or work away from town and spend away from home for more than a week. This group of individuals are mostly truck drivers and other employees who work for the contractor and are brought in as skilled labourers.

Mitigation measures

The project contractor shall be required contractually to ensure that prevention and management of sexually transmitted diseases as a result of social interaction between staff and local populations is conducted as part of the overall project through:

- Education and sensitisation of workers on HIV/AIDS and STIs;
- Provision of condoms to the construction workers and the project team;
- Formation of peer education groups from among the project staff to ensure continuity in training and awareness raising;
- Institution of HIV/AIDS awareness and prevention campaign amongst workers for the duration of the contract; and
- Promote employment of local staff as much as possible to reduce level of in-migration as a result of the project.

7.3.8 Improper Solid Waste Disposal

Solid wastes generated during construction include papers used for packing, plastics, cuttings and trimmings off materials, containers, rods of metals, sharp objects (nails) among others. Dumping around the site will interfere with the aesthetic status and has a direct effect on the surrounding community. Improper disposal of the same solid wastes off-site could also be an environmental concern. The resulting off-site effects could be aesthetic, pest breeding, pollution of physical environment including water resources, invasion of scavengers and informal recycling by communities.

Mitigation measures

- A site waste management plan should be prepared by the contractor prior to commencement of construction works. This should include designation of appropriate waste storage areas, collection and removal schedule and identification of approved disposal site;
- Unusable construction waste, formwork and other construction material, must be disposed of at an approved landfill or sold to willing buyers for salvage value;
- Proper solid waste receptacles and storage containers should be provided, particularly for the disposal of lunch and drink boxes so as to prevent littering of the site.
- Arrangements should be made for the regular collection of litter and for its disposal with the County Government of Narok;
- Ensure that the solid waste collection, segregation, and disposal system established within the plan is functioning properly at all times during operation;
- Recycle and re-use wastes where possible such as scraps metal;
- All solid waste should be managed in line with the Environmental management and coordination (Waste Management) Regulations, 2006; and
- Segregation of hazardous wastes for safer handling.

7.3.9 Occupational, Public Health and Safety

Construction workers are likely to have injuries and hazards as the construction works unavoidably expose workers to occupational health and safety risks. The workers are also likely to be exposed to risk of accidents and injuries resulting from accidental falls and slips into open trenches, injuries from hand tools and construction equipment, exposure to excessive noise and vibration, dust etc.

Local services such as medical, water supply, sanitation and waste disposal can be over stretched by the sudden increase in workers population. If no adequate workers accommodation plan is instituted, the general public will also be exposed to safety hazards arising from construction activities involving construction vehicles, open trenches, dust, noise etc.

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

Construction workers may be exposed to infections if they are not provided with clean drinking water, sanitation facilities and proper water disposal facilities.

Food for the construction workforce is usually provided by mobile individuals most of which operates without licenses. This can compromise health of the workers especially if such foodstuffs are prepared in unhygienic conditions.

Mitigation measures

- Incorporate code of conduct to construction workers with clear expectations and consequences upon breaching;
- Machines and vehicles shall be operated by dully qualified personnel;
- Ensure that all construction machines and equipment are in good working conditions to prevent occupational hazards;
- Establish a Health and Safety Plan (HASP) for all the construction works;
- Require the contractor to appoint a trained health and safety officer for the duration of the construction work to formulate and enforce HASP;
- Provide workers with appropriate PPE's and enforce usage;
- A First Aid Kit should be provided within the site and during construction phase. This should be fully equipped at all times and should be managed by qualified persons.
- Provide workers training on safety procedures and emergency response such as fire, oil and chemical spills, pipe bursts and other serious water loss risks;
- Construction area should be fenced off from the public and access restricted as necessary for public safety;
- Install and maintain appropriate hazard warning signs around the site;
- Due care should be taken to maintain hygienic conditions at site by providing proper sanitation facilities and ensuring standard cleanliness of the facilities;
- The food suppliers should have licenses for handling the foodstuff from local public health offices; and
- The contractor should have workmen's compensation cover. It should comply with workmen's compensation Act, as well as other ordinances, Regulations and union Agreements.

7.3.10 Traffic impact

The transmission and distribution lines are proposed to be laid on existing road reserves. From observation during the field survey, the C 13 to Lolgorian road is in poor condition and traffic along the road is generally low. However, the condition of the C17 road is much better. The traffic along that road is also higher than that along the C13 road. During construction, there may be sections whereby the transmission and distribution pipes cross the roads thereby causing disruption of normal traffic flow as well as creating associated delays and inconveniences to the road users.

In addition, the construction activities can potentially cause traffic along the roads in this sense:

- Construction workers may pile the spoils along the side of the road on even on the actual road surface
- The vehicles and machines in use on the active sites may be parked on the road thereby causing obstruction for other road users

These could potentially cause obstruction and disruption of traffic along the said road.

Mitigation measures

The contractor shall be required to formulate and implement a traffic management plan incorporating:

- Provision of alternative routes in areas where accesses have been disrupted;
- Dust suppression measures to enhance visibility at construction sites for oncoming traffic and road users;
- Plans for short diversion routes which should be well maintained by regular sprinkling to reduce dust. Adhere to road reserve if possible;
- Provision and maintenance of clear traffic signages of ongoing construction works, regulate speed limits and diversion signage to notify approaching traffic;
- In urban areas, schedule delivery of materials to the sites during periods of light traffic between 9.00am - 12.00 pm and 2.00 pm - 4.00 pm during week days;
- Project vehicle should have and only use designated parking areas;
- Sensitize workers and area residents on the importance of exercising care in the project area in as far as traffic movement and other safety issues are concerned
- Obtain permission from the local community as well as the County government if diversion routes go beyond the Right of Way;
- Reinstatement of diversion routes (and old tracks) to original condition;
- Institute a traffic management plan incorporating adequate temporary signages and flagmen as necessary.

7.4 Positive Impacts during operation phase

7.4.1 Improved public health

During the operation phase of the project, there will be provision of additional supply of safe water for drinking and use to Kilgoris and Logorian towns. Nonetheless to meet the projected water demand, water from Mogor River, the CRVWWDA proposes to augment with three new boreholes and rehabilitation of an existing borehole in Logorian town as well as augmentation of the existing WTP in Kilgoris town. This development will ensure that the residents are reliably supplied with clean water for both domestic and commercial use. As a result, occurrence of water related diseases will immensely decline.

Enhancement measures

- NARWASCO to ensure routine maintenance for sustainable longevity of the system for the two towns.
- CRVWWDA and NARWASCO to review the need and plan for improved sewerage system in both towns.

7.4.2 Improved access to water services

The primary beneficiaries of the project are the urban residents. Being a pastoralist community, majority of the residents in both towns complained of having difficulties when

getting water for their daily use. This is due to high transport cost attached, long distances and general lack of a clean source of water.

Pastoralists in Lolgorian expressed their struggles in getting water for their animals especially during the dry seasons. Majority are forced to walk long distances in search of water for both human and animal consumption.

The additional water supply to the towns from Mogor river will ameliorate the problem of accessing water by reducing time spent and distances covered in search as well as eliminate the need to disinfect water (mostly through boiling). These effects will have a positive impact on household budgets. People living in low income areas and informal settlements will benefit from the Project by covering shorter to get safe water from the installed water kiosks. All in all, the project will play a part in meeting the SDG goal on improved Access to clean water and sanitation for all.

The value addition of the project will also trickle into household budgets by cutting down expenditures on water, especially people living in low income areas and informal settlements.

Enhancement measures

- To serve some of the communities within the project area, several water points will be provided to enhance community access, the locations of these water kiosks will be identified in consultation with the local residents and will be chosen bearing in mind the close proximity to the target population. The amount of water dispensed by the kiosks will vary depending on the number of residents in that area. Water meters will be installed at each of the water kiosks.
- For Lolgorian, a water pan should be developed to serve the domestic animals especially during the dry season. This will lessen the demand burden for the available water supplied in a predominantly pastoral environment.

7.4.3 Empowerment of women

Women play an important role in domestic and general economy of the town. Nonetheless, they are hard hit by the vagaries of water shortage. The long distances covered and the unreliability of the springs force them to spend more time in search of water and forgo some other livelihood and economic commitments. For instance, the public meeting held in Moyoi location, about 10% in attendance were women. The explanation for their low turnout was associated with domestic chores and responsibilities since children were away in school.

Therefore, the water supply will allow women more time to pursue other economic activities such as farming, selling their products in the open market, businesses among other income generating activities. Additionally, greatly reduce the bother posed to women and children during the search for water.

Enhancement measures

- Women should be specifically consulted for siting of the community water points.

7.4.4 Visual intrusion and landscape impact

There will be some alterations in the topography from the newly constructed structures. A lot of earthworks will be done at these sites resulting in visual intrusion. For instance, the new water storage tank might be a new land mark which is visible from far. Also, the new WTP will be situated where there was open land for animal grazing therefore changing the landscape and land use.

Mitigation

- Landscape enhancement through planting of hedges and trees.

7.4.5 Improved working conditions for O&M staff

The project will see construction of offices at the WTP and new houses, in addition to setting up a fully equipped laboratory. These will improve the working conditions of the operation and maintenance staff at the water treatment plant as well as create new employment opportunities.

NARWASCO should adhere the final O&M manual developed by the contractor for sustained quality working environment.

7.4.6 Increased accountability for used water

Currently, most piped water users are not metered. Also due to the dilapidated state of the existing distribution networks, there is loss of water through leakages, therefore leading to a lot of unaccounted for water. This will change with the new system as the conditions of the pipes will be better and the water supplied will be metered.

7.5 Negative impacts during operation phase

7.5.1 Impacts of river abstraction on downstream users and environment

According to the seasonal stream flow analysis in this report, the volumes of River Mogor fluctuate depending on the season. There are two months of the year where the water volume in the river is at its lowest. This information was verified by WRA during stakeholder consultation. During those dry seasons, one can walk across the river as was observed during the field studies. Even so, there is usually available water for cattle to drink at specific places along the river whereby water collects.

At full operation of the new works, abstraction of water will lead to a reduced base flow of the Mogor River downstream of the Intake. This may impact the communities that live downstream of the river since they depend on the same river for their domestic consumption and water for their cattle as well as aquatic life. This can potentially lead to conflict in the community over the water resource. However, from hydrological studies that have been done on the river, the abstracted volume of water will be below the minimum flow for the river. The reduction in the river's base flow is therefore not expected to be of major significance. Also, the water abstraction from the river will be supplemented with water from boreholes for Logorian town and an augmented WTP in Kilgoris town therefore lowering the demand on the water abstracted from Mogor River.

During the public meeting, some of the suggestions from the community in terms of water supply were as follows:

- The area residents of Olomisimis location requested for water points for the community to be situated two kilometres apart for ease of access;
- The residents requested for two official distribution lines from the new storage tank to serve the area residents of Poroko location (on the hill side) and Olotarin location (below the hill);
- The residents of Ololchani proposed that boreholes be drilled along their locality in order to provide alternate sources of water supply other than the proposed one; and
- There are some springs which if protected could help supply the residents with water. It could be tapped and troughs put along the stream for use by animals.

Noteworthy, results from analysis of Mogor river historical flow records (between 1990-2010) showed high temporal variability in the period between 2004 and 2010. Climate change and increased human activities in catchments were considered to influence rainfall and stream flow patterns in terms of average flows, minimum and maximum flow.

The following should be noted:

- From consultations with the WRA officer in charge of the sub catchment, it was reported that there were no other licensed abstractors on Mogor River;
- The rationale for assuming that downstream release meets the environmental requirements was factored in the design. From hydrological analysis, it was found out that the minimum flow recorded for Mogor River is in the range of 2,592 m³/day. A design flow of 1,100 m³/day has conservatively been considered, which is lower than the minimum ever recorded flow for Mogor.
- The proposed abstraction amount has considered the downstream water users likely to be affected by the project. The amount proposed to be abstracted is lower than the minimum flow of the river therefore allowing for water flow downstream;

Mitigation

- Ensure that the operation allows for the environmental flow as provided in the design at the abstraction point;
- Consider adding boreholes and wider distribution networks in future in order to serve a wider population;
- Ensure there is consultation with the members of the public on where the community water points should be situated; and
- CRVWWDA and NARWASCO to collaborate with local WRA and WRUAs in catchment protection and conservation.

7.5.2 Impact on aquatic species

During Key stakeholder consultations the County Fisheries officer indicated that there were fish species in the river. Examples of the aquatic life identified as inhabiting River Mogor include: Catfish, Tilapia, *Barbus* sp, *Carp* sp, and, *Haplochromis* sp.

Loss of breeding grounds

This can occur where there is over abstraction of water from the river. When water volumes are low, the riparian vegetation dies off therefore interferes with their regulatory functions. The fish depending on the water are affected by the high increased nutrient load. The pH and acidity for aquatic organisms is affected. During consultations with WRA we were informed that there are no other water abstractors on the river. This may change in the future. However, at the moment, the amount of water to be abstracted by this proposed project was informed by the hydrological study which established that the water proposed for abstraction was below the minimum flow of the river therefore allowing for enough water to sustain the aquatic life. The project is therefore not envisaged to interfere with the breeding grounds unless through over abstraction.

Mitigation

- The project should not abstract more water than is permitted;
- During low seasons, the project should consider rationing the water abstracted in order to reduce the water stress, on the river; and
- Catchment conservation and protection programs should be implemented in liaison with other agencies in order to ensure there is sustainability of the resource for future use.

7.5.3 Water pollution from treatment wastes

The operation of the new WTP will produce some sludge as Aluminium Sulphate ($AlSO_4$) and chlorine will be the main chemicals be used for treatment of raw water. Sludges from Chemical Mixing Tanks, Flocculation Basins and Sedimentation Tanks contain some amount of residual chlorine and aluminium. When washed into rivers and streams, these can kill aquatic invertebrates and even fish due to eutrophication and changes in the biochemical characteristics of steam water (such as temperature, pH, Dissolved Oxygen (DO) and Biological Oxygen Demand (BOD)). The immediate downstream water may also be rendered unsuitable for direct use as is the current practice by some local residents.

During surface runoff, oil from generators and serviced machines may end up in the water body and affect the lives of aquatic organisms. The oil causes the slime on the fish's body to wear off having the fishes prone to infections.

Mitigation

- Sludge treatment facility should be an integral part of the project for removal of sludge by filtration in Sludge Drying Beds constructed at the Treatment Works. Sludges from Chlorination and pH Correction Tanks contain Chlorine and Soda Ash. These sludges are removed in Soak away Pits. All chemical sludges to be buried on site, and the pH of the soil monitored continuously. There will be no disposal of the sludge into the River,
- Proper management of the treatment works to ensure that there are no overflows or operational failures causing pollution of underground and surface water;
- Continuous monitoring of water treatment effluent to ensure adherence to the Environmental Management and Coordination (Water Quality) Regulations, 2006 and Environmental Management and Co-ordination (Waste Management) Regulations, 2006;
- Installing an early warning system (EWS) for downstream community in anticipation of unprecedented overflow of wastes from sludge lagoons. A communication protocol should be developed for this; and
- Explore reuse of filter backwash and application in land/agriculture.

7.5.4 Sewage and effluent disposal

Provision of constant water supply to the residents of the towns translates to increase in effluent/waste water disposal resulting from sanitary facilities, kitchen and laundry among others. Kilgoris and Lolgorian towns have no existing sewer system therefore effluents emanating from such activities end up predominantly disposed in the open drainage system. This poses a health risk to the resident if no appropriate measures are taken.

Three ablution blocks have been proposed in Lolgorian town. These will be connected to septic tanks. Poor maintenance and management of the blocks and septic tanks can pose public nuisance from odour and even public health problems.

Mitigation

- Sensitize residents on health and sanitation issues associated with untreated waste water contaminating food, kitchen wares, and stored water or end up in the river;
- Installation of Kilgoris and Lolgorian sewerage systems in future, to augment the existing capacity in dealing with added waste water burden brought about by the project;
- Narok county government to require all new urban household and commercial buildings using the flush system to incorporate septic tanks or soak pits in line with applicable standards; and
- Sanitary facilities should be kept clean always, through regular washing/cleaning too.

7.5.5 Occupational health and safety impacts

During operation and maintenance of works by the attendants, there may be a certain risk of health impact for workers handling chemicals used for water treatment at the Treatment Works i.e. Aluminium Sulphate (Alum), Chlorine and Soda Ash. In addition, activities involving servicing and maintenance of electrical and plumbing machines, cleaning of washout valves etc. when undertaken without proper mechanisms in place, can result in serious injuries and long-term health deterioration of affected workers.

Mitigation

- Adequate storage facilities for chemicals and provide PPE's to attendant staff;
- Only qualified staff should be allowed to undertake treatment works operations;
- Detailed instructions on use and precaution measures shall be available in a comprehensive Operation and Maintenance (O&M) Manual to be prepared and submitted to the Water Service Operator on completion of the Works;
- Provide material data sheets for all chemicals used at the treatment plant and undertake continuous staff training on safety and health, in line with OSHA, 2007;
- Maintain incident accident records for emerging cases;
- Formulate and implant occupational safety and health plan for all the project the O&M activities; and
- Undertake annual safety and health audits in line with OSHA, 2007.

7.5.6 Insecurity

Security is a prerequisite to/for any development as it ensures materials/project is secure. It also controls movement within the project sites especially for the intruders who might be injured by the materials and other hazardous features available within the site. During the public meeting held at Intimigom Primary, the school board requested that there be security guards to man the reservoir tank to restrict the community member from freely accessing the school compound in search of water.

Mitigation measures

- The sensitive project installation should be enclosed using suitable fencing and hoarding materials to beef-up security and to control movement within the site;
- There should be guard houses at the gate. Security guards should always monitor the gate of the facility to keep away the intruders and to control movement within the site;
- The guards stationed at the gates should document movements in and out of the site/property; and
- Sensitise the communities on requisite security requirements and controlled access to some of the installations.

7.5.7 Impacts of Invasive or noxious weedy Species

Impacts of invasive and noxious weedy species on land cover will be limited to areas initially disturbed or excavated then have been abandoned or partially restored. Invasive / weedy species may be opportunistic, colonizing grazing and farmland areas. After completion of the construction works, immediate restoration by sowing adequate grass cover and planting appropriate species of shrubs and trees. Extremely steep hillsides will be protected by technical measures such as terracing, gabions or other means.

Mitigation

- Ensure that the land is restored to its original state after pipe laying has been done;
- Monitor restored areas to achieve acceptable ground cover and maturity, weed out invasive and colonizer species taking advantage of ground disturbance.

7.5.8 Community conflicts over available water resources

Water is a scarce resource in the community. As it is, there are communities downstream of the proposed abstraction point that rely on the water from the river for both domestic use and livestock uses. During dry seasons, the volume of water available for use reduces.

At full operation of the new works, abstraction of water will lead to a reduced base flow of the Mogor River downstream of the Intake especially during the dry seasons. This can potentially lead to conflict in the community over the water resource. However, the proposed abstraction has considered and allowed for adequate reserve flow. From hydrological analysis (section 4.1.4), it was found out that the minimum flow recorded for Mogor River is in the range of 2,592m³/day. A design flow of 1,100m³/day has conservatively been considered, which is lower than the minimum ever recorded flow for Mogor.

Also, there are members of the community living along the proposed rising mains for the clean water that is Olosentu, Olchamba, Olpisiai, Olmonlonyi, Soinming and Eutirisha villages. According to the proposed design these members are not beneficiaries of the proposed project. This might be a source of water resources use conflict in the community since these residents also face water scarcity same as the target beneficiaries of the project.

Mitigation

- Ensure that the design flow allows for the adequate environmental flow as provided at the abstraction point;
- Ensure that there are water distribution lines serving communities that live downstream of the water project.
- Consider adding boreholes and wider distribution networks in future in order to serve a wider population.
- The communities living along the rising mains should also be provided with access to water thorough water kiosks. This will help in avoiding water conflict in the community between those who have access to water and those who don't; and
- Ensure participatory monitoring of abstraction (with WRA and WRUAs) to enhance transparency.

7.5.9 Noise Pollution

A 225kVA generator will be installed at the booster pump at the clear water pumping station. This will constitute an intermittent source of noise throughout the operation period. The noise will be a nuisance to nearby settlements in Olosentu and Olomisimis and attendant workers. This can be problem if improper mounting is done at the installation and no regular maintenance is undertaken on the generators.

Mitigation measures

- Ensure that suitable mounting is done at the installation stage incorporating noise and vibration abatement;
- Clearly label the high noise areas;
- Provide PPE (Hearing Protection) to workers operating within or visiting identified high noise areas, depending on the level of exposure;
- In order to meet noise level requirements, the generator should be equipped with standard noise attenuation features. Where the generator exceeds acceptable noise limits, it should be equipped with silencers or lagging materials or specially designed acoustic enclosures; and
- Ensure regular maintenance of installed generators to manufacturer's specifications.

7.5.10 Emissions and Hazardous Wastes

The proposed power generator will be run by diesel and require regular servicing involving the replacement of oil filters, fuel filters etc. Emissions will contribute to greenhouse gases. However, the impact is deemed insignificant given the low power ratings of the generators.

Improper handling of associated maintenance (oil based) wastes may be hazardous to the receiving environment.

Mitigation measures

- Ensure regular inspection and maintenance of installed generators according to manufacturer's specifications.
 - Ensure regular servicing that included replacement of oil filters and fuel filters etc
 - Ensure proper handling of hazardous wastes associated with maintenance;
 - Minimise the use of the generators to only when it is needed.
-

7.6 Positive Impacts during decommissioning phase

While the water supply project is not anticipated to be decommissioned in the near future but periodically maintained for extended service, temporary contractor's facilities will be decommissioned by the end of construction works' defects liability period (DLP).

The contractor is expected to prepare a detailed decommissioning plan for all his temporary facilities including camps, borrow sites and quarries. The plans detailing environmental restoration measures and associated safety and health protection should be submitted to NEMA for approval at least three months before the actual decommission works begin. The following presents anticipated decommission impacts of the contractor's facilities.

7.6.1 Employment opportunities

This a positive impact where both skilled, semi-skilled and unskilled workers will be employed during decommissioning phase.

Enhancement measure

- The Contractors should not underpay local people who will be employed on casual basis; and
- A decommissioning health and safety plan must be prepared prior to works commencement.

7.6.2 Site Rehabilitation

Decommissioning phase will lead to rehabilitation of the site that was cleared to pave way for construction activities. This will ensure that the environment is left as natural as possible close to or better than before. The site could therefore be converted back to a grazing ground.

7.7 Negative Impacts during decommissioning phase

7.7.1 Loss of jobs and income

Most of the workforce that will be employed by the contractor will lose their jobs immediately after the closure of construction. The loss of jobs will have far reaching impacts as it will lead to loss of income and social stress.

Mitigation measures include:

- Notify the workers in advance on the project closure date and adequately compensate them;
- Dismissal procedures to be compliant with Employment Act, 2007;
- Provide counselling & alternative skills for alternative activities;

- Formerly employed staff at the project, should get recommendation letters to assist in getting job search and reuse acquired skills and earn income.

7.7.2 Noise Pollution

Activities likely to produce noise during decommissioning include demolition of structures and movement of heavy ground vehicles, disassembling all the prefabricated structures, disconnection of services, breaking down concrete foundations and handling of debris from sites. Though short lived, the generated noise will affect exposed workers and, in some cases, the nearby communities.

Mitigation measures include:

- Schedule noisy activities during the day time period;
- Use silencers on machines where possible;
- Ensure machinery is well maintained to reduce noise emitted.

7.7.3 Air/dust Pollution

This is expected to result from demolishing of structures and excavation and loading of debris/spoil material. This will affect demolition staff as well as the neighbouring residents.

Mitigation measures include:

- Practice dust management techniques, including watering down during drier period;
- Set up dust barriers/ screens at strategic locations, especially downwind;
- Provide and enforce the appropriate use of PPE against dust.

7.7.4 Improper handling and disposal of Solid Waste Material

It is expected that large amounts of solid waste material arising during decommissioning and hence proper disposal of these materials is critical.

Although demolition waste is generally considered as less harmful to the environment since they are composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment. In addition, even the generally non-toxic chemicals such as chloride, sodium, sulphate and ammonia, which may be released as a result of leaching of demolition waste, are known to lead to degradation of groundwater quality.

Mitigation measures include:

- Disposal of solid waste in compliance with EMCA 2006 Waste Management Regulations;
- Segregation of waste to encourage reuse and recycling;
- Contractor should liaise with local County government and NEMA office to establish the appropriate landfills for particular; and
- Ensuring that the contracted waste collector is registered with NEMA to collect and dispose wastes.

7.8 Cumulative Impacts

Cumulative impacts relate to the aggregate of past, present and future actions, and may also arise from additional factors or developments related to the construction of proposed treatment works and water supply pipelines. Effects from different activities may also interact to cause additional effects not initially apparent when considering the individual developments or changes, and there may also be synergistic interaction between different factors.

The following cumulative impacts are anticipated from implementation of Kilgoris and Lolgorian water supply augmentation and sanitation project

- Availability of reliable water supply will attract further investment to the towns. Increased generation of waste water from the towns from increased availability of piped water and additional investments is anticipated. However, there is no waterborne sewerage in both towns and their environs. This can cause serious waste water management and associated public health problems;
- The project targets river water. With continued water abstraction and introduction and increase in farming activities in the future, the river water might eventually be stressed from reduced ability to self-clean and suffer from heavier sedimentation load. This might in the long run also make water treatment expensive if no multi-agency approach is adopted to ensure sustainable catchment management strategy.

Mitigation

- Liaise with WRA to demarcate the riparian area as well as to sensitize people (through WRUAs) about farming and undertaking other proscribed activities along the riparian areas that may contribute to river sedimentation.
- Equip the community with appropriate resources like seedlings to plant trees along the riparian; and
- In the long term, CRVWWDA should consider development of waterborne sewerage system for both towns.

8 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

8.1 Environmental Management Plan

The Environmental and Social Management Plan (ESMP) is prepared to show how site-specific concerns and mitigation measures are addressed through the construction, operation and decommissioning phase of the proposed Water supply and sanitation project.

The ESMP has been developed with project knowledge and information available to date. As project commencement and scheduling plans are developed and changed, components of the ESMP might require amending. This is therefore a working document, which can be updated whenever new information is received or site conditions change.

The contents will include but not be limited to:

- Current environmental and social issues and parameters to be mitigated;
 - Mitigation measures proposed;
 - Lines of responsibility;
 - Cost of undertaking the environmental and social mitigation measures;
 - The time frame in which these mitigation measures will be implemented.
-

8.2 Purpose and objectives of ESMP

The specific objectives of the ESMP are to:

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

8.3 Auditing of the ESMP

CRVWWDA and the contractor shall conduct regular audits to the ESMP to ensure that the system for implementation of the ESMP is operating effectively. The audit shall check that a procedure is in place to ensure that:

- The ESMP being used is the up to date version;
- Variations to the ESMP and non-compliance and corrective action are documented;
- Appropriate environmental training of personnel is undertaken;
- Emergency procedures are in place and effectively communicated to personnel;
- A register of major incidents (spills, injuries, complaints) is in place and other documentation related to the ESMP; and

- Ensure that appropriate corrective and preventive action is taken by the Contractor once instructions have been issued.
-

8.4 Responsibilities of the ESMP

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

- CRVWWDA and NARWASCO;
- NEMA;
- Contractor;
- Supervising Consultant;
- County Government of Narok;
- Directorate of Occupational Safety and Health (DOSH), Narok County Office.

8.4.1 CRVWWDA and NARWASCO

CRVWWDA who is the proponent will be charged with the responsibility of ensuring that the proposed development has been put up in an environmentally sound manner. This can be achieved by inclusion of environmental specifications in the tender specifications, selection of renowned environmentally conscious contractors and supervision to ensure that the objectives of this ESMP are met. NARWASCO on the other hand will be responsible for efficiently operating the infrastructure as well as maintaining the facility in good condition.

8.4.2 National Environment Management Authority (NEMA)

The responsibility of NEMA is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Government of Kenya in the implementation of all policies relating to the environment.

8.4.3 The Contractor

The persons/firms contracted to put up the water supply infrastructure will be required to comply with the requirements of the ESMP within this report. To ensure strict compliance environmental specifications of this ESMP should form part of the contract documents. The Contractor shall be required to have suitably qualified staff to oversee ESMP implementation.

8.4.4 Supervising Consultant

The supervising consultant will have to ensure that the proposed ESMP is up to date and is being used by the contractor. Periodic audits of the ESMP will have to be done to ensure that its performance is as expected.

8.4.5 County Government of Narok

The relevant departmental officers in the above local authorities should be called upon where necessary during project implementation to provide the necessary permits and advisory services to the project implementers.

8.4.6 Directorate of Occupational Safety and Health Services

Directorate of Occupational Safety and Health Services (DOSHS) will be responsible for registering the project site as a work station and subsequent enforcement of relevant provisions in occupational safety and health in line with occupational safety and Health Act, 2007.

Error! Not a valid bookmark self-reference. presents the ESMP for the proposed water supply project during the construction, operation and decommissioning phases respectively.

Table 8-1: Environmental and social Management Plan

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
Construction Phase					
Soil-related impacts	Soil contamination	<ul style="list-style-type: none"> Plan emergency response measures in case of accidental oil spills; Maintenance and servicing of construction equipment and vehicles shall be done only on designated purpose-built surfaces to avoid contamination of soil; Ensure that all construction equipment and vehicles are serviced off site at licensed garages; Any contaminated soil should be handled properly as hazardous waste and removed from site for safe disposal; and All spoils should be disposed off appropriately and the site shall be fully cleaned prior to hand over as a way of minimizing soil contamination. 	Contractor	Entire construction phase	43,000 <i>(for 1.2m high sand bags along 200m of River Mogor bank)¹</i> Mitigation measures to be included in contractor's contract document
	Soil erosion at the Kilgoris and Lolgorian WTP	<ul style="list-style-type: none"> Improvising embankments as protection measure along drainage channels and the river bank to trap soil particles before they end up into the river. Minimize and restrict construction disturbance/excavations within the project footprint; Program of Works for Kilgoris and Lolgorian should be prepared in line with Narok weather pattern so as to avoid such works during adverse weather conditions especially excessive rains. 			
	Disposal of Cut-to-Spoil	<ul style="list-style-type: none"> The valuable top soil containing organic material, nutrients as well as seeds and the soil fauna should be excavated separately and piled in an appropriate manner for re-use. Adopting the minimize (excavation of materials) and reuse 			

¹ One sandbag costs \$3–6, and a sandbag wall of +1.2 m requires 72 bags at ~\$210–420 <https://www.mdpi.com/2073-4441/10/11/1646/htm>

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
		principles for generated soil material.			
Land take	Loss of productive land	Following completion of detailed design, separate comprehensive ARAP studies should be undertaken prior to commencement of the project in order to compensate the affected land owners. The process should be consultative and involve all stakeholders in the affected community. However, using the public utility land is highly recommended for both towns.	CRVWWDA; Contractor	Before and during construction	Cost to be captured in the Abbreviated RAP report
Impacts on water sources	Changes in Surface Water Quality	<ul style="list-style-type: none"> Reclaim and maintenance of the riparian land (through plant trees) by involving WRA and WRUAs; Monitoring of effluent discharged into environment and in particularly changes in water quality downstream. Any discharged effluents must adhere to the Environmental Management and Coordination (Waste Management) regulation, 2006. Regular inspection on the operational condition of construction equipment and machinery (especially leaks of oils, fuel, hydraulics), refuelling protocols (at safe location away from water, availability of spill kits and knowledge of their use, and emergency spill procedures); Any on site/camp storage areas for fuels, oils or other liquid chemicals shall be sited away from surface water drains. The base shall be impermeable limiting any seepage to the ground and also not draining directly into the surface water drains. Where practicable, drainage from storage compounds shall be passed through oil interceptors prior to discharge; Apply standard best practice site sediment control procedures to minimise sediment in site drainage waters returning to the river; Ensure all staff and workers are fully aware of the limits to the site for each activity, Standard Operating Procedures, and emergency procedures; River diversion works should be timed such that downstream users are not exposed to abrupt sedimentation. This should be communicated beforehand. 	Contractor; CRVWWDA; WRUAs	Entire construction phase	No additional Cost to the BoQ

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
		<ul style="list-style-type: none"> Spilled cement or concrete should be collected and disposed away from natural water ways or storm water drainage; and Sensitisation of workers on proper handling of concrete spillages or waste cement. 			
Impacts on Flora and Fauna	Vegetation Clearing and Disturbance	<ul style="list-style-type: none"> Vegetation clearing shall minimize felling of maturing trees; Vegetation clearing should be selective and restricted to the project footprint. If cutting of trees is unavoidable, replanting to restore cover and with native tree species is recommended; and Monitor the project area of recolonization by invasive/weedy species, especially in excavated or disturbed areas. Such species should be weeded out. 	Contrator	Entire construction phase	163,000 (Landscaping at 15,900/- per ha for ~ 10.2 ha to be cleared of vegetation) ²
Noise pollution	Excessive noise and vibrations on sensitive receptors	<ul style="list-style-type: none"> Avoid night time construction when noise is loudest; Sensitive noise should be identified and avoided, where possible; Alternative methods should be optimised in areas where earthmoving equipment are likely to result in excessive noise and dust; Provide PPE (hearing protection) to persons operating within or visiting identified high noise areas; The noise emission characteristics should be considered during selection and mobilization of construction equipment; In order to meet noise level requirements, the works equipment should be equipped with standard noise attenuation features. Machines that exceed acceptable noise limits should be equipped with silencers or lagging materials or specially designed acoustic enclosures and sensitive receptors like schools and hospitals; Sensitize truck drivers and plant operators to switch off engines while offloading materials; to avoid gunning vehicle engines or hooting especially when passing through sensitive 	Contractor	Entire construction phase	50,000 (Ear muffs for approx. 50 workers) Mitigation guidelines to be included in the contractor's contract document

² SDG target 15.3 on land degradation neutrality for 2015 – 2030 is USD 318billion per year for restoration of 2 billion ha. Reference: Liagre L., Almuedo P. L., Walter S.; McGuire D., Besacier C., Matta R., Conigliaro M. (2015). Forest and landscape Restoration. <http://www.fao.org/3/a-i5031e.pdf>

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
		areas such as schools, churches, residential areas and hospitals.			
Air pollution	Impacts on plant and human health	<ul style="list-style-type: none"> Limiting the number of motorised vehicles on use and number of trips through planning. Use predetermined tracks; Wet all active construction areas as and when necessary to lower dust; Compact, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites; Construction vehicles should adhere to speed limits within construction roads; and Machinery and vehicles to use approved fuels and be regularly serviced to reduce associated emissions. 	Contractor	Entire construction phase	3,000 per day (for sprinkling water from a 5,000 L water bowser to reduce dust)
HIV and AIDS	Spread of HIV / AIDS and STI related infections.	<p>The project contractor shall ensure that prevention and management of sexually transmitted diseases as a result of social interaction between staff and local populations is conducted as part of the overall project through:</p> <ul style="list-style-type: none"> Education and sensitisation of workers on HIV/AIDS and STIs; Provision of condoms to the construction workers and the project team; Formation of peer education groups from among the project staff to ensure continuity in training and awareness raising; Institution of HIV/AIDS awareness and prevention campaign amongst workers for the duration of the contract; and Promote employment of local staff as much as possible to reduce level of in-migration as a result of the project. 	CRVWWDA/ Contractor / HIV&AIDS Service Provider	Entire project cycle	No additional cost (4,000,000 as per BoQ, Bill No. 1)
Solid waste disposal	<ul style="list-style-type: none"> Reduction in aesthetics; Littering; pest breeding, 	<ul style="list-style-type: none"> A site waste management plan should be prepared by the contractor prior to commencement of construction works. This should include designation of appropriate waste storage areas, collection and removal schedule and identification of approved 	Contractor	Entire construction phase	130,000 (5 garbage bins of 1100 L capacity) + 10,000 p.m

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
	pollution of physical environment	<ul style="list-style-type: none"> disposal site; Unusable construction waste, formwork and other construction material, must be disposed of at an approved landfill or sold to willing buyers for salvage value; Proper solid waste receptacles and storage containers should be provided, particularly for the disposal of lunch and drink boxes so as to prevent littering of the site. Arrangements should be made for the regular collection of litter and for its disposal with the County Government of Narok; Ensure that the solid waste collection, segregation, and disposal system established within the plan is functioning properly at all times during operation; Recycle and re-use wastes where possible such as scraps metal; All solid waste should be managed in line with the Environmental management and coordination (Waste Management) Regulations, 2006; and Segregation of hazardous wastes for safer handling. 			<i>for solid waste collection</i> 600,000 (10 High Density Polyethylene portable toilets @ 60,000) + 20,000 p.m. for exhauster services
Occupational Public health and safety	Health of the workers and the community	<ul style="list-style-type: none"> Incorporate code of conduct to construction workers with clear expectations and consequences upon breaching; Machines and vehicles shall be operated by dully qualified personnel; Ensure that all construction machines and equipment are in good working conditions to prevent occupational hazards; Establish a Health and Safety Plan (HASP) for all the construction works; Require the contractor to appoint a trained health and safety officer for the duration of the construction work to formulate and enforce HASP; Provide workers with appropriate PPE's and enforce usage; A First Aid Kit should be provided within the site and during construction phase. This should be fully equipped at all times and should be managed by qualified persons. 	CRVWWDA / Contractor	Entire project cycle	1,824,000

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
		<ul style="list-style-type: none"> • Provide workers training on safety procedures and emergency response such as fire, oil and chemical spills, pipe bursts and other serious water loss risks; • Construction area should be fenced off from the public and access restricted as necessary for public safety; • Install and maintain appropriate hazard warning signs around the site; • Due care should be taken to maintain hygienic conditions at site by providing proper sanitation facilities and ensuring standard cleanliness of the facilities; • The food suppliers should have licenses for handling the foodstuff from local public health offices; and • The contractor should have workmen's compensation cover. It should comply with workmen's compensation Act, as well as other ordinances, Regulations and union Agreements. 			
Traffic impact	Traffic disruption	<ul style="list-style-type: none"> • Provision of alternative routes in areas where accesses have been disrupted; • Dust suppression measures to enhance visibility at construction sites for oncoming traffic and road users; • Plans for short diversion routes which should be well maintained by regular sprinkling to reduce dust. Adhere to road reserve if possible; • Provision and maintenance of clear traffic signages of ongoing construction works, regulate speed limits and diversion signage to notify approaching traffic; • In urban areas, schedule delivery of materials to the sites during periods of light traffic between 9.00am - 12.00 pm and 2.00 pm - 4.00 pm during week days; • Project vehicle should have and only use designated parking areas; • Sensitize workers and area residents on the importance of exercising care in the project area in as far as traffic movement and other safety issues are concerned 	Contractor	Throughout the project construction phase	Mitigation guidelines to be included in the contractor's contract document

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
		<ul style="list-style-type: none"> Obtain permission from the local community as well as the County government if diversion routes go beyond the Right of Way; Reinstatement of diversion routes (and old tracks) to original condition; Institute a traffic management plan incorporating adequate temporary signages and flagmen as necessary. 			
Visual intrusion and landscape impact	Aesthetic degradation	<ul style="list-style-type: none"> Land enhancement through planting of hedges and trees. 	Contactors / CRVWWDA	Construction phase	No additional Cost to the BoQ
Operation Phase					
Uptake of water from Mogor River	Impacts of river abstraction on downstream users and environment	<ul style="list-style-type: none"> Ensure that the design flow allows for the environmental flow as provided at the abstraction point; Consider adding boreholes and wider distribution networks in future in order to serve a wider population; Ensure there is consultation with the members of the public on where the community water points should be situated; and CRVWWDA and NARWASCO to collaborate with local WRA and WRUAs in catchment protection and conservation. 	CRVWWDA / WRA / WRUAs	Operation phase of the project.	TBD
Impact on aquatic species	Loss of breeding grounds due to low flow of water	<ul style="list-style-type: none"> The project should not abstract more water than is permitted; During low seasons, the project should consider rationing the water abstracted in order to reduce the water stress, on the river; and Catchment conservation and protection programs should be implemented in order to ensure there is sustainability of the resource for future use. 	CRVWWDA / NARWASCO/ WRA / WRUAs	Operation phase of the project	
Sewage and effluent disposal	Health and sanitation related diseases issues	<ul style="list-style-type: none"> Sensitize residents on health and sanitation issues associated with untreated waste water contaminating food, kitchen wares, and stored water or end up in the river; Installation of Kilgoris and Lolgorian sewerage systems in future, to augment the existing capacity in dealing with added waste water burden brought about by the project; 	CRVWWDA / County Department of Health	Operation phase of the project.	TBD

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
		<ul style="list-style-type: none"> Narok county government to require all ne urban household and commercial buildings using the flash system to incorporate septic tanks or soak pits in line with applicable standards; and Sanitary facilities should be kept clean always, through regular washing/cleaning too. 			
Impacts on occupational health	Occupational health and Safety	<ul style="list-style-type: none"> Adequate storage facilities for chemicals and provide PPE's to attendant staff; Only qualified staff should be allowed to undertake treatment works operations; Detailed instructions on use and precaution measures shall be available in a comprehensive Operation and Maintenance (O&M) Manual to be prepared and submitted to the Water Service Operator on completion of the Works; Maintain incident accident records for emerging cases; Provide material data sheets for all chemicals used at the treatment plant and undertake continuous staff training on safety and health, in line with OSHA, 2007; Formulate and implant occupational safety and health plan for all the project the O&M activities; and Undertake annual safety and health audits in line with OSHA,2007. 	CRVWWDA	Operation phase of the project.	144,000 yearly (supposing 7 staff ³ i.e. operations, maintenance , supervision, clerical, laboratory, yard work)
Water pollution	Contamination of water sources	<ul style="list-style-type: none"> Sludge treatment facility should be an integral part of the project for removing sludge by filtration in Sludge Drying Beds constructed at the Treatment Works. Sludges from Chlorination and pH Correction Tanks contain Chlorine and Soda Ash. These sludges are removed in Soak away Pits. All chemical sludges to be buried on site, and the pH of the soil monitored continuously. There will be no disposal of the sludge into the River, Proper management of the treatment works to ensure that there are no overflows or operational failures causing pollution of underground and surface water; 	LVSWWDA County Government of Narok	Throughout the operation phase	1,200,000 per year (for quarterly water sampling and analysis of the source river water)

³ Labour productivity of water service providers in Kenya was 7 employees (2013 – 2014) https://en.wikipedia.org/wiki/Water_supply_and_sanitation_in_Kenya

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
		<ul style="list-style-type: none"> Continuous monitoring of water treatment effluent to ensure adherence to the Environmental Management and Coordination (Water Quality) Regulations, 2006 and Environmental Management and Co-ordination (Waste Management) Regulations, 2006; Installing an early warning system (EWS) for downstream community in anticipation of unprecedented overflow of wastes from sludge lagoons. A communication protocol should be developed for this; and Explore reuse of filter backwash and application in land/agriculture. 			
Insecurity	Insecurity	<ul style="list-style-type: none"> The sensitive project installation should be enclosed using suitable fencing and hoarding materials to beef-up security and to control movement within the site; There should be guard houses at the gate. Security guards should always monitor the gate of the facility to keep away the intruders and to control movement within the site. The guards stationed at the gates should document movements in and out of the site/ property; and Sensitise the communities on requisite security requirements and controlled access to some of the installations. 	CRVWWDA	Throughout the operation phase	No additional Cost to the BoQ
Invasive/alien species	Impacts of Invasive or noxious Species weedy	<ul style="list-style-type: none"> Ensure that the land is restored to its original state after pipe laying has been done; Monitor restored areas to achieve acceptable ground cover and maturity, weed out invasive and colonizer species taking advantage of ground disturbance. 	CRVWWDA / Land owners	Throughout the operation phase	No additional Cost to the BoQ
Water resource conflict	Community conflicts over available water resources	<ul style="list-style-type: none"> Ensure that the design flow allows for the adequate environmental flow as provided at the abstraction point; Ensure that there are water distribution lines serving communities that live down stream of the water project. Consider adding boreholes and wider distribution networks in future in order to serve a wider population; The communities living along the rising mains should also be 	CRVWWDA / WRUAs / WRA	Throughout the operation phase	TBD

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
		<p>provided with access to water thorough water kiosks. This will help in avoiding water conflict in the community between those who have access to water and those who don't; and</p> <ul style="list-style-type: none"> • Ensure participatory monitoring of abstraction (with WRA and WRUAs) to enhance transparency. 			
Noise pollution	Excessive noise and vibrations	<ul style="list-style-type: none"> • Ensure that suitable mounting is done at the installation stage incorporating noise and vibration abatement; • Clearly label the high noise areas; • Provide PPE (Hearing Protection) to workers operating within or visiting identified high noise areas, depending on the level of exposure; • In order to meet noise level requirements, the generator should be equipped with standard noise attenuation features. Where the generator exceeds acceptable noise limits, it should be equipped with silencers or lagging materials or specially designed acoustic enclosures; and • Ensure regular maintenance of installed generators to manufacturer's specifications. 	CRVWWDA	Throughout the operation phase	No additional Cost to the BoQ
Ground contamination	Emissions and Hazardous Wastes	<ul style="list-style-type: none"> • Ensure regular inspection and maintenance of installed generators according to manufacturer's specifications. • Ensure regular servicing that included replacement of oil filters and fuel filters etc • Ensure proper handling of hazardous wastes associated with maintenance; • Minimise the use of the generators to only when it is needed. 	CRVWWDA	Throughout the operation phase	No additional Cost to the BoQ
Decommissioning Phase					
Employment	Loss of jobs and source of income	<ul style="list-style-type: none"> • Notify the workers in advance on the project closure date and adequately compensate them; • Dismissal procedures to be compliant with Employment Act, 2007; • Provide counselling & alternative skills for alternative activities; • Formerly employed staff at the project, should get 	CRVWWDA / Contractor	During decommissioning phase	To be determined

Project Activity/ Environmental / social aspect	Impact	Recommended mitigation measures	Responsibility for implementation	Frequency of monitoring	Cost
		recommendation letters to assist in getting job search and reuse acquired skills and earn income.			
Noise Pollution	Excessive noise and vibrations	<ul style="list-style-type: none"> Schedule noisy activities during the day time period; Use silencers on machines where possible; Ensure machinery is well maintained to reduce noise emitted. 	CRVWWDA / Contractor	Throughout decommissioning phase	To be determined
Air and dust from demolition of equipment	Air and dust pollution	<ul style="list-style-type: none"> Practice dust management techniques, including watering down during drier period; Set up dust barriers/ screens at strategic locations, especially downwind; Provide and enforce the appropriate use of PPE against dust. 			No additional Cost to the BoQ
Waste management	Improper handling and disposal of waste	<ul style="list-style-type: none"> Disposal of solid waste in compliance with EMCA 2006 Waste Management Regulations; Segregation of waste to encourage reuse and recycling; Contractor should liaise with local County government and NEMA office to establish the appropriate landfills for particular; and Ensuring that the contracted waste collector is registered with NEMA to collect and dispose wastes. 	CRVWWDA / Contractor	Throughout decommissioning phase	To be determined
Cumulative Impacts					
Cumulative Impacts	Cumulative Impacts	<ul style="list-style-type: none"> Liaise with WRA to demarcate the riparian area as well as to sensitize people (through WRUAs) about farming and undertaking other proscribed activities along the riparian areas that may contribute to river sedimentation. Equip the community with appropriate resources like seedlings to plant trees along the riparian; and In the long term, CRVWWDA should consider development of waterborne sewerage system for both towns. 	CRVWWDA / Contractor	Project life cycle	To be determined

8.5 Environmental and Social Monitoring

The overall objective of environmental and social monitoring is to ensure that mitigation measures are implemented and that they are effective. Environmental and social monitoring will also enable response to new and developing issues of concern. The activities and indicators that have been recommended for monitoring are presented in the ESMP.

Environmental monitoring is also carried out to ensure that all construction and operation activities comply and adhere to environmental provisions and standard specifications, so that all mitigation measures are implemented. The contractor shall employ an officer responsible for implementation of social/environmental requirements. This person will maintain regular contact with the proponent's environmentalist and the respective County Environmental Officers. The contractor and proponent's environmentalist have responsibility to ensure that the proposed mitigation measures are properly implemented during the construction phase.

The environmental monitoring program will operate through the construction, and operation phases. It will consist of a number of activities, each with a specific purpose with key indicators and criteria for significance assessment.

Monitoring includes:

- Selection of environmental parameters;
- Visual observations; and
- Regular sampling and test measurements of these parameters.

Periodic ongoing monitoring will be required during the life of the Project and the level can be determined once the Project is operational.

Monitoring will be done in three fronts:

- Physical monitoring;
- Biological monitoring; and
- Social monitoring.

8.5.1 Internal monitoring

It is the responsibility of the proponent to conduct regular internal monitoring of the project to verify the results of the Contractor's ESMP implementation and to audit direct implementation of environmental mitigation measures contained in the ESMP and construction contract clauses for the Project.

The monitoring should be a systematic evaluation of the activities of the operation in relation to the specified criteria of the condition of approval.

The objective of internal monitoring and audit will be:

- To find out any significant environmental and safety and health hazards and their existing control systems in force; and
- Meeting the legal requirements as stipulated in the Environmental Management & Coordination Act, EMCA-1999 and OSHA, 2007.

8.5.2 External monitoring and evaluation

Further to internal audits, it is recommended that a consultant be hired to carry out Annual Environmental Audits in line with NEMA requirements. NEMA has the overall responsibility for issuing approval for the Project and ensuring that their environmental guidelines are followed during Project implementation. Its role therefore is to review environmental monitoring and

environmental compliance documentation submitted by the implementing authorities and they would not normally be directly involved in monitoring the Project unless some specific major environmental issue arose.

CRVWWDA through the consultant will therefore provide NEMA with reports on environmental compliance during implementation as part of their progress reports and annual environmental auditing reports. Depending on the implementation status of environmentally sensitive project activities, NEMA may perform annual environmental reviews in which environmental concerns raised by the project will be reviewed alongside project implementation.

The proposed monitoring plan is presented in Table 8-2.

Table 8-2: Monitoring Plan

Environmental Component	Parameter	Standard	Location	Frequency	Implementation	Supervision
Land and Wayleave acquisition, where necessitated by the final detail design	Signed consent forms and compensation paid as per land and crop valuation	Valuation roll	Intake works; Transmission Mains; and water treatment plant.	Monthly until construction is complete	CRVWWDA	CRVWWDA
Noise levels	Complaints; and Noise levels on dB (A) scale	EMCA guidelines on Noise	Selected Active construction Sites	As directed by the supervision consultant	Contractor	Supervision Consultant
Air Quality	Total suspended particles Visible dust	EMCA and WHO guidelines	Populated areas	Monthly	Contractor.	Supervision Consultant CRVWWDA
Groundwater Depth and discharge	Depth to groundwater; Discharge rates.	WRA Guidelines	Existing boreholes and wells	Monthly	CRVWWDA / NARWASCO and Contractor	CRVWWDA and WRA
Groundwater quality	pH Salinity (EC) Nitrates Phosphorous Pesticide residues	WRA Guidelines	Existing boreholes and wells	Monthly Monthly 6 months 6 months if indicated by drainage or surface water tests	CRVWWDA / NARWASCO and Contractor	CRVWWDA and WRA
Surface water	Flow rate ; Effluent quality	WRA Guidelines	Rivers Mogor	Monthly	CRVWWDA / NARWASCO and Contractor	CRVWWDA and WRA
Surface water quality – intakes and receiving waters	pH Salinity (EC) Nitrates Phosphorous Pesticide residues Coliforms BOD COD	EMCA Guidelines	Intake points and selected points downstream of water treatment plant	Monthly Monthly 6 months 6 months Monthly Monthly Monthly	CRVWWDA / NARWASCO and Contractor	CRVWWDA
Solid waste	Waste Management plan Housekeeping; and Waste tracking	EMCA; and ESMP	Construction sites Water treatment Plant	Quarterly	CRVWWDA and Contractor.	Supervision Consultant
Soil Erosion	Turbidity in river and storm water	NEMA guidelines	Site, on the banks of river Mogor; and on high terrain. Wash out valve areas; Roadside drains.	During and after the rainy seasons	Contractor	Supervision Consultant
Rehabilitation of	Monitoring to	ESMP	All work areas	As required	Contractor	Supervision

Environmental Component	Parameter	Standard	Location	Frequency	Implementation	Supervision
work sites	ensure all work sites are progressively rehabilitated					Consultant
Health and Safety	Environment, Occupational safety and health officer engaged; Safety plans in place; Safety training for workers, accident reports, community consultations and feedback	ESMP; OSHA 2007	Project area	Quarterly	Contractor	CRVWWDA and DOSHS
Public Health	Project Health & Safety Plan, posters displayed, health awareness campaigns conducted,	ESMP; OSHA 2007	Project area	Quarterly	Contractor	CRVWWDA
Vegetation and habitats	Vegetation structure, species density, fuel wood usages, commercial forestry and illegal logging incidences	ESMP	Project area and environs	Annually	Contractor	CRVWWDA
Aquatic environment/River crossings	Flow velocity Wetted perimeter PH Depth Salinity Turbidity Habitat connectivity	ESMP	Mogor river.	Quarterly	Contractor	CRVWWDA
Efficiency at waste water treatment works	Effluent quality indicators	Design specifications and Water Quality standards	The proposed new WTP for Mogor river water abstraction; The proposed augmented WTP for Langata Ngima river	Quarterly	CRVWWDA	NEMA & WRA
Water usage	Water meters (Master meters)	WRA Guidelines	Intake; Reservoir	Monthly	NARWASCO	
Fuel usage	Generator operation bills	Energy Act	Pumping stations	Annual	CRVWWDA and NARWASCO	EPRA
Employment opportunities	HR Policy; Labour return; WIBA over; Safety plans.	WIBA, OSHA			Contractor CRVWWDA and NARWASCO	Ministry of labour and DOSHS

9 CONCLUSION

The development of the proposed water supply project for Kilgoris and Lolgorian towns is necessary as its implementation will significantly improve access to clean water by the beneficiaries. The current water supply option available for the town is far from adequate to meet the demand for the water. This will lead to overall improved level of sanitation and health as a result reduced occurrence of water and sanitation related diseases for both towns.

This ESIA report, based on the final Detailed Engineering Design for the Kilgoris and Lolgorian water supply and sanitation project, is an update of the Preliminary ESIA report that utilized the conceptual design. The changes between the conceptual design and final design are minimal, the envisaged loss of productive land has been minimised by the design as much as possible by ensuring that the proposed project shall be situated within the existing public road's ROW as much as is feasible. The following has been considered so far:

- Major pipeline sections have been aligned to the existing public roads. Only sections where there is encroachment into the public road will require a RAP;
- There is limited land take expected and it is specific to the Intake, raw water rising mains and the water treatment works;
- There is wide County and stakeholder support; and
- Hydrological data available supports the project without compromising the design flow.

Nonetheless, this ESIA has recommended mitigation measures against the identified adverse social and bio-physical impacts arising from project.

This being a water abstraction project, it is important that the water abstracted does not exceed the minimum flow of the river. The minimum flow recorded for Mogor River is in the range of 2,592 m³/day. A design flow of 1,100 m³/day has conservatively been considered, which is lower than the minimum ever recorded flow for Mogor. This will ensure that the project does not interfere with the ecological functions and flow requirements for the river. As informed by WRA, there are no current recorded downstream users.

In conclusion, the Project should comply with all local laws and regulations, which seek to ensure that the construction work does not adversely affect the environment and social resources. Any adverse impacts that arise will be mitigated on an on-going basis through the ESMP proposed in this report. At the operation phase, the monitoring plan shall ensure the project complies with the best environmental practices.