UMMA DAM ESIA REPORT

JUNE 2022

EXECUTIVE SUMMARY

Introduction

This EIA report was necessitated firstly by a need to define and address the fundamental environmental concerns relating to the development of the proposed Umaa Dam in Kitui County to integrate them in the design of the project in order to ensure maximization of expected benefits and a reduction of negative impacts. Secondly and as required by National Environment Management Authority to acquire the license to develop the project

Background

National Water Harvesting and Storage Authority (NWHSA) (previously known as National Water Conservation and Pipeline Corporation) was established under the water act 2016 section 30 (1).

The major functions of National Water Harvesting and Storage Authority (NWHSA) include:

i. Undertake on behalf of the national government, the development of national public water works for water resources storage and flood control;

ii. Maintain and manage national public water works infrastructure for water resources storage;

iii. Collect and provide information for the formulation by the cabinet secretary of national resources storage and flood control strategies.

iv. Develop a water harvesting policy and enforce water harvesting strategies

v. Undertake on behalf of the national government strategic water emergency interventions during drought; and

vi. Advice the cabinet secretary on any matter concerning national public water work for water storage and flood control.

The Initial Project Report to National Environment Management Authority (NEMA) was done in 2008 and a license issued in February 2009. A letter was written to NEMA on the 17th of August 2020 seeking NEMAs decision on the validity of the then issued license. NEMA responded on the 7th of September 2020 advising that, given the time lapse, the changes in development trends in the area and the likely changes in the design, the license issued in 2009 is no longer valid and a fresh ESIA study needed to be conducted.

Umaa Dam is located about 160 kilometers east of Nairobi in Kitui County. The dam axis is sited about 7 km Northeast of Kitui Town. The altitude of the site is approximately 1200m above sea level. The proposed dam barrier cuts across Nzeeu River, in part of the Kabonge village. Umaa Dam reservoir covers a total land area of 8.1 hectares and storage reliability is of the order of 8 months in a year. (Umaa dam final report).

A design review was conducted for the proposed dam in 2020. After review, the proposed dam is to be a zoned earth fill embankment dam of 30 m height and 182 m crest length. The dam will incorporate a horizontal drainage blanket and inclined chimney drain. The upstream slope is 3:1: H: V whereas downstream slope is 2.5:1: H: V. The spillway has capacity of 159 m^3/s which represents the Probable Maximum Flood flow. Likewise, the river diversion capacity is 24.64 m^3/s which is based on 5 years ARI flows is envisaged as using two 600 mm and 300 mm diameter conduits, and later using the conduit to locate draw off and scour pipe. The daily release capacity of the reservoir is 2650 m^3/s.

Methodology

The impacts of the proposed project were assessed through project site visits and the following:

- Evaluation of the location, extent of the water supply pipelines, the treatment works and the current land use of the project area;
- Evaluation of the design and proposed construction materials and methodology and;
- Stakeholders' meetings and Public Barazas.

The assessment team used both primary and secondary data. Primary data was collected through site visits, personal interviews, and public consultations. Secondary data was obtained through literature review.

Findings

i. The proposed Umaa dam is seen by the local community as a major investment infrastructural project in the area with multiple benefits to the locals and as such the community and the stakeholders are generally supportive of the project.

ii. Currently Siltation of the reservoir is not considered a major problem to the proposed reservoir but may in future become a threat to the dam unless appropriate measures as detailed in the Environmental Management plan are enforced.

iii. Increased water supply beyond the current supply level will require that a suitable wastewater treatment and disposal facility be provided.

iv. There will be no flooding of any indigenous forest as the area does not have any but only exotic forest and therefore no biodiversity loss.

v. Dam construction and impoundment activities will not involve clearing and disposal of a huge biomass as the area to be impounded does not contain dense vegetation cover.
vi. Various positive impacts are likely to accrue from the proposed dam to the community and to the country.
vii. There will be no need for resettlement and compensation as the land was legally acquired from the local community and compensation made.
viii. Dam decommissioning shall be considered only after a review of all remediation options.
ix. There are no documented mineral deposits in the area to be inundated.

Conclusion

Based on the findings, it is evident that construction of the proposed dam will result in overall socio-economic growth and development because of improvements in the availability of safe drinking water and for domestic uses in Kitui town and its surroundings. The potential negative impacts can be mitigated with strict adherence to the ESMP

Recommendations

Based on the above observations and taking into consideration that this study did not identify any negative environmental impacts for which suitable mitigation measures could not be suggested, the project is therefore considered socio-economically acceptable and environmentally sound and is therefore recommended for approval by NEMA and subsequent implementation.

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CLIENT: National Water Harvesting & Storage Authority

REPORT TYPE: Umma Dam ESIA Report

LEAD EXPERT: George Macharia

This report was compiled by a team comprising of Environmentalist, Engineer, Office Admin., Chemist, Environment Intern and Surveyor on behalf of the project proponent.

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Eng. Aphia Kaluku	Project Engineer
Dennis Osoro	Chemist
Doreen Gakii	Environmentalist
Christine Huti	Secretary
Iddi Mbarak	Intern Environment.

Lead Expert's Signature:  Date: 29th June 2022

NEMA Reg. No.: 9491

PROJECT PROPONENT

THE CHIEF EXECUTIVE OFFICER

NATIONAL WATER HARVESTING & STORAGE AUTHORITY

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NAME: CS. Sharon Obonyo

Signature…….. **Date**……

1.0 INTRODUCTION

1.1 Background

Initial Project Report to National Environment Management Authority (NEMA) was done in 2008 and a license issued in February 2009. A letter was written to NEMA on the 17th of August 2020 seeking NEMAs decision on the validity of the then issued license. NEMA responded on the 7th of September 2020 advising that, given the time lapse, the changes in development trends in the area and the likely changes in the design, the license issued in 2009 is no longer valid and a fresh ESIA study needed to be conducted.

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Treatment facilities are to be provided for in the design and the project is meant for water supply to the nearby communities.

The catchment area associated with the Nzeeu River upstream of the proposed dam location stretches from Kabonge forest. According to the previous study findings, the catchment area at the dam site is approximately 5.33 km^2

1.2 Objective of the ESIA

The purpose of the ESIA is to ensure that Project activities under consideration are environmentally and socially sound and sustainable. The ESIA study specifically is aimed at detailing positive and negative effects of the Project on the environment and preparing an ESIA Study Report recommending appropriate solutions to minimize any undesirable effects resulting from the Dam implementation.

1.3 The need for an Environmental and Social Impact Assessment (ESIA)

Initial Project Report to National Environment Management Authority (NEMA) was done in 2008 and a license issued in February 2009. A letter was written to NEMA on the 17th of August 2020 seeking NEMAs decision on the validity of the then issued license. NEMA responded on the 7th of September 2020 advising that, given the time lapse, the changes in development trends in the area and the likely changes in the design, the license issued in 2009 is no longer valid and a fresh ESIA study needed to be conducted.

1.4 Purpose of the report

This report has been prepared by National Water Harvesting & Storage Authority for the purpose of applying for environmental impact assessment license from National Environmental Management Authority to construct the Umaa Dam.

1.5 Report preparation methodology

Preparation of this report involved assessing and quantifying the potential impacts both positive and negative from the proposed dam. Baseline information was collected and used to analyze the potential impacts of the proposed project. The ESIA team also conducted field visits, literature review. Consultation with stakeholders among others.

1.6 The ESIA team

The ESIA Team Comprised of the following:

George Macharia	Chief Chemist, EIA Lead Expert
Joe Duncan Ondulo	Chief Surveyor
Eng. Aphia Kaluku	Project Engineer
Dennis Osoro	Chemist
Doreen Gakii	Environmentalist
Christine Huti	Secretarary
Iddi Mbarak	Intern Environment.

2.0 PROJECT DESCRIPTION

2.1 Project Location

Umaa Dam is located about 160 kilometers east of Nairobi in Kitui County. The dam axis is sited about 7 km northeast of Kitui Town. The altitude of the site is approximately 1200m above sea level. The proposed dam barrier cuts across Nzeeu River, part of the Kabonge village. Umaa Dam reservoir will cover a total land area of 8.1 hectares and storage reliability is of the order of 8 months in a year as per the Ministry of water Development, (Umaa dam Final design Report).

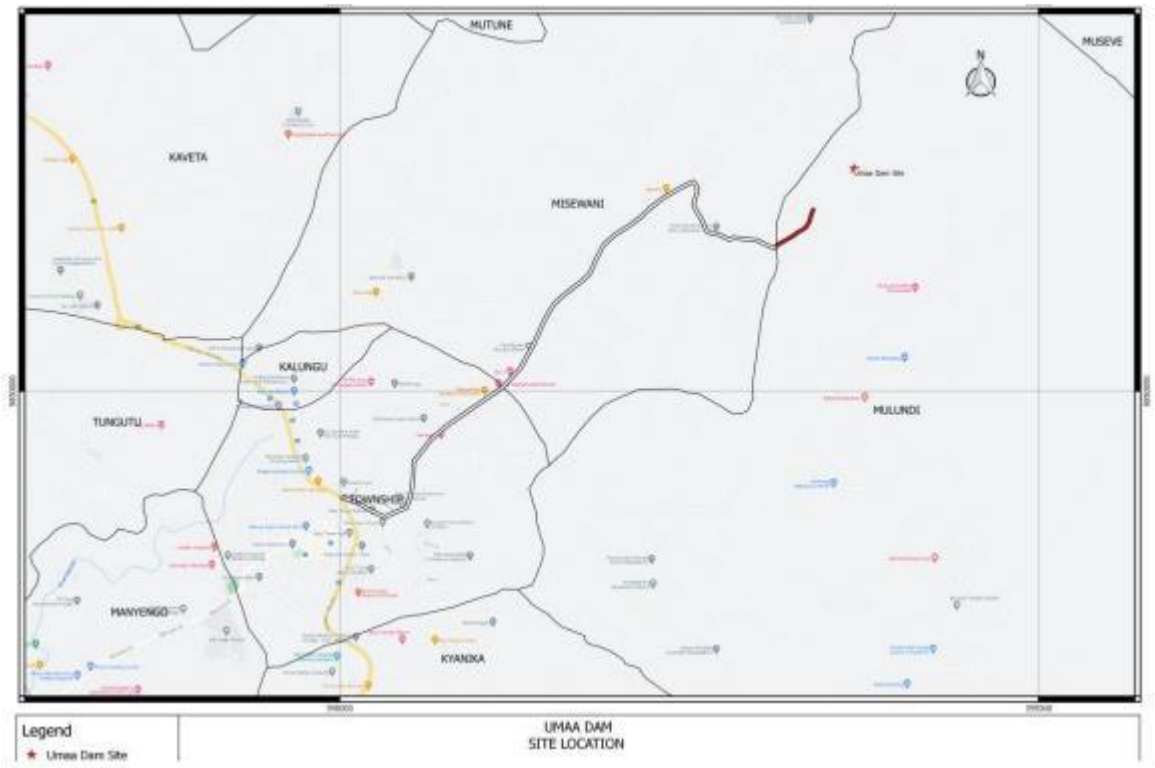

Figure 1:Project site location

2.2 Dam component

Umaa Dam is located on Nzeeu River, downstream of the confluence of Mukoleka and Muvati Rivers about 7kms Northeast of Kitui Town Centre.

The Project is intended to boost the water supply of Kitui town by approximately 2500m^3/d and arrest the impacts of flooding in the area.

Umaa Dam is classified as an embankment earth fill dam whose components consists of:

- The foundation which is designed to be impervious and capable of reducing seepage of impounded water to values lower than 5x10^{-7}cm/s:
- Homogeneous embankment consisting mainly of one type of fill:
- Spillway designed to discharge flood arising out of an extreme event:

- Diversion works that are designed to divert a certain determined flow during construction:
- Draw off works that are designed to abstract water from the reservoir for the intended use once the dam is complete: and
- Treatment works and reticulation system

2.3 Water supply component

The process design incorporates an inlet chamber, here the raw water is stabilized for a maximum retention time of 2 minutes, the chamber also acts as an equalization tool mitigating against raw quality surges in the transmission line. Once the water leaves the chamber it goes to a flocculation chamber which has a channel preceding it. In this channel a measurement devise is also fixed, this could be a V-Noth or a Rectangular weir. The channel also acts as a section where flocculants and coagulants can be added to the water before it goes to the flocculation channel. The flocculation comprises of baffle walls that allow water to flow at slow speeds of less than between 0.1 m/s to 0.5 m/s depending on the section of the channel. This allows flocs to accumulate and attain settling weight needed for gravitational settlement and removal. The flow is by gravity and with a retention time of between 15 – 20 minutes allows for extensive mixing and flocculation before the water goes into the sedimentation tank.

The ministry of water design manual 2005, recommends that the velocity gradient G be between 30 – 60 s^{-1} and that the product of velocity gradient and retention time t, be between 30,000-60,000. The above two parameters have been met by the design. From the flocculation chamber the water treatment process proceeds to the sedimentation tank which has a retention time of minimum 3 hours according to the manual (Manual, 2005) and Length to width ratio of not less than 3. The sedimentation basin allows for suspended solids collection and removal via a scour pipe at the bottom sump. The sedimentation tank is designed sloping towards a collection sump from which sludge is exhausted. From the sedimentation basin the water is collected via a collection channel to the filter channel and into the filtration unit. The filtration unit is a graded downflow filtration unit comprising of graded gravel and sand of characteristics.

The water treatment plant capacity is 3,975 m^3 /day, this is considering a 50% surge consideration to prevent overload factor of safety in operation. The Consultant has revised the treatment plant design to enable the filters to meet the filtration rate thresholds and the retention times needed for the sedimentation of flocculated water as defined in the MWI Water Supply Design manual. (Manual, 2005).

2.4 Project Access

Access roads from Kitui town to the dam is tarmac for the five kilometers, the last 2km access roads were improved to allow heavy construction equipment and plant reach the site.

2.5 Borrow sites

Two borrow sites have been identified, one at the Air strip area and the other at Kitui show ground.

For the Air strip area is a private land at coordinates 37N E 0273375; N9860280. The area is found to contain red clay material of high plasticity. The depth of the clay as seen on the road cut slope is about 3 meters in deep and this is depicted by several pits done while making clay bricks and excavation of pit latrines.

The area around Kitui show ground is about 9 kilometers south of project area at coordinates 37N 0386805;9847926. The land is currently owned by both Kitui Government and Kenya Agricultural and Livestock Organization (KALRO).

2.6 Actual Project Activities

The major Works to be executed comprise mainly of but are not limited to the following:

2.6.1 Construction phase

2.6.2 Dam construction

The dam components will include the dam embankment, the spillway, and the outlet structures

2.6.3 Dam Embankment

A zoned earth fill dam will be constructed consisting of clay core, shell material flanking the clay core, filter drain (two stage), and riprap face. The Clay core will be sourced from two assessed site, which are:

- Proposed Quarry One (Air Strip area) – about 10 km from the Umaa dam site, and coordinate location 37N E 0273375, N9860280 (WGS84 CRS); and
- Proposed Quarry Two (Kitui Show Ground) – about 10 km from the Umaa dam site, and coordinate location 37N 0386805,9847926 (WGS84 CRS).

About 100,000 m^3 of the clay core material will be moved and lifted to compose part of the dam.

The shell material will consist of more permeable material from the clay core, which will protect the core from slope instability. This material will be sourced from within the dam reservoir area. About 160,000 m^3 of the shell material will be moved and lifted to form part of the dam,

The filter drain will be composed of fine and coarse aggregate, which will be sourced at the reservoir area. The fine aggregate will be the river sand material, while the coarse aggregate will be quarried and crushed onsite. About 18,700 m^3 will be moved and lifted to form part of the dam.

Site clearance for the dam wall area will be conducted, which will consist of removal of all plant and vegetation, and scrapping of the topsoil layer, which varies from 0.3 m to 1.5 m to suitable soil.

The riprap material will be sourced from the reservoir area. It is proposed to open a quarry to source the material. About 75 m^3 of riprap material will be dumped at the face of the earth embankment to protect the upstream face from adverse water wave and wind effects.

2.6.4 Appurtenant structures

The dam appurtenant structures will consist of the spillway and outlet works.

The reinforced concrete spillway structure is partially constructed and will be completed.

Figure 2:partially constructed concrete spillway and reinforced concrete diversion culvert

The reinforced concrete diversion culvert is partially constructed and will be completed. The diversion culvert will house the 300 mm diameter raw water and 600 mm diameter scour pipes. An intake tower will be constructed at the end of the diversion culvert, which will house the intake of the 300 mm raw water and 600 mm scour pipes.

2.7 Water treatment plant

The water treatment plant was partially constructed in 2010. The structures that will be completed include the following:

- Flocculation basin
- Sedimentation tank
- Filter house
- Clear water tank
- Pump house including completion of the building structure and installation of three pumps
- Back wash tank (expansion of the tank)
- Staff houses (electrical works and finishes only)

- Administration building (electrical works and finishes only)

Figure 3:Partly constructed water treatment plant

Figure 4:constructed Staff houses (only electrical works and finishes not completed)

Earthworks will include construction of a trench for the 300 mm diameter raw water pipe leading to the flocculation basin, and the treated water from the filters to the clear water tank, a total distance of about 400 m.

A gravel surface road will be constructed to facilitate movement of vehicles and people to salient structures of the treatment plant.

2.8 Rising Mains

A 200 mm diameter pipe from the clear water tank to an existing 1500 m^3 tank operated by TANATHI was laid and is 50% complete. The pipe fittings will be completed during the construction and backfill works will be conducted to bury the pipe at about 1 m below the ground level.

2.9 Other activities

Other activities include:

- Landscaping including top soiling and grassing.
- Temporary Contractor's camp, Engineer's accommodation, and offices
- Any other activity not listed above in either category but deemed to be necessary by the Engineer, shall be subject to the Engineer's formal instructions and within the mode of payment stipulated either by day works or on a measured basis.

2.10 Demobilization

After the construction period, construction equipment and dismantled camp materials will be salvaged and removed from the site by the contractor.

2.11 Operation phase activities

The operation phase will include mainly maintenance of the water supply system and dam embankment. Reviews of the instrumentation will be conducted monthly. Every five years, the dam embankment will undergo a full audit to review the soundness of the structure.

2.1 Decommissioning phase

Decommissioning refers to the final disposal of the project and associated materials at the expiry of the project life span. The proposed dam design is adequate for 50 years anticipated economical life of the dam. Monitoring and observation facilities will be used in dam risk evaluation; dam decommissioning will be opted after a review of possible dam remediation option show that it's the most efficient in terms of cost and risk elimination.

Dam decommissioning process will constitute ;

- Dam decommissioning ESIA;
- Dam decommissioning design;
- Excavation of the dam;

- Dam removal, notch excavation, armouring, and channel restoration;
- Demolish and burry the spillway;
- Disposal of materials;
- Cleanup and rehabilitation of site
- Revegetation of former dam area; and
- Post decommissioning monitoring.
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3.0 PROJECT ALTERNATIVES

3.1 Introduction

The Environmental and Social Impact Assessment studies identifies and assesses alternatives to the proposed development/project. The best alternative will be selected based on less negative impacts and cost benefit analysis. Listed below are the alternatives considered.

3.2 "No" Project Alternative/the "Yes" Project Alternatives

This is an important analysis as it helps the proponent measure impacts from the project visa vis the impacts without the proposed project

3.2.1 The "NO" project Alternative Option

The 'No' project alternative option in respect to the proposed project implies that the status quo is maintained. This implies that the environmental situation will neither improve nor deteriorate and the project area will remain as it is before project implementation i.e., there will be no pollution, no extra cutting of forest trees and at the same time no positive impacts to the surrounding community. On the other hand, the project will provide water for domestic, and livestock use.

The NO alternative option will imply that:

1. The local community will continue to live without water for domestic, for downstream irrigation and improved catchment area.
2. The sanitation level in Kitui County will be low posing challenges on the wellbeing of the town
3. The productivity of the downstream irrigation practice will be low and reduced ability to create wealth

3.2.2 The YES project Alternative Option

This alternative brings out the idea that the project is implemented according to the final designs. This means the dam will be built at the best axis that maximizes storage. With the development of the project it will lead to the following benefits if all the negative impacts are mitigated against:

1. Improving water availability through the created storage.
2. Improved sanitation levels in Kitui town and its surroundings.
3. Food security through increased agricultural production.

4. Reduction of environmental degradation and adaptation to climate change.
5. Improved livelihoods of the communities in the project area.
6. Educed poverty and boost local and regional development.
7. Contribute to climate resilience (green) growth.

3.2.3 Yes/No project alternative conclusion

Since the project is geared towards improving the Sanitation of the Kitui town and livelihood of the surrounding communities, the NO project alternative is the least preferred. With these benefits at hand of the 'yes' project alternative, it is the best option for this project.

4.0 BASELINE ENVIROMENTAL CONDITIONS

4.1 Kitui County

Kitui County is the sixth largest County in Kenya by land area. It is situated in the Eastern part of Kenya, with its headquarters at Kitui town, about 160 kilometers from Nairobi City. The County is resource rich with commercially viable coal reserves in Mui Basin. Other mineral resource includes limestone, iron ore and sand. Forty-six (46) percent of the Tsavo East National Park is in Kitui County and has a great heritage with great untapped tourism potential. Proximity to Nairobi and the Standard Gauge Railway offers great opportunities for economic transformation. Permanent rivers, namely, Tana and Athi flow through the County. The County had an estimated population of about 1.1 million persons in 2016.

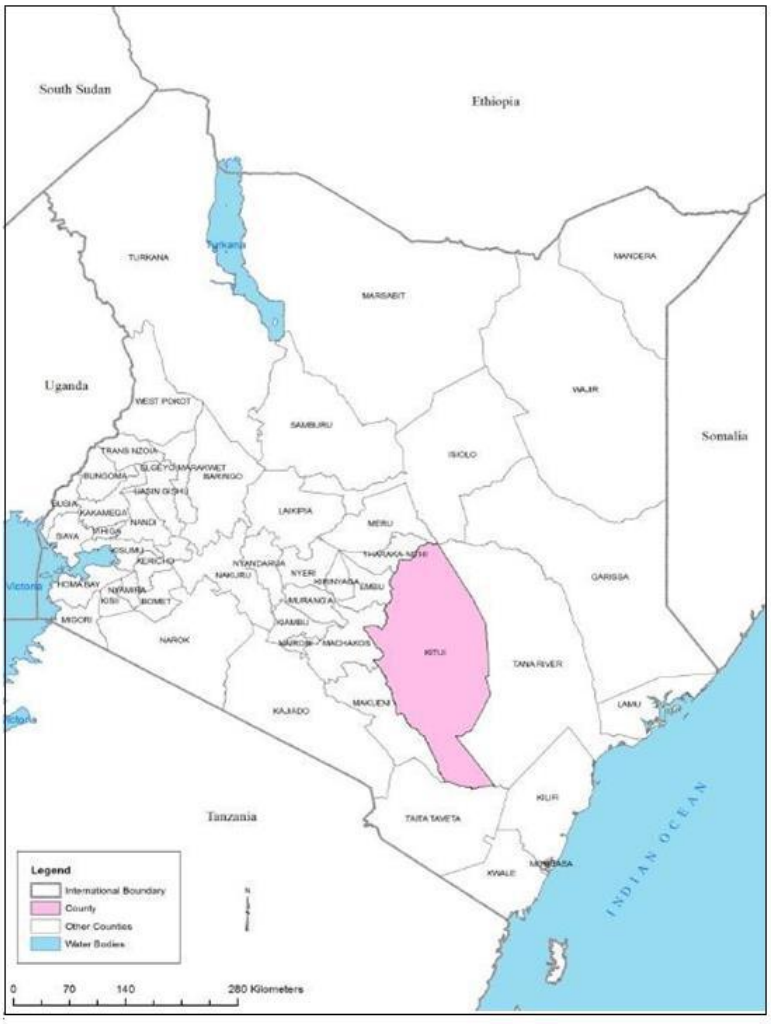

Figure 5:Location of the County in Kenya (Source: Kenya National Bureau of Statistic)

4.2 Climate and physical features

4.2.1 Altitude

The altitude of the district ranges between 400m and 1800m above the sea level. The central part of the district is characterized by hilly ridges separated by wide low-lying areas and has slightly low elevation of between 600m and 900m above the sea level to the eastern side of the district, the main relief feature is the Yatta plateau, which stretches from the North to the South between rivers Athi and Tana. The plateau is almost plain with wide shallow spaced valleys. The highest areas in the district are Kitui Central, Mutitu hills and Yatta plateau. Due to their high altitudes, they receive more rainfall than other parts in the district and are the most productive areas.

4.2.2 Climate

The County has an arid and semi-arid climate with rainfall distribution that is erratic and unreliable. However, the highlands namely, Migwani, Mumoni, Kitui Central, Mui, Mutitu Hills and Yatta plateau receive relatively high rainfall compared with lowlands of Nguni, Kyuso and Tseikuru.The lowest annual average temperature is 14^{0}C and the highest annual average temperature is 24^{0}C.

4.2.3 Ecological zone

The County has seven Agro-ecological zones. These are: Upper-Midland 3-4; Upper-Midland 4; Lower-Midland 3; Lower-Midland 4; Lower-Midland 5; Inner Lowland 5; and Inner Lowland 6

Table 1:Agro-Ecological Zones by Sub-County

Zone	Sub County	Agricultural Development Potential
UM 3-4	Kitui Central, Kitui East, Mwingi West, Kitui Rural	Coffee, Maize, Sunflower, Vegetables, Sorgum, Avocado, Millet, Sweet Potatoes, Cabbage, Pawpaw
UM4	Kitui Central, Kitui Rural, Kitui West, Mwingi West,Mwingi North	Coffee, Maize, Sunflower, Vegetables, Sorghum,Avocado, Millet, Sweet Potatoes, Cabbage, Pawpaw, Bananas, Mango, Fodder and Pasture
LM3	Kitui East, Mwingi North	Cotton, Dry Land Maize Varieties, Sweet Potatoes, and Beans
LM4	Kitui Central, Kitui Rural, Kitui West, Kitui East, KituiSouth, Mwingi Central, Mwingi	Sorghum, Millet, Dry Maize Varieties, GreenGrams, Ground Nuts, Cow Peas, Sunflower, Vegetables, Dolichos

	West,Mwingi North	
LM5	Kitui East, Kitui South, KituiRural, Kitui Central, Kitui West, Mwingi Central, Mwingi North	Livestock, Millet, Sorghum, Fodder and Pasture
IL5	Kitui East, Mwingi North, Mwingi Central	Livestock, Millet, Sorghum
IL 6	Kitui South, Kitui East, Mwingi Central, Mwingi North	Livestock, Millet, Sorgum

Source: Kitui County Statistical Abstract 2016

4.3 Population size and distribution

According to the 2019 Kenya population and housing census the population in Kitui County was 1,136, 187 with population density of 37 people per km² and an annual growth rate of 2.2%. Population distribution by sex in the county is 549,003 males, 587,151 females and 33 intersex persons.

Table 2:Distribution of population, number of households and average household size in the county

County	Population +	Number of household	Average household size
Kitui	1,130,134	262,942	4.3

Table 3:Distribution of population, land area and population density in the county

County	population	Land area(sq.km)	Population density (no. per sq. km)
Kitui	1,136,187	30,429.5	37

Table 4:Distribution of population by sex and sub county

Sub county	Sex			Total population
	male	female	Intersex	
Ikutha	39,986	42,976	2	82,964
Katulani	23,150	23,957	1	47,108

Kisasi	22,646	23,496	-	46,142
Kitui central	52,123	53,863	5	105,991
Kitui west	33,887	36,983	1	70,871
Kyuso	36,789	40,077	1	76,867
Lower yatta	31,701	31,268	-	63,329
Matinyani	23,362	24,448	1	47,811
Migwani	37,525	41,726	4	79,255
Mumoni	13,748	15,596	-	29,344
Mutitu	26,388	28,896	3	55,287
Mutitu North	10,337	10,877	1	21,215
Mutomo	54,819	58,531	6	113,356
Mwingi Central	52,539	56,174	-	108,713
Mwingi East	40,314	44,820	5	85,139
Nzambani	22,929	23,857	2	46,788
Thagicu	7,141	7,994	1	15,136
Tseikuru	19,169	21,262	-	40,871

Source: 2019 Kenya population and Housing census

4.3.1 Economical Characteristics

Agricultural development in Kitui just as in other marginal lands is problematic due to low rainfall and the menace of wildlife and pests. In the District crop production has been made quite unreliable and unevenly distributed in the recent years the district has been experiencing crop failure of almost 90% thus rendering most people in the district destitute and in dear need of food. The people of Kitui are engaged in various economic activities for their livelihoods. Whereas the majority is engaged in agriculture, livestock keeping remains the income earner in the district and especially in the drier area. People practice mixed farming because livestock acts as a buffer during poor rain seasons. Most of what is harvested is consumed domestically, and there is hardly any net surplus. The district is famine-prone; whatever is produced must be supplemented with external food aid to avert starvation. Major commercial activities like wholesale, retail shop keeping process of food products, honey farming harvesting and refining are other economic activities taking place in urban centers and marketplaces. Not to be underrated in their capacity to absorb the labor force are the Jua–kali workshops spread out in all towns and markets centers. Cotton ginning, formerly a major commercial activity has greatly declined due to worsening climatic conditions, while charcoal burning, and sales has gone up considerably. There are several financial institutions in the district, most of these Micro-enterprises make acquisition of credit to small-scale businesspeople and farmers possible and has been a great boost to the people in the district as they strive to fight and alleviate

poverty. Self-help groups have also increased in number in the district and have become a great source of income for the members. The groups, which are registered at the department of Social Services and the department of culture, are involved in many income generating activities which include Beekeeping, poultry keeping water kiosks, basketry, merry go round and small loans to members among other activities.

4.3.2 Cultural Characteristic

Culturally, the people of Kitui are mainly Kamba, and the language mostly spoken is Kikamba. There are also other communities like Swahili, Kikuyu, Asians, Embu and Meru. Other languages also spoken include Kiswahili, Kikuyu Ki-mbeere and other Swahili is the main language especially in town centers that have a variety of tribes. The major religion in Kitui is Christianity, followed by Muslim. The Kamba people in Kitui are mostly farmers although due to adverse weather conditions this brings very little if any products. Crops mainly grown in Kitui include Maize, beans, cowpeas , pigeon peas , sorghum , millet finger , sweet potatoes , cassava , fruits include mangoes , oranges, lemons, passion fruit ,avocadoes , among others vegetable are also grown along the river backs and these include lettuce, cabbages , tomatoes, green peas , capsicum and onions.

Due to these poor weather conditions most plants do not do so well except the traditional foods plants that is drought resistant. These include sorghum, millet, finger millet, cassava and sweet potatoes. The department of culture tries to encourage the planting and consumption of these foods for food security, but these are only for domestic consumption. If adapted this trend could reverse the drastic effects of famine. Several food security groups have been established and they are encouraged to plant and use traditional food plants. Traditional food festivals have also been held where the public is sensitized on the need to plant and consume these traditional foods.

Shifting cultivation – The local community are known to practice cultivation, which has adverse effect on environment. They use fire to clear the vegetation, which is followed by land tillage without proper soil conservation structure. After first two seasons, the land productivity is affected thus cause environmental degradation. This is mostly happening within hilltops, sloppy areas and natural protected areas, as shown in the in photograph.

Bee Keeping The bee keeping is done in areas where natural vegetation is intact. The most preferred tree species are of acacia type. In areas where bee keeping is done the beekeepers discourage human activities, which threatened the vegetation, thus enhance bi-diversity conservation.

Hunting and Wood Curving – Among other major activities that, the local community uses to supplement income-generating activity are hunting and wood curving.

4.4 Soils and land use

4.4.1 Soils

Soil is an important non-renewable natural resource that supports life and is especially significant because of their importance of agriculture. Soil patterns are influenced by geology, landforms altitude and climate.

There are four (4) major soil types in the central part of the district. Two (2) of which are found in the central part of the District The distribution of soil types in different ACZS provide information that may facilitate planning of that use and management. Soils vary in their physical and chemical characteristic, being either saline or sordic or both.

Main soil types are alfisols (Acrisols, luvisols and ferralsols with some pockets of vertisols. These soils are generally friable clay, sandy clay, loams and loamy sandy. The soils have a high tendency to cap under the raindrop impacts, thus resulting/vulnerable to soil erosion. These soils are relatively coarse, low in organic matter and generally shallow in depth. Apart from the Yatta Plateau, and the range of hills in the central part of the district, the topography is undulating and gives way to plains toward the east. Various gneisses of the Basement System are the bedrock and are exposed in the hills east of Kitui and Mutomo, and northeast of Endau. The soils of the hills are usually shallow and stony. Occasionally they may be somewhat more fertile. On the associated foothills, the soils are of moderately low to high fertility. The uplands in the western part of the district carry soils characterized by an increase of clay with depth of low fertility and low to moderate fertility. South of Kangondi there is some areas with soils of moderate to high fertility.

The major part of the central district is non-dissected sedimentary plain. These soils have natural fertility. Soils having hardpan and of low natural fertility occur near the eastern district boundary. These soils are often found with soils of low to moderate fertility. Along the major water courses on the flat river terraces, soil of moderate, to high fertility occur Most of the soils in the plains are of low to moderately low fertility and show a sodic / salinity hazard. In some areas in the east of the district “badlands” are found with poor soils rich in sodium.

4. 4.2 Land ownership categories/ classification

In Kitui County, like in the rest of Kenya, there are three categories of Land. According to The Constitution of Kenya, Article 61 (2) “Land in Kenya is classified as public, community or private”. The Constitution, further defines public land as: (a) land which at the effective date was un alienated government land as defined by an Act of Parliament in force at the effective date; (b)land lawfully held, used or occupied by any State organ, except any such land that is occupied bythe State organ as lessee under a private lease; (c) land transferred to the State by way of sale, reversion or surrender; (d) land in respect of which no individual or community ownership can be established by any legal process; (e) land in respect of which no heir can be identified by any legal process, among others. Further, the

Constitution in Article 62, states that "Public land shall vest in and be held by a County government in trust for the people resident in the County". Inthis regard, it is not clear how much land in Kitui County is Public Land. To this end, there is a need to find out the extent of public land in Kitui County.

The second category of land is community land. According to Article 63 of The Constitution, "Community land shall vest in and be held by communities identified on the basis of ethnicity, culture or similar community of interest". To some extent, community land includes what was formally known as Trust Lands and Group Ranches. There is also a need to establish how much community land is within Kitui County. In addition, areas of community land that are occupied by families, should be adjudicated and Title Deeds issued to the occupants of the land.

The final category is private land. According to Article 64 of the Constitution, "private landconsists of: (a) registered land held by any person under any freehold tenure; (b) land held byany person under leasehold tenure; and (c) any other land declared private land under an Act of Parliament. Private land is considered to have secure land tenure and can act as a major form ofwealth creation in the County. In this regard, people who have secure rights to land can invest init because they are not afraid of losing their investment. The formal titles to land can also be usedto secure credit form financial institutions, after which the money can be reinvested in the land orin another income generating activity.

4.4.3 Mean holding size

The County has a total area of 30,496.4 km² of which; 6,369 km² of the County land consists of the Tsavo East National Park and is not available for agriculture, 14,137.2 km² is arable agricultural land and 6,364.4 km² non-arable land. Over 85% of the County's population lives in rural areas. The average population density is 44 persons/km² which is sparse. The average size of land holding in the County is 0.12 km² per person (12 ha per person).

4.4.4 Percentage of land with title deeds

Approximately over 46% of the County land falls in the arable category with 83% of the inhabitants lacking title deeds reason being that most of the land has not been adjudicated. Only about 25% of land owners in the County have title deeds. The process of land adjudication and registration has slightly improved and land owners are constrained with regards to securing investment loans from banks and Micro Finance Institutions (MFIs). The County Ministry of Lands, Infrastructure and Urban Development has tried to hasten the process of land adjudication so as to fast track the issuance of title deeds to land owners in the County.

2.4.5 Incidence of landlessness

Introduction of private land ownership and population growth are known to increase landlessnessin an area. In the past, people lived in villages and shared access to land. When land is individualized, the registered land owner has the right to block other people, including family members from using the land. This can cause landlessness. In thesis published by Ndulu (2013), which has the title "Settlements, Evictions and Their Effects: The Case of Residents of Kwa Vonza in Kitui County, Kenya" there is evidence of landlessness in Kitui County. However, the County government needs to carry out a survey and establish the exact number of landless people and possible provide a settlement scheme for them.

4.4.6 Settlement Patterns

The settlement patterns are influenced by agricultural potential of an area and proximity to urbanareas. In Kitui County people tend to settle at the foot of hills where agriculture is possible. Usually soil is eroded from the top of the hills and accumulated at the bottom. In this regard, the foothills have deeper soil that is suitable for growing crops. Urban and peri-urban areas also have high densities because of access to social amenities. Kitui Central Sub County is the mostdensely populated, followed by areas around Mwingi Town. Kitui East Sub County is the least densely populated because it has drier climate.

4.4.7 Agriculture

Over 80% of the population in this district depends on subsistence agriculture. Two percent of the district is high potential whereas 32 percent is medium potential for crop production basically 70, percent of the farm families depend on livestock economies. Because of this narrow and uncertain socio-economic livelihood coupled with unreliable rainfall patterns, the district has remarried a food deficit.

4.4.8 Livestock farming

Types of Livestock Production Systems

The following types of production systems are in practice in the district:

- Free range system
- Intensive system,
- Extensive system (mostly in the ranches)
- Semi-intensive system

4.4.9 Fisheries Resources

Types of fisheries production systems

- Earth dam fisheries
- Riverine fisheries – Athi River
- Fish pond culture

- Ornamental fisheries

4.5 Infrastructure Development

2.5.1 Roads and Rail Network

The County has one Class A road passing through the County, the A3 Thika-Garissa road. The Kibwezi- Kitui-Mwingi Road is being upgraded to be completed by 2020. There are other roads proposed in the Road Sub-Sector Investment Programme (RISP) 2010-2024 including: D478-Kola to A3-Nguni; B6-Kituito A3-Ngooni; D507-Nuu to A3-Nguni; D507-Voo to B7-Ikutha; B7-Chuluni to D507-Mwitika; and E731-Miambani to D509-Mikuyuni. The County has Class E earth road network covering about 1,172.20 Kms. Upgrading of major roads to all-weather status and open up more feeder roads in the County will enhance connectivity and open the region for businesses and economic opportunities.

There are three airstrips in the County, namely, Ithookwe, Tseikuru and Mutomo airstrips. Refurbishment and routine maintenance will enhance connectivity. The County can also benefit significantly from T- Junction of the SGR at Kibwezi town via Mutomo and onwards to Mui Basin, which has commercially viable coal reserves.

Figure 6:All weather road in kwa Nzou , Kitui central location

4.5.2 Information, Communication Technology

The County Government recognizes the potential of ICT as an enabler of social economic development through delivery of public services and governance. The County is served by mobile telephone service providers by

Safaricom, Airtel, and Telecom but the quality of coverage varies with the location. The County is served by 12 post offices run by the Postal Corporation of Kenya (PCK) which oversees mail and parcel delivery as well as offering data communication services. Kitui County has fiber optic connection, but it is yet to be extended to serve all key departments in the County.

The main sources of energy for lighting are paraffin lantern, paraffin tin lamp, electricityconnection from mains, solar energy, and battery lamp (Table 2). About 33.4% ofhouseholds use paraffin lanterns compared to a national average of about 15.7%.
Electricity connections remain below the national average.

Table 5:Percentage distribution of households by source of lighting fuel

	Main electricity	Generator	Solar	Parafin laterns	Paraffin tins	Pressure lamps	Fuel wood	Battery lamps	Candle
National	41.1	0.5	14.1	15.7	19.3	0.2	1.6	4.8	0.9
Kitui	18.2	0.0	17.0	33.4	18.7	0.0	0.2	11.1	0.7

Source: Kenya National Bureau of Statistics: KIHBS 2015/16

The main source of cooking fuel is firewood with 79.5% of the household's using firewood compared to the national average of 54.6%. The use of Liquefied Petroleum Gas (LPG), Kerosene and charcoal for cooking is low in the County compared to the national average (Table 3). At the County, 76.4% of the households use traditional stone fire as a primary cooking appliance, compared to a national average of 46.4%.

Table 6:Percentage of households by main source of cooking fuel

	Firewood	Electricity	LPG	Bio	Kerosine	Charcoal	Others	Dung	Crop Residue
National	54.6	1.0	13.4	0.2	14.0	14.6	1.6	0.1	0.2
Kitui	79.5	1.2	5.1	0.0	9.0	9.0	2.3	0.0	0.0

Source: Kenya National Bureau of Statistics: KIHBS 2015/16

Figure 7:photo showing electricity connection in Kitui central location.

4.5.4 Housing types

The main types of houses are classified in terms of the different materials used in construction. Roofing materials in the County are mainly Corrugated Iron sheets roofs at 94.5%. A large percentage of households use earth/sand, and cement as floor material at 58.6% and 40.4%, respectively.

Walling of houses also varies with 33% having cement finish, 25.8% with bricks, and 23.5% with bamboo with mud/cow-dung.

4.6 AGRICULTURE

4.6.1 Irrigation infrastructure and schemes

4.6.1.1 Irrigation potential

Kitui County topography is suitable for irrigation production system and the irrigation potential in the County is estimated to be 11,095 hectares of which a paltry 1,850 hectares is utilized. The potential for exploitable irrigation can be expanded to 500,000 hectares through development of the Tana and Athi River basins. The whole County is land mass lies within the Tana River drainage basin except a narrow strip along the south and southwest border draining into the Athi River. These two rivers form the northern, western and southern boundaries of the County. The Tana River is Kenya's largest and drains the eastern flank of the Aberdares and the southern slopes of Mount Kenya into the Indian Ocean. The length of this river within Kitui County is 405Km while that of Athi River is

325Km. There are numerous seasonal rivers draining into both Athi and Tana rivers. The most prominent ones with potential for wells development for irrigation are; Thunguthu, Katse and Nziitu in Mwingi North Sub-County; Tyaa in Mwingi Central; Ikoo, Nzeeu and Thua in Kitui East Sub-County and Kitui Central sub-counties; Kalundu in Kitui Central and Kitui Rural, Tiva in Kitui Central, Kitui Rural and Kitui South sub-counties; Mwiiwe and Wingoo in Kitui East, Kitui Rural and Kitui South, and Kaayo, Kauwi and Mutendea in Kitui West sub-County. Sand dams, water pans and earth dams are additional sources of water for irrigated agriculture.

4.6.1.2 Irrigation schemes (small/ large scale)

There are 5 irrigation schemes in Kitui County; Yatta/Kwavonza, Tseikuru, Zombe/Mwitika, Kitui Rural and Kyangwithya West wards, and 31 irrigation clusters. The irrigation schemes are financed by the National government, while the clusters are mainly financed by the County government. Two clusters are financed by NGOs. Irrigation clusters cover a total acreage of 101.5 acres (40.6 hectares). Most of irrigation schemes grow assorted vegetables and green maize; one scheme in Tseikuru ward in Mwingi North sub County grows assorted vegetables and cotton whereas the schemes in Tseikuru Kyuso, and Mumoni wards grow assorted vegetables and water melons. These irrigation schemes if well-managed, would ensure food security for the region as well as allow for successful cultivation of cash crops that can be exported to markets across Kenya as well as global markets. Experience from other Countries and Counties shows irrigation to be a major driver of agricultural productivity, therefore the County government should stronglyembrace and expand this venture as a matter of priority.

Table xx: Small-Scale irrigation Schemes

Table 7:Small-Scale irrigation Schemes

S/No	Name of Irrigation Cluster	Location	Status
1.	Kyanika irrigation cluster 7 acres (County government)	Nzambani Ward, Kiluilu Village (Kitui East)	Farmers producing assorted vegetables together with green maize
2.	Kamulambani model farm 0.5 acres (County government)	Mutinying Ward, Kavole Village,	Farmers producing assorted vegetables together with

		Kitui Central	green maize
3.	Wingoo irrigation cluster 0.25 acres under open drip (County government)	Miambani Ward, Munganga Village, Kitui Central	Farmers producing assorted vegetables together with green maize
4.	Kalikuvu model farm 0.5 acres open drip (County government)	Kyangwithya West Ward, Itoleka Village, Kitui Central	Farmers producing assorted vegetables together with green maize
5.	Kilimu Phase I irrigation cluster 5 acres under open drip (County government)	Kwamutonga/Kithumula Ward, Kithumula Village, Kitui West	Farmers producing assorted vegetables together with green maize
6.	Mbusyani irrigation cluster 6.25 acres under open drip (County government)	Kisasi Ward, Mbusyani Village, Kitui Rural	Farmers producing assorted vegetables together with green maize
7.	Migaani women group open drip 1.0-acre cluster (County government)	Waita Ward, Mutyangombe Village	Farmers producing assorted vegetables together with green maize
8.	Nzamakuu irrigation cluster 30 acres (County inherited from the National government)	Kiomo/Kyethani Ward, Etawa Village, Mwingi West	Farmers producing assorted vegetables together with green maize
9.	Anna villa model farm 0.5 acres open drip cluster (County government)	Nguutani Ward, Nzalae Village, Mwingi West	Farmers producing assorted vegetables together with green maize
10.	Kavalyani youthful ventures open drip 2 acres (cluster) (County government)	Migwani Ward, Itoloni Village Mwingi West,	Farmers producing assorted vegetables together with green maize
11.	Thunguthu phase I irrigation cluster open drip 2 acres (County government)	Kyuso Ward, Ithui Village, Mwingi North	Farmers producing assorted vegetables together with green maize
12.	St. Ursula secondary school cluster (County government)	Kyangwithya West Ward, Tungutu Village, Kitui Central	Farmers producing assorted vegetables together with green maize
13.	Mbusyani phase II irrigation cluster 4 acres (County	Kisasi ward, Kitui Rural	Farmers producing assorted vegetables together with green maize

	government)		
14.	Athi/kilawa irrigation cluster 8 acres (County government)	Athi ward, Kitui South	Farmers producing assorted vegetables together with green maize
15.	Chuluni irrigation cluster 6 acres (County) government	Chuluni ward, Kitui East	Farmers producing assorted vegetables together with green maize
16.	Ikanga/Kyatune(Kongo) 2.5 acres (County government)	Ikanga/Kyatune, Kitui South	Farmers producing assorted vegetables together with green maize
17.	Thunguthu phase II 4 acres (County government)	Kyuso ward, Mwingi North	Farmers producing assorted vegetables together with green maize
18.	Waita irrigation cluster 8 acres (County government	Kyuso and Waita wards, Mwingi North	Farmers producing assorted vegetables together with green maize
19.	Thaana Nzau irrigation cluster 2 acres (County government)	Thaana/Kyome ward, Mwingi West	Farmers producing assorted vegetables together with green maize
20.	Ithumula irrigation cluster 5 acres (County government)	Ikanga/Kyatune ward , Kitui South	Farmers producing assorted vegetables together with green maize
21.	Kaangweni irrigation cluster 3 acres (County government)	Nzambani ward, Kitui East	Farmers producing assorted vegetables together with green maize
22.	Kalambani irrigation cluster 5 acres (County government)	Mutha ward, Kitui South	Farmers producing assorted vegetables together with green maize
23.	Ititu Vijana (County government)	Kiomo/Kyethani ward , Mwingi West	Farmers producing assorted vegetables together with green maize
24.	Red cross clusters Food security schemes(NGO)	Tseikuru, Kyuso, Mumoni, Mwingi North	Farmers producing assorted vegetables together and water melons
25.	Kalundu Irrigation Scheme (National government)	Kyangwithya West, Kitui Central	Not being used due to power Connections
26.	Kavisuni Irrigation Scheme (National government)	Kitui Rural	Farmers producing assorted Vegetables
27.	Ngomano Irrigation Scheme (National government)	Zombe/Mwitika, Kitui East	Farmers producing assorted Vegetables
28.	Upper Ngethwa irrigation cluster (County government)	Matinyani, Kitui West	Farmers producing assorted Vegetables
29.	Wikithuki/ Usueni Irrigation Scheme (National government)	Tseikuru, Mwingi North	Farmers producing assorted vegetables and cotton

30.	Mandalwa Irrigation Scheme (National government)	Yatta/Kwavonza, Kitui West	Farmers producing assorted Vegetables
31.	Kyandui Irrigation cluster (County government)	Mulango, Kitui Central	Farmers producing assorted Vegetables
32.	Maaini irrigation cluster	Ikutha, Kitui South	Farmers producing assorted Vegetables
33.	Mendene irrigation cluster	Mutitu/Kaliku	Farmers producing assorted Vegetables
34.	Kamathitu irrigation cluster	Mumoni	Farmers producing assorted Vegetables
35.	Mbauni irrigation cluster	Kithumula/Kwamutonga	Farmers producing assorted Vegetables
36.	Nzambia irrigation cluster	Kanyangi	Farmers producing assorted Vegetables

Source: County Directorate of Agriculture (CDA)

4.7 Crop, Livestock, Fish Production and Value addition

4.7.1 Main crops produced

The economy of the County is dependent on agriculture, which contributes to rural employment, food production and rural incomes. The level of food self-sufficiency in the County is 51%, however approximately 10% of the entire population is absolutely food insecure. The sector plays a major role by contributing about 87.3% of income earned by the rural population. The main food crops grown in the County include cereals such as maize, sorghum, and millets; pulses such as green grams (Ndengu), cowpeas and pigeon peas; root crops such as cassava, sweet potatoes and arrow roots; industrial crops such as cotton, sisal and sunflower, and horticultural crops represented mainly by fruits such as mangoes, pawpaw,sugarcane and water melons as well as vegetables such as tomatoes, kales, onions and bullet chilies. The total annual average crop production is 80,680MT for cereals valued at Kshs 4.24 billion, 771MT for industrial crops valued at Kshs 29.04 million and 36,950MT for horticultural crops valued at Kshs.990 million. County crops are grown as sources of food and income and production is mainly dependent on rain. Rainfall in the County is not only inadequate but erratic thus necessitating the use of irrigation to augment food production.

Figure 8:photo showing sugarcane plantation

4.7.1.1 Acreage under food and cash crops

Kitui has the potential to be a major food producing County in Kenya if appropriate agricultural interventions coupled with irrigation-based crop production are adopted. Currently, the average acreage (hectares) under food production is 192,325 compared to a potential of 400,000 for cereal crops; 298,277 compared to a potential of 380,000 for pulses; 350 compared to a potential of 2,000 for cassava; 907 compared to a potential of 170,000 for industrial crops (sisal, cotton and sunflower); 2765 compared to a potential of 16,500 for fruits, and 1170 compared to a potential of 84,500 for vegetables, respectively.

4.7.1.2 Average farm sizes

The types of farms in the County are mainly smallholder which integrates crops and livestock production. The average small-scale farm size in the County is estimated at 4.38 hectares and 50 hectares for large scale farms (ASDSP HH Baseline Survey, Vol. 1, 2014). The small-scalefarms are common in densely populated areas around Kitui and Mwingi towns, areas of Migwani, Matinyani, Kyangwithya East, parts of Kyangwithya west, Nzambani, upper parts of Mulango and Mutonguni. A few large-scale farms especially of sorghum and green grams are found in Katutu, Kanyonyo, Kwa Vonza, Kanyangi, Mutomo, Ikutha and Kanziku. Other large- scale farms under free range livestock production system are found in Kyuso, Sosoma-Engamba, Tseikuru, Muumoni, Mui, Kanyonyo, Endau, Malalani and Mutha areas.

4.7.1.3 Main storage facilities

There are four National Cereals and Produce Board stores in Kitui County located at

Kyuso, Mutitu, Kitui, and Mwingi towns. In addition, 38 aggregation centers spread across the County have been identified but are not well equipped for storage at the moment. The total storage capacity for the County is 500,000, 90-kg bags. Crop produce losses due to post-harvest handling and management and inadequate availability of storage facilities and structures at household level in the County is high.

4.7.1.4 Agricultural extension, training, research, and information services

There is one Agricultural Training Centre (ATC) and one Agricultural Mechanization Station (AMS) in Kitui County. The two institutions are located at County headquarters in Kitui town. The ATC hosts demonstration plots while the AMS provides agricultural mechanization services through which they generate revenue. There is therefore need to open up branches of ATC in every sub-county to enable many farmers to access modern agricultural technology transfer with ease.

4.7.2 Main livestock breeds and facilities

The main livestock types kept in the County are cattle (beef and dairy), goats (meat and dairy), sheep and poultry (indigenous and exotic). Farmers have also ventured into apiculture. Livestock cushions farmers against adverse condition especially in times of drought. The sector largely contributes to income generation and food security in main livestock zones. In LM4, LM5, IL5 and IL6 it contributes approximately 40-50% of total household incomes while in UM3 and UM4 it contributes 20-30% of household incomes. The County annual average production levels for various livestock enterprise products are as follows; 3,077 tonnes of beef, 1466.6 tonnes of goat meat (Chevon) and 70 million eggs, 4.2 million liters of milk and 960 tonnes of honey against the estimated potential annual local demand of 32,120 tonnes of meat, 100.4 million liters of milk and 171.6 million eggs. Rangeland and pastures occupy about 1,048,728 hectares, which is about 80% of the County. The livestock carrying capacity is approximately 4.4 hectares per Livestock unit (LU). The Zebu constitutes 97% of breed kept while Boran and Sahiwal account for 3%. Over 55% of beef cattle are found in AEZ IL6 and 40% in UM 4 and IL5. The balance of 5% is found in UM3 and UM4. The preferred dairy breeds are Ayrshire, Friesian, Guernsey and Jersey and their crosses in that order. The main goat meat breeds are the Small East African, Gala and their crosses, whereas the main dairy goat breed is the Toggenburg (95%) and a few German Alpine (5%). Poultry includes domestic fowl, ducks, quails, turkeys, Guinea fowl, and geese. The most common poultry kept is indigenous chicken which is integrated in farming by over 90% households in the County. Farmers in the suburbs of major urban centers rear exotic breeds of poultry for egg and meat.

4.7.2.1 Ranching (number, ownerships and activities)

The County has five cooperative ranches namely; B2 Yatta Ranch 53,000 acres, Nziu Ranch 76,000 acres, Sosoma Ranch 150,000 acres, SEKU and GASP ranches. The Nziu and Sosoma ranches are no longer operational. SEKU and GASP are being run by the South Eastern Kenya University and the Catholic Diocese of Kitui respectively. B2 Yatta is owned by a Co-operative Society thus is classified as a group ranch, while Nziu and Sosoma are institutional ranches. Ranching is a very important production system for beef enterprise development and breed improvement. The annual income accruing from the three ranches in the County is estimated at Ksh 916 million. However, the ranching production system faces a number of challenges.

4.7.2.2 Hides Skins and Leather

There are 71 slaughter slabs across the County and majority slaughter goats. Cattle are slaughtered in the following areas, Kitui town, Mwingi town, Mutomo and Kabati markets.There are no industries in the County to process hides and skins into leather and its products. The County annual hides production is estimated at 11,709Kgs valued Ksh. 1,813,680 while for goats, sheep and calf production is 239,835 pieces with an estimated value of Ksh 21,850,380.

4.7.3 Apiculture (Bee-keeping)

Beekeeping has been practiced in Kitui County since time immemorial. It is viable and sustainable form of farming because of the amount of land considered as rangeland standing at over 70% and rainfall that support adequate vegetation necessary for bee foliage. Honey is produced mainly from traditional log hives by individual farmers locally referred to as 'Ikuli'. Most beekeeping activities are concentrated in Mwingi North, West and Central. Notable production is also seen in Kitui Rural, East and South. The bulk of beekeeping and honey production equipment are log hives which account for 95% of honey produced locally. Modern hives are few and account for a paltry 5% of honey production. There are 120,000 traditional hives and 10,387 modern hives in the County. The bulk of the honey estimated at 960 tonnes per annum valued at Ksh 290 Million is harvested from traditional hives. The modern hives produce an estimated 94 tons of honey with a value of Ksh. 28 million according to 2013 to 2015 average production figures. Honey from Kitui is still held in high regard.

Small scale value addition is being undertaken by Mwingi Honey Cooperative. The County government is also promoting production and processing of honey through establishment of 16 honey processing units. Beekeeping is an enterprise with a lot of potential for improvement for honey production and income generation. The enterprise can be an important base for sustainable development of cottage industries in the County.

4.8 Tourism and Wildlife

Main tourist attractions and activities

The County's tourist attractions are categorised as: National parks, game reserves and othertourist attraction centres such as Nzambani rocks.

Table 8:Visitors by tourist Attraction 2013-2014

Attraction	Name	Residents		Non-residents	
		2013	2014	2013	2014
National Parks	Tsavo east	30	50	150	180
Game Reserves	South Kitui	50	60	15	25
	Mwingi	80	95	30	50
Other Tourist Attraction	Nzambani rock	150	180	10	25

Source: Kitui County Statistical Abstract

4.9 Industry and Trade

Table 6 shows trends in selected indicators for the industry and trade sector, 2013 to 2017.

Table 9:Business Details of the County

Details	2013	2014	2015	2016	2017
Trading centers		200			
Registered Retail traders		5532	9260	12055	13060
Registered wholesale traders		142	430	802	1530
Jua Kali Associations		9			
Jua Kali Artisans		75	236	360	420
Jua Kali Sheds			865	1405	1503
Modern Markets					
Boda Boda Sheds					

Kitui County had 200 shopping centers in 2014. The number of registered traders has more than doubled within a period of three years from 5,532 in 2014 to 13,060 in 2017. Similarly, the number of registered wholesale traders stood at 1,530 in 2017 up from 142 in 2014. The number of registered jua kali artisans increased from 75 in 2014 to 420 in 2017. This is mainly attributed to improved measures by the County

Government to enhance the registration of businesses and partly due to increase in the number of new businesses operating in the County. During the period, a total of 7 modern markets, 104 market sheds, 84 boda boda sheds and 26 public toilets were built.

About 10% of the market sheds are not in use because they have not been officially commissioned. All the modern markets are already in use. Most of these markets targeted fruit and vegetable traders. Therefore, markets for traders dealing with non-food items need to be considered too in the next five years. In 2017 the number of jua kali sheds were 1,503.There are plans to build more jua kali and boda boda sheds and also modern markets in the next five years so as to improve on the revenue collection and facilitate trade by creating a conducive environment for the traders across the County. The traders will also be able to lock their goods safely instead of carrying the goods to their homes in the morning and evening. There is also a proposal to have the markets installed with solar panels which is a cheap source of lighting the markets and can also be used in the cottage industries.

Table 10:Number of MSMEs in the Country and Selected County

County	Licensed				Unlicensed '000
	Total '000	Micro Per cent	Small Per cent	Medium Per cent	
Kitui	16.7	97.5	2.5	-	71.5
Machakos	39.1	91.8	7.8	0.4	234.4
Makueni	27.4	97.7	2.2	0.1	106.3
Total	**1,560.5**	**92.2**	**7.1**	**0.7**	**5,850.3**

Source: The 2016 MSME Survey Basic Report, KNBS

The Micro, Small and Medium Enterprises (MSMEs) are considered as sources of economic growth by creating employment, enhancing competition, fostering innovation reducing poverty which leads to social transformation. The role of MSME sector has been identified and prioritized as a key growth driver for achievement of the country's economic development blue print popularly known as the Kenya's Vision 2030 - the development blueprint which seeks to transform Kenya into an industrialized middle-income country, providing high quality life to all its citizens by the year 2030. Accordingly, the Vision 2030 emphasizes the need to deal with the informal economy through measures aimed at raising productivity, generation of jobs, owner's incomes and public revenues. It also recognizes the need for capacity building and appropriate financial services for MSMEs.

A number of MSMEs are formal, while majority fall within the informal sector of the

economy. The MSMEs act as major job providers and they produce a significant share of total value added.They also provide a large segment of the poor and middle-income populations with affordable goods and services. The MSMEs cover almost all the sectors of the economy operating seasonally or all year round and are located in markets, streets, households or mobile.

MSMEs are defined according to employment size. According to the official Kenya definition, they are enterprises having between 1 and 99 employees (GOK, 2005). Micro-enterprises have less than 10 employees while small enterprises have 10-49 employees. The medium sizedenterprises have between 50 and 99 employees.

According to the Micro, Small and Medium Enterprises (MSMEs) survey conducted in 2016 by the Kenya National Bureau of Statistics (KNBS), Kitui County was reported to have a total of 16,700 enterprises licensed by the County Government out of which 97.5 are micro and 2.5 per cent translating to about 418 enterprises. There is no medium enterprise in the County.

The numbers of unlicensed enterprises were notably high at 71,500. Most of these businesses were identified from the households. This is an indication that most enterprises operating in the County are not licensed (81%) and only 19% are licensed. This shows that there is agood chance for the County to increase its revenue from businesses by increasing the number of licensed businesses. This can be attained by creating a favorable environment for people to do business by setting up market sheds and modern markets across the County that are accessible. By so doing, people who operate their businesses along the street, households and those who move with their goods will have a place to do their businesses.

4.9.1 The Blue Economy (including Fisheries)

Fish farming was introduced in the County through the economic stimulus programme (2009- 2013). In the programme each constituency was earmarked to receive 200 fish ponds. Though faced with many challenges like water availability and lack of equipment the sector is growing with subsequent support from the County government. The two common fish species in the ponds are Nile, tilapia and Catfish. There are diverse species in the dams, but the most prominent ones are Cat fish, Carps, Tilapia and Others (Labeo, Eels, Mormyrus and Barbus). The main source of inland capture fishery is the Kiambere Dam along the Tana River in Mwingi North sub-County. The total fish production in the County is 57.71MT valued at 22, 366,000. The mainmarkets for the products from the dam include Mwingi, Kitui, Embu, Nairobi, and Kabati among others.

Table 11:Fish production in Kitui County

Fish Source	Location and number	Production (MT)	Value (Ksh)
Capture Fisheries (Dams)	Kiambere, Tana and Athi rivers	49.19	18,816,000
Aquaculture (ponds)	Countywide (1500)	8.52	3,550,000

4.10 Forestry, Agro Forestry and Value addition

4.10.1 Forest cover

The table below gives data on the forest cover in percentage terms and the cover in hectares of gazetted and non gazetted forests and their projections. The gazetted forest cover is 16 in no and covers 37,750 hectares as at 2014. We don't have any data on what it is currently. The forest cover has increased from 3.5% to 7% and Kitui was voted the most improved County in forest cover recently. This is projected to increase to 10% and the current CIDP.

Gazettement is to preserve the forests biodiversity, environmental nature, cultural, scientific nature, or other special significant and natural form. Such forests in Kitui have natural species that produce fruits such as Turmeric tamarind and others. Research is needed in Kitui to determine the medicinal or cosmetic value of the vegetation and determine if they can becommercially exploited. This can be done in conjunction with SEKU University. There's no data on the volume and value of charcoal trade although it has been significant. This baseline needs to be established as it will form the basis for measuring the outcome of the programme of modernizing the charcoal economic activity.

Table 9 summarizes the current state of forest cover and the commercial value of the business that emanates from the forests.

Table 12:Forest cover in Kitui

Items	2014
No of gazetted forests	16
No of non-Gazetted forests	76
Size of gazetted forests HA	37,750
Size of non-Gazetted forests	-
Size of forest cover %	3.5
Timber quantity cubic meters	2,248
Value of timber Ksh mill.	1.016
No of poles	1,774,258

Value of the poles Ksh mill .	532.277

Source: Kitui County Statistical Abstract 2015

4.11 Health Access and Nutrition

Kitui County has several hospitals and health centers to meet the health needs of residents, among them Kitui County Referral Hospital, Mwingi Sub-County General Hospital, Kitui Nursing Home, Neema Hospital, Jordan Hospital, mission-run hospitals such as Muthale Missionhospital and some private health centers. Kitui County has commissioned 23 new health facilitiesto reduce the distance, time and cost to accessing healthcare services.

There are 240 functional public health facilities in the County, accounting for 6% of the country's 4, 000 public health facilities. This exceeds the national average of 85 health facilities per County by 145 (63%) facilities. However, a health facility distribution analysis conducted by the former Commission for Implementation of the Constitution (CIC) showed that the 230 health facilities were unevenly and inequitably distributed in the County. In three Sub-Counties, Kitui Central, Kitui West and Mwingi West, over 95% of the residents live within an average distance of 5 kilometers from their homes to the nearest health facility.

Similarly, due to terrain and condition of the roads, it takes people in these three Sub-Counties less than 30 minutes to reach health facilities in their areas as recommended by World Health Organization (WHO). In some areas of the under-served Sub-Counties, people travel distances of between 15-25 kilometers to access existing health facilities.

The County has initiated a process leading to the construction, opening and operationalization of 23 new health facilities to bridge the distance gap and ensure services are brought closer to the people.

4.11.1 Morbidity

The five main common diseases in the County are malaria 49%, diarrhoea 3.4%, stomach ache 5%, Flu 4.1% and Upper respiratory tract infection 7.7%. The main causes of morbidity for children under 5 years in the County are: URTI, diarrhoea, skin diseases, intestinal worms, confirmed malaria, and pneumonia. Patients over 5 years of age die due to URTI, skin diseases, confirmed malaria, diarrhoea, URTI, rheumatism and hypertension.

Additionally, HIV/AIDS is also a prevalent disease especially in the urban centers with

aprevalence rate of 6.1%. The main Non-Communicable Diseases (NCDs) include cancer, diabetes, hypertension, benign prostrate hypertrophy (BPH) and arthritis.

4.11.2 Nutritional Status

The nutrition status of the population in the Kitui County remains poor as a result of frequent droughts resulting to food insecurity at the household level, sub-optimal infant and young child feeding practices, poor child care practices, inadequate access to health services and poor hygiene and sanitation practices in the communities. Wasting rates among children less than five years are at 4.6%. Stunting is currently at 38.2% (Kitui Nutrition Survey Sept 2013) which isway above the national average of 26%. Prevalence of underweight is 20.7% as compared to the national average of 16%.

The Infant and Young Child Nutrition (IYCN) practices are suboptimal across the County. Exclusive Breast Feeding (EBF) for six months stands at 45% (Kitui Nutrition Survey) while *eHealth* 85.4% had initiated breastfeeding within the first hour after delivery. Only 76.9% of the caregivers fed their children more than three times in a day indicating inadequate complementaryfeeding. The household dietary diversity score (HDDS) was 4.7%, with 95.2% of households accessing food by purchasing (Kitui Nutrition Survey, 2012); which implies that many households have limited options of livelihoods in the wake of low household incomes and high prices of staple food.

4.11.3 Immunization coverage

The immunization for Kitui County is generally low at 63 % compared to the National status
83.5 %. The trend has worsened from 75% in 2012 and as such the Ministry of Health and Sanitation is focusing on the health of children under one. To reverse the trend and improve immunization coverage to 80%, there has to be an increase in outreach services and an increase in the number of immunizing centers available, as well as ensuring adequate vaccine supply. In addition, there is an increase in prevalence rates of cervical cancer cases. Currently, Kitui County has had the pilot vaccination of the HPV vaccine.

4.11.4 Maternal health care

Kenya status decline in maternal mortality rate from 488/100,000 to 362/100,000 by 2018.
The proportion of mothers delivering under the care of skilled health workers is only at 27.6%, which is below the national average of 42%. Infant Mortality- 63/1000 live births is high compared to the National to 39 per 1,000 live births and WHO

status 41 in 2016. Neonatal Mortality-43/1000 live births.

4.11.5 Access to family planning services/Contraceptive prevalence

The percentage of mothers attending the WHO recommended minimum number of 4 antenatal clinics is 52.5%, compared to the country average of 52%. The proportion of mothers delivering under the care of skilled health workers is only at 27.6%, which is below the national average of 42%. Provision of reproductive health services needs to be brought closer to the people by setting up at least one well equipped and staffed maternity unit at the ward level.
Contraceptive acceptance stands at 58%. The low acceptability of contraceptives can be attributed to the prevailing culture, traditions and lack of awareness within the community whichpromotes negative attitudes towards the uptake of contraceptives.

4.11. 6 HIV/Aids prevalence rates and related services

Kitui County is categorized as a medium burden County with HIV Prevalence of 4.2%, compared to National status 5.6 % with prevalence among female higher (5.7%) than male (2.5%). HIV and AIDS morbidity and mortality poses a serious challenge thus affecting negatively on labor force productivity and HIV orphan hood at 9%.

Table 13:Trends of HIV positivity (graphical representation)

Sub County	2012	2013	2014	2015
Kitui Central	4.58%	3.79%	3.02%	9.21%
Kitui Rural	10.31%	3.68%	2.27%	1.43%
Kitui East	13.57%	6.89%	2.11%	1.43%
Kitui West	6.9%	2.29%	2.24%	1.49%
Kitui South	15.43%	4.31%	2.7%	1.07%
Mwingi North	5.7%	2.98%	2.6%	1.42%
Mwingi Central	8.41%	5.81%	2.69%	1.8%
Mwingi West	8.93%	5.86%	4.06%	1.42%

*Source: **DHIS 2015***

4.12 Education, Skills, Literacy and Infrastructure

4.12.1 Pre- School Education (Early Childhood Development Education)

The table shows the number of children registered in both public and private classes in 2014

Table 14:ECDE Centres

County	2014

	Public	Private
Kitui	1518	308
Total	1826	

Source: County Statistical Abstract

4.12.2 Primary Education

Table 15:Primary schools 2013-2014

Sub-County	*2013*		*2014*	
	Public	*Private*	*Public*	*Private*
Ikutha	127	5	134	12
Katulani	59	2	62	4
Kisasi	44	2	46	4
Kitui central	-	-	-	-
Kitui west	81	4	85	8
Kyuso	94	4	99	8
Lower Yatta	81	2	85	4
Matinyani	45	4	47	8
Mwingi west	88	13	93	28
Mumoni	73	1	77	2
Mutitu	98	9	103	18
Mutomo	139	4	147	8
Mwingi central	109	14	115	32
Mwingi east	114	6	120	12
Nzambani	45	2	47	4
Tseikuru	53	3	56	6
Sub-Total	1,250	75	2,318	158
Total	1325		1476	

Source: County Statistical Abstract

Figure 9:photo showing a primary school in kitui central

4.12.3 Secondary Education

Table 16:Secondary Schools 2013-2014

Sub-County	*2013*		*2014*	
	Public	*Private*	*Public*	*Private*
Ikutha	23	-	22	1
Katulani	18	-	17	1
Kisasi	16	-	15	-
Kitui central	31	-	29	-
Kitui west	30	-	28	1
Kyuso	20	-	19	-
Lower Yatta	24	-	23	1
Matinyani	36	-	34	2
Mwingi west	41	-	39	2
Mumoni	20	-	19	-
Mutitu	21	-	20	-
Mutomo	26	-	25	-
Mwingi central	35	-	33	1
Mwingi east	27	-	26	1
Nzambani	14	-	13	-

Tseikuru	12	-	11	-
Total	394	-	374	10

Source: County Statistical Abstract

4.12.4 Tertiary Education

Table 17:Universities and Technical Institutions by Category, 2013-2014

Category	*2013*		*2014*	
	Public	*Private*	*Public*	*Private*
Universities	1	-	1	-
University Campuses	5	-	-	1
Technical University Colleges	-	-	-	1
National polytechnics	-	-	-	-
Institute of technology	2	-	2	-
Technical training institutes	-	1	-	1
Sub Total	8	1	3	3
Total	9		6	

Source: County Statistical Abstract

4.12.5 Adult and continuing Education

Table 18:Adult Education Centres

Sub-County	*2014*
Ikutha	24
Katulani	6
Kisasi	11
Kitui central	11
Kitui west	18
Kyuso	24
Lower Yatta	32
Matinyani	8
Mwingi west	14
Mumoni	32
Mutitu	33
Mutomo	25
Mwingi central	35
Mwingi east	25
Nzambani	4

Tseikuru	9
Total	311

Source: County Statistical Abstract

4.12.6 Technical, Vocational Education and Training

Table 19:Teacher Training Colleges

Category	*2013*		*2014*	
	Public	*Private*	*Public*	*Private*
Pre-primary	2	-	2	-
Primary	1	2	1	2
Secondary	-	-	-	-
Subtotal	3	2	3	2
Total	5		5	

Source: County Statistical Abstract

4.13 Social-economic Baseline

4.13.1 Household Gender and Age profile

Most of the household heads were within the 45 – 54 years age bracket accounting for 29.3 % of the respondents while 6.1% were within the age bracket of 18-24 years. The distribution is shown in the figure below.

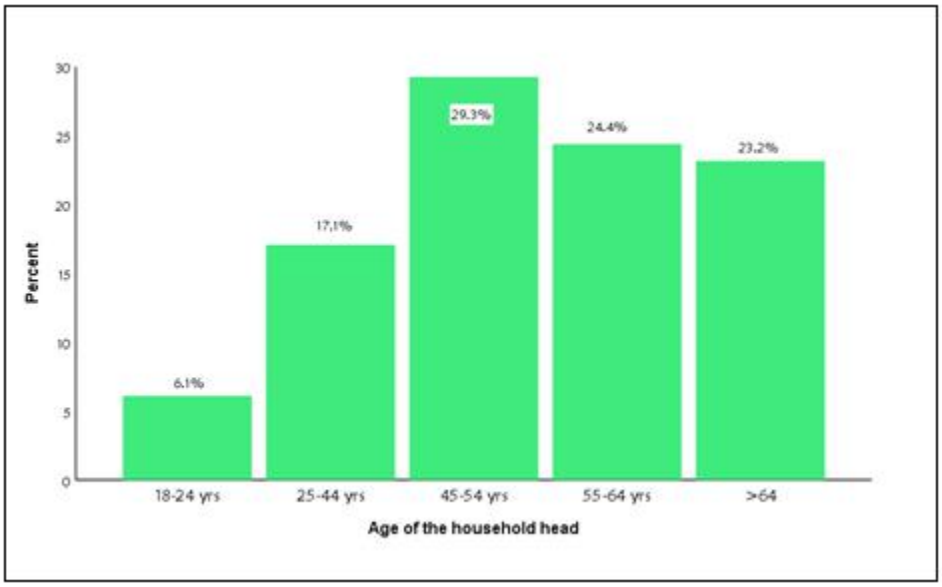

Figure 10:Household gender and age profile

The survey showed that 44.6% had household size between 6-10 members, followed by 38.6% for household size of 1-5 members and household size more than 10 accounted for 16.9%.

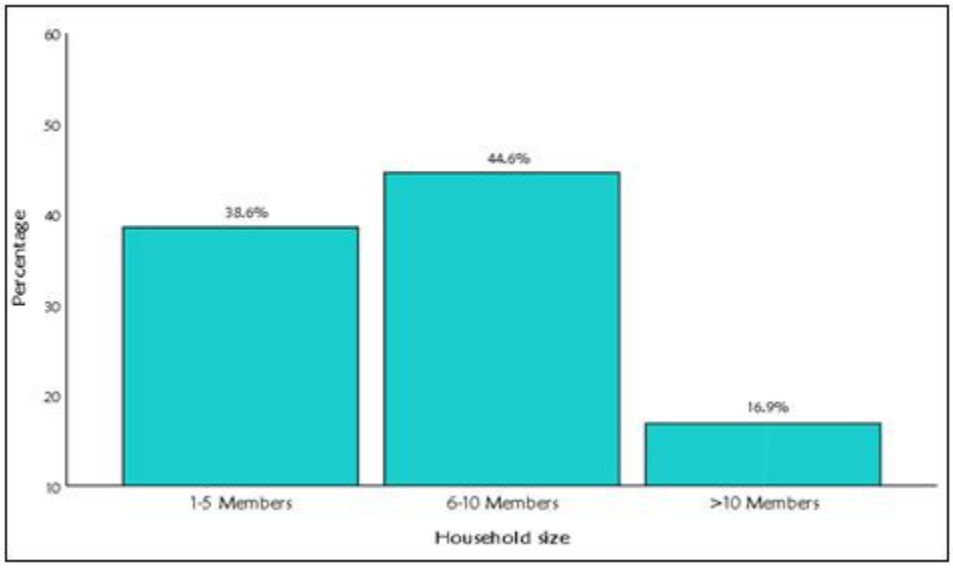

Figure 11:Household size profile

The households interviewed in the study consisted of (70.7%) male and (29.3%) female respondents.

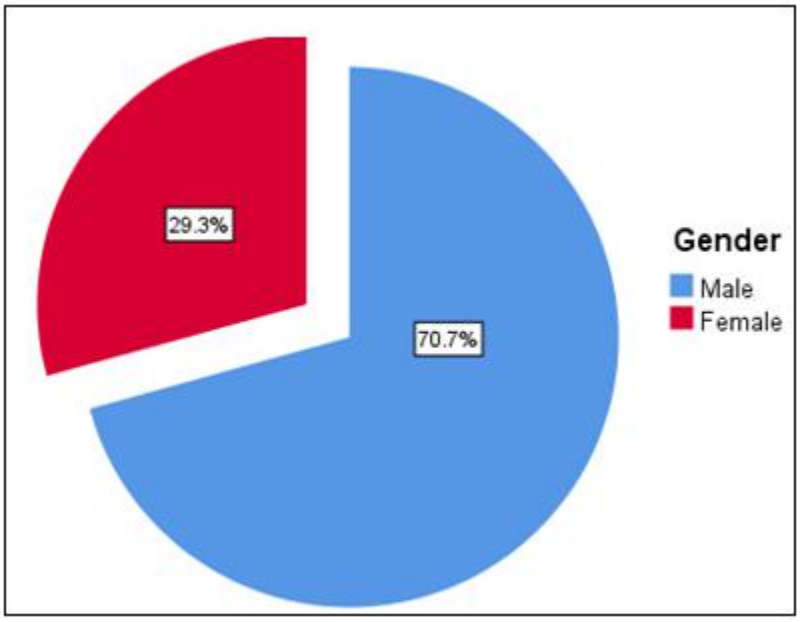

Figure 12:Household sex profile

The study showed a significant disparity in terms of gender of the household head (only 29.3% of the households are female headed. In addition, gender disparity is also seen in monthly household income with the av-average household income being Kshs 8,707 and Kshs24,612 for the female and male headed households, respectively.

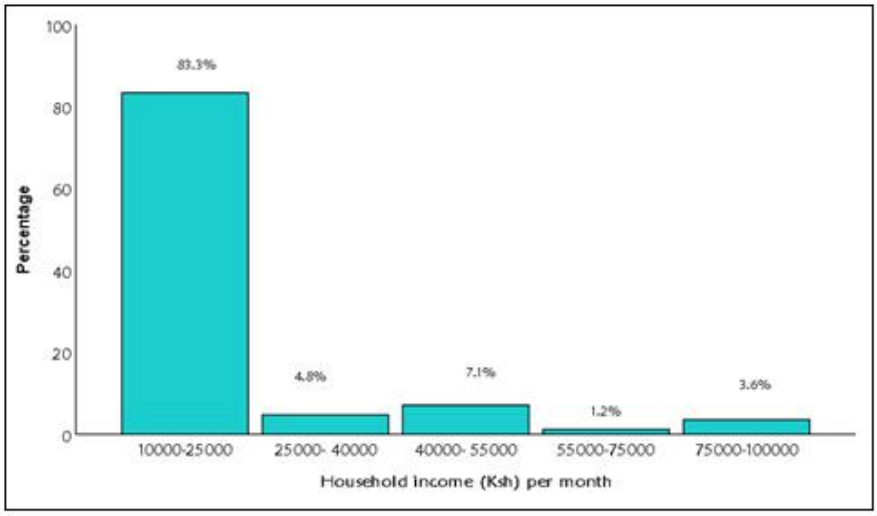

Figure 13:Household income profile

The findings revealed that only (12.0%) of household heads had no formal education, (31.3%) had primary education, secondary (51.8%), (8.4%) had post-secondary education with (7.2%) of the sampled household heads having reached university education.

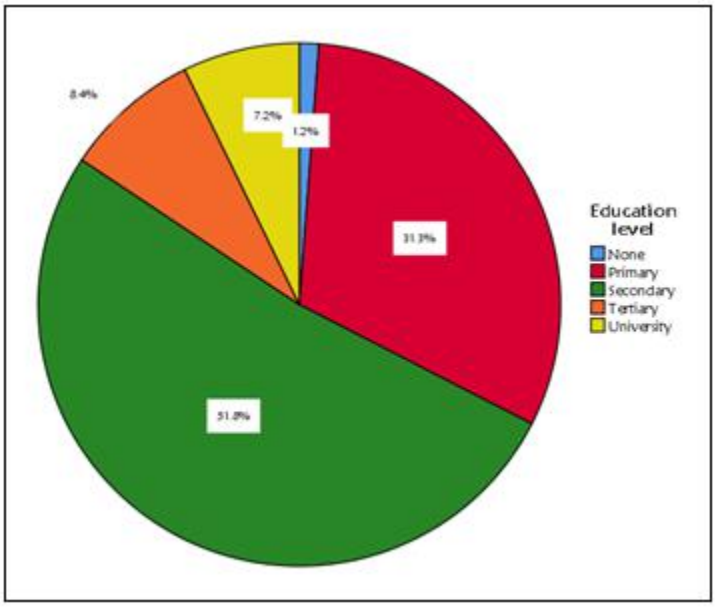

Figure 14:Household Education Level

Disaggregated education levels by gender are as shown in Figure 4.3, male household heads on the overall have higher literacy levels of up to (69.2%).

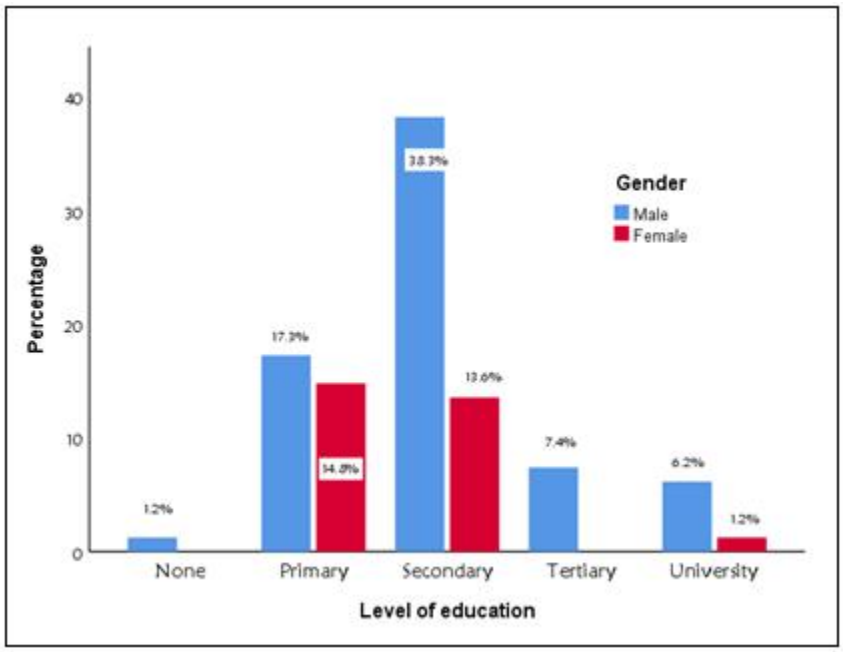

Figure 15:Household disaggregated education levels

4.13.2 Economic Profile of Households

About (16.7%) of the households have their main economic activity being business, (8.3%) in full employment, (14.3%) are engaged as casuals
while (55.9%) are involved in farming consisting of crop production, livestock rearing, and mixed farming as shown in (Table 4.4).

Primary Occupation of Household Head	Percentage
Crop Production	21.4
Livestock rearing	2.4
Mixed Farming	32.1
Businessperson	16.7
Full employment	8.3
Casual employment	14.3
Others	4.8
Total	100.0

4.13.3 Expenditure

The average income per month is KShs 24,612 for the male headed households while female headed households average at KShs 8,707 per month.

4.13.4 Water Supply

The results from the study showed that access to piped water in the project area is 30.1 % while 69.9 % of the residents have no access to piped water.

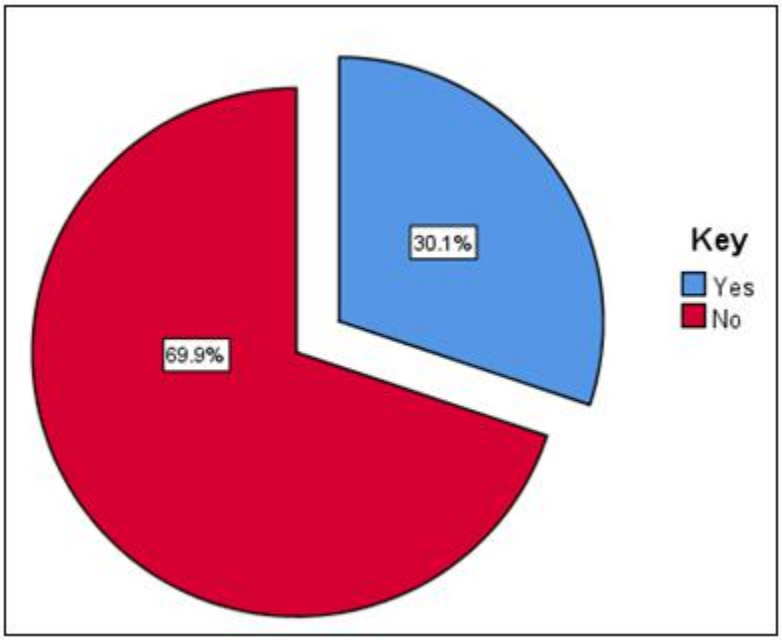

Figure 16:Access to piped water supply

Other sources of water in the project area includes shallow wells (26.8%), Borehole (18.3%), private piped connections (14.6%), water kiosk (12.2%), springs (8.5%), Tankers (7.3%) and rainwater harvesting (6.1%).

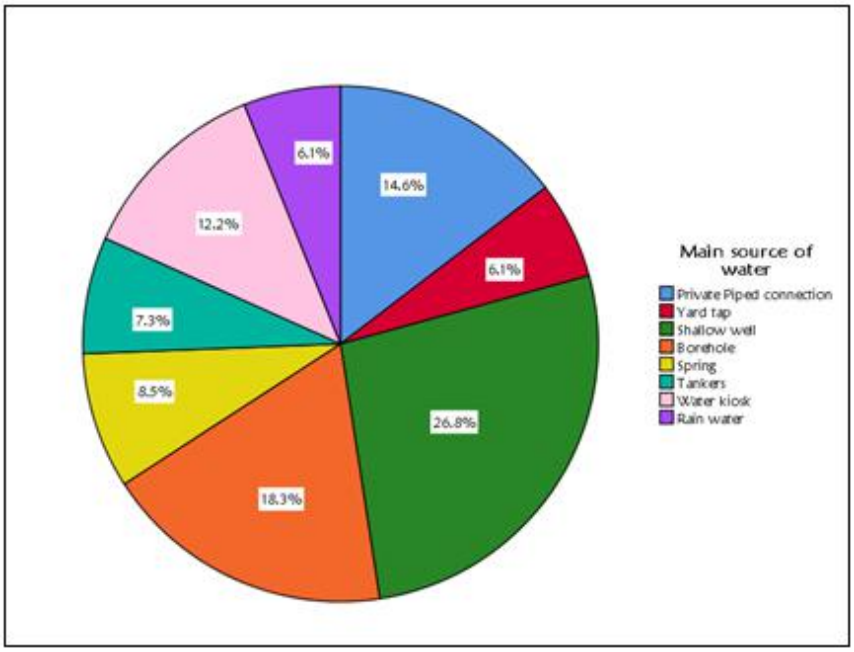

Figure 17:Other sources of water in the project area

4.13.5 Sanitation

Improved sanitation facility is one that hygienically separates human excreta from human contact. They include flush/pour flush to pipe sewer system, septic tank, pit latrine, ventilated improved pit latrines, pit latrines with slab. Unimproved sanitation is one that does not ensure hygienic separation of human excreta from human contact.it includes pit latrines without slab or platform, hanging latrines and bucket latrines (source: JMP 2015 for MDG monitoring). Open defecation is when feces are disposed in the fields, forest, bushes, open water bodies, beaches or other open spaces with solid waste (source: JMP 2015 for MDG monitoring).

The survey showed that 82.9 percent of the respondents use pit latrine, flush toilets (15.9%) and those with no sanitation facility accounted for 1.2%.

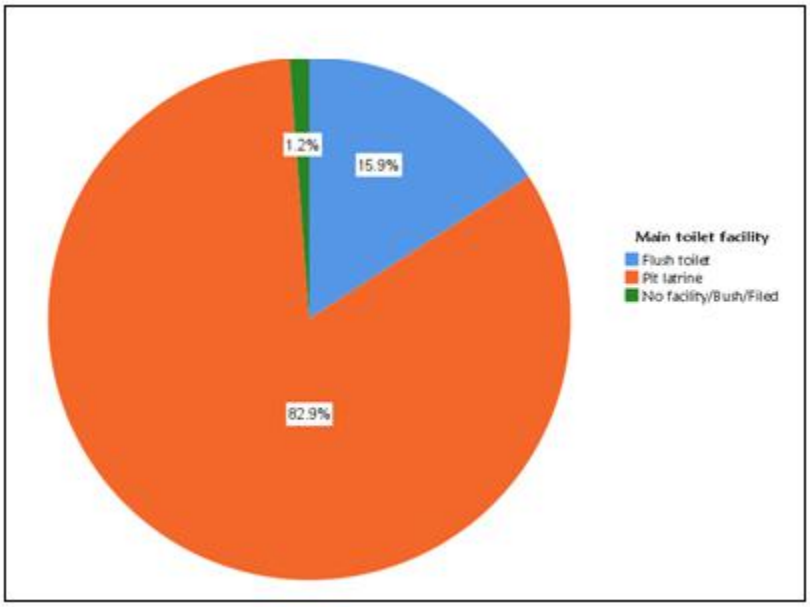

Figure 18:Sanitation Facility used in the Project Area

4.13.6 Health

The main cause of morbidity from the study are Malaria (48.8%), Typhoid (20.3%), Amoeba (13.0%), Tuberculosis (5.7%), Bilharzia (4.9%), Cholera (4.9%), Diarrhea (0.8%), Pneumonia (0.8%) and Flu (0.8%).

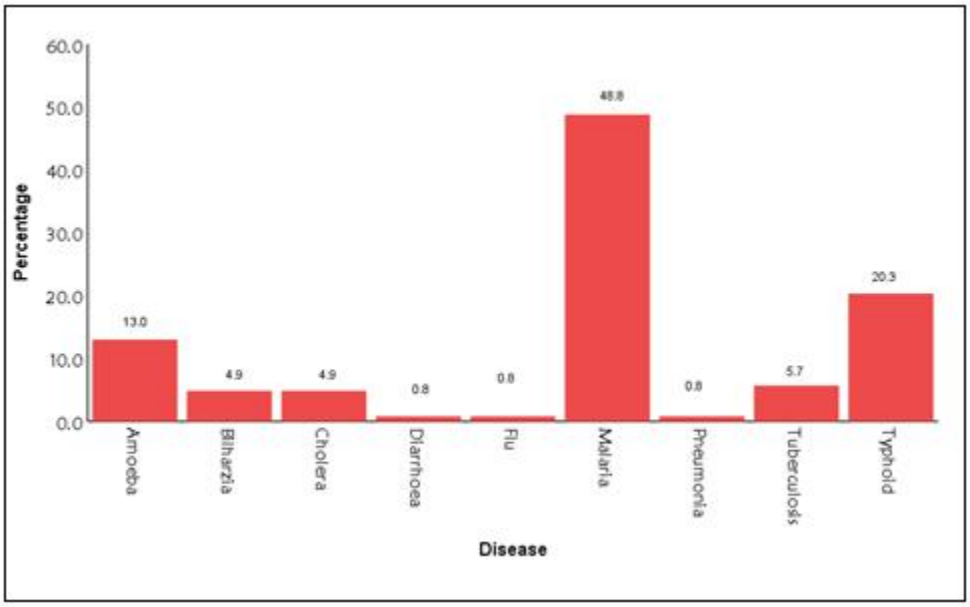

Figure 19:The Prevalent Diseases in the Project Area

The survey showed that on average each household was willing to pay Ksh 5,000 per month for improved water services.

Table: Preferred amount Household's are willing to pay for Water per month

How much are you willing to pay per month per family for improved water services	
Mean	5,000.00
Median	1,000.00
Mode	1,000.00
25th Percentile	425.00
50th Percentile	1,000.00
75th Percentile	2,500.00
90th Percentile	2,463.89

5.0 REVIEW OF EXISTING POLICIES, LEGAL, REGULATORY, AND INSTITUTIONAL FRAMEWORKS.

5.1. Overview

This chapter presents a review of policy, legal and regulatory frameworks applicable to environmental management of the completion of the proposed Umaa dam and water supply Project at National and international levels. Kenya Government has a wide range of policy, institutional and legislative frameworks to address the major causes of environmental degradation on ecosystems emanating from industrial and economic development programmes. However, they are spread over several sectors. In spite of this, the Kenya legal and institutional framework is currently undergoing several changes to be aligned with the requirement of the new constitution. The literature reviewed in this section puts into consideration the anticipated changes and the current laws that govern natural resource sharing, management, utilization, and protection.

ESIA studies are carried out to identify potential positive and negative impacts associated with the proposed project with a view to taking advantage of the positive impacts while providing effective mitigation measures for the negative effects. The requirements on ESIA are contained in sections 58 to 67 of the Act.

According to section 68 of the environmental management and coordination Act (EMCA) 1999, reviewed 2105) the Authority shall be responsible for carrying out environmental audits on all activities that are likely to have a significant effect on the environment. Environmental auditing (EA) is a tool for environmental conservation and has been identified as a key requirement for existing facilities to ensure sustainable operations with respect to environmental resources and socio-economic activities in the project neighborhoods. The government has established regulations to facilitate the process on ESIAs and environmental audits. The regulations are contained in the Kenya Gazette Supplement No. 56, legislative supplement No. 31, and legal notice No. 101 of 13th June 2003.

5.2. Policy Framework

5.2.1. Sustainable Development Goals (SDGs)

Sustainable Development goals which were initiated by world leaders in 2015 as an advancement of the Millennium Development Goals (MDGs) provide concrete, numerical benchmarks for tackling extreme poverty in its many dimensions. The SDGs also 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 reduce by half, tens of millions of lives will be saved, and billions more people will have the opportunity to benefit from the global economy.

Goals 6, 7, 13, 14 and 15 of the SDGs revolve around ensuring Environmental Sustainability. The goals highlight on.

- ✓ Ensuring availability of sustainable management of water and sanitation for all.
- ✓ Ensuring a clean and more sustainable supply of water within related watersheds.
- ✓ Ensuring access to affordable, reliable, sustainable, and modern energy for all; Combating climate change through the reforestation of degraded and degrading landscapes whereby reforestation helps in strengthening community resilience to climate change;
- ✓ Protecting, restoring, and promoting sustainable use of terrestrial ecosystem, sustainably manage forests, combat desertification and halt and reverse land degradation, and halt biodiversity loss and,
- ✓ Conservation and sustainable use of oceans, seas, and marine resources.

The proposed project will contribute towards sustainable management of water and will ensure clean and more sustainable supply of water within Kitui town. The ESIA study will ensure that the proposed project reflects Environmental Sustainability especially during the time of construction and implementation.

5.2.2. Kenya's Vision 2030

Vision 2030 is geared towards transformation of Kenya into an industrialized middle-income country by 2030. The blueprint recognizes that Kenya is a water scarce country and further that the economic and social development envisaged in the vision 2030 will require more high-quality water supplies. The water and sanitation sector goal in line with the Vision 2030 is "to ensure that improved water and sanitation are available and accessible to all".

It is based on the 3 pillars of political, social, and economic advancement and it aims to transform the economy and achieve sustainable growth. Environmental considerations of development are contained within the social and economic pillar just like for Agriculture. The vision aims at reducing poverty through creating opportunities for the poor by making institutions stronger.

One of the strategies proposed is to construct water and sanitation facilities to support industries and the growing urban population. Regarding environment, the Vision states that Kenya aims to be a nation living in a clean, secure, and sustainable environment by 2030. The goals for 2012 are: (i) to increase forest cover from less than 3% at present to 4%; and (ii) to lessen by half all-environment related diseases. Specific strategies involve: promoting environmental conservation for better support to the economic pillar flagship projects and for the purposes of achieving the Millennium Development Goals (MDGs); improving pollution and waste management through the design and application of economic incentives; and the commissioning of Public-Private Partnerships (PPPs) for improved efficiency in water and sanitation delivery.

The Umaa dam project is in line with Vision 2030 in that it is geared towards promoting environmental conservation for better support to the economic pillar flagship projects and for the purposes of achieving the Millennium Development Goals (MDGs). The project should have an afforestation programe to replace the trees that shall be cut that aims at combating climate change.

5.2.3. National Environmental Action Plan (NEAP)

According to the Kenya National Environment Action Plan (NEAP, 1994) the Government recognized the negative impacts on ecosystems emanating from industrial, economic, and social development programmes that disregarded environmental sustainability. Under the

NEAP process Environmental Impact Assessments were introduced targeting the industrialists, business community and local authorities.

National Water Harvesting and Storage Authority is abiding by this policy guideline by ensuring that the environmental and social baseline surveys are carried out and then an ESIA that will develop an Environmental Management and Monitoring Plan to manage the Environment and ensure that the post project period will have better environment than it was before the project.

5.2.4. National Policy on Water Resources Management and Development

While the National Policy on Water Resources Management and Development (1999) enhances a systematic development of water facilities in all sectors for promotion of the country's socio-economic progress, it also recognizes the by-products of this process as wastewater. It, therefore, calls for development of appropriate sanitation systems to protect people's health and water resources from institutional pollution.

Industrial, business and large scale agricultural development activities, therefore, should be accompanied by corresponding waste management systems to handle the wastewater and other waste emanating there from. The same policy requires that such projects should also undergo comprehensive EIAs that will provide suitable measures to be taken to ensure environmental resources and people's health in the immediate neighborhood and further downstream are not negatively impacted by the discharges. As a follow-up to this, EMCA 1999 requires annual environmental audits to be conducted in order to ensure that mitigation measures and other improvements identified during EIAs are implemented.

The key objectives of the Policy include:

- To ensure that from the onset, all development policies, programmes and projects take environmental considerations into account,
- To ensure that an independent environmental impact assessment (EIA) report is prepared for any industrial venture or other development before implementation,
- To come up with effluent treatment standards that will conform to acceptable health guidelines.

Under this paper, broad categories of development issues have been covered that require a "sustainable development" approach. These issues relate to waste management and human settlement. The policy recommends the need for enhanced reuse/recycling of residues including wastewater, use of low or non-waste technologies, increased public awareness raising and appreciation of a clean environment. It also encourages participation of stakeholders in the management of wastes within their localities. Regarding human settlement, the paper encourages better planning in both rural and urban areas and provision of basic needs such as water, drainage, and waste disposal facilities among others.

The proposed project is in line with this sectoral policy as it will increase access to water in the catchment through rehabilitation and management of the catchment by planting more trees to offset the ones that shall be cut. It will also increase access of water to the beneficiaries who are the residents of Kitui Town.

Land Policy

The National Land Policy in section 3.4 on Environmental Management Principles provides for the policy actions for addressing the environmental problems such as the degradation of natural resources, soil erosion, and pollution of air, water, and land. The policy advocates for environmental assessment and audit as a land management tool to ensure environmental impact assessments and audits are carried out on all land developments that may degrade the environment and take appropriate actions to correct the situation. Public participation has also been indicated as key in the monitoring and protection of the environment. Section 3.4.3.3 advocates for the Implementation of the polluter pays principle which ensures that polluters meet the cost of cleaning up the pollution they cause and encourage use of cleaner production technologies. In section 131 (d) the government undertakes to provide mechanisms for resolving grievances arising from human/wildlife conflicts for sustainable management of land based natural resources.

The proposed project works shall implement the Environmental and Social Monitoring Plans to ensure that no rivers within the project area are polluted by the subsequent activities during construction and operational phases. The project shall be implemented in forest land and tree planting shall be one of the activities for conservation while taking care of the wildlife within the forest reserve.

5.2.5. Principles of Land use

From the constitution of Kenya 2010, Land in Kenya shall be held, used, and managed in a manner that is equitable, efficient, productive and sustainable, and in accordance with the following principles--

a. Equitable access to land;

b. Security of land rights;

c. Sustainable and productive management of land resources;

d. Transparent and cost effective administration of land;

e. Sound conservation and protection of ecologically sensitive areas;

f. Elimination of gender discrimination in law, customs and practices related to land and property in land; and

g. Encouragement of communities to settle land disputes through recognized local community initiatives consistent with this Constitution.

These principles shall be implemented through a national land policy above developed and reviewed regularly by the national government and through legislation. The development of the Umaa dam and water supply project shall observe the above principles in its entire project cycle i.e. construction and operation.

5.2.6. Sessional Paper No. 6 (1999)

The key policy objectives of Sessional Paper No. 6 of 1999 include:

- Ensuring that all development projects at the inception stage and programs, as well as policies, consider environmental conditions.
- Ensuring that an EIA report is prepared for any undertaking or development project before implementation; and
- Coming up with effluent treatment standards that will conform with acceptable health guidelines.

It is important to note that issues of wastewater management and human settlements are given prominence and, therefore, the policy recommends re-use and recycling of residues (i.e. waste water), use of low waste generation technologies and increasing public awareness on the benefits of a clean environment. It also recognizes the role of stakeholders in all these initiatives within their localities.

The paper encourages better planning in rural and urban areas in the provision of needs, i.e. water, drainage system, waste disposal facilities, etc.

This assessment has been undertaken to be in line with this sessional paper that requires EIA for proposed projects so that impacts can be identified and mitigated.

5.2.7. The national policy on transboundary water resources management and development 2014

The purpose of the trans-boundary waters policy is to provide a roadmap for cooperation in attaining sustainable, equitable and reasonable utilization of the shared water resources of Kenya. The policy provides a framework for sustainable management and utilization of water resources, the promotion of socio-economic development, cooperation amongst riparian states and facilitation of joint information collection, planning and data sharing. The policy also provides a framework for coordination of the management and sustainable utilization of both shared and territorial waters to avoid duplication of resources, reduce institutional conflicts and eliminate overlapping mandates.

Much progress has been made regarding trans-boundary water resources management through the initiatives of the African Ministers' Council on Water (AMCOW), East Africa Community (EAC) and many other bilateral organizations. However, Kenya still does not have a comprehensive framework or strategy for trans-boundary water resources management. The key document in water sector management, namely the National Water Policy of Kenya (Session Paper No. 1 of 1999), recognizes the need for one and recommends an assessment of existing international treaties on shared waters with a view to the adoption of provisions appropriate to the country's conditions and needs. Similarly, the Water Act of 2002 is deficient in as far as it does not contain express provisions on the management of shared water resources.

The shared surface water resources

They include;

a. Lake Victoria, which is shared with Tanzania and Uganda. The lake is the world's second largest freshwater lake and with a catchment area which extends to the five East African countries. It also forms part of the Nile River System and contains about 50% of Kenya's surface water resources;

b. Rivers Sio-Malaba-Malakisi, Lwakhakha, and Suam all of which are shared with Uganda;

c. Lake Turkana, which is shared with Ethiopia, is the world's second largest desert lake with a catchment extending to the Ethiopian highlands and drained by River Omo;

d. River Daua, which is shared with Ethiopia and Somalia[1]; and

e. Rivers Mara, Umba, Lumi and Pangani and Lakes Natron, Jipe and Chala which are shared with Tanzania.

The proposed project is to be implemented on a river that is not shared with any country hence not triggering application of the recommendations in this policy.

5.3. LEGAL FRAMEWORKS

5.3.1. New Constitution of Kenya, 2010

Environmental management and natural resources utilization is enshrined in the Kenya constitution 2010 under several articles.

In article 69 of the Constitution of Kenya, 2010, 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.

The constitution in article 42 emphasizes the need for a clean and healthy environment through management of substances that may pollute the environment or cause harm to human health. The right to a clean environment is further enforced by article 70. Article 186 and the fourth schedule allocate functions of natural resources management and environmental protection to both the national and county governments. The national government is required to protect the environment and natural resources with a view of establishing a durable and sustainable system as stated in article 22 of the fourth schedule.

The county government on the other hand shall Control air pollution, noise pollution and other public nuisances as stipulated in article 3 of the fourth schedule and in article 10, the county government shall implement specific national government policies on natural resources and environmental conservation. Some of the development impacts will be a

concern to the County government hence need for collaboration between National water harvesting & Conservation Authority, the contractor, and the Kitui County government.

The principles of land policy that ensure land is held, used, and managed in a manner that is equitable, efficient, productive, and sustainable is set out in article 60 of the constitution. NWH&CA intends to develop the land in the proposed Umaa dam and water supply to ensure its efficient management and utilization. Proper land management by regulating the use of any land, or any interest in or right over any land, in the interest of defending, public safety, public order, public morality, public health, or land use planning is ensured by the constitution in article 66.

Regarding environmental protection and natural resources management, article 62 sub-article 1 stipulates what constitutes public land. These include water courses and forest reserves on which the project will be developed. The public land areas are held by the national government in trust for the people of Kenya and shall be administered on their behalf by the National Land Commission as stated in article 62 sub-article 3. The land commission shall also monitor and have oversight responsibilities over land use planning throughout the country regardless of the classification as stated in article 67-2(h).

For the purposes of this project, the constitution of Kenya provides for sound environmental management and sustainability and therefore this study provides one of the tools through which this can be achieved.

5.3.2. The Environmental (Impact Assessment and Audit) Regulations, 2003

The Environmental Impact Assessment guidelines require that a study be conducted in accordance with the issues and general guidelines spelt out in the second and third schedules of the regulations. These include coverage of the issues on schedule 2 (ecological, social, landscape, land use and water considerations) and general guidelines on schedule 3 (impacts and their sources, project details, national legislation, mitigation measures, a management plan and environmental auditing schedules and procedures. The Act further stipulates that ***No*** licensing authority under any law in force in Kenya shall issue a license for any development project for which an environmental impact assessment is required under the Act unless the applicant produces to the licensing authority a license of environmental impact assessment issued by the NEMA. The project proponent was also required to pay mandatory fees that are due before processing of EIA or EA license.

This report process and structure/format has adhered to this regulation

5.3.3. Environmental Management and Coordination Act, 1999

The main objectives of EMCA (1999) and the related regulations are to provide for the establishment of an appropriate legal and institutional framework, including procedures for the management of the environment in Kenya. The Act further aims to improve the legal and administrative coordination of the diverse sectoral initiatives in the field of environment, to enhance the national capacity for its effective management. In addition, the Act seeks to harmonize all the sector specific legislation touching on the environment in a manner designed to ensure protection of the environment. This is in line with national objectives and sustainable development goals enunciated in Agenda 21 of the Earth Summit. As such, in terms of environmental management, EMCA (1999) provides a comprehensive and an appropriately harmonized legal and institutional framework for the handling of all environmental issues in Kenya, and supersedes all sectoral laws.

Part VI of EMCA (1999) makes provision for the carrying out of EIA. It is mandatory for any proponent of a project to submit a project report to NEMA in a prescribed format. After reviewing the proponents' report, and NEMA is satisfied that the proposed project is likely to have significant negative impacts in the environment, it will direct the proponent of the project to undertake at his or her own expense an environmental impact assessment study and prepare a report. NEMA shall publish such a report and invite comments thereon from the public before deciding to issue an environmental impact license. NEMA, at any time after issuing the environmental impact assessment license, may direct the proponent to submit a fresh environmental impact study, where there is substantial change in the project or where environmental threats, not earlier foreseen, have emerged.

Environmental Management and Coordination Act (EMCA), 1999 in its Second Schedule 4 (b) requires river diversions and water transfer between catchments undergo Environmental and Social Impact Assessment (ESIA). A report will be compiled to comply with EMCA and the Environmental (Impact Assessment and Audit) Regulations, 2003.

Some key Sections of the Act relevant to the proposed project are:

5.3.3.1. Environmental Impact Assessment and Audit Regulations 2003 (Legal Notice No. 101) and Environmental Impact Assessment and Audit Regulations (Amendment) 2009

Regulation 24 – Annual Environmental Audit

Annual environmental auditing after presentation of an EIA study report shall be undertaken by the licensee to ensure implementation of environmental management plan is audited on regular basis, an audit report submitted to NEMA annually, and ensuring that

the criteria to audit is based on environmental management plan developed during the EIA process or after the initial audit.

Regulation 40 - Monitoring changes after project implementation Monitoring by NEMA and Lead Agencies shall be done to establish any possible changes in the environment and their possible impacts, immediate and long term effects of its operations, identify and determine parameters and measurable indicators, and conduct changes that occurred after implementation. The aim of this section is to provide the Proponent and Contractors with quick reference to most critical legal and policy provisions to enable proper planning and impact assessment during project planning and implementation. The Environmental Management and Coordination Act (EMCA, 1999) is the main framework environmental law in Kenya. The Act guarantees every Kenyan the right to a clean and healthy environment. However, there are other sectoral laws that guide management of various environmental components. It is worth noting that if a sectoral law conflicts with EMCA, EMCA prevails and the other law is null and void to the extent of that inconsistency.

The proponent who is National Water Conservation and Storage Authority will submit an Environmental Audit report yearly in accordance to these regulations

5.3.3.2. Water Quality Regulations, 2006, (Legal Notice No.121)

Water Quality Regulations apply to water used for domestic, industrial, agricultural and recreational purposes; water used for fisheries and wildlife purposes; and water used for any other purposes. Different standards apply to different uses. These regulations provide for the protection of lakes, rivers, streams springs, wells and other sources. The overriding objective of the regulations is to protect human health and the environment. Proper enforcement of the regulations can lead to marked reduction in water-borne diseases. The regulations provide guidelines and standards for the discharge of poisons, toxins, radioactive and other pollutants into the aquatic environment. Standards have also been set for discharge of effluent into the sewer and aquatic environment. The National Environment Management Authority regulates discharge into the aquatic environment.

The First and the Ninth Schedule of the Regulations stipulates standards for sources of domestic water supply and irrigation water respectively (Annex 1 and 2). Persons (real or legal) discharging effluent into the environment are required to submit quarterly discharge monitoring records to NEMA.

The proponent will ensure that the sources of water for Umaa dam meet the specified standards provided in these regulations.

5.3.3.3. Environmental Management and Coordination (Air Quality) Regulations, 2008

The objective is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. It provides for the establishment of emission standards for various sources, such as mobile sources and stationary sources.

The proponent and constructor will ensure mitigation measures are put in place to control dust and exhaust emissions especially during construction of the project infrastructure.

Regulations, 2006

These Regulations were 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 6 requires waste generators to segregate waste by separating hazardous waste from non-hazardous waste for appropriate disposal. 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.

The proposed Umaa project, during construction, will generate substantial volumes of spoil materials among other wastes which will need to be disposed as per the guidelines in the regulations.

5.3.3.4. 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;
- 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.

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

Regulation 5 further makes it an offence for any person to make, continue or cause to be made or continued any noise in excess of the noise levels set in the First Schedule to these Regulations, unless such noise is reasonably necessary to the preservation of life, health, safety or property. The First and Second schedules of the regulations have set standards for maximum permissible noise levels at construction sites and intrusive noise levels respectively.

Part II section 3(I) of these Regulations states that: 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. Section 3(2) states that in determining whether noise is loud, unreasonable, unnecessary or unusual, the following factors may be considered;

i. Time of the day,
ii. Proximity to residential area,
iii. Whether the noise is recurrent, intermittent or constant,
iv. The level and intensity of the noise,
v. Whether the noise has been enhanced in level or range by any type of electronic or mechanical means, and
vi. Whether the noise can be controlled without much effort or expense to the person making the noise.

Part II Section 4 states that: except as otherwise provided in these Regulations, no person shall (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 centimeters per second beyond any source property boundary or 30 metres from any moving source.

Part III, Section 11(1) states that any person wishing to (a) operate or repair any machinery, motor vehicle, construction equipment or other equipment, pump, fan, air-conditioning apparatus or similar mechanical device; or (b) engage in any commercial or industrial Activity, which is likely to emit noise or excessive vibrations shall carry out the Activity or Activities within the relevant levels prescribed in the First Schedule to these Regulations. Any person who contravenes this Regulation commits an offence.

Section 13(1) states that except for the purposes specified in sub-Regulation (2) hereunder, no person shall operate construction equipment (including but not limited to any pile driver, steam shovel, pneumatic hammer, derrick or steam or electric hoist) or perform any outside construction or repair work so as to emit noise in excess of the permissible levels as set out in the Second Schedule to these Regulations. These purposes include emergencies, those of a domestic nature and /or public utility construction. It is expected that the regulations will be relevant to the project during implementation and constructions works or decommissioning phase where construction machinery and vehicles involved will lead to emission of noise and vibrations

The Umaa Project during construction activities will generate noise and vibrations. The contractor will be required to ensure compliance with the above regulations in the components that are close to the town in order to promote a healthy and safe working environment throughout the construction phase.

5.3.3.5. The Environmental Management and Coordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009

The regulations provides for the conservation and sustainable use of wetlands and their Resources. It further in part III provides for the sustainable utilization and conservation of resources on river banks, lake shores, and on the seashore by and for the benefit of the people and community living in such areas. To achieve the intended aim, the regulations enshrine community participation in the management of such designated riparian resources

to prevent pollution and siltation. The wetlands, River Banks, Lake Shores and Sea Shore Management Regulations in part II and III has set principles that should be adhered to, to manage wetlands and that EIA/EA is mandatory for all Activities that are likely to affect the wetlands.

The minister (now Cabinet secretary under the new constitution) for environment can declare an area a protected wetland depending on its significance. Therefore Activities in such a protected area will be controlled in accordance to such wetland management plan. Cultivation is among those Activities allowed in wetlands but is subject to determination of the impacts of such Activities to the wetland. However the regulation in section 12 requires acquisition of a permit before commencement of such Activities from relevant institutions.

NEMA for that matter in consultation with other lead agencies is obligated to develop a wetland management inventory nationally. But regardless of the ownership of the wetland, the regulations stipulate that the land owner or users have an obligation to observe the integrity of the wetland. The regulations further in part III articulate that special measures should be taken to prevent soil erosion siltation and pollution for management of river banks, lake shores and sea shore.

The regulations are relevant to the Umaa project because it is anticipated that the dam and water supply plant within the project area will affect the wetlands in Kitui forest reserve and there is need to establish a balance between conservation and sustainable utilization.

The Proposed Umaa project, in operation will continuously abstract water from the river and restructure sections of their banks/ channels at particular spots through intake works. It is thus paramount that this legislation be integrated during planning, construction and operation of the project.

5.3.3.6. The Environmental Management and Coordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006(Legal Notice No. 160)

The regulations prohibits any person from engaging in Activities that could be detrimental to ecosystems integrity, introduction of alien species in local environment or unsustainable utilization of natural resources without an EIA license issued by NEMA. NEMA on the other hand in consultation with other lead agencies is obligated to develop an inventory of biological diversity resources. The Regulations further provides for monitoring of biological diversity and protection of environmentally significant areas, access to genetic resources, benefit sharing and offences and penalties. The Kitui forest region has plants and animal (insects, fish, birds, amphibians, reptiles and mammals) species of interest to the nation,

region and the international community. Introduction or augmentation of the Umaa dam may have impacts on the biological diversity of the project area particularly on aquatic species during diversion of water for use or chemical pollution of aquatic system. Hence there is need to observe the regulations during project implementation, operation or decommissioning. However an inventory of biological diversity within the project area is scattered over several agencies within the project area based on their mandate and interests including but not limited to; National Museums of Kenya, Kenya wildlife, Kenya forest services, fisheries, Kenya Marine and research institute, nature Kenya, wildlife club etc. consequently there is need to develop an integrated database that is shared by all stakeholders on biological diversity in the project area.

This regulations aim at enhancing preservation of biodiversity and safeguarding of endangered and rare plant and animal species within any human activity area. Section 4 of the legislation expressly prohibits any activity which may have adverse effects on any ecosystem, lead to introduction of alien species in a given area or result in unsustainable utilization of available ecosystem resources.

5.3.3.7. Environmental Management and Coordination (Fossil Fuel Emission Control) Regulations 2006

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

In Umaa dam Project regulations will be applicable to equipment and machinery used by the contractor during the dam and irrigation infrastructure construction. Also the booster pump stations when in operation can trigger this regulation.

5.3.4. The Water Act, 2016

This Act provides the guidelines for proper management of water, conservation and control of water resources to ensure the water resources are sustainable. Under this Act waste water, storm water, sewage systems and drainages are supposed to be put in design drawings in the building plan of the project components; This Act also prohibits water pollution by a developer in his/her area of jurisdiction.

Since the project will involve dams and water supply, the proponent will ensure that appropriate measures to prevent pollution of underground and surface water resources

are implemented throughout the project cycle. The proponent shall also seek the necessary approvals of sources of water supply to the proposed project site throughout the project cycle.

The Act provides for establishment of a Water Resource Authority, whose functions include:

- Formulate and enforce standards, procedures and Regulations for the management and use of water resources and flood mitigation;
- Regulate the management and use of water resources;
- Enforce Regulations made under this Act;
- Receive water permit applications for water abstraction, water use and recharge and determine, issue, vary water permits; and enforce the conditions of those permits;
- Collect water permit fees and water use charges;
- Determine and set permit and water use fees;
- Provide information and advice to the Cabinet Secretary for formulation of policy on national water resource management, water storage and flood control strategies;
- Coordinate with other regional, national and international bodies for the better regulation of the management and use of water resources; and
- Advise the Cabinet Secretary generally on the management and use of water resources.

The act also provides for establishment of a Water Service Regulatory Board whose functions are:

- Determine and prescribe national standards for the provision of water services and asset development for water services providers;
- Evaluate and recommend water and sewerage tariffs to the county water services providers and approve the imposition of such tariffs in line with consumer protection standards;
- Set license conditions and accredit water services providers;
- Monitor and regulate licensees and enforce license conditions;

- Develop a model memorandum and articles of association to be used by all water companies applying to be licensed by the regulatory board to operate as water services providers;
- Monitor compliance with standards including the design, construction, operation and maintenance of facilities for the provision of water services by the water works development bodies and the water services providers;
- Advise the cabinet secretary on the nature, extent and conditions of financial support to be accorded to water services providers for providing water services;
- Monitor progress in the implementation of the water strategy and make appropriate recommendations; powers and functions of the regulatory board;
- Maintain a national database and information system on water services;
- Establish a mechanism for handling complaints from consumers regarding the quality or nature of water services;
- Develop guidelines on the establishment of consumer groups and facilitate their establishment;
- Inspect water works and water services to ensure that such works and services meet the prescribed standards;
- Report annually to the public on issues of water supply and sewerage services and the performance of relevant sectors and publish the reports in the gazette;
- Make regulations on water services and asset development which shall include business, investment and financing plans in order to ensure efficient and effective water services and progressive realization of the right to water services;
- Advise the cabinet secretary on any matter in connection with water services; and
- Make recommendations on how to provide basic water services to marginalized areas.

The proponent should ensure that a Water abstraction permit for the project is obtained from WRA. The proponent will be required to ensure that project activities throughout all phases do not cause pollution of the water resources and also continuously monitor the quantity and quality of water being abstracted from the rivers.

5.3.5. The Water Resources Management Rules, 2007

As a subsidiary to the Act, a legislative supplement, The Water Resources Management Rules, 2007 was gazetted to guide all policies, plans, programmes and activities that are subject to the Water Act, 2002. The Water Resources Management Rules empower Water Resources Authority (WRA) to impose management controls on land use falling under riparian land. It also enables any person with a complaint related to any matter covered by these rules to the appropriate office in WRA as per the Tenth Schedule which provides a format for report on complaints.

Part A of the Sixth Schedule: Conservation of Riparian and Catchment Areas Rules (Rule 116) define the riparian land on each side of a watercourse as a minimum of six metres or equal to the full width of the watercourse up to a maximum of thirty metres on either side of the bank. It further provides activities proscribed on riparian land as:

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

Rule 63 provides for Compensation flow and a permit holder storing or arresting the flow of water by means of a dam or weir located on a body of water or watercourse shall unless otherwise decided by WRA, provide at a depth measured from the top of the dam or weir and to be specified by WRA in each particular case, an outlet, controlled by a valve, sluice gate or other device, which shall be capable of being operated at all stages of the flow of such body of water or watercourse so that the normal flow, or other flow as required by WRA, of such body of water or watercourse can be passed through or around such dam or weir at all stages.

The project intends to arrest flash floods of Nzeeu river by means of a dam. The design has to allow for adequate compensation flow through the proposed spillways in line with these rules and any other WRA requirements.

5.3.6. Public Health Act (Cap 242)

The Public Health Act is the principle instrument for ensuring the health and safety of the people. Its core function is the prevention of disease, treatment and care of the sick (curative services) and control of nuisance. The Act therefore makes regulations and lays standards for a healthy living environment. Part XI Section 129 of the Act places the responsibility of protecting water supplies on the local authorities. The Ministry of Health

is in charge of administration of the Act, with the Director of Medical Services as the Principal Officer. However, where a municipality is capable of discharging responsibilities under the Act, such a municipality is designated as a local health authority. In such a situation, the relevant powers under the Act are delegated to the municipality, but the Director of Medical Services may take over if the Authority is in default. During the execution of the proposed project, this Act is relevant in various ways.

5.3.6.1. Section 115

During construction, nuisance is prohibited especially for all conditions liable to be injurious or dangerous to health.

5.3.6.2. Section 118

Section 118 outlines nuisance liable to be dealt with, i.e. accumulation or deposit of refuse, offal, manure or any other material that is offensive or injurious or dangerous to health, and an accumulation of stone, timber or other machine likely to harbor rats or rodents.

5.3.6.3. Section 126 rule 62 – Drainage and Latrine Rules

It is a statutory requirement that drainage, latrines, septic and conservancy tanks and any other pretreatment methods of sewage effluents seek written permission or/and approval from the local authority, and be built in conformity to provisions of sub-rules (a) to (e) of this section.

The project construction and operation activities are bound to expose both workers and members of the public to situations injurious to health. All activities of the project are thus expected to abide by this act to ensure a healthy environment.

5.3.6.4. Sections 136–143 Breeding Places of Mosquitoes

The civil and building contractors will ensure that during construction, breeding places of mosquitoes and nuisance yards are kept free from bottles, whole or broken. The project area shall not be overgrown by grass. The wells and any pits should be covered. Gutters may be perforated. Larva should be destroyed to eradicate mosquitoes completely by introduction of fish in the dam, as mere presence of mosquito larvae is an offence.

The implementation of Umaa project will make sure that no waste is disposed into the environment to cause nuisance to the public. Also in the project operation, the operator will control the spread of mosquitoes through spraying on trees and introduction of fish into the dam to feed on larvae.

5.3.7. Forest Act, 2005

The Forest Act, 2005 was enacted in November 2005 to repeal the Forest Act, Cap 385 and awaits the Minister to gazette the commencement date. The Act provides for the

establishment, development, and sustainable management, including conservation and rational utilization of forest resources for the social economic development of the country, recognizing that forests play a vital role in the stabilization of soils, ground water, protecting water catchments, and moderating climate by absorbing greenhouse gases, among other things. Its provisions apply to all forests and woodlands on state, local authority and private land of the country declared as provisional forest by the Minister. The administration of forests is headed by the established Kenya Forest Service, managed by a board. Community participation is integrated through forest community associations and forest user associations. The Act also establishes the forest management and conservation fund headed by a finance committee. The Act requires sustainable management of indigenous forests and woodlands and presidential decree for protection of trees can be issued. Variation of forest boundaries or revocation of state or local authority forests and state forest concession is subject to an independent EIA and public consultation.

Section 42 of the Act states that '(1) The conditions on which a license for mining and quarrying, or any other activity carried out in the forest, shall, where the activity concerned is likely to result in the depletion of forest cover in any forest, include a condition requiring the licensee to undertake compulsory re-vegetation immediately upon the completion of the activity. It further states that re-vegetation shall be undertaken in consultation with the Kenya Forestry Service, which shall determine the seeds and seedlings proposed to be used in such re-vegetation. The Director of Kenya Forest Service (KFS) is required to maintain register of all licenses issued under the Act.

Provisions of part VI and part XII of EMCA 1999 shall apply mutatis mutandis to and in respect of a license under this Act, and any EIA as well as reference to the National Environment Tribunal required under this Act. The provisions of EMCA 1999 regarding reference to the Tribunal established under that Act shall apply to the settlement of disputes arising under the Forest Act, 2005. Offences under the Act are punishable under the law, and citizens can petition the High Court for a declaration of contravention of the Act provisions. Thus, the Act directs, regulates, and harmonizes development and use of forests in the country. In addition, the Act provides a vital link with the Environment Management and Coordination Act.

5.3.8. Malaria Prevention Act Cap 246

Section 5–Drainage System

No operations shall obstruct flow of water into or out of any drainage. The management shall be required to maintain the drainage system within the area of the project for removal of water from any land around the project to prevent larvae breeding.

5.3.9. Penal Code, Cap. 63

Section 191–Fouling Water

The management shall ensure that no foul water of any public spring or reservoir is rendered unfit for the purpose for which it was ordinarily used for by the community.

Section 192–Dwellings and Neighbourhood

The operation phases of the project shall ensure that health of persons in general dwellings or carrying on business in the neighbourhood or passing along a public facility are protected.

5.3.10. Legal Notice 40 (Building, Operation & Work of Engineering) Rules 1984

These rules require the contractor to ensure health, safety and welfare of employees and states. It further requires the main contractor to notify the chief inspector within 7 days of commencing or undertaking building operation or works of engineering.

The rules require that walls of excavations deeper than 1.2m be reinforced with timber of suitable quality or with other suitable material to prevent so far as is reasonably practicable the danger or injury resulting from a fall or dislodgement of earthwork. A first aid box shall also be provided and be distinctively marked 'FIRST AID' and placed under the charge of a responsible person whose name shall be plainly indicated in a prominent place or near the box.

Overall Legal Compliance Statement

The proponent has taken cognizance of the applicable legal obligations pertaining to this proposed development by demonstrating full commitment to compliances with applicable laws and regulations applicable to the implementation of this proposed project.

5.3.11. Occupational Health and Safety Act, 2007

This legislation provides for protection of workers during construction and operation phases. The Act applies to all workplaces whether temporarily or permanently with an aim of securing safety, health and welfare of persons at work and non-workers. During project implementation, operation and decommissioning stages, the safety of people who will be hired or in constant interaction within the working area need to be ensured. The project proponent and the contractors will guarantee safety within the project area at different stages of the project cycle. The project proponent in consultation with the contractors are required to prepare a safety and health policy statement with respect to safety and health at work places of workers and any other person in the vicinity (section 7).In the event that there will be more than twenty employees at site, the project proponent or contractor should establish a safety and health committee at the workplace. In spite of this, workers on the other hand are responsible of their own safety and should bring to the attention of the person in charge any dangerous situation. Regular auditing of the workplace should also be done annually to establish the state of health and safety at site.

The Act requires that all workplaces must be registered with the director of Occupational health and safety officer who on notification has power at any time to enter examine or inspect a workplace. Safety of workers therefore should be ensured at all-time including using personal protective gears. People will be hired during project implementation, operation and decommissioning stages and their safety should be ensured according to the provisions of this Act. However, it is sometimes challenging to monitor implementation of safety at workplaces and most often steps are taken after an incident. For instance, there are no air quality standards in Kenya and also capacity to determine air quality levels.

Sufficient and suitable sanitary conveniences for persons employed in the factory/ workplaces shall be provided, maintained and kept clean, and effective provision shall be made for lighting the conveniences, and where persons of both sexes are, such conveniences shall afford proper separate accommodation for persons of each sex.

The contractor will have to fulfil this legislation during the entire project implementation.

5.3.12. Energy Act of 2006

This is an Act of Parliament passed to amend and consolidates the law relating to energy, to provide for the establishment, powers and functions of the Energy Regulatory Commission and the Rural Electrification Authority and for connected purposes. The

Energy Act of 2006 replaced the Electric Power Act of 1997 and The Petroleum Act, Cap 116. The Energy Act, amongst other issues, deals with all matters relating to all forms of energy including the generation, transmission, distribution, supply and use of electrical energy as well as the legal basis for establishing the systems associated with these purposes.

The Energy Act, 2006, also established the Energy Regulatory Commission (ERC) whose mandate is to regulate all functions and players in the Energy sector. One of the duties of the ERC is to ensure compliance with Environmental, Health and Safety Standards in the Energy Sector, as empowered by Section 98 of the Energy Act, 2006.

In this respect, the following environmental issues will be considered before approval is granted:

- *The need to protect and manage the environment and conserve natural resources.*
- *The ability to operate in a manner designated to protect the health and safety of the project employees, the local and other potentially affected communities.*

Licensing and authorization to generate and transmit electrical power must be supported by an Environmental Impact Assessment Report (EIA) approved by NEMA.

5.3.13. The Radiation Protection Act (Cap 243 Laws of Kenya)

This is an Act of Parliament to provide for the protection of the public and radiation workers from the dangers arising from the use of devices or material capable of producing ionizing radiation and for connected purposes. Since 1982, Kenya decided to join in the global movement for the use of nuclear energy for peaceful purposes, a movement lead by the International Atomic Energy Agency (IAEA). Most of such uses are in the fields of medicine, agriculture, energy and environmental monitoring. The dangers of injury to the public prompted the adoption of the Radiation Protection Act (Cap 243) in November 1984 to provide according to its citation, protection of the public and radiation workers from the dangers arising from the use of devices or materials capable of producing ionizing radiation and for connected purpose.

The Act prohibits the unauthorized manufacture, production, possession or use, sale, disposal, lease, loan or dealership, import, export of any irradiating device or radioactive material. All authorized buyers, sellers, users, of such device must be properly licensed.

The Act is administered by the Chief Radiation Protection Officer assisted by a Radiation Protection Board.

The proposed project won't emit/produce ionizing radiations.

5.3.14.The County Government Act, 2012

The Kenya constitution 2010 provides for two tier government levels. Local area planning and development will be controlled at county government level. The county government Act provides local governance principles, guide planning and development process as well as community participation. Section 5 of the Act stipulates the functions of the county governments as provided for in the constitution.

The Act in part VIII on the other hand indicates the significance of community participation in decision making. It articulates how the local people can be involved in the management of the county government affairs and decision making process. In Part IX and X, the Act compels the county governments to provide adequate information and public civic education as a way of capacity building to ensure meaningful participation.

To ensure integrated and sustainable development at both national and county government level, the Act in part XI states the principles of county planning and development process. Section 102 in particular outlines the principles of planning and development facilitation in a county. One of the objectives of county planning is to harmonize between national, county and sub-county spatial planning requirements as stated in section 103(a) of the Act. Section 104 in subsection 2 on the other hand states that such planning framework should integrate economic, physical, social, environmental and spatial planning.

The county planning unit is responsible of coordinating all integrated development plans within the county. However Counties are required to prepare a five year integrated development plan as stipulated in section 108. Such plans will be informed by among other things, all known projects, plans and programs to be implemented within the county by any organ of state (Section 108, (2b) iii). Therefore the project proponent should liaise with the county planning unit during project implementation process to ensure the project is in line with the goals and objectives of the integrated development plan.

5.3.15.For the project to be implemented, it has to be acceptable to the County Governments of Kitui and it has to be in line with their development agendas. The project is acceptable to Kitui County government and is geared towards supplying water to its people which is one of their agenda to increase water accessibility to the people of Kitui

5.3.16. Physical Planning Act, Cap 286

The protection of the environment, the conservation of the natural resources and pollution are basically tied up with the question of the permitted use of land. The land planning law in Kenya is found in the Physical Planning Act, Cap 286. The main purpose of the physical planning legislation is to control the use of land, which is of great importance since it affects

the environment. When an owner seeks to develop a plot of land, which is within the jurisdiction of the local authority, approval from the Director of Physical Planning is mandatory. The Act defines 'Development' to mean any material change in the use or density of any building or land. Section 36 specifically provides that in connection with a development activity, which will have an injurious impact on the environment, the applicant shall be required to submit together with the application an Environmental Impact Assessment Study Report (EIASR). Section 29 of the Act allows for prohibition or control of the use and development of land and buildings in the interest of proper and orderly development of an area. Section 30 of the Act states that any person who carries out development without permission will be required to restore the land to its original condition, and that no other licensing authority shall grant license for commercial and industrial use or occupation of any building without development permission granted by the local authority. Section 36 states that where the project will be injurious to the environment, the developer shall be required to submit an Environmental Impact Assessment Report and thereafter, an Environmental Audit every year.

This act guides the implementation of projects. The act zones areas as a gazetted forest reserve. The proponent will have to change user before implementing the project and its components

5.3.17.Work Injury Benefits Act (WIBA), 2007

It is an act of Parliament (No. 13 of 2007) to provide for compensation to workers for injuries suffered in the course of their employment. It outlines the following:

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

During construction period, the contractor will need to abide by all the provisions of WIBA. Similarly, the same will be required of the proponent during operation phase of Umaa dam Project.

5.3.18. The Wildlife Conservation and Management Act, 2013

This Act became operational on 10 January 2014. One of its guiding principles is the devolution of conservation and management of wildlife to landowners and managers in areas where wildlife occurs, through in particular the recognition of wildlife conservation as a form of land use, better access to benefits from wildlife conservation, and adherence to the principles of sustainable utilization. Section 25 of the act provides for compensation for injuries and damages caused by wildlife (species listed in its third schedule) to humans and their properties respectively. Such compensation claims are to be reviewed and awarded by County Wildlife Conservation and Compensation Committees at the ruling market rates: provided that no compensation shall be paid where the owner of the livestock, crops or other property failed to take reasonable measures to protect the properties from damage by wildlife or land use practices are incompatible with the ecosystem-based management plan for the area.

The act in its sixth schedule list various animal and tree species that are nationally considered as critically endangered, vulnerable, nearly threatened and protected. It also lists in its seventh schedule, national invasive species for which control is required. Section 48 restricts activities involving the above listed species without a permit from KWS. KWS can make recommendations to the responsible cabinet secretary, to prohibit carrying out of any activity which: is of a nature that may negatively impact on the survival of species listed in sixth schedule; or is specified in the notice or prohibit the carrying out of such activity without a permit issued by KWS.

Any critically endangered, vulnerable, nearly threatened or protected species found within the project area will have to be managed in line with this Act.

5.3.19. The Kenya Roads Board Act, Cap 408 of 1999

This is the main legal instrument that governs management of road network in the country. The act whose commencement date was 01 July 2000 encourages participation of all stakeholders in the road sector during the planning, design, construction and maintenance.

5.3.20. Public Roads and Road of Access Act (Cap 399)

The Act provides for the following with regard to public roads:

- Dedication of line of public travel;
- Application to construct roads of access;

- Notice to be served on land owners affected;
- Granting of leave to construct road of access;
- Notification of order to be registered;
- Right of way over road of Access;
- Power to cancel or alter road of access; and
- Prohibition of classes of traffic

Of relevance with the proposed Umaa is the need for rehabilitation of and laying out of access roads.

5.3.21. The Kenya Roads Act of 2007

The act stipulates the legal and institutional aspects of the road sub-sector policy. The Act provides for the establishment of three independent Road Authorities, namely:

1) Kenya National Highways Authority (KeNHA), responsible for the administration, control, development and maintenance of all class A, B and C roads in Kenya,
2) Kenya Rural Roads Authority (KeRRA), responsible for rural and small town roads including class D, E roads and Special Purpose Roads; and
3) Kenya Urban Roads Authority (KURA) responsible for all City and Municipal Roads.

The Authorities fall under the Ministry responsible for infrastructure and retains the role policy formulation and general oversight of public roads including regulatory aspects such as technical standards.

The proponent will require liaison with these institutions in the improvements existing and development of any new roads within the project area in which the Umaa Dam and Water supply shall be constructed.

5.3.22. Land Legislation

5.3.22.1. The Land Act, 2012

This is an Act of Parliament intended to give effect to Article 68 of the Constitution, to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land based resources, and for connected purposes. Parts 1 and 2 of section 4 of the Act outline the main guiding principles in land management and administration, binding to all land actors including state officers. These principles are to be applied when Enacting, applying or interpreting any provisions of this Act; and when

making or implementing public policy decisions. The act vests management of land on National Land Commission (NLC). In discharging their functions and exercising of their powers under this Act, the Commission and any State officer or public officer shall be guided by the following values and principles;

a) Equitable access to land;

b) Security of land rights;

c) Sustainable and productive management of land resources;

d) Transparent and cost effective administration of land;

e) Conservation and protection of ecologically sensitive areas;

f) Elimination of gender discrimination in law, customs and practices related to land and property in land;

g) Encouragement of communities to settle land disputes through recognized local community initiatives;

h) Participation, accountability and democratic decision making within communities, the public and the Government;

i) Technical and financial sustainability;

j) Affording equal opportunities to members of all ethnic groups;

k) Non-discrimination and protection of the marginalized;

l) Democracy, inclusiveness and participation of the people;

m) Alternative dispute resolution mechanisms in land dispute handling and management.

Land in Kenya is classified as either public, private or community land. One can acquire certificate of title to land through allocation, adjudication, compulsory acquisition, transfers, transmission or lease exceeding twenty one years. The Act further guarantees equal recognition and enforcement of land rights regardless of the type of tenure whether freehold or lease hold.

Access to land and use on the other hand plays a role in environmental management and sustainability. In recognition of this, the land commission has the obligation under the Act

in section 19 to conserve land based natural resources. The commission is supposed to identify ecologically sensitive area that has endangered or endemic species of flora and fauna, demarcate to prevent environmental degradation or climate change (section 11). In addition, the cabinet secretary ensures quality control through regulation of service providers. However the Act is not clear on land use or management practices that are deleterious to the environment.

The commission can acquire land for public purpose or interests where need be as stipulated by the Act in part VIII. In the event of such acquisition, a just compensation is to be paid to persons with interest in the land. The Act further articulates the procedure to be followed by any party with interest in the land before compensation is paid. Any person with dispute over land matters or is not satisfied by the process of land acquisition can seek redress from the land and environment court. The court is constituted with exclusive jurisdiction to hear and determine disputes, Actions and proceedings related to land issues.

If need be, the commission has a power to create public right of way under section 143 and any institution or person has a right to execute any works, installation or structure on such way leave. For such away leave to be granted, an application can be done by state department, county government, public authority or cooperate bodies as stipulated in section 144. Section 129 gives the commission or any authorized person a right of entry to any land whereas anyone who obstructs such an officer commits an offence under the Act as articulated in section 130. The courts have power to enforce public right of way as stipulated in section 149 of the Act. However section one 148 stipulates that compensation should be paid for the use of such a land to the lawful owner or occupier. The compensation shall be paid from a land compensation fund established under section 153. It is prohibited under the Act in section 156 for a person to wrongfully obstruct or encroach on any public right of way. In the event of such a breach, the commission can seek redress from the court.

5.3.22.2. Acquisition of Private Land for Public Use

Section 110(1) of the Act provides that land may be acquired compulsorily under this if the Commission certifies, in writing, that the land is required for public purposes or in the public interest as related to and necessary for fulfillment of the stated public purpose. 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. Elements for consideration under this procedure include the following:

- ✓ The Act requires that the owners, residents and their spouses should also be notified; as opposed to just the owners;
- ✓ The inspector would also have to get the consent of the occupier and give them not less than seven days' notice to enter the premises;
- ✓ The Commission shall have the power of a court to summon and examine witnesses and compel the production and delivery to the Commission of documents of title to the land;
- ✓ Separate award of compensation to every person. An award is final and conclusive evidence of the size of the land, the value in the opinion of the Commission and the amount of compensation payable, whether or not the person attends the inquiry;
- ✓ Regulations and rules pertaining to this process are yet to be gazetted;
- ✓ Section 107(4) allows for circumstances where the acquiring authority may proceed with land acquisition at stage 1;
- ✓ The Commission shall make rules to regulate assessment of just compensation;
- ✓ The Act does not explicitly state when the inspection will be done. Whether it is before approval of the request for compulsory acquisition or before serving the notice for acquisition.
- ✓ The Commission may postpone an inquiry or adjourn the hearing of an inquiry from time to time for sufficient cause.

5.3.22.3. Provisions on Acquisition of Way Leave

The Land Act, 2012 provides for mechanisms of way leave acquisition either as public right of way or communal right of way. Section 143 of the act empowers NLC to create public rights of way. A public right of way may be: (a) a right of way created for the benefit of the national or county government, a local authority, a public authority or any corporate body to enable all such institutions, organizations, authorities and bodies to carry out their functions, referred to in the Act as a way leave; or (b) a right of way created for the benefit of the public, referred to in section 145 of this Act as a communal right of way.

A public right of way shall attach to and run with the servient land in respect of which it has been created and shall be binding on all owners from time to time of the servient land,

any manner they are occupying the land, whether under a land or a derivative right thereof, or under customary law or as a successor in title to any such owner or as a trespasser.

Section 144 (1) states that an application, for the creation of a way leave, shall be made by any State department, or the county government, or public authority or corporate body, to the NLC.

In applying for way leave, section 144(4) requires the applicant to serve a notice on:

a) All persons occupying land over which the proposed way leave is to be created, including persons occupying land in accordance with customary pastoral rights;

b) The county government in whose area of jurisdiction land over which the proposed way leave is to be created is located;

c) All persons in actual occupation of land in an urban and per-urban area over which the proposed way leave is to be created; and

d) Any other interested person.

Subsection (5) requires NLC to publish the application along the route of the proposed way leave calculated to bring the application clearly and in a comprehensible manner to the notice of all persons using land over which the proposed way leave is likely to be created.

Section 145 (1) provides that a county government, an association, or any group of persons may make an application to the commission for a communal right of way. Once an application has been made to NLC, the determination for creation of a way leave is conducted as per section 146 of the act and includes:

- NLC, after at least ninety days from the date of the serving of notices, considering all the information received and all representations and objections made by any person served with a notice and recommending to the Cabinet Secretary whether to:

    a) appoint a public inquiry to give further consideration to the representations and objections; or

    b) refer the application to the County Government for its opinion on whether to approve the application; or

    c) initiate and facilitate negotiations between those persons who have made representations on the application and the applicant with a view to reaching a consensus on that application;

- The Cabinet Secretary determining whether or not to create to create a public right of way, after taking account, as the case may be, of:
    - ➢ the recommendations of the Commission; or
    - ➢ the advice of the county government; or
    - ➢ the outcome of any negotiations referred to above;
- The Cabinet Secretary creating a public right of way by order in the Gazette.

The order comes into force thirty days after its publication in the gazette. An appeal against an order creating the way leave is allowed within six weeks after the order has been made. Such appeal is made to the Court on a point of law against an order made by the Cabinet Secretary, but apart from such an appeal, an order of the Cabinet Secretary shall not be questioned by way of judicial review or otherwise in any court.

According to section 148, prompt compensation shall be payable (by the State Department, county government, public authority or corporate body that applied for the public right of way) to any person for the use of land, of which the person is in lawful or actual occupation, as a communal right of way and, with respect to a way leave, in addition to any compensation for the use of land for any damage suffered in respect of trees crops and buildings as shall, in cases of private land, be based on the value of the land as determined by a qualified valuer.

In case of disagreement or dissatisfaction on amount or method of or time taken to make payment, the affected individual may apply to court for determination and award. Section 148 (6) stipulates that NLC shall make regulations prescribing the criteria to be applied in the payment of compensation. However, these regulations have not yet been formulated.

This legislation will be not be applied on the Umaa project because it is purely in a forest reserve which is a government land.

5.3.22.4. Commissions on the National Land Act, 2012

This is an Act of Parliament to make further provision as to the functions and powers of the National Land Commission, qualifications, and procedures for appointments to the commission; to give effect to the objects and principles of devolved government in land management and administration, and for connected purposes.

The mandate of the Commission, as provided for in the Act, Pursuant to Article 67(2) of the Constitution, shall be:

- To manage public land on behalf of the national and county governments;
- To recommend a national land policy to the national government;

- To advise the national government on a comprehensive programme for the
- registration of Title in land throughout Kenya;
- To conduct research related to land and the use of natural resources, and make recommendations to appropriate authorities;
- To initiate investigations, on its own initiative or on a complaint, into present or historical land injustices, and recommend appropriate redress;
- To encourage the application of traditional dispute resolution mechanisms in land conflicts;
- To assess tax on land and premiums on immovable property in any area designated by law; and
- To monitor and have oversight responsibilities over land use planning throughout the country
- On behalf of, and with the consent of the national and county governments, alienate public land; To monitor the registration of all rights and interests in land;
- To ensure that public land and land under the management of designated state agencies are sustainably managed for their intended purpose and for future generations;
- Develop and maintain an effective land information management system at national and county levels;
- Manage and administer all unregistered trust land and unregistered community land on behalf of the county government; and
- Develop and encourage alternative dispute resolution mechanisms in land dispute handling and management.
- This Commission will be integral in the management of land issues arising from the project implementation, especially as far as portals and pipelines way leave acquisition is concerned.

5.3.22.5. The Land Registration Act, Act No. 3 of 2012

This is an Act of Parliament intended to revise, consolidate and rationalize the registration of titles to land, to give effect to the principles and objects of devolved government in land registration, and for connected purposes.

5.3.22.6. Land Registry

Section 7(1) of the Act provides for establishment of a land registry in each registration unit which shall keep registers of the following regarding land:

- ✓ A land register, in the form to be determined by the Commission;
- ✓ The cadastral map;
- ✓ Parcel files containing the instruments and documents that support subsisting entries in the land register.
- ✓ Any plans which shall, after a date appointed by the Commission, be geo-referenced;
- ✓ The presentation book, in which shall be kept a record of all applications numbered consecutively in the order in which they are presented to the registry;
- ✓ An index, in alphabetical order, of the names of the proprietors; and
- ✓ A register and a file of powers of attorney.
- ✓ Maintenance of documents, including land title deeds

Further, section 9(1) provides that the Registrar shall maintain the register and any document required to be kept under this Act in a secure, accessible and reliable format. These documents include:

- ✓ Publications, or any matter written, expressed, or inscribed on any substance by means of letters, figures or marks, or by more than one of those means, that may be used for the purpose of recording that matter;
- ✓ Electronic files; and
- ✓ An integrated land resource registers.

The register, as provided for in part 2 of section 9, shall contain the following particulars;

- ✓ Name, personal identification number, national identity card number, and address of the proprietor;
- ✓ In the case of a body corporate, name, postal and physical address, certified copy of certificate of incorporation, personal identification numbers and

- ✓ passport size photographs of persons authorized and where necessary attesting the affixing of the common seal;
- ✓ Names and addresses of the previous proprietors;
- ✓ Size, location, user and reference number of the parcel; and
- ✓ Any other particulars as the Registrar may, from time to time, determine.

These provisions are essential to any new land acquisition or transaction processes arising from implementation of the project.

5.3.22.7. The Land and Environment Court Act, 2012

This is an Act of Parliament to give effect to Article 162(2) (b) of the Constitution; to establish a superior court to hear and determine disputes relating to the environment and the use and occupation of, and title to, land, and to make provision for its jurisdiction functions and powers, and for connected purposes. The principal objective of this Act is to enable the Court to facilitate the just, expeditious, proportionate and accessible resolution of disputes governed by this Act. Section 13 (2) (b) of the Act outlines that in exercise of its jurisdiction under Article 162 (2) (b) of the Constitution, the Court shall have power to hear and determine disputes relating to environment and land, including disputes:

- Relating to environmental planning and protection, trade, climate issues, land use planning, title, tenure, boundaries, rates, rents, valuations, mining, minerals and other natural resources;
- Relating to compulsory acquisition of land;
- Relating to land administration and management;
- Relating to public, private and community land and contracts, chooses in action or other instruments granting any enforceable interests in land; and
- Any other dispute relating to environment and land.

Section 24 (2) also states that the Chief Justice shall make rules to regulate the practice and procedure, in tribunals and subordinate courts, for matters relating to land and environment. Section 30 (1) states that all proceedings relating to the environment or to the use and occupation and title to land pending before any Court or local tribunal of competent jurisdiction shall continue to be heard and determined by the same court until the Environment and Land Court established under this Act comes into operation or as

may be directed by the Chief Justice or the Chief Registrar. Any land or/and environmental cases arising from the project will be handled in accordance with the provisions of this act.

This act will be used by those aggrieved by the ESIA process or the project within their neighbourhood

5.4. NATIONAL REGULATORY FRAMEWORKS

5.4.1. Waste Management Regulations, 2006 (Legal Notice No.121)

These are meant to stream the handling, transportation, and disposal of various types of waste. The regulations emphasize on waste minimization, cleaner production, and segregation of waste at the source. Under the Regulations, NEMA licenses transporters, incinerators, landfills, composers, recyclers, and transfer stations. Licensing employs a risk-based approach by concentrating on facilities considered to pose a high risk to the environment.

In article 87 section 1 of the Environmental Management and Coordination Act 1999, no person shall discharge or dispose of any wastes, whether generated within or outside Kenya, in such a manner as to cause pollution to the environment or ill health to any person. There is need for one to acquire a license for generation, transporting or operating waste disposal facility as is provided for in article 88. Article 90 through to 100 outlines more regulations on management of hazardous and toxic substances including oils, chemicals and pesticides. Under the regulations, a waste generator is defined as any person whose activities produces waste while waste management is the administration or operation used in handling, packaging, treatment, conditioning, storage and disposal of waste. The regulations requires a waste generator to collect, segregate and dispose each category of waste in such manners and facilities as provided by relevant authorities. Regarding transportation, licensed persons shall operate transportation vehicles approved by NEMA and will collect waste from designated areas and deliver to designated disposal sites.

It is expected that waste generating Activities will result during project implementation, operation and decommissioning and that such waste should be handled according to set regulations. At the same time there is un-used motor vehicles on site which shall need to be written off and almost all the materials recovered for recycle.

This regulation will be applicable during the project implementation. It will guide the handling of wastes from all activities of the project.

5.4.2. Noise and Excessive Vibration Pollution (Control) Regulation, 2009

The Regulations prohibit any loud, unreasonable, unnecessary, or unusual noise that annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and

the environment. In determining whether noise is loud, unreasonable, unnecessary, or unusual, the following factors may be considered:

i. Time of the day.
ii. Proximity to the residential area.
iii. Whether the noise is recurrent, intermittent or constant;
iv. The level and intensity of the noise;
v. Whether the noise has been enhanced in level or range by any type of electronic or mechanical means; and,
vi. Whether the noise can be controlled without much effort or expense to the person making the noise.

The regulation will be applicable during construction and operation of the project. All operations like blasting during excavations will be guided by these regulations

5.5. INTERNATIONAL POLICY FRAMEWORK

Kenya is a signatory as well as a party to various international conventions, treaties and protocols relating to the environment and aimed at achieving sustainable development. According to the Registrar of International Treaties and other Agreements in Environment (UNEP 1999), there are 216 treaties, 29 of which are of interest to Kenya. The country is a signatory to 16 such agreements, which range from use of oil, protection of natural resources and protection of the atmosphere.

5.5.1. Protection of Natural Resources

There are 12 agreements of significance to Kenya under this category which the country has signed and ratified. This section reviews a number of policies that are triggered or met by the proposed project.

5.5.2. Convention on Biological Diversity

This global convention was held to foster conservation and sustainable use of biological resources, to preserve their diversity for posterity. Kenya is a signatory to this convention, having ratified it in 1994. The provisions of this Convention have since been integrated in the laws of Kenya, climaxed by the development of the Kenya National Biodiversity Strategy and Action Plan in 2000 by the Ministry of Environment and Natural Resources.

This project is in line with the spirit of the convention, there is need to integrate biodiversity in water resource planning as the environment has been considered a legitimate user of water thus the project shall consider the volume of water abstracted leaves enough water for the existent ecosystems.

5.5.3. The Ramsar Convention

This is the Convention on Wetlands of International Importance. It was held in Ramsar, in 1971 and came into force in 1975, hence the name Ramsar Convention. The aim of this convention was to raise to global context the value of wetlands in our ecosystem and encourage partner states to develop instruments for conservation and management of wetlands. Kenya ratified the convention in June 1990. The convention defines "Wise use of wetlands" as "the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development". "Wise use" therefore has at its heart the conservation and sustainable use of wetlands and their resources, for the benefit of humankind. Under the "three pillars" of the Convention, the Parties have committed themselves to:

- ✓ Work towards the wise use of all their wetlands through national land-use planning, appropriate policies and legislation, management actions, and public education;
- ✓ Designate suitable wetlands for the List of Wetlands of International Importance ("Ramsar List") and ensure their effective management; and
- ✓ Cooperate internationally concerning trans-boundary wetlands, shared wetland systems, shared species, and development projects that may affect wetlands.

Kitui forest has wetlands and, to avoid detrimental effects of water abstraction, hydrological survey will been done to ensure that the development of Umaa Project is sustainable by abstracting water in quantities that will have minimal effect on water uses downstream.

5.5.4. African Convention on the Conservation of Nature and Natural Resources

It was held on 15 September 1968 in Algiers. The convention sought to awaken the continent on the need to preserve natural ecosystems and employ sustainable use of natural resources of economic importance, particularly the soil, water, flora, and fauna.

Some indigenous trees might exist within the project area whose conservation are important. The project shall encourage the planting of indigenous trees to try to restore a balance within the ecosystem.

5.5.5. Kyoto Protocol to the United Nations Framework Convention on Climate Change

The Kyoto Protocol requires signatories to the United Nations Framework Convention on Climate Change to reduce their greenhouse emissions levels to 5% below 1990 levels by the year 2012. The Protocol came into force on 16th February 2005, after it received the prerequisite signatures. However, major countries like United States, China, India, and Australia are not signatories to the Protocol.

Compliance with this convention will largely inform the technical and environmental evaluation of the project if any additional funding may be required in future. There is thus a necessity that proper adherence to minimal carbon emission levels be ensured during the operational phases of the project.

5.5.6. The 1992 United Nations Framework Convention on Climate Change (UNFCCC);

The primary purpose of the convention is to establish methods to minimize global warming and in particular the emission of the greenhouse gases. The UNFCCC was adopted on 9th May 1992 and came into force on 21st March 1994. The Convention has been ratified by 189 states. Kenya ratified the Convention on 30th August 1994. The project implementation will most certainly be accompanied by use of a variety of hydrocarbon based fuels and other chemical substances. Some of the gases or compounds resulting from consistent use of these substances are real ozone layer threat. The result is increase greenhouse gas emission into the atmosphere. There will thus be need to employ domesticated versions of the agreed carbon-curbing measures to protect the ozone layer from further depletion.

5.5.7. Vienna Convention for the Protection of the Ozone Layer

Intergovernmental negotiations for an international agreement to phase out ozone depleting substances concluded in March 1985 with the adoption of the Vienna Convention for the Protection of the Ozone Layer. This Convention encourages intergovernmental cooperation on research, systematic observation of the ozone layer, monitoring of CFC production, and the exchange of information.

The Montreal Protocol on Substances that Deplete the Ozone Layer was adopted in September 1987, and was intended to allow the revision of phase out schedules on the basis of periodic scientific and technological assessments. The Protocol was adjusted to accelerate the phase out schedules. It has since been amended to introduce other kinds of control measures and to add new controlled substances to the list. Kenya signed the Montreal Protocol in February 1988 and has ratified the Protocol and its four amendments, namely; London (1990), Copenhagen (1992), Montreal (1997), and Beijing (1999).

5.5.8. United Nations Convention to Combat Desertification (UNFCCC) of 1994

The convention requires parties to take climate change considerations into account in their relevant social, economic, and environmental policies and actions. The proponent has undertaken this EIA with the aim of minimizing adverse effects of the project on the economy, on public health and on the quality of the environment.

5.5.9. The World Commission on Environmental and Development

The commission focuses on the environmental aspects related to development and requires all development projects to be sustainable economically, socially and environmentally. The principle of the organization emphasis that development project should have no permanent negative impact on the biosphere and in particular the ecosystems. It is recommended that the project proponent incorporate mitigation measures to ensure that the project impacts on the ecosystem in reduced.

The Proponent are using participatory methods to involve the target group and concerned stakeholders in order to inform and enlighten them on the likely negative environment and social impacts for them to prepare mitigation measures so as to ensure the proposed project is sustainable throughout its life span.

5.5.10. The Convention of Control of Desertification (UCCD) (1992)

This convention requires Parties to promote cooperation among affected parties in the fields of environmental protection and the conservation of land and water resources, as they relate to desertification and drought. Kenya ratified this on 24 Jun 1997.

The beneficiaries are advised to engage in activities geared towards eradicating drought through engaging in tree planting activities, encouraging clean energy use and water conservation.

5.6. WORLD BANK SAFEGUARD POLICIES

The objective of the World Bank's environmental and social safeguard policies is to prevent and mitigate undue harm to people and their environment in the development process. These policies provide guidelines for the bank and borrower staffs in the identification, preparation, and implementation of programs and projects. Safeguard policies have often provided a platform for the participation of stakeholders in project design, and have been an important instrument for building ownership among local population.

The Safeguard Policies aims at improving decision making, to ensure that project options under consideration is sound and sustainable, and that potentially affected people have been properly consulted. This section describes how these World Bank Safeguard Policies will be triggered by the proposed project. The table below shows the safeguards which may or may not triggered by the project implementation

Table 0-20: Table of World Bank Safeguard Policies triggered by the project

Safeguard Policies Triggered by the Project	Yes	NO
Environmental Assessment (OP 4.01)	✓	

Natural Habitats (OP 4.04)	✓	
Cultural Property (OP 4.11)	✓	
Involuntary Resettlement (OP 4.12)	✓	
Indigenous Peoples (OP 4.10)		✓
Forests (OP 4.36)	✓	
Safety of Dams (OP 4.37)	✓	
Projects in Disputed Areas (OP 7.60)		✓
Projects on International Waterways (OP 7.50)		✓
World Bank Policy OP 4.09 Pest Management		✓
Safety of electrical transmissions (Operational Policy, OP/BP 4.37)	✓	

5.6.1. World Bank Policy OP 4.01 Environmental Assessment

World Bank requires environmental assessment for projects proposed for the Bank financing to help ensure that they are environmentally sound and sustainable, and thus improve on decision making. Projects are screened and assigned categories (A, B, C or FI) depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

Category A: A proposed project is classified as Category A if it is likely to have significant adverse impact on the environment. A project with complicated impact or unprecedented impact which is difficult to assess is also classified as Category A. The impact of Category A projects may affect an area broader than the sites or facilities subject to physical construction.

Category B: A proposed project is classified as Category B if its potential adverse environmental impact is less adverse than that of Category A projects. Typically, this is site-specific, few if any are irreversible, and in most cases normal mitigation measures can be designed more readily.

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impact. Projects that correspond to one of the following are, in principle, classified as Category C.

Following screening of the Main project, Dam construction and water supply project in the forest reserve, this project has been classified as category A, requiring a full Environmental and Social Impact Assessment (ESIA).This is because the environmental and

social impacts of Umaa dam and water supply Project are anticipated to be significant involving forest clearance .Implementation of Umaa Project is required to take place within WB 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.

5.6.2. World Bank Policy OP 4.04 Natural Habitats

The WB recognizes that conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development.

Although the natural terrestrial vegetation covers in the project area had already been significantly altered at the dam site and the treatment plant site, Umaa project will occur on a natural river valley dominated by native species. Precaution is thus required in line with OP 4.04 to ensure the riverine resources management are sustainable.

5.6.3. World Bank Policy OP 4.11 Physical Cultural Resources

OP 4.11 on Physical Cultural Resources, was revised on April 2013 to takes into account the recommendations in Investment Lending Reform: Modernizing and Consolidating Operational Policies and Procedures, Given that some cultural resources may not be known or visible, it is important that a project's potential impacts on cultural resources are considered at the earliest possible stages of project processing. The assessment of impacts to cultural heritage has been based on identified above ground features and known sites of archaeological interest, this is because, there is no archaeological cultural and settlement inventory covering the project area throughout the history of human occupation. However, as the policy requires, precaution is necessary in case of chance find.

This policy will not be triggered because the proposed project is not located in, or in the vicinity of, recognized cultural heritage sites. However, the contractor and National Water harvesting &Storage will be required to follow chance find Procedures and contact the National Museums of Kenya (NMK) should any archaeological site or artefact encountered during construction.

5.6.4. World Bank Operational Policy 4:12 Involuntary Resettlement

The World Bank safeguard policy on involuntary resettlement, Operational Policy (OP 4.12) establishes guidelines for land acquisition and compensation of people affected by a

world bank sponsored project. Key principles and policy objectives of OP 4:12 can be summarized as:

- To minimize or avoid involuntary resettlement where feasible and to explore all viable alternative project designs;
- To conceive and implement resettlement activities as sustainable development programs where affected people are provided with sufficient investment resources and opportunities to share in project benefits;

The project doesn't trigger this policy as there will be no areas where people will be fully or partially displaced by the project. However, a full ESIA and RAP study will be carried out to provide guidance on land acquisition and compensation since the project is in a gazetted forest land under the custodian of KFS and KWS.

The above policy principles will be applied through consulting affected persons/organizations and according them opportunities to participate in the planning and execution of resettlement programs. This will assist the Project affected persons (PAPs) where resettlement is necessary, to improve their livelihood and living standards, income earning capacity and production levels, or at least to restore them in a manner that maintains sustainability of resettlement programs.

5.6.5. World Bank Policy OP 4.20 Indigenous Peoples

To design and implement projects in a way that fosters full respect for Indigenous Peoples' dignity, human rights, and cultural uniqueness and so that they: (a) receive culturally compatible social and economic benefits; and (b) do not suffer adverse effects during the development process.

This policy is not triggered because during reconnaissance survey, screening was done to determine whether Indigenous Peoples are present in, or have collective attachment to, the project area. It was concluded that there are no indigenous people in the project area.

5.6.6. Safety of electrical transmissions (Operational Policy, OP/BP 4.37)

The objectives of this policy are as follows: For new electrical transmissions, to ensure that experienced and competent professionals design and supervise construction; the borrower adopts and implements electrical transmission safety measures for the electrical transmission and associated works. For existing electrical transmissions, to ensure that any electrical transmission that can influence the performance of the project is identified, an electrical transmission safety assessment is carried out, and necessary additional electrical transmission safety measures and remedial work are implemented.

This policy is triggered because Umaa dam and water supply project has an electricity transmission component to the treatment works and booster station thus it would be important to adhere to these safety guidelines.

5.6.7. World Bank Policy OP 4.36 Forests

The objective of this policy is to assist borrowers to harness the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development and protect the vital local and global environmental services and values of forests. Where forest restoration and plantation development are necessary to meet these objectives, the Bank assists borrowers with forest restoration activities that maintain or enhance biodiversity and ecosystem functionality. The Bank assists borrowers with the establishment of environmentally appropriate, socially beneficial and economically viable forest plantations to help meet growing demands for forest goods and services.

This policy is triggered because in the project area is within the gazetted natural forests of Kitui forest. Engagement with KWS and KFS will be done to discuss on compensation mechanisms in a separate land report.

5.6.8. World Bank Operational Policy 4:37 Safety of Dams

Dam safety is a matter of significant importance in many countries in the world today because of the presence of a large number of dams, existing, under construction or planned. The safe operation of dams has significant social, economic, and environmental relevance. When the World Bank finances new dams, Operational Policy (OP) 4.37: Safety on Dams requires that experienced and competent professionals design and supervise construction, and that the borrower adopts and implements dam safety measures through the project cycle. The policy also applies to existing dams where they influence the performance of a project. In this case, a dam safety assessment should be carried out and necessary additional dam safety measures implemented. OP 4.37 recommends, where appropriate, that Bank staff discuss with the borrowers any measures necessary to strengthen the institutional, legislative, and regulatory frameworks for dam safety programs in those countries. This OP provides guidelines to ensure safety at Bank financed projects involving dams. Safety measures require appropriate plans for:

- Construction supervision and quality assurance;
- Instrumentation plan;
- Operation and Maintenance (O&M) plan; and
- Emergency preparedness plan.

This policy is triggered because there will be construction of a new dam component in the project. During construction, the guidelines will be adhered to so that the safety is ensured even during the operation phase of the project. As per the policy there will be a review by an independent panel of experts of the investigation, design, and construction of the dam and the start of operations; preparation and implementation of detailed plans: a plan

for construction supervision and quality assurance, an instrumentation plan, an operation and maintenance plan, and an emergency preparedness plan. With this policy, a Dam Safety Plan will be prepared as part of the ESMP in the Environmental and Social Impact Assessment.

5.7. INSTITUTIONAL FRAMEWORKS

The following are the main institutions that perform regulatory roles and are relevant to the project.

5.7.1. Ministry of Water and Sanitation

The mandate is formulation, review and implementation of policy on the water sector, for sustainable development of our Nation.

The functions include:

- Water harvesting and storage infrastructure for water conservation, which will help in mitigating droughts and famine;
- Catchments area conservation;
- Water resources management policy;
- Urban and rural water development and supply;
- Wastewater treatment and control;
- National water conservation and Pipeline Corporation;
- National irrigation policy which aims to sustainably accelerate development and performance improvement of irrigation, drainage and water storage;
- Irrigation and dam construction schemes;
- Flood preparedness and management to cope with and mitigate the impacts;
- Water quality and pollution control by adopting the 'Polluter Pays' principles in order to ensure water user responsibility.

5.7.2. Ministry of Environment and Forestry

This is the state office in charge of all issues affecting, and affected by, the environment and all its components.

The ministry's core mandate includes the following:

- Environment and forestry Policy formulation, analysis and review;
- Sustainable management of forestry and conservation of environment;
- Continuous development of geo-database for integrated natural resources and environmental management systems;
- Conduct applied research and dissemination of research findings in land resources and geology;

- Carry out geological surveys, mineral exploration and regulation of mining and use of commercial explosives;
- Promote, monitor and coordinate environmental activities and enforce compliance of environmental regulations and guidelines;
- Meteorological services.

Water resources, land, flora and fauna and the air are core components of the natural environment. The proposed development project will utilize flush floods, surface water and all the other resources at one stage or another. Any extractive or depository uses of the resources are guided by the various programmes and regulations under the ministry and consistent consultative partnerships, including adherence to relevant legal provisions will be required in the entire course of the project.

5.7.3. The Kenya National Water Harvesting and Storage Authority(KNWH&SA)

The Government of Kenya (GoK) through the Kenya National Water Harvesting and Storage Authority is the project-implementing agency, and its core mandate is:

To assess, manage and safeguard the water resource base that supports the peoples of Kitui through applying the principles of knowledge-based integrated water resources management to water development planning and assessment. The Government of Kenya through the NWH&SA will be responsible for the development of the project and its operation in collaboration with The County Government of Kitui

5.7.4. The National Environment Management Authority (NEMA)

The authority is mandated to carry out, among others, the following activities in the sector;

- Responsible for approval of ESIA reports before project implementation
- Promote the integration of environmental considerations into development policies, plans, programmes and projects, with a view to ensuring the proper management and rational utilization of environmental resources, on sustainable yield basis, for the improvement of the quality of human life in Kenya;
- Undertake and coordinate research, investigation and surveys, collect, collate and disseminate information on the findings of such research, investigations or surveys;
- Identify projects and programmes for which environmental audit or environmental monitoring must be conducted under this Act;
- Initiate and evolve procedures and safeguards for the prevention of accidents, which may cause environmental degradation and evolve remedial measures where accidents occur e.g. floods, landslides and oil spills;

- Undertake, in cooperation with relevant lead agencies, programmes intended to enhance environmental education and public awareness, about the need for sound environmental management, as well as for enlisting public support and encouraging the effort made by other entities in that regard;
- Render advice and technical support, where possible, to entities engaged in natural resources management and environmental protection, so as to enable them to carry out their responsibilities satisfactorily.

The responsibility of NEMA is to exercise general supervision and coordination 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. Some of the NEMA functions are performed through committees established by EMCA as follows.

5.7.4.1. Standards and Enforcement Review Committee (SERC)

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

5.7.4.2. Public Complaints Committee

EMCA has also established a Public Complaints Committee, which provides the administrative mechanism for addressing environmental harm. The Committee has the mandate to investigate complaints relating to environmental damage and degradation. The members of the Public Complaints Committee include representatives from the Law Society of Kenya, NGOs and the business community.

5.7.4.3. County Environmental Offices

NEMA has offices at county levels contributing to decentralized environmental management.

The project will have to be licensed by NEMA before construction starts and during operation NEMA will have overall supervision of environmental matters.

5.7.5. Tanathi Water Works Development Agency

Tanathi Water Works Development Agency is one of the eight Water Services Boards established under the Water Act 2002 section 51(2), as part of the reforms in the water sector with the mandate of ensuring efficient and economical provision of water and sewerage services within their respective areas of jurisdiction. The Board was established

in March 2004 vide gazette notice no. 1717 as Tanaathi Water Services Board but it was changed to Tanathi Water Works Development Agency in Water rules 2016.

The Board contracts, monitors and enforces agreements with Water Service Providers (WSPs), in accordance with regulations set by the Water Services Regulatory Board (WASREB).

Direct provision of water and sanitation services is however undertaken by Water Service Providers (WSPs) who are the Agency's agents. However, if for either economic or social reasons it is not possible to establish a WSP, the Board is mandated to undertake service provision.

The mandate of the Board is to ensure efficient and economical provision of water and sewerage services within its area of jurisdiction

Since the project lies within its mandate area, they specific Water Works Development Agency will be consulted especially with reference to the water supply component.

5.7.6. Water Resources Authority (WRA)

The Water Resources Authority is a national organization with the mandate of regulation of water resources issues such as water allocation, source protection and conservation, water quality management and pollution control and international waters. The services provided by WRA include:

- Planning, management, protection, and conservation of water resources.
- Planning, allocations, apportionment assessment and monitoring of water resources.
- Issuance of water permits.
- Water rights and enforcement of permit conditions.
- Regulation of conservation and abstraction structures.
- Regulation and control of water use.
- Coordination of the Water resources management plan.

The Authority has the following powers and functions:

- To develop principles, guidelines and procedures for the allocation of water resources;

- To monitor, and from time to time reassess, the national water resources management strategy;
- To receive and determine applications for permits for water use;
- To monitor and enforce conditions attached to permits for water use;
- To regulate and protect water resources quality from adverse impacts;
- To manage and protect water catchments;
- in accordance with guidelines in the national water resources management strategy, to determine charges to be imposed for the use of water from any water resource;
- To gather and maintain information on water resources and from time to time publish forecasts, projections and information on water resources;
- To liaise with other bodies for the better regulation and management of water resources;
- To advise the Minister concerning any matter in connection with water resources.

WRA sub-regional office at Kitui will be responsible for issuance of water rights and enforcement of any conditions attached.

5.7.7. Water Services Regulatory Board

Water Services Regulatory Board (WSRB) regulates the provision of services by registered Water Services Providers (WSP) through the Water Services Boards (WSB). WSBs have been created for the various regional drainage basins in the country.

5.7.8. Kenya Plant Health Inspectorate Service (KEPHIS)

It is a regulatory agency for quality assurance on agricultural inputs and produce in Kenya. It undertakes, plant variety protection, seed certification, phyto-sanitary inspection of imports and exports, analysis of soil, water and agro-inputs.

It is mandated to perform the following functions:

- Certification of the quality of seeds and fertilizers;
- Testing and monitoring the presence of harmful residual agro-chemicals on agricultural produce, soils and water systems;
- Coordination of the release of superior and well adapted varieties/cultivars to the farming community;
- Protecting the rights of the breeders/discoverers of new plant varieties through grant of rights to the owners of such varieties and registering them;
- Preventing introduction into the country of harmful foreign weeds, pests and diseases through adherence to strict quarantine regulations and procedures;

- Inspecting and grading agricultural produce for import and export to ensure that they are of high and acceptable quality;
- Implementing the national policy on the introduction and use of genetically modified plant species, insects and micro-organisms in Kenya.

5.7.9. Pest Control and Products Board

It is a statutory organization of the government established to regulate the importation and exportation, manufacture, distribution and use of pest control products. It performs the following functions:-

- To facilitate the availability of new pesticides with proven safety, economic value, quality and efficacy through efficient registration process;
- To reduce environmental contamination and health risks (considering education, proper disposal of unsafe or unusable chemicals and adherence to minimum residue levels);
- To revise the Act governing the regulation of pesticides to include obsolete pesticides disposal, transport, penalties and other shortfalls;
- To monitor the quality of pest control products already in the market.

5.7.10. Kenya Forest Service

Kenya Forest Service (KFS) is mandated to manage protected forests within the country. Protection of the of the Kitui forest will be vital for sustained water supply for the project. The Kenya Forest Service will carry out the afforestation within the project area to cover the trees that will be cut for the project construction.

5.7.11. Kenya Wildlife Service

Kenya Wildlife Service (KWS) is principal institution responsible for implementation of the Wildlife Management Act, 2013. KWS is responsible for protection of all wildlife within an area.

5.7.12. Directorate of Occupational Safety and Health

Directorate of Occupational Safety and Health (DOSH) is a government agency responsible for enforcement of Occupational Safety and Health throughout the country for the protection of workers and the public at all workplaces in line with OSHA, 2007.

5.7.13. County Government of Kitui

Kitui County will be hosting the project and will have various inputs in the project implementation in line with constitutional functions of county governments. The functions

of the county government relevant to the proposed project, as outlined in the Fourth Schedule, Constitution of Kenya 2010 are as follows:

- Agriculture and husbandry;
- Provision of essential services such health services, county transport, education;
- Control pollution and disasters management;
- Monitor cultural activities, public entertainment and public amenities;
- County planning and development;
- County public works and services;
- Implementation of specific national government policies on natural resources and environmental conservation; and
- Encourage public participation in county governance and development

The county governments of Kitui is expected to help in coordinating various project related activities as far as general environmental conservation and public participation are concerned. This will be better achieved through the respective county ministries of Environment and Natural Resources and ministries of Water and Irrigation.

5.7.14.Water Resources Users Association(WRUA)

In the project area doesn't have a WRUA that exists on the Nzeeu River. It need to be formed and to be registered by Water Resource Authority. The WRUA's mandates are to.

- ✓ Exchange of information and ideas on the water resource use;
- ✓ Discuss potential projects and developments that may affect water usage with a view to obtain the consent of other WRUA members and the public;
- ✓ Resolve conflicts on water use;
- ✓ Monitor water availability and use;
- ✓ Lobby for resources to improve availability, reliability, quality or other aspects of the water resources.

6. DESCRIPTION OF ENVIRONMENTAL/SOCIO-ECONOMIC IMPACTS, RISKS AND MITIGATION

6.1. General

Following the site visits, potential environmental and social impacts of the proposed project have been identified to determine whether the proposed Project will have a diverse effect on the environment.

6.2. Key Environmental and Socio-Economic Impacts Identified

6.2.1. Anticipated Positive Impacts and Enhancing Measures at Construction Phase.

The implementation of Umaa dam and Water supply project is anticipated to have positive impacts to the physical, social, economic and biological environment. The socio-economic benefits will be manifested to local communities by improving their living standards and sanitation levels, the nation through improving the food security situation where agriculture shall be practiced, the region and global community through export of agricultural produce or importing of farm inputs. However, it is upon all stakeholders to ensure the sustainability of the proposed project for long-term positive impacts to be realized. The following describes the positive impacts anticipated at construction phase;

6.2.1.1. Employment Opportunities

From the sample survey undertaken and from the 2019 population census in the project site, it was found that 64% of the population is between 19-55 years. This is therefore an active population able to work in the proposed project. The project thus will create direct employment to several people during construction as skilled and non-skilled laborers. The living standards of a significant number of people will improve due to the availability of income from the construction of the project. Finally, during the construction phase, there will be a significant increase in the people working in the area and this will promote the economy of the county both directly and indirectly.

Enhancing Measures

However, for the local people to benefit, the local people need to be given first preference in employment opportunities particularly unskilled and skilled labour unless it cannot be found within the project area. The contractor should source materials locally from suppliers to employ more people. Project stakeholders should also enforce the government policy of providing 30% of jobs or supplies of goods and services to Vulnerable and Marginalized groups within the project area.

6.2.1.2. Increased income

Most of the people in the project area have low income. Many of the income come from livestock rearing, motorcycle transport and mixed farming. With the new project, it is anticipated that there will be an increase in household income generated from various activities including Supply of goods and services for construction, and incomes from the employed youths from the project area

Enhancing Measures

For the income to be of significance to the local population, deliberate moves should be taken including Local people to be given preferential treatment in supplies and provision of labour particularly manual and skilled jobs when available skilled personnel are present in the project area.

6.2.1.3. Opportunities for skill acquisition.

With generally young population of between 19-55 and many of them with primary and above qualification, the project will provide a good opportunity for skill acquisition. They will acquire skills which will be vital for them to work in other similar projects in future.

Enhancement

More locals should be trained on various trainings for maximum skill acquisition and majority unskilled workers should be utilized during project implementation for them to acquire necessary skills vital for their future endeavors.

6.2.2. Positive Impacts during Operation Phase

6.2.2.1. Employment Opportunities

The proposed project has several components such as Water supply and dam management that will require several people to work. The project therefore will create direct employment to several people during operation. A larger proportion of the population will also be employed indirectly in the farm service provision sector, marketing, and supply chain through the sale of products. The living standards of a significant number of people will improve due to the availability of income from products of the project.

Enhancing Measures

For the local people to benefit, the local people need to be given first preference in employment opportunities particularly unskilled and skilled labour in the operation of the project components. The key stakeholders in consultations with the government should consider value addition process to be done in the project area to provide more job opportunities. Project stakeholders should also enforce the government policy of providing 30% of jobs or supplies of goods and services to Vulnerable and Marginalized groups.

6.2.2.2. Increased income

It is anticipated that there will be an increase in household income generated from various activities including; Supply of goods and services during operation, increased demand for farm labour or from construction activities, increased sales from farm production due to availability of markets, increased demand for farm inputs and equipment, Increased

demand for agricultural production service provision and need for labour services in agro-industries among others. This will be a boost to a community whose income levels are deemed as low.

Enhancing Measures

For the income to be of significance to the local population, deliberate moves should be taken including; Local people to be given preferential treatment in supplies and provision of labour particularly manual jobs, Farmers to form cooperatives that will assist in marketing the produce through other state institutions, relevant institutions to ensure accreditation of farm inputs and equipment supplied to farmers and public awareness on quality agricultural production to be emphasized among the local farmers.

6.2.2.3. Opportunities for skill acquisition.

The implementation of the project activities will require several training to the employees and/or farmers by extension officers e.g. on farm water management and various aspects of crop husbandry so as to promote productivity incase irrigation will pick up downstream at Songa areas. This is meant to capacity build the farmers to pass knowledge across the board. Qualified personnel shall be hired and further training enhanced to sharpen the farmers skills in the delivery of extension information.

Enhancement

More locals should be trained on various trainings for maximum skill acquisition and majority unskilled workers should be utilized during project operation for them to acquire necessary skills vital for their future endeavors.

6.2.2.4. Improved Food Security and Nutrition

The area of Umaa receives minimal rainfall and it is food insecure. Therefore, the project will increase quantity of food produced once its implemented as the Songa people will have water downstream to carry out irrigation. Food security will be achieved both at an individual household level and at the national level resulting from the increase in agricultural production. It is proposed that local people to adopt high yield livestock. Therefore, a variety in agricultural production will serve the nutritional needs of the local people, improving their health.

Enhancing Measures

To achieve sustained production of increased amount of food requires provision of farm inputs and extension services. There is also need to control and manage pre and post-harvest pests and diseases to reduce the associated food loss. Where possible the farmers should be assured access to post harvesting facilities. However, for food security situation to be attained there is a need to ensure access to food produced by the locals as well as in areas where it is needed through sustainable distribution networks.

Farmers in the Songa areas downstream will also need to work with extension officers in adopting high nutritional value crops and animal breeds. The research institutions working in the project area need to develop nutritious crop varieties. Agricultural and value addition technologies should be adopted and should preserve the food nutritional value. Community need to link farmers to relevant institutions for these to be achieved effectively.

6.2.2.5. Improved Animal husbandry and productivity

It is anticipated that damming and cropping of different crops will reduce the availability of grazing areas in the project area and reduced grazing area will necessitate the adoption of high yield livestock by the local people. Improved animal husbandry and productivity will improve income of the local people and their nutritional status. The manure from livestock can also be used to improve land productivity.

Enhancing Measures

For improvement of animal husbandry and productivity to be achieved, the locals need to adopt high production animals. Therefore, public awareness on need for improved animal husbandry is required as well as provision of veterinary services, production of fodder crops and processing animal feeds from paddy crop residues.

6.2.2.6. Poverty Alleviation

The project area has relatively high poverty rates with high dependency rates (6-10 household members). However, the introduction of the Umaa dam in Kitui county is anticipated to create employment opportunities and direct income from the agricultural production chain activities on the downstream population. These are anticipated to improve the local economy thereby reducing the cost of living as well as reduce poverty indices among the local people.

Enhancing Measures

Sustainable poverty reduction requires that public awareness on the importance of adopting agricultural production as a business venture by the local people is created.

Increased agricultural productivity on the other hand requires the key stakeholders to ensure availability and access to markets by the local people. The local government should also ensure value addition facilities to reduce associated losses and that product fetch a higher price.

6.2.2.7. Increased Access to the market and project area

Inaccessibility of ready markets is a main challenge to most farmers in Kenya with the social survey showing 81% unable to access proper storage, market, get poor prices for their produce. However, the proposed Sio-Sango project and irrigation if operated with farmers, county governments in conjunction with cooperatives will increase marketing of scheme produce. Improvement in quality control of produce and provision of access roads and other infrastructure will increase farmers' access to the market. This is anticipated to increase the income of the local farmers and their households. Anticipated increase in value addition to agricultural produce will also enhance market accessibility which would otherwise not be accessed by raw products.

Enhancing Measures

The relevant stakeholders should provide farmers with real time market information as well as assistance in marketing of farm products for optimal and sustained access to markets. NIB should link farmers to relevant state corporations such as National Cereals and produce Board (NCPB), among others. Farmers should also form cooperatives to enhance bargaining power for their produce. Value addition through growth of agro-industries should serve to maintain high quality produces. Rehabilitate the access road networks to ensure that all farms are served adequately. The roads should also be kept in good working conditions particularly during the wet season.

6.2.2.8. Increased land value and demand.

The current market prices for land are low in Kitui But with improvement in land productivity and availability of other services like water, power and improved roads will attract more people to the project area. This will result in the increase in demand of land for cultivation, settlement, or development due to increased opportunities. The changes in the demand supply chain of land will push up its value.

Enhancing Measures

People within the project area should be protected against exploitation from people seeking for cheap land. They need to be enlightened on the value of land to be aware of the current market price.

6.2.2.9. Improved Soil fertility

Intensification of agricultural production will require replenishing of soil fertility. It is anticipated that Agro-forestry and conservation agriculture in the project area will improve soil fertility. The operation of the project on the other hand is anticipated to increase affordability and accessibility of inorganic fertilizers due to increased income and the willingness of financial institutions to provide credits for farm inputs. Controlled use of inorganic fertilizers and guidance by the extension service experts will also assist in improving soil fertility.

Enhancing Measures

Improving soil fertility will require sustained availability of extension workers to assist farmers in determining soil requirements and the best response. The farmers should be assisted to adopt Agro forestry plant species that improve soil fertility. Where inorganic fertilizers are required then they should be accredited and farmers provided by credit facilities to access the same.

6.2.2.10. Improved Catchment Management

Sustainable flow of rivers supplying water to the dam need to be maintained and will require concerted efforts by key stakeholders to conserve catchment areas, which will in turn reduce sedimentations, siltation and eutrophication in watercourses and in the dam at operation phase. Catchment management will improve the flow of water in the rivers to meet the demands and reduce any possible water users' conflicts.

Enhancing Measures

WRA in consultations with key stakeholders and IWUA should prepare catchment management strategies for specific rivers supplying water in the dam. These efforts should also be subjected to public awareness and participation in conservation activities by people living in the catchment areas. Incentives should be provided to communities conserving catchment areas.

6.2.2.11. Water conservation

Construction of Umaa dam will come in handy to help in water storage facilities thus conserving water that would have been discharged downstream inform of flash floods.

Enhancing Measures

In addition to investing in water storage facilities, farmers should practice agro-forestry to provide wind breaks, adoption of efficient irrigation methods within the project design, line canals and drains where there is seepage, use of crop varieties that conserve water such as planting highland rice and planting of water friendly trees.

6.2.2.12. Water supply to the community

The implementation of the Umaa project has a component of water supply to the local communities. This will improve water sanitation in the area and at the sometime will provide safe water for community reducing waterborne diseases.

Enhancement

The water supply section should provide safe communal water points according to the settlements so that the locals do not travel long distances to get the water.

6.2.3. Anticipated positive impacts during decommissioning phase

6.2.3.1. Creation of Employment Opportunities

The project will create direct employment to several people during decommissioning phase that will include renovation of the dilapidated project facilities or demolishing them to restore sites back to their original conditions. The living standards of a significant number of people will improve due to the availability of income from decommissioning activities.

Enhancing Measures

For the local people to benefit, the local people need to be given first preference in employment opportunities particularly unskilled labour and skilled labour in the decommissioning of the project components.

6.2.3.2. Site restoration improving aesthetic value

During the project decommissioning, different project components will be renovated and where possible, demolished. The sites will be restored back improving aesthetic value of the project area.

Enhancement Measures

- ✓ Restoring sites back to their original state or make it better than before the project.
- ✓ Planting of indigenous trees in the sites and maintain them to acclimatize with the area.

6.2.4. Anticipated Negative Impacts and Mitigation Measures at Construction Phase

Dam and Water supply is considered an effective way of increasing water supply, agricultural production and improved quality of life. However, their development/implementation have negative environmental and social impacts. The impacts will emanate from physical construction of the whole project components. There is need therefore to identify the adverse impacts and mitigation measures to improve environmental and social sustainability of the project before implementation stage.

The project activities at construction phase include;

- ✓ Contractor mobilization
- ✓ Building of contractor's camp sites
- ✓ Clearing of sites for construction purpose of the dam and its components
- ✓ Clearing of sites for construction of main canals
- ✓ Construction of dams and its components
- ✓ Rock blasting
- ✓ Material transportation to sites
- ✓ Diversion of river for room to build
- ✓ Using different machines for operation activities
- ✓ Building of access roads and tarmacking of road to the dam site
- ✓ Planting of trees in the catchment areas
- ✓ Building of live fence around the dam
- ✓ Disposal of wastewater generated during construction
- ✓ Disposal of solid and spoils generated
- ✓ E.t.c.

The environmental assessment team identified negative impacts of the proposed development and proposed mitigation measure at construction stage as described below.

6.2.4.1. Loss of habitat.

There are swampy areas and forest areas in the project proposed sites. These habitats to diverse plants, monkeys, birds and other organisms. The proposed site has a river Nzeeu ecosystem that is a habitat to microbial organisms, and aquatic organisms. The construction activities highlighted above especially for the dam construction are likely to affect the fauna that is dependent to the project area thereby challenging the conservation of the local biodiversity.

Mitigation measures,

Measures have been proposed to minimize such loses including planting of more trees within the forest reserves. Key stakeholders to enhance public awareness and participation in conservation activities, Enforcement of wildlife Act and EMCA 1999 (wetlands conservation) Act.

6.2.4.2. Loss of aquatic organisms.

Construction of the Umaa dam and its facilities across the river will impede free movement or migration of aquatic organisms downstream for breeding purposes during the river diversion at construction. Also, the contractors' activities on release of wastes into the river will impact on the living organisms in the river

Mitigation measures

To mitigate against loss of aquatic organisms, river diversion should be carried out in a way that minimal organisms will be affected. The contractor to observe that no wastewater is released into the river that will cause loss of aquatic life. Proper handling of chemicals and wastes to be observed so that NEMA standards are observed. Finally, the contractor to carry out an independent ESIA for the contractor's camp to address issues on environment.

6.2.4.3. Loss of vegetation.

The proposed development will necessitate the clearance of vegetation to develop an earth dam, and other infrastructure. It is however important to note that vegetation in most dam areas had been cleared with little vegetation of shrubs in places where the components exist.

Mitigation measures

encouraging local people in catchment areas to plant more vegetation that is water friendly during the component of catchment management. The dam reserves area shall be planted of trees (local) to cover up the trees cut during project construction.

6.2.4.4. Loss of aesthetic value

The project site has nice scenery. Clearance of vegetation, rehabilitation and construction of dam will change the landscape of the community. This with poor waste and waste water disposal may result to loss of aesthetic value of the project area during project construction. Also, the excavations to reach the formation levels of construction will lead to permanent change of the site to water body

Mitigation measures

Loss of aesthetic value can be minimized through reinstating the site after construction and rehabilitation activities. The farmers will also vegetate the boundaries of plots through agro forestry concept.

6.2.4.5. Loss of water resources

This impact stems from the changes in hydrological conditions owing to the development of the Umaa project. During construction, large quantities of water will be required. This will range from activities of construction and contractors domestic workers.. This implies that less water will be released downstream during flash floods.

Mitigation measures

These impacts can be minimized with the following measures;

- ✓ Recycling and Re-use of water within the project site
- ✓ Reduce water usage through efficient ways that safes of conserves water.

6.2.4.6. Changes in hydraulics of the rivers.

Construction of the dam will mean diversion of river Nzeeu to create room for construction. This means there will be change of direction of river flow from the original route. This will have an impact on the downstream water quantity downstream.

Mitigation measures

During construction, the contractor will ensure that adequate water is released downstream through prior preparation of diversion channel. It shall be lined to prevent more percolation.

6.2.4.7. Excessive noise and vibration.

The proposed project located in a village, forested area set up with a lot of tranquility. The construction works, delivery of materials by heavy trucks and the use of machinery/equipment including tractors, excavators, trucks, bulldozers, generators, grinders, mixers, blasting equipment, compactors and crushers together with drilling works will contribute to high levels of noise and vibration within the construction site and the surrounding area where ambient noise levels are low. This is anticipated to increase noise levels in the project area affecting particularly sensitive receptor areas such as immediate neighbors.

Mitigation measures

Excessive noise and vibration in the schemes can be reduced if the following will be observed.

- ✓ switching of vehicles and machines when not in use;
- ✓ Avoiding unnecessary hooting, insulate noisy machines and activities during construction to minimize noise impact to neighboring communities;
- ✓ workers to be provided with personal protection equipment, machines and equipment to be fitted with silencer devices where possible;
- ✓ Workers using drilling equipment to be provided with specialized anti-vibrating gloves, machines to be serviced to reduce generation of noise and vibrations;
- ✓ Warnings to be issued to the locals in case of any unusual noise;
- ✓ The noisy activities should restricted to daytime but most important;
- ✓ The project proponent will ensure that NEMA noise and Vibration standards are observed in all project activities as shown in the baseline conditions.

6.2.4.8. Air Pollution and Climate Change.

Project activities associated with implementation the project will release pollutants that will affect the air quality and contribute to climate change. The pollutants will result from

dust emission and exhaust fumes from vehicles for implementation. The clearance of vegetation for the area to be impounded by water will contribute to less carbon being sunk contributing to climate change.

6.2.4.9. Dust Emission

Dust will be generated from the heavy movement of traffic on the earth roads present in the area during project construction and decommissioning. It is also anticipated that construction activities particularly construction of access roads, and dam will increase dust emitted. Further, demolition activities will result in generation of dust as the works will be vigorous.

Mitigation measures

To mitigate against the impacts of dust emitted in the project area, several measures have been proposed including;

- ✓ The access roads to be watered during the construction period;
- ✓ Plant more vegetation for carbon sequestration;
- ✓ Limit the speed on dusty roads to 30km/hr;
- ✓ Construction to take the shortest time possible;
- ✓ Workers to use masks when working in dusty conditions;
- ✓ Using dust nets to trap dust at construction sites;
- ✓ Ensure dust levels do not surpass the NEMA standard highlighted in the chapter on baseline.

6.2.4.10. Exhaust fumes.

Increase in exhaust fumes is anticipated from moving automobile, construction machines and equipment during construction period. The emissions contain normally unburned hydrocarbons, nitrogen oxides, aromatic hydrocarbons, carbon dioxide, carbon monoxide and particulates. They are known to contribute to photochemical smog, health issues, acid rains and global climate change.

Mitigation measures

The following measures will be undertaken to mitigate against exhausted fumes; Construction vehicles to have catalytic devices to ensure complete burning of waste gases, use of clean petroleum that is low in Sulphur, lead or other pollutants, proper servicing of vehicles and construction machines as well as plant more vegetation for carbon sequestration

6.2.4.11. Increase in Water pollution.

It is expected that with the development of dam water quality both for surface and ground water will be compromised. Activities that will be associated with water pollution at construction stage will include; Wash down of debris generated from various construction activities, surface runoff from non-point and point sources pollution from various human-economic activities, poor disposal of solid wastes from construction camps, Poor management of oil and greases from contractor's service bays and spills from use of construction machines and equipment such as oil and other hazardous chemicals.

Similarly, the influx of populations in the project area will increase waste and waste water generated and since the area does not have water treatment facilities, it will be drained back to the river channel untreated. Water pollution will affect the water parameters hindering normal chemical characteristics of the water and indirectly affecting all organisms that encounter the contaminated water.

Mitigation measures

In spite of the possibility of affecting the water quality, measures will be proposed to reduce such possible impacts in the schemes including;

- ✓ the contractor and the client to prepare an integrated waste management plan during construction and operation period of the project;
- ✓ Proper handling of loose soils during construction to prevent it from getting into water channels;
- ✓ The contractor's camps to have adequate sanitation facilities that can treat waste water before releasing into the environment;
- ✓ Ensure all repairs and maintenance work are done at the contractors' yard to avoid spillages,
- ✓ Compact loose material/soils and;
- ✓ Ensure recommended water quality standards of effluents from the contractors camp are adhered to as per the provisions of NEMA water quality regulation as shown in the baseline section on water quality.

6.2.4.12. Soil erosion.

During project construction, the following activities: construction of Access roads, head works, canals, Conveyance of irrigation water and clearance of vegetation in the command area are anticipated to increase soil erosion. This is because of loose soils and less vegetation to hold soil during construction period. These will impact on the fertility of the soils, siltation, and eutrophication of aquatic ecology.

Mitigation measures

The following measures will be taken to minimize the impacts; intensive re-vegetation on bare grounds after construction, Planting of grass on steep slopes, compaction of loose soils after excavations, reuse of materials for refill, the canal design to adopt sub critical flow velocity to avoid erosion and practice of conservation agriculture.

6.2.4.13. Soil pollution.

Soil pollution is anticipated in the project area during construction phase of the project. During construction phase, Oil and diesel spill from construction machines, grease from repairs of construction machines and equipment from the contractors' camps is anticipated to pollute the soils. This is anticipated to change the chemical composition of the soils affecting the biochemical process.

Mitigation measures

- ✓ Proper servicing of construction equipment free of leaks and using a designated workshop and fueling areas that are paved will reduce the extent of anticipated soil pollution.
- ✓ Installation of oil traps in contractor's camps to prevent leakage of oil into the soils
- ✓ Collection and Reusing of used oil in other constructive uses will assist.

6.2.4.14. Wastewater effluent.

During the construction phase, it is anticipated that various liquid wastes including grey and black water, concrete washing and canal watering, runoff from workshop areas and various liquid wastes from the washing of construction vehicles and equipment. Population influx will result in increase in water consumption for domestic and other uses. The resultant by-product of all these activities will be generation of wastewater. These liquid wastes are likely to cause imminent threats to the groundwater quality and other aquatic bodies. Negatively, the sites do not have sanitation facilities to treat on the generated effluents.

Mitigation measures

- ✓ The contractor's camp shall have a fully approved ESIA report, which will address all the impacts of its operation during the project implementation and operation period.

- ✓ The grey water runoff from the working areas should be contained and properly channeled and be reused.
- ✓ Water containing pollutants such as cement, concrete, lime, chemicals and fuels should be discharged into a conservancy tank for removal from the site.
- ✓ Potential pollutants should be stored, kept and used in such a manner that any escape can be contained to avoid degrading the water table.
- ✓ Any pollution incidents on site should be resolved speedily.
- ✓ Any discharge from the site should meet the NEMA requirements on effluents as brought out in waste water quality standards in previous chapters.

6.2.4.15. Increase in solid waste generation.

Construction activities and the contractor's camp and dam will ultimately lead to the production of solid wastes such as excavated soil and rock debris, metal cut offs, plastics, cardboards, paper, wood and waste concrete among others. Population influx on the other hand together with improved standards of living during project implementation will improve the purchasing power of the people. Such will lead to more wastes being generated thereof. During decommissioning, debris of various materials is expected and is expected to add more wastes into the environment. The effects of improperly waste management could be detrimental causing environmental pollution, nuisance to the local communities, and increased vermin among other undesirable effects.

Mitigation measures

- ✓ Waste minimization in the schemes will require the contractor to promote the reuse,
- ✓ recycling and reduction of wastes generated during construction,
- ✓ adequate litter collection facilities,
- ✓ approval of waste disposal sites by NEMA in accordance with the waste management regulations,
- ✓ chemical and hazardous wastes should not be burnt or dumped in open pits as well as adequate
- ✓ re-use of all excavated materials in the works.

6.2.4.16. Downstream Water use conflicts.

The demand for irrigation water and water for livestock in the downstream of proposed Umaa dam is anticipated to be high when the water flows in the river channel is low during construction. This may stir up conflict between downstream water users during dry seasons due to water access rights.

Mitigation measures

- ✓ Harvesting of rainwater during the dry season and the need to provide piped water supply for domestic users.
- ✓ Contractor to use other water source for construction purpose and leave the stream water flow downstream.
- ✓ Provision of water troughs for wildlife and for communities at their areas of concerns

6.2.4.17. Occupational health and safety.

Occupation health concerns will be high in the project area particularly during construction of the project. Occupational risks expected during construction phase include; Fire or explosions due to flammable materials in the contractors' camps, spillage of corrosive or hazardous substances, injuries and accidents sustained by workers, moving machine parts/equipment or falling materials and debris in excavated areas.

Occupational risks expected during operation include Occupational health issues related to use of agrochemicals by the farmers, drowning in flooded pit holes

Mitigation measures

The following measures have been proposed to minimize the impacts of occupational risks;

- ✓ Ensure safety of the construction workers by putting first aid area and injury reporting mechanism
- ✓ Establish the appropriate safety measures in the O & M manual for the operation phases.
- ✓ Ensure safety of residents by providing safety signs at strategic places around the access roads.
- ✓ Ensure compliance to Occupational Safety and Health Act Cap. 514 and its Subsidiary Legislations.
- ✓ Provide personal protective equipment to workers.

- ✓ There should be adequate provision of the requisite sanitation facilities for human waste disposal
- ✓ The workers should receive the requisite training especially on the operation of the machinery and equipment.
- ✓ Provide clean drinking water for the employees.
- ✓ Develop a site safety action plan detailing safety equipment to be used, emergency procedures, restriction on site, frequency and personnel responsible for safety inspections and controls.
- ✓ Recording of all injuries that occur on site in the incident register, corrective actions for their prevention are instigated as appropriate.
- ✓ Provision of prevention tools such as condoms at the health center and construction site availed to all.

6.2.5. Anticipated Negative Impacts and Mitigation Measures at Operation Phase

Dam and Water supply is considered an effective way of increasing water supply, agricultural production and improved quality of life. However, their operation have negative environmental and social impacts. The impacts emanate from management of the irrigation system and agricultural management practices in the schemes. There is need therefore to identify the adverse impacts and mitigation measures to improve environmental and social sustainability of the project at operation phase.

The operation activities during project operation include the following;

Dam Activities;

- ✓ Desilting the dam
- ✓ Disposal of silts

Water supply activities

- ✓ Using chemicals in treatment
- ✓ Pumps for pumping mains
- ✓ Disposal for backwashed water
- ✓ Disposal of human wastes
- ✓ Use of machinery in operation activities

Catchment Conservation activities

- ✓ Planting of trees in the catchment areas

- ✓ Building of gabions in soil erosion prone areas

The environmental assessment team identified the negative impacts of the proposed development at operation stage and proposed mitigation measure as indicated below.

6.2.5.1. Increase in solid waste generation.

Operation activities of the project including staff quarters at the dam site, irrigation activities will lead to the production of solid wastes such as plastics, cardboards, paper, wood, agricultural waste and food waste among others. The production of these wastes is expected to be higher during project operation considering waste from fertilizer and pesticides products associated with farming activities. Growth of the Agro Industry is expected to further introduce wastes into the environment. Agro Industries use agricultural products as raw materials therefore wastes of various kinds are expected to be generated. Population influx on the other hand together with improved standards of living will improve the purchasing power of the people. Such will lead to more wastes being generated thereof. The effects of improperly waste management could be detrimental causing environmental pollution, nuisance to the local communities, and increased vermin among other undesirable effects.

Mitigation measures

- ✓ Promote the reuse, recycling and reduction of wastes generated during operation,
- ✓ adequate litter collection facilities,
- ✓ approval of waste disposal sites by NEMA in accordance with the waste management regulations,
- ✓ Chemical and hazardous wastes should not be burnt or dumped in open pits
- ✓ Promote re-use of agricultural wastes.

6.2.5.2. Water Loss.

This impact stems from the changes in hydrological conditions owing to the installation and operation of the dam and water supply components. The water supply project will draw water from the dam and treat before distributing it via the rising main to Kitui town. As a hydrological result it is found that; the downstream river discharge is reduced, the evaporation is increased, the groundwater recharge is increased, the level of the water

table rises and loss of water through seepage is increased. The population influx in the project on the other hand are anticipated to lead to consumption of large volumes of water to meet the various needs associated with various processes. All these are direct effects leading to water loss.

Mitigation measures

These impacts can be minimized with the following measures ;

- ✓ Irrigating at cool times of the day for instance morning and at night hours,
- ✓ Planting of low water requirement crop varieties for example highland rice,
- ✓ Use of efficient irrigation methods
- ✓

6.2.5.3. Air Pollution

During the operation phase of the project, chemicals for water treatment and fumes from pumps will lead to air pollution.

- *Greenhouse gases*

Agricultural activities stated in the project area will lead to production of greenhouse gases including water vapour, carbon dioxide (CO_2), methane (CH_4) through a process known as methanogenesis, nitrous oxide (N_2O: dinitrogen monoxide) and nitric oxide (NO). The gases will be generated from applied nitrogen fertilizers, digestive process of ruminant animals, animal wastes, evapotranspiration and microbial activities particularly in the paddy.

Mitigation measures

To reduce the amount of greenhouse gases produced, several measures should be including: Reducing water logging to allow aeration of the soils particularly after harvesting paddy crops by draining paddies once or several times during the growing seasons. Avoiding biomass burning but instead use it for compost organic manure. Apply crop residues or organic manure to dry fields to increase aerobic decomposition of the matter and practice agroforestry by planting plants with high primary productivity for carbon sequestration.

6.2.5.4. Increase in Water pollution.

It is expected that with the development of dam and water supply with possible activities of irrigation downstream, water quality both for surface and ground water will be compromised. Activities that will be associated with water pollution at operation phase

will include; surface runoff from non-point and point sources pollution from various human-economic activities, poor disposal of chemical containers and other solid wastes, poor quality of tail water that could have concentration of agrochemicals, spills from use of farm machines and equipment such as oil and other hazardous chemicals and leaching from use of agrochemicals.

Similarly, the influx of populations in the project area will increase waste and waste water generated. Water pollution will affect the water parameters hindering normal chemical characteristics of the water and indirectly affecting all organisms that encounter the contaminated water.

Mitigation measures

In spite of the possibility of affecting the water quality, measures will be proposed to reduce such possible impacts in the schemes including;

- ✓ the farmers and NIB to prepare an integrated waste management plan during operation period of the schemes;
- ✓ controlled use of agrochemicals to prevent deposition in water courses;
- ✓ maintain a strip of 6m along riverbanks;
- ✓ Ensure all repairs and maintenance work are done at the contractors' yard to avoid spillages,
- ✓ Compact loose material/soils and;
- ✓ Ensure recommended water quality standards in the tail water are adhered to as per the provisions of NEMA water quality regulation.

6.2.5.5. Changes in hydraulics of the rivers.

The hydrological studies indicate a variation in peak river flows during the dry and wet seasons. It was observed that there is high water flow during wet seasons and very low flows during the dry season. With the development of the Umaa dam the flows of the river will change in a way that water flowing downstream will be less than what has been flowing before the project implementation. The demand for water will be high during its dry season, therefore water that will flow to the river channel will have impact on the hydrological flow of the riverine system in terms of quantity. The impact will affect the general hydrological flows including the shores of the river, water quality, aquatic organisms, riverine ecology as well as resulting in user conflicts for shared rivers. These are operational impacts that may be permanent in nature.

Mitigation measures

To sustain environmental water requirement and also to meet the demands of downstream users the Community will;

- ✓ Control the amount of water to be released to the river channel from the dam by basing on a minimum environmental flow (MEF)
- ✓ for farmers downstream

6.2.5.6. Excessive Noise and Vibration;

demolition works will involve movement of various heavy machinery which are anticipated to generate noise and vibration beyond the ambient level. This is anticipated to increase noise levels in the project area affecting particularly sensitive receptor areas such as schools or health facilities.

Mitigation measures

Excessive noise and vibration can be reduced if the following will be observed;

- ✓ switching of vehicles and machines when not in use;
- ✓ Avoiding unnecessary hooting, insulate noisy machines and activities during operation to minimize noise impact to neighboring communities;
- ✓ workers to be provided with personal protection equipment, machines and equipment to be fitted with silencer devices where possible;
- ✓ Warnings to be issued to the locals in case of any unusual noise;
- ✓ The noisy activities should restricted to daytime but most important;
- ✓ The project proponent will ensure that NEMA noise and Vibration standards are observed in all project activities presented in baseline conditions.

6.2.5.7. Social cultural changes.

The proposed development is anticipated to attract people to the project area. This might put pressure on various resources and influence change of culture of the local people.

Mitigation measures

- ✓ Local people to adopt appropriate technology for crop and animal production.
- ✓ Improve local varieties through research.
- ✓ Preserve vegetative areas of cultural heritage.

- ✓ Synchronized celebration of cultural festive and agricultural production work related activities.

6.2.5.8. Increase in communicable diseases.

Refers to diseases that are transmitted directly from one individual to another, sexually transmitted infections are the most common in the project area and an influx of population in the project area is anticipated to increase infection rate. Immoral behavior due to increase in income from construction activities' wages, income from farm labour or sell of produce will increase commercial sex activities. Changes in behavior may be exacerbated by high poverty levels among the locals. HIV was also identified as one of diseases that affect the project area.

Mitigation measures

To minimize the impacts of increase in communicable diseases, it is proposed that key stakeholders to carry out public awareness campaigns against HIV/AIDS, STIs, Tuberculosis and other communicable diseases present in the area, Accessible health care services to be provided to the local populace, free VCT centres to be provided in the project area as well as sex education and awareness among the youth.

6.2.5.9. Increase in vector borne diseases.

Factors such as Water stagnation, flooding in some parts of the schemes and inadequate sanitation facilities in the project area will increase breeding of vectors and transmission of vector borne disease. Malaria is common in children in the project area at the baseline stage.

Mitigation measures

If the following measures are adhered to; public awareness and sensitization on management and prevention of vector breeding for Malaria, Bilharzia, Filariasis, Dracontiasis or Trypanosomiasis, provision of sanitation services in the project area, provision and equipping of medical facilities in the project area, use of preventive measures such as protective clothing and controlling of flooding water in the project area through storage facilities will reduce impacts of vector borne diseases.

6.2.5.10. Downstream Water use conflicts.

The demand for irrigation water in the in the downstream communities is anticipated to be high when the water flows in the valley is low. At the same time, reduced water flows

into the river channel will bring conflict downstream for those people utilizing the water but are out of the irrigation command area. This may stir up conflict between upstream and downstream water users during dry seasons due to water access rights at times of dry season

Mitigation measures

To minimize water use conflicts, there is need for the formation of community water users associations for water conflicts resolution and management, enforcement and adhering to the water management rules by all key stakeholders, harvesting of rain water during the dry season and the need to provide piped water supply for domestic users.

6.2.6. Negative impacts during decommissioning phase

At decommissioning phase, different activities will take place on the project. The design life of 40 years will be over and the project components will be rehabilitated or demolished. During decommissioning phase, the following activities will be carried out;

- ✓ Rehabilitation of irrigation main canals
- ✓ Rehabilitation of dam
- ✓ Rehabilitation of water supply
- ✓ Where possible demolishing of components
- ✓ Disposal of waste generated during the process
- ✓ Demolition vehicles operations
- ✓ Noise from vehicle operation

The negative impacts associated with decommissioning are as described below;

6.2.6.1. Excessive Noise and Vibration;

Demolition works will involve movement of various heavy machinery which are anticipated to generate noise and vibration beyond the ambient level. This is anticipated to increase noise levels in the project area affecting particularly sensitive receptor areas such as schools or health facilities as renovation/demolition will be taking place on various project components.

Mitigation measures

Excessive noise and vibration can be reduced if the following will be observed;

- ✓ switching of vehicles and machines when not in use;
- ✓ Avoiding unnecessary hooting, insulate noisy machines and activities during operation to minimize noise impact to neighboring communities;
- ✓ workers to be provided with personal protection equipment, machines and equipment to be fitted with silencer devices where possible;
- ✓ Warnings to be issued to the locals in case of any unusual noise;
- ✓ The noisy activities should restricted to daytime but most important;

The project proponent will ensure that NEMA noise and Vibration standards are observed in all project activities presented in baseline conditions.

6.2.6.2. Increase in waste generation.

During decommissioning, debris of various materials is expected and is expected to add more wastes into the environment. The effects of improperly waste management could be detrimental causing environmental pollution, nuisance to the local communities, and increased vermin among other undesirable effects. At baseline, the project area is poor in waste management as they burn unwanted wastes polluting the environment.

Mitigation measures

Proper disposal of wastes generated at decommissioning phase. Recycling and re-use of waste where possible.

6.2.6.3. Air pollution

The demolition and renovation activities will lead to generation of dust, which affect the air conditions by increasing particulate matter in the air.

Mitigation;

- ✓ Watering of surfaces during decommissioning activities
- ✓ Ensuring that air quality standards highlighted in the baseline are adhered to.

Occupation Health and safety

Occupation health concerns will be high in the project area during decommissioning phase of the project. Occupational risks expected during decommissioning phase include; Fire or

explosions due to flammable materials in the pump houses, spillage of corrosive or hazardous substances, injuries and accidents sustained by workers, moving machine parts/equipment or falling materials and debris in excavated areas.

Injuries and accidents sustained to workers as they use various kind of farm equipment and machinery for renovation/demolition.

Mitigation measures

The following measures have been proposed to minimize the impacts of occupational risks;

- ✓ Ensure safety of the workers by putting first aid area and injury reporting mechanism
- ✓ Establish the appropriate safety measures in the O & M manual for the decommissioning phases.
- ✓ Ensure safety of residents by providing safety signs at strategic places around the access roads.
- ✓ Ensure compliance to Occupational Safety and Health Act Cap. 514 and its Subsidiary Legislations.
- ✓ Provide personal protective equipment to workers.
- ✓ There should be adequate provision of the requisite sanitation facilities for human waste disposal
- ✓ The workers should receive the requisite training especially on the operation of the machinery and equipment.
- ✓ Provide clean drinking water for the employees.
- ✓ Develop a site safety action plan detailing safety equipment to be used, emergency procedures, restriction on site, frequency and personnel responsible for safety inspections and controls.
- ✓ Recording of all injuries that occur on site in the incident register, corrective actions for their prevention are instigated as appropriate.
- ✓ Provision of prevention tools such as condoms at the health center and construction site availed to all.

6.2.7. Irreversible Impacts

The major irreversible impact is the change in land use at the dam site. Currently, the area is under forest and after implementation, the same area will be submerged under water.

This impact will change the dynamic of the area in that the plants, which were there, will be removed and replaced with a dam filled with water. This impact will be addressed by planting more vegetation (indigenous) within the project site to keep the same weather that was before.

6.2.8. Cumulative impacts

Water storage in the Umaa dam and abstraction for the water supply will marginally reduce the net water volume available downstream. In itself, this will affect downstream water users on Nzeeu river, when combined with other existing and planned water abstractions from the Umaa sub-basin, it will contribute to probable significant impacts on water availability in dry years and ultimate quantity of water that will be available downstream.

Mitigation Measures

The mitigation measure for this is planting of water friendly trees in the entire catchment of the Nzeeu system to increase water flow that will meet the demand of the developments leaving excess water to flow into downstream. Also the dam to release the environmental flow into the channels always.

7. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

7.1. Overview

Environmental management is an important aspect of project management and in protecting the environment. The objectives of environmental and social management plan is to ensure smooth implementation of environmental and social protection measures, mitigate adverse environmental impacts of project implementation, and ensure environmental and social protection activities are carried out smoothly in the project areas. Umaa dam and Water supply Project has been subjected to comprehensive environmental and social impacts assessment in accordance with prevailing environmental and agricultural policies, laws and guidelines. Various potential adverse environmental and social impacts associated with the project have been identified and an ESMP formulated at the ESIA study stage to guide in mitigating the negative impacts. However, the implementation of some of the ESMP actions will require a response beyond the project level. There is need therefore to have a multi-sectoral approach that will require unified management structures for such proposed measures. The project proponent is required to identify the actions and respond appropriately. Where the expert team could not determine the realistic costs of some of the proposed environmental management activities due to the associated hidden costs, further actions will be proposed to come up with more accurate costs. It is upon the project proponent and the environmental enforcement agencies to ensure that the proposals are adhered to during the project implementation.

As part of the ESMP a pest management Plan and dam safety Plan will be prepared to guide on operation of cropland in the irrigation command area and the safety of the dam in case of failure to the downstream people. The ESMP prepared below brings out the potential impact, mitigation measures, responsibility during the time of its implementation, time frame which the impact will occur (preliminary &Design, Implementation/construction, operation and decommissioning) and the cost of the mitigation measure.

Table 21:Environmental and Social Management Plan-Construction Phase

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
Biodiversity.						
1.	Loss of Aquatic organisms.	• Dams, Contractor's camps, irrigation canals ✓ Building of contractor's camp sites ✓ Clearing of sites for construction purpose of the dam and its components ✓ Construction of dams and its components ✓ Diversion of river for room to build ✓ Disposal of wastewater	• Ensure recommended water quality standards in the tail water are adhered to as per the provisions of NEMA water quality regulation. • Ensure no observable aquatic organism is destroyed during construction. • KWS in consultations with the local people to gazette conservation areas where need be, • Key stakeholders to enhance public awareness and participation in conservation activities, • Enforcement of wildlife Act 2013 and EMCA (wetlands, River Banks, Lake Shores and	NEMA, WRA Contractor and Community	During construction phase	2,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
		generated during construction	Sea Shore Management) Regulations, 2009.			
2.	Loss of vegetation.	• Dam, and water supply, rising main and distribution components. ✓ Clearing of vegetation for construction purpose	• Introduce vegetation strips to unproductive land to compensate for what will be cleared, • Identify endangered species of trees to be planted in other places where they will not be affected. • consider re-vegetation around the upstream points and along the rivers • Plant more trees in the dam reserve areas to increase vegetation • Encourage local people in catchment areas to plant more vegetation.	GoK, KFS Contractor. Community.	During construction	2,500,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
3.	Loss of aesthetic value	• All the project components. ✓ Excavations ✓ Generation of spoils ✓ Cutting of trees ✓ Construction of access roads	• Reinstate the site after construction and rehabilitation activities. • Planting of more trees within the project areas to improve aesthetic value of the area	GoK. Contractor Supervising consultant	Construction phase.	Part of construction cost.
4.	Loss of habitat.	• All the project components ✓ Cutting of trees ✓ Destroying habitats to wildlife	• NEMA in collaboration with WRA to gazette wetlands that may exist within the area • KWS in consultations with the local people to gazette conservation areas where need be, • Key stakeholders to enhance public awareness and participation in conservation activities, • Enforcement of wildlife Act and EMCA 1999 (wetlands conservation) Act.	GoK WRA. NEMA.	Construction phase	2,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			• Planting of similar trees lost in other areas of the project to create more habitat that is vital for the project.			
5.	Loss of Water sources	• Dam ✓ Closing of community spring for construction	• Provide provision for roof catchment in the area to compensate on water loss • Minimize on water wasting during the time of construction • Provide alternative water source to the community	Contractor, GoK	construction phase	1,500,000
Pollution.						
6.	Water pollution	✓ Dam, contractor's camp, Effluents from camps ✓ Sediments from excavations that will pollute water ✓ Maintenance of construction vehicles	• The contractor to prepare an integrated waste management plan during construction and operation period of the schemes, • Ensure all repairs and maintenance work are done at the contractors' yard to avoid spillages,	Contractor and	During construction	2,500,00

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			• Compact loose material/soils and • Ensure recommended water quality standards in the tail water are adhered to as per the provisions of NEMA water quality regulation. • Prevention of non-point source of pollution to the water for irrigation. • Regular water sampling of boreholes and water downstream to detect water pollution that will be handled immediately.			
7.	Excessive Noise and Vibrations.	• Dam, and Rising main and pumps ✓ Noise from the operating machines ✓ Rock blasting	• workers using drilling equipment to be provided with specialized anti-vibrating gloves, • switching off vehicles and machines when not in use, • Machines and equipment to be fitted with silencer devices where possible,	Contractors, supervising consultant and Workers	During construction.	1,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			• The site for construction should be hoarded off • An improvised rock breaking system should be adopted by use of Ammonium Nitrate • avoiding unnecessary hooting, • workers to be provided with personal protection equipment, • machines to be serviced to reduce generation of noise and vibrations, • warnings to be issued to the locals in case of any unusual noise, • the noisy activities should be restricted to daytime • Ensure that NEMA noise and Vibration standards are observed in all project activities.			

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
8.	Dust emission.	• Dam, Water supply, Rising main, access roads ✓ Dust emission due to construction activities	• The access roads to be watered during the construction period, • Plant more vegetation for carbon sequestration, • limit the speed on dusty roads, • Workers to use masks when working in dusty conditions.	Contractor.	During construction.	2,000,000.
9.	Water borne Diseases.	Dam ✓ Loss of sources of water due to submergence of the dam	• public awareness and campaigns on hygiene behaviour change, • Promotion of household water treatment methods • provision of safe water for domestic use to the local people • Provision of alternative water sources to those who use water from wells being affected by the project • Building of hospitals in the project area and equipping	Community to work with the County government, Northern Water Works development Agency and other relevant institutions.	During project construction	2,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			them to treat the illnesses when they occur.			
10.	Changes in Hydraulics of the river.	• Dam ✓ Diversion of the river for construction	• Provision of water harvesting and storage facilities during wet seasons to supplement abstracted water. • Plant more water loving trees in the project area to increase flows in the river • Diverting the river to ensure continued flow downstream during construction.	Contractor/GoK	During construction	5,000,000
11.	Exhaust fumes	• All the project components ✓ Operation of construction vehicles	• Construction vehicles to have catalytic devices to ensure complete burning of waste gases, • use of clean petroleum that is low in sulphur, lead or other pollutants, • proper servicing of vehicles and Construction machines	Contractor and GoK	During construction	Part of construction cost.

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			according to manufacturer's specifications • Plant more vegetation for carbon sequestration.			
Soil.						
12.	Soil erosion.	• Dam and Water Supply and rising main ✓ Clearing of vegetation for construction purpose	• Planting of trees in the project catchment areas to minimize soil erosion • Where there is intense soil erosion, gabions should be built as a measure to reduce soil erosion • There should be intensive re-vegetation on bare grounds after construction. • Compaction of loose soils after excavations and reuse of materials for refill. • The canal design to adopt sub critical flow velocity to avoid erosion. •	Contractor, County governments and farmers.	During construction	800,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
13.	Siltation, eutrophication and sedimentation.	• Dam and water supply ✓ Loose materials on sites due to construction ✓ Spoils as a result of excavations	• Re-using of excavated materials as fill or for other works, • Compacting of loose soil and planting of grass to hold the soil	Contactor	Construction phase.	No direct cost estimates.
Wastes.						
14.	Waste water and effluents.	• Dam sites, Contractor's camp, water supply and energy plant ✓ Waste water from the construction Activities	• The grey water runoff from the working areas should be contained and properly treated before being released to the river • Where possible wastewater need to be treated to meet the effluent standards before releasing it the receiving water. • Water containing pollutants such as cement, concrete, lime, chemicals and fuels should be discharged into a conservancy tank for removal from the site.	Contractor, County Government of Kitui,	During construction,	Part of construction cost.

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			• Potential pollutants should be stored, kept and used in such a manner that any escape can be contained to avoid degrading the water table. • Any pollution incidents on site should be resolved speedily. • The construction should have sanitation facilities that will not pollute water			
15.	Increase in waste.	• Dam, Water supply, obsolete machinery and access roads ✓ Different wastes resulting from contractor construction activities.	• promote the reuse, recycling and reduction of wastes generated, • Provision of adequate litter collection facilities, • Approval of waste disposal sites by NEMA in accordance with the waste management regulations, • The chemical and hazardous wastes should not be burnt or dumped in open pits	Contractor,	During construction,	700,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			• Debris should be utilized in filling up of quarries within the project area			
Social issues.						
16.	Increased communicable diseases.	All the project components ✓ Spread of communicable diseases among workers and local communities	• Hospitals should be built in the project area for to treat the locals for all the illnesses. • Carry out public awareness campaigns against HIV/AIDS, STIs, Tuberculosis and other communicable diseases present in the area, • Accessible health care services to be provided to the local populace, • Free VCT centres to be provided in the project area	Contractor, Ministry of health and County government of Kitui	Construction phase	3,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			as well as sex education and awareness among the youth.			
17.	Downstream Water use conflicts.	• Dam and water supply and possible irrigation areas ✓ Use of water from the river for construction purpose	• Harvesting of rain water for use during the dry season and • The need to provide piped water supply for domestic users. • Base flow should be always released into the river to flow downstream	IWUAs WRUAs, County Governments, Operation team	During project Operation.	No direct cost estimates.
Public Health and safety Plan.						
18.	Occupational Health and Safety (OHS).	▪ Dam, water supply and contractors camps ✓ Working conditions for workers ✓ Securing of working areas ✓ Construction of crossings ✓ Daily works of the contractor ✓ Noisy machines	▪ Ensure safety of the construction workers by putting first aid area and injury reporting mechanism ▪ The contractor to have his workable health and safety rules to apply always at work places ▪ Securing of sites to prevent any accident at sites ▪ Ensure safety of residents by providing safety signs at strategic places around the	Contractor, supervising consultant Community	Construction phase	Part of construction cost.

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
		✓ Explosion of materials/rocks	access roads. ▪ Ensure compliance to Occupational Safety and Health Act Cap. 514 and its Subsidiary Legislations. ▪ Provide adequate crossings where canals will pass ▪ Provide personal protective equipment to workers. ▪ There should be adequate provision of the requisite sanitation facilities for human waste disposal ▪ The workers should receive the requisite training especially on the operation of the machinery and equipment. ▪ Preparation of a working dam safety plan ▪ Provide clean drinking water for the employees. ▪ Develop a site safety action plan detailing safety equipment to be used, emergency procedures, restriction on site, frequency and personnel responsible for safety inspections and			

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			controls. ▪ Recording of all injuries that occur on site in the incident register, corrective actions for their prevention are instigated as appropriate. ▪ Provision of prevention tools such as condoms at the health center and construction site availed to all ▪ The contractor to register workplace and ensure fire and safety gears are in order and to be regularly maintained during operation			
Cost of ESMP at Construction Stage						**22,000,000**

Table 22:Environmental and Social Management Plan-Operation Phase

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
Biodiversity.						

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
1.	Loss of Aquatic organisms.	• Possible Irrigation command area ✓ Polluted water quality from the command area	• Ensure recommended water quality standards in the tail water are adhered to as per the provisions of NEMA water quality regulation. • KWS in consultations with the local people to gazette conservation areas where need be, • Key stakeholders to enhance public awareness and participation in conservation activities, • Enforcement of wildlife Act 2013 and EMCA (wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009.	NEMA, WRA and Community	During operation phase	2,000,000
2.	Loss of vegetation.	• Possible Irrigation areas	• Farmers to Practice Agro-forestry on at	GoK.	During construction	2,500,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
		✓ Clearing of vegetation for irrigation purpose	least 10% of their farms. • Introduce vegetation strips to unproductive land to compensate for what will be cleared, • Identify endangered species of trees to be planted in other places where they will not be affected. • consider re-vegetation around the upstream points and along the rivers • Plant more trees in the dam reserve areas to increase vegetation • Encourage local people in catchment areas to plant more vegetation.	Community.		

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
3.	Occurrence of invasive species.	• Possible Irrigation areas ✓ Emergence of invasive species in the project area	• Improve in soil fertility • Use of seeds coated with pesticides. • Practice crop rotation, Inter cropping and Strip cropping. • Before planting any new plant or crops in the area, it should be approved by relevant institutions • Equipment required for the construction works should be clean and free from any alien plants and mud which may contain seeds of alien species. • Raw materials to be used for construction such as sand and rocks should be sourced in areas where there are no alien/ invasive species.	Community, contractor County government and seed company	During project Operation.	2,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			• Enforce the crops Act 2013 where possible • Where invasive crop occurs, it should be reported to relevant institutions to handle the issue before it spreads to other areas			
4.	Increased pests and diseases.	• Possible Irrigation irrigation areas ✓ Emergency of new pests and diseases due to different crops	• Use of crop varieties resistant to pest and diseases • Practice good agricultural practices like crop rotation. • Use of integrated pest management concept. • Minimise diseases vector breeding areas. • Use of certified seeds. • Controlled use of agrochemicals.	Community, Agricultural extension officers, County governments and seed company	During project Operation.	2,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			• Provision of post-harvest produce storage facilities. • Provision of food banks. • Sanitation in the field should be adequately maintained. • Training programs should be developed especially on integrated pest management. • Enforce the crops Act 2013 • Incase of new pests, early reporting to relevant authority before it spreads out.			
5.	Loss of habitat.	• Irrigation ✓ Changing of habitat to other uses like irrigation downstream	• KWS in consultations with the local people to gazette conservation areas where need be, • Key stakeholders to enhance public awareness and	GoK WRA. NEMA. Farmers.	operation phase	2,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			participation in conservation activities, • Enforcement of wildlife Act and EMCA 1999 (wetlands conservation) Act. • Planting of similar trees lost in other areas of the project to create more habitat that is vital for the project.			
6.	Water loss	• Dam and Water supply components, water pipe bursts ✓ Evaporation and evapotranspiration ✓ Pipe bursts	• Provide provision for roof catchment in the area to compensate on water loss	IWUA to be formed, Community, Agriculture, Fisheries and Food Authority (AFFA) and County governments).	Operation phase	5,000,000
7.	Water logging	• Possible Irrigation command area	• Ensuring efficient functioning of drain canals,	IWUA to be formed, Community in	Operation phase.	5,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
		✓ Poor drainage of soils ✓ Over irrigation of fields ✓ Excessive rainfall in the fields	• Proper maintenance of canals to avoid seepage and leakages, • Adopt agricultural practices that reduce hardpans, • Installation of appropriate drainage channels to drain any excess water from the farms, • Regular maintenance and operation of the irrigation infrastructure. • During time of rain season, water should not be allowed to be supplied to the irrigation areas or into the firms	cooperation with NWCPC. Dam Operating team.		
Pollution.						
8.	Water pollution.	• Water supply plant ✓ Wastes from operation	• The contractor and Community to prepare an integrated waste management plan	Kitui water and Sanitation Company	During operation.	5,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			during construction and operation period of the schemes, • maintain a vegetated strip of 6m along riverbanks, • Ensure recommended water quality standards in the tail water are adhered to as per the provisions of NEMA water quality regulation. • Regular water sampling of boreholes and water downstream to detect water pollution that will be handled immediately.			
9.	Excessive Noise and Vibrations.	• Irrigation and Water supply plant ✓ Machines operation ✓ Pumps operation	• Switching off machines that are not in use • avoiding unnecessary hooting,	Kitui water and Sanitation Company	During Operation	1,500,00

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			• workers to be provided with personal protection equipment, • machines to be serviced to reduce generation of noise and vibrations, • the noisy activities should be restricted to daytime • Ensure that NEMA noise and Vibration standards are observed in all project activities.			
10.	Water borne Diseases.	• Possible Irrigation areas ✓ Weeding in flooded areas ✓ Using of water from the irrigation areas for domestic uses	• public awareness and campaigns on hygiene behaviour change, • Promotion of household water treatment methods • provision of safe water for domestic use to the local people • Provision of alternative water sources to those who use water from	Community to work with the County governments, TANATHI WWDA and other relevant institutions.	During project operation.	5,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			wells being affected by the project • Use of protection gears such as gumboots by farmers. • Building of hospitals in the project area and equipping them to treat the illnesses when they occur.			
11.	Changes in Hydraulics of the river.	•	• Control the amount of water released from the dam not to go below the base flow downstream. • Clean tail water and channel back to the river particularly in flood irrigation schemes. • Use high water conservation agricultural practices to reduce amount of	IWUA/ WRUA. WRA. Community and County government of Kitui	Operation phase.	2,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			water used (Planting of high land rice variety). • Provision of water harvesting and storage facilities during wet seasons to supplement abstracted water. • Plant more water loving trees in the project area to increase flows in the river			
12.	Exhaust fumes	• Power house, and irrigation components • Operation of the power house • Machine operation during ploughing releasing carbon-monoxides	• use of clean petroleum that is low in sulphur, lead or other pollutants in operation vehicles, • proper servicing of vehicles and Construction machines according to manufacturer's specifications • Plant more vegetation for carbon sequestration.	Community	During decommissioning.	2,000,000.

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
13.	Agrochemical Pollution	• Possible Irrigation areas downstream ✓ Spraying of chemicals ✓ Applying of fertilizers during planting	• Use of personal protection gears during spraying, • adoption of integrated pest management practices, • Planting of wind break vegetation, • spraying of crops should be done on a calm day • Adoption of sustainable agricultural practices to reduce the impacts of agrochemical pollution. • Strict following of manufacturers conditions when using chemicals • Adequate capacity building of farmers on agro-chemical use.	Community, County governments	During operation	5,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
14.	Greenhouse gases (Methane)	• Irrigation ✓ Water logging as a result of poor drainage ✓ Burning of biomass by farmers	• Reduce water logging to allow aeration of the soils particularly after harvesting paddy crops. It can be done by draining paddies once or several times during the growing seasons. • Avoiding biomass burning but instead use it for composed organic manure • Crop residues or organic manure to be applied on dry fields to increase aerobic decomposition of the matter. • Practicing agroforestry by planting plants with high primary productivity for carbon sequestration.	Community.	Operation phase.	2,000,000
Soil.						

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
15.	Soil erosion.	• Irrigation components and catchment management component ✓ Clearing of vegetation for irrigation purpose ✓ Planting of trees ✓ Building of gabions ✓ Canal water flow rate	• Planting of trees in the project catchment areas to minimize soil erosion • Where there is intense soil erosion, gabions should be built as a measure to reduce soil erosion • There should be intensive re-vegetation on bare grounds after construction. • Compaction of loose soils after excavations and reuse of materials for refill. • The canal design to adopt sub critical flow velocity to avoid erosion. • Practice of conservation agriculture. • Enforce the crops Act 2013	County governments and Community.	During construction operation and decommissioning.	5,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
Wastes.						
16.	Wastewater and effluents.	• Dam, water supply and possible irrigation command area ✓ Pollution of water as a result of project implementation	• Any pollution incidents on site should be resolved speedily. • Frequent measurement on effluents from project area to rectify mitigation measures if pollution is taking place.	County Government of Kitui.	During operation a	3,000,000
Social issues.						
17.	Increased child labour / workload for women.	• Possible Irrigation areas ✓ Child labour in agricultural farms	• Enforcement of the Government policy on compulsory primary and secondary education, • Hiring people with national Identification Cards and • Promoting public awareness on gender roles.	Community.	Construction phase.	200,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
18.	Increased communicable diseases.	• Dam, water supply component ✓ Spread of HIV/AIDS to workers and locals	• Hospitals should be built in the project area for to treat the locals for all the illnesses. • Carry out public awareness campaigns against HIV/AIDS, STIs, Tuberculosis and other communicable diseases present in the area, • Accessible health care services to be provided to the local populace, • Free VCT centres to be provided in the project area as well as sex education and awareness among the youth.	workers Community. Ministry of health and County government of Kitui	Operation phase.	5,000,000
19.	Increase in vector borne diseases	• Dam and Possible irrigation activities downstream ✓ Spread of malaria spreading mosquitoes	• Stagnant water should be regularly drained off to prevent potential breeding grounds for mosquitoes.	County Government of Kitui Ministry of Health.	During project operation.	5,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
		✓ Working barefoot in flooded fields leading to vector borne diseases	• Regular spraying within trees • Public awareness and sensitization on management and prevention of vector breeding for Malaria, Bilharzias, Filariasis, Dracontiasis or Trypanosomiasis, • Provision of sanitation services in the project area, provision and equipping of medical facilities in the project area, • Use of preventive measures such as protective clothing and controlling of flooding water in the project area through storage facilities will reduce impacts of vector borne diseases.	Community.		

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			• Adequate provision of health facilities by building of hospitals in the project area. • Regular spraying of homes to control presence of mosquitoes. • Adequate provision of mosquito nets at subsidized prices. • Adequate information should be disseminated regularly on the need to treat drinking water.			
20.	Human wildlife conflicts.	•	• The locals should not kill wild animals but instead call KWS to take them to conservation areas • KWS in consultations with the local people to gazette conservation areas where need be, • Key stakeholders to enhance public	NEMA, WRA, KWS and local communities.	During project Implementation and Operation	1,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			awareness and participation in conservation activities, • Enforcement of wildlife Act and EMCA 1999 (wetlands conservation) Act.			
21.	Downstream Water use conflicts.	• Dam and water supply and possible irrigation areas ✓ Conflicts due to overdraw of water upstream in the canal ✓ Less water going downstream along the river channel during dry season	• Formation of community irrigation water users associations for water conflicts resolution and management, • Enforcement and adhering to the water management rules by all key stakeholders, • Rationing irrigation water supply during dry seasons, • Harvesting of rain water for use during the dry season and	IWUAs WRUAs, County Government of Kitui, Operation team and Community.	During project Operation.	4,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			• The need to provide piped water supply for domestic users. • Base flow should be always released into the river to flow downstream			
22.	Social cultural changes	• Irrigation ✓ Change of culture for the locals due to development	• Preserve vegetative areas of cultural heritage. • Local people to adopt appropriate technology for crop and animal production. • The locals to adapt to social cultural changes through capacity building accepting change.. • Improve local varieties through research. • Synchronized celebration of cultural festive and agricultural	County government of Kitui and Community.	During project operation	No direct cost estimates.

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			production work related activities.			
Public Health and safety Plan.						
23.	Occupational Health and Safety (OHS).	▪ Dam Water supply, and possible irrigation downstream ✓ Crossing of canals on roads ✓ Safety of downstream people and properties when the dam is in breach ✓ Safety of workers working in irrigation areas	▪ Ensure safety of the workers by putting first aid area and injury reporting mechanism ▪ Establish the appropriate safety measures in the O & M manual for the operation phases. ▪ Ensure compliance to Occupational Safety and Health Act Cap. 514 and its Subsidiary Legislations. ▪ Provide adequate crossings where canals will pass ▪ Provide personal protective equipment to workers. ▪ There should be adequate provision of the requisite sanitation facilities for human	Community	Operation phase.	Part of construction cost.

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			waste disposal ▪ The workers should receive the requisite training especially on the operation of the machinery and equipment. ▪ Preparation of a working dam safety plan is attached in the report ▪ Provision of prevention tools such as condoms at the health center and construction site availed to all			
Cost of ESMP at Operation Stage						**53,500,000**
ESM During Decommissioning Phase						
1.	Increased waste generation	▪ All the project Components ✓ Renovation of dilapidated components ✓ Demolition of them when necessary ✓ Transportation	▪ promote the reuse, recycling and reduction of wastes generated, ▪ Provision of adequate litter collection facilities,	Demolition contractor	Decommissioning phase	2,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
		of wastes ✓ Disposal of wastes	▪ Approval of waste disposal sites by NEMA in accordance with the waste management regulations, ▪ The chemical and hazardous wastes should not be burnt or dumped in open pits ▪ Debris should be utilized in filling up of quarries within the project area			
2.	Dust pollution	▪ All components ✓ Renovation of dilapidated components ✓ Demolition of them when necessary	▪ The access roads to be watered during the re-construction/demolition period, ▪ Plant more vegetation for carbon sequestration, ▪ limit the speed on dusty roads,	Demolition contractor	Decommissioning	2,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			▪ Workers to use masks when working in dusty conditions.			
3.	Noise Pollution	▪ All components ✓ Renovation of dilapidated components ✓ Demolition of them when necessary	▪ Switching off machines that are not in use ▪ avoiding unnecessary hooting, ▪ workers to be provided with personal protection equipment, ▪ machines to be serviced to reduce generation of noise and vibrations, ▪ the noisy activities should be restricted to daytime ▪ Ensure that NEMA noise and Vibration standards are observed in all project activities.	Decommissioning Contractor	Decommissioning phase	2,000,000
4.	Occupation health and Safety	▪ All components of the project ✓ Renovation of dilapidated components	▪ Ensure safety of the farm workers by putting first aid area and injury reporting mechanism	Decommissioning Contractor	Decommissioning phase	3,000,000

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
		✓ Demolition of them when necessary	▪ Establish the appropriate safety measures in the O & M manual for the operation phases. ▪ Ensure compliance to Occupational Safety and Health Act Cap. 514 and its Subsidiary Legislations. ▪ Provide adequate crossings where canals will pass ▪ Provide personal protective equipment to workers. ▪ There should be adequate provision of the requisite sanitation facilities for human waste disposal ▪ The workers should receive the requisite training especially on the operation of the machinery and equipment. ▪ Preparation of a working dam safety			

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			plan is attached in the report ▪ Provision of prevention tools such as condoms at the health center and construction site availed to all ▪			
5.	Aesthetic value	▪ All components of the project ✓ Renovating project components ✓ Demolishing of components	▪ Restoring sites back to their original state of make them better ▪ Planting of trees ▪ Planting of grass in	Decommissioning contractor and the Government of Kenya	Decommissioning phase	5,000,000
6.	Exhaust fumes	• Power house, and irrigation components • Operation of the power house • Machine operation during decommissioning releasing carbon-monoxides	• use of clean petroleum that is low in sulphur, lead or other pollutants in operation vehicles, • proper servicing of vehicles and Construction machines according to manufacturer's specifications	Decommissioning contractor	During decommissioning.	2,000,000.

No.	Potential Impacts	Project component and Activities	Mitigation measures	Responsibility	Time frame	Cost Ksh.
			• Plant more vegetation for carbon sequestration.			
Cost of ESMP at Decommissioning Stage						16,000,000
Total COST of ESMP						**91,500,000**

NATIONAL WATER HARVESTING & STORAGE AUTHORITY

Hifadhi Maji, Boresha Maisha

8. PUBLIC PARTICIPATION

The main purpose of the public participation was to provide a platform for the community to discuss expected social and environmental impacts of the proposed project.

8.1. Methodology

Selection of venue and date of meeting was done in consultation with the local administration of Two venues were identified: Kwa – Ukungu Catholic Church Hall and Mayengo's Chief's Camp Hall.

The public (community) were notified of the public participation date and venue through their respective chiefs and sub-chiefs. Key stakeholders among them the County Commissioner, Deputy County Commissioner and County Government were consulted to collect data and capture their views regarding the Umaa dam project.

Officers from National Water Harvesting and Storage Authority did presentation about the Umaa dam project for the purpose of enabling the community to clearly understand all the aspects of the project. The participants were then allowed to give their contributions and concerns regarding the project. Data was also collected by administering of questionnaires, Focus group discussions and Key informant interviews

8.2. Outcome of the Consultative public participation

No	Name	Concern	Response
1	Caroline K. David	How will the women benefit from the Project?	Instead of spending more hours searching for water it would be easily available
2	Sarah Josephat	Will people from the community benefit from the project in terms of Jobs etc? especially their children	Yes. The community will be considered first when it comes to the project to be implemented
3	Julius Mwema	What plans do NWHSA have for the catchment areas for the slopes to reduce soil erosion and siltation in the dam? What precautions are being taken when it comes to blasting and dust from the construction of the dam?	We shall ensure that the project is done well to avoid siltation into the dam. We shall put a check dam to help in the siltation of the sand. The community will be sensitized through a meeting to ensure that all people understand and are aware of the effects of the challenges through meeting

No	Name	Concern	Response
		Is there any medical cover in case one of the community members gets injured? Is NWHSA Intending to plant trees to conserve the environ? If so, are the trees provided or they will look for their trees to plant. How will they filter workers since they come from 6 sub locations?	Yes The community will be informed about the opportunity so that they can apply for the post.
4	Sarah Mitau	Who will sponsor the project? Is it the National Government or the Donor? How will they account for the funds which are going to be used on the project? Will there be accountability and transparency? How will be the Quality of Water from the Dam?	National Government is the main sponsor of this project. There will be site meeting every month and through the representatives they will be informed accordingly.
5	Catherine Mumo	Government Projects are slow to commence, when is this Umaa Dam commencing?	Once the designs are approved the work will commenced immediately.
6	Sila Muthome	How will the community from Musembo get water from the forest since they are on the upper kitui of the dam	They will ensure that people within the Umaa dam benefit, by either building water tank which will supply water to them or drill a borehole for them.
7	Joseph John	Will the road to Umaa dam be tarmacked?	No. it was not in the BQS but the road should be expanded to avoid traffic when works are being done.

Figure 20:Public participation at Kwa – Ukungu Catholic Church Hall

Figure 21:Public participation at Mayengo's Chief's Camp Hall.

8.3. Summary of the views expressed

1. The communities after understanding the project and what it entails are positive towards the project.
2. The community has great hopes that their perennial water problem would get a paramount solution once the Umaa dam is completed.
3. The community expects to be given priority in job opportunities once the project commences.

9. CONCLUSION AND RECOMMEDATION

9.1. Introduction

This EIA report was necessitated firstly by a need to define and address the fundamental environmental concerns relating to the development of the proposed Umaa Dam in Kitui County to integrate them in the design of the project in order to ensure maximization of expected benefits and a reduction of negative impacts. Secondly and as required by National Environment Management Authority to acquire the license to develop the project.

9.2. Findings

i. The proposed Umaa dam is seen by the local community as a major investment infrastructural project in the area with multiple benefits to the locals and as such the community and the stakeholders are generally supportive of the project.
ii. Currently Siltation of the reservoir is not considered a major problem to the proposed reservoir but may in future become a threat to the dam unless appropriate measures as detailed in the Environmental Management plan are enforced.
iii. Increased water supply beyond the current supply level will require that a suitable wastewater treatment and disposal facility be provided.
iv. There will be no flooding of any indigenous forest as the area does not have any but only exotic forest and therefore no biodiversity loss.
v. Dam construction and impoundment activities will not involve clearing and disposal of a huge biomass as the area to be impounded does not contain dense vegetation cover.
vi. Various positive impacts are likely to accrue from the proposed dam to the community and to the country.
vii. There will be no need for resettlement and compensation as the land was legally acquired from the local community and compensation made.
viii. Dam decommissioning shall be considered only after a review of all remediation options.
ix. There are no documented mineral deposits in the area to be inundated.

9.3. Conclusion

Based on the findings, it is evident that construction of the proposed dam will result in overall socio-economic growth and development because of improvements in the availability of safe
drinking water and for domestic uses in Kitui town and its surroundings. The potential negative impacts can be mitigated with strict adherence to the ESMP

9.4. Recommendations

Based on the above observations and taking into consideration that this study did not identify any negative environmental impacts for which suitable mitigation measures could not be suggested, the project is therefore considered socio-economically acceptable and environmentally sound and is therefore recommended for approval by NEMA and subsequent implementation.