

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY
REPORT FOR THE PROPOSED CONSTRUCTION OF 28MW KHALALA
HYDROPOWER PROJECT ALONG NZOIA RIVER AT KHALALA
BRIDGE IN SITIKHO LOCATION, WEBUYE WEST SUB-COUNTY, BUNGOMA
COUNTY



January, 2019

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ECOTECH ENGINEERING LIMITED
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DECLARATION

I hereby declare that we, Ecotech Engineering Limited:

- have knowledge of and experience in conducting assessments, including knowledge of the Environmental Management and Coordination Act, Cap 387, its regulations and guidelines that have relevance to the proposed Khalala Hydropower Project;
- have performed the work relating to this project in an objective manner, regardless of whether or not the views and findings were favourable to the proponent;
- have complied with the Act - Cap 387 and its regulations, guidelines and other applicable laws both at the County, National and International levels.

I also declare that there is, to my knowledge, no information in my possession that reasonably has or may have the potential of influencing:

- any decision to be taken with respect to the application in terms of the Act and its regulations; or
- the objectivity of this ESIA Report, ESMP or any other document prepared in terms of the Act and its regulations that relates to this project.

.....

Consultants Team Leader Name and Signature **Date**

Khalala Hydropower Kenya Limited hereby declares her intention to abide by the existing international and / or national laws and regulations regarding environmental protection during the construction, operation and decommissioning of the proposed Khalala Hydropower Project.

Khalala Hydro Power Kenya Ltd is committed to the implementation of the Environmental and Social Management Plan (ESMP) proposed in this ESIA report and other mitigation measures recommended as well as other best practices in the world. Khalala Hydro Power Kenya Limited to the best of our knowledge; we declare and submit that all information contained in this report is an accurate and a truthful representation of the Environmental and Social Impact Assessment Study.

.....

Proponent’s Representative Name and Signature **Date**

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LIST OF ABBREVIATIONS AND ACRONYMS

A.S.L	Above Sea Level
AQG's	Air Quality Guidelines
CIA	Cumulative Impact Assessments
CIDP	County Integrated Development Plan
CSR	Corporate Social Responsibility
CSR	Corporate Social Responsibility
dB	Decibel
DOSHS	Directorate of Occupational Safety and Health Services
EF	Environmental Flow
EHS	Environmental, Health, and Safety
EM	Electro-Mechanical
EMCA	Environmental Management and Coordination Act
EPC	Engineering Procurement and Construction
EPC	Engineering Procurement and Construction
EPs	Equator Principles
ERC	Energy Regulatory Commission
ERC	Energy Regulatory Commission
ESH	Environmental Sanitation and Hygiene
ESIA	Environment and Social Impact Assessment
ESMP	Environment and Social Management Plan
FDC	Flow Duration Curve
FiTs	Feed-in-Tariffs
GHG	Green House Gas
GIIP	Good International Industry Practice
GoK	Government of Kenya
GPS	Global Positioning System
GSS	Grid Sub Station
GWh	Giga Watt Hour
HMMP	Hazardous Materials Management Plan
HSE	Health Safety and Environment
IEIA	Integrated Environment Impact Assessment

IFC	International Finance Corporation
IPPs	Independent Power Producers
ITCZ	Inter-Tropical Convergence Zone
KEBS	Kenya Bureau of Standards
KEBS	Kenya Bureau of Standards
KEMFRI	Kenya Marine and Fisheries Research Institute
KETRACO	Kenya Electricity Transmission Line
KHP	Khalala Hydropower Project
KP	Kenya Power
kV	Kilo Volt
KWS	Kenya Wildlife Service
LPG	Liquefied Petroleum Gas
M&E	Monitoring and Evaluation
M&E	Monitoring and Evaluation
m ³	Cubic metres
MCM	Million Cubic Metres
mg/m ³	Milligrams per Cubic Metre
Mm	millimetres
MoE	Ministry of Energy
MP	Measurement Point
MSMEs	Micro, Small and Medium Enterprises
MVA	Mega Volt-ampere
MW	Mega Watts
NEMA	National Environment Management Authority
NLC	National Land Commission
O&M	Operation and Maintenance
ODS	Ozone Depleting Substances
OEL	Occupational Exposure Level
PAI	Project Area of Influence
PAPs	Project Affected Peoples
PC&D	Public Consultation and Disclosure

PCR	Physical Cultural Resources
PCs	Public Consultations
PM10	Particulate Matter less than 10 micrometres in diameter
PM2.5	Particulate Matter less than 2.5 micrometres in diameter
POC	Point of Connection
PPA	Power Purchase Agreement
PPE	Personal Protective Equipment
PSCP	Pollutant Spill Contingency Plan
RAP	Resettlement Action Plan
RES	Renewable Energy Sources
SCR	Short Circuit Ratio
SHOC	Safe Handling of Chemicals
Sq.	Square
STP	Sewerage Treatment Plant
TMP	Traffic Management Plan
ToR	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change
VECs	Valued Ecosystem Components
WB	World Bank
WBG	World Bank Group
WHO	World Health Organization
WRA	Water Resources Authority
WRMA	Water Resources Management Authority
WTN	Waste Transfer Notes

NON-TECHNICAL EXECUTIVE SUMMARY

Introduction

Khalala Hydropower Kenya Limited proposes to set up a hydropower facility - Khalala Hydropower Project (KHP) in the upper reaches of River Nzoia at Khalala Bridge in Sitikho Location, Webuye West Sub-county, Bungoma County in Western Kenya with a total capacity of 28MW. The power that will be generated from this facility is approximately 129 GWh per year at an Environmental Flow of 6m³/s as determined by the hydrological surveys conducted on the river.

Project Location

The proposed Khalala Hydropower Project is located 19 Km from Webuye town in the upper reaches of River Nzoia in the villages of Sitikho and Khalala Msabale, Sitikho Sub-location, Webuye West sub-county, Bungoma County with only the weir and intake access road located within Sikubale village, Sivilie location, Navakholo Sub-County in Kakamega County.

Country Profile

Kenya as a country has a considerable hydropower potential estimated in the range of 3000 - 6000 MW. Currently over 750MW is exploited, mainly in large installations owned by the national power generation utility, KenGen. This hydropower potential is located in five geographical regions, representing Kenya's major drainage basins as elaborated in section 1.2 of this ESIA report.

The Applicant/Proponent

Khalala Hydropower Kenya Limited is a privately owned entity incorporated in Kenya in the year 2018 and legally permitted to transact and engage in any undertaking within the country.

Project description

The Khalala Hydropower Project (KHP) is a proposed hydropower facility expected to generate 28MW of electricity with an annual energy output of 129 GWh at 6m³/s of Environmental Flow. The project shall involve harnessing the hydropower potential of the River Nzoia with the headwork's located at Khalala Bridge and discharging the water through a 5600m long conveyance system to the forebay tank and thereafter by a 800m long penstock pipe to the powerhouse located near River Nzoia in Khalala Msabale village. After the power generation, the water will be released back into River Nzoia through a tailrace channel of 30m. The power generated will then be connected to the National Grid, either through (i) Connection to 33kV bus at Musaga 132/33kV substation via a double circuit 33kV line; (ii) Connection to the existing 132kV Uganda – Musaga line using: a) 132kV Loop in – Loop out connection and b) 132kV Tee-off connection; and (iii) Connection to 132kV bus at Musaga 132/33kV substation via: a) a 33kV double circuit line and a 33/132kV transformer at Musaga; and b) a direct 132kV single circuit evacuation line.

Project components

The major components that will form part of the proposed Khalala Hydropower Project include; Weir and Intake structure, Desander/ de-silting tank and Headrace Channel,

Forebay, Spillway, Penstock pipe, Power House, Tailrace water discharge, six access roads and a construction workers camp site.

Access roads

The access roads proposed for the project are six in number. All these access roads are existing community roads hence minimal impacts are expected from the construction, grading and improvement of these access roads. The proponent has also proposed to have two motorable crossing points on the headrace canal as well as several pedestrian and animal crossing points.

Project cost and investment plan

The estimated cost for this project is 81.92 Million United States Dollar

Need for ESIA

Following the gazettelement of the *Environmental (Impact Assessment and Audit) Regulations* in June 2003; Revised 2016, and the Principal Act (*EMCA*), 1999, (Amendments, 2015) all proposed projects must undertake an Environmental Impact Assessment pursuant to facilities and utilities listed in the Second Schedule of the *Environmental Management and Co-ordination* Section 58 of the Principal Act. The proposed Khalala Hydropower Project as stipulated under the Second Schedule (Section.58 (1), (4)): *Being an 'Electrical infrastructure (Item No. 10, (a) electricity generation stations), '(i) an activity out of character with its surrounding' [which is] (ii) out scale with its surroundings and (iii) involves major change in land use (No. 1)'. and thus the need to undertake the ESIA for the proposed project.*

Policy, Administrative and Legal Framework

The Environmental Management and Co-ordination Act (EMCA), No. 8, 1999 (Amendments, 2015)/ Cap 387 and the Environmental (Impact Assessment and Audit) Regulations of 2003; 2016 are the legislative framework for EIA in Kenya. Section 58 of the Act requires all projects in the second schedule to carry out Integrated Environmental Impact Assessments. Section 18 of the regulation gives information to be captured in the IEIA Report. The National Environment Management Authority (NEMA) is the institution charged with overseeing the implementation of EMCA Cap 387 and subsequent amendments and statutes thereafter. The proposed project falls within the Second Schedule of the EMCA. Other statutes include: Public Health Act, Cap 242; Water Act, 2016; Local Government Act, Cap 265; Penal Code, Cap 63; Energy Act, 2006; Electric Power Act, 1997; OSHA 2007; The Physical Planning Act of 1996, Cap 286; The County Governments Act, 2017; EMC (Water Quality) Regulations 2006; EMC (Waste management) Regulation 2006; EMC (Noise and Excessive Vibration Pollution Control) Regulations 2009; EMC (Air Quality) Regulations 2014; and the Land Planning Act, Cap. 303 amongst others.

Objectives of the ESIA

The current Environmental and Social Impact Assessment evaluates the magnitude of potential benefits and impacts on the natural and human environment, during the construction and operation of the proposed Khalala Hydropower Project. All short and long term, direct and indirect impacts, including residual impacts that may persist after

the application of the proposed mitigation measures, were identified and analyzed appropriately.

Scope of the ESIA

The ESIA report covers all the activities (construction and operation phases) of the proposed Khalala Hydropower Project as described in the project description. These include construction of project infrastructure including; the weir and intake, headrace canal, forebay, spillway pipe, penstock pipe, powerhouse, tailrace water discharge point, the six associated access roads and installation of the power generation equipment.

Assessment Methods and Significance

The approach to assessing and assigning significance to an environmental effect relied upon a Magnitude-Sensitivity matrix as well as expert judgements and reasoned argument; consideration of any relevant County, National and International Legislation, Regulations, Standards or Codes of Practice as well as the advice and views of relevant Governmental Organizations and stakeholders were also important in making conclusions.

Bio-physical Environment

Study Area

The study area was chosen after a preliminary assessment of the hydrological and environmental characteristics of the area and the identification of key issues arising from the construction and operation of the proposed Khalala Hydropower Project development. This allowed for the detection of environmentally sensitive receptors and the extent of the possible impacts associated with the project development.

Climate and Meteorology

The climate of the area is mainly tropical humid and receives mean rainfall of between 1,200-2,700mm to a minimum of 600-1,100mm per year. The project area is characterized by annual day temperatures varying from 16°C in the highland areas of Cherangany Hills and Mt Elgon to 28°C in the low land areas.

Air Quality

The most important sources of air pollution in the project area are motor vehicles and trucks hauling sugarcane. Air pollution within the project area is not considered to be a high risk as yet but anticipated to be high during the project construction phase.

Noise quality

Noise levels were recorded at the proposed project components location; mainly the weir, forebay and powerhouse as well as other ambient background noise measurement points such as residential areas and schools. Records of the minimum and maximum noise levels were taken and the average calculated for each of the areas.

Landscape physiography and Topography

The major physical features in the region include; the extinct volcanic Mt Elgon, Mt. Elgon forest reserve, National park and mountain vegetation. At the project site there is Sitikho falls as well as the rocky outcrops.

Hydrology and Catchment characteristics

River Nzoia originates on the easterly slopes of Mt Elgon and Cherangani hills through Kitale plain, which forms part of the pre-Miocene period and has a slight southerly tilt with the principal drainage system eventually flowing into Lake Victoria.

Flow Analysis and River Discharge

A flow duration curve (FDC) for a particular point on a river that shows the proportion of time during which the discharge there equals or exceeds certain values. The total average discharge from the measurement carried out at the Khalala Bridges was 42.10m³/s at 1754 hrs with a flow velocity of 0.47m/s. The river at the site was 24.64m wide with an area of 88.91m².

Environmental Flows

Environmental Flows (EF) is the flows of water (in terms of quality, quantity and timing) in rivers that is necessary to maintain aquatic ecosystems. The calculated Environmental Flow for the project is either 10m³/s or 6m³/s.

Water quality

Surface water sampling was undertaken to ascertain the river system health based on a number of parameters. The parameters under analysis were color, electrical conductivity, odour, PH, suspended matter, taste, calcium, chloride, magnesium, sodium, total dissolved solids, total hardness, total iron, zinc, ammonia, fluorides, lead, manganese, nitrates phosphates and nitrites among others.

During the survey, seven water samples were collected from a number of sampling points to ascertain the river system health based on a number of parameters. The samples included; Sample Reference WS-001 and BWS-001 from the proposed Powerhouse location, Sample Reference BWS-002 from the proposed forebay location parallel to the river, Sample Reference WS-003 from the proposed sediment tank location in Sitikho, Sample Reference WS-004 and BWS-003 from the proposed weir location at Khalala Bridge; and Sample Reference WS-002 from Msabale Community spring. The waters from the river were chemically not fit for use but Sample Reference WS-002 was found to be adequate for drinking purposes.

Geology

The lower sections of the catchment area have granitoid intrusions as the dominant types of rocks that have undergone a high degree of metamorphism. Most of the upper part of Nzoia catchment are separated by the Nandi escapement and consist of gneisses with no intrusions present.

Soils and Soil quality

Soils within the catchment are underlain by weathering products of granitic rocks together with the associated metamorphics. These are generally moderately reddish brown to red latosols (mostly Ferralsols and Nitosols). The soils were tested and found to be mainly acidic in nature.

Vegetation

The immediate impact zone of the project comprises mostly of manmade habitats and therefore the floral diversity was found to be low. The vegetation type and distribution in the project area has been influenced by the landform, climatic factors, soil, animals and human factors. The key vegetation types included shrubs, grasses, woodlands and

farmlands. None of the recorded plant species were unique or restricted to the area. Furthermore, none of the species identified are listed as globally threatened (IUCN, 2012).

Provided in Section 3.4.1 of this ESIA, are the detailed descriptions of the general vegetation in the project area and the vegetation of the key project features such as:(i) at the proposed weir site, (ii) at the proposed forebay tank, and (iii) at the proposed powerhouse/ tail race water discharge point.

Fauna

Only a few species of mammals were observed during this survey. The fauna of this area include Mongoose, Hares, Ground squirrels, moles and rats. Other forms of mammals are found in conservation reserves such as Mt Elgon forest reserve and National park. Opportunistic encounters was used during the field survey and it involved recording any mammalian, amphibian or reptilian and bird species encountered anywhere within the project area.

The bird species that were encountered most frequently include species such as; *Coliusstriatus kikuyuensis* (specked mouse bird), *Pachyphantes superciliosus* (compact weaver), *Plocues cucullatus* (Black-headed village weaver), *Streptopelia capicola* (ring-necked dove) and *Lagonosticta rubricate hildebrandtii* (African firefinch). All these bird species in the project area are listed as of Least Concern according to the IUCN Red list.

Aquatic Biodiversity

The ESIA study was conducted over a short duration and could not be relied upon to undertake aquatic environment assessment and hence the decision to rely on Kenya Marine and Fisheries Research Institute survey reports of the River Nzoia ecosystem surveys carried out in 2018. Both physical characteristics and water quality chemical parameters are pertinent to characterization of the aquatic habitat hence samples were also collected for this purpose and results are presented in other sections of this ESIA report.

Socio-economic characteristics

The proposed project's area of influence (PAI) is defined to include the villages of Sikubale on the left bank of the river in Navakholo Sub-county, Kakamega County (where the weir will be located), while Mwembula, Murono, Welemba, Kisengwa and Cheliminyi are located within Webuye West and this is where the headrace canal passes; other villages include: Msabale, Khalala, Nambindo and Siranjofu villages where the forebay, penstock, and powerhouse are to be located) in Webuye West Sub-County, Bungoma County.

Assessment methodology

In order to adequately assess the socio-economic baseline, both qualitative and quantitative methods were used. A socio-economic matrix was first developed which included listing of all the relevant stakeholders and key parameters for consideration in the proposed project area. Data collection was undertaken at the household level as well as communities/ settlements and other relevant aggregations as identified in the matrix. Techniques that were used in data collection include:

- Secondary data collection at both local/ County and national levels;

- Structured interviews and questionnaires: In these interviews, the same questions were asked in the same order using questionnaires so as to provide systematic analysis and comparisons.
- Stakeholder engagement and public meeting
- Photography: photographs of importance and concerns on current situation of the various sites, stakeholder meetings and the surrounding physical, biotic and social environment were taken using digital cameras to record empirical evidence;
- Mapping: data was captured using GPS and maps processed using GIS to identify the existing status of physical features, geology and soil, drainage vegetation and land use, population and administrative units.

Stakeholder Consultation

Brief and concise consultations were carried out in diverse parts of the project area with the following aims:

- To inform the County and community leaders and interested parties about the proposed project;
- To get the general overview of the project area from the community perspective;
- To establish if the local people have any issues of concern with regard to the proposed Khalala Hydropower Project;
- To identify and document the diverse socio-cultural and economic setups in the project area that could be potentially impacted by the project activities; and
- To document the views, opinions and comments received from both the public and the key stakeholder engaged.

The socio-economic baseline data collected is provided in Chapter Three while the details of public participation and Stakeholder Engagements are presented in Chapter Six.

Location and Administrative structures

Both Bungoma and Kakamega Counties are situated in the former Western Province of Kenya. Bungoma County lies between latitude 0⁰ 28' and latitude 10 30' North of the Equator, and longitude 34⁰ 20' East and 35⁰ 15' East of the Greenwich Meridian. The project is located along River Nzoia which acts as the boundary between the two counties. The weir and intake point are located in Sivilie Location within Kakamega County while the rest of the civil works are in Sitikho Location in Bungoma County.

Demographic Characteristics and Religion

The 2009 Kenya Population and Housing Census showed that Bungoma County had a population of 1,374,627 made up of 671,222 males and 703,405 females. This population was projected to grow to 1,919,490 and 2,040,343 in 2020 and 2022 respectively. Based on the Census report, Kakamega County had a population of 1,660,651 comprising 800,896 males and 859,755. This was projected to grow at an annual growth rate of 2.5% thus; the county population was projected to grow to 2,184,885 and 2,296,907 by the year 2020 and 2022 respectively.

Ethnicity and Religion

Ethnically the population in the project affected areas is not culturally diverse with almost the entire population being Luhya speaking. According to socio-economic census survey carried out during the household data collection, the affected persons in the PAI belong primarily to the variants of Bukusu and Abanyala sub-tribes and speak 'Lubukusu' and 'Olunyala' respectively. Both sub-tribes fall within the broad Luhya Bantu category. The people in the PAI closely identify with these two sub-tribes and most socio-cultural interactions are defined by the customs and traditions of their respective sub-tribe.

The baseline data indicates that 90% of the villagers living in the affected villages are Christian by faith and the rest are Muslims in the area.

Education Levels and health status

According to the socio-economic census survey conducted in the PAI, literacy and education levels among the PAP household members indicated that most of the household heads could read and write in any language. Most of the children in the PAP households attended government primary schools.

Notable health facilities in the vicinity of the project area include Khalala, Sitikho, Kuywa and Milo Dispensaries with the most prevalent diseases in the PAI found to be Malaria, stomach Problems, Respiratory problems and HIV.(See Figure 3-11)

Water

In general, it was established that the two counties rely on both surface and ground water sources for its supply. Most of the PAPs households use unprotected water sources like rivers and streams. The main source of drinking water was from community springs and that used for other domestic purposes was obtained from River Nzoia.

Transport

The PAI is linked via an earth road traversing through the project area from Webuye approximately 19km. There are several other community access roads which are generally in a pretty dilapidated condition and become impassable especially during the heavy rain season. Most of these access roads have been earmarked for upgrading and will be used in accessing project features.

Settlement and land use

The Counties of Bungoma and Kakamega are rural counties where by majority of people have settled in rural areas with a few in urban areas. The rural settlement is scattered with uneven settlement patterns

Land is a factor of production where all economic and social activities take place. Land use pattern in the two counties include: agriculture, forestry, mining, construction of human settlements, business, social and public amenities. Bungoma County has 2,880.78 sq. km of arable land mainly for crop farming and livestock production.

Land Tenure

Land in the two counties can be classified into public land, community land and private land. The existing land tenure systems within the PAI, have evolved under different socio-economic settings that include; customary, leasehold and freehold tenure. In

general, land within the PAI is considered customarily owned where the rights of land are regulated by the local customs. The people of the present generation inherit land from the previous generation. This system has led to increasing fragmentation of land and in turn to inefficiency in agricultural production as observed during the survey.

Sources of energy

The residents of the project area depend upon various sources to meet their daily energy requirement for lighting and cooking. Solar is the major source of lighting in the project area. 59% of respondents indicated that their major lighting source is solar while 36% use kerosene lamps and only 5% make use of electricity.

Agriculture

This is the dominant type of land use in the area and the crops grown include; maize, cassava, banana, beans and other vegetables and fruits. Cash crop included mainly sugarcane.

Livestock production

Main livestock in the project area are cattle, sheep, goats, donkeys and pigs. Other animals kept by the residents are rabbits and poultry. In Bungoma County, the average land carrying capacity is 3 livestock units per acre. Indigenous chicken and cattle are the most common livestock kept by PAPs families.

Archaeological Cultural property

There were no significant historical, archaeological or protected resources or areas that are recognized officially by the National Museums of Kenya on or near the project area. Individual villages and households have their revered areas such as shrines where they conduct bi-annual traditional circumcision rites. Such a site was located a few metres from the proposed weir and intake location.

Potential impacts

The following table identifies the relevant and potential impacts associated with the proposed Khalala Hydropower Project. A complete discussion of the impact assessment is provided in Chapter 7 of this ESIA report.

Impact rating after mitigation for the proposed Khalala Hydropower Project

Environmental Impact	Phase	Impact severity after mitigation
Impact on Nzoia River Ecology	Construction	Minor (3)
	Operations	Minor (3)
Loss of crops and property	Construction	Minor (4)
Land take/ loss	Construction	Minor (4)
Soil erosion	Construction	Minor (3)
Soil contamination	Construction	Minor (4)

Environmental Impact	Phase	Impact severity after mitigation
Increased diseases vector populations as a result of changes in water ecology	Operations	Minor (4)
Increased traffic	Construction	Minor (3)
Vegetation impacts	Construction	Minor (3)
Fauna impacts	Construction	Minor (3)
	Operations	Minor (3)
Sedimentation and siltation	Construction	Moderate(6)
Impact on downstream river flows and community water sources	Operations	Minor (4)
Impacts on surface water quality	Construction	Moderate(6)
	Operations	Minor (2)
Impacts on tourism and cultural resources	Construction	Minor (3)
Increased spread of STD's and other communicable diseases	Construction	Minor (4)
Physical resettlement of people and associated impacts	Construction	Moderate(8)
Vehicular and other equipment emissions	Construction	Minor (4)
Increased dust levels	Construction	Moderate(8)
Noise effect and vibrations	Construction	Minor (4)
	Operations	Minor (4)
Poor sanitation due to poor domestic waste practices	Construction	Minor (3)
Effects of blasting	Construction	Moderate(8)
Invasive plant species	Construction	Minor (3)
Increased Pressure on the social service sector	Construction	Moderate (6)
	Operations	Minor (3)

Unplanned/contingency impacts

These are non-routine events and unplanned impacts (contingency impacts). They were considered in this ESIA evaluation and include: floods; failure hazards (Weir break);

riots/ demonstrations /protests; accidents; and susceptibility of the project to Climate Change.

Cumulative impacts

Cumulative impacts are impact results from the aggregated effect of more than one project occurring at the same time, or the aggregated effect of sequential projects. A cumulative impact is “the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions”. This results to the impacts being classified as either additive or in-combination cumulative impacts. Key cumulative impacts would result from increased dust levels, traffic, and water use conflict.

Environmental management

Several key elements are involved in environmental best management; leadership and commitment; policy and objectives; organization, resources and documentation; evaluation and risk management; planning; implementation and monitoring; auditing and review. These tasks make up an effective environmental management systems.

The proponent is committed to minimizing the environmental impact of the project operations through complying with applicable environmental law and providing staff with adequate training to see the successful completion of the project.

Conclusion

The current ESIA has identified the environmental impacts arising during the construction and operation stages of the proposed project. Both positive and negative environmental effects with varying magnitudes and characteristics have been assessed. The application of the proposed mitigation measures is expected to alleviate majority of the impacts to the extent that no significant issues will remain. With regards to the more severe negative environmental effects described above, the use of best practice construction and management techniques in conjunction with the implementation of the proposed mitigation measures should limit their effect within acceptable limits. Based on the study assessment, and taking into account the significant and permanent benefits associated with the implementation of the project at the local, regional and national scales, the ESIA Study team supports the construction and subsequent operation of the Khalala Hydropower Project.

CHAPTER ONE

1. INTRODUCTION

1.1 INTRODUCTION

Khalala Hydropower Kenya Limited (Ltd) proposes to set up a hydropower facility - Khalala Hydropower Project (KHP) at Sitikho in Webuye West Sub-county, Bungoma County in Western Kenya with a total installed capacity of 28MW. This facility will utilise the hydropower potential of River Nzoia with the weir and intake point located at Khalala Bridge, in Sikubale village, Sivilie Location, Navakholo Sub-county, Kakamega County. The rest of the project features shall be located in Khalala and Sitikho areas of Sitikho Location, Webuye West Sub-county, Bungoma County. The power generated from the facility is determined to be approximately 129 GWh per year against 6m³/s of Environmental Flow (EF), which will be sold to the Kenya Power (KP), based on a Power Purchase Agreement (PPA) the company shall enter into with the utility company - Kenya Power at a later time.

The proponent is committed to ensure that the ecological integrity, healthy and sustainability of the environment is not compromised during the project lifecycle and as a requirement by the Government of Kenya to comply with the legal and regulatory laws and statutes. This necessitated the undertaking of this ESIA process. The proponent through the engagement with the Environmental Consultants has ensured that this new project undergoes an ESIA process in an effort to comply with the legal requirement of the Government of Kenya on the fulfilment of the Environmental (Impact Assessment and Audit) regulations 2003; 2016 and EMCA, 1999 (Amendments, 2015). The outcome of this exercise was this ESIA report that will be submitted to NEMA for approval and subsequent licensing of the project. The proposed Khalala Hydropower Project with an installed capacity of 28MW is a medium to high risk project according to NEMA's categorization of projects and therefore its impacts are deemed to be wide spread and with far reaching effects on the bio-physical and socio-economic welfare of the people but with the impacts envisaged being able to be mitigated with best industry practices.

However, according to World Bank categorization of projects the Khalala Hydropower Project is a Category B where the projects potential adverse environmental impacts on human populations or environmentally important areas are less adverse, the impacts are site-specific; few if any of them are irreversible; and most of the impacts can easily be mitigated through effective design. The good practice handbook on environmental flows for hydropower projects, Guidance for the private sector in emerging markets a production of the World Bank Group (2018) indicates that Khalala Hydropower is a low-impact design and operation project- the term used in reference to "run-of-river" hydropower project. From this handbook and as presented in the matrix of relative levels of (unmitigated) impact typically associated with 14 permutations of design and location of a single hydropower project the Khalala Hydropower Project is categorized in Group 1 out of the total 10 Groups that depends on the impact associated for categorization; where 0= no or minimal impact and 3= Large impact. Group 1 b;-Low-impact design and operation- with diversion and the 14 permutations relating to a typical run of the river hydropower is shown in Figure 1-1 below. The term run- of-river hydropower is a term that is widely used to convey the message that a hydropower project will have a low impact on its host river ecosystem as is the case for the proposed Khalala Project.

		Group 1		Low-impact design - no diversion		Low-impact design - with diversion - and operation	
		n/a	3	n/a	0	0	0
		n/a	0	0	0	0	0
		On tributary	0	0	0	0	0
		Mainstem upstream of large trib	0	0	0	0	0
		Mainstem downstream of large trib	0	0	0	0	0
		On tributary	0	0	0	0	0
		Mainstem upstream of large trib	0	0	0	0	0
		Mainstem downstream of large trib	0	0	0	0	0
		On tributary	0	0	0	0	0
		Mainstem upstream of large trib	0	0	0	0	0
		Mainstem downstream of large trib	0	0	0	0	0
		On tributary	1	1	1	1	1
		Mainstem upstream of large trib	1	1	1	1	1
		Mainstem downstream of large trib	2	3	2	3	3
		On tributary	0	0	0	0	0
		Mainstem upstream of large trib	0	0	0	0	0
		Mainstem downstream of large trib	0	0	0	0	0
		n/a	n/a	n/a	n/a	n/a	n/a
		Impact on dry season					
		Impact on wet season					
		Impact on dry season flow					
		Impact on wet season flow					
		Impact on timing of season					
		Upstream barrier effect					
		Downstream barrier effect					
		Dewatered river reach					
		Downstream of tailrace					
		Longitudinal connectivity					
		Inter-basin impacts					

Figure 1-1: Extract from World Bank Group Environmental Flows for Hydropower Projects Handbook

This project was thus subjected to an extensive and multidisciplinary ESIA exercise that formed the initial preliminary site assessment as part of the ESIA process before compilation of this ESIA report and development of an Environmental and Social Management Plan (ESMP) as per the requirements of Environmental (Impact Assessment and Audit) regulations 2003; 2016 and EMCA, 1999 (Amendments, 2015) and thereafter preparation of a Resettlement Action Plan (RAP) Study for the Project Affected Peoples (PAPs) in the Project Area of Influence (PAI).

1.2 BACKGROUND

Kenya has a promising potential for power generation from renewable energy sources. They include abundant solar, hydro, wind, biomass and geothermal resources that have led the government to seek the expansion of renewable energy generation in the country. The country has a considerable hydropower potential estimated in the range of 3000 - 6000 MW. Currently over 750MW is exploited, mainly in large installations owned by the national power generation utility, KenGen. The existing hydropower plants contribute about 30% of national annual electricity generation with at least half of the overall potential originating from smaller rivers that are key for small-hydro resource generated electricity. With the introduction of the feed in tariff policy in 2008 (2nd Revision, 2012) small-scale candidate sites have since come up and serve well for the supply of villages, small businesses or farms.

It is estimated that the undeveloped hydroelectric power potential of economic significance is 1,449 MW, out of which 1,249 MW is for projects of 30MW or bigger. The average energy production from these potential projects is estimated to be at least 5,605GWh per annum. This hydropower potential is located in five geographical regions,

representing Kenya's major drainage basins. They include: Lake Victoria basin-North and South (329MW); Rift Valley basin (305MW); Athi River basin (60MW); and Tana River basin (790MW). Khalala Hydropower Project is located in Lake Victoria North Catchment Basin at Sitikho area in Webuye West Sub-county. It is from the growing consciousness of the possibilities that small hydropower might offer vast generation options and several studies and investigations that led to the conceptualization of Khalala Hydropower Project – this is one of the few hydro schemes being realized as part of the national grid supply.

The economic risk in hydropower projects is large as they are capital intensive. Coupled with uncertainty with regard to power prices in the future, and the costs of building and producing hydropower varying strongly from one power plant to the other, investment in this sphere of renewable energy is still low. Additionally, a hydropower-dominated power system like Kenya's is vulnerable to large variations in rainfall and climate change. This may be a challenge at times of rains failure but for Khalala Hydropower Project which is located on River Nzoia, this is not expected as the plant is designed optimally to ensure generation even during low flows in the river. The capacity will not always be 28MW, it will vary with the flows hence the 6No. turbines.

The basis for undertaking this ESIA Study was that the proposed Khalala Hydropower Project (KHP) constitutes several activities, which would generate considerable changes and significant effects to the environment including land, water, atmospheric resources and biological diversity. The key activities that will be undertaken during the construction of the proposed Khalala Hydropower Project will involve the following among others:

- Construction of basic hydropower structures which include the Weir, Headrace channel, Sedimentation tank, Forebay Tank, Spillway, Penstock and powerhouse;
- Construction and development of the campsite;
- Construction of the transmission line;
- Acquisition of the right of way and land/ way leaves for the headrace canal; and
- Construction of access roads among others

The above mentioned activities might give rise to environmental and social impacts, both negative and positive. Impacts such as restriction on land use/ land intake, landscape impairment and visual amenity, and habitat encroachment that could affect flora and fauna, water resource contamination, and social disruption are likely to result from the implementation of the project. Therefore, proper identification, quantification and mitigation of potential impacts associated with the project are crucial prior to implementation. The ESIA was thus designed to establish, in advance, some appropriate level of environmental management measures for synchronization with project activities from the planning, implementation, operation and decommissioning stages. The current ESIA evaluation however does not address the environmental and social impacts of proposed transmission line. The proposed Khalala Hydropower Project is aimed at addressing the increased demand for energy in the Country.

1.3 THE PROPONENT

Khalala Hydropower Kenya Limited is a privately owned entity incorporated in Kenya in the year 2018 and legally permitted to transact and engage in any undertaking within the country.

1.4 THE CONSULTANT

Ecotech Engineering (K) Ltd is a privately owned Kenyan firm incorporated in the year 2015. Ecotech Engineering (K) Ltd (subsequently referred here as "Ecotech") is a mid-sized, environmental and engineering consulting firm that aims to provide engineering and environmental consulting services in the different industry sectors. Ecotech is a full environmental spectrum consulting firm that brings together diverse expertise needed to enhance the appropriate management of the environment and project engineering sustainability through proactive measures to enhance due diligence, efficiency and project execution. The company offers multi-disciplinary consulting, design and management services which provides our clients with solutions to complex issues that faces all sectors of commerce and industry today. These services are provided at a variety of levels and offer solutions to unique and technically challenging problems. The company is largely comprised of professional engineers, Health and safety experts, environmental experts and planners; and socio-economic/community development experts who provide technical expertise in a variety of engineering and project management services.

Based on the information of the construction and development of the proposed Khalala Hydropower Project at the proposed site and other project details, Ecotech purposed to undertake the ESIA process which entailed identifying potential / likely environmental and social impacts of the project activities in relation to the physical, biological, socio-economic and cultural environment. The ESIA process further examined, analyzed and assessed the proposed project with a view of ensuring that environmental and social impacts are adequately addressed. The ESIA is being finalized through the preparation of this ESIA report and an Environmental and Social Management Plan (ESMP) which specifically will include measures that the proponent and the contractor (s) shall adopt and apply to deal with, amongst other disciplines, environmental due diligence, public health and safety, and employee welfare at the proposed project site. The ESMP, therefore, should indicate impact issues and effects, proposed mitigation measures, stakeholders involved in monitoring performance of developed mitigation measures, frequency of monitoring and costs involved. The ESIA and ESMP must also comply with Good International Industry Practice (GIIP) for Hydropower projects, meet all the requirements of Kenya's Environmental legislation specifically EMCA-Cap 387 and its statutes as well as any other donor requirements therein such as WBG safeguard policies, IFC Performance Standards and WB Equator Principles

Ecotech knows that the project is a "Medium to High Impact" project in terms of the NEMA's categorization of projects defined as: Projects with potentially medium to high impact project with adverse environmental and social risks and/or impacts that are wide spread and not site specific, varied and largely require special attention to address them. However, the ESIA team determined that the project associated impacts are largely reversible and can be readily addressed through appropriate mitigation measures. This was guided by the baseline data collected in the project area against the predicted impacts of the project based on the design and its location as such the Khalala Hydropower Power is a low impact project as discussed in section 1.1 above. Ecotech affirms that the ESIA process for the project was effective and appropriate to the nature and scale of the proposed Khalala Hydropower Project and is commensurate with the level of the environmental and social risks envisaged at the proposed project site.

1.5 THE PROJECT

The Khalala Hydropower Project is a proposed hydropower facility that is expected to generate 28MW of electricity with an annual energy output of 129 GWh at 6m³/s of Environmental Flow. The project shall involve harnessing the hydropower potential of the River Nzoia at weir (00° 28' 56.4" N; 34° 40' 58.3" E) and discharging the water through a 5600m long conveyance system to the forebay tank and thereafter by a 800m long spiral welded steel penstock pipe to the powerhouse located near River Nzoia in Khalala Msabale village (00° 27'17.8" N; 34°39' 06.0"). After the power generation, the water will be released back into River Nzoia through a tailrace channel of 30m. The distance between the abstraction and release points in the River Nzoia is approximately 7km. The power generated at the Khalala Hydropower Project will be connected to the National Grid, either through (i) connection to 33kV busbar at Musaga 132/33kV substation via a double circuit 33kV line, (ii) connection to the existing 132kV Uganda – Musaga line using either 132kV Loop in – Loop out or 132kV Tee-off connection and (iii) Connection to 132kV bus at Musaga 132/33kV substation through either a 33kV double circuit line and a 33/132kV transformer at Musaga or a direct 132kV single circuit evacuation line.

In the event that the project development is not completed within the near term and there is overlap in construction periods for the projects necessary approvals will be obtained. Furthermore, if construction of the project facilities fall within the community areas, there would be cumulative impacts linked to unidentified effects on communities and habitats. In other words, disturbed conditions observed may have stabilized or returned to normal, but increasing numbers of construction activities undertaken sequentially or with temporal and spatial coincidence may result in cumulative adverse effects. Appropriate mitigation measures will be put in place to handle this scenario in the event it occurs.

The points of diversion of water from the River Nzoia and the point of re-entry of the water back into the river as well as other key components of the project are shown in Table 1-1 below.

Table 1-1: Location of Khalala Hydropower Project

Project Component	Latitude (E)	Longitude (N)
Weir	34° 40' 54.3"	00°28'58.7"
Sedimentation Tank	34° 40' 33.0"	00° 28' 37.5"
Forebay	34° 39' 25.0"	00° 27' 38.9"
Power house	34° 39' 06.0"	00° 27' 17.8"
Tail water discharge point	34° 39' 5.17"	00° 27' 15.11"
Camp site	34° 40' 55.67"	00° 29' 03.91"

1.6 PROJECT LOCATION

The proposed Khalala Hydropower Project is located 19Km from Webuye town in the upper reaches of River Nzoia in the villages of Sitikho and Khalala Msabale, Sitikho Sub-location, Webuye West sub-county, Bungoma County. The headwork's that include the weir and intake will be located in Sikubale village, Sivilie location in Navakholo Sub-

County, Kakamega County while all the other civil engineering structures will be located within the villages of Sitikho and Khalala, Sitikho location, Webuye West Sub-county, Bungoma County. The proposed weir and intake (N 00°28'58.7"; E 034° 40'54.3") will be located just before Khalala Bridge on the border of Webuye West and Navakholo Sub-county in Sikubale village, Sivilie Location. The headrace channel and de-siltation tank shall be located in the villages of Mwembula, Welemba, Murono, Chelimiyni, Kisengwa and Sitikho while the Forebay tank, spillway, Penstock and Powerhouse shall be located within the village of Khalala, Nambindo and Msabale. The project site is about 7 km from Nzoia - Kuywa confluence in 1DD sub-catchment. The project site is defined by coordinates: E34° 40'54.57", N 0°28'57.64" at altitude 1400m a.s.l on topographical sheet no. 102/1 of scale 1:50000 as shown in Figure 1-2 below.

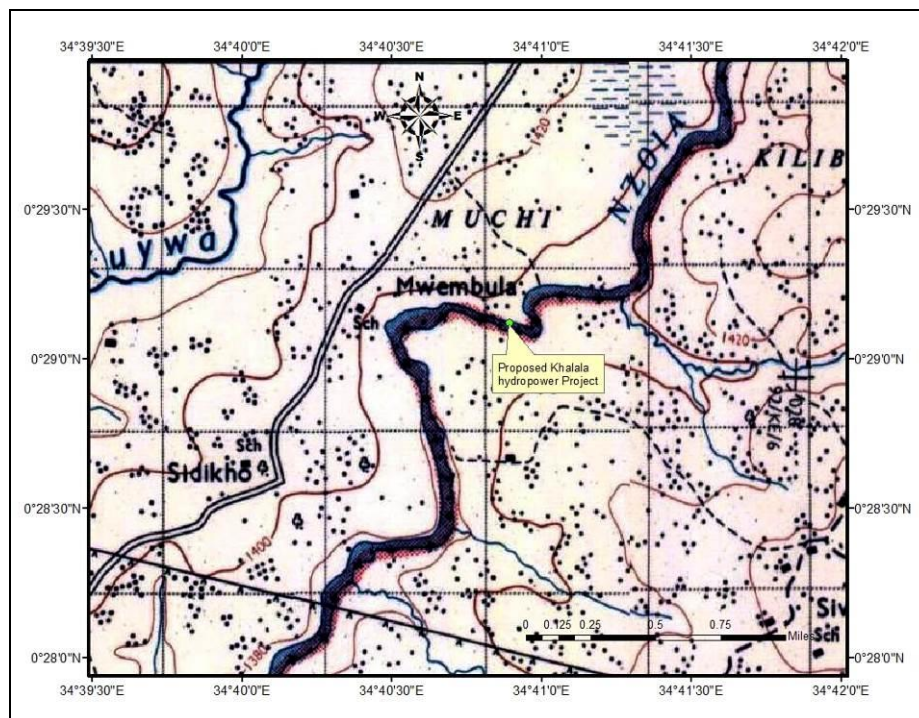


Figure 1-2: Project Location Map

1.7 LAND REQUIREMENTS

The Khalala Hydropower Project requires land for the key project features, access roads and camp site location. All these areas have been determined and plans for engaging the land owners are in the pipeline. The total land to be acquired for the project is approximately 114 acres and this will be acquired on a willing seller - willing buyer basis. However, the proponent will work with the County and National land boards as well as per the relevant land laws of the land.

1.8 PROJECT JUSTIFICATION

The Kenya's Energy Least Cost Power Development Plan for the period 2017-2037 notes that the country has a current installed capacity (grid connected) of 1,429MW while the electricity demand by end of 2017 was 1,710MW and the same is projected to rise to 9,790MW by 2037. In order to alleviate the current energy deficit, Kenya has been embarking on projects geared towards promoting investments in the energy sector.

Implementation of power projects such as the proposed 28MW Khalala Hydropower Project, will contribute immensely towards alleviating the country's energy deficit.

The Ministry of Energy has also put in place policy initiatives such as the Feed in Tariff policy, 2008(Rev. 2012) targeted at alternative sources of energy such as wind, geothermal, co-generation and biomass generated electricity. These policy initiatives are hoped to attract private sector investments as well as help enhance national energy security while contributing to employment and income generation. The decision to develop the proposed Khalala Hydropower Project is a good investment in terms of economic development. It is important and a timely intervention as it contributes to increasing the country's alternative environmental friendly power demand and also supports the call for renewable energy alternatives worldwide to curb climate change. The proposed Khalala Hydropower Project is a renewable energy project and will result in a reduction of anthropogenic emissions of greenhouse gases by displacing an equivalent amount of electricity that would otherwise have been generated by thermal power plants that are currently used as a short-to medium term measure to address the country's energy deficit.

1.9 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF THE KHALALA HYDROPOWER

1.9.1 Need for ESIA

Following the gazettelement of the *Environmental (Impact Assessment and Audit) Regulations* in June 2003; Revised 2016, and the Principal Act (*EMCA*), 1999, (Amendments, 2015) all proposed projects must undertake an Environmental Impact Assessment pursuant to facilities and utilities listed in the Second Schedule of the *Environmental Management and Co-ordination* Section 58 of the Principal Act. The proposed Khalala Hydropower Project as stipulated under the Second Schedule (Section.58 (1), (4)):

Being an 'Electrical infrastructure (Item No. 10, (a) electricity generation stations;), '(i) an activity out of character with its surrounding' [which is] (ii) out scale with its surroundings and (iii) involves major change in land use (No. 1)'

We understand that the construction and subsequent operation of Khalala Hydropower Project will generate significant impacts at the project level as a result of the several activities undertaken. They will involve among others, the following:

- Construction of basic hydropower structures which include the Weir, Headrace channel, Forebay Tank, Spillway, Penstock and powerhouse;
- Construction of the transmission line;
- Acquisition of the right of way and way leaves for the headrace canal;
- Construction of camping areas; and
- Construction of access roads among others

The above mentioned activities will give rise to environmental and social impacts, both negative and positive. Impacts such as restriction on land use, surface water degradation, landscape impairment and visual amenity, and habitat encroachment that could affect flora and fauna, soil contamination, and social disruption are likely to result from the implementation of the project. Therefore, proper identification, quantification

and mitigation of potential impacts associated with the project were crucial prior to implementation hence this ESIA process.

1.9.2 Terms of Reference

The TOR for this assessment was based on the NEMA Environmental Impact Assessment and Audit Regulations, dated June 2003; 2016; and draft IEIA 2018. These regulations require that the report should contain descriptions of the following where possible:

- The physical location of the project including the baseline conditions of the project area; **Chapter One and Two**
- A description of the project including: project objectives, project design, activities, technology, procedures and processes, materials to be used, products, by-products and waste generated during the project construction, operation and decommissioning phases; - **Chapter One and Two**
- Description of the recipient environment; - **Chapter Three**
- A description of the national environment legislative and regulatory framework, baseline information and any other relevant information related to the project; - **Chapter Four.**
- Alternative locations, technologies or processes available; analysis of alternatives, and reasons for preferring the proposed design options; - **Chapter Five.**
- Informed consent for public participation and stakeholder engagement as well as measures to prevent health hazards and to ensure security in the working environment for the employees, the project area community and for the management of emergencies;- **Chapter Six**
- The potential environmental effects of the project, including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated;- **Chapter Seven**
- An environmental management and monitoring plan matrix outlaying the activities, associated impacts, mitigation measures, monitoring indicators, implementation timeframes, responsibilities, and cost;- **Chapter Eight**
- Conclusions, recommendations and identification of gaps and uncertainties which were encountered in compiling the report; - **Chapter Nine** and
- Any other information that NEMA may require.

1.9.3 Scope of this ESIA

The ESIA report covers all the activities (construction and operation phases) of the proposed Khalala Hydropower Project as described in the project description. These include construction of project infrastructure (key of these are; the weir and intake, headrace canal, forebay, penstock, powerhouse, camp site and the associated access roads) and installation of the power generation equipment. Khalala Hydropower Kenya Ltd should liaise with the relevant lead agencies for all activities not assessed in this ESIA where necessary, to obtain the necessary approvals before such activities are carried out.

1.9.4 EIA Premises

The key premises that affect EIA process in Kenya were established from the initial stages of the project and have provided the general guidance, framework, and commitment to standards acceptable nationally and internationally. These premises shall

be retained and variations allowed only in certain circumstances with supporting evidence to do so. The premises include:

- the area is within the exclusive jurisdiction of both Bungoma and Kakamega County Governments within the Kenyan State Government borders. Therefore, country laws/ national laws and policies, including the environmental laws shall apply;
- the project recognizes the laws and regulations of the Government of Kenya (GoK) as represented by the Ministry of Environment, Water and Forestry, Ministry of Energy, Ministry of Lands, Energy Regulatory Commission (ERC), National Environment Management Authority (NEMA), Kenya Wildlife Service (KWS), Kenya Marine and Fisheries Research Institute (KEMFRI). the State Department of Water, National and the Local Government Environmental Agencies, Agriculture, Fisheries among others and insists that best options will be adopted for the project execution;
- the project should be designed and operated to comply with local and national laws, together with all the international protocols, agreements and conventions entered into by Kenyan Government or in tandem with donor requirements;
- the agreements and understanding reached with government officials during the course of the ESIA process will be respected and honoured throughout the project life cycle;
- extensive consultations have and will continue to be held with National, County and Local Governments together with the host communities and concerned Non - Governmental Organizations (NGOs); and
- an Environmental and Social Management Plan (ESMP) will be developed as part of this ESIA report. The implementation of this plan will be the responsibility of the proponent and / or contractors.

This ESIA has been prepared to evaluate the potential environmental and social impacts associated with the proposed Khalala Hydropower Project. To this end, an intensive multidisciplinary fieldwork was conducted between 6th - 20th December 2018. This was complemented by the review of baseline data of the area conducted before the fieldwork and thereafter. Data on ecological set up, socio-economic structures and health status of the area were obtained both through stakeholder engagement, public meetings as well as through review of relevant environmental and socio-economic reports.

1.9.5 Objectives of the ESIA

The purpose of the proposed Khalala Hydropower Project ESIA is to ensure that project activities under consideration are environmentally and socially sound and sustainable while the objective of the ESIA is to evaluate the potential impacts of the proposed Khalala Hydropower Project in relation to the physical, biological and socio-economic environments; as well as ensuring compliance with the existing legal and institutional framework. The ESIA aims at achieving the following objectives:

- To identify and assess the potential environmental and social impacts of the proposed Khalala Hydropower Project;
- Assimilate baseline data and information relating to the physical, biological and social environment in and around the proposed project site;

- Have a series of dialogues with the Lead Agencies, local communities/ households living in and around the proposed project site as well as other stakeholders of the project to obtain their views;
- Assess the potential environmental impacts that might emanate from the construction as well as operation phases of the proposed project;
- Formulate the necessary counter measures against the potential adverse impacts so as to minimise the possible negative impacts due to project implementation;
- Propose an Environmental and Social Management Plan (ESMP) to guide the implementation of mitigative measures and monitoring throughout the implementation of the project and contribute to the overall process of project monitoring and auditing. This will enable the project developer to take timely action to prevent negative environmental and social impacts before they become irreversible; and
- To prepare an ESIA Study report compliant with EMCA, Cap 387, properly addressing all the items specified in the Terms of Reference (ToR) approved by the Authority and detailing findings and recommendations from the study.

1.9.6 Assessment Methods and Significance

The approach to assessing and assigning significance to an environmental effect relied upon a Magnitude-Sensitivity matrix as well as expert judgements and reasoned argument; consideration of any relevant International, Kenyan and County Legislation, Regulations, Standards or Codes of Practice as well as the advice and views of relevant Governmental Organizations.

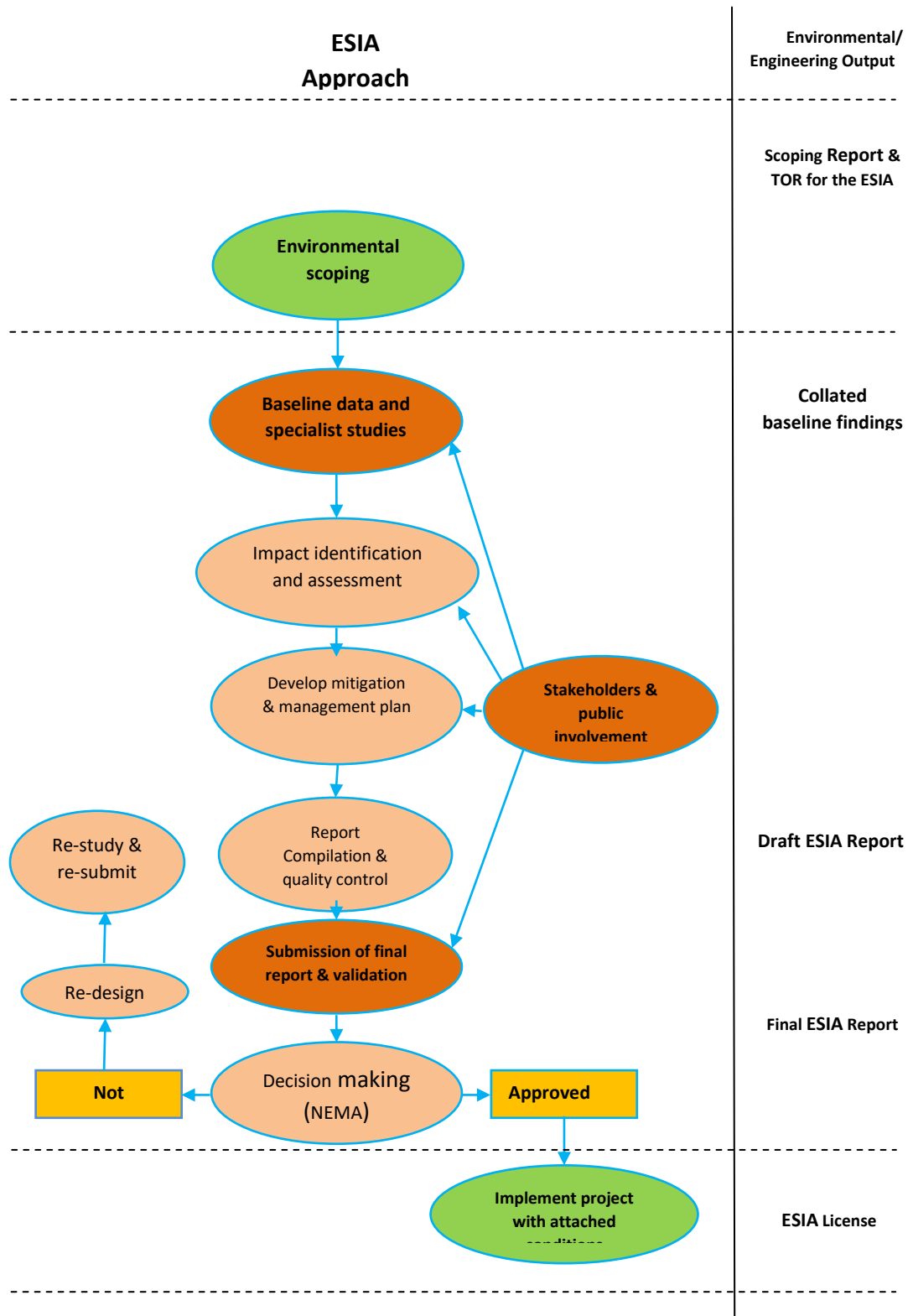
1.9.7 The EIA process

Based on our understanding of the scope of works under the consultancy services, Ecotech Environmental team carried out this assignment as outlined in the Figure 1-3 ESIA approach which is consistent with the approach recommended in the *Environmental (Impact Assessment and Audit) Regulations of 2003; 2016 and EMCA 1999 (Amendments, 2015)*.

1.9.8 ESIA Report

The ESIA report is presented in Nine Chapters. Chapter one is an introduction with the ESIA Terms of Reference (TOR), relevant background information about the proponent (the Applicant), the consultant, project location, objectives and project justification. The second chapter describes the proposed project, location, project activities, waste management and decommissioning. The third chapter describes baseline condition of the study area. Chapter Four gives the elaborate legal and administrative requirements and donor obligation on part of the proponent. Chapter five looks at the project alternatives in terms of location, design, size, technology etc. while Chapter Six is concerned with informed consent for public participation, stakeholder consultations and Occupational Health and safety issues. The Seventh Chapter discusses the associated and potential environmental and social impacts as well as cumulative impacts of the proposed project and the mitigation measures. Chapter Eight recommends a cost-effective ESMP to be adopted and other management plans to supplement the ESMP and Chapter Nine provides conclusion and offers advice on project implementation. The last section of the report is comprised of references and appendices as are appropriate for inclusion in the report.

Figure 1-3: Standard ESIA Approach



1.9.9 Approach and Methodology

1.9.9.1 Stakeholder Consultations

Experts in relevant fields, leaders of thought in environmental matters, Non-Governmental organizations and regulators, local communities have been consulted for their opinions on issues relating to the potential ecological and socio-economic impacts of the proposed project. Key stakeholders consulted included (comments made and the respective responses and comments are presented in Annexure of this ESIA):

- ✓ Bungoma County Commissioner
- ✓ Kakamega County Commissioner
- ✓ One Acre Fund-Webuye West
- ✓ Kenya Human Rights-Webuye Branch
- ✓ Webuye West Sub-County Administrator
- ✓ Business Community Representation
- ✓ Rural Electrification Authority
- ✓ Water Resources Authority
- ✓ Kenya Power-Webuye Branch
- ✓ Bungoma County Government Departments of Water, Environment, Trade, Energy, Tourism , Lands, Agriculture, Fisheries and Gender
- ✓ Kakamega County Government Departments of Water, Environment, Trade, Energy, Tourism, Lands and Gender.
- ✓ Senior Chief and Chief of Sitikho Location-Webuye West Sub-County
- ✓ Senior Chief and Chief of Sivilie Location-Navakholo Sub-county
- ✓ Community members in the Project's Area of Influence (PAI).

1.9.9.2 Field Visits

One-seasoned fieldwork survey was carried out to verify and complement information gathered from desktop studies. The fieldwork covered all relevant components of ecological, socio-economic and health components of the environments. Samples collected during the one-season field sampling were analyzed in an established and accredited laboratory. Results as produced from the laboratory are as presented in the Annexes.

During the site visits, data including but not limited to the following was collected: vegetation, fauna, topography, land use, socio-economic profile (demographic characteristics, land tenure and settlement pattern, economic profile, health services, water and sanitation, education, public administration, employment status and cultural heritage), and soils/geology. Specific site visits addressing the biological and physical environment involved walking through the proposed project area and collecting baseline data through observation, photography, collection of samples, in-situ and ex-situ analysis and laboratory analyses.

Sample stations and other features of concern in the proposed project area were marked and recorded using a hand held Global Positioning System (GPS) unit. Methodologies were developed for the different study variables and these are presented in the environmental and social baseline description together with their results.

1.9.9.3 Impact Prediction and Evaluation

Predicting the magnitude of a development likely impacts and evaluating their significance is core for environmental assessment process (Morris & Therivel, 1995). Predictions were based on the available environmental baseline of the project area. These predictions were described in both quantitative and or qualitative terms. The assessment of all associated and potential impacts of the proposed project were carried out using checklist method. Various methods and techniques were applied in impact identification, prediction and evaluation. The team, with the help of the relevant stakeholders, identified and analyzed potential impacts linking these with specific project activities and phases. The first task was to consider both positive and negative impacts of the project and a number of tools were applied during the identification and assessment of impacts.

1.9.9.4 Literature Review

Desktop research was used to establish an environmental information database for the ESIA. Consulted materials include textbooks, articles, maps, internet, photographs and past ESIA reports and baseline report of the area conducted between 6th - 20th December, 2018.

1.9.10 Benefits of the ESIA

The benefits of the EIA will, among other things, include:

- Obtaining authorization; this is required by regulatory authorities before the commencement of any major development;
- Providing a forward planning tool; when environmental implications are taken into account with other design considerations at the conceptual design stage. It allows for important decisions to be built into the project while avoiding undue damage to the environment;
- Providing a designing tool that would allow a systematic evaluation of potential environmental problems from the proposed development and identification of key issues which require special consideration for effective environmental management and controls;
- Involving all stakeholders through consultation so as to address common problems, impacts, and mitigating measures that might be proposed in order to obtain a social license for the project;
- Informing and assisting management with a view to establish and achieve long term management objectives in order to minimise associated financial and environmental risks; and
- Confidence building by the Khalala Hydropower Kenya Limited.

1.9.11 Project activities

The activities of the whole Khalala Hydropower Project are as follows:

- ☞ Permit to survey
- ☞ Environment and Social Impact Assessment

- ☞ Land Acquisition
- ☞ Hydropower Generation Plant License
- ☞ Engineering Design
- ☞ Material Procurement and Transportation
- ☞ Bush clearing
- ☞ Excavation
- ☞ Construction of weir/intake, power house, forebay, camping areas and access roads
- ☞ Headrace channel and canal construction
- ☞ Commissioning and Handover

CHAPTER TWO

2. PROJECT DESCRIPTION

2.1 INTRODUCTION

This section of the report describes the proposed project, and identifies the locations of the various project components, as well as a description of the various project components and arrangements for the provision of services to and on the site.

2.2 PROJECT COMPONENTS LOCATION

The proposed Khalala Hydropower Project is located 19 Km from Webuye town in the upper reaches of River Nzoia in the villages of Sitikho and Khalala Msabale, Sitikho Sub-location, Webuye West sub-county, Bungoma County with only the weir and intake access road located within Sikubale village, Sivilie location, Navakholo Sub-County in Kakamega County. All the civil engineering structures will be located within the villages of Sitikho and Khalala. The take-off point and tail-water Point coordinates are 00° 28' 57.64" N; 34° 40' 54.57" E and 00° 27' 15.11" N; 34° 39' 05.17" E respectively. The proposed weir (N 00° 28'58.7"; E 034° 40'54.3") will be located at Khalala Bridge on the border of Webuye West and Navakholo Sub-county in Kakamega County. The headrace channel shall be located in the village of Sitikho while the Forebay tank, Penstock and Powerhouse are located within the village of Khalala Msabale.

Table 2-1: Proposed location of key project infrastructure

Project Component	Latitude (E)	Longitude (N)
Weir	34° 40' 54.3"	00° 28' 58.7"
Sedimentation Tank	34° 40' 33.0"	00° 28' 37.5"
Forebay	34° 39' 25.0"	00° 27' 38.9"
Power house	34° 39' 06.0"	00° 27' 17.8"
Tail water discharge point	34° 39' 5.17"	00° 27' 15.11"
Camp site	34° 40' 55.67"	00° 29' 03.91"

The proposed project site can be accessed via the Mombasa – Nairobi - Eldoret - Malaba Highway by taking the road to Webuye town and just before the interchange of Webuye to Kitale, one takes a left turn on the earthen road breaking from the Highway at Kobil Petroleum Service Station and then travelling a distance of approximately 19km to the village of Sitikho.



Map 2-1: Satellites view of the project features location

2.3 TYPE OF PROJECT DESCRIPTION

The Khalala Hydropower Project is a proposed hydropower facility expected to generate 28MW of electricity with an annual energy output of 129 GWh at 6m³/s of Environmental Flow. The project shall involve harnessing the hydropower potential of the River Nzoia at weir (N 00^o 28'58.7"; E 034^o 40'54.3") and discharging the water through a 5600m long conveyance system to the forebay tank and thereafter by a 800m long spiral welded steel penstock pipe to the powerhouse located near River Nzoia in Khalala Msabale village (N 000 27' 17.1"; E 0340 39' 03.9"). After the power generation, the water will be released back into River Nzoia through a tailrace channel of 30m. The distance between the abstraction and release points in the River Nzoia is approximately 7km. The power house will accommodate EM Plant , with an outside 33kV Substation with three power transformers and one station supply transformer, metering equipment, turbines, generators, governors, electrical switch gear and panels etc. The power generated at the Khalala Hydropower Project will be connected to the National Grid, either through (i) connection to 33kV busbar at Musaga 132/33kV substation via a double circuit 33kV line, (ii) connection to the existing 132kV Uganda – Musaga line using either 132kV Loop in – Loop out or 132kV Tee-off connection and (iii) Connection to 132kV bus at Musaga 132/33kV substation through either a 33kV double circuit line and a 33/132kV transformer at Musaga or a direct 132kV single circuit evacuation line.

2.4 PROJECT COMPONENTS

The construction schedule for Khalala Hydropower Project is estimated to take about 18 months with work beginning immediately following the acquisition of PPA and awarding of the contract and after all the necessary approvals have been acquired by the proponent.

Below are the major components that will form part of the proposed Khalala Hydropower Project;

- ✓ Weir and intake structure,
- ✓ Desander and Headrace Channel,
- ✓ Forebay and spillway,
- ✓ Penstock pipe,
- ✓ Power House and Tail race water discharge point,
- ✓ Six access roads,

In addition to the above, the proposed Khalala Hydropower Project associated support structures include:-

Temporary workers' camps/ contractor's camp; The construction camp which will accommodate more than 100 individuals at maximum design capacity and shall include: Staff quarter buildings including: dormitories, recreational areas, ablution facilities, washing areas, emergency medical facilities, storage areas, and guard rooms as required; all services for the Contractor's camp, including potable water supply, power supply, waste water treatment (kitchen and washing), sewage treatment (mainly septic tank but this will also be dependent on what is agreeable to the local authorities in the area), surface runoff treatment, and trash collection; Security fences and security personnel; All required Contractor's site offices; local and long distance communication systems including Internet connection; All required construction plant and equipment parking/ storage areas; Workshops for maintenance and repair of plant and equipment; Warehouses for storage of construction materials and equipment; Diesel/ petrol / lubricants supply and related storage facilities; and Testing facilities; Temporary office; Employer's permanent accommodation in the main camp area (permanent staff quarters and housing); Workshop/ stores incorporated in the powerhouse; Vehicle/ equipment storage and parking yard; Stone/ murram quarries, borrow pits and sand mining areas.

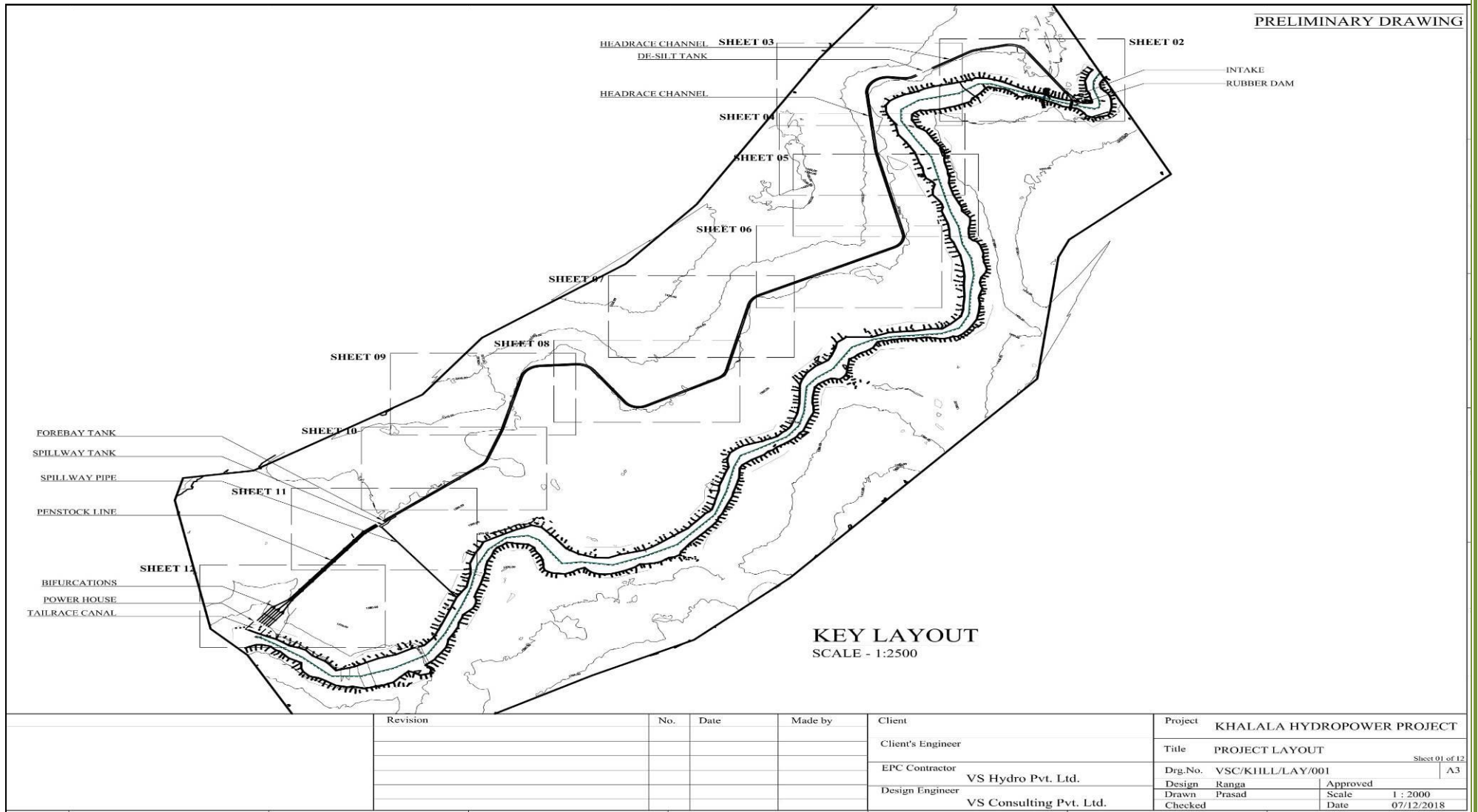


Figure 2-1: Project Layout

2.5 ACQUISITION OF PERMITS/ APPROVALS

Prior to the commencement of the construction phase of the project, a number of permits and approvals will have to be secured to ensure legal compliance and foster cooperation and harmony among the different stakeholders. The key permits and approvals that are relevant to the proposed Khalala Hydropower Project are presented in Table 2-2. Permitting and acquisitions of licenses is a complicated process requiring multiple approvals from many central and local government agencies. Water rights, land acquisition and site access are among the key elements that are fundamental to this project and should be obtained early in advance. Local concerns should also be assessed and mitigation strategies developed and put in place - this will be through this ESIA process. Mitigation strategies developed and implemented should be effective and practicable at the project level. Commonly accepted international standards i. e. the IFC Performance Standards, Equator Principles and World Bank Safeguard Measures have been integrated in the project.

Table 2-2: Requisite permits and approvals for Khalala Hydropower Project

Necessary permit/ approval	Responsible agency	Current status
Feasibility study permit	MoE	Expression of Interest Issued
Construction permit; excavate, drill, tunnel or disturb the river bed	WRA	Pending
Surface water abstraction permit	WRA	Pending
Divert or block any river from its normal course	WRA	Pending
ESIA Certificate of approval	NEMA	In process
Construction and registration of workplaces	DOSHS	Pending
License for extraction of stone/ aggregate and murram materials	Department of Geology and Mines	Pending
Use, storage and disposal of explosives	Department of Defense	Pending
Use of explosives in blasting of rocks	Department of Defense	Pending
Waste water discharge permit	NEMA	Pending
Solid waste Disposal	NEMA	Pending
Storage of petroleum products	ERC	Pending

It is important to note that the permits/ approvals considered here are those required to enable implementation of the proposed project as described in this report. Any alterations, future developments or other associated structures that are not covered by

this ESIA will require a separate assessment and approvals as the lead agencies will determine, in line with the Kenyan Environmental laws and other national laws.

2.6 DESCRIPTION OF PROJECT COMPONENTS

2.6.1 Weir and Intake Structure

The weir and intake will be located at Sikubale village, Sivilie Location in Navakholo Sub-county, Kakamega County just before Khalala Bridge and will not be used for water storage but rather to maintain the upstream water level at the intake. The weir is a 'run over the river' structure built across the open river channel to raise the upstream water level and/or to measure the flow of water. As the project is a run-over-the-river type, the weir is proposed to divert water from River Nzoia, which will result in the minimum storage required for regulating purposes. Orientation and the location were finalized by considering rock outcrops. The weir will have a maximum height of 6.5 m and an Inflatable Rubber Dam type is proposed. A side intake is also proposed as this will minimize silt and trash entry into the headrace canal. The intake will be an open channel of reinforced concrete, and will be approximately 4m high.

Weir Dimensions

Weir and intake	
Coordinates	00° 28' 56.4" N 34° 40' 58.3" E
Type	Inflatable Rubber Dam
Height	6.5m
Length	85m
Weir Crest Level	1400.5m a.m.s.l
Ponding area	0.4km ²
Ponding length along the river	730m
Pond operating level	1400m a.m.s.l

2.6.2 De-silting tank and Headrace canal

A headrace water diversion canal which includes the de-silting tank will be extending from the weir and will generally run along a contour to the forebay. From the intake, a rectangular head canal will be built on the right bank, with a covered section for the road crossing, approximately 250m long up to the proposed de-sander. The Desander/sedimentation tank will be situated directly downstream of the intake and its function is to insure that sediment suspended in the water is removed before the water flow passes through the turbine, the sedimentation tank is located in the village of Sitikho. The desired environmental flow will be released using two outlets; one at the weir bottom and the other at the Desander for constant flushing of the sediments back to the river.

The De-silting tank is made out of Reinforced Cement Concrete with dimensions of 95m (length) x 20m each and 60m total (width) 8m (depth). A vertical steel gate will be installed in the de-silting tank to flush the accumulated sediments at regular intervals. The outlet will be directed back to the river through a sedimentation pit. From the desander, an open headrace canal with a rectangular profile shall be built up to the forebay and spillway. The length of the total low pressure water conveyance shall be 5600m.

Desander/ De-silting tank dimensions

De-silting tank	
Coordinates	00 ⁰ 28' 37.5" N 34 ⁰ 40' 33.0" E
Type	Three bay
Length	95m
Width	20m each and 60m total
Height	8m

2.6.3 Forebay tank and Spillway Structure

This structure connects the headrace with the penstock and provides sufficient water volume for start-up processes, thus preventing air entrainment into the penstock, which could trigger water column collapse and associated pressure fluctuations. In addition, the forebay equalizes surge waves due to load rejection. The forebay tank is designed to maintain the minimum time storage and avoid any air entering into the penstock pipe. The forebay tank is a reinforced concrete structure, located on the slightly stable or flat land at the end of the canal, and will have a de-silting section. This consists of a sloped bed for easy ejection of silt, a spillway to spill excess water and a trash rack. A Vertical steel gate is provided to flush any sediment deposited in the forebay tank. The spill way will be located on the left side of the forebay and it shall be a step type spillway excavated into the bedrock, dropping approximately 500m into the river.

Forebay Dimensions

Forebay	
Coordinates	00 ⁰ 27' 38.9" N 34 ⁰ 39' 25.0" E
Length	80m
Width	40m
Depth	8m

2.6.4 Penstock

The penstock is used to convey pressurized water from the forebay or surge tank to the power house through turbines. The penstocks are 3m x3.5m diameter after the forebay, then each penstock bifurcate to be 6m x 2.5m diameter with the maximum velocity inside the penstock being 2.5m/s. The total penstock length from the forebay to the power house is approximately 3420m.

Penstock dimensions

Penstock	
Length along Penstock	800m
Cumulative length along penstock	3420m
Gross Head at Section End	55m

2.6.5 Powerhouse

The powerhouse will be an open air powerhouse constructed at the right bank of the river and located at the 90 Degree left Turn into the River. The approximate size of the powerhouse will be 60m x 15m. The structural components such as floor slabs and columns will be constructed using concrete. The powerhouse roof will be supported using steel frames and covered with Zinc-Aluminium sheeting materials and the powerhouse has been designed in order to be located above the high flood level of the river. It will accommodate EM Plant , with an outside 33kV Substation with three power transformers and one station supply transformer, metering equipment, turbines, generators, governors, electrical switch gear and panels etc. The power house will also have an area for repairs and lifting arrangements for the machinery, storage space for spares and equipment for maintenance of the civil works.

Powerhouse dimensions

Power House	
Coordinates	00 ⁰ 27' 17.8" N 34 ⁰ 39' 06.0" E
Length	60m
Width	15m
Type of Turbine	Francis
Number of Units	6 Nos each 6.6MW
Rated Speed	1500 rpm

2.6.6 Tailrace canal

A tailrace channel will be built to convey the released water from the turbines back into the river. Discharges from the turbine will be directed to the tailrace water channel. Since the power house is located closer to the river, the total length of the tailrace channel is about 30m.

Tailrace canal dimensions

Tailrace canal	
Coordinates	00 ⁰ 27' .4" N 034 ⁰ 39' 04.6" E
Total length	30m

2.6.7 Electro-Mechanical (EM) Plant

The project Electro-Mechanical (EM) plant will be comprised of 6 turbine generator units, Horizontal Francis turbines coupled to 6.6kV Synchronous generators working at 500 rpm. The flow will be controlled by the Main Inlet Valves of diameter 1600-1800mm and turbine runner pitch diameter of 1400mm. six hydraulic oil pressure units shall control the MIV and turbine hydraulic functions, while a Siemens S 7-300 based control system, coupled to 6.6kV Siemens breakers will comprise the LV and control switchgear. Three transformers 6.6 kV-33kV and 12kVA each will step up the power to 33kV levels.

2.6.8 Transmission line

The generation voltage of the power plant will be 6.6kV; this will be stepped up to 33kV through three phase transformers. Generated power could be evacuated to the National grid via the following options:

- Option I: Connection to 33kV bus at Musaga 132/33kV substation via a double circuit 33kV line.
- Option II: Connection to the existing 132kV Uganda – Musaga line using:
 - (i) Case A: 132kV Loop in – Loop out connection
 - (ii) Case B: 132kV Tee-off connection
- Option III: Connection to 132kV bus at Musaga 132/33kV substation via:
 - (i) Case A: Via a 33kV double circuit line and a 33/132kV transformer at Musaga
 - (ii) Case B: Via a direct 132kV single circuit evacuation line.

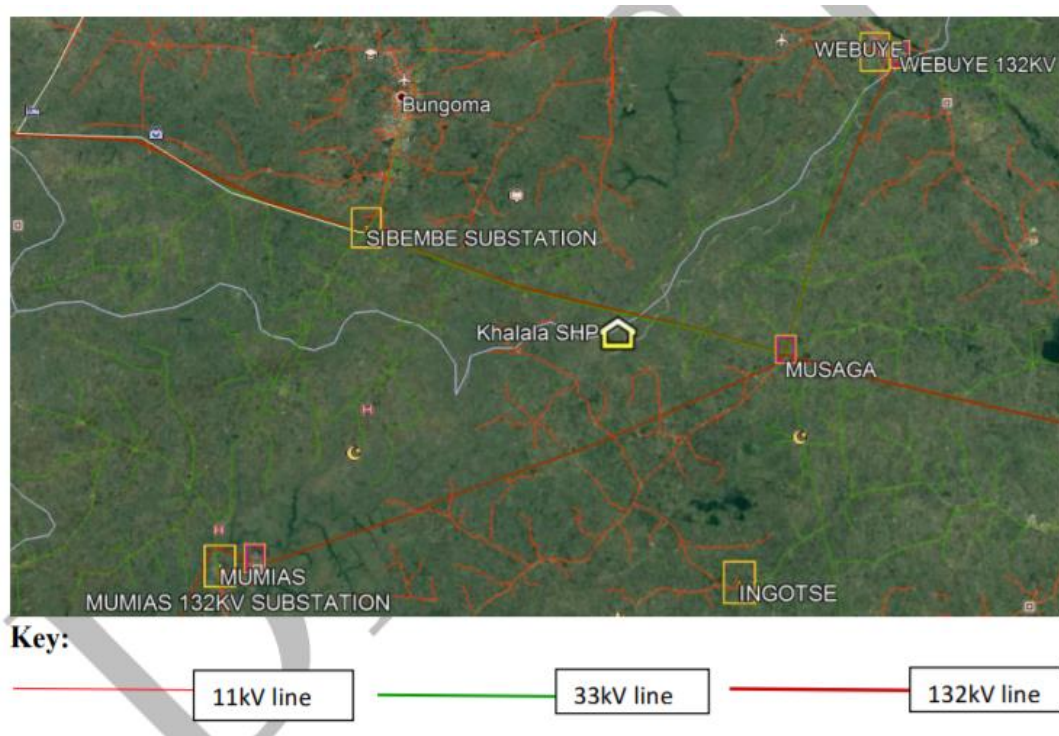


Figure 2-2: Existing KPLC Network in the area

Option I (Connection to 33kV bus at Musaga 132/33kV substation)

This interconnection option entails establishing a step-up substation at Khalala Hydropower plant site to step up the generated line to line voltage to 33kV, construction of an approximately 10.5km, 33kV overhead double circuit line to Musaga 132/33kV substation and establishment of an additional 33kV bay at the substation to accommodate the incoming feeders. The 75sq. mm ACSR, Racocon conductor type was adopted for this simulation. In this option, there are no voltages or thermal violations observed. The interconnection of the 28MW generation greatly improves the voltage

profile in the 33kV network in the area. The monitored bus voltages are all very close to 1pu with a high of 1.0102pu at the point of interconnection (Musaga 33kV bus) and a low of 0.9840pu at Kakamega 33/11kV substation. The line loadings are all below the rated values for the specific conductors used. This option reduces the loading of the 132kV lines feeding Musaga 132/33kV substation considerably. The evacuation lines (both circuits) are each loaded at 74% while the total evacuation line real power loss is approximately 1.2MW.

Option II (Connection to the existing 132kV Uganda (Tororo) – Musaga line)

This option entails establishing a step-up substation near Khalala power house site to step up the generated line to line voltage to 132kV and then connecting to the existing 132kV line connecting Musaga 132/33kV substation to the Ugandan system. The connection to the 132kV line can be done in two ways:

Case A: Loop in – Loop out Connection: This option would involve diversion of the existing 132kV line via the Khalala power plant substation. The step-up transformer(s), circuit breaker(s) and associated equipment would be located at the Hydropower plant substation. An approximately 2.6km double circuit 132 kV line would be required for this option. A disadvantage of this option is that it would result in effective extension of the Musaga – Uganda (Tororo) 132kV line length by approximately 5.2km. The loop in – loop out line section adopted in this simulation was of 150sq. mm ACSR, Wolf conductor type.

Case B: Tee-off Connection: This option would involve connection directly to the existing Musaga – Uganda (Tororo) 132kV line at a suitable location via a section tower. The step-up transformer(s), circuit breaker(s) and associated equipment would be located at the solar power plant site. A 2.6km single circuit 132kV line would be required in this option. The configuration is limited in operation flexibility especially during contingencies and has protection challenges. The tee-off line section adopted in this simulation was of 150sq. mm ACSR, Wolf conductor type.

The effects from these two interconnection cases are expected to be similar and so are the results obtained. In both options, there is no voltage or thermal violations experienced. In both cases, the generated power from Khalala Hydropower plant is observed to be flowing towards Musaga 132/33kV substation. In case A the line loadings for circuit 1 and 2 in the double circuit loop in/out evacuation line are 12% and 39% respectively, while in Case B the evacuation Tee-off line is loaded at 31%. In both cases the evacuation line real power losses are less than 0.1MW.

Option III (Connection to 132kV bus at Musaga 132/33kV substation):

Case A: Via a 33kV double circuit line and a 33/132kV transformer at Musaga:

This interconnection case entails establishing a step-up substation at Khalala Hydropower plant site to step up the generated line to line voltage to 33kV, construction of an approximately 10.5km, 33kV overhead double circuit line to Musaga 132/33kV substation and establishment of an additional 33/132kV transformer bay at the substation to accommodate the incoming lines. The transformer will facilitate connection to the 132kV busbar as stipulated in the guidelines. The 75sq. mm ACSR, Raccoon conductor type was adopted in this simulation.

Via a direct 132kV single circuit evacuation line: This case would involve establishing a step-up substation at the project site to step up the generated line to line voltage to 132kV and the construction of an approximately 10.5km long overhead 132kV

single circuit line to evacuate the generation from the power plant. An additional 132kV bay will be needed at Musaga 132/33kV substation to accommodate the incoming 132kV feeder. The evacuation line adopted in this simulation was of 150sq. mm ACSR, Wolf conductor type.

This option considered the use of a direct 132kV line in addition to the use of a double circuit 33kV line with a 33/132kV transformer at Musaga substation. In this option, there is no voltage or thermal violations experienced. The generated power from the proposed hydropower plant is used to supply the loads connected to the MV side (33kV bus) of Musaga transmission substation. The surplus power generated is transmitted to nearby load centers. The voltage profile resulting from this interconnection option is similar to 31 Khalala Hydropower project Confidential that of Option II but with slight voltage improvements. In Case A of this option the evacuation 33kV circuits are loaded at 73% each with an evacuation line real power losses of approximately 1.2MW. The evacuation line loading for Case B is 31% with real power losses of approximately 0.1MW.

The connection of a plant to the power system can compromise the supply quality, particularly causing large voltage fluctuations beyond the acceptable +/- 10% at the point of connection. The amount of generation that can be connected at a particular point in the power system is therefore limited depending on the power network relative system strength (system impedance) at the point of connection. High system impedance (weak system) results to large voltage fluctuations with changes in generation output while low system impedance (strong system) results to lower voltage fluctuations and therefore higher capacity to absorb power. Power system strength with respect to the interconnecting generator is expressed in terms of system Short Circuit Ratio (SCR), defined as ratio of the interconnected grid's short circuit MVA (before connecting the generator) to the MW size of the interconnecting generator. The lower the SCR, the weaker the electric power grid will be. The power system is determined to be strong with respect to installed capacity if the short circuit ratio is above 20 and weak if it is below 10.

Based on the above criteria, Option I (Direct connection to Musaga 33kV bus) is relatively weak and thus it is not technically preferable to use this Point of Connection (POC) as the interconnection point for Khalala Hydropower plant. This is because the short circuit ratio (SCR) level at Musaga 33kV busbar is below the threshold (10) relative to the 28MW expected from the proposed project. The other two options (II and III) have SCRs of 37 Khalala HP project Confidential above 10 in this case, and they can both sufficiently evacuate the expected generation from Khalala Hydropower Project.

2.7 ACCESS ROADS

2.7.1 Existing access road

The existing community roads and foot paths connecting Kuywa, Sitikho and Khalala trading centres will be improved and graded to connect to the project features such as the weir/ intake point, head race canal, forebay tank, spillway, and powerhouse/tailrace to permit the transport of construction material, machinery and electro - mechanical equipment to the site. Construction materials will be carried along the proposed Access Road 1 and 3. Access road 3 that runs along the headrace channel/ canal or penstock will transport materials for construction of the Forebay, Desander and Power house as well as being left open to be used by the community members while Access Road 1 will be used for the weir and intake. This is mainly to avoid excessive excavation along canal

areas. All existing footpaths and routes to be constructed traverse through farmlands, homesteads, home gardens and bare lands as well as lead to animal watering points. For this reason, the proponent shall establish adequate number of both motorable and pedestrian / or animal crossing points along the canal. Preliminarily the proponent has proposed two motorable points and five pedestrian / animal crossing points. The development of these crossings along the canal should take in account the need for safety of the local community. The proponent shall work with the local administration, community members and PAPS in establishing the exact crossing points during project execution.

2.7.2 Proposed project access roads

All the proposed access roads are existing community roads hence minimal impacts are expected from the construction and improvement of access roads

Access 1: To connect the weir and intake to the headrace canal.

Access 2: To access the weir and intake point.

Access 3: Follows the headrace canal and will be used to access the entire canal.

Access 4: Will be used to access the sedimentation tank.

Access 5: Leads to the forebay tank.

Access 6: To connect to the powerhouse and the tailrace water point.

2.8 CONSTRUCTION CAMPS

2.8.1 Temporary construction (worker's) camp

The Contractor shall be responsible for the design, construction, maintenance, and dismantling of: a temporary construction/workers' camp; and associated services/facilities, for the Contractor's staff.

Khalala Hydropower should provide land to the Contractor for the duration of the project as a designated location for the construction camp within the vicinity of the proposed Khalala Hydropower Project. The designated land will be shared between the Contractor's camp and the Employer's camp. Final coordinates will be given by the proponent-Khalala Hydropower Kenya Ltd though the camp site is proposed to at coordinates $00^{\circ} 29' 03.91''N$, $34^{\circ} 40' 55.67''E$. It is the entire responsibility of the Contractor to provide and maintain the temporary construction camp, facilities, and services necessary during the construction period.

The proponent will appoint a contractor to construct the proposed Khalala Hydropower Project and associated support structures. It will entirely be the responsibility of the appointed Contractor to provide and maintain, throughout the construction period, the facilities necessary for the construction of the works, including:

- All required temporary workers' camps and associated infrastructure (water supply, power supply, canteens, emergency medical facilities, sewage system and wastewater treatment and waste handling facilities etc.);
- All required Contractor's offices;
- Local and long distance communication systems including Internet connection;

- All required construction plant and equipment;
- Workshops for maintenance and repair of the plant and equipment;
- Stock yards / warehouses for storage of construction materials and equipment;
- Diesel/ petrol / lubricants supply and related storage facilities; and
- Testing facilities for construction materials

The appointed contractor will however perform their duties in accordance with the proponent's requirements.

2.8.2 Temporary office

The appointed Contractor shall provide a temporary office for the proponent, located in the Contractor's main camp area. The proposed camp site will be situated within the following coordinates; 00° 29' 3.91" N and 034° 40' 55.67" E. The office layout shall be approved by the Employer prior to an order being placed. The Employer's site office shall comprise of units to make up the following: office space; small conference room; Pantry; toilets connected to the site sewerage system; and storage space (lockable).

There shall be sufficient entrances/exits and fire exits, to the approval of the employer and local and national health and safety requirements. All rooms shall be air conditioned. All floors shall have a vinyl floor covering.

The Contractor shall provide, install and maintain all services i.e. electricity, air conditioning, telephones, full time unlimited internet, plumbing etc. to the approval of the employer. The Contractor shall also supply, install and maintain a fire suppression system within the offices to the employer's and national health and safety standards approval. This system shall include fire extinguishers and detectors complete with alarms, panels and a minimum of two external visual and audible alarms.

2.8.3 Employer's permanent accommodation

The Contractor shall supply, install and maintain accommodation services and shall be located in the Contractor's main camp area. The building shall remain after completion of the project for the employer's maintenance staff.

There shall be sufficient entrances/exits and fire exits, to the approval of the employer and to meet national health and safety standards. The accommodation shall be capable of being made secure when not in use to the approval of the employer.

The Contractor shall supply, install and maintain a fire suppression system within the accommodations to the employer's and national health and safety standards approval. This system shall include fire extinguishers and detectors complete with alarms panels and a minimum of two external visual and audible alarms.

The Contractor shall supply, install and maintain a suitable lightning conductor to the employer's accommodation in accordance with local and national regulations. All furniture and equipment for the employer's accommodations shall be provided by the Contractor and approved by the employer.

2.8.4 Workshop/stores incorporated in the powerhouse

The Contractor shall construct a workshop and stores room within the powerhouse. The room shall have lockable steel doors and windows. The function of the workshop is to provide a minimum working space and be equipped with perimeter heavy duty lockable storage units for small tools and small spare parts. There shall be ample electrical outlets. The location of the workshop should provide convenient and level access to the loading bay so that heavy items can be unloaded by the overhead travelling crane and manually wheeled into the workshop.

2.8.5 Vehicle/ equipment storage and parking yard

The vehicle/ equipment storage and parking yard will be located within the contractor's camp. The yard is expected to be the base for a fleet of standard vehicles and equipment during the construction phase of the Khalala Hydropower Project, characteristic of the anticipated project works and will provide for vehicle parking and turning of large vehicles during normal construction activities. It is anticipated that the following types of vehicles and equipment will be required:

- ✓ One large crane for handling goods within the storage yard;
- ✓ Trucks of various sizes;
- ✓ Mobile cranes;
- ✓ Tractors with winches;
- ✓ Truck/ trailer mounted water tanks;
- ✓ 4-wheel drive vehicles;
- ✓ Compressors with pneumatic equipment such as rock drills;
- ✓ Concrete mixers;
- ✓ Graders, excavators, compactors; and
- ✓ Diesel generators etc.

At a minimum, the following activities will be carried out during the construction of the vehicle/ equipment storage and parking yard.

The area of the vehicle/equipment storage and parking yard will be cleared of vegetation, stripped of topsoil, and levelled and compacted to provide a good working surface.

Stripped topsoil will be temporarily stockpiled for reuse during site restoration.

The site will be constructed with imported and compacted murram designed to form a hard, durable surface ready for associated equipment.

A fire break will be maintained outside the vehicle/ equipment storage and parking yard perimeter.

The vehicle/equipment storage and parking yard will also serve as a muster station and staging area for vehicles and equipment in case of an emergency.

2.8.6 Stone/ murrum quarries and burrow pits

It is the proponent's intention that: murrum / material stones will be sourced from existing and approved local quarries within Bungoma County and only approved quarries will be used. It is also assumed that these will most likely be existing production centres that are not limited to supplying Khalala Hydropower Kenya Limited hence assumed that the necessary assessments for these quarries have already been conducted by their respective operators where this is not true then assessments will be conducted as appropriate. Assessments of these quarry areas therefore do not form part of the current ESIA. Thus, this support component will not be assessed further in this ESIA.

2.8.7 Workforce Requirements

The construction and operation of Khalala Hydropower Project will require a number of employees including Engineers, Electricians, Supervisors, Health and Safety Experts, Accounts Clerks, Masons, Carpenters, Bar Benders, Riggers, Labourers and Security Personnel etc. Depending on the availability of the human resources in the surrounding areas, all semi-skilled and unskilled employment opportunities, where possible, will exclusively be provided to the people of nearby villages within the PAI or outside the PAI.

2.8.8 Training for powerhouse personnel

Experienced O&M staffs are difficult to find for hydropower installations in remote areas and the Sitikho location is a typically case scenario. To secure necessary staff, it is thus necessary in such cases, to train personnel with the required educational background and technical capability. Additionally, such staff will require work experience, best obtained from working on similar power plants. Experience cannot be substituted with education for most of the routine jobs related to the operation of hydropower plants. There is also the possibility of highly educated personnel finding their work tedious and looking for alternatives. Hence, the prospect of recruiting raw personnel and providing more intensive training is more attractive. The process of recruiting operational and maintenance staff will start early in the implementation phase, preferably a couple of months before the commencement of plant installation. The ideal situation will be to have all potential operational staff actively participating in the installation of plant and equipment.

2.8.9 Required equipment/ machinery

Key equipment that will be used in the development of the proposed Khalala Hydropower Project will include the following among others: Motor Grader;, 6T Rollers, 10T Tippers, Water Bowsers, Excavators, Dumpers, Bulldozers, Concrete mixer, Concrete Pumping Machine, Back Hoe, Air Compressor, Dewatering pumps, Diesel Generators and Welding Plants etc.

2.9 PROJECT ACTIVITIES

2.9.1 ESIA Activities

In the course of executing the ESIA, a preliminary assessment involving literature review, desk studies, field reconnaissance survey, as well as consultations were carried out. The above activities were followed by a multidisciplinary field sampling to obtain additional baseline information and laboratory analyses were conducted. These together formed the basis for the ESIA report.

2.9.2 Site Preparation

Prior to site preparation, land for the project would be acquired and owners of the delineated land compensated. Before bush clearing/ site preparation, surveyors would mark both the boundaries of the working width (right of way) with posts/beacons.

Early activities of the construction phase will include site preparation by clearing vegetation. The activities will be carefully planned and coordinated by Project Coordinator. Disposal activities associated with the above will be handled as described in the Waste Management Plan and ESMP sections of the ESIA report. Within the working width, vegetation that would be removed would be piled on one side of the trench for the canal to prevent excavated materials from washing into the un-cleared areas.

2.9.3 Construction

Construction of the Khalala Hydropower project will be executed in accordance with a standard planning framework that will be reviewed as it becomes expedient by project team to ensure:

- Maximum efficiency in construction;
- Minimum adverse environmental and health impacts;
- Earliest completion time; and
- Compliance with the laws of the land and all regulatory requirements

2.9.3.1 Construction schedule

The length of time from the awarding of the construction contract to the commissioning of the power plant is estimated to be approximately eighteen months, with work beginning immediately following PPA acquisition and contract award. Preparatory activities will involve mobilization, land acquisition, construction of access roads and quarters etc. The major activities, such as construction of the headrace canal and penstock path will begin in the 1st year of the construction period. The powerhouse construction and transmission line erection will commence in the 2nd year of the construction period. Structures such as the weir, forebay tank and de-silting tank will be constructed in the middle of the construction schedule.

2.9.3.2 Civil works

The civil works will include setting out, excavations, backfill, construction of tank foundations, reinstatement and all other civil works, including formwork, concreting and reinforcement. The facilities sites shall be prepared to the levels and measurements approved by the Employer's representative. Bench marks shall be established and constructed at the start of the works and shall be maintained for the period of the contract. They shall refer to an approved datum. All work shall be as shown on the drawings or as directed by the Employer's representative to the specified levels, depths, widths and tolerances. Prior to commencing construction, the Engineering Procurement and Construction (EPC) Contractor shall establish reference points to define the works.

The EPC Contractor shall set out levels of the works at intervals as are required to do the works. Before commencement of any excavation, the site shall be surveyed in conjunction with the Employer's representative to establish existing ground levels and these agreed levels shall form the basis for the calculation of quantities of any subsequent excavation and backfilling. These levels shall be taken before any topsoil has been removed. The EPC Contractor shall in the presence of the Employer's

representative set out the works in accordance with the drawings, making any changes the Employer's representative may deem necessary and confirming the exact positions of other services.

During the progress of the Works, the EPC Contractor shall not remove, damage, alter or destroy in anyway whatsoever, any plot or survey beacons. He shall notify the Employer's representative of the need to interfere with any beacon. The Employer's representative shall approve any removal and reinstatement that he considers necessary. Should any beacon be found to be above or below the level of the finished work, the EPC Contractor shall immediately report the same to the Employer's representative. Should any beacon be damaged or destroyed by the EPC Contractor he shall forthwith report the damage to the Employer's representative

All excavations in open cut shall be the minimum necessary for the construction of the works. Bulk excavations shall be made to such sizes, depths and inclinations as the Engineer may direct or as may be necessary to construct the Works. Any excavated material stored on site for any purpose shall be deposited in such a manner that no damage and as little inconvenience as possible is caused. The Contractor shall comply with the procedures and requirements of the proponent for the minimum headrace canal channel width excavations.

2.9.3.3 Sources of construction materials and equipment

All materials to be used in the construction of the project shall be tested in accordance with the appropriate National and International Standard and requirements to verify their suitability for the purpose. The actual quantities of the various bulk materials required will vary depending on the outcome of the detailed design exercise, yet to be carried out. Sourcing of the materials is the responsibility of proponent/ contractor, subject to any constraints imposed by this ESIA report.

2.9.3.4 Logistics Arrangements

In consideration of the massive movement of construction equipment, materials and resources during the construction phase of the project, the construction work itself will need proper logistics arrangement.

2.9.4 Operation

2.9.4.1 Commissioning, Operation and Maintenance of Hydropower activities

The commissioning phase of the project development requires civil, mechanical, and electrical engineering expertise to cover the broad spectrum of hydropower development. Lenders may also hire an independent engineer for the commissioning phase. Before commissioning tests begin, all required documents such as quality certificates, test procedures, tests results from equipment installation and all other tests shall be made available to the lead commissioning engineer.

The O&M arrangement will depend to a great extent on the financial viability and profitability of the plant (i.e. the cost of EM plant vs. cost of maintenance). Since this is a high cost and high revenue generating project, the proposed Khalala plant is very advanced with a high level of automation, to ensure proper plant operation and minimum downtime. However, the open headrace system is less complicated but more cumbersome in that, the cleaning will be manually done, as will the operation of the head-works gates and other controllers, and therefore, a workforce shall be required for

the maintenance and operation of the head-works system. This is especially true for the maintenance of the hydraulic system and for functions like silt and trash removal. These tasks do not justify installation of intricate automated systems, and can be reliably carried out with manual labour.

A major advantage of this kind of project is the relatively simple and straight forward monitoring required. Due to the intrinsic simplicity of the production process, a daily reporting procedure will provide total overview of the project's operational performance to the proponent. Daily performance analysis considering yield received versus power generation will be carried out and any variation from the expected power generation instantly identified. It will be the duty of the plant superintendent to include reasons for detected variations as comments in the daily report, and propose corrective measures and major implications if there are any. This data will then be used to compile monthly progress reports based on rainfall, stream flow and energy generation. This report will also provide a cash flow statement including a detailed account of extraordinary expenditure occurring during the relevant period.

2.9.4.2 Waste and Disposal Activities

Effective and responsible handling and disposal of wastes are key elements in environmental management system. Wastes refer to any material (solid, liquid, gaseous or mixture) that is surplus to requirements. Waste management for the project shall be carried out in consultation and in line with the waste management plan and guidelines for Khalala Hydropower Kenya Limited. The proponent shall take all practical and cost effective measures to minimise the generation of wastes, by employing the four R's (Reduce, Reuse, Recycle, and Recovery) through the process of optimization or redesign, efficient procedures and good housekeeping.

Waste shall be managed in the following ways;

- Inventorization
- Classification
- Segregation
- Wastes quantification
- Wastes tracking; and
- Wastes disposal

Wastes disposal shall be carried out in consultation with the NEMA Wastes management section and as per the County bye-laws.

2.9.4.2.1 Solid Wastes

These types of waste include cleared vegetation, domestic refuse, pegging trash, scrap metals, filters, welding torches and spent electrodes. In line with waste management procedures, identified solid wastes will be sorted and disposed of in designated areas.

All chemicals used by the proponent would be handled and ultimately disposed of according to the requirements of Safe Handling of Chemicals (SHOC) system. There shall be maintained records of all chemicals stored on site, identifying their Health, Safety and Environmental implications. Regular checks shall be made by the proponent/ contractor to ensure that records are maintained and storage facilities are in good handling practices. Solid wastes would be disposed of in the following manner: Plastic containers depending on their size will either be returned to the supplier, cleaned for reuse or

crushed. The disposal of industrial wastes would be conducted in designated areas in accordance with the regulations.

2.9.4.2.2 Effluent/ liquid wastes

Due to lack of a sewer line in the project area, the proponent commits to handle liquid wastes/ effluents as will be appropriate through installation of a Sewerage Treatment Plant (STP) at the campsite.

An elaborate and detailed management strategies of the types of wastes envisaged from the project activities is provided in Chapter 6. However, this management approach will be harmonized with Khalala Hydropower Waste Management Plan-MP 12 as is presented in Chapter 8.

2.9.4.2.3 Occupational health and safety training

A personal protective equipment (PPE) policy will be enforced at the site throughout in line with the requirements of the Khalala Health Safety and Environment (HSE) Management Plan. This system should be implemented by the Contractor and verified by the Site Environmental, Health and Safety Advisor who will be based on the site on fulltime basis. All personnel involved in work execution or supervision will have the appropriate qualifications and accreditations and will be properly trained in the appropriate HSE risk management. Particular attention will be paid to delivering comprehensive training to all newcomers; periodic refreshment to all staff at pre-determined frequency; checking competency as needed; and the renewal of accreditations before expiry dates are reached. The proponent will be notified immediately of all accidents, incidents, near misses, equipment damage or leaks/spills which may occur. A high hygiene standard should be maintained within the housekeeping, catering, food, water and waste processing areas.

2.9.4.2.4 Emergency Preparedness and Response

A bridging document will be put in place prior to the start of the proposed activities in order to ensure that the Emergency Response Plan (ERP) is as per the contractor's procedure and in compliance with Khalala Hydropower Kenya ERP, procedures and standards.

2.9.4.3 Administrative team

The administrative team will oversee the efficient functioning of the project and make all decisions related to the proper operation and maintenance of the project, and will comprise of the following personnel:

- ✓ Managing Director;
- ✓ Finance Director;
- ✓ Technical Director;
- ✓ Plant Manager;
- ✓ Health, Safety and Environment Director;
- ✓ Social Performance Director;
- ✓ Resident Engineer; and

- ✓ Administration Director.

2.9.5 Decommissioning

It is anticipated that the hydropower station facilities will be continuously maintained and repaired, and will be operated for several decades. Because of their long useable life, the circumstances under which they might ultimately be decommissioned are difficult to foresee at this stage. Thus, only a site construction decommissioning approach can be considered at this stage in the study. As a result, the practical decommissioning will for now involve the following:

- Restoration of sites through levelling and re-vegetation measures;
- Removal of obsolete equipment and associated equipment parts;
- Demobilisation and return of imported labour force after the project;
- Grievance management mechanisms with the host communities before site closure;
- Repairs of damaged roads and restoration of access routes and route deviations;
- Removal of construction debris and unused materials

2.9.6 Project cost and investment plan

Table 2-3: Project Cost and Investment plan

KHALALA HYDROPOWER PROJECT	
Project Cost Parameters	USD. Million
Civil works	73.8
Electro-Mechanical works	
Design Cost	
Installation and Commission	
Interconnection and Transmission Line	
Project Formulation and rights	
Loan Processing Fee	
Administrative and Pre-operation expenses	
Promoter Shares	
Contingency (Local)	0.0
Owners Cost	3.0
Total	76.80
Preliminary Interest (After Rs Deposit Credit)	5.12
Loan Fees + Commission	-
Total project Cost	81.92

CHAPTER THREE

3. DESCRIPTION AND ANALYSIS OF BASELINE ENVIRONMENT

3.1 INTRODUCTION

The chapter provides an analysis of the existing environmental conditions of the study area and establishes the reference point from which the subsequent audit assessment will be carried out.

3.2 QUALITY ASSURANCE/CONTROL PROCEDURE IN THE FIELD

The study undertook the detailed field assessment and sampling of the following environmental aspects: terrestrial environment; aquatic environment; water quality; soil; air and noise quality. Appropriately samples were then labeled properly, including the sample identification code, date, sampling location, source of sampling and receptor etc. and taken for further analysis as was appropriate.

Labeling: Assured that sample labels were complete and easily identified the sample.

Equipment: The fit for use equipment were employed in the assessment.

Sample Collection: Methods used to collect samples or sampling techniques were standard at every site.

3.3 PHYSICAL ENVIRONMENT

The following characteristics of the study area constitute the baseline environment:

3.3.1 Climate and Meteorology

The climate of the basin is mainly tropical humid and receives mean rainfall of between 1,200-2,700mm to a minimum of 600-1,100mm per year. The project area is characterized by annual day temperatures varying from 16°C in the highland areas of Cherangany Hills and Mt Elgon to 28°C in the low land areas. The rainfall is bimodal with dry spells experienced between December and March. The distribution of rainfall is affected by topography and the south-westerly winds from Lake Victoria. Due to high elevation (1400 to 2300m), rates of évapo-transpiration in the catchment are generally low and decreases with increasing altitude, and in some months it exceeds rainfall. The relative humidity is normally in the range of 50% to 60% of the potential evapo-transpiration within the catchment. The lowest temperature occurs in the months of June to August that coincides with the lowest evapo-transpiration amounts. Generally in the drier months, the evapo-transpiration exceeds rainfall amounts. The evapotranspiration however does not vary as much as rainfall in a given year (Githui, 2007).

Generally, Nzoia River basin experiences four seasons in a year as a result of the inter-tropical convergence zone (ITCZ). There are two rainy seasons and two dry seasons, namely, long rains (March to May) and the short rains (October to December) associated with ITCZ. There is no distinctive dry season but relative to the rainy seasons, the dry seasons occur in the months of December to February and in some parts, June to September.

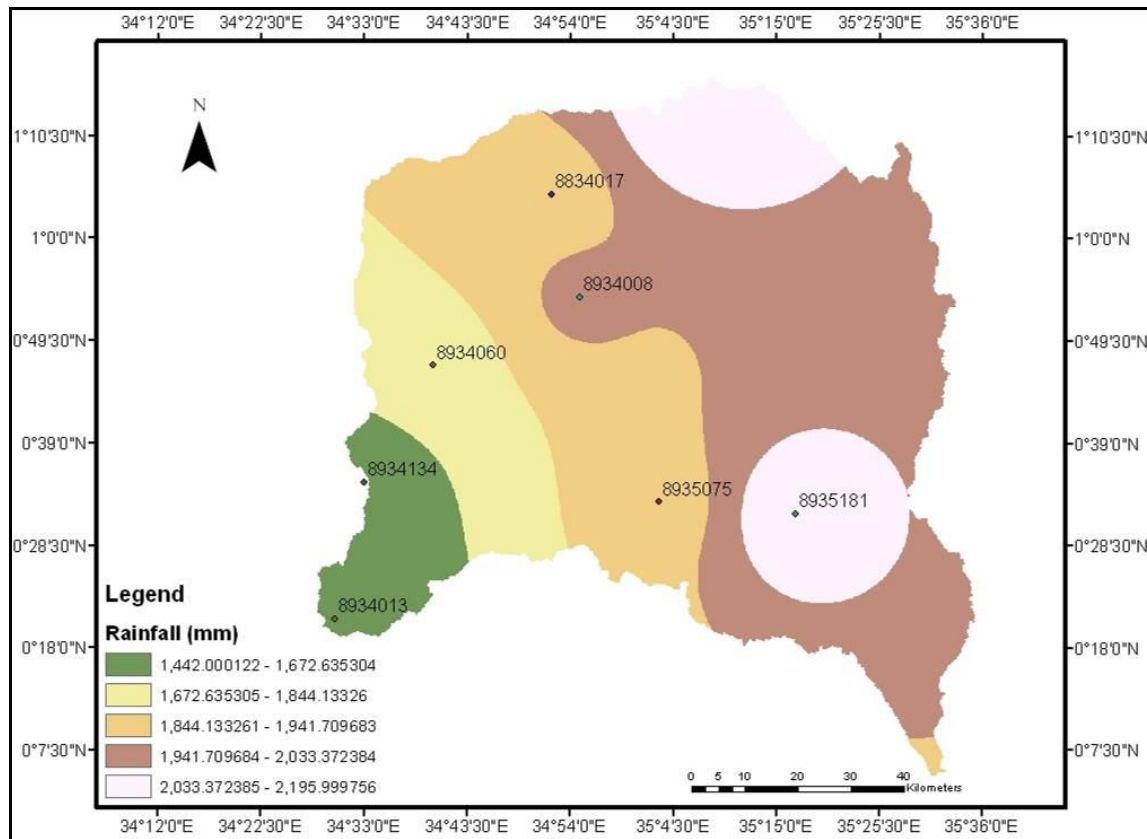


Figure 3-1: Spatial rainfall distribution in the catchment area upstream of the proposed project area

3.3.2 Landscape-Relief and Topography

The major physical features in the region include; the extinct volcanic Mt Elgon, Mt. Elgon forest reserve, National park and mountain vegetation. The other physiographic features include hills (Chetambe, Sang’alo and Kabuchai), rivers, waterfalls such as Nabuyole and Teremi. Mt. Elgon and Sang’alo hill have attractive caves. The altitude of the project area and its environs ranges from over 4,321m (Mt. Elgon) to 1200m above sea level. Mount Elgon is a 4,321m high extinct volcano, Kenya’s second-highest mountain (after Mount Kenya).

Bungoma County has only one gazetted forest, the Mt. Elgon forest reserve which measures 618.2Km², and one National park, which measures 50.683 Km². The project area has both planted and indigenous forest vegetation. The main physiographic feature in the project area is River Nzoia.

3.3.3 Hydrology and Hydrogeology

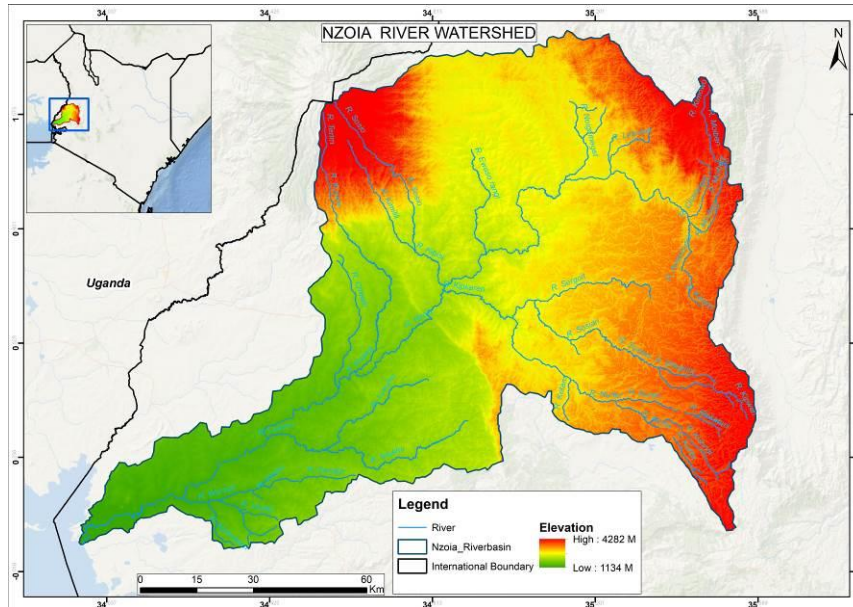
This section analyses both the terrestrial and aquatic hydrological characteristics of the study area. Specifically, the section examines rivers, streams and channels running through or located in the vicinity of the site, underlying aquifers and ground water bodies.

3.3.3.1 Catchment characteristics

River Nzoia originates on the easterly slopes of Mt Elgon and Cherangani hills through Kitale plain, which forms part of the pre-Miocene period and has a slight southerly tilt with the principal drainage system eventually flowing into Lake Victoria near Port Victoria

in Busia County (Government of Kenya, 2014). River Nzoia is a larger river with an approximate length of 257km and a catchment of 12,842km². The river is connected upstream by small streams which combine into a large river downstream.

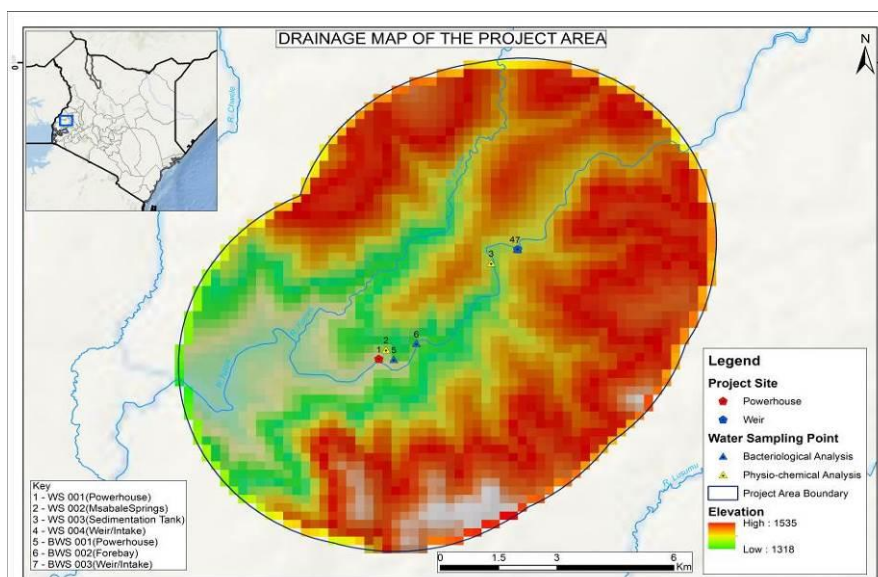
The river is threatened by catchment activities like conversion of wetlands into farms, urban developments, poor management of domestic and industrial wastes, and leaching of agrochemical residues causing decreased forest cover, increased soil erosion and river pollution (Yi et al., 2010). The effluents from factories along the river not only alters fish composition but is also affects the ecology and behaviour of fish (Balirwa, 1979).



Map 3-1: River Nzoia Drainage

3.3.3.2 Drainage Pattern of the Area - Rivers, Streams and Channels

The project area is well drained due to the undulating topography. Water erosion is the major form of erosion in the project area. Storm water is channeled to the existing natural drainage system in the project area which flows into River Nzoia.



Map 3-2: Project area drainage and water sampling points

3.3.3.3 Rainfall Analysis

Rainfall has an enormous impact on human activity, natural vegetation, surface runoff and groundwater recharge. The period of seasonal rainfall in the study area is characterized by spatially erratic short duration and high intensity rains. The rainy seasons spans parts and for this reason the total annual rainfall is calculated on the basis of calendar years. At the Nzoia Sugar Company rainfall station (8934139), the total annual rainfall varied between 1305mm and 2012mm (Figure 3-6 below) with a long term mean of 1780mm/year for the period 1983 - 2012.

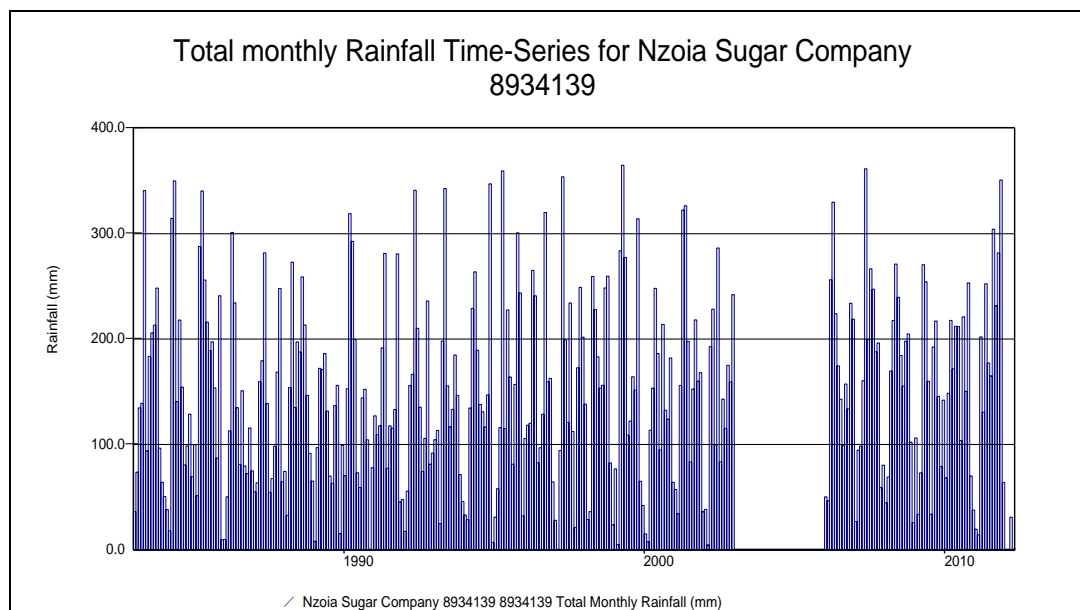


Figure 3-2: Monthly rainfall at Nzoia Sugar Factory station (8934139) for period 1983 – 2012

3.3.3.4 Water resources

The proposed project area lies in the Lake Victoria catchment zone with all the rivers draining into Lake Victoria. The existing water supply system comprises of a combination of surface and groundwater systems. River Nzoia is the main water resource in the area together with myriads of permanent streams flowing throughout the year. Most of the locals fetch water from natural sources (springs).



Plate 1: Dilapidated Khalala community water spring

3.3.3.5 Flow analysis and Discharge for River Nzoia

A flow duration curve (FDC) represents available flow and its distribution; the FDC is also used to calculate energy generation. A FDC for a particular point on a river shows the proportion of time during which the discharge there equals or exceeds certain values. Flow duration curves for long periods of runoff are useful for deciding what proportion of flow should be used for particular purposes, since the area under a curve represents volume.

When evaluating sites for suitability for a hydropower generation, it is important to assess the probability that the river/stream will have sufficient flow to meet the need for the proposed project. This is informed by the fact that the amount of energy produced by a run-of-river hydropower plant mainly depends on the sequence of stream flows workable by the plant during its lifetime, which is controlled by the river flow availability. In this study, instantaneous maximum discharges were considered for flood frequency analyses and low frequency analyses were used to specify low flow duration. The instantaneous discharge was used with high flows because damage often occurs even if the site is inundated only for a very short period of time.

The proposed project site on Nzoia River at Khalala has no regular gauging station and as such a regular gauging station (1DA02) about 19km upstream of the proposed abstraction site was used to relate the flows. The station is critical to derive flow duration curve for the site. For this reason, discharge data used for hydrological analysis data for the station was obtained from WRA Regional Office, Kakamega.

In this study, the catchment area of Nzoia River at the gauged site and regular gauging station (1DA02) is 8788.73km² and 8514.21 km² respectively. The station has historical data that covers the period 1947-2017. The data was used to determine the FDC at the proposed project site. The total average discharge from the measurement was 42.10m³/s at 1754 hrs with a flow velocity of 0.47m/s. The river at the site was 24.64m wide with an area of 88.91m².

3.3.3.6 Mean Daily flow

Statistical analysis was used in the study to characterize the general flow regime of Nzoia River. The natural flow variability was best described by daily discharge time series. Hydrological indices for Nzoia River at the proposed project site that could be inferred included mean daily flow, Q95 (reserve flow) and Q50 (flood flow), instantaneous peaks, maximum and daily minimum discharges. Highest instantaneous peaks are essential for assessing regulation requirements while the maximum and daily minimum discharges indicate the range of water availability. Data used in this study for the station 1DA02 on River Nzoia ranged from 2-Apr-1947 to 30-June-2017. From the analysis the average daily flow was 53.127m³/s translating to 110.16MCM/day and 40209.93MCM/year. The mean annual low flow was 11.149m³/s for the period 1947-2017 that translates to 4.59MCM/day and 1675.41MCM/year.

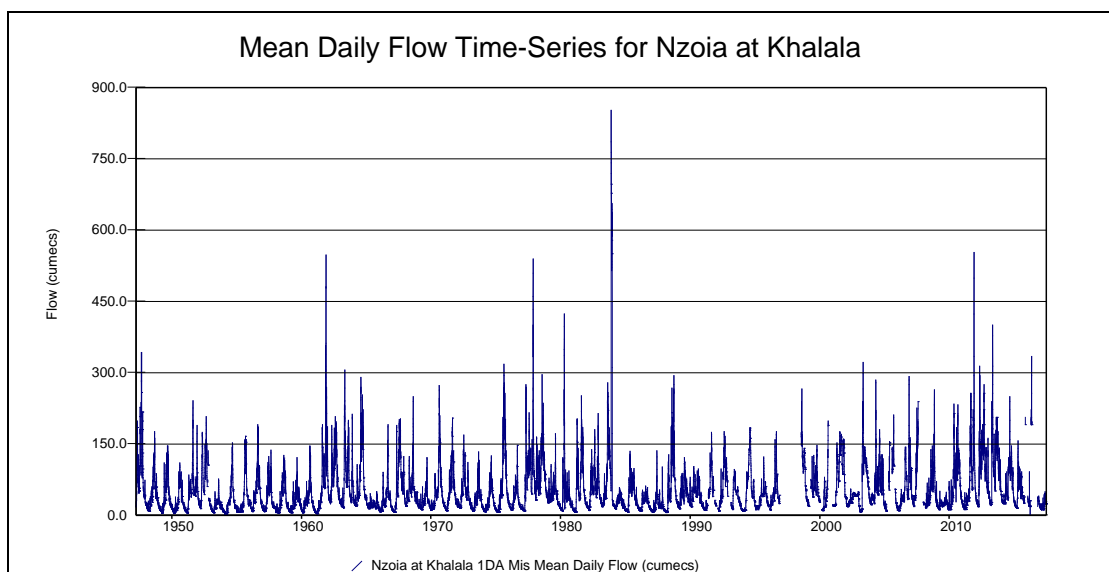


Figure 3-3: Time series of Mean Daily Flow for Nzoia River at Khalala project site

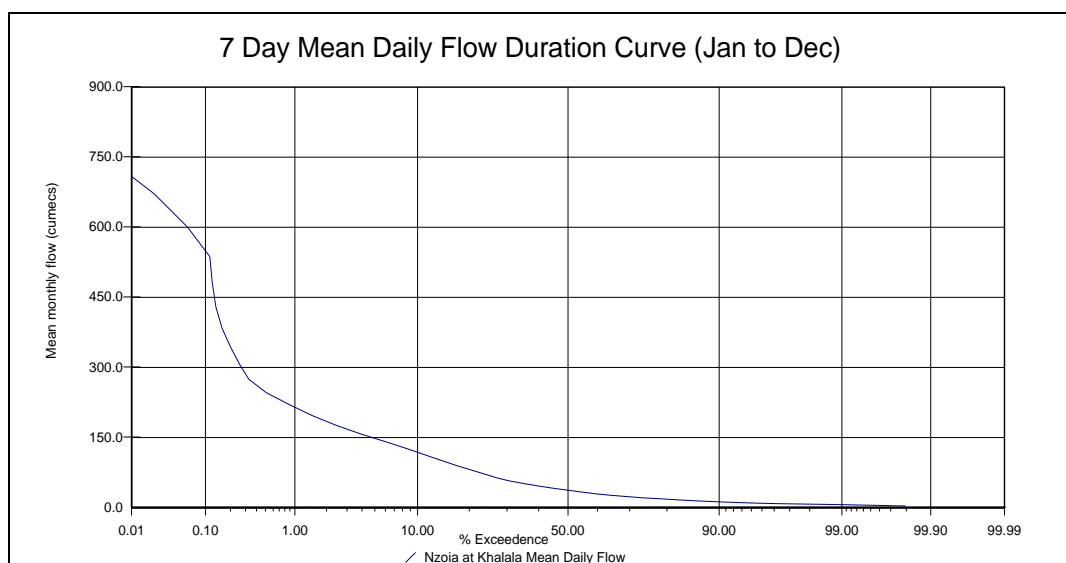


Figure 3-4: A 7-day flow duration curve for Nzoia River at the Khalala project intake

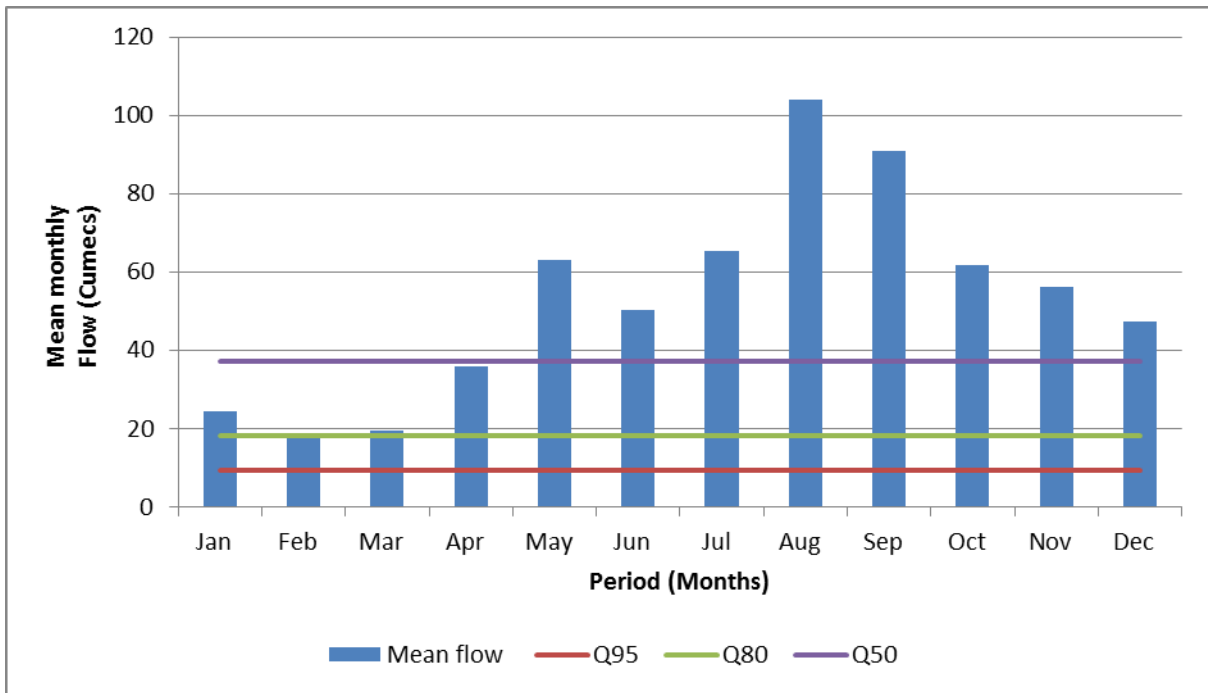


Figure 3-5: Mean monthly flow discharges for River Nzoia at Khalala

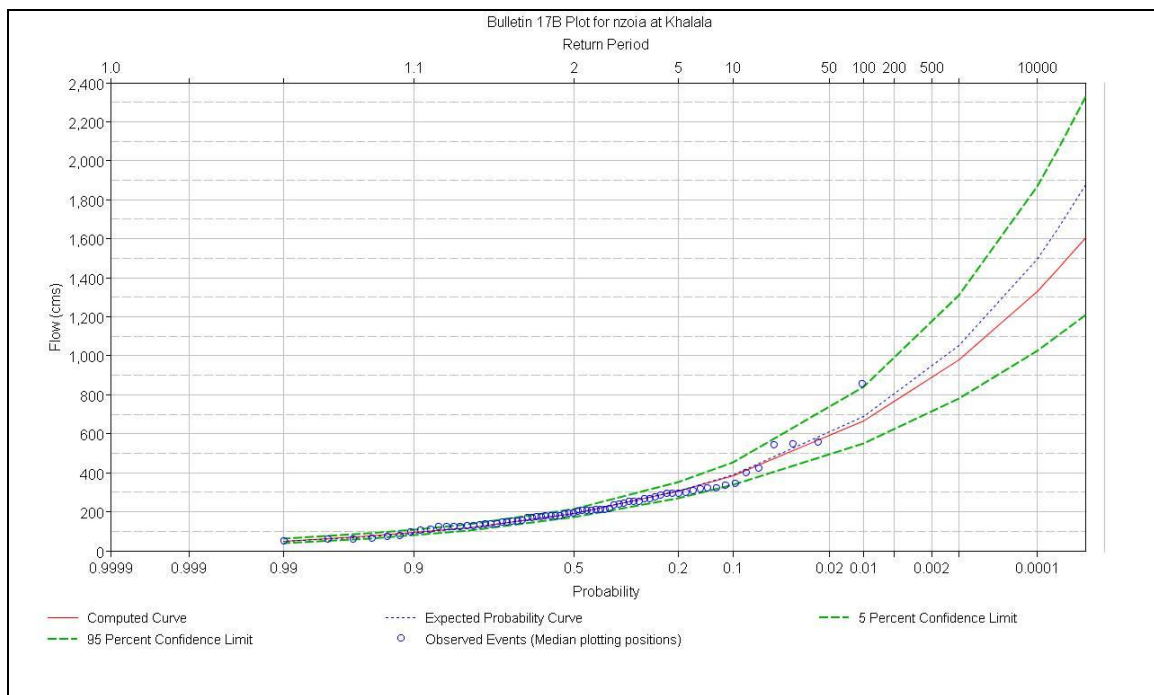


Figure 3-6: Flow frequency curve for Nzoia River at the proposed project intake

3.3.3.7 Ecological / Environmental Flow

Environmental Flows (EF) is the flows of water (in terms of quality, quantity and timing) in rivers that is necessary to maintain aquatic ecosystems, in other words, a flow regime in the river capable of sustaining a complex set of aquatic habitats and ecosystem processes. Through implementation of an environmental flow, a proposed project can achieve a flow regime, or pattern, that provides for human uses and maintains the essential processes required to support a healthy river ecosystem. However, the

environmental flow does not necessarily require restoring the natural, pristine flow patterns that would occur outside of a proposed project, but is rather intended to generate a broad set of values and benefits from the river.

In the Khalala Hydropower Project; Hydrological Index Methods (or rule of thumb, threshold, or standard setting, desktop methods, or flow duration curve methods) - primarily using hydrological data (historical monthly or daily flow records) for making flow recommendations for maintaining river health at designated level was used. The method relied primarily on the use of hydrological data, usually in the form of naturalised, historical monthly or daily flow records, for making environmental flow determinations. In this approach, a set proportion of flow, often termed the minimum flow (Cavendish and Duncan, 1986; Milhous et al., 1989), represents the environmental flow that is intended to maintain the freshwater fishery, other highlighted ecological features, or river health at some acceptable level, usually on an annual, seasonal or monthly basis.

According to Brown (2003), flows in rivers are generally needed for various purposes such as to:

- Maintain river flow conditions such as flow velocity, water depth and acceptable turbidity levels, making it possible for the river to purify itself (dilution of effluents and waste water);
- Maintain low flows, which support the livelihood of the people (who use the river as a source of drinking water, washing, bathing, fishing, recreation and tourism, etc);
- Sustain both terrestrial and aquatic ecosystems. For example, low flow provides water to wild animals, maintains soil-moisture along the river-banks, etc. Small floods stimulate spawning in fish and allow passage for migratory fish and germination of seeds along river-banks. Large floods deposit nutrients on the banks and distribute seeds; and
- Recharge groundwater and aquifers by large floods, which maintain the perennial nature of rivers acting as a source of water during the dry season. Furthermore, large floods flush sediments and natural obstructions in the river course and maintain a sufficiently deep channel for navigation.

Reiser et al. (1989a) highlighted the Tennant method as the most commonly applied hydrological methodology worldwide. This method comprises of a table linking different percentages of average or mean annual flow to different categories of river condition, on a seasonal basis, as the recommended minimum flows. The method is based on the assumption that flows that are satisfactory for the needs of fish and other aquatic biota will also be sufficient for maintaining recreational and aesthetic qualities. Based upon empirical relationships and observations, Tennant suggested that minimum flows at any time of the year must be 10% of mean annual discharge. Below the 10% threshold, fish habitat and recreational value would be severely degraded.

In line with the Tennant method, the suggested environmental flow of 10% of mean flow for Nzoia River is equivalent to, $(10\% * 53.127\text{m}^3/\text{s}) = 5.313\text{m}^3/\text{s}$. From the studies conducted and the recommendations by the hydrologist, the recommended EF for Khalala Hydropower Project is given as $6\text{m}^3/\text{s}$. By comparison of the $6\text{m}^3/\text{s}$ and the determined $5.313\text{m}^3/\text{s}$ we deem that the EF is adequate enough to maintain the aquatic

life in the river as well as be able to offer other services. The Abstraction Permit for the proposed Khalala Hydropower Project is yet to be issued by Lake Victoria North Catchment Basin which we anticipate will also give mandatory minimum Environmental Flow for the River. However, at the proposed EF this is adequate to maintain the river flow conditions, support the livelihood of people, sustain both the terrestrial and aquatic ecosystems and recharge groundwater and aquifers.

According to Section 3.4.2 (Aquatic Environment), during the 2018 KEMFRI survey, fish species were caught from River Nzoia upstream the proposed intake point. Other aquatic biodiversity identified in the same river from a different study indicates presence zooplanktons, phytoplanktons, rotifers and benthic macro-invertebrates.

3.3.3.8 Water quality

Surface water sampling was undertaken to ascertain the river system health based on a number of parameters. During the sampling survey, three water samples were collected for microbiological analysis and four samples collected physico-chemical analysis. The Microbiological sample included;

- Sample Reference BWS-001 coordinates: 00⁰ 27' 16.4" N and 034⁰ 39' 04.6" E from the proposed power house and tail water discharge point interface with the River section at Khalala Msabale;
- Sample Reference BWS-002 coordinates: 00⁰ 27' 30.7" N and 034⁰ 39' 35.1" E from the point where the proposed forebay is located parallel to the river and just immediately before the point where the spillway canal joins the river, Msabale area; and.
- Sample Reference BWS-003 coordinates: 00⁰ 28' 55.3" N and 034⁰ 40' 59.4" E from the proposed weir and intake location, Sikubale village.

During the physico-chemical water quality sampling, three samples were collected from the river in the project impact area and one sample collected from the community drinking water source in Khalala Msabale village, they included:

- Sample Reference WS-001 coordinates: 00⁰ 27' 16.7" N and 34⁰ 39' 04.0" E from power house and tail race water discharge point;
- Sample Reference WS-002 coordinates: 00⁰ 27' 25.0" N and 34⁰ 39' 10.0" E from Msabale community Spring;
- Sample Reference WS-003 coordinates: 00⁰ 28' 42.9" N and 34⁰ 40' 37.4" E from the de-sander/ de-siltation point location along the river; and
- Sample Reference WS-004 coordinates: 00⁰ 28' 55.6" N and 034⁰ 40' 59.0" E from the weir and intake point.

Ultimately, these water samples were also collected based on whether they fell within the potential pollution pathway within the proposed project area.

For each sampling site, the surface water samples were collected from approximately 0.2-0.5m below the water surface in clean and sterilized labelled 250ml Pyrex glass bottles for microbiological samples and washed drinking water bottles of approximately one litre used to collect samples for physico-chemical analysis. In the field, the microbiological water samples were kept in a cooler containing dry ice and transferred

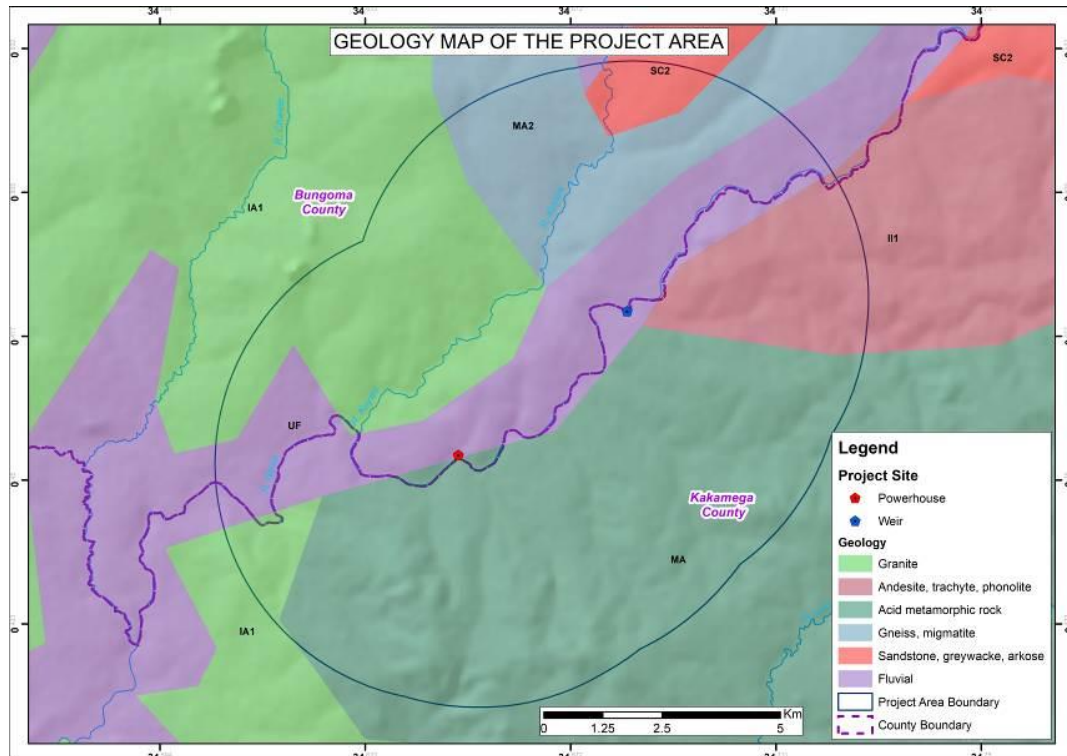
within 6 hours for analysis at the Water Resources Management Authority Laboratory in Nyalenda, Kisumu while the water samples for physico-chemical analysis were taken to WRMA Central laboratories in Nairobi.

The results of the water quality laboratory analysis (see Annexure 2) indicate that the water quality parameters of the samples collected at the selected sites were not within the recommended national and WHO potable water standards except for the WS-002. For the sample reference WS-002; Msabale Community spring, the water was found to be chemically suitable for domestic use while sample references WS-001, WS-003 and WS-004 were found to be coloured and turbid with high iron content. The laboratory results report recommended water quality analysis to ensure the water is maintained at the recommended parameters as the WHO standards and KEBS (KS 459-1:2007) standards.

3.3.4 Geology

Three major rock types are found in the proposed project catchment area: The Nyanzian and Kavirodian systems, Mozambique belt rocks system and Tertiary lavas. The Kavirodian system has undergone low grade metamorphism but of sediments. Rocks in this system include mudstones and grits which are of Archean age. These rocks are banded and have a general east-west strike and occur interbedded. In the Nzoia catchment area, these rocks extend into the Nandi escarpment. The Mozambique metamorphic belt rocks that belong to this group have experienced a high degree of metamorphism so that their original structures are highly modified. Two groups are inferred: the well foliated gneisses and schists and those that are of intrusion origin.

The lower sections of the catchment area have granitoid intrusions as the dominant types of rocks that have undergone a high degree of metamorphism. Most of the upper part of Nzoia catchment are separated by the Nandi escarpment and consist of gneisses with no intrusions present. Lavas of tertiary age lie within the periphery of the eastern side of the catchment. The tertiary lavas include trachytes, phonolites and basalts. The Mt Elgon area is also of tertiary age. It is believed that exposed metamorphic rocks between Mt Elgon and the volcanic lavas in the Eldoret area resulted from peneplanation and erosion.



Map 3-3: Geological Map of the Project area



Plate 2: Geological rocks in the river channel and on the banks at the weir and intake

3.3.5 Soils

Soils within the catchment are underlain by weathering products of granitic rocks together with the associated metamorphics. These are generally moderately reddish brown to red latosols (mostly Ferralsols and Nitosols). On valley bottoms, black marsh soils are found. In general, soils are of fairly high infiltration capacities except those which occur on bottom lands. They have in general high moisture retention capacities

At the proposed project area of influence the soils can be classified into three categories; Acrisols, Gleysols and Nitosols. The soils are of varying texture from loam to clay soils and so is the colour of the soil in the project area. Due to the sodic nature of these soils the soil structure is usually pulverized during the dry season and susceptible to windborne erosion. Further, these soils are difficult to traverse by vehicles/ machinery during the wet season due to their stickiness and plasticity that causes vehicles to get stuck in the mud.

Soils at the weir: SS-001

These soils were mainly of alluvial deposits. They exhibited strong surface sealing and caking. The texture was silty clay with a brown to black colour patterns and intermittent rocky outcrops of the river banks. The sampling point was SS-001 with coordinates:

00⁰ 28' 55.3" N and 34⁰ 40' 58.7' E.

Soils at the Sedimentation tank: SS-002

The soils were mainly loamy with a fine texture and grey to brown in colour. The sampling point was SS-002 with coordinates: 00⁰ 28' 37.6" N and 34⁰ 40' 32.3" E.

Soils at the Forebay: SS-003

The soils were loose fine loamy soils with caking nature that breaks easily. They were brown to grey in colour. The sampling point was SS-003 with coordinates:

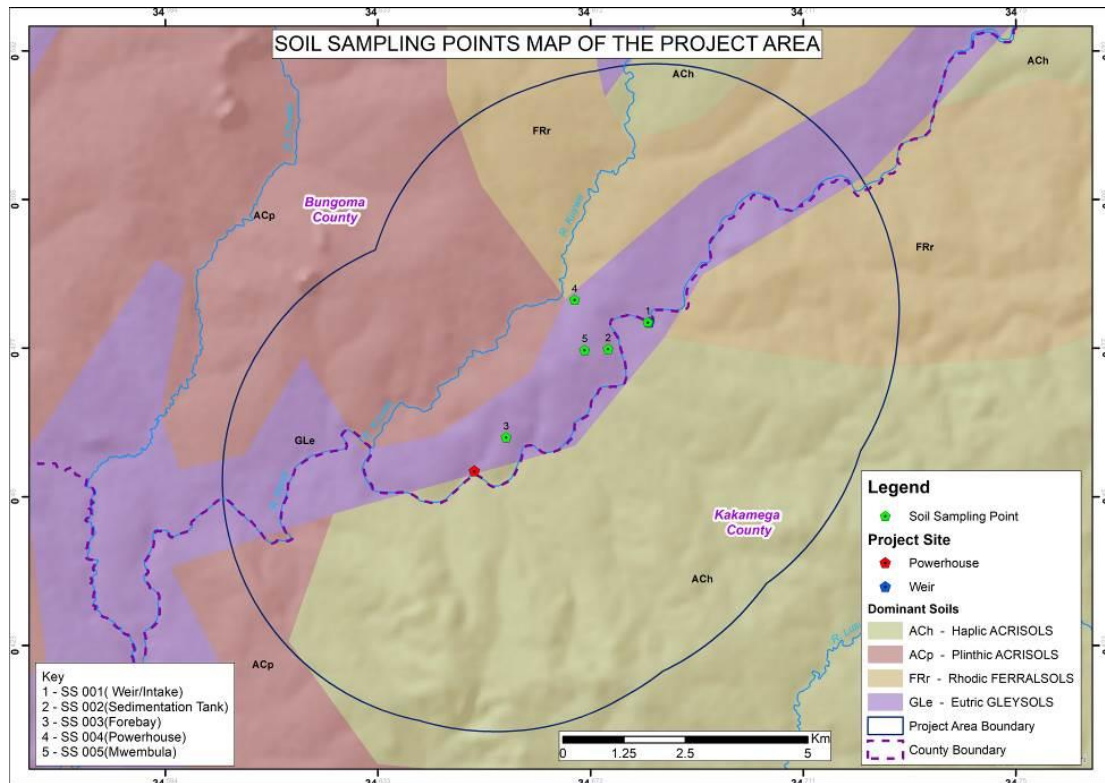
00⁰ 27' 39.0" N and 34⁰ 39' 25.0" E.

Soils at the Power house: SS-004

The location had clay soils. The soils were very elastic and easily to be moulded. The soils also supported the growth of dense grass cover as well exhibiting surface pitting in bare areas. The sampling point was SS-004 with coordinates: 00⁰ 29' 10.2" N and 34⁰ 40' 35.6" E.

Soils at Mwembula village: SS-005

This soil sample was loamy with a fine texture and brown in colour. The sample was taken outside the key project features. The sampling point was SS-005 with coordinates: 00⁰ 28' 36.9" N and 34⁰ 40' 16.8" E.



Map 3-4: Soil mapping unit and sampling points in the Project area



Plate 3: Soils at the weir showing surface sealing

3.3.5.1 Soil quality

A composite soil sample was collected from a 0-30cm depth from each of the project feature location namely; the weir, the sediment tank, forebay and the power house with one more sample collected within the general zone of influence. The composite soil

samples were taken to Kenya Agricultural and Livestock Organization National Agricultural Research Laboratories and were analysed for the following parameters: Soil PH, Exchange acidity, Potassium, Calcium, Magnesium, Iron, Zinc Copper, Manganese, Nitrogen (total), Phosphorous (total) and total organic Carbon and sodium.

The soil samples were taken for soil fertility and the test results from KALRO National Agricultural Research Laboratories indicates that all the soil samples had soil PH being either medium, strong and extreme acidity. The other parameters such as exchange acidity, Iron, Zinc, Copper, Manganese, Potassium were adequate. The remaining parameters including Nitrogen (total), Phosphorous (total) and total organic Carbon, Magnesium and Calcium showing low values. The results as obtained from the KALRO National Agricultural Research Laboratories are as presented in the Appendix 2.

3.3.6 Air Quality

Khalala Hydropower Kenya Limited has an Air Quality Management Plan that states that each project shall comply with the Country’s related environmental laws addressing the air quality aspects and any terms of site specific environmental approvals issued by regulators and authorized institutions. For this case, it was important that the ambient air quality of the proposed project is established.

This Air Quality Monitoring was conducted with the objective of quantifying the existing air quality at the proposed project site before initiation of the project related activities with specific parameter being Particulate Matter (PM10, and PM2.5).

The prevailing weather conditions during the sampling period was characterized of calm Easterly winds with a maximum speed of 03 knots on the Beaufort scale which were diffused during the morning hours. It was sunny, the sky was clear with few alto-cumulus clouds to the extent of 2 oktas. The relative humidity was 50% with nil precipitation.

The Air Quality assessment used WHO Air Quality Guidelines-Global Update 2005 and Environmental Management and Coordination (Air Quality) Regulations 2014, Third Schedule, ‘Emission Limits for Controlled and Non-Controlled Facilities’. The most important source of air pollution in the project area were motor vehicles and trucks hauling sugarcane. Air pollution within the project area is not considered to be a high risk as yet but anticipated to be high during the project construction phase.

EMC (Air Quality) Regulations, 2014

These rules under the property boundary states that No person, operator or owner of any facility shall cause or allow fugitive emissions to cause the ambient air quality at its property boundary to exceed the limits prescribed under the First Schedule. It further states that, No person, owner or operator of a facility shall cause or allow the emission of air pollutants in excess of the limits stipulated under the Third Schedule. The EMC (Air quality) Regulations 2014 for Ambient Air Quality at property boundary for general pollutant is as shown below.

Pollutant	Time Weighted Average	Property Boundary
Particulate matter (PM)	Annual Average*	50 µg/m ³
	24 hours**	70 µg/m ³

World Health Organization Air Quality Guidelines

The World Health Organization (WHO) has published Air Quality Guidelines (AQGs); these are listed in Table 4.1 (IFC 2007). The limits are broadly similar to EU Limit Values and are not mandatory; they have been set at a level that provides protection of human health for all members of the public.

WHO Ambient Air Guidelines

WHO Ambient Air Guidelines		
Parameter	Averaging	Guideline Value in $\mu\text{g}/\text{m}^3$
Particulate Matter PM₁₀	1 Year	70 (Interim target-1)
		50 (Interim target-2)
		30 (Interim target-3)
	24 hours	20 (guideline)
		150 (Interim target-1)
		100 (Interim target-2)
Particulate Matter PM_{2.5}	1-year	75 (Interim target-3)
		50 (guideline)
		35 (Interim target-1)
	24-hour	25 (Interim target-2)
		15 (Interim target-3)
		10 (guideline)
		75 (Interim target-1)
		50 (Interim target-2)
		37.5 (Interim target-3)
		25 (guideline)

In addition to guideline values, interim targets are given for each pollutant. These are proposed as incremental steps in a progressive reduction of air pollution and are intended for use in areas where pollution is high. These targets aim to promote a shift from high air pollutant concentrations, which have acute and serious health consequences, to lower air pollutant concentrations. If these targets were to be achieved, one would expect significant reductions in risks for acute and chronic health effects from air pollution. Progress towards the guideline values should, however, be the ultimate objective of air quality management and health risk reduction in all areas.

Results of Inhalable Particulate Matter (PM₁₀)

Location	Time (mins)	Flow Rate (L/min)	Volume (m ³)	Concentration (µg/m ³)	WHO Air quality guidelines (µg/m ³)	EMCA (Air Quality) Regulations, 2014 (µg/m ³)	Parameter
MP 01	1440	2.5	3.6	2.44	20	70	PM ₁₀
MP 01	1440	2.5	3.6	0.97	10	100	PM _{2.5}

PM₁₀ entails particles with diameter 10 micrometers or less while PM_{2.5} entails particles that have a diameter of less than 2.5 micrometres. From the results analysis in table above, all the points sampled for PM₁₀ and PM_{2.5} were within the Environmental Management and Co-ordination (Air Quality), Regulations, 2014, the WHO air quality guidelines and WHO guideline values for air quality standard over a 24 hour measurement period.

The results indicate that the ambient air quality of the sampled locations were within the criteria stipulated in the Kenyan Regulatory Limits – Environmental Management and Coordination (Air Quality) Regulations, 2014 and the WHO/IFC Standards. This is typical of the project area which can be classified as rural and other area according to the Kenyan Air Quality Regulations, 2014. However, it should be noted that the results of the air quality survey should be considered in the context of seasonal aspects. Where the relevant national standards / WHO guidelines are not exceeded may imply that if the same locations are surveyed during the dry and cold season with more or less permanent cloud cover and low dispersion rates air pollution levels are likely to be significantly higher than already critical concentrations measured during the present survey.



Plate 4: Air Quality Measurements

3.3.7 Noise quality

Standards used in assessment were; the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations 2009 and the Factories and other places of work (Noise Prevention and Control) Rules 2005 and in accordance with international noise standards, in particular ISO 1996:1822 - Acoustic Description and Measurement of Environmental Noise. Baseline noise levels of the proposed project area were determined during a site visit conducted on 20th December, 2018. The measurements were collected using a Sound Level Meter IEC 651 Type II (auto ranging-30-130dB). The data collection was undertaken with the dosimeter set on slow mode for affective averaging purposes before the Minimum and Maximum readings were recorded in decibels (dB).

Noise levels were recorded at the proposed project components location; mainly the weir, forebay and powerhouse as well as other ambient background noise measurement points were selected based on proximity of the sensitive receptors to the location of the proposed project components. Records of the minimum and maximum noise levels were taken and the average calculated.

Noise is any undesirable sound that is intrinsically objectionable or that may cause adverse effects on human health or damage to the environment. Vibration is any oscillatory motion of solid bodies of deterministic or random nature described by displacement, velocity or acceleration with respect to a given reference point. The recommended noise limits to reduce hearing loss (occupational deafness) by International Labour Organization (ILO) and World Health Organization and The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations 2009 are:

- 55dB (A) for 8 hours daily as the occupational exposure level (OEL), which most workers can continually be exposed to noise without developing occupational hearing loss in industries.
- For workshops and plant areas where occasional communication is required, the recommended limit is 65 - 85 dB (A).

A summary of the ambient noise level measurements at each proposed project component and selected sites is presented in Table 3-1 below. The specific details of each of the noise measurements including; (i) the specific dates on which the noise measurements were recorded, (ii) the specific times when noise measurements were recorded, (iii) the specific coordinates at which noise measurements were taken including coordinates for sensitive receptor sites in relation to the proposed project components, (iv) the anthropogenic factors that may have influenced the noise levels recorded (e.g. bird calls, local community conversations, etc.) were also recorded.

Table 3-1: Noise Measurement in the PAI

Full name of feature/area	Coordinates	Min readings	Max. readings	Average readings	Description
Proposed Weir site	00 ⁰ 28' 58.0" N 034 ⁰ 40' 55.3" E	32.4	106.9	69.7	The proposed point where the weir will be constructed is in a cultivated area, Noise influenced by the motorcycles, river flow, birds, and other insects.
Sensitive receptor along the headrace canal (Homestead)	00 ⁰ 28' 55.3" N 034 ⁰ 40' 59.4" E	31.7	82.4	57.1	The major sources of noise were playing children
Sensitive receptor along the headrace canal (Sitikho schools)	00 ⁰ 28' 26.1" N 034 ⁰ 40' 09.1" E	31.9	94.7	63.3	Motorbikes along the road at the point
Sensitive receptor in the project area; Khalala market	00 ⁰ 27' 43.3" N 034 ⁰ 38' 57.2" E	32.3	78.2	55.3	Sources of noise were from the people in the centre

Full name of feature/area	Coordinates	Min readings	Max. readings	Average readings	Description
Proposed Forebay tank site and Homestead	00 ⁰ 27' 38.4" N 034 ⁰ 39' 24.7" E	34.5	78.1	56.3	The sources of noise were insects, birds and echoes from the river
Proposed powerhouse location Sensitive receptor (Homesteads)	00 ⁰ 27' 16.9" N 034 ⁰ 39' 05.2" E	66.0	91.2	78.6	Noise from River Nzoia echoes, children, insects and birds

Based on the results presented in the table above, some of the average noise levels recorded at the proposed project components and selected sites were within permissible limits for residential areas as provided for in the EMC (Noise and Excessive Vibration Pollution Control) Regulations, 2009 which set the maximum limit as 55dB(A) during the day. These noise levels were largely influenced by sound from bird and insects calls and background conversations/ playing children in the nearby. The locations that registered noise levels that exceeded the maximum occupational exposure (OEL) limits as contained in the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations 2009 included the weir/ intake point and the power house.

3.4 BIOLOGICAL ENVIRONMENT

This section analyses the study area's ecology with particular attention to the aquatic environment given that fauna and flora on the already developed or rather disturbed terrestrial segment of the site is extremely limited.

3.4.1 Terrestrial Environment

The vegetation type and distribution in the project area has been influenced by the landform, climatic factors, soil, animals and human factors. Although the plots revealed very reasonable data on the distribution, diversity, and abundance of the various plant stratum according to the land use types in the area, a cumulative list was compiled from both the plots, and opportunistic encounters that were recorded as they were encountered in the study area. This resulted in the following habitat types within the project area.

3.4.1.1 Shrub-lands

This is the most dominant habitat type in the entire project area. This is characterized with multi-stem woody plants that are less than 8 metres in height. The development and establishment of species within this habitat type can be linked to soil salinity levels, soil sodicity levels, water and anthropogenic influence. Shrub-land habitats in the project area are found in the undisturbed sections of the land and in areas with moderately well drained and developed soils. This type of vegetation type was mainly found on the areas adjacent to the riverine vegetation. Some of the shrubs and herbs vegetation observed

in the project area include *Solanum incanum*, *Tethonia diversifolia*, *Abutilon mauritanium*, *Leonotis mollisima*, *Sennabi capsularis*, *Ricinus communis*, *Mimosa pigra*, *Lantana camara*, *Agave sisalana*, *Aspilia plurisetata*, *Thevetia peruviana*, *Plectranthus barbatus* and *Psidium guajava*.



Plate 5: Shrub-land at the tailrace water discharge point

3.4.1.2 Grassed shrub-land

This type of habitat comprises a mixture of two types of habitats namely; grasses and shrubs. Where the habitat occur shrubs represents at least 60-70% and grasses takes over the remaining 30-40%. This type of habitat is found in patches in the uncultivated fields. The shrubs species observed in this habitat included *Thevetia peruviana*, *Dovyalis caffra*, *Rhus natalensis*, *Solanum incanum* and *Lantana camara* with the grass species including *Chloris gayana*, *Themeda triandra*, *Cynodon dactylon*, *Pennisetum clandestinum*, *Bidens pilosa*, *Andropogon Chrysostachyus*, *Andropogon pralonsia*, *Exothea abyssinica*, *Digiteria scalaram*, *Eragrostis lascantha*, *Seteria sphacelata*, *Pennisetum catabasis* and *Sporobolus filipes*, *Hyperenia spp* and *Cymbopogon spp*, *Panicum maximum*, *Bidens pilosa*, *Sporobolus pyramidalis* and *Tagetes minuta*. The legumes include *Trifolium johnstoni*, *Medicago sativa* (Alfalfa or Lucerne), *Sesbania sesban* etc.



Plate 6: Grassed section and riparian river banks as observed from the weir and intake point

3.4.1.3 Farmlands/ Plantations

Planted vegetation dominated areas within the PAI with minimal natural vegetation. They include plantations and single stands of *Zee mays* (Maize), *Manihot esculenta* (Cassava), *Musa balbisiana* (banana), *Carica papaya* (pawpaw) and *Saccharum officinarum* (Sugar cane). Agricultural activities in the project area are mostly subsistence and cash crop farming. In subsistence farming, which is the main agricultural activity, mixed farming is practiced. The main cash crops in the area are maize and sugar cane. These crops are grown in small scale land holdings at a family level while those on large scale in the areas near the PAI were for Nzoia Sugar Company Limited.



Plate 7: Farmland within the project area

3.4.1.4 Woodlands

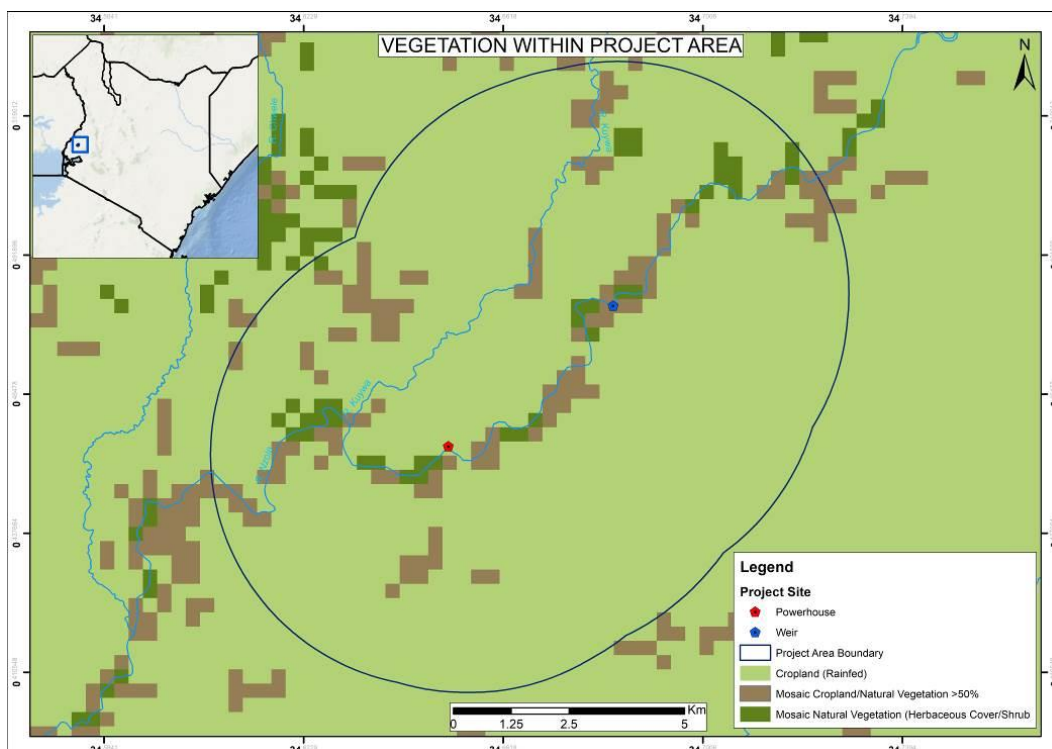
It is a low-density forest forming open habitat with plenty of sunlight, limited shade and little undergrowth. This habitat type is characterized with few woody trees growing with more open spaces within them. This type of habitat was mostly evident in single stands

at settlements or homesteads, on the river banks and along road corridors in the project area. The dominant species are *Cupressus lusitanica*, *Gravellia robusta*, *Croton megalocarpus*, *Ficus sycomorus*, *Eucalyptus globulus*, *Spathodea campunulata*, *Sesbania sesban*, *Erythrina abyssinica*, *Syzygium guminii*, *Erybotrya japonica*, *Casuarina equisetifolia*, *Markhamia lutea* and *Harungan Madagasraiciencies*.

No endemic, rare or endangered plant species were observed.



Plate 8: A typical woody establishment in the project area



Map 3-5: Project Area Vegetation map

3.4.1.5 Flora of the project area

3.4.1.5.1 Vegetation at the proposed Weir Site

The vegetation at the weir point varied from sugar cane plantation, grassed patches dotted with shrubs such as riverine papyrus, *Psidium quajava*, *Boscia spp*, *Leonotis mollissimo*, *Lantana camara*, *Solanum incanum*, *Phoenix reclinata*, *Agave sisalana* and *Spathodea compunalata*.



Plate 9: *Psidium quajava* shrubs and *Saccharum officinarum* plantation

3.4.1.5.2 Vegetation at the proposed Sedimentation tank

The vegetation at this locality was majorly of a farmland with sugarcane cultivation. Other areas were interspersed with grassed farmland.



Plate 10: *Saccharum officinarum* young plantation at the sediment tank location

3.4.1.5.3 Vegetation at the proposed Forebay tank

The proposed forebay tank site had sugarcane plantation save for shrubs and tree cover on the plot fences and along the footpaths in the locality.



Plate 11: *Saccharum officinarum* plantation at the Forebay location

3.4.1.5.4 Vegetation at the proposed Powerhouse location

The location of the power house is within a homestead set up approximately 200m from the river banks. The key species in the locality were *Sesbania sesban*, *Psidium quajava*, *Markhamia lutea*, *Erythrina abyssinica*, *Musa spp* and *Saccharum officinarum*.



Plate 12: A homestead a few metres from the proposed powerhouse location

3.4.1.6 Fauna of the project area

3.4.1.6.1 Mammals of the project area

The presence and numbers of mammals were surveyed in the PAI using the following methods:

- Direct and opportunistic observation: All mammals that were observed were identified to species level;

- Desktop Reviews: Data about the project area was obtained from existing literature;
- Use of animal footprints in the project area; and
- Local people were also consulted as a valuable source of information.

The fauna of this area include Mongoose, Hares, Ground squirrels, moles and rats. Other forms of mammals are found in conservation reserves such as Mt Elgon National park and forest reserve.

3.4.1.6.2 Birds of the project area

The diverse collection of bird species reported in the project area include; *Colius striatus kikuyuensis* (speckled mouse bird); *Pachyphantes superciliosus* (compact weaver), *Plocues cucullatus* (Black-headed village weaver), *Streptopelia capicola* (ring-necked dove), *Lagonosticta rubricate hildebrandtii* (African firefinch), *Balearica regulorum gibbericeps* (Grey crowned cranes), *Ardea melanocephala* (Black headed heron) and African fish eagle. Some of the birds observed during the study are shown in Plate 11 below.



Plate 13: Sample birds spotted in the project area

3.4.1.6.3 Herpetofauna of the project area

The Visual Encounter Surveys (VES) method, which involves walking through a study area or habitats for a prescribed time systematically searching for reptiles and amphibians, was used along the riverine ecosystems. Opportunistic encounters was the other method used during the Herpetofauna survey and it involved recording any amphibian or reptilian species encountered anywhere and at any time within the project area, to maximize the number of species encountered.

The sub-humid and semi-humid environment with cooler temperatures forms a good habitat for reptilian and amphibian life. Some of the predominant species of amphibians and reptiles in the area include *Mabuya varia* (variable skink), *Hemidactylus mabouia* (tropical house gecko), *Mabuya striata* (Striped skink), *Bufo funereus Sombre* (Toad) *Calluma sp* (chameleons), *Arbonia sp* (lizards), frogs and crocodiles.

No reptile species of conservation concern were identified.



Plate 14: Reptilian toad spotted at the powerhouse location

3.4.1.6.4 Insects

Insects' species in the project area include ants, beetles, butterflies, dragonflies, damselflies, termites, ticks, scorpions, grasshoppers, locusts, crickets, moths, mosquitoes, wasps, locusts, bees and spiders.

3.4.2 Aquatic Biodiversity of the project area

Both physical characteristics and water quality chemical parameters are pertinent to characterization of the aquatic habitat. For assessment of the baseline aquatic environment, Kenya Marine and Fisheries Research Institute (KEMFRI) survey reports: Monitoring of Pollution in Four Biodiversity Hotspots in Lake Victoria; and Assessment of the fisheries status in River Nzoia both conducted in 2018 were used to obtain the data as presented in the following sections.

3.4.2.1 Fish

The latter study on the assessment of the fisheries status in River Nzoia recorded a total of 16 macro-invertebrate genera belonging to 13 families and 8 orders. The study also found out that *Barbus altianalis* dominated the catch with a percentage contribution of 87.08% by weight, pushing *Labeo victorianus* to a distance second with a paltry contribution of 4.24%. The study further found out that the species richness was generally higher during the dry season as compared to the wet season. Most fishes in River Nzoia were caught at pools covered with emergent macrophytes. Very few fish were caught at the run. This shows that conservation of rocky areas and protection/restoration of areas with good vegetative cover can enhance *Barbus altianalis* fishery production. Other species which were found in the river included: *Barbus neumayeri*; *Amphilius jacksonii*; *Leptogranis sp*; *Schilbe mystus*; *Lates niloticus*; *Synodontis victoria*; *Brycinus jacksonii*; *Haplochromines* and *Barbus nyanzae*. Also it was observed that the upstream areas recorded higher species diversity.

Table 3-2: Changes in fish species composition in the wet and dry season

River Nzoia		
Season	Upstream	River mouth
Wet season (March 2018)	<i>B. altianalis</i> <i>B. nyanzae</i> <i>O. niloticus</i> <i>Gambusia sp</i> <i>L. victorianus</i> <i>A. jacksonii</i>	<i>L. niloticus</i> <i>S. mystus</i> <i>B. jacksonii</i> <i>L. victorianus</i> <i>S. victoriae</i> <i>Haps</i>
Dry season (July 2018)	<i>B. paludinosus</i> <i>B. cercops</i> <i>B. altianalis</i> <i>B. nyanzae</i> <i>B. kerstenii</i> <i>L. victorianus</i> <i>A. jacksonii</i> <i>B. nyanzae</i> <i>B. jacksonii</i> <i>B. neumayeri</i> <i>B. cercops</i> <i>C. somereni</i>	<i>B. jacksonii</i> <i>S. victoriae</i> <i>L. niloticus</i> <i>Haps</i>

3.4.2.2 Phytoplankton

Phytoplanktons are primary producers and a vital food organism for other aquatic animals. Therefore they provide a base in the aquatic food web which is the most important factor for production of organic matter in an aquatic ecosystem. The interplay of physical, chemical and biological properties of water leads to the production of phytoplankton, while their assemblage (composition, abundance, diversity and distribution) is also structured by these factors. The wet and dry season survey results obtained from KEMFRI reports revealed spatial and temporal changes of phytoplankton community structure that is influenced by anthropogenic inputs of nutrients from catchment areas. Diatoms were dominant by over 60% in wet season survey than in the dry season (with over 55%), because of a direct result of supply of nutrients from agricultural lands. Conversely, in the River Nzoia mouth, members of the diatoms were more common and represented by *Synedra Cunningtonii* and *Aulacoseira spp* in both seasons. The blue green family was more during dry season especially *Anabaena spp* and *microcystis spp* unlike March-wet season where there were less numbers observed in the river mouth. The studies also found out that, although diatoms dominated the rivers phytoplankton, there appeared to be some pockets of other algal groups such as *Euglenophytes*- dominated by *Phacus* and *strombomonous* genera, *Chlorophytes*, *Cyanophytes* and *Cynobacteria* which also contributed significantly to phytoplankton community. (KEMFRI, 2018)

3.4.2.3 Zooplanktons

Zooplankton abundance in rivers is majorly influenced by water velocity. High speed/ fast flowing waters do not provide stable conditions for the growth and establishment of a robust zooplankton assemblage. The zooplankton of the studied rivers consisted of three major groups namely: *Copepoda* *Cladocera* and *Rotifera* dominated by taxa *Copepoda*. *Cladocera* were represented by five genera comprising six species; *Diaphanosoma exiscum*, *Moina micrura*, *Bosmina longirostris*, *Daphnia lumholtzi*, *D. barbata sp.* and *Chydorus sp.* In Nzoia River, rotifers were the most diverse group with eight species identified represented by the family *Brachionidae* comprising of the species *Brachionus angularis*, *B. falcatus*, *B. calyciflorus*, *B. caudatus* and *B. patulus*. Other rotifera species encountered included *Filinia spp.* and *Polyarthra*. Rotifers are considered to be good indicators and can also serve as indicators of trophic conditions (Sladeczek, 1983) as well as being good indicators of saprobity (organic-pollution manifested by BOD₅, dissolved oxygen content and specific communities of indicator organisms). The rotifers are distinctly aerobic invertebrates and indicate the situation only within limno-saprobity. *Brachionus calyciflorus* is a common cosmopolitan species of alkaline waters which consider planktonic and tolerates gross pollution (Wilkins, 1972). Comparison on the zooplankton abundance revealed some variations in almost all of the sampling sites in March and July 2018 with the abundance of the same reducing in number for both the study seasons.

3.4.2.4 Aquatic macro-invertebrates

The aquatic macro invertebrates recorded from the studies conducted on the river in the two seasons included the following order; *Odonota*, *Coleoptera*, *Diptera*, *Ephemeroptera*, *Trichoptera*, *Hemiptera*, *Palmonata*, *Oligochaeta* and *Pelecypoda*. *Coleoptera* had five family species; *Odonota*, *Ephemeroptera* and *Hemiptera* each was represented by three family species; *Decapoda* and *Palmonata* had two family species while *Trichoptera*, *Pelecypoda* and *Oligochaeta* had only one family species.

3.4.2.5 Water Quality

Nzoia river catchment is playing host to several urban centers including Kitale and three major sugar industries, namely Nzoia, Butali and Mumias. The river also originates from an agriculturally active area where maize is the major crop, and indeed the area is described as Kenya's bread basket. In this regard, it is evident that fluvial flows would be significant and would in turn end up in the river systems (Onywere et, al. 2007). The extent of the sugarcane area, which is a mono-crop cultivation activity, has threatened subsistence farming. Sugarcane cultivation requires heavy application of fertilizer and pesticides to fight sugarcane bores and this is a major source of water pollution, land and wetland degradation in the area. This is seen in the high turbidity of the water that indicates high levels of siltation from erosion. Although plantation agriculture has led to commercial farming and industrial growth, it is a major source of pollution discharge from the industry. Farming activities from small holder farms have taken up all the available land including the wetlands leading to land degradation (erosion, wash off, riverbank destruction and flooding). The water quality analysis results have been appended in the appendices. All the samples collected from River Nzoia indicated coloured and turbidity water with high Iron concentration.

3.4.2.6 Physico-chemical Characteristics- Results analysis

The parameters under analysis were color, electrical conductivity, PH, Conductivity, Total Dissolved Solids, calcium, chloride, magnesium, sodium, total dissolved solids, total hardness, total iron, zinc, ammonia, fluorides, lead, manganese, nitrates phosphates and nitrites among others. Sample Reference WS-002 for Khalala community water spring was found to be physico-chemically suitable for domestic use while Sample References WS-001, WS-003 and WS-004 waters were found to be coloured turbid with high iron content. The reports recommended treatment and biannual water quality analysis to ensure the water is maintained at the recommended parameters as per the WHO standards and KEBS (KS 459-1:2007) standards.

3.4.3 Abstractions on River Nzoia

There are a number of abstractors with valid permits along the River Nzoia upstream of the proposed project site with the major abstractors in the catchment found to include: Pan Paper Mills, Nzoia Water and Sewerage Company, Nzoia Sugar Company, Kenya Electricity Generating Company Ltd, Eldowas, Mt. Elgon East Water Project. Data obtained from WRA-LVNCA indicate that the amount of abstraction permitted upstream of the proposed abstraction point from the total normal flow is 139138.669m³/day. It is assumed in the study that the flow passing the proposed site is exclusive of the water abstracted upstream.

Table 3-3: List of water abstractors from Nzoia River and its tributaries

PERMIT HOLDER	WATER BODY	DRAINAGE AREA NO.	PERMIT NO.	AMOUNT AUTHORIZED M3/D	PURPOSE
KENGEN CO. Ltd.	Sosiani River	1CD	WRMA/LVNC/3	22.715	Domestic
Mr. David K. Cheluget	Cheluget dam	1 CB	WRMA/LVNC/9	360	General Irrigation
Mr. Soren Pedron	Spring tribo of Kipk	1 CB	WRMA/LVNC/10	9	Domestic
Khamulati Coop.Society	Kimilili River	1DB	WRMA/LVNC/15	22.72	Industrial
ELDOWAS	Moiben River	1 BA	WRMA/LVNC/83	28,000	Public
Zena Roses LTD	Kipkaren River	1CB	WRMA/LVNCA/82	157.5	Domestic
				135	General Irrigation
Peter Makokha Amukowa	Khalaba	1DD	WRMA/LVNCA/79	4.5	Domestic
				36	General Irrigation
ST Pauls Lugari Boys Sec Sch	Ezalwa	1CE	WRMA/LVNCA/75	20	Domestic
Cherangani / Kachibora Comm. W/S	Losorua	1BB	WRMA/LVNCA/74	198.23	Domestic
Samson Kibe Mwangi	Chemenei	1CF	WRMA/LVNCA/67	1.08	Domestic
				4.5	Minor Irrigation
Maji Mazuri Flowers	Maji Mazuri	1CB	WRMA/LVNCA/20	27	Domestic
Ngiya Girls High SCH	Urewe	1BG	WRMA/LVNCA/22	22.72	Domestic
Moi University [Main Campus]	Kesses Dam	1CC	WRMA/LVNCA/28	4973.85	Domestic
				1800	General Irrigation
Nzoia Sugar LTD	Kuywa River	1DB	WRMA/LVNCA/37	158.4	Domestic
				792	Industrial
Flax Centre Water Project	Nundoroto	1CD	WRMA/LVNCA/112	402.3	Domestic
				36	Topping up cattl
CEO LVNWSB [Bungoma W/S]	Kuywa	1DB	WRMA/LVNCA/56	7000	Public
ELDOWAS	Sosiani	1CB	WRMA/LVNCA/115	15000	Public
Pan African Paper Mills Webuye	Nzoia	1DA	12813	1204	Domestic
				60916	Industrial
				7274	Power
Chepkulo COMM. W/P	Chepkulo	1CA	WRMA/LVNCA/111	87	Domestic
Kimenjo Arap Maasai	Singelet	1CD	WRMA/LVNCA/107	1.454	Domestic
ELDOWAS	Ellegerini	1CE	WRMA/LVNCA/90	3450	Public
CEO LVNWSB [Webuye W/S]	Nzoia	1DA	WRMA/LVNCA/91	7000	Public
Anthony Cyrill Mills	Kabeyon	1BG	WRMA/LVNCA/85	22.7	Domestic
				139138.669	

3.4.4 Ecosystem services

According to IFC PS 6 'ecosystem services', refer to the benefits that people, including businesses, derive from ecosystems, which can be organized into four types: (i) provisioning services, which are the products people obtain from ecosystems; (ii) regulating services, which are the benefits people obtain from the regulation of

ecosystem processes; (iii) cultural services, which are the non-material benefits people obtain from ecosystems; and (iv) supporting services, which are the natural processes that maintain the other services.

Ecosystem services valued by humans are often underpinned by biodiversity. Impacts on biodiversity can therefore often adversely affect the delivery of ecosystem services. Intentional or accidental introduction of alien, or non-native, species of flora and fauna into areas where they are not normally found can be a significant threat to biodiversity, since some alien species can become invasive, spreading rapidly and out-competing native species. This thus calls for due diligence during the project activity so that the same are not interfered with or altered in any way.

The native tree species in the project area offer a variety of ecosystem services of use to the community; various parts of *Azadarachta indica* are used to treat a variety of ailments as well as used for production of insect repellent or health and beauty products. *Ficus sycomorus* bark is used for the treatment of scrofula, coughs, and throat or chest diseases. The latex is used for treatment of dysentery and chest diseases, or is applied to inflamed areas, while ringworm is treated with the bark and milky latex. Leaves of the same are effective against jaundice and as an antidote for snake-bite, while the roots have laxative and anthelmintic properties. *Agave Sisalana*, *Dovyalis caffra* and *Lantana camara* are all used as hedge plants while *Phoenix reclinata* and *Agave sisalana* are used for making ropes, twines, mats or baskets in weaving industry.

The fruit of *Solanum incanum* are used for treatment of skin mycotic infections and the fresh roots/ leaves of *Sesbania sesban* are used to treat scorpion stings, boils and abscesses. The decoctions of leaves can be used as a drench for cattle to repel tsetse fly. It can also be used to treat sore throat, gonorrhoea, syphilis, spasmodic fits in children as well as jaundice during pregnancy among women. The leaves from the two species are used as green manure with the latter being a nitrogen fixing tree (leguminous). The root bark of *Rhus Natalensis* is used to produce dye while the bark of *Casuarina equisetifolia* produces tannin that can be used in leather industry.

Trees and shrubs such as *Casuarina equisetifolia*, *Phoenix reclinata* and *Thevetia peruviana* are used as ornamental plants. *Markhamia lutea* is used in making traditional arm chairs and is also a good building material. *Erythrina abyssinica* is used for cleansing purposes as well as in the treatment of mumps.

Grasses found in the project area also play a very important role in the lives of the community members. The grasses are mostly used as fodder for livestock and at times used in traditional house thatching.

Table 3-4: Selected trees and shrubs uses in the Project Area

Botanical name	Uses
<i>Agave sisalana</i>	Widely used to make twine, ropes and strings, fishing nets, buffing cloth, dart boards and hammocks.
<i>Phoenix reclinata</i>	The dried palm leaves are used for making of mats as well as in weaving baskets. It can be used in soil conservation by controlling soil erosion. It is also used for ornamental purposes. Parts of the tree are used as a remedy for pleurisy
<i>Azadarachta indica</i>	Bark and roots in powdered form are also used to control fleas

Botanical name	Uses
	<p>and ticks on pets.</p> <p>Neem produces pain relieving, anti-inflammatory and fever reducing compounds that can aid in the healing of cuts, burns, ear-aches, sprains and headaches, as well as fevers.</p> <p>The tree has anti-bacterial properties that help in fighting against skin infections such as acne, psoriasis, scabies, and eczema while twigs are used as toothbrushes.</p> <p>Neem oil, leaves and neem extracts are used to manufacture health and beauty care products.</p>
<i>Lantana camara</i>	<p>Used as a hedge plant; fruits are edible</p> <p>The leaves are boiled and applied for swellings and pain of the body. Its bark is astringent and used as a lotion in cutaneous eruptions and leprosy ulcers.</p>
<i>Markhamia lutea</i>	<p>This tree is popular for firewood and charcoal because it has a high woody biomass.</p> <p>The tree provides nesting sites for birds and also used in making traditional arm chairs.</p>
<i>Sesbania sesban</i>	<p>Primarily as a green manure and a source of cut and carry forage.</p> <p>Is a nitrogen-fixing tree and may be useful if intercropped with other crops.</p> <p>Prevents soil erosion along rivers as it is good at riverbank stabilization.</p> <p>Fresh roots and leaves are used to treat scorpion stings, boils and abscesses. The decoctions of leaves can be used as a drench for cattle to repel tsetse fly.</p> <p>It is also used to treat sore throat, gonorrhoea, syphilis, spasmodic fits in children and jaundice during pregnancy among women</p> <p>This tree is popular for firewood and charcoal because it has a high woody biomass.</p>
<i>Solanum incanum</i>	<p>The fruit of <i>Solanum incanum</i> are used for treatment of skin mycotic infections. The leaves and stems are used in compost.</p>
<i>Dovyalis caffra</i>	<p>Used as a hedge plant</p>
<i>Plectranthus barbatus</i>	<p>'Toilet paper' as the leaves are used in rural areas</p>
<i>Thevetia peruviana</i>	<p>The seed oil is used to make 'paint' with antifungal, antibacterial and anti-termite properties. Planted as an ornamental plant.</p>
<i>Rhus natalensis</i>	<p>Fruits have a sweet-sour taste, mainly eaten by children.</p> <p>Livestock fodder.</p> <p>The stem of the plant is a source of toothbrush. The stem contains an antibiotic that prevents toothache.</p> <p>Source of fuel-wood or charcoal</p> <p>Leaves used for heartburn, roots for influenza and abdominal pains, leaves for cough and stomach-ache.</p> <p>A decoction of the roots is taken as a remedy for diarrhoea</p>

Botanical name	Uses
<i>Casuarina equisetifolia</i>	The tree is beautiful and hence suitable as an ornamental one. Grows vigorously on barren, polluted sites and thrives in deep sandy soils and therefore suitable for reclamation of degraded areas. Its bark is a source of tannin. Root extracts are used in the treatment of dysentery, diarrhoea and stomach-ache.
<i>Erythrina abyssinica</i>	Tree is used for cleansing purposes and treatment of mumps
<i>Ficus sycomorus</i>	The bark is used for the treatment of scrofula, coughs, and throat and chest diseases. The latex is used for treatment of dysentery and chest diseases, or is applied to inflamed areas, while ringworm is treated with the bark and milky latex.

3.5 BASELINE SOCIO-ECONOMIC ENVIRONMENT

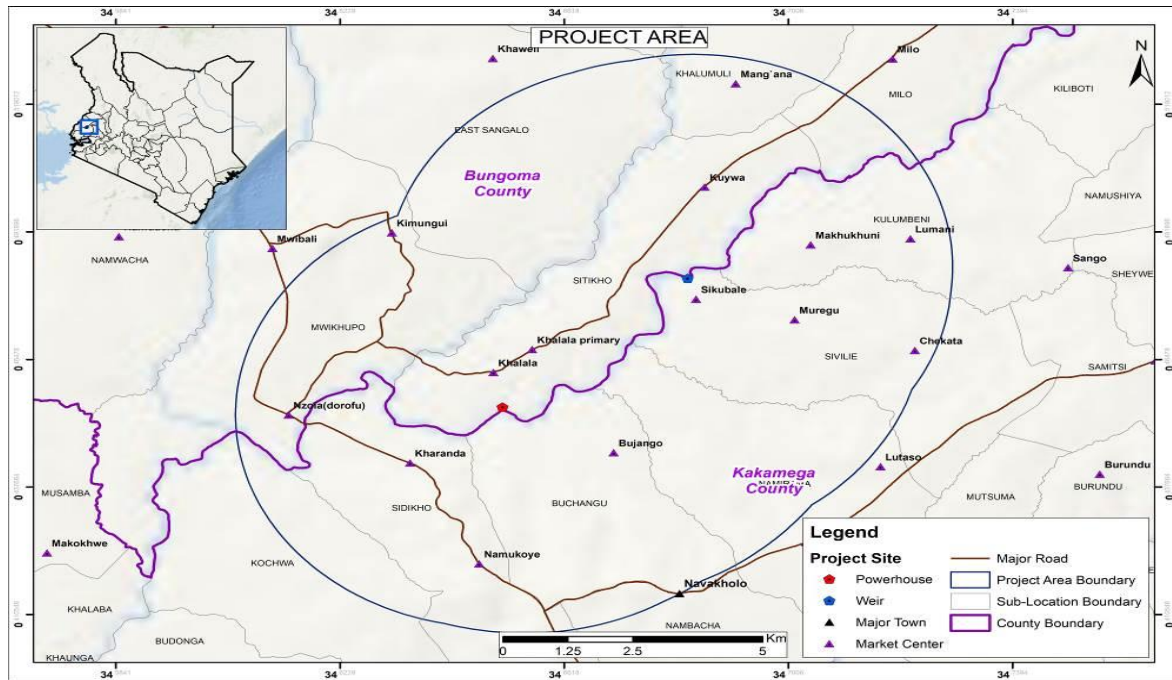
This section provides information on key socio-economic issues and activities relevant to the project. It includes an overview of social characteristics, economic settings, health, education and demography. While the team tried to exhaust all available information, it should be noted that detailed information on some of the issues are not available and where available, they date back several years ago.

In order to understand the social issues associated with the project, socio-economic baseline data for Bungoma and Kakamega Counties was collected by Ecotech Engineering team from both secondary and primary sources. Secondary sources included the County Integrated Development Plans, the National Census records, and Annual Development Plans for the two counties. Primary data was collected through household surveys, key informant interviews and feedback from public meetings.

3.5.1 Location and Administrative structures

Both Bungoma and Kakamega Counties are situated in the former Western Province of Kenya. Bungoma County lies between latitude 00⁰ 28' and latitude 01⁰ 30' North of the Equator, and longitude 34⁰ 20' East and 35⁰ 15' East of the Greenwich Meridian. It covers an area of 3032.4 sq. km and borders the republic of Uganda to the North West, Trans-Nzoia County to the North-East, Kakamega County to the East and South East, and Busia County to the West and South West. Kakamega County, on the other hand, borders Vihiga County to the South, Siaya County to the West, Bungoma and Trans Nzoia Counties to the North and Nandi and Uasin Gishu Counties to the East. It covers an area of 3,051.3 sq. km and is the second most populous county after Nairobi with the largest rural population.

Bungoma County is divided into 12 Sub-Counties, 45 wards and 149 sub-locations. Webuye West Sub-county (project host sub-county) is subdivided into 4 Wards namely: Misikhu, Sitikho, Matulo and Bokoli. Sitikho (the proposed project area) comprises Matisi, Sitikho, Milo and Khalumuli sub-locations. Politically, the County has 9 constituencies and 45 County Assembly Wards. Administratively, Kakamega County comprises 12 Sub-counties, 60 wards, 187 Village Units and 400 Community Areas while politically, it comprises 12 constituencies and 60 electoral wards.



Map 3-6: Project Area administrative map

3.5.2 Demographic characteristics

3.5.2.1 Population

The 2009 Kenya Population and Housing Census showed that Bungoma County had a population of 1,374,627 made up of 671,222 males and 703,405 females. This population was projected to grow to 1,919,490 and 2,040,343 in 2020 and 2022 respectively. Based on the census report, Kakamega County had a population of 1,660,651 comprising 800,896 males and 859,755. This was projected to grow at an annual growth rate of 2.5% thus; the county population was projected to grow to 2,184,885 and 2,296,907 by the year 2020 and 2022 respectively. Navakholo Sub-county is the most densely populated in the County.

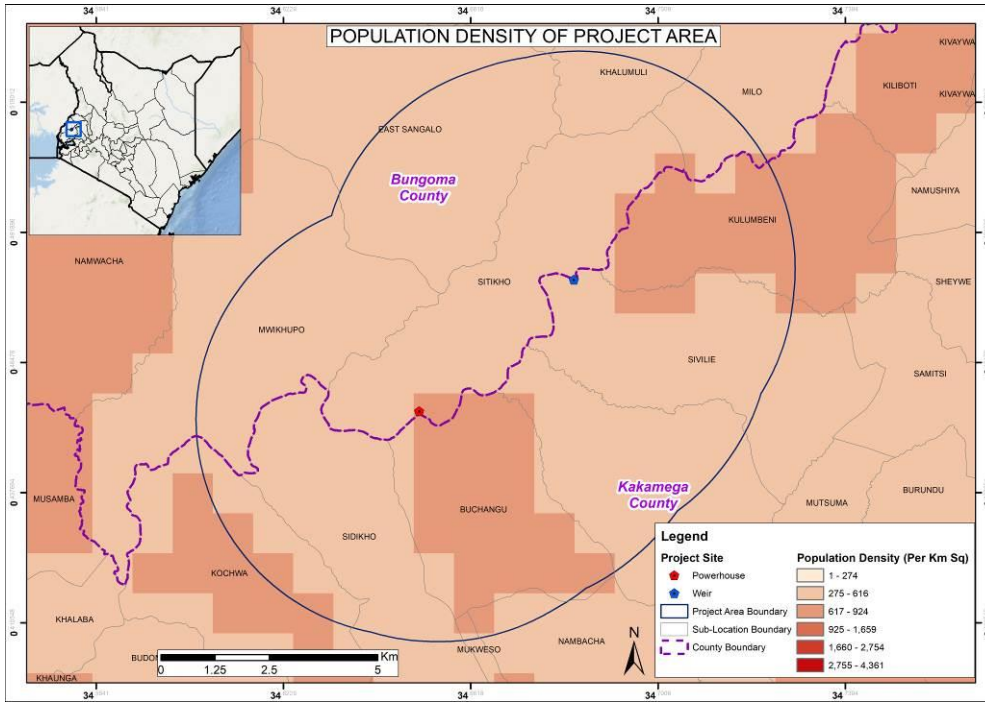
The population residing in the proposed project affected villages is primarily rural.

3.5.2.2 Ethnicity

Ethnically the population in the project affected areas is not culturally diverse with almost the entire population being Luhya speaking. Although, it was observed and confirmed during the field survey, that there is slight variation in the dialect among the population groups (Abanyala and Bukusu).

3.5.2.3 Religion

Most (90%) of the villagers living in the affected villages are Christians by faith. It was however noted that there also exist a few (10%) Muslims in the area. According to data obtained from the respondents, 77% of the respondents subscribe to protestant churches, 13% are Catholics while 10% subscribe to the Islamic faith.



Map 3-7: Project Area Population Map

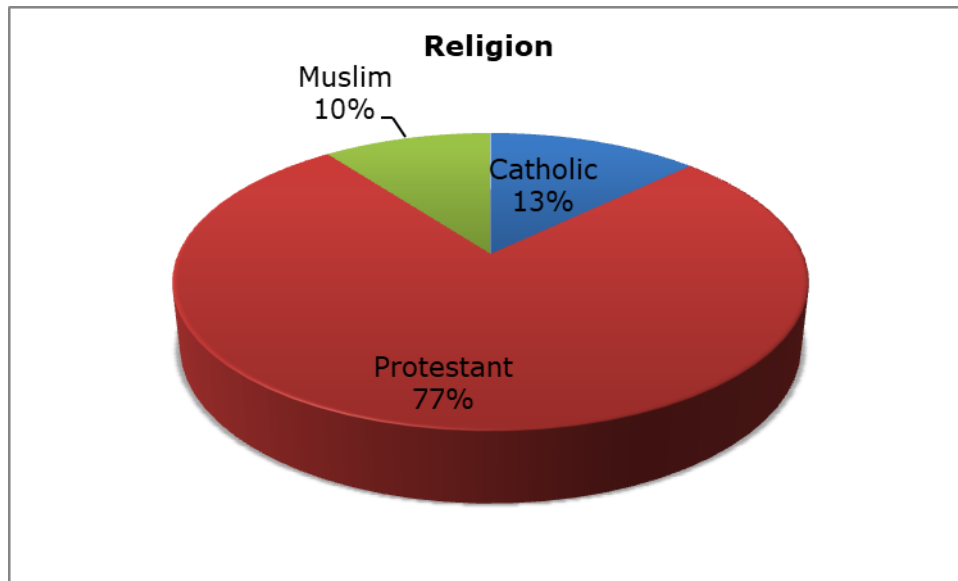


Figure 3-7: Religious affiliations in the Project area



Plate 15: A church in the project area

3.5.3 Education and literacy

3.5.3.1 Education

According to the Bungoma County CIDP (2018 – 2022), there are 1,292 ECDE Centres, 961 Primary Schools and 306 Secondary Schools. There are also 90 youth polytechnics offering vocational training.

Kakamega County currently has 1,943 ECDE centres; 1, 235 Primary Schools and 436 secondary schools. Other learning institutions in the county include Masinde Muliro University of Science and Technology and satellite campuses for different universities; about 315 Adult education centres; and 4 functional public technical training institutions.





Plate 16: Sitikho and Khalala Primary schools; and Sitikho Secondary school

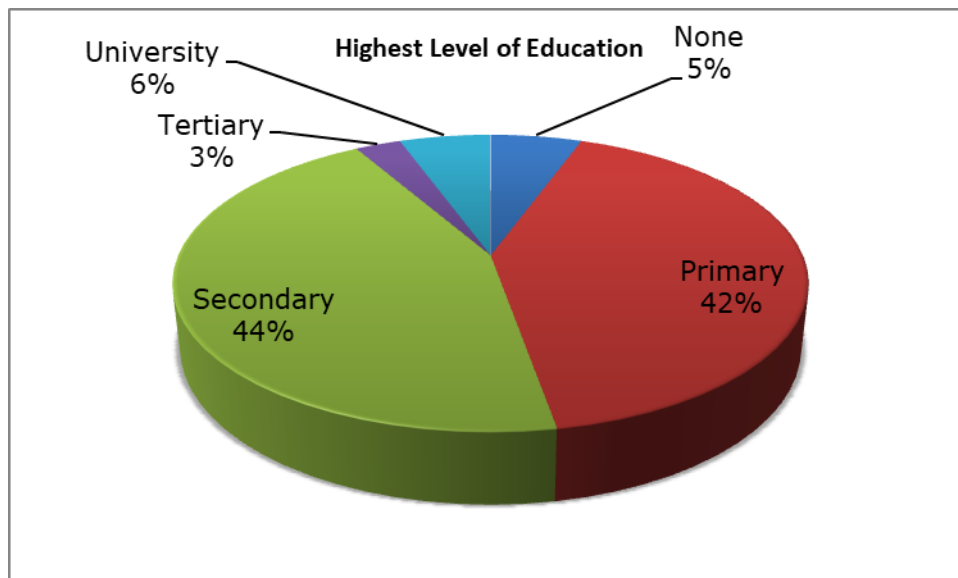


Figure 3-8: Highest level of education obtained by respondents

Only 6% of the respondents had university education with a further 3% in possession of tertiary level of education. 44% had obtained secondary school education while 42% had completed primary education level. 5% of the respondents had not attended school at all.

3.5.3.2 Literacy

Literacy is one of the indicators of socio-economic development of any society. The overall literacy rate for Western Kenya stands at 71.5% against the national one at 71.4%.

3.5.4 Health status

There are a total of 184 health facilities in Bungoma County. These include: 17 hospitals, 14 Health Centres, 102 dispensaries, 20 Faith Based facilities and 52 private clinics. For

Kakamega County there is 1No. County General Hospital, 9No. Sub-county hospitals, 9No. Mission/ NGO hospitals, 1No. private hospital, 8No. Nursing homes; and 27No. Public health centres. Furthermore, the county has 1No. Private health centre, 66No. Public dispensaries, 3No. Private dispensaries and 107No. Private clinics (Kakamega County CIDP, 2018). Notable health facilities in the vicinity of the project area include Khalala, Sitikho, Kuywa and Milo Dispensaries. Disease prevalence in the project area according to the respondents is as illustrated in Figure 3-9 below.



Plate 17: Sitikho and Khalala Dispensary Sign posts

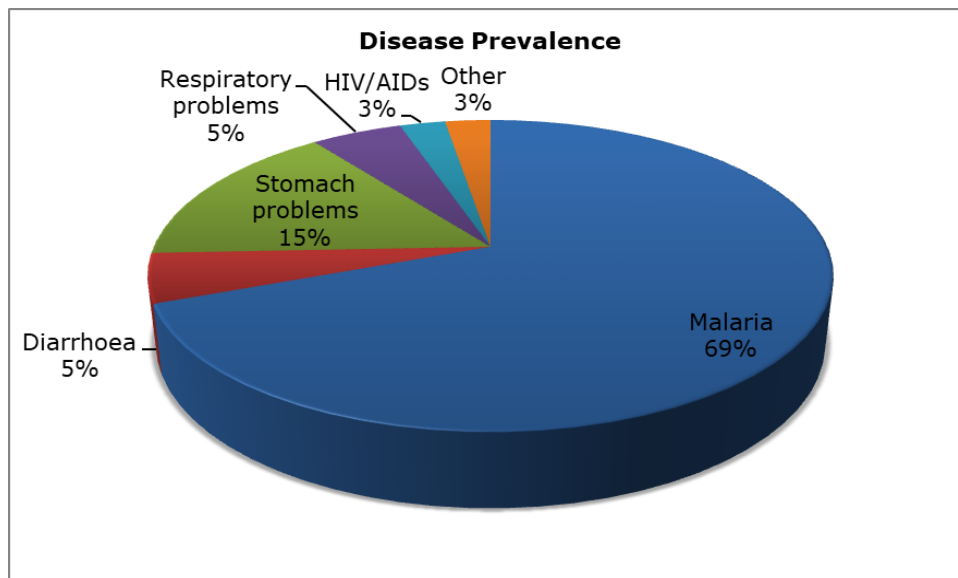


Figure 3-9: Disease prevalence in the project area

3.5.5 Water and Sanitation

3.5.5.1 Water

In general, it was established that the two counties rely on both surface and ground water sources for its supply. The main sources of water include boreholes, springs and

rivers. Notable rivers in the counties are Nzoia, Yala, Isikhu, Firatsi, Sasala, Lusumu and Kipkaren. These form the major sources of water for domestic use and irrigation. Rural areas are mainly supplied by community water projects, NGO’s, private sector actors as well as self-supply through hand dug wells.

77% of households interviewed in the project area indicated their main source of potable water is protected springs while borehole and rivers sources account for 10% each. A further 3% obtain their water from unprotected springs (See figure 3-10 below).



Plate 18: River Nzoia and a section of Sitikho Falls in the project area

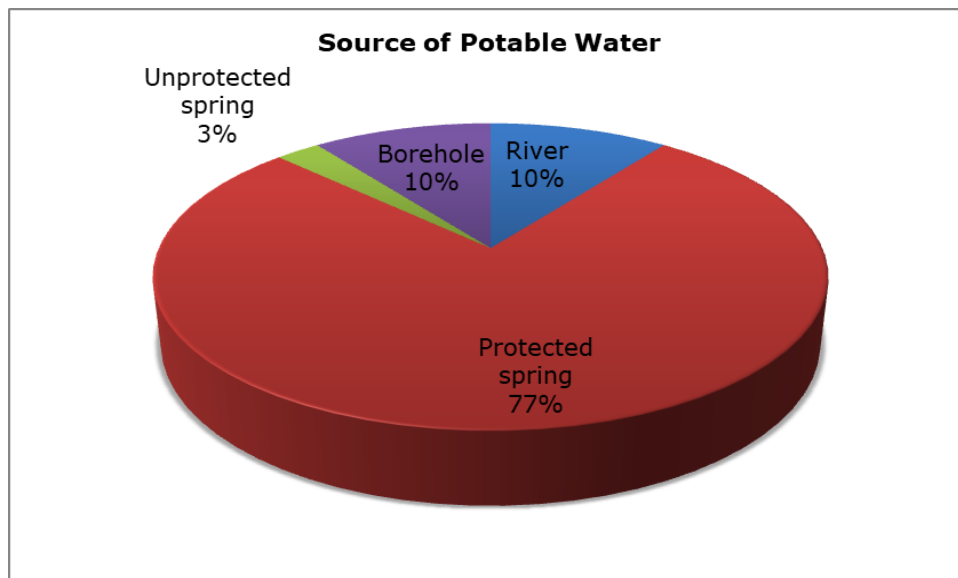


Figure 3-10: Sources of potable water in the project area

3.5.5.2 Sanitation

The main source for a in the project area is pit latrines.

3.5.6 Housing in the PAI

Housing in the project area is classified according to roof, wall and floor material as follows;

Floor material

According to the Bungoma County CIDP, the county has 20% of its residents living in homes with cement floors while 79% have earth floors while a paltry 1% of the residents have wood or tile floors. 79% of interviewed respondents in the project area indicated that their houses have earthen floors while 21% indicated having cemented floors (See figure 3-11 below).

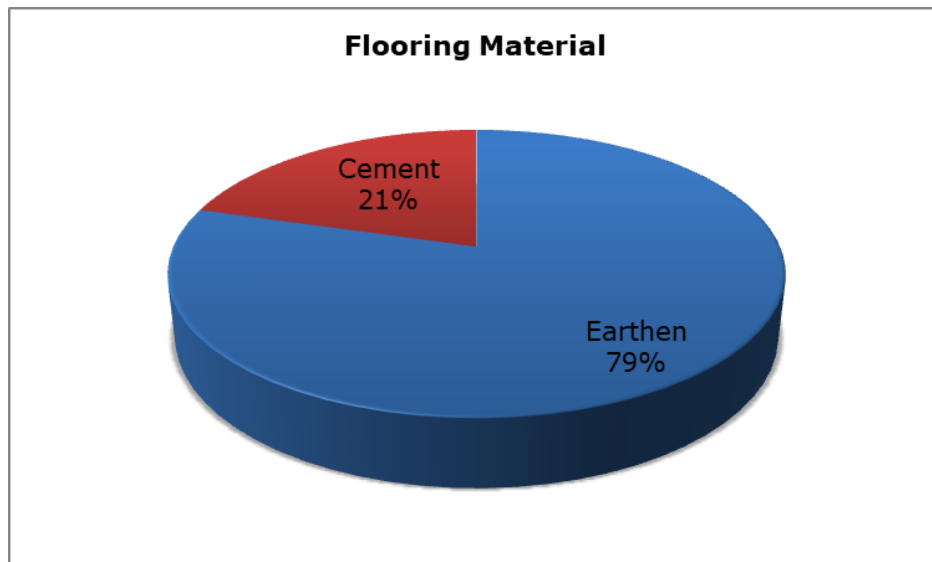


Figure 3-11: Flooring Material

Walling material

Only 16% of homes in Bungoma County have either brick or stone walls, while 83% of homes have mud/ wood or mud/cement walls, and less than 1% has wood walls. 1% of residents have corrugated iron walls, grass/ thatched walls, tin or other walls. In the project area, only 21% of the respondents had walls made of bricks while the majority, 79% had mud-walled houses (see figure 3- 12 below).

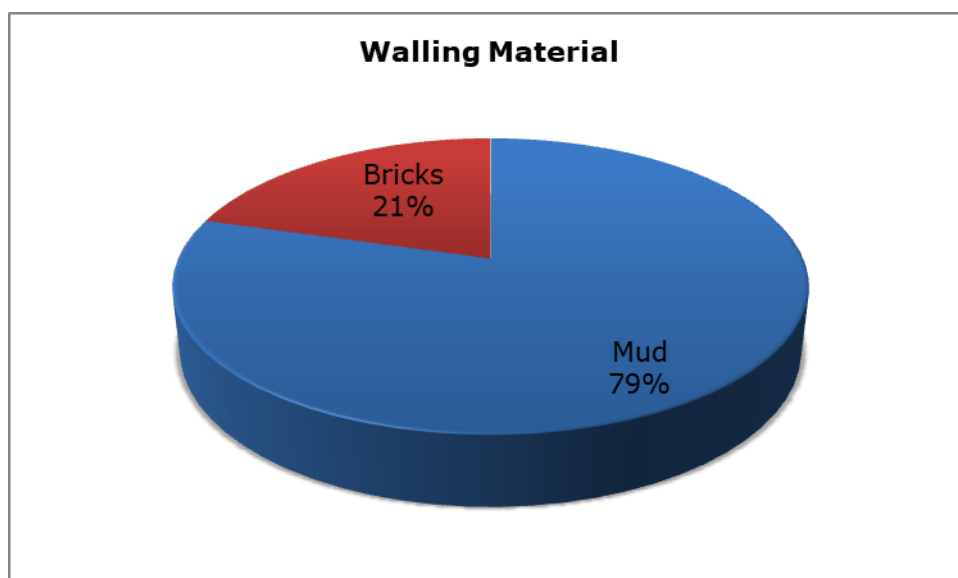


Figure 3-12: Walling Material

Roofing material

Bungoma County has less than 1% of its residents owning homes with concrete roofs, while 78% have corrugated iron sheet roofs. Grass and makuti roofs cover 19% of homes. On the other hand, Kakamega County has semi-permanent houses in rural areas with a few permanent houses. Households in urban areas have permanent houses with few houses in informal settlement being semi-permanent and temporary. The temporary houses are made of mud and cow dung in walling while roofing is done using grass and iron sheets. Permanent houses are constructed using bricks and iron sheets.



Plate 19: Housing types in the project area

3.5.7 Infrastructure

3.5.7.1 Road Network

Road network in the proposed project area is consist of earth-surface roads as shown in Plate 20 below



Plate 20: Roads in the project area

3.5.7.2 Airstrips

There are a total of 4 airstrips in the two counties with Bungoma County having two underutilized airstrips in Webuye and Bungoma towns and Kakamega County also having two airstrips in Kakamega and Mumias towns.

3.5.7.3 Railway Network

A railway line passes through both counties with two railway stations namely: Lugari and Butere in Kakamega County.



Plate 21: A section of Metre Gauge Railway Line in the project area at Shimalabandu

3.5.8 Posts and Telecommunications

The two counties are served by a network of post offices and sub-post offices in all the major urban areas. G4S Security, Wells Fargo and a number of public service vehicle couriers also operate in the Counties. There are several mobile phone and internet service providers including Safaricom, Airtel-Kenya, Telkom Kenya, Jamii Telkoms and Liquid Telkoms.

3.5.9 Financial Services

There are a good number of financial institutions in the two counties, namely, Kenya Commercial Bank (KCB), Equity, Family, Cooperative, National, Diamond, Bank of Africa and Barclays bank. They are also served by various micro-finance institutions such as Sidian bank, Kenya Women Finance Trust (KWFT), and Faulu. Insurance services on the other hand include Geminia, NHIF, British American Insurance, Pan African Insurance, Blue Shield, African Merchants Assurance Company (AMACO) and Cooperative Insurance Company of Kenya.

3.5.10 Sources of Energy

The residents of the project area depend upon various sources to meet their daily energy requirement for lighting and cooking.

Lighting energy

About 4% of residents in Bungoma County use electricity as their main source of lighting while a further 27% use lanterns, 67% use tin lamps, and 1% use wood fuel. Solar is the major source of lighting in the project area. 59% of respondents indicated that their

major lighting source is solar while 36% use kerosene lamps and only 5% make use of electricity (see figure 3-13).



Plate 22: KETRACO transmission line pylons in the project area

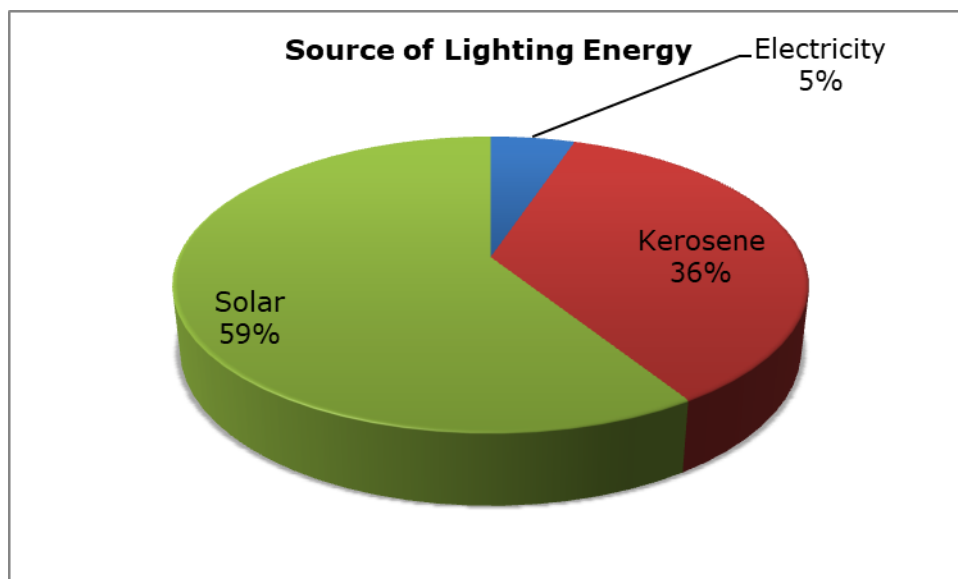


Figure 3-13: Source of lighting energy

Cooking energy

According to the KNBS statistics of 2013, 1% of Bungoma County residents use liquefied petroleum gas (LPG), 2% use paraffin, 85% use firewood and 11% use charcoal as cooking fuel. Firewood is the most common cooking fuel by gender at 85% of male headed households and 86% of female headed households. On the other hand, wood is the main source of solid fuel for cooking in Kakamega County. According to the Kakamega Multiple Indicator Cluster Survey report 2013/14, 79.2% of the county population use wood as their main source of energy, 1.1 % use LPG, 0.6% use biogas, 13.8% use charcoal and 1.2% use grass/ shrub while cooking as alternative sources of solid fuel.

Majority (92%) of the study respondents indicated that firewood is their main source of cooking fuel. Only 5% use charcoal while 3% cook using electricity (see figure 3-14 below).

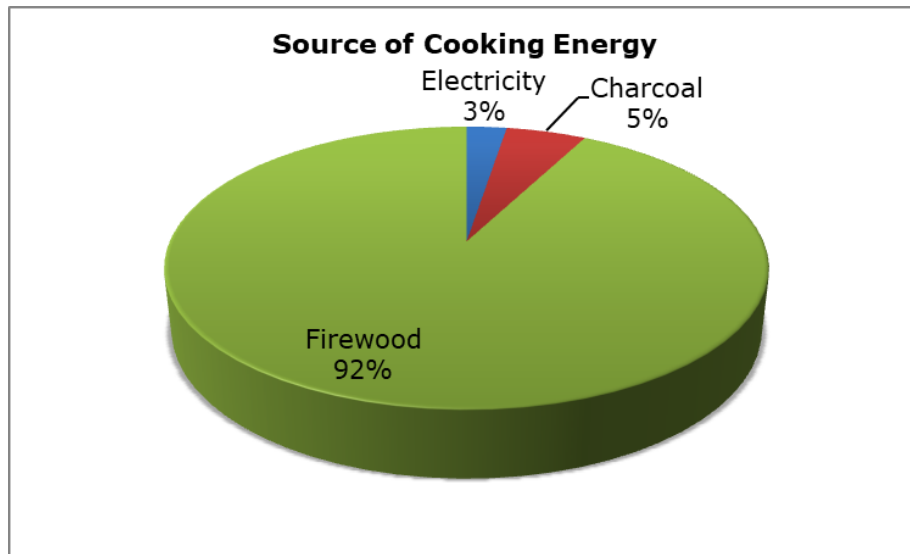


Figure 3-14: Cooking Energy sources in the project area

3.5.11 Settlement

The Counties of Bungoma and Kakamega are rural counties whereby majority of people have settled in rural areas with a few in urban areas. The rural settlement is scattered with uneven settlement patterns. There is also a tendency of people settling along the infrastructural facilities like roads forming a linear settlement pattern. Settlement patterns in the project area was found to be influenced by productivity of agricultural land, transport and communication network and access to sources of employment, social and economic amenities and services.

3.5.12 Land Use Pattern

Land is a factor of production where all economic and social activities take place. Bungoma County has 2,880.78 sq. km of arable land mainly for crop farming and livestock production. Land use pattern in the two counties include: agriculture, forestry, mining, construction of human settlements, business, social and public amenities. Land is also used as collateral to obtain credit as well as for aesthetic purposes. Kakamega County has 753,745.5 acres of land out of which the arable land is 545,806.4 acres; non-arable land is 208, 210.9 acres while urban areas take 63,011.8 acres.

The land use in the PAI falls into the following categories:

Agricultural land: This is the dominant type of land use in the area and the crops grown include, maize, cassava, banana, beans and other vegetables and fruits. Cash crop included mainly sugarcane.

Built structures: These include the houses and the immediate compound area where the houses, animal shelters and latrine are located. Other structures include; the schools, churches and shopping centres.

Infrastructure: Only all-weather roads and foot paths were found in the PAI which is entirely located in a remote and rural place. An existing motorable track from Webuye to Sitikho, a distance of about 19km was under rehabilitation during the ESIA study.

3.5.13 Land Tenure

Land in the two counties can be classified into public land, community land and private land. This is then sub-divided further to agricultural/ arable land, Non arable land and Forest land. Land in the proposed project area is privately owned (freehold); however, it was established that only a few residents have individual title deeds to their lands. Majority reside on common family lands registered on the names of deceased parents and grandparents and thus guided by customary rights.

3.5.14 Livelihood Activities and Income

a) Crop farming

Main crops produced in the project area include maize, beans, finger millet, sweet potatoes, cassava, bananas, sorghum, Irish potatoes and assorted vegetables. Sugar cane, cotton, palm oil, coffee, tea, sun flower and tobacco are grown as cash crops in Bungoma County. It was established that most of the agricultural activities in the area are rain-fed. Dependency on rain-fed agriculture exposes families to instances of food insecurity because of unpredictable weather patterns.



Plate 23: Crops grown in the project area

b) Livestock Keeping

The main livestock kept in the project area are cattle, sheep, goats, donkeys and pigs. Other animals kept by the residents are rabbits and poultry. In Bungoma County, the average land carrying capacity is three livestock units per acre (LUs/acre). Indigenous chicken and cattle are the most common livestock kept by families.



Plate 24: Cattle in the project area

c) Fishing activities

During this study, it was established that the department of agriculture has promoted fish farming in the Bungoma County through Economic Stimulus Programme (ESP). There are several fish ponds and hatcheries with tilapia, cat fish and mud fish being the main types of fish being produced. Apart from fish farming, communities residing close to dams and main rivers engage in fishing activities on subsistence basis. The Department of Fisheries in Kakamega County is currently implementing the Kakamega County Fish Farming Programme which does pond construction and renovation and provides fish farm subsidies (fingerlings, feeds).

d) Quarrying and sand harvesting Activities

Sand harvesting is common along river banks within the project area including Nzoia River.



Plate 25: Sand harvesting in River Nzoia

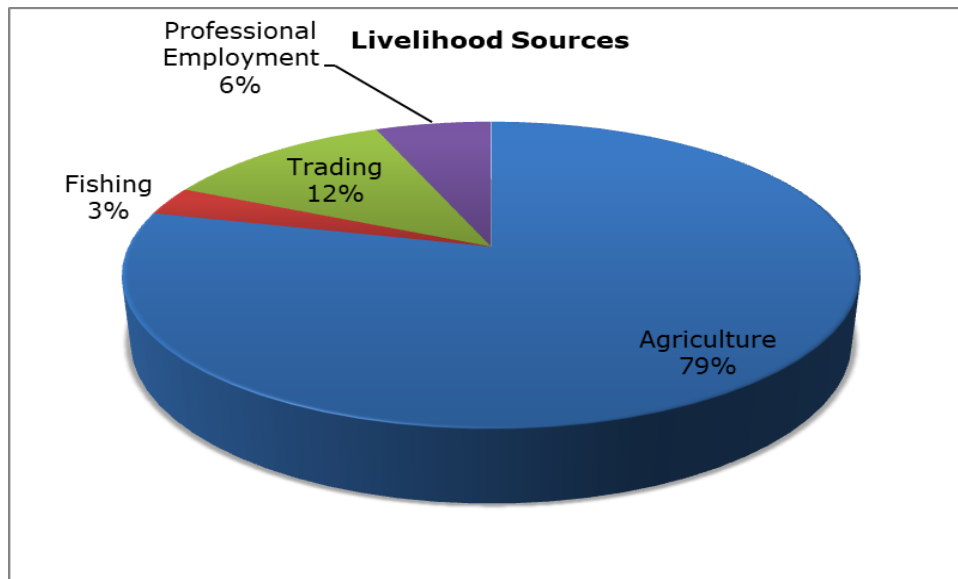


Figure 3-15: Main Livelihood sources in the project area

From the figure above, 79% of project area residents depend on agriculture as their main livelihood stream while only 3% practice fishing. Others engage in trading activities (12%) in the nearby market centres with a further 6% of the respondents being in professional employment.

3.5.15 Main tourist attractions

Bungoma County has various tourist attraction sites including scenic hills (Chetambe, Sang'alo and Kabuchai) and perennial rivers (Nzoia, Sosio, Kibisi, Kuywa, Lwakhakha, Malakisi, Sio and Khalaba). Other attractions include: cultural sites (Sikele Sia Mulia and Mwibale wa Mwanja); fauna and flora and Waterfalls that include, Nabuyole and Sitikho in Webuye and Teremi in Mt Elgon. Man – made attractions in the county including dams, Sang'alo cultural centre, dini ya musambwa headquarters at Maeni, and Mfunje-ropes Bridge in Webuye are sites to behold. Eco-tourism and cultural heritage tourism (circumcision ceremonies, songs and dances) form part of the rich industry. Mt. Elgon forest reserve in Bungoma County has a wide range of wild animals including antelopes, monkeys, snakes, guinea fowl, quail birds, rabbits, insects and hares, and rare birds species and the various tree species.

The Kakamega Forest is a big tourist attraction in Kakamega County due to the large species of birds, butterflies and other animals' species. Other tourism attraction activities in the county include bull fighting in Shinyalu and Ikolomani, cock fighting in Shinyalu, the dog market in Lubao, Malava, the crying stone in Ilesi, Lukova in Matete and Mawe Tatu in Likuyani. The county is also rich in cultural practices such as the existing Wanga Kingdom which attracts a number of people to the county.

3.5.16 Major industries

The main factories and industries in the Bungoma County include; Nzoia Sugar Company, Rai Paper, Malakisi Tobacco Leaf Centre, Webuye Heavy Chemicals Industry, Kitinda Dairy, Musese and Chesikaki coffee factories. They rely on raw materials produced locally. Kakamega county is the host to the biggest sugar factory in the Country i.e. Mumias sugar factory. Other sugar factories in the County include, Butali and West Kenya. There also exist other small scale industries in the county which are

pre-dominantly in the sugarcane growing regions such as jaggeries, bakeries, small scale milk cold rooms and the fish factory in Kakamega town.

3.5.17 Micro, Small and Medium Enterprises (MSMEs)

The MSMEs are considered as sources of employment generation, economic growth, and social transformation. A significant proportion of the MSMEs in the two counties are formal, while majority fall within the informal economy based on their size, location, ownership, status of formality and economic activity. The sub-sector produces a significant share of total value added, and provides a large segment of the poor and middle-income populations with affordable goods and services.

3.5.18 Cultural Resources

Cultural resources include archaeological sites and historic structures and features that are protected under the National Heritage Act and work with the National Museums of Kenya. They can be man-made and natural physical features associated with human activity and, in most cases, are finite, unique, fragile, and non-renewable.

There were no significant historical, archaeological or protected resources or areas that are recognized officially by the National Museums of Kenya on or near the project area. Individual villages and households have their revered areas such as shrines where they conduct bi-annual traditional circumcision rites. The residents bury their dead within their homesteads.

The key cultural site/ circumcision rite of passage at the weir and intake point was marked with coordinates: 00⁰ 28'56.6" N and 34⁰ 40'55.0" E.

3.5.19 Awareness of the Project

92% of those interviewed are aware of the proposed Khalala Hydropower Project. Most of the PAPs confirmed to have heard about the proposed project during public consultation meetings while others had heard about the project from their neighbours. Only 8% had not heard about the project prior to the household surveys.

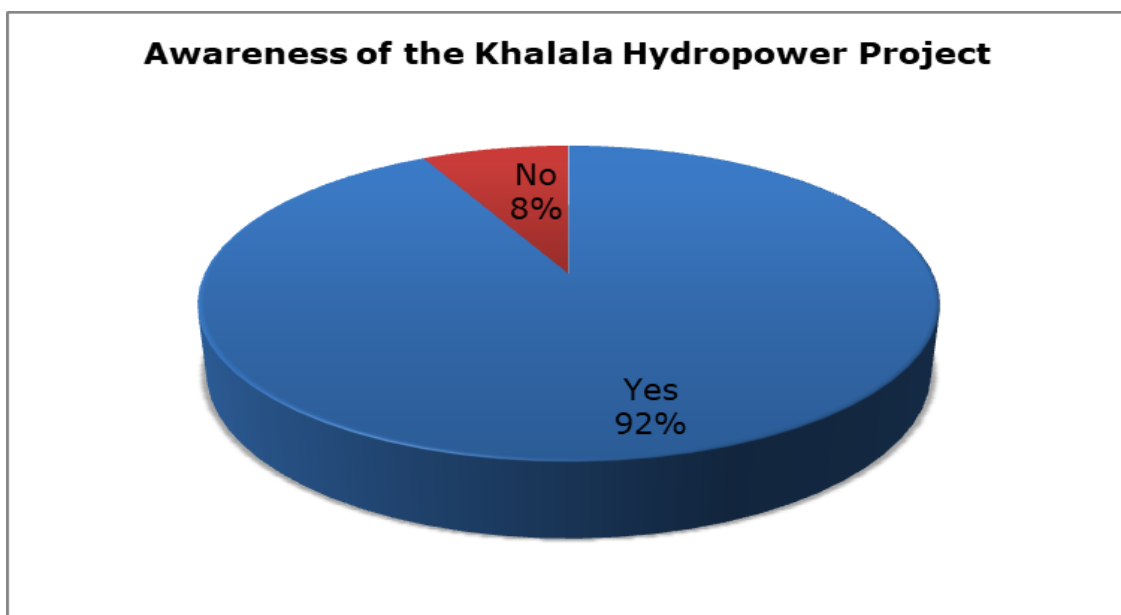


Figure 3-16: Awareness of the Project

CHAPTER FOUR

4. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

4.1 RELEVANT NATIONAL POLICIES AND GUIDELINES

It is a requirement under the Environmental Management and Co-ordination Act No. 8 of 1999 (Amendments, 2015)/ Cap 387 and Environmental (Impact Assessment and Audit) Regulations 2003; 2016 to carry out an Environmental Impact Assessments (EIA) as per Section 58 of the EMCA for all projects in the second schedule. Section 18 of the regulations sets out the information to be captured in the EIA report. The institution charged with overseeing the implementation of Cap 387 is the National Environment Management Authority (NEMA).

The policy frameworks under which activities such as the one being proposed here fall include: Environment and Development Policy, National Policy on Water Resources Management and Development (Sessional Paper No.1 of 1999), Energy Policy (Sessional Paper No.4 of 2004), Land Policy., Feed in Tariff Policy, Health Policy, Economic Recovery for Wealth and Employment Creation Strategy, Kenya Vision 2030 etc. Acts that have a bearing on the rules and regulations and relate to energy exploitation and use include: Public Health Act, Cap 242; Water Act, 2016; Local Government Act, Cap 265; Penal Code, Cap 63; Wildlife (Conservation and Management) Act, Cap 376, and Electric Power Act, 1997 among others.

4.2 THE CONSTITUTION OF KENYA, 2010

The Constitution provides that every person has the right to a clean and healthy environment (Article 42). The State is obliged to ensure that the environment and natural resources are conserved and genetic resources and biological diversity are protected. In that regard it must eliminate any processes or activities that would be likely to endanger the environment. Everyone is expected to cooperate with the State organs and other people to protect and conserve the environment and ensure that the use and development of the natural resources are ecologically sustainable (Article 69). These environmental rights are enforceable in a court of law (Article 70).

Land must be used in a sustainable manner, and in accordance with the principles of sound conservation and protection of ecologically sensitive areas. The State may regulate the use of any land or right over any land in the interest of land use planning (Article 66). The Constitution gives recognition to public, community and private land. Land use regulation goes beyond exploitation merely for economic purposes, and lays emphasis on conservation. Community land vests in communities identified on the basis of ethnicity, culture, or other similar common interest. Apart from land registered or transferred, it consists of land that is lawfully held, managed or used by specific communities as grazing areas or shrines, and ancestral lands (Articles 60 – 72). The State is generally mandated to regulate the use of any land in the public interest. Public land is described as including: all minerals and mineral oils; specified government forests; government game reserves; water catchment areas; national parks; government animal sanctuaries; specially protected areas; and all rivers, lakes and other water bodies as defined by law. However, land on which minerals and oils deposits exist is held by the national government in trust for the Kenyan people (Article 62).

Article 174 of the Constitution sets out the objects of devolution of government, which include: (a) giving powers of self-governance to the people and enhancing their participation in the exercise of the powers of the State and in making decisions affecting them; (b) recognizing the right of communities to manage their own affairs and to further their development; (c) protecting and promoting the interests and rights of minorities and marginalised communities; (d) promoting social and economic development and the provision of proximate, easily accessible services throughout Kenya; (e) ensuring equitable sharing of national and local resources throughout Kenya; and (f) facilitating the decentralisation of State organs, their functions and services, from the capital of Kenya.

The Fourth Schedule of the Constitution sets out the functions devolved to the county governments, including agriculture; county health services; control of air and noise pollution; cultural activities; county transport; animal control and welfare; county planning and development; pre-primary education; implementation of specific national government policies on natural resources and environmental conservation; county public works and services and fire-fighting services and disaster management being key devolved functions.

4.3 THE POLICY FRAMEWORK

4.3.1 Environment and Development Policy

The Environment and Development Policy is outlined in Sessional Paper No.6 of 1999. It covers the following environment and development issues: biological diversity; land and land based resources; water resources; fisheries and marine resources; energy resources; atmospheric resources; waste management; management of toxic and dangerous chemicals; radiation management; environmental health and occupational safety; human settlements; disaster management; implementation strategies; priorities for action; human resources development; environmental planning; environmental laws; environment and land use practices; environment, industry and economic development, research and technology coordination; and participation; regional and international cooperation; and NEMA.

It outlines the following principles:

- Environmental protection is an integral part of sustainable development.
- The environment and its natural resources can meet the needs of present as well as those of future generations if used sustainably.
- All people have the right to benefit equally from the use of natural resources as well as an equal entitlement to a clean and healthy environment. Poverty reduction is an indispensable requirement for sustainable development.
- Sustainable development and a higher quality of life can be achieved by reducing or eliminating unsustainable practices of production and consumption, and by promoting appropriate demographic policies.
- Endogenous capacity building is essential for development, adaptation, diffusion, and transfer of technologies for sustainable development.

- Indigenous/ traditional knowledge and skills are vital in environmental management and sustainable development.
- Effective public participation is enhanced by access to information concerning the environment and the opportunity to participate in decision-making processes. Public participation including women and youth is essential in proper environmental management.
- For sustainable environmental management, the Polluter Pays Principle (PPP) should apply.
- Access to judicial and administrative proceedings, including redress and remedy, is essential to environmental conservation and management.
- Private sector participation in environmental management is essential for sustainable development.
- Precautionary Principle: Effective measures should be taken to prevent any threats of damage to the environment, notwithstanding lack of full scientific certainty.
- Peace, security, development, and environmental protection are interdependent and indivisible.
- International co-operation and collaboration is essential in the management of environmental resources shared by two or more states.

4.3.2 The National Energy Policy 2012

The energy sector plays a vital role in the socio-economic development of a nation. In Kenya, petroleum and electricity as sources of energy are the main drivers of the economy, while biomass is mainly used in the rural areas. The sector currently relies solely on the import of all petroleum products. However, with the discovery of oil and gas deposits in the northern parts of Kenya, this will change. Policy direction in the energy sector was previously governed by Sessional Paper No. 4 of 2004 which had the objectives of: Providing sustainable quality energy; energy as a tool to accelerate economic empowerment for urban and rural development; improving access to affordable energy; enhancing security of supply; promoting development of indigenous energy resources; and promoting energy efficiency and conservation as well as prudent environmental, health and safety practices in the energy sector.

The new policy has been prepared to bring on board emerging issues such as Vision 2030, and more importantly, the functions of county governments in the new Constitutional dispensation. In view of the recent oil discovery in northern Kenya, it is necessary to develop petroleum production capacity and infrastructure to meet the increasing market needs at home and in the region. These developments will include modernizing the existing refinery and building a new one, thereby making products more competitive, creating wealth and ensuring security of supply and stabilizing prices. Increased use of LPG will be encouraged to reduce dependence on biomass and eliminate the use of kerosene in homes. Natural gas may be used for power generation, transport and domestic purposes.

In line with the proposed Khalala Hydropower Project- a Renewable Energy undertaking the policy notes that the government plans to promote and accelerate the exploitation of renewable sources of energy as they have the potential to enhance energy security,

mitigate climate change and generate income as well as create the much-needed employment.

The overall objective of the energy policy is to ensure affordable, sustainable and reliable supply to meet national and county development needs, while protecting and conserving the environment.

The specific objectives are to:

- Utilize energy as a tool to accelerate economic growth for the national and county governments as well as urban and rural development.
- Improve access to quality, reliable and affordable energy services.
- Provide a conducive environment for the provision of energy services.
- Promote development of indigenous energy resources.
- Promote energy efficiency and conservation.
- Ensure that prudent environmental, social, health and safety considerations are factored in energy sector developments.
- Ensure that a comprehensive, integrated and well-informed energy sector plan is put in place for effective development.
- Foster international co-operation in energy trade, investments and development.
- Promote energy research, development, training and local manufacture of energy plant, equipment, appliances and materials.
- Promote appropriate standards, codes of practice and specifications for equipment, systems and processes in the energy sector.
- Promote diversification of energy supply sources to ensure supply security.
- Promote healthy competition in the sector.
- Protect consumer interests.
- Promote both local and international investments in the energy sector.
- Promote an elaborate response strategy in energy related disaster management.
- Generate at least 70% of electricity from clean or renewable resources and build the infrastructure necessary to transmit that electricity.
- Provide for the phased transfer of provision of energy services to the counties in accordance with Article 174 of the Constitution.

4.3.3 Feed-in-Tariffs Policy

The government of Kenya recognises that renewable energy sources (RES) have the potential to generate income and employment, over and above contributing to the electricity supply and diversification of generation sources. The National Energy Policy as enunciated in Sessional Paper No.4 of 2004 and operationalized by the Energy Act No. 12 of 2006, encourages implementation of these indigenous renewable energy sources to enhance the country's electricity supply capacity. The Sessional Paper incorporates strategies to promote the contribution of renewable energy sources in generation of electricity.

In Sessional Paper No. 4 of 2004 on Energy the government committed to promoting electricity generation from RES while Chapter V Section 103 of the Energy Act 2006 on 'Promotion of Renewable Energy and Energy Conservation', empowers the Minister responsible for Energy to promote development and use of renewable energy technologies.

Section 6.4.1 (i)-(iv) of the Sessional Paper No. 4 of 2004 on Energy provides for the government to undertake pre-feasibility and feasibility studies on the potential for RES and for the packaging and dissemination of information on renewable energy sources to create investor and consumer awareness on the economic potential offered by other renewable sources of energy.

Pursuant to these policy strategies and in recognition of the potential of RES in Kenya, the Ministry of Energy (MoE) encourages potential Independent Power Producers (IPPs) to carry out feasibility studies on renewable energy generation on the basis of which Power Purchase Agreements (PPAs) with the Off-taker is negotiated.

The objectives of the FiTs system are to:

- Facilitate resource mobilization by providing investment security and market stability for investors in electricity generation from renewable energy sources;
- Reduce transaction and administrative costs and delays associated with the conventional procurement processes;
- Encourage private investors to operate their power plants prudently and efficiently so as to maximize returns.

4.3.4 National Policy on Water Resources Management and Development

This policy is famously referred as Sessional Paper No.1 of 1999. The management of water resources in Kenya is guided by four specific policy objectives, namely:

- Preserve, conserve and protect available water resources and allocate it in a sustainable, rational and economic way;
- Supply water of good quality in sufficient quantities to meet the various water needs, including poverty alleviation, while ensuring the safe disposal of wastewater and environmental protection;
- Establish an efficient and effective institutional framework to achieve a systematic development and management of the water sector; and
- Develop a sound and sustainable financing system for effective water resources management, water supply and sanitation development.

4.3.5 The Land Policy (Sessional Paper No. 3 of 2009)

The overall objective of the National Land Policy is to secure land rights and provide for sustainable growth, investment and the reduction of poverty in line with the government's overall development objectives. Specifically, it seeks to develop a framework of policies and laws designed to ensure the maintenance of a system of land administration and management that will provide all citizens with:

- The opportunity to access and beneficially occupy and use land;
- Economically, socially equitable and environmentally sustainable allocation and use of land;
- Effective and economical operation of the land market;
- Efficient use of land and land-based resources; and
- Efficient and transparent land dispute resolution mechanisms.

Inadequate environmental management and conflicts over land and land-based resources is one of the major issues the policy aims to resolve.

4.3.6 Wildlife Policy 2011

The wildlife policy is aimed at promoting protection and conservation of wildlife in Kenya, both in protected and non-protected areas. Kenya's wildlife policy is embodied in the Sessional Paper No. 3 of 1975. The policy is implemented by the Kenya Wildlife Service (KWS).

4.3.7 National Biodiversity Strategy (NBSAP) of 2000

The strategy is a national framework of action for ensuring that the present rate of biodiversity loss is reversed and present levels of biological resources are maintained at sustainable levels for posterity. The general objectives of the strategy are to conserve Kenya's biodiversity; to sustainably use its components; to fairly and equitably share the benefits arising from the utilization of biological resources among the stakeholders; and to enhance technical and scientific cooperation nationally and internationally, including the exchange of information in support of biological conservation.

4.3.8 The National Environmental Sanitation and Hygiene Policy 2007

The Environmental Sanitation and Hygiene Policy (ESH) is intended to improve people's health and quality of life. Strategic interventions have been developed to determine the success of the policy implementation. One of the key purposes of this policy is to clarify the various roles in order to enhance the existing legal and constitutional framework and to encourage the private sector, civil society and community participation in the planning, implementation and ownership of ESH services. It is envisaged that all households have been educated and made aware of the importance and need for improved environmental sanitation and hygiene practices for improved health, resulting in positive behaviour change.

Sanitation and the Environment: One of the key objectives of the policy is to protect the environment from pollution and its negative effect on human health. The government will seek to minimize negative impacts arising from various types of sanitation systems, and maximize positive effects. In situations where inappropriate hygiene and sanitation systems have negative environmental impacts, the particular choice of technology will be weighed against the unimproved or less elaborate sanitation practices. The Health Ministry, through its Division of Environmental Health in conjunction with relevant agencies, will provide guidelines for the delivery and management of environmental infrastructure, particularly household sanitation, and solid waste disposal including healthcare waste and other wastes. Well-functioning sanitation and hygiene systems are a means of protecting the environment. Monitoring will be increased and undertaken systematically to help prevent environmental pollution from liquid and solid wastes. The policy is designed in a manner that will create job opportunities, e.g. labour intensive construction, sustainable livelihoods and long-term entrepreneurial activities. Poor access to adequate sanitation and hygiene is a major hindrance to poverty alleviation. The health risks associated with poor ESH increase poverty. The government envisages that this policy is an important step towards poverty reduction.

4.3.9 Economic Recovery for Wealth and Employment Creation Strategy

The overall goal of the Strategy is to ensure clear improvements in the social and economic well-being of all Kenyans, thereby giving Kenyans a better deal in their lives and in their struggle to build a modern and prosperous nation. The key areas covered in

the Strategy are: Expanding and improving infrastructure; Reforms in Trade and Industry; Reforms in forestry; Affordable shelter and housing; Developing arid and semi-arid lands; and Safeguarding environment and natural resources. The Strategy, which has commanded a great deal of attention in recent years, essentially subsumes the Poverty Reduction Strategy Paper (PRSP).

4.3.10 HIV/AIDS Policy of 2009

The policy identifies HIV/AIDS as a global crisis that constitutes one of the most formidable challenges to development and social progress. The pandemic heavily affects the Kenyan economy through loss of skilled and experienced manpower due to deaths, loss of man hours due to prolonged illnesses, absenteeism, reduced performance, increased stress, stigma, discrimination and loss of institutional memories, among others

4.3.11 Kenya Vision 2030

Kenya Vision 2030 seeks to transform the country into an industrialized “middle-income country providing a high quality of life to its citizens by the year 2030”. The Vision 2030 is based on three ‘pillars’: the economic, the social and the political. The adoption of the Vision follows the successful implementation of the Economic Recovery Strategy for Wealth and Employment Creation (ERS) launched in 2002. The Vision is to be implemented in successive five-year medium-term plans. The economic, social and political pillars of Kenya Vision 2030 are anchored on macroeconomic stability, continuity in government reforms, enhanced equity and wealth-creation opportunities for the poor, infrastructure, energy, science, technology and innovation, land reform, human resources development, security, as well as public sector reforms.

The foundations for the Vision are: Macroeconomic Stability for Long-term Development; Continuity in Governance Reforms; Infrastructure; Enhanced Equity and Wealth-Creation Opportunities for the Poor; Science, Technology and Innovation (STI); Land Reform; Human Resources Development; Security; Energy; and Efficient Public Sector.

4.4 KENYA LEGISLATION, REGULATIONS AND STANDARDS

4.4.1 The Environmental Management and Co-ordination (Amendments) Act, 2015, Cap 387

EMCA Cap 387 provides for the establishment of an appropriate legal and institutional framework for the purpose of managing the environment and matters connected with it. NEMA (“the Authority”) is established under Section 7 of the Act. Its mandate is to monitor the operations of industries, projects or activities to determine their immediate and long-term effects on the environment. The Authority may prescribe measures to ensure that the biological resources in place are preserved, issue guidelines to promote the conservation of the various terrestrial and aquatic systems, and protect species, ecosystems and habitats threatened with extinction. Below are some of the subsequent regulations under EMCA.

4.4.1.1 Environmental Management and Co-ordination (Water Quality) Regulations, 2006

These regulations are contained in the Kenya Gazette Supplement No. 68, Legal Notice No. 120. They apply to waters used for domestic, industrial, agricultural and recreational, fisheries and wildlife, and water used for any other purposes. Different

standards apply to different modes of usage. These regulations provide for the protection of lakes, rivers, streams, springs, wells and other water sources. It is an offence to contravene the provisions of these regulations with a fine being imposed on the offender.

4.4.1.2 Environmental Management and Co-ordination (Waste management) Regulation, 2006

The Waste Management Regulations (2006) are contained in the Kenya Gazette No. 69, Legal Notice No. 121. The Waste Management Regulations are meant to streamline the handling, transportation and disposal of various types of waste. The aim of the Waste Management Regulations is to protect human health and the environment. The regulations place emphasis on waste minimization, cleaner production and segregation of waste at source. The regulation requires licensing of transporters of wastes and operators of disposal site (sections 7 and 10 respectively). Of immediate relevance to proposed development for the purposes of this project report is Part II Sections 4(1-2). Section 4 (1) states that –No person shall dispose of any waste on a public highway, street, road, recreational area or any other public place except in a designated waste receptacle and Section 4(2) and 6 explains that the waste generator must collect, segregate (hazardous waste from non-hazardous) and dispose waste in such a facility that shall be provided by the relevant local authority.

4.4.1.3 Environmental Management and Co-ordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009

These Regulations require that no person or activity shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise that annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. In determining whether noise is loud, unreasonable, unnecessary or unusual, the following factors may be considered: time of the day; proximity to residential receptors; noise frequency, level and intensity; and whether the noise is subject to be controlled without unreasonable effort or expense to the person making the noise. These regulations also relate noise to its vibration effects and seek to ensure that no harmful vibrations are caused by controlling the level of noise. Part II Section 4 state that: except as otherwise provided in these Regulations, no person shall: a) Make or cause to be made excessive vibrations that annoys, disturbs, injures or endangers the comfort, response, health or safety of others and the environment; or b) Cause to be made excessive vibrations which exceed 0.5 centimetres per second beyond any source property boundary or 30 metres from any moving source.

Part III Section 2 (1) states that any person wishing to a) operate or repair any machinery, motor vehicle, construction 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 provided in the First Schedule to these Regulations. Any person who contravenes these Regulations commits an offence.

4.4.1.4 Environmental Management and Co-ordination (Air Quality) Regulations, 2014

The objective of these Regulations is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. The general prohibitions state that no person shall cause the emission of air pollutants listed under First Schedule (Priority air pollutants) to exceed the ambient air quality levels as required/ stipulated under the

provisions of the Seventh Schedule (Emission limits for controlled and non-controlled facilities) and Second Schedule (Ambient air quality tolerance limits).

4.4.1.5 Environmental Management and Co-ordination (Wetlands, Riverbank, Lakeshore and Seashore Management) Regulations, 2009

The Environmental Management and Co-ordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009 applies to all wetlands in Kenya whether occurring in private or public land. The objectives of the regulations is to provide for the conservation and sustainable use of wetlands and their resources in Kenya and promote the integration of sustainable use of resources in wetlands into the local and national management of natural resources for socio-economic development. The regulations also aims at ensuring the conservation of water catchments and the control of floods and the sustainable use of wetlands for ecological and aesthetic purposes for the common good of all citizens.

4.4.1.6 The Environmental Management and Co-ordination (Controlled Substances) Regulations, 2007

The EMC (Controlled Substances) Regulation is aimed at controlling the production, consumption and, exports and imports of controlled substances. Controlled substances are grouped into three lists as indicated below:

- ✓ Group 1 list consists of halogenated flouro-chemicals with ozone depleting substances (ODS).
- ✓ Group 2 list consist of hydrobromo-flourocarbons with ODS.
- ✓ Group 3 list consist of bromo-chloromethane with ODS.

Products containing controlled substances include air conditioners, air coolers, refrigerants, portable fire extinguishers, heat pump equipment, dehumidifiers, insulation boards, panels and pipe covers, pre-polymers, etc.

4.4.1.7 Environmental Management and Co-ordination (Fossil Fuel Emissions) Regulations, 2006

The EMC (Fossil Fuel Emission Control) Regulations, 2006 aims at eliminating or reducing emissions emitted from internal combustion engines to acceptable levels. The regulation provides guidelines on use of clean fuels, use of catalysts and inspection procedures for engines and generators.

4.4.2 The EIA Guidelines and Administrative Procedures

The EIA and Administrative Procedures arose from the policy framework and the legislative and regulatory (the Principal Act 1999, and its regulations) procedures in order to assist in the integration of environmental concerns in economic development so as to foster sustainable development. The document sets out guidelines for carrying out EIA, Environmental Audit and Monitoring, Strategic Environmental Assessment (SEA) and dealing with issues of trans-boundary, regional and international conventions, treaties and agreements. It sets out the procedure in EIA studies and Environmental Audits as well as the contents and format of the reports required to be submitted to NEMA for consideration. The EIA study review process and decision-making are also explained. The guidelines are mainly intended to assist project proponents, EIA

practitioners, lead agencies and members of the public to understand the process and form the basis on which decisions are made.

4.4.3 The Energy Act, No. 12 of 2006

The Energy Act relates to the health and safety of the project and the environment. Khalala Hydropower (K) Limited will need to conform to the relevant local and/or international standards and comply with the applicable statutes on environmental, health and safety standards.

4.4.4 Electric Power Act (1997)

This Act relates to the project's inception. This provides procedure and rules and guidelines from licensing a power generating station to power purchase. This will be important for the whole project life cycle.

4.4.5 The Public Health Act, Cap. 242

This statute relates to the waste generated at the camp and worksite(s) and its safe disposal and/or discharge. The Act states that no person or institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires local authorities to take all lawful, necessary and reasonable practicable measures to maintain areas under their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable for injurious or dangerous to human health. Such nuisance or conditions are defined under section 188 wastes, sewers, drains or refuse pits in such a state, situated or constructed as in the opinion of the medical officer of health to be offensive or injurious to health. Noxious matter or waste flowing or discharged from any premises into a public street or into the gutter or side channel or watercourse, irrigation channel or bed not approved for discharge is also deemed as a nuisance. Other nuisances are accumulation of materials or refuse which in the opinion of the medical officer of health is likely to harbour rats or other vermin. On the responsibility of local authorities, part XI section 129 of the Act states in part "It shall be the duty of every local authority to take all lawful, necessary and reasonable practicable measures for preventing any pollution dangerous to health of any supply of water which the public within its administrative unit has a right to use and does use for drinking or domestic purposes". The Act states that collections of water, sewage, rubbish, refuse and other fluids which permits/ facilitate breeding or multiplication of pests shall be deemed nuisance and are liable to be dealt with in the manner provided by this act.

4.4.6 The Penal Code Cap 63

Chapter XVII on —Nuisances and offences against health and convenience contained in the penal code strictly prohibits the release of foul air into the environment which affects the health of the persons. It states —Any person who voluntarily vitiates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling or carrying on business in the neighbourhoods or passing along a public way is guilty of a misdemeanour. Section 191 of the Act states that any person or institution that pollute water from public springs or reservoir, rendering it less fit for its ordinary use is guilty of an offence. The proponent shall be required to ensure strict adherence to the Environmental and Social Management Plan provided in the report throughout the project cycle in order to mitigate against any possible negative impacts to the community and the environment. Monthly and quarterly monitoring on the level of

implementation of the provisions of the ESMP shall be carried out and further mitigation measures given in case of any negative impacts to the environment and its resources. The proponent is also required to comply with any improvement orders provided by the relevant national and county government officials and departments.

4.4.7 The Occupational Safety and Health Act, No. 15 of 2007

The Act requires all employers to register their premises by making an application before they start operations. The Act also sets minimum standards that are to be maintained in such workplaces to safeguard health, safety and welfare of workers. These are all aimed at elimination of hazards from workplaces. The act makes it mandatory for occupiers or employers to provide Personal Protective Equipment (PPE) and practicable means to prevent injury to health of workers who are exposed to any potentially harmful substances or conditions. The Act further requires all workplaces to have stocked first aid boxes under the charge of trained first aid attendants. The Act offers more specific guidelines under rules made to govern certain aspects of health and safety. Such rules include the following: Safety and Health committee rules; First Aid Rules; Hazardous Substances Rules; Noise Rules; Medical Examination Rules; and Building Operations and Works of Engineering Construction Rules, 1984

4.4.8 Work Injury Benefits Act (WIBA) No. 13, 2007

It is an Act of Parliament 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 incapacitation resulting from accident; Compensation in fatal cases; Compensation in cases of permanent or partial incapacity; Compensation in case of temporary incapacity; Personnel entitled to compensation and methods of calculating the earnings; and No compensation shall be payable under this Act in respect of any incapacity or death resulting from a deliberate self-injury. 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.

4.4.9 The Water Act, 2016 and Water Resources Management Rules, 2007

This Act provides for the regulation, management, and development of Water resources and water and sewerage services in line with the 2010 Constitution. Section 21 provides for national monitoring and information systems on water resources. Following on this, subsection 2 allows the Water Resources Authority to demand from any person, specified information, documents, samples or materials on water resources. Under these rules, specific records may be required to be kept and the information thereof furnished to the authority on demand.

Section 36 of the Act requires a permit to be obtained for among others any use of water from a water resources, discharge of a pollutant into any water resource. As per section 40 of the same Act, application for such a permit shall be subject to public consultation as well as an environmental impact assessment as per the Environmental Management and Coordination (Amended) Act, Cap 387. The conditions of the permit may also be varied if the authority feels that the water so used is causing deterioration of water quality or causing shortage of water for other purposes that the Authority may consider has priority. This is provided for under section 46 of the Act. Section 63 of the Act accords every person in Kenya right to clean and safe water in adequate quantities and to reasonable standards of sanitation as stipulated in Article 43 of the constitution. Section 91 states that a water

service provider shall be responsible for the effective and economical provision of water service to fulfil the right to water and any other conditions specified in the license.

Section 143 states that a person shall not, without authority conferred under this act, interfere with, divert or obstruct water from any water resource. They shall also not cause pollution to the water resource in any way. In section 145 (d) no person shall without lawful authority, wilfully let off or discharge water from the works of any permit holder so that the permit holder loses the use of that water.

The Water Resources Management Rules, 2007 apply to the safe discharge of waste emanating from camp and worksites.

4.4.10 The National Land Commission Act, No. 5 of 2012

An Act of Parliament to make further provision as to the functions and powers of the National Land Commission (NLC), 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

Section 5(1) outlines the function of the National Land Commission, which are: 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.

4.4.11 Land Laws (Amendment) Act (No. 28 of 2016)

This is an amendment of the principal Act Land Act No. 6 of 2012.

Part III – Administration of public land: Section 20 highlights on license for temporary purposes. The Commission may grant a person a license to use unalienated public land for a period not exceeding five years subject to planning principles as it may prescribe. The Commission may serve a notice to quit upon the licensee at any time after the expiration of nine months from the date of the license. The fee payable under a license under this section, the period and the agreements and conditions of the license, shall be prescribed by the Commission. The licensee may, with the consent of the Commission, transfer the benefit of a license under this section, and the transfer and the consent thereto shall be endorsed on the license.

Part VIII – Compulsory acquisition of interests in land: Section 110 emphasizes that land may be acquired compulsorily under this Part if the Commission certifies, in writing, that the land is required for public purposes or in the public interest as related to and necessary for fulfillment of the stated public purpose. Section 111 states that if land is acquired compulsorily under this Act, just compensation shall be paid promptly in full to all persons whose interests in the land have been determined.

4.4.12 Land Control Act Cap. 302

This is an Act of Parliament to provide for controlling in agricultural land. Each of the following transactions that is to say: (a) the sale, transfer, lease, mortgage, exchange, partition or other disposal of or dealing with any agricultural land which is situated within a land control area; (b) the division of any such agricultural land into two or more parcels to be held under separate titles, other than the division of an area of less than twenty acres into plots in an area to which the Development and Use of Land (Planning) Regulations, 1961 (L.N. 516/1961) for the time being apply; and (c) the issue, sale, transfer, mortgage or any other disposal of or dealing with any share in a private company or co-operative society which for the time being owns agricultural land situated within a land control area is void for all purposes unless the land control board for the land control area or division in which the land is situated has given its consent in respect of that transaction in accordance with this Act.

4.4.13 The Environment and Land Court Act, 2011

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 land. The Environment and Land Court is one of the Courts contemplated by article 162 (2). It is a Superior Court and has the same status as the High Court. The court is established under section 4 of the Environment and Land Court Act No. 19 of 2011. It has jurisdiction to hear any other dispute relating to environment and land. The jurisdiction of the court is provided under section 13 of the Act. The Court has original and appellate jurisdiction to hear and determine all disputes in accordance with Article 162 (2) (b) of the Constitution and with the provisions of the Act or any other written law relating to environment and land. The court has powers to deal with disputes relating to land administration and management. The court is also empowered to hear cases relating to public, private and community land and contracts or other instruments granting any enforceable interests in land. The court also exercises appellate jurisdiction over the decisions of subordinate courts or local tribunals in respect of matters falling within the jurisdiction of the Court. The court further exercises supervisory jurisdiction over the subordinate courts, local tribunals, persons or authorities in accordance with Article 165 (6) of the Constitution.

4.4.14 The Wildlife Conservation and Management Act No. 47 of 2013

The Act deals with the conservation and management of wildlife in Kenya; the Act provides that wildlife should be conserved so as to yield optimum returns in terms of cultural, aesthetic, scientific and economic benefits. The Act requires that full account be taken of the inter-relationship between wildlife conservation and land use. The Act controls activities within the national parks, which may lead to the disturbance of wild animals. Unauthorized entry, residence, burning, damage to objects of scientific interest, introduction of plants and animals and damage to structure are prohibited under the law

4.4.15 Forest Conservation and Management Act No. 34 of 2016

Part IV of the Act provides for the Conservation and Management of forests be it public, community or private forests. Section 42 of the Act further states that all indigenous forests and woodlands shall be managed on a sustainable basis for purposes of: Conservation of water, soil and biodiversity; Riparian and shoreline protection; Cultural use and heritage; Recreation and tourism; Sustainable production of wood and non-wood

products; Carbon sequestration and other environmental services; Education and research purposes and Habitats for wildlife in terrestrial forests and fisheries in mangrove forests.

Section 75.(1) of the Act states that where a provision of this Act requires a person to conserve or protect the environment, the relevant provisions of the Environmental Management and Co-ordination Act, Cap 387, shall also apply with respect to the manner in which the conservation or protection shall proceed. (3) A user or other related right shall not be granted under this Act where the requirement for a strategic environmental, cultural, economic and social impact assessment license under the Environmental Management and Co-ordination Act, Cap 387, has not been complied with.

4.4.16 Climate Change Act No. 11, 2016

The Act applies to the development, management, implementation and regulation of mechanisms to enhance climate change resilience and low carbon development for the sustainable development of Kenya. Without prejudice to subsection (1), the Act shall be applied in all sectors of the economy by the national and county governments to: mainstream climate change responses into development planning, decision making and implementation; build resilience and enhance adaptive capacity to the impacts of climate change; formulate programs and plans to enhance the resilience and adaptive capacity of human and ecological systems to the impacts of climate change; mainstream and reinforce climate change disaster risk reduction into strategies and actions of public and private entities; promote low carbon technologies, improve efficiency and reduce emissions intensity by facilitating approaches and uptake of technologies that support low carbon, and climate resilient development; facilitate capacity development for public participation in climate change responses through awareness creation, consultation, representation and access to information; mobilize and transparently manage public and other financial resources for climate change response; provide mechanisms for, and facilitate climate change research and development, training and capacity building; mainstream the principle of sustainable development into the planning for and decision making on climate change response; and integrate climate change into the exercise of power and functions of all levels of governance to enhance cooperative climate change governance between the national and county governments.

4.4.17 The Physical Planning Act, Cap. 286 Part V—Control of development

This statute covers all development activities that may result in adverse effects on the environment, particularly the generation of waste and the method of its discharge.

Section 30. (1), No person shall carry out development within the area of a local authority without a development permission granted by the local authority under this section. (2) Any person who contravenes sub-section (1) shall be guilty of an offence and shall be liable to a fine not exceeding one hundred thousand shillings or to an imprisonment not exceeding five years or to both. (3) Any dealing in connection with any development in respect of which an offence is committed under this section shall be null and void and such development shall be discontinued. (4) Notwithstanding the provisions of sub-section (2) (a) The local authority concerned shall require the developer to restore the land on which such development has taken place to its original condition within a period of not more than ninety days; (b) If on the expiry of the ninety days' notice given to the developer such restoration has not been effected, the concerned local authority shall restore the site to its original condition and recover the cost incurred

thereto from the developer. Section 31. Any person requiring development permission shall make an application in the form prescribed in the Fourth Schedule, to the clerk of the local authority responsible for the area in which the land concerned is situated. The application shall be accompanied by such plans and particulars as are necessary to indicate the purposes of the development, and in particular shall show the proposed use and density, and the land which the applicant intends to surrender for: a) Purposes of principal and secondary means of access to any subdivisions within the area included in the application and to adjoining land; and b) Public purposes consequent upon the proposed development.

Section 36, If in connection with a development application a local authority is of the opinion that proposals for industrial location, dumping sites, sewerage treatment, quarries or any other development activity will have injurious impact on the environment, the applicant shall be required to submit together with the application an EIA report. Accordingly, Section 29 (a) of the Physical Planning Act has granted all county governments in Kenya, the County Governments of Kakamega and Bungoma being no exception, the power to prohibit or control the use and development of land and buildings.

4.4.18 The County Governments Act No. 4, 2012; 2017

This Act repealed the Local Government Act 265 in response to the Kenya's Constitution requirements on devolved governance. The proponent will according to the County Government Act of 2012(Rev. 2017) ensure that the project activities conform to the regulation that shall be passed.(section 135 (1) The Cabinet Secretary may make regulations for the better carrying out of the purposes and provisions of this Act and such Regulations may be made in respect of all county governments and further units of decentralization generally or for any class of county governments and further units of decentralization.) comply to the set regulations and bye laws.

4.4.19 The National Museums and Heritage Act, Cap. 216

This statute relates to the disturbance of, and interference with, sensitive cultural, natural heritage and archaeological sites and their protection.

4.5 INSTITUTIONAL FRAMEWORK

In 2001, the Government established the administrative structures to implement the Environmental Management and Co-ordination Act 1999/ Cap 387 (herein referred to as the Principal Act). Later the Act was amended in 2015. There are over twenty (20) institutions and departments which deal with environmental issues in Kenya. Some of the key institutions include the National Environmental Management Authority, Kenya Forest Service, Kenya Wildlife Services, Kenya Marine and Fisheries Research Institute and Water Resources Authority among many others. There are also local and international NGOs involved in environmental issues in the country. Described here below are legal organizations whose aim is to ensure sustainable management of environmental resources, ensuring communities are beneficiaries of development projects within their surrounds, protecting vulnerable ecosystems and organisms and facilitate for coexistence between the built and natural environment.

- National Environment Management Authority
- County Environmental Committee

- National Environmental Complaints Committee

The main administrative structures are described in the following section.

4.2.1. The National Environment Management Authority (NEMA)

Is an authority formulated under EMCA Cap 387, part 7 (1). The responsibility of NEMA is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Government in the implementation of all policies relating to the environment. The Authority gives licenses to any development project once it reviews ESIA reports prepared (this study report) so as to assess the possible impacts of the proposed project as well as give mitigation measures to ensure protection and sustainability of the environment and the development. The Authority also formulates national environment action plans every six years. The proponent has consulted widely to establish issues that may arise as a result of the project development. A detailed ESMP is developed to mitigate the negative impacts and enforce the positive impacts created by this project. The proponent will submit this ESIA study report to NEMA for relevant approval and licensing of the project.

4.2.2. County Environmental Committees

The County Environmental Committees contribute to decentralized environmental management and enable the participation of local communities. These committees are responsible for the proper management of the environment within the county, develop a county strategic environmental action plan every five years and perform any additional functions as are prescribed by the Act or as may, from time to time be assigned by the County Governor by notice in the gazette. These environmental committees consist of the following: Representatives from all the line ministries; Sub counties representatives; farmers and / or pastoral representatives; NGOs involved in environmental management in the County/ Sub counties; and representatives of each regional development authority in the County.

The committees are empowered to discuss the environmental issues affecting their area of jurisdiction, within and at the County level.

4.2.3. National Environmental Complaints Committees

This committee is tasked with undertaking public interest litigations on behalf of the citizens in environmental matters. It also investigates any allegations / complains against any person or against the Authority in relation to conditions of the environment in Kenya. The committee prepares and submits to the Cabinet Secretary periodic reports of its activities which form part of annual report on the state of the environment. This committee investigates complaints regarding environment and public interest litigations and contractor to abide by ESMP developed so as to avoid any litigations.

4.2.4. Water Resource Authority (WRA)

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

- ✓ Planning, management, protection and conservation of water resources;
- ✓ Planning, allocation, apportionment, assessment and monitoring of water resources;

- ✓ Issuance of water permits, water rights and enforcement of permit conditions;
- ✓ Regulation of conservation and abstraction structures;
- ✓ Catchment and water quality management;
- ✓ Regulation and control of water use; and
- ✓ Coordination of the Integrated Water Resource Management (IWRM) Plan.

The contractor and the proponent will be required to apply for water diversion and abstraction permit from WRA – Lake Victoria North Catchment Basin at Kakamega offices.

4.2.5. Ministry of Lands

Land management in Kenya is vested in the Government through the Ministry of Lands. The Ministry is made up of the following five departments: Administration and Planning; Lands; Land Adjudication and Settlement; Survey; and Physical Planning.

The following five semi-autonomous bodies also fall within the Ministry: Land Arbitration Tribunal; Valuers Registration Board; Estate Agents Registration Board; Land Control Boards; and Physical Planning Liaison Committee.

The Ministry of Lands is charged with the enforcement and regulation of all the Acts relating to land

4.6 INTERNATIONAL CONVENTIONS AND AGREEMENTS

4.6.1 United Nations Framework conventions on Climate Change

The objective of the 1992 UNFCCC is to tackle the negative effects of climate change. The Conventions' stated aim is to stabilize greenhouse gas concentrations at a level that allows ecosystems to adapt naturally to climate change so that food production is not threatened, while enabling economic development to proceed in a sustainable manner (article2). The Convention sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change, recognizing that the climate system can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. Articles 2 and 3 particularly apply to this project. The proponent should support Kenya in her responsibility to anticipate, prevent or minimise the causes of climate change and mitigate its adverse effects by minimizing or eliminating activities that would bring about environmental degradation and climate change. The contractor should implement the ESMP and provision of this convention during the constructions to ensure that the gaseous emissions are reduced.

4.6.2 The 1985 Vienna Convention for the protection of the Ozone Layer

The Vienna Convention for the Protection of the Ozone Layer, 1985 was adopted after consensus was reached on 22nd March 1985. The overall objective of the Vienna Convention is to protect human health and the environment against the effects of ozone depletion. As a framework convention, it does not establish any specific controls on ozone depleting substances. Instead, it establishes a general obligation on the parties to protect the ozone layer (article 2) and emphasizes the need for international cooperation. The machineries to be used in the project have to be well maintained and eco-friendly; newer models of machineries are more eco-friendly than previous versions.

The contractor is therefore recommended to use newer models of machineries and ensure they are well maintained so as to reduce Greenhouse Gas emissions by the project.

4.6.3 The Bonn Convention on migratory species of wildlife animals (1979);

The convention acknowledged the need to take action to avoid any migratory species becoming endangered. It recognizes that wild animals are irreplaceable and must be conserved. As described in the convention; *"Migratory species" means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries.*" Articles III provides a guideline on how to deal with endangered migratory species whereas Article IV gives an overview of the subject of agreement for all migratory species. Matters of dispute settlement are discussed in Article XIII. Parties must protect them, conserve and restore their habitat, mitigate obstacles to migration and control other factors that might endanger them.

4.6.4 The International Convention on Trade in Endangered Species (CITES);

This treaty acknowledges that flora and fauna are an irreplaceable part of the natural systems and therefore aims to protect certain species of wild fauna and flora against over-exploitation through international trade. The treaty provides guidelines on exportation, re-exportation, importation and introduction from the sea. It strives to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

4.6.5 Convention for the Protection of World Cultural and National Heritage (1972)

Adopted by the General Conference of UNESCO at its seventeenth session in Paris, 1972. The convention aims to promote cooperation among nations to protect culture and heritage around the world with outstanding universal value for current and future generations. It demonstrates the necessity, for everyone regardless of their nation, to safeguard the unique and irreplaceable property, to whatever people it may belong. Articles 1 and 2 provide the definitions of cultural and natural heritage. With relevance to this project and project area and as described during the convention, the following shall be considered as definitions of cultural and natural heritage. "Cultural heritage site: *works of man or the combined works of nature and of man, and areas including archeological sites which are of outstanding universal value from the historical, aesthetic, ethnological or anthropological points of view.*" And "Natural heritage: *geological and physiographical formations and precisely delineated areas which constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation.*" Articles 11 and 12 provide an inventory of property forming part of the cultural and natural heritage.

4.6.6 United Nations Convention to Combat Desertification

The purpose of this Convention is to combat desertification and mitigate the effects of drought in Africa. It encourages international collaboration at all levels and arrangement of partnerships that would together contribute to the achievement of sustainable development in affected areas. This would result in improved land productivity as well as

improved ecosystem resources and services hence improving living conditions particularly at the community level.

4.6.7 Ramsar Convention, 1971

The Convention on wetlands is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. It was adopted in the Iranian city of Ramsar in 1971 and came into force in 1975, and it is the only global environmental treaty that deals with a particular ecosystem. The Convention's member countries cover all geographic regions of the planet.

4.6.8 Basel Convention, 1989

This Convention is based on the control of trans-boundary movements of hazardous wastes and their disposal. It requires that hazardous wastes and other wastes be accompanied by a movement document from the point at which a trans-boundary movement commences to the point of disposal. The objective is to protect human health and the environment against the adverse effects of hazardous wastes. The implementation of the proposed project will be carried out in accordance with the guidelines of this Convention, particularly handling and transportation of hazardous wastes.

4.7 INTERNATIONAL POLICIES

Development partners or their agencies fund most development projects in developing countries, Kenya inclusive. Most development partners require the World Bank (WBG) or International Finance Corporation (IFC) guidelines as a basis for funding development projects. Therefore, the Khalala Hydropower Project ESIA addresses the WBG, IFC and Equator Principles (EPs) social and environmental safeguard policies.

4.7.1 World Bank Operational Policies

The operational policies provide the basis on which the bank screens proposed projects to determine the appropriate extent and type of environmental assessment to be undertaken. The WBG classifies proposed projects as class A, B, C and F1 depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. The project sponsor and promoter is responsible for any environmental due diligence required by the safeguard policies.

There are ten 'safeguard policies' that the bank regards as critical to ensuring identification, minimisation and mitigation of potential social and environmental impacts of development projects, they are; Environmental Assessment; Physical Cultural Property; Projects in Disputed Areas; Forests; Indigenous Peoples; Projects involving International Waters; Involuntary Resettlement; Natural habitats; Pest management; and Safety of Dams.

The discussion below presents the safeguard policies relevant to the proposed Khalala Hydropower Project. WBG Safeguard policies on disputed areas, Projects involving International Waters, Forests and Pest Management are not discussed since the project does not trigger such policies.

4.7.1.1 Environmental Assessment: OP/BP 4.01

This is the umbrella policy for the WBG's safeguard policies and requires an environmental impact assessment to be carried out before implementation of category A projects. Category A projects are those that are likely to have significant adverse impacts and irreversible environmental impacts. Conversely, category B projects are those with limited impacts that can be mitigated, and require an initial environmental evaluation or project appraisal document with an EMP covering all negative impacts. The proposed Khalala Hydropower Project falls under category B projects, and hence the need to prepare an Environmental and Social Impact Assessment. The objective of this policy is to ensure that Bank-financed projects are environmentally sound and sustainable, and that decision-making is improved through appropriate analysis of actions and of their likely environmental impacts. This policy is triggered if a project is likely to have potential (adverse) environmental risks and impacts on its area of influence. OP 4.01 covers impacts on the natural environment (air, water and land); human health and safety; physical cultural resources; and trans-boundary and global environment concerns. The proposed Khalala Hydropower Project has already been subjected to an ESIA to meet this policy requirement.

4.7.1.2 Natural Habitats: OP/BP 4.04

This policy guideline requires infrastructure development to take into account the conservation of biodiversity, as well as the numerous environmental services and products which natural habitats provide to human society. OP 4.04 prohibits projects, which would lead to significant loss or degradation of any critical natural habitats, whose definition includes those natural habitats, which are legally protected, officially proposed for protection, or unprotected but known to have high conservation value. The WB therefore supports the protection, management, and restoration of natural habitats in its project financing, as well as policy dialogue and economic and sector work. The WB supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. Natural habitats are land and water areas where most of the original native plant and animal species are still present. They comprise many types of terrestrial, freshwater, coastal, and marine ecosystems including areas slightly modified by human activities, but retaining their ecological functions and most native species. This policy is triggered by any project (including any subproject under a sector investment or financial intermediary) with the potential to cause significant conversion (loss) or degradation of natural habitats, whether directly (through construction) or indirectly (through human activities induced by the project). The ESMP has addressed all impacts related to degradation of natural habitats within the project area.

4.7.1.3 Safety of dams- OP 4.37

The safeguard policy on dams states that, for the life of any dam, the owner is responsible for ensuring that appropriate measures are taken and sufficient resources provided for the safety of the dam, irrespective of its funding sources or construction status. Because there are serious consequences if a dam does not function properly or fails, the WB is concerned about the safety of new dams it finances and existing dams on which a Bank-financed project is directly dependent. The WB also requires that the borrower adopts and implements certain dam safety measures for the design, bid tendering, construction, operation, and maintenance of the dam and associated works.

The WB distinguishes between small and large dams; where small dams are normally less than 15 metres in height. This category includes, for example, farm ponds, local silt retention dams, and low embankment barriers while large dams are 15 metres or more in height. For small dams, generic dam safety measures designed by qualified engineers are usually adequate. For large dams, the WB requires certain guidelines to be met. The Khalala Hydropower is regarded as a small dam as the embankment is only for creation of a barrier to divert water flow.

4.7.1.4 Physical Cultural Resources: OP/BP 4.11

This policy provides guidelines for the preservation of cultural property and seeks to avoid their elimination, otherwise mitigation activities should be undertaken to limit the adverse impacts as far as possible. The objective of this policy is to assist countries to avoid or mitigate adverse impacts of development projects on physical cultural resources. For purposes of this policy, "physical cultural resources" are defined as movable or immovable objects, sites, structures, groups of structures, natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. The cultural interest may be at the local, provincial or national level, or within the international community.

This policy applies to all projects requiring a Category A or B Environmental Assessment under OP 4.01, project located in, or in the vicinity of, recognized cultural heritage sites, and projects designed to support the management or conservation of physical cultural resources. Physical cultural resources and cultural heritage sites such as Sitikho falls and community initiation rites of passage sites are located in the project area and thus the policy is triggered.

4.7.1.5 Indigenous Peoples/ Historically Underserved Traditional Local Communities: ESS7

This proposed Safeguard maintains the key provisions of OP/BP 4.10 while recognizing that some shareholders may use different terms to describe Indigenous Peoples.

The objective of this policy is to:

- Ensure that the development process fosters full respect for the dignity, human rights, and cultural uniqueness of indigenous peoples;
- Ensure that adverse effects during the development process are avoided, or if not feasible, ensure that these are minimized, mitigated or compensated; and
- Ensure that indigenous peoples receive culturally appropriate and gender and inter-generationally inclusive social and economic benefits.

This policy recognizes that the roles of men and women in indigenous cultures are often different from those in the mainstream groups, and that women and children have frequently been marginalized both within their own communities and as a result of external developments, and may have specific needs. Indigenous Peoples or underserved traditional local communities are inextricably linked to the land on which they live and the natural resources on which they depend. They are therefore particularly vulnerable if their land and resources are transformed, encroached upon, or significantly degraded. Projects may also undermine language use, cultural practices, institutional arrangements, and religious or spiritual beliefs that Indigenous Peoples view as essential to their identity or well-being.

However, projects may also create important opportunities for Indigenous Peoples to improve their quality of life and well-being. A project may create improved access to markets, schools, clinics and other services that seek to improve living conditions. The proposed project will affect people living in the project area thus triggering this policy. The study revealed that the project area is inhabited by the elderly, widows, orphans, very poor in the society among others that are marginalized in the community. The locals will directly and indirectly benefit from the project and all negative impacts are to be mitigated.

4.7.1.6 Involuntary Resettlement: OP/BP 4.12

The objective of this policy is to:

- Avoid or minimize involuntary resettlement where feasible, exploring all viable alternative project designs;
- Assist displaced persons in improving their former living standards, income earning capacity, and production levels, or at least in restoring them;
- Encourage community participation in planning and implementing resettlement; and
- Provide assistance to affected people regardless of the legality of land tenure.

This policy covers not only physical relocation, but any loss of land or other assets resulting in: Relocation or loss of shelter; Loss of assets or access to assets; and loss of income sources or means of livelihood, whether or not the affected people must move to another location.

The policy requires that those who are affected by the project leading to lose of land or property should be well compensated by the proponent. Those land parcels and other assets affected by the project must be adequately addressed through the Resettlement Action Plan (RAP). When projects result in involuntary resettlement. OP 4.12 describes the detail and elements that a resettlement plan should include such as objectives, potential impacts, socio-economic studies, legal and institutional framework, eligibility, valuation and compensation for losses, resettlement measures, relocation planning, community participation, and grievance redress procedures, implementation schedule, costs and budgets, and monitoring and evaluation. This report should thus conform to the WB policy requirement on contents and structure.

Elaborated below are sections relevant to the Khalala Hydropower Project.

WB OP 4.12.(6a) requires an institution of measures to ensure that displaced persons are (i) informed about their options and rights, (ii) consulted on, offered choices and provided with technically and economically feasible resettlement alternatives, and (iii) provided prompt and effective compensation at full replacement costs.

WB OP 4.12(8) requires that particular attention be paid to the needs of vulnerable groups among those displaced such as those below the poverty line, the landless, the elderly, women and children, indigenous peoples, and ethnic minorities.

WB.OP 4.12 (13a) stipulates that any displaced persons and their communities and any host communities receiving them should be provided with timely and relevant

information, consulted on resettlement options and offered opportunities to participate in planning, implementing and monitoring resettlement.

WB OP 4.12 (12a) states that payment of cash compensation for lost assets may be appropriate where livelihoods are land-based but the land taken for the project is a small fraction (less than 20%) of the affected asset and the residual is economically viable.

WB OP 4.12 paragraphs (6b & c) state that in case of physical relocation, displaced persons are provided with; Assistance (such as moving allowances) during relocation; Residential housing, or housing sites, or as required, agricultural sites for which a combination of productive potential, location advantage, and other factors are equivalent to the advantages of the old site; and development assistance in addition to compensation measures such as land preparation, credit facilities, training, or job opportunities.

WB OP 4.12 paragraph 13(a) requires that appropriate and accessible grievance mechanisms are established to sort out any issues arising. These frameworks will be relevant in mitigating adverse socio-economic impacts associated with the proposed Khalala Hydropower Project.

Table 4-1: World Bank Safeguards

WORLD BANK SAFEGUARD POLICY	RELEVANCE TO THE PROJECT
Environmental Assessment	Contribution towards sustainability of the project both environmentally and socially by integration of environmental and social components in decision making through ESIA.
Natural Habitats	Project operations will ensure that natural habitats and their functions are promoted through conservation and protection.
Physical Cultural Resources (PCR)	The project recognizes key archeological, religious including graveyards and burial sites, aesthetic, or other cultural significance and endeavours protect them.
Involuntary Resettlement	The displaced persons will be supported in re-establishing their lives and living standards by putting in place proper compensation and resettlement mechanisms.
Pest Management	There is no usage of pesticides and if there use is to be warranted then it should be environmentally friendly.
Indigenous Peoples/ Underserved Traditional Local Communities:	Marginalized and minority groups will be recognized and their rights and cultural distinction protected, while advancing their respect and dignity.
Forests	The project does not affect any gazetted forest. Planted trees cut down should be compensated by the proponent.

Projects in Disputed Areas	Public participation and stakeholder consultation as well as grievances redress mechanisms will be set up promote public participation and acceptability of the project.
Projects on International Waterways	The project has a trans-boundary effect at a county level- Bungoma and Kakamega. However, after adoption of the ESMP there will be minimized resultant impact on the river.
Safety of Dams	The project area does not have a dam but has run over the river weir that act as a barrier for diversion of water.

Table 4-2: Summary of the relevant World Bank safeguards

NO.	World Bank Safeguard Policy	Triggered (√)	Not Triggered (×)
1)	Environmental Assessment: OP/BP 4.01	(√)	
2)	Natural Habitats: OP/BP 4.04	(√)	
3)	Forests: OP/BP 4.36		(×)
4)	Physical Cultural Resources: OP/BP 4.11	(√)	
5)	Indigenous Peoples/ Underserved Traditional Local Communities	(√)	
6)	Involuntary Resettlement: OP/BP 4.12	(√)	
7)	Projects in International Waters: OP 7.50		(×)
8)	Projects in Disputed Areas: OP 7.60		(×)
9)	Safety of Dams (OP/BP 4.37)	(√)	
10)	Pest Management (OP 4.09)		(×)

In addition to all the above World Bank Guidelines, IFC's Environmental Health and Safety General Guidelines as well as Performance Standards on Social and Environmental Sustainability which include the following will be followed and adhered to where applicable:

Performance Standard 1: Social and Environmental Assessment and Management Systems

The proponent has conducted an Environmental and Social Impact Assessment (ESIA) of the proposed Khalala Hydropower Project in an integrated manner to include key aspects such as;

- ✓ Accurate Project description, including alternatives;
- ✓ Appropriate social and environmental baseline data identification;
- ✓ Consideration of all relevant social and environmental risks and impacts in the Project's area of influence (PAI) during construction and operation;

- ✓ Appropriate stakeholder engagement through disclosure of the Project-related information and consultation on matters that directly affect stakeholders; and
- ✓ Appropriate Project Affected Persons (PAPs) identification in the PAI

The standard requires the proponent to compensate workers and affected communities or offset for risks and negative impacts generated by the project. Grievances from stakeholders and affected communities must be addressed appropriately. Khalala Hydropower Kenya Ltd must sufficiently and continuously throughout the course of the project engage the affected community on issues that are likely to affect them.

Performance Standard 2: Labour and Working Conditions

It requires the proponent to give equal treatment to men and women in the workplace, and give them equal opportunities in the economic sphere. There must not be any discrimination of employees on any ground. Labour practices must be fair. Forced labour is prohibited. Children must not be engaged in hazardous or exploitative labour. Workers are entitled to fair remuneration and to reasonable working conditions. They also have the right to participate in a trade union and to go on strike. There must be a grievance mechanism for workers to raise workplace concerns. A poor worker-management relationship may undermine worker commitment and jeopardize the successful and timely completion of the project. The proposed labour and working conditions at the project site will have to consider the requirements of this PS.

Performance Standard 3: Pollution Prevention and Abatement

This standard recognizes that project and other economic activities often generate increased levels of air, water and land pollution, and endeavours to direct the proponent toward avoiding or minimizing adverse impacts on human health and the environment. This may be achieved by avoiding or minimizing pollution from project activities, reducing project related greenhouse gas emissions (GHG) which threaten the public health and welfare of current and future generations, and by promoting sustainable use of resources, including water and energy. Khalala Hydropower Kenya Ltd should consider ambient conditions and apply technically and financially feasible principles of resource efficiency and pollution prevention, as well as techniques that will avoid or minimize adverse impacts on health and the environment during the life of the project.

Khalala Hydropower Project needs to comply with both the county, national and international environmental laws related to pollution, wastes, hazardous materials, resource use and GHG emissions.

Performance Standard 4: Community Health, Safety and Security

This standard requires the proponent to avoid or minimize risks and adverse impacts to the health and safety of the local community arising from the proposed project activities. Khalala Hydropower Kenya Ltd must see to it that the design, construction and operation of its equipment and decommissioning of the infrastructure do not increase community and third party exposure to incidents and injuries. Transportation and disposal of hazardous materials, if not done safely, may expose the community to adverse effects. Degradation of natural resources such as adverse impacts on water quality and quantity may result in health-related impacts to Sitikho and Khalala community members hence environmental due diligence is key. The proponent needs to evaluate risks and impacts

to the health, safety and resources of the affected communities during all project stages and establish appropriate measures favouring prevention and avoidance. Necessary measures to prevent major accidents and limit their consequences in major accident prevention / emergency preparedness plan and management system including internal and external emergency plan should also be identified and implemented.

Performance Standard 5: Land Acquisition and Involuntary Resettlement

The objective of this standard is to avoid or minimize adverse social and economic impacts from land acquisition or restrictions on land use. This would mean avoiding or minimizing displacement of persons, using alternative project designs and avoiding forced evictions. Other objectives are to improve or restore livelihoods and standards of living and to improve living conditions for displaced persons. Achieving the latter objective may mean providing adequate housing and security of tenure. Khalala Hydropower Kenya Ltd should therefore consider the community land use within the project area and offer adequate compensation or resettlement plans / alternatives to affected families in the proposed PAI. The proposed Khalala Hydropower Project during project planning, need to have demonstrated that it has avoided, and when avoidance is not possible, minimized physical and economic displacement. All relevant information has been disclosed, and informed participation of affected persons has been done.

Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management

This standard seeks to protect and conserve biodiversity, maintain the benefits from ecosystem services, and promote the sustainable management of living natural resources. Khalala Hydropower Kenya Ltd should avoid adverse impacts to priority system services that are of relevance to the affected community where it has direct management control or significant influence over them. Conservation needs must, as far as is possible, be integrated with development priorities. The proponent must have evaluated risks and impacts to biodiversity, ecosystem services and sustainable management of living natural resources during all project stages (construction and operation phases) and established measures as part of an appropriate mitigation hierarchy. A due diligence regarding natural habitats, critical habitats, legally protected, and invasive alien species, including establishment of measures as part of an appropriate mitigation hierarchy should also be carried out.

Performance Standard 7: Indigenous Peoples

The proponent is expected to respect the human rights, dignity, culture, practices, aspirations and livelihoods of the indigenous people. The project must avoid negative impacts on such communities or minimize and/or provide compensation for such impacts. This is because indigenous groups are a vulnerable part of the population, and they may be rendered even more vulnerable if their lands and resources are significantly degraded, or if their culture, religion, language, beliefs and institutions are threatened. They are likely therefore to be more vulnerable to adverse impacts generated by the project than non-indigenous peoples. Such impacts would include loss of identity, culture, natural resource-based livelihoods, impoverishment and diseases. The inhabitants of the project area are culturally peasant farmers hence Khalala Hydropower Kenya Ltd should carefully consider their activities to cause minimal disturbance to their way of life.

Performance Standard 8: Cultural Heritage

This standard requires the proponent to protect cultural heritage from adverse effects that its activities may cause, and seek to preserve it. Project activities such as removing non-replicable cultural heritage may deny the host country the benefits accruing from the use of its cultural heritage (e.g. tourism) if adverse effects are generated and if the cultural heritage is not preserved. The project area has Sitikho water falls that can be identified as a tourist site that is not exploited currently. During the ESIA exercise, the ESIA team evaluated cultural heritage and the affected communities were consulted regarding any significant impacts to cultural heritage. Mitigation measures were proposed for implementation in accordance with national regulations and best international practice.

4.7.2 Equator Principles

The Equator Principles (EPs) is a credit risk management framework applied to determining, assessing and managing environmental and social risk in Project Finance transactions. Its main objective is to provide a minimum standard for due diligence in order to inform and support risk during decision-making. In addition, while the Principles are not intended to be applied retroactively, and apply to all project financings covering expansion or upgrade of an existing facility where changes in scale or scope may create significant environmental and/or social impacts. There are ten principles under the EP applied to all projects in a chronological manner namely; Principle 1: Review and Categorization; Principle 2: Social and Environmental Assessment; Principle 3: Applicable Social and Environmental Standards; Principle 4: Action Plan and Management System; Principle 5: Consultation and Disclosure; Principle 6: Grievance Mechanism; Principle 7: Independent Review; Principle 8: Covenants; Principle 9: Independent Monitoring and Reporting; and Principle 10: EPFI Reporting.

4.7.3 The World Bank Group's Environmental, Health and Safety (EHS) Guidelines, 2007

The EHS guidelines are technical reference documents with general and industry-specific examples of GIIP. The guidelines are designed to be used together with the relevant industry sector EHS guidelines which provide guidance to users on EHS issues in specific industry sectors. These guidelines emphasise and spell out key parameters to consider under environmental, occupational health and safety, community health and safety, construction and decommissioning aspects. Therefore, the construction and decommissioning of the proposed project will be undertaken with due consideration to these guidelines. The WBG EHS guidelines of 2007 shall apply to this project and will be referred to during project implementation and monitoring.

4.7.4 WB guidelines on pollution prevention, natural habitats, environmental assessment

These guidelines focus on promoting sustainable development by shedding light on the importance of environmental pollution prevention and raising economic benefits through the use of cleaner production and good management techniques. The guidelines are to ensure reduction of pollution emissions from the production processes, mainly through a combination of cleaner production and end of pipe treatment. The guidelines are provided to protect human health and reduce environmental pollution.

CHAPTER FIVE

5. ANALYSIS OF PROJECT ALTERNATIVES

5.1 INTRODUCTION

Alternatives to a project are defined as functionally different ways of achieving the same end (CEA Agency, 1997). Under the NEMA Environmental (Impact Assessment and Audit) regulations, of 2003; 2016, analysis of alternatives to a proposed project is a requirement. The alternatives considered in a project include alternative technologies and processes available and reasons for preferring the chosen technology and processes, analysis of project site, design and technologies alternatives and reasons for preferring the proposed site, design and technologies.

In accordance with current ESIA good practice and as one of the NEMA requirements for the ESIA process in the country- Kenya, it is appropriate for the ESIA process to investigate alternatives to a proposed project. This section outlines various alternatives that have been considered to the project design or implementation, focusing on the environmental and social implications. This section aims at establishing whether there are reasonable alternatives, which could be pursued to meet the project's objectives with less impact on the environment and the society, and if there are, to explain what other factors determined the choice of proposal. Two types of alternatives exist: Fundamental Alternatives and Incremental Alternatives.

Fundamental Alternatives are projects that are completely different from the proposed project and usually involve a different type of methodology on the proposed site, or a different location for the proposed project. Conversely, Incremental Alternatives are modifications or variations to the design of a project that provide different options to reduce or minimize environmental impacts. Alternatives are "different means of meeting the general purpose and requirements of the project" which includes alternatives to:

- ✓ The property on which or location where it is proposed to undertake the project;
- ✓ The type of project to be undertaken;
- ✓ The design or layout of the project;
- ✓ The technology to be used in the project; and
- ✓ The operational aspects of the project.

5.2 FUNDAMENTAL ALTERNATIVES

5.2.1 A different type of project

Besides hydroelectricity, there are several other energy resource options which include biomass, geothermal, wind energy, solar energy, biogas and, oil and gas. However, hydropower generation has advantages over the rest as it is based on a reliable proven technology that has been around for more than a century and hydropower plants can be easily rehabilitated or upgraded utilizing recent advances in hydro technologies. Hydropower generation is renewable and it does not reduce the water resources it uses and thus does not require fuel. It is also an economical and competitive renewable source of energy. Additionally, rehabilitating or upgrading of existing hydropower schemes provides opportunities for cost-effective capacity increases and lastly,

hydropower generation exploits domestic water resources, thereby achieving price stability by avoiding market fluctuations.

5.2.2 Process Alternative Energy Option

The Khalala Hydropower Project can be replaced by a coal-fired or thermal power plant of 28MW. Economic analysis of the thermal power alternative indicates that construction of the Khalala Hydropower is a less expensive power generation option. Further the project provides a sustainable energy option using renewable natural resources which is in line with Equator Principle. Currently, alternative renewable energy supplies such as wind, solar, and biogas cannot compete commercially with coal-fired or hydropower generation. Increasing the coal-fired generation capacity will have significant negative environmental impacts due to the total increase in GHG emissions. The proposed building of an Oil pipeline from Lokichar to Lamu and exporting the same to refine the recently discovered oil reserve in the country is neither feasible option currently due to the cost implications.

5.2.3 A different location

Khalala Hydropower Kenya Ltd, the developer for Khalala Hydropower Project has an overall objective of adding 129GWh at 6m³/s Environmental Flow of estimated annual energy to the national grid. This objective can be achieved with the current project location along Nzoia River. The results of hydrological and geological studies confirmed that Nzoia River was adequate for a design flow of 72m³ /s and hence the estimated annual energy. Without any other project utilising the waters of Nzoia River for Hydropower generation at the proposed site, the alternative of undertaking the proposed Khalala Hydropower at a different location other than the current location is not a feasible alternative.

The locations of the sedimentation tank, forebay tank and spill way structure were selected based on the stability of the sites and the suitability of the nearby gently sloping terrain at the forebay location to be used as the spillway.

The proposed power house location was selected to optimize the head observed during the contour survey. The trace of the penstock line was selected to minimize the cut and fill sections and minimize the disturbance to the gentle slopes and existing houses and buildings. The tail race water discharge point is near the river section and the length of the same will need or require minimal civil works.

From the social context, the current project layout and orientation of the project features was based on the fact that the project feature location impacted on a low population thus reducing on the direct or negative impacts of the physical resettlement to the affected families or communities.

5.3 INCREMENTAL ALTERNATIVES

Incremental alternatives are modifications or variations to the design of a project that provide different options to reduce or minimise environmental impacts. Several project alternatives were considered so that there is maximum economic benefit to the nation and optimal resource utilization while keeping environmental impacts within acceptable range. Financial viability of the project was also considered in the analysis. Based on the engineering surveys and hydrology study, the following two project alternatives were identified:

The design and layout of the activity and the Alternative configurations and technologies (see Section 5.3.1); and the no-action alternative is discussed in Section 5.3.2

5.3.1 The Design and layout alternatives

Design and layout alternatives include different weir alignments, heights, method technologies, distance of conveyance and setting of the power house and tailrace. These key parameters are commonly used in optimization. A layout of project components on the left bank of the river was eliminated at the pre-feasibility study stage in consideration of issues related to the land access and socio-economic concerns.

Several alternatives were considered in selecting the weir site. All these alternatives were studied on economic and environmental basis and the alternative with least disturbance to the present environmental conditions was selected.

In selecting the height of the weir, various alternatives were studied and ultimately it was decided to maintain the weir height in such a manner that the resulting pond will be confined to a small area whereby the impact on riverine vegetation is minimized. The length of the spillway section was selected taking in to consideration of the terrain and return period of flood in the area.

In order to mitigate constraints resulting from the approximately 7Km stretch, the length of the headrace canal is to be shortened hence positioning the forebay and de-silting tanks closer to the intake point. Locating the forebay tank near to the intake as well as to the stream eliminates the need for a separate spill way. The length of the headrace canal will be 5600 meters and is an open channel. This poses both environmental and safety concerns to the adjacent communities in Sitikho location.

5.3.1.1 Water conveyance mechanism

The following three alternatives for the water conveyance mechanism were considered viz, open rectangular channel, steel pipe and GRP pipe. The comparison of unit cost of those alternatives is given in the Table 5-1 below.

Table 5-1: Comparison of alternative methods of water conveyance

Parameter	Steel pipe	GRP Pipe	Open Channel
Ease of Transportation	Low	Low	High
Head loss due to friction	High	Moderate	Low
Ease of construction	High	High	Moderate
Corrosiveness	High	Low	Low
Construction time	Low	Low	High
Maintenance requirement	Low	Low	High
Unit cost	High	High	Low
Safety concerns	Low	Low	High
Environmental concerns	Low	Low	Moderate

From the above comparisons, the open channel was considered as the most conventional option and thus adopted in the design.

5.3.1.2 Machine selection with alternatives

Based on hydrology study and head of the project, the most appropriate type of turbine is Horizontal Shaft Francis Turbines. Francis turbine was used in as the river has a constant flow and thus its efficiency will not be affected due to fluctuations in the normal flow and the plant is designed to optimally ensure generation even during low flows in the river. The capacity will not always be 28MW, it will vary with the flows and that is why there are 6 turbines.

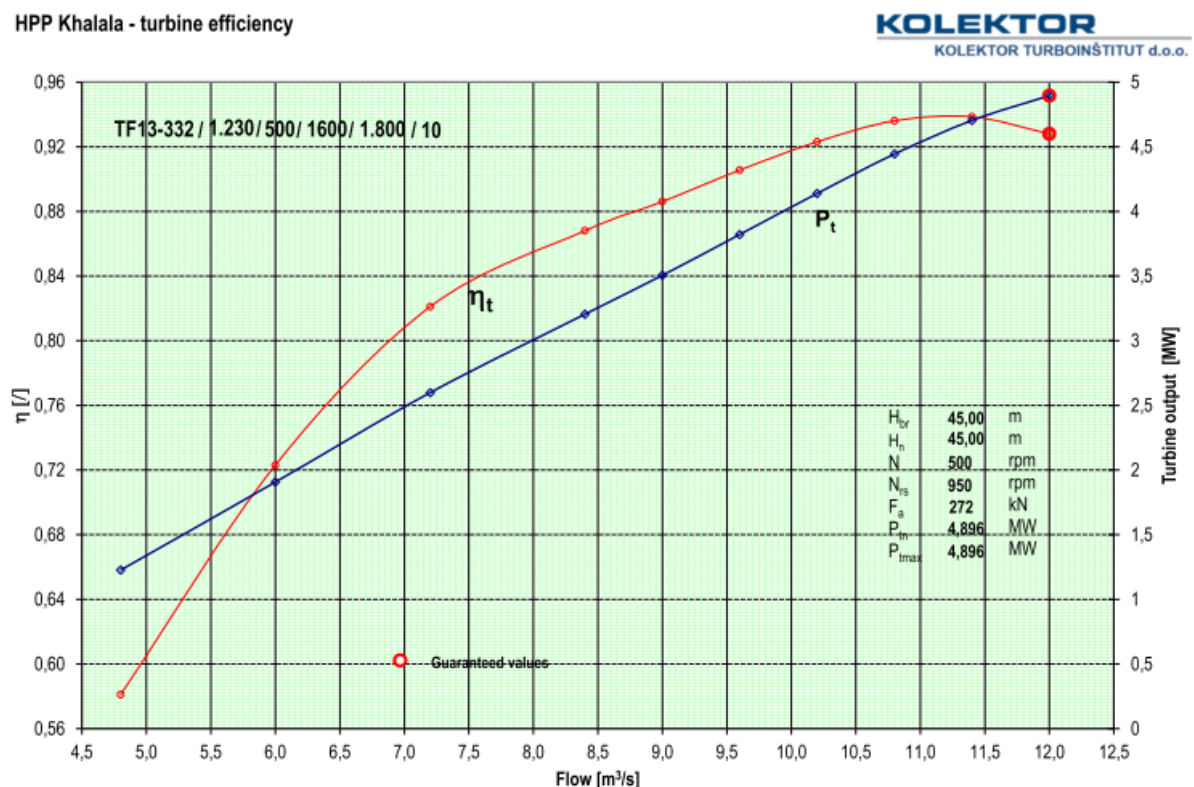


Figure 5-1: Khalala Turbine Efficiency Curve

5.3.2 No Action Alternative

The no-project scenario will mean the status quo of the area remains and no occurrence of adverse impacts as well as positive impacts posed by the project implementation. By adding 28MW/ 129GWh to the National Grid annually, the proposed project will contribute to the country's renewable energy policy targets. In the absence of Khalala Hydropower project, an equivalent amount of energy has to be obtained from other means, most likely by thermal power options which would result in emissions of CO₂, SO_x, NO_x and particulates.

Under the do-nothing alternative, the disparity between the minimum and maximum daily power demand will continue to increase. The continued increase in the base-load demand for the grid will increase the frequency and duration of power outages and load shedding. This will impact economic development of the area and hinder poverty

reduction efforts. The no project option will have the forgone costs and benefits including;

- The targeted consumers will forgo improved electricity supply
- Electricity deficit in the country will still be experienced
- Generation of employment opportunities through expansion of business activities that would have been spurred by availability of electric power will not occur
- The rural electrification programme will suffer
- Increased pressure in the use of biomass as a source of energy

In this context, in order to alleviate the current energy deficit, Kenya has been embarking on projects geared towards promoting investments in the energy sector. The Kenya's Energy Least Cost Power Development Plan for the period 2017-2037 notes that the country has a current installed capacity (grid connected) of 1,429MW while the electricity demand by end of 2017 was 1,710MW and the same is projected to rise to 9,790MW by 2037. This thus calls for power projects that will aid reduce the demand. Implementation of power projects such as the proposed 28MW Khalala Hydropower project, will contribute immensely towards alleviating the country's energy deficit therefore the selection of "No action" alternative is not a wise option.

The decision to develop the proposed Khalala Hydropower Project is a good investment in terms of economic development. It is important and a timely intervention as it contributes to increasing the country's alternative environmental friendly power demand and also supports the call for renewable energy alternatives worldwide to curb climate change. The proposals to generate electricity from alternative sources to feed the national grid are not economically justifiable as long as exploitable potential hydropower sources are available. This gives hydropower a potential edge over the other alternative technologies on the basis of economics and efficiency.

CHAPTER SIX

6. INFORMED PUBLIC CONSENT AND CONSULTATION PROGRAMME AND OCCUPATIONAL HEALTH AND SAFETY

6.1 INTRODUCTION

According to International Finance Corporation (1998), Public Consultation “.is a tool for managing two-way communication between the project sponsor and the general public. Its goal is to improve decision making and build understanding by actively involving individuals, groups and organizations with a stake in the project. This involvement increases a project’s long term viability and enhance its benefits to locally affected people and other stakeholders.”

Public consultation is key in creating awareness of any project’s anticipated impacts as well as plays a very important role in gaining agreement on the management and technical approaches in order to maximize benefits and reduce negative consequences. Consultation with members of the public ensures project ownership and reduces financial risks (that may be occasioned by delays, legal disputes or negative publicity), direct cost savings, increased market share (through good public image) in addition to enhanced social benefits to local communities.

Public disclosure on the other hand is important as it is critical to the effective participation of project affected populations. An informed public is more likely to understand the trade-offs between project benefits and its demerits; be able to contribute meaningfully to project design; and have greater trust in the project proponent. IFC policies on resettlement, land acquisition and compensation provide a framework for public consultation, participation and establishment of a process to redress the grievances of affected people. Consultation with the affected people and with local government officers, civil society and other political representatives of the affected population is essential for gaining a comprehensive understanding of the types and extent of adverse effects.

6.2 OBJECTIVES

Stakeholder and public consultations ensure that:

- all stakeholders are identified and included in the consultation and disclosure process;
- adequate and timely information is provided to the project affected population and other stakeholders;
- initial information disclosure about the project is accurate and comprehensible to the non-technical stakeholders and the local population;
- all stakeholders are given sufficient opportunity to voice their opinions, concerns and suggestions;
- the opinions, concerns and suggestions of the stakeholders influence project decisions;
- regular feedback is provided to the stakeholders on the project activities future plans; and
- effective communication continues during the construction and operational phases of the proposed project.

6.3 STAKEHOLDER ANALYSIS

Stakeholder analysis is defined as the process of determining the stakeholders who will be affected directly or indirectly, positively or negatively by the proposed project and who can contribute to, or hinder its success. It is necessary to keep all stakeholders informed during project implementation so as to accord their support and advice. A stakeholder analysis was undertaken for Khalala Hydropower Project in order to identify the relevant stakeholders.

Stakeholders are individuals, groups and entities that are affected by a development activity either directly or indirectly, or those that may exert either positive or negative influence on the project. Those that are directly affected are known as, primary stakeholders whilst those that are affected indirectly, are known as secondary stakeholders. They should be prioritized by identifying direct (those with direct interest or influence of the project) and indirect stakeholders whose interest is indirect. A number of key stakeholders were involved in the consultations component of the ESIA baseline study. Consultations were carried out with four groups of stakeholders, namely; directly affected persons, indirectly affected persons, Government Agencies and NGOs in the PAI.

6.4 IDENTIFICATION AND INVOLVEMENT OF KEY STAKEHOLDERS

The ESIA process's key concern is involving the right stakeholders at appropriate stages. This is achieved through appropriate stakeholder identification techniques. Stakeholder identification was undertaken to determine who is likely to be either directly or indirectly affected, positively or negatively, by the proposed Khalala project (PAPs), and who can contribute to or hinder a project's success (other relevant stakeholders). It is vital that a project proponent comprehensively identify and prioritize all project stakeholders including the disadvantaged and the voiceless. Those identified were and / or will then be consulted to varying degrees depending on the level of impact, at strategic points during the life cycle of the project. Stakeholders identification was useful in prioritizing, analyzing and assessing stakeholder issues while creating management systems and strategies to address specific concerns. Stakeholders identified for this project are as shown in Table 6-1 below:

Table 6-1: Project stakeholder identified and engaged

Stakeholder Group	Stakeholders
National Government	County Commissioners – Kakamega and Bungoma Counties
	Assistant County Commissioner 1 – Navakholo Sub-county
	Chiefs and Assistant Chiefs, Village Elders – Sitikho(Webuye West), Sikubale (Navakholo Sub-county)
County Government	Office of the Governor – Bungoma County
	County Chief Officers in Charge of: Ministry of Energy (Renewable Energy); Ministry of Environment, Water and Natural Resources; Ministry of Gender and Social Services, Ministry of Agriculture; Gender, Lands, Agriculture and Fisheries.
	Webuye West Sub-county Administrator

Stakeholder Group	Stakeholders
Lead Agencies	Lake Victoria North Water Resources Management/ Water Resources Authority – Kakamega Office
	Kenya Power – Webuye West
Project Affected Communities	Webuye West – Sitikho Sub-location and Location <ul style="list-style-type: none"> • Msabale and Khalala Villages, • Kisengwa and Welemba Villages. • Cheliminyi and Mwembula Villages, • Siranjofu and Nambindo Villages, and • Murono and Sitikho Villages
	Navakholo Sub-county: Sivilie Location, Sikubale Village
NGOs	One Acre Fund and Human Rights Watch

6.5 STAKEHOLDER ENGAGEMENT AND CONSULTATIONS

The Environmental Management and Coordination Act, Cap 387 and its subsequent Environmental (Impact Assessment and Audit) Regulations, 2003; 2016 emphasize the need for stakeholder participation in the ESIA process. Neighbours of a proposed project have to live with the project if implemented. They have the most to gain if the project impacts are beneficial to them. Conversely, they have the most at stake if the project goes awry. Not just neighbours but for projects whose impacts have a wide geographical spread, distant communities need to be involved. Stakeholder input is thus vital at the earliest stage possible in project development and should continue throughout the project cycle.

The study made use of the following consultation strategies:

- Public meetings / Barazas
- Key informant interviews
- Household interviews
- Stakeholder meetings

Public consultation was extensively carried out in the entire project area to elicit concerns and compliments from the members of the public in general and PAPs in particular. Consultation meetings were convened in public areas within the villages to enable maximum attendance. These were organized in collaboration with the area Chief, Assistant Chief and the respective village elders.



Plate 26: Public and Key Stakeholder Engagement meetings – (A) Mwembula and (B) Sitikho Public meetings; (C) Bungoma and (D) Kakamega Key Stakeholder Engagement Meetings

6.6 COMMUNITY RESPONSES

Community consultations yielded feedback on a range of issues associated with the proposed project. An overview of the key issues raised during these consultations is provided below and originated from a range of stakeholders including local residents, government authorities, NGOs etc. This feedback, in addition to field studies, questionnaires and meetings with key stakeholders formed the basis of the development of mitigation measures and management plans for the ESIA report.

a) Environmental

- damage to environmental resources (e.g. water resources, habitats);
- potential impacts on flora and fauna;
- Water quality and quantity issues;

b) Employment

- nature and extent of employment opportunities associated with the project;
- priority recruitment of project affected villages including preference for local workers and skills development and training;
- the need for a fair and equitable recruitment process which is not susceptible to corrupt processes or bias in the process;

c) Land Acquisition and Compensation

- a fair and transparent land acquisition process;
- sufficient information about the process and how it would work;
- a fair and equitable compensation process for damage to buildings and agricultural infrastructure as a result of construction activities; and
- timely payments of compensation.

d) Safety, Security and Health

- the integrity of the proposed canal and whether or not homesteads would be in danger from its proximity;
- injury to local residents during construction;
- injury to animals on the Right of Way during construction;
- the need for adequate security measures to protect the canal and nearby homesteads; and
- Increased traffic on local roads.

e) Construction Camps

- direct or indirect economic benefits;
- potential employment opportunities;
- supply of local goods and services to camps;
- potential increases in noise, traffic and dust; and
- damage to roads by construction machinery.

f) Proponent's commitment to implementation

- Proponent to commit to implement the project upon receipt of all required approvals.

g) Free electricity supply

- Whether it's within the proponent's mandate to connect local homesteads with electricity.

6.7 FUTURE CONSULTATION

When planning future engagement activities, the project proponents should give consideration to the type of stakeholder being engaged and the purpose of engagement. For example, formal correspondence and presentations are likely to be the preferred engagement method for government officials. Communities on the other hand are likely to be better suited to public meetings or informal focus group discussions facilitated by posters, non-technical pamphlets and other visual presentation aids in local languages. Whether the purpose of engagement is to disseminate project information and updates, gather information, consult stakeholders or simply maintain a relationship will also affect the level and type of engagement.

All communication and disclosure material should be produced in a culturally appropriate manner and should be translated into the main local languages (Swahili and local Luhya dialects) to support community participation. Copies of all consultations materials should be kept and records of all meetings should be kept including attendance and minutes.

6.8 RECOMMENDATIONS FOR SOCIAL INVESTMENT

Corporate Social Responsibility (CSR) according to McWilliams and Siegel (2001) is a situation where a particular firm goes beyond compliance and engages in 'actions that appear to further some social good and benefits, beyond the interests of the firm and that which is required by the law. Khalala Hydropower Kenya Ltd strongly believes in extending a hand to society. The company considers CSR as a core element in their business endeavours. While the stakeholders and community members in the project area are aware that the proponent cannot provide all their needs, they requested for possible interventions from the proponent. Conversely, from the proponent's side she considers to have CSR in the water supply and support and improvement of social amenities like schools and health facilities. From the stakeholder consultations, public meetings and questionnaire administration, the following are the propositions on what the proponent can engage in as part of their CSR.

6.8.1 Water supply

The project area is challenged by poor infrastructure for potable water supply. Most of the community members depend on dilapidated water springs as their main source of water for domestic use while the other core water use such as for animal drinking and washing purposes are obtained from River Nzoia. It would be prudent going by the situation on the ground to at least aid in the improvement of the community water springs where possible from the proponent's side (See Plate 1)

6.8.2 Infrastructure

The residents were concerned that Khalala's activities that would involve transportation of heavy equipment would worsen the state of the already poor roads or rather footpaths used to take animals to the watering points which were observed to be impassable during rainy seasons. The proponent can assist in improving these roads that will also be used as the access roads for the different project components during construction and / or operational phases.

6.8.3 Education Sector

Some of the challenges facing the education sector in the PAI included: lack of or dilapidated school infrastructure and lack of housing for the teaching staff and poverty which makes pupils not proceed to Secondary school. The proponent can assist the community by building and/or improving infrastructure like classrooms, school fence, desks, toilets etc. The proponent can also support children feeding programmes to enable more children access early childhood education. There are four primary schools and one secondary school in the PAI that includes Sitikho, Mukite, Mwembula, and Khalala primary schools and Sitikho Friend Secondary School (See Plate 16)

6.8.4 Health Sector

Some of the challenges faced by the health sector in the project area include: lack of personnel, lack of adequate medical equipment and infrastructure. While it is the role of the County government to support the health sector in their counties, the proponent can partner with the health facilities and other Non-governmental agencies in various ways. These include provision of medical facilities, supporting medical camps, supporting the communities during emergencies and making infrastructural improvements to the health centres in the area. There are three health centres within the PAI that include: Khalala, Sitikho and Kuywa (See Plate 17).

6.9 OCCUPATIONAL HEALTH AND SAFETY

Health, Safety and Environmental protection and responsibility are among the most important aspects of infrastructural industry activities. The health and safety of all personnel and the impact of operations on third parties and on the environment are of paramount importance. It shall be the responsibility of Khalala Hydro Power Kenya Ltd and the appointed contractor to ensure that high safety standards are maintained and all members at the project site adhere to safe working practices. Some of the safety issues include, but are not limited to, the following factors: Risk of personal injury at work, especially during excavation; Noise generation from the machines; Heat / sun exposure/ dehydration; Diseases; Solid and liquid waste management, including wastewater and effluent discharges; Oil and chemical spills; Fire; and material handling.

It is a requirement that Khalala Hydro Power Kenya Ltd Environmental, Health and Safety Management System (HSE-MS- Occupational Health, Safety & Accident Prevention Plan; MP-6; 2105-1-28), together with other HSE related policies are integrated into the project lifecycle. The workers must ensure that they adhere, at all times, to all national and international health and safety standards applicable. The contractor shall be compliant with the findings of the ESIA report and the NEMA licensing conditions. All personnel should be issued with necessary personal protection equipment (PPE) and trained by their supervisors to complete their assigned tasks in a safe and secure manner. The key to achieving healthy and safe working conditions is to ensure that health and safety issues are planned, organized, controlled, monitored and reviewed. Read in part the plan states that;

The purpose of the safety plan is to identify potential hazards associated with job activities and possible on-site conditions and to provide safety and health guidelines to address those specific hazards and to assist all those concerned in complying with applicable standards as identified in the document or during subsequent site inspections.

Everyone controlling site work has health and safety responsibilities. Checking that working conditions are healthy and safe before work begins and ensuring that the proposed work is not going to put others at risk and this requires planning and organization.

6.9.1 Planning and organizing the work

This shall involve gathering as much health and safety information about the project and the proposed site before work begins. Sources of information will include: the client; Design team; Contract documents; Specialist contractors and sub-consultants; Equipment and material suppliers; and HSE relevant laws regulations or guidelines. The contractor shall also find out about the history of the site and its surroundings and identify possible and potential hazards within and around the project site. Specifically, Khalala Hydropower and / or her Contractor should undertake the following during organization:

- The contractor shall decide who will supervise the work – check that they are adequately trained and experienced.
- Khalala Hydropower should make sure that the Main Contractor and sub-contractors on site provide adequate supervision for their workers.

- The Contractors management on the project will oversee that work methods and safety precautions are agreed before work is started are put into practice during execution.
- Khalala Hydropower and her Contractor should make sure that people working for sub-contractors also get the information they require and are adequately provided with training, supervision etc. as needed by the changing project activities.
- Khalala Hydropower should have a Site Health and Safety Advisor/ Environmental Field Advisor who shall be responsible for coordination and direction of all site activities in regard HSE and necessary to implement the Safety Plan

6.9.2 Notifying the site to DOSHS

Khalala Hydropower shall be required to notify DOSHS through an application to register their place of operations as a workplace, this is in accordance with the Factories and Other Places of Work (Safety and Health Committees) Rules, 2004. The Rules state that a project site should be registered as a work place with DOSHS if it regularly employs twenty or more employees. As per these rules, the Project Management Unit is also required to establish a Safety and Health Committee in the manner provided in the Rules.

6.9.3 Setting up the site access and boundaries

Khalala Hydropower is required to take all applicable local, National and International regulations as well as best industry practices so that the normal operations of the community are not affected. One of these approaches is to limit the level of contact with the local community infrastructure through establishment of boundaries as well as setting rules at the project level. Khalala Hydropower shall also ensure that there are safe access roads onto and around the site for people and vehicles. There should also be a plan how pedestrians will be able to cross the canal especially at the designated crossing points without posing danger to their safety. Among others the plan shall include: motorable, pedestrian and animal crossing points; how vehicles shall be kept clear of pedestrians on the roads and at the vehicle loading/ unloading areas, parking areas and areas where drivers' vision may be obstructed. The site rules shall be enforced to make sure there is a system to ensure necessary precautions are kept in place during both working and off-work hours.

6.9.4 Welfare facilities

Khalala Hydropower and the Prime Contractor shall be responsible for providing or making available site welfare facilities. Every worker should have access to adequate toilet and washing facilities. Toilets need to be easily accessible from where the work is being done and so are the washing facilities.

a) Sanitary conveniences

These shall be provided at camp level and where possible mobile units will be acquired for field use. The numbers of toilets required will depend on the number of people working on the project site at a particular time. Wherever possible toilets should be flushed by water and connected to an STP system proposed in this report. Men and women will use different sanitary facilities but in both cases they should be lockable from

the inside. A washbasin with water, soap and towels or dryers should also be located close to the toilets.

b) Washing facilities

On all sites sections, basins large enough to allow people to wash their faces, hands and forearms shall be provided. All basins should have a supply of clean hot and cold, or warm, running water. This is particularly necessary, where the work is dirty or workers are exposed to toxic or corrosive substances

c) Rest facilities

These facilities should be available for taking breaks, smoking and meal breaks at the camp level. The facilities should provide shelter from wind and rain and be heated as necessary. There should be provisions for non-smokers to use the facilities without suffering discomfort from tobacco smoke, hence the need to provide separate facilities or prohibit smoking in the rest facilities.

d) Storing and drying clothing and personal protective equipment

The Prime Contractor shall make sure that there are proper arrangements for storing: Clothing not worn on site (e.g. hats and coats); Protective clothing needed for site work (e.g. wellington boots, overalls, gloves etc.) and other personal equipment such as ear defenders, goggles, harnesses etc. The Contractors site office or HSE office at the camp level should be a suitable storage area, provided it is kept secure. Where there is a risk of protective site clothing contaminating everyday clothing, the items should be stored separately.

e) Drinking water

Khalala Hydropower and the Prime Contractor shall make sure there is a supply of drinking water. The drinking water tank should be clearly marked if it is possible not to confuse the drinking water supply with other water supplies or other liquids such as: those not fit for consumption (e.g. water from storage tanks used for wheel washers); or certain toxic materials. Cups or other drinking vessels should be available at the water point, unless the water is supplied as an upward jet that can be drunk from easily (e.g. a drinking fountain). Alternatively, drinking water could be supplied to the crew members in adequate quantities as bottled water.

6.9.5 Fuelling Station

A parking bay for vehicles will be demarcated within the campsite area, and it will have a fuelling station. Possible impacts may arise as a result of spillage which may contaminate soil and groundwater resources.

The following design and operational standards should be observed

- The fuelling station will be underlain with a spill-containing liner
- The fuel storage area will be set at one end of the parking bay area, and will be bunded. The bunds should have the capacity to contain all the fuel stored inside the fuel bladder in case of leakage at 110% of the stored fuel volume
- The fuel storage area will have a tarpaulin covering to protect it from extremes of weather, and should be well aerated

- The fuel storage floor shall be concrete-based, and canvas-lined to capture minor spillages
- Clearly marked spill kits will be placed adjacent to the refuelling area, and all staff involved in vehicle maintenance and refuelling will be trained in their use. Clear 'no smoking' signage shall be posted in this area.

6.9.6 Camp Clinic

A fully equipped and staffed ambulance will be on standby in case of accidents or emergencies, and will be supported by a fully equipped and staffed clinic that will be located in the camp site. There should also be an on-call helicopter/ service provider for crew movement and emergency evacuations.

6.9.7 Good order, storage areas and Waste Management Strategy

Khalala Hydropower and the Prime Contractor shall make sure that the camp site is kept tidy and under good housekeeping. The walkways shall be kept free of tripping hazards such as trailing cables, building materials and waste. This is especially important for emergency routes. All flammable waste materials (such as packaging and timber offcuts) shall be cleared away regularly to reduce fire risks. The indoor floor areas shall be kept dry, clean and tidy while outdoor footpaths shall be level and firm and should not be used for storing materials.

The Prime Contractor shall designate storage areas for plant materials, waste, flammable substances and hazardous substances (e.g. pesticides and timber treatment chemicals). Flammable materials shall be stored away from other materials and protected from accidental ignition. Care must be taken not to store materials where they obstruct access routes or where they could interfere with emergency escape at the camp level.

If materials are stored at height (e.g. on top of a container or on a scaffold gantry), there is need to make sure necessary guard rails are in place if people could fall when stacking or collecting materials or equipment.

All storage areas should be kept tidy, whether in the camp site or field level. The Prime Contractor should plan deliveries to keep the amount of materials on site to a minimum.

A decision shall be made on how the waste stream will be managed to ensure it is timely and effective. The Prime Contractor should consider whether to be responsible for collecting their own waste or whether to provide someone else to do this for the site.

All project related wastes should be collected at a designated waste collection point, segregated into types, appropriately stored in recycling area and periodically transported to a designated NEMA approved site. Organic/ food waste and paper should be collected from waste bins strategically distributed on the camp site awaiting collection for safe disposal in line with EMC (Waste Management Regulations), 2006. All options should be considered in avoiding, minimizing or transporting any unsuitable excavated materials from site, as this is undesirable from both an ecological and economic perspective. Where practicable, materials should be reused or recycled appropriately before being disposed of.

Classification of Wastes

The classification of wastes can be distributed as follows:

1. Construction wastes/debris
2. Non-Hazardous wastes:
 - Biodegradable waste: food wastes
 - Combustible waste: paper, cardboard, wood and derivatives (chipboard, etc.).
 - Non-combustible waste: scrap metal, tins/cans, wire, tyres, plastics, glass, etc.
 - Domestic organic waste (sewage).
3. Hazardous Waste:
 - Batteries (dry, liquid and gel cells)
 - Equipment (machinery, etc.)
 - Expired chemicals
 - Filters
 - Used lubricants/ hydraulic fluids.
 - Paint related materials (paint / thinners / pots)

Waste Material Recovery

During project construction phase, the materials that shall be of economic value if re-used or can be recycled for use gain should be identified. In this regard, there is need to identify suitable recycling and disposal options for the equipment and materials that are dismantled, in line with best management principles of the waste hierarchy. The project should employ the 3Rs Strategy where material wastes resulting from the construction activities shall be reduced, most of which should be re-used directly and where the same can be re-modelled for other uses through recycling. Recycling and reuse of material wastes should be maximized to the greatest extent possible, subject to safety and pollution considerations. Where practicable, and subject to considerations about safety and pollution, local people should be provided with the first choice concerning acquisition of recyclables or reusable materials if the same are not feasible on the project construction activities.

Waste disposal

All wastes should be collected and segregated at the camp site prior to being disposed of properly. This will include:

- Non – Hazardous Waste
- Construction rubbles/ waste or debris should be collected onsite and be disposed of after completion of construction process.
- Biodegradable waste: Food waste should be collected on daily basis and disposal undertaken weekly during both construction and operational phases
- Combustible waste: paper, cardboard, wood and derivatives (chipboard, etc.)- This type of wastes should be collected on weekly basis
- Non-combustible waste: scrap metal, tins/cans, wire, tyres, plastics, glass, etc. Non-combustible waste should be collected and stored at a designated area on

the site, tyres, filters, wires and scrap metals should be stored at the mechanic workshop area while tins, plastic bottles, cans and glasses should be kept at the recycling area. These wastes should then be transferred to NEMA designated sites by an approved waste collector for onward disposal.

- Effluent/ sewage: Connection to a Sewage Treatment Plant installed at the camp site.

Storage of Wastes

Waste storage areas should be located with respect to minimizing/ eliminating the following:

- Impact with respect to mobilization of dust/ particles
- Odour - to the neighbours
- Visual impacts at the project site
- General site security

Waste storage areas shall be operated and maintained in accordance with the following principles:

- Storage areas should be clearly indicated with signs indicating the type of waste being stored, where appropriate, the MSDS shall be displayed in close proximity.
- Suitable fire protection and spill/ leak contingency should be provided.
- Storage areas should be maintained clean and tidy
- Storage areas should be inspected on a daily basis for leakages spills etc.

In the storage of hazardous wastes, the following principles should be adhered to:

- Hazardous or other "special" wastes should be stored and handled in accordance with any specific stipulations as stated in the respective MSDS, which should be displayed in close proximity
- As a minimum, hazardous wastes should be stored on an impermeable surface with surround drainage or in a bund, and should be protected from the elements. Due to the limited space available, storage areas will be small and therefore waste should be regularly collected for disposal.

Transfer of Wastes

Waste transfer should always be overseen by a nominated waste handler on the site during construction. There is no much waste produced during project operations. Wastes Transfer Notes (WTN) shall be completed for every waste transfer and filled with correct details from the approved agents. All records shall then be kept on the site by the Contractor during construction phase and the Plant Manager at operational level..

Waste Register

The objective of the register is to allow the Prime Contractor/ Plant Manager to record every waste product generated from any activity in as accurately as possible. The Waste Transfer Notes (WTN) shall be completed by the HSE Assistant/ designated employee on the site responsible for waste management. These shall be based on visual inspection to allow an estimation of weight and actual waste weights as determined by the waste

collector. A copy shall then be submitted to the agent in charge of transportation for final disposal.

Inspections and Audits

Waste management should be an integral part of the Prime Contractor routine weekly / monthly inspection and auditing system. In addition HSE Officer and management personnel should on a day to day or weekly basis carry out a visual check of:

- Storage of hazardous substances;
- Storage of non-hazardous substances;
- Cleaning of storage areas;
- Suitable fire protection;
- Suitable spill and leak containment; and
- Inspection of handling practices.

6.9.8 Emergency procedures

Khalala Hydropower Kenya Ltd activities will require a project specific Emergency Response plan (EPRMS) whose objective is to reduce the frequency and severity of consequences from emergency incidents. There is need to plan emergency procedures before work begins and put general precautions in place from the start of work. This should be in line with Khalala Hydropower Emergency Preparedness & Response Management Plan; MP 7- 2015-1-28. In most sites, the most obvious emergency is fire. The general principles for dealing with fire risks can be applied to planning for other emergencies. Some emergencies may require evacuation of the site or part of the site, while others might involve the rescue of an injured person.

Planning for an emergency

When planning emergency procedures, routes and exits; the following should be into account:

- The type of work being done on site.
- The characteristics and size of the site and the number and location of workplaces on the site. A large site with people working at many locations will need bells or sirens at a number of places to raise the alarm while on small sites with only two or three people working, an air horn may be adequate;
- The plant and equipment being used (e.g. consider tower crane drivers, people working on suspended access equipment or where the exit may be obstructed by design or equipment);
- The number of people likely to be present on the site at any one time. On sites where many people work, escape routes need to be wide enough to allow everyone to get through easily without them becoming overcrowded; and
- The physical and chemical properties of substances or materials on or likely to be on the site (e.g. work at petrochemical installations or at sites where flammable paints or glues are in use may require an increased standard of ventilation).

Take precautions to ensure:

- The likelihood of emergencies arising is as low as possible;

- Everyone on site should be alerted in case of an emergency;
- Everyone working on site (including sub-contractors who may only be at the site for a few hours) should know what signal will be given if there is an emergency and know what to do;
- Someone who has been trained in what to do should be on site while work is in progress and should take responsibility for coordinating procedures;
- Emergency routes or evacuation routes need to be established, kept clear, signed and adequately lit. This is very important at night times and where possible provide lighting that will come on automatically in an emergency;
- There should be arrangements for calling the emergency services. It is good practice to let the Fire Brigade know about any work in tunnels, confined spaces or above 18 m (above this height they may require specialist access equipment) and anywhere else where specialized rescue equipment may be needed;
- Arrangements for treating and recovering injured people should be available;
- If an emergency does arise, someone competent or Senior Manager should direct and coordinate emergency services.

Precautions to prevent fires

The following precautions should be taken to prevent fires:

- Use less-easily ignited and fewer flammable materials, e.g. use water-based or low-solvent adhesives and paint;
- Keep the quantity of flammables at the workplace to a minimum;
- Always keep and carry flammable liquids in suitable closed containers;
- If work involving the use of flammable materials is being carried out, stop people smoking and don't allow other work activities involving potential ignition sources to take place nearby. For example, if floor coverings are being laid using solvent-based adhesives, don't allow soldering of pipes at the same time;
- Ensure that pipes, barrels, tanks etc. which may have contained flammable gases or liquids are purged or otherwise made safe before using hot cutting equipment, such as a cutting torch or angle grinder. A pipe or container may appear to be empty, but can contain enough material on its sides, or within rust or other sediments, to produce a flammable or explosive atmosphere within it when heated or disturbed. Specialist advice should be sought first.

To minimize the risk of gas leaks and fires involving gas-fired plant or sites where gas cylinders are used:

- ✓ Close valves on gas cylinders when not in use;
- ✓ Regularly check hoses for wear and leaks;
- ✓ Prevent oil or grease coming into contact with oxygen cylinder valves;
- ✓ Do not leave bitumen boilers unattended when alight;

- Store flammable solids, liquids and gases safely. Separate them from each other and from oxygen cylinders or oxidizing materials. Keep them in ventilated secure stores or an outdoor storage area. Do not store them in or under occupied work areas or where they could obstruct or endanger escape routes;
- Have an extinguisher to hand when doing hot work such as welding or using a disc cutter that produces sparks;
- Check the site before work, lunch break and at the end of the day to see that all plant and equipment that could cause a fire is turned off. Stop hot working an hour before the day's work closure as this will allow more time for smouldering fires to be identified; and
- Provide closed metal containers to collect rubbish and remove them from the site regularly. Collect highly flammable waste such as solvent-soaked rags separately in closed fire-resisting containers.

Precautions in case of fire

If a fire should break out, people must be able to escape from it. To achieve this Khalala Hydropower Kenya Ltd shall consider the following procedures;

a) Means of giving warning

Khalala Hydropower Kenya Ltd will set up a system to alert people on site; this be a permanent mains operated fire alarm (which will be tested regularly, e.g. fortnightly). The fire alarm warning will be distinct, audible above other noise and recognized by everyone on site as a fire.

b) Means of escape

Khalala Hydropower Kenya Ltd shall plan escape routes and ensure they remain available and unobstructed at the camp level. These escape routes shall give access to a safe place where people will assemble and be accounted for. Signs will be needed if people are not familiar with the escape routes and adequate lighting provided.

c) Means of fighting fire

As well as providing fire extinguishers for hot work, fire extinguishers should be located at identified fire points around the site. The extinguishers should be appropriate to the nature of the potential fire:

- Wood, paper and cloth – water extinguisher;
- Flammable liquids – dry powder or foam extinguisher;
- Electrical – Carbon Dioxide (CO₂) Extinguisher.

Nominated person(s) should be trained in how to use extinguishers.

d) First Aid

Factories (First-Aid) Order required by section 50 (1) of the Act require the occupier to provide first-aid boxes or cupboards at a work place which are adequate and appropriate equipment, facilities and personnel to enable first aid to be given to his employees if

they are injured or become ill at work. Khalala Hydropower Kenya Ltd will ensure that the minimum requirements as listed below are met for the site:

- A first aid box with enough equipment to cope with the number of workers on site as per the order;
- An appointed person to take charge of first-aid arrangements;
- Information telling workers the name of the appointed person or first aider and where to find them. A notice at the site 'Muster Point' is a good way of doing this.

The first-aid arrangements should cover shift working, night and weekend working where this is carried out and this may necessitate appointing or training several people to ensure adequate cover.

e) Reporting injuries, diseases and dangerous occurrences

Khalala Hydropower Kenya Ltd has a duty under the law (OSHA, 2007) to report to DOSHS certain types of accidents/ injuries that might happen to her employees. Khalala Hydropower Kenya Ltd has a legal obligation to report certain accidents which involve a self-employed worker or member of the public and certain dangerous occurrences. These include: deaths; serious injuries and dangerous occurrences immediately and less serious injuries within seven days. The law also requires certain occupational ill-health issues and diseases to be reported. Further details of when the reporting is effected are given in Factories and other places of work (Safety and health committees) Rules which the Khalala Hydropower Health and Safety Advisor at site level will acquaint with.

f) Site rules

Khalala Hydropower Kenya Ltd shall enact certain safety precautions while construction work is in progress in addition to the management plans. These rules will be specific to the project and will assist everyone. The rules will cover, for example, the use of personal protective equipment, traffic management systems, pedestrian routes, site tidiness, fire prevention, emergency procedures or permit-to-work systems. These rules shall also be very clear where they apply. Khalala Hydropower Kenya Ltd will make sure that everybody knows and follows the rules relevant to them.

6.9.9 Site management and supervision

This will entail making provision of either all or some of the following by Khalala Hydropower Kenya Ltd:

- Safety while working at height.
- Selecting the right means of access and work equipment.
- Safe working platform and prevention of slips and trips.
- Inspection and audit reports.
- General access scaffolds; guard rails, toe boards and brick guards.
- Tower scaffolds, and electrical safety.
- Mobile and suspended access equipment.
- Safety nets and soft landing systems.
- Rope access techniques; and safety harnesses.
- Ladders and stepladders.
- Roof work and fragile surfaces; and roof truss installation.

- Management of site traffic and mobile plant.
- Moving goods safely.
- Hazardous substances and processes.
- Personal protective equipment and General Public Safety

Some of the key Khalala Hydropower management plans during construction and operational phases are presented in Chapter 8 of this ESIA report.

CHAPTER SEVEN

7. ASSOCIATED POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES

7.1 INTRODUCTION

The current Environmental and Social Impact Assessment follows the methodology set out by Environmental Management and Coordination Act, Cap 387 and EIA/EA Regulations; 2003; 2016 and assesses the environmental and social impacts during the construction and operation of the proposed Khalala Hydropower Project.

The framework methodology used in the current ESIA comprises the following steps:

- Definition of the project and study area boundaries;
- Consulting with interested organizations/ Departments;
- Data collection and baseline description;
- Identification and assessment of potential environmental and social impacts during construction and operation phases; and
- Description of measures to mitigate potential significant adverse environmental/ social impacts and recognition of any residual effects after the application of those measures.

7.2 ASSESSMENT METHODS AND SIGNIFICANCE

This assessment has relied upon the experience of the ESIA team as well as existing standards and guidelines to describe the impact and significance of an environmental effect. Where appropriate, specific significance criteria based on International, National and Local/ County guidelines are defined and reported. The approach to assessing and assigning significance to an environmental effect or social impact relied upon the Magnitude-Sensitivity Matrix as shown in Table 7-1, expert judgments and reasoned argument; consideration of any relevant County and National Legislation, Regulations, Standards or Codes of Practice as well as the advice and views of relevant Governmental organizations were all taken into account.

7.2.1 Public Information and Consultation with Authorities

Due to the large scale and high profile of the proposed Khalala Hydropower Project development, the project has gained county public interest. The public and stakeholders in the PAI have therefore been informed constantly not only during the ESIA stage but also during the land survey, hydrological assessment and design phases of the project. There is currently great interest, expectation and excitement on the proposed development particularly from the people of Sitikho Sub-location, who are generally looking forward to their locality being transformed into a developed area.

An extensive presentation of the project was given by the ESIA team together with the Client representative in two workshop/ stakeholder forums organized by the client- one being held in Kanduyi town at Elegant Hotel and the other one in Kakamega town at Amalemba, Fresh Highway Guest House on 19th and 20th December 2018 respectively. Prior to these two stakeholder forums four public participation meetings were held in the PAI and all the directly and indirectly affected people were engaged as it was appropriate.

The current ESIA design of the proposed project has been a result of an ongoing process of information exchange and consultation between the various lead agencies, county departments and ESIA team members. Consultation has taken place and information has been obtained from the relevant County departments from Kakamega and Bungoma Counties as well as other lead agencies such as Water Resources Authority-Lake Victoria North Catchment Basin and Kenya Marine and Fisheries Research Institute. All comments and suggestions received from the Authorities have been taken into account during the assessment and formulation of the ESMP as well as the preparation of the entire ESIA report.

The stakeholder meetings were attended by approximately 30 key participants and were seen very favourably with only positive reactions received from the attending stakeholders. Conversely, the turn out in the public meetings was high and the locals welcomed the project.

7.2.2 Impact description

A potential impact is both a description of the planned project activities and their effects on the environmental or social receptors. Relevant impact characteristics include:

- Adverse or beneficial;
- Direct or indirect;
- Short, medium, or long-term in duration; and permanent or temporary;
- Local, regional or global scale affect; including trans-boundary (neighbouring countries); and
- Cumulative impacts

The relative intensity of the impact can be assessed by these characteristics. The sensitivity of the environmental and social receptors was determined by specialists by ranking the components of the baseline data collected during the ESIA.

7.2.3 Impact severity for planned project activities

The proposed project activities and their impact severity was determined by evaluating the intensity of the impact and the sensitivity of the environmental and social receptors, which is largely subjective but based on the professional judgements of the entire team of specialists. This methodology required assigning of numerical descriptors to the impact intensity, as well as the environmental and social receptors, for each potential impact. The numerical descriptors are 1, 2, 3, or 4; which are equivalent to very low, low, medium or high. The impact severity was then calculated as the product of the two numerical descriptors, which was equivalent to negligible, minor, moderate or major, as indicated in Table 7-1. This approach is a semi-qualitative method designed to provide a broad ranking of the different potential impacts of Khalala Hydropower Project.

7.2.4 Impacts of unplanned events (or contingencies)

Unplanned events which have a potential to occur at the proposed project were identified to include: vehicle accidents, riots/ protests, floods or oil spillages, that are difficult to assess within the framework outlined above, because:

- Their intensity is difficult to quantify, since there is a wide range of possible events (i.e. the impact intensity is highly variable); and

- Unplanned events that may result in a severe environmental or social impact usually result in high financial, social and political liabilities and costs to the proponent.

As best environmental practices, the project has substantial built-in controls to avoid such occurrences.

7.2.5 Mitigation and residual significance

The use of mitigation is reported, where appropriate, followed by a description of the residual effects, namely those which remain after the implementation of mitigation measures. The potential impacts are assessed for severity and mitigation measures are designed to reduce this impact severity. The impact severity is then re-assessed, assuming application of the mitigation measures, to derive the 'residual' impact severity.

7.2.6 Determination of impact severity

Table 7-1: Magnitude Intensity-Sensitivity receptor Matrix

MAGNITUDE - SENSITIVITY MATRIX			SENSITIVITY OF RECEPTOR			
			Very low	Low	Medium	High
			1	2	3	4
INTENSITY OF IMPACT	Very Low	1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low	2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium	3	3 Minor	6 Moderate	9 Moderate	12 High
	High	4	4 Minor	8 Moderate	12 High	16 High

7.3 POSITIVE IMPACTS OF THE PROPOSED KHALALA HYDROPOWER PLANT

The proposed Khalala Hydropower Project will have a number of socio-economic benefits. These include:-

7.3.1 Increased revenue to the government

Both County and National government will have increased revenue from the project operations. The electricity that will be generated by the proposed Khalala Hydropower Project will generate revenue for the country in general in the form of Value Added Tax (VAT) on electricity, levy on transmission of bulk purchases of electricity and license fees.

7.3.2 Alternative source of energy

From ESIA survey, majority of the rural populations in Sitikho depend on fuel wood as a source of energy without any complement. The proposed project is anticipated to

produce 28MW of electricity which will complement fuel wood in the project area as well as other adjacent Sub-Counties hence reducing reliance on fuel wood.

7.3.3 Increasing the electricity supply to the national grid/reduction of Carbon Emissions

The proposed Khalala Hydropower Project is estimated to add 129GWh of electricity to the National Grid annually. This is expected to boost rural community economic development given the role that access to electricity plays in socio-economic transformation. Equally of importance will be the fact the energy generated will go a long way towards replacing the current non-sustainable energy production alternatives whose GHG emissions or carbon footprint is rather high.

7.3.4 Creation of employment opportunities

The project will create employment opportunities for skilled, semi-skilled and unskilled labour. Skilled personnel will be employed as Managers, Supervisors, Engineers, Architects, Surveyors, Health and Safety, and in other technical positions whereas semi-skilled and unskilled labourers will be employed as support staff and perform non-technical and administrative tasks. The community members in the project areas are highly expectant of employment opportunities that are likely to arise from the project activities. From all the public meetings conducted during the assessment, the community members mentioned that Khalala Hydropower Kenya Ltd should consider offering jobs to the locals first before sourcing manpower from outside the PAI. They also stated that the jobs should be distributed fairly so that communities from all the villages benefit. These employment opportunities may be limited and short-term because of the short period of the proposed project.

7.3.5 Improvement in social services

Roads in the area are in poor condition and transport links are poorly developed. There are four primary schools and one Secondary school while health facilities are only two and thus insufficient, poorly staffed and poorly equipped. Currently there are no motorable roads in the project area of influence unless with the use of 4-wheel drive. The proposed project will directly or indirectly benefit local communities and increase service delivery, as it has the potential to lead to the establishment and improvement of some social services in the project area such as feeder roads that will be used as project access routes.

From the public meetings, stakeholders' interviews and observations, the specific project areas are characterized by high rates of unemployment, scarcity of water and poor access to health services and education facilities. The community members expect the proposed project to contribute to the improvement of the living standards in various ways such as through employment opportunities, business opportunities and improvement of social services such as schools, health facilities and provision of water. The community members and the stakeholders interviewed during the assessment emphasized that the local people should be given priority for jobs that will arise from the proposed projects.

7.4 NEGATIVE IMPACTS OF THE PROPOSED KHALALA HYDROPOWER PLANT AND PROPOSED MITIGATION MEASURES

The potential negative impacts associated with the Khalala Hydropower Project are presented in the sections below, together with the proposed mitigation measures suggested for the respective impacts.

7.4.1 Impact on Nzoia River Ecology

The analysis of the potential project impact discussed in this section is related to the possibility that during the implementation of the proposed project activities, the integrity of Nzoia River will be compromised.

7.4.1.1 Construction Phase

During the construction phase of the project; the project will require employees who include Engineers, Electricians, Supervisors, Accounts Clerks, Masons, Carpenters, Bar Benders, Riggers, Labourers and Security Personnel to mention but a few, over a period of 18 months. The project will improve sections of road networks within the PAI for easy access of proposed project features such as the powerhouse and forebay. These roads are currently used by local communities and they will continue to do so, the same will be used by project workers. The high rate of human population growth due to the project and concomitant needs for agricultural land, fuel wood, timber and other natural resources, combined with development in areas surrounding the River will exert increasingly heavy tolls on the integrity of the river. This will be through degradation of water in the river, reduction in the water levels after diversion and subsequent water pollution either caused by soil erosion and sedimentation problems, oil spillages or as a result of poor camp effluent management practices. However, based on the design there will be minimal interference with the River Nzoia ecosystem as a result of Khalala Hydropower project as there are limited activities within the river riparian save for the weir/ intake point and the power house which shall be located within the river riparian.

The intensity of the impact is low and the sensitivity of the receptor is medium resulting in a moderate impact severity before mitigations.

Proposed mitigation measures

- Develop adaptive land use management and monitoring plans for the riparian section;
- Sensitise communities, workers, and migrants to avoid further damage to Nzoia River;
- Work with the WRMA staff and WRUA members to enable more extensive monitoring of the river;
- Affected areas will be re-vegetated to prevent soil erosion; and
- The proponent will also initiate and/or support projects aimed at contributing to the wider protection of the river catchment against degradation and depletion.

With the implementation of the above mitigation measures, the residual impact severity will reduce to minor.

7.4.1.2 Operation Phase

During this phase the number of employees will be reduced. However, there will be improved road network and hence the project area will be easily accessible for trade and commerce by community members and in-migrants as a result of the project development. This will result to increased agricultural production activities and trade in Sitikho.

The intensity of the impact is very low and the sensitivity of the receptor is medium resulting in a minor impact severity before mitigations.

Proposed mitigation measures

Mitigation measures for the operations phase are similar to those described for the construction phase above.

With the implementation of the above mitigation measures, the residual impact severity will remain minor.

7.4.2 Loss of crops and property

The analysis of the impact discussed in this section is related to the possibility that existing crops will need to be cleared for the construction of the project components. Baseline information indicates that the project is located in the community area, the main economic activity on this land is agriculture and crops grown include; *Zee mays* (Maize), *Musa balbisiana* (banana), *Saccharum officinarum* (Sugar cane) and fruit trees like *Persia americana* (avocado), *Mangifera indica* (mangoes) and *Carica papaya* (pawpaw).

Houses and other infrastructure are also found in the alignment of the proposed project structures. This impact will be applicable to the construction phase only since no more land will be needed thereafter.

7.4.2.1 Construction Phase

The project will lead to loss of crops and other properties falling within the project footprint due to the acquisition of land for construction of part of the headrace canal, the forebay, the penstock path, powerhouse and the access road 3 to these sites. Loss of crops threatens food security and can impact on livelihoods of the local community.

The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures

- A comprehensive property impact survey should be conducted which should indicate all affected properties within the right of way (ROW), their owners and the replacement costs;
- Valuation of such property should be conducted by experienced and registered valuers in association with the County land board and local leaders;
- Separate land surveys should be carried out for the permanent and temporarily affected land. All forms of compensation pertinent to loss of land should be conducted in line with the provisions of the Land Act, 2016;

- A comprehensive Resettlement Action Plan (RAP) should be prepared to ensure that PAPs are appropriately compensated and resettled;
- Prior to compensating the affected persons, adequate community sensitisation meetings should be carried out to ensure that the PAPs are aware of the entire program including visitation schedule per village and how each PAP will be contacted and approached for payment;
- Prior to the compensation process, the PAPs should be individually notified about the compensation amount to be paid and the proposed form of compensation e.g. land for land, cash etc. The PAPs may accept or refuse the compensation proposed depending on their expectations and damages incurred; and
- The project footprint should be limited to only that which is required i.e. the minimum possible.

With the implementation of the above mitigation measures, the impact severity will reduce to minor.

7.4.2.2 Operation Phase

Impacts associated with the loss of crops and properties are anticipated to be particularly relevant during the construction phase only. As such, no assessment was done for the potential for loss of crops and property in the operations phase.

7.4.3 Loss of land / Land take

The analysis of the potential impact discussed in this section is based on the fact that land will be acquired during the implementation of the proposed project activities. The baseline information indicates that land ownership in the project area is mainly customary and agriculture is the main form of land use in the area. The project structures are located in an area characterised by homesteads amidst cultivated farmlands and other infrastructure such as schools, with sections of the proposed access roads being on existing footpaths and animal watering access points. This impact will be applicable to the construction phase only since it is assumed that no more land will be needed thereafter.

7.4.3.1 Construction Phase

The construction of Khalala Hydropower Project will necessitate the acquisition of land for both permanent and temporary activities. Permanent land take will result from the construction of the reservoir (weir) and related infrastructure such as, the headrace canal, penstock, forebay and powerhouse.

To access the site during project construction and operation, it will be necessary to upgrade, including widening, the existing road network as well as construct new access roads to the project infrastructure, these activities will further lead to permanent loss of land to the project.

There will be temporary land take due to the construction of a workers' camp. All the land required for construction of project structures and infrastructure is owned by the local community members under the customary and freehold land tenure systems.

This impact will lead to temporary or permanent abandonment of activities such as farming that are being carried out within the project footprint. In particular, loss of

arable land is likely to threaten the food security of the local communities since subsistence agriculture is their major source of livelihood, with the directly affected people being the most hit. The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures

- The proponent must work with the County Governments, politicians and other local leaders to sensitise PAPs on the intentions of land acquisition. This must be done prior to project implementation to give people sufficient time for planning and proper assessment;
- The proponent must develop a thorough Resettlement Action Plan (RAP) and implement this plan in accordance with the Kenyan laws and donor agency guidelines such as World Bank Group and its Safeguard Policies;
- Land surveying and property Valuation must be undertaken by competent authorities such as Certified Valuers and Land Surveyors. Negotiations with land and property owners should be in compliance with local market prices and government rates so as to establish rational figures for compensation and subsequent resettlement of the affected persons;
- The PAPs should be individually notified about the compensation amount(s) to be paid and the proposed form of compensation; and
- The project footprint should be limited to only that which is required i.e. the minimum possible.

With the implementation of the above mitigation measures, the impact severity will reduce to minor.

7.4.3.2 Operation Phase

Impacts associated with the loss of land are anticipated to be particularly relevant during the construction phase only. As such, no assessment was done for the potential for loss of land/ land take in the operations phase.

7.4.4 Increased rate of soil erosion

The analysis of the potential project impact discussed in this section is related to the possibility that during the implementation of the proposed project activities, there will be increased soil erosion within the project area.

The surface soils in PAI include; residual clay material that consists gravely clay. The PAI is therefore generally prone to high runoff rates given the nature of the soils. Potential causes of increase in soil erosion were identified and analysed on a case by case basis. These were then used to discuss the likely increase in soil erosion as a result of the proposed project activities.

7.4.4.1 Construction Phase

During the construction phase of the project, a range of earthworks and construction activities are anticipated. These will entail construction of project features namely: access roads, campsite, powerhouse, forebay, penstock excavations, headrace canal and the intake weir. The construction phase will also involve establishment of support structures (construction camps, workers camp, temporary offices, vehicle equipment

storage and parking yard). Most of these works will involve activities such as surface levelling, vegetation removal/clearance, embankment construction and stabilisation works, which have the potential of exposing the land surface to the elements of erosion.

The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures

- Disposal of cut soil and all the debris trapped by the sediment traps will be undertaken outside fragile ecosystems (the riverine section) under the direction of the Resident Engineer who will approve disposal sites in collaboration with the Health and Safety Advisor;
- There will be controlled clearance of vegetation and this will be limited to only sections that are required for the access and installation of the project infrastructure;
- An efficient drainage system will be incorporated in the project design to ensure that storm water especially along the access roads to the power-house and forebay and along the headrace canal is efficiently and effectively controlled;
- Where possible, construction activities will not take place during heavy rains;
- Disturbed areas will be rehabilitated using a suitable indigenous cover grass. These grass species will be planted along the drainage channels to reduce the scouring effect of water;
- Affected areas will be re-vegetated to prevent soil erosion; and
- The proponent will also initiate and/or support projects aimed at contributing to the wider protection of the river catchment against degradation and depletion.

With the implementation of the above mitigation measures, the residual impact severity will reduce to minor.

7.4.4.2 Operation Phase

This phase is characterised by activities that involve monitoring site visits and running of the hydropower station. Although the proposed plant will run on a highly automated system, the open headrace system will involve manual cleaning and so will the operation of the head works gates and other controllers. This does not have the potential of increasing the rate of soil erosion. Therefore, this impact is considered insignificant and thus no further assessment during this phase

7.4.5 Soil contamination

The analysis of the potential project impact discussed in this section is related to the possibility that during the implementation of project activities, poor waste management, and oil/fuel and chemical leaks will contaminate the soil, thus affecting its quality. The soils are of good quality since the soil analytical results of the samples taken from the proposed project features location indicate that the assessed parameters were within the regulatory limits.

7.4.5.1 Construction Phase

Pollution of soil may result from discharge of fuel, chemicals and construction material spillage onto soil. Biodegradable and non-biodegradable wastes will be generated during the construction phase. These will include stones, sand, steel (metallic bars), insulators and other construction materials. Plastic wastes such as mineral water bottles, polythene bags, jerry cans, and other plastic accessories may be generated at the camps and work centres. Organic wastes such as food stuff and human waste will also be generated at the camps and work centres. Oil and fuel leaks might occur from vehicles, equipment and machinery used during construction. These wastes, if not well managed, have the potential to contaminate the surrounding soil and alter both its chemical and physical properties thus affecting its productivity. The soils at the proposed site are mainly used for agricultural purposes hence soil quality is of particular relevance. The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures:

- The proponent will ensure that all wastes generated during construction activities such as conductors, steel and metallic bars, insulators and other accessories are collected and disposed of appropriately at designated sites;
- All organic waste generated at labour campsites such as food stuffs shall be collected and transported by a licensed waste collection entity to designated landfills/ dumping sites within the project area;
- All plastic waste generated (at campsites and in the course of undertaking works) such as mineral water bottles, polythene bags, jerry cans, will be collected preferably in mobile vans and handed over to a licensed waste collector or re used;
- Fueling will be carefully undertaken at designated and well maintained fuelling centres;
- The waste management hierarchy will be followed during the construction phase. According to this hierarchy, source reduction of waste will be the first option and disposal of unavoidable waste as option of the last resort;
- Undertake routine preventive maintenance of motorised equipment to avoid any fuel leakage and spills;
- Storage of fuels and oils should be undertaken in a manner that does not allow leakage to the soil as the fuel can readily infiltrate the soils polluting the soils, ground and surface water; and
- Collect and dispose of all waste generated from project activities in accordance with EMC (Waste Management) Regulations 2006 and international best practice.

With implementation of the above mitigation measures, the residual impact severity will reduce to minor.

7.4.5.2 Operation Phase

Hydropower operation activities in this phase are automated but activities such as manual cleaning of the open headrace system, operation of the headworks gates and

other controllers will be carried out. Maintenance of the hydraulic system and functions like silt and trash removal are also carried out. All these will involve generation of biodegradable and or non-biodegradable waste such as oils. Spillage could also occur from overall maintenance of machinery, equipment and vehicles at the hydropower plant. However, the use of hazardous materials during operations is limited to fuels and lubricants of the equipment/machinery. No disposal of these substances is planned.

Domestic and sanitary waste will also be generated and this includes foodstuffs, plastics, paper and human waste – however it is assumed that at this stage, permanent waste management facilities will have been established for the project. As such, no assessment is made for the impact on soil quality in the operations phase. Nevertheless, in addition to the mitigation measures suggested for the construction phase above, the following is recommended during operations.

Proposed mitigation measures

All the waste collected from the headrace system at the time of cleaning will be disposed of appropriately at designated waste disposal sites – during flushing of the sedimentation tank, sediments will be flushed back into the river where they came from.

7.4.6 Increased disease vector populations as a result of changes in water ecology

The analysis of the potential project impact discussed in this section is related to the possibility that during the development of the proposed Khalala Hydropower Project, there will be an increase in disease vector populations as a result of changes in river ecology. Baseline information indicates that the most common diseases treated in Webuye West Sub-county are Malaria and typhoid. Both of these diseases are associated with vectors that breed in water. The potential increase in disease vector populations as a result of changes in water ecology is assessed in the section below. This impact is applicable to the operations phase only since there will be no permanent changes in water ecology during construction.

Operation Phase

Construction of the flow diversion weir across the river has the potential of altering the river ecology. The impoundment is relatively small considering the height of weir. However, the possibility of increasing disease vector populations because of this impoundment cannot be ruled out.

In light of the above, a permanent change in water flows in Nzoia River and the creation of the reservoir/weir could influence disease incidences in the local region through creation of suitable habitats/ favourable conditions for the breeding of some disease vectors and pathogens, specifically for diseases such as malaria and typhoid. The decreased stream flow rate in the river, both upstream and downstream, resulting from the diversion of water flow into the channel is expected to increase the incidence and breeding places for vectors that transmit malaria, typhoid, urinary and intestinal bilharzia.

This is particularly likely to affect children, and other users of the river. Treatment for these diseases is relatively simple, although it is crucial to seek medical attention immediately. If left untreated, serious disabilities or even death can occur. However, the proposed project area already has inadequate health facilities and timely treatment of

vector-borne diseases is likely to be a challenge. The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures

- Safe supply of potable water, and water purification education will be undertaken to address threats of intestinal and guinea worms; and
- The project will have a health program in place geared towards community protection. This will include sensitisation of the local community members and encouraging them to use mosquito nets.

With implementation of the above mitigation measures, the residual impact severity will reduce to minor.

7.4.7 Increased traffic

The analysis of the potential project impact discussed in this section is related to the fact that during the implementation of project activities, traffic in the area will increase as a result of project related vehicular movements associated with the transportation of project related materials and equipment that will be brought into the project area.

Machinery to be used includes motor graders, rollers, tippers and water bowsers. The PAI is 19Km away from the Webuye town and is linked via an earth road. Within the PAI, there is only earthen or murrum community access roads/ footpaths linking the different social amenities such as schools, trading centres water points among others.

Most of the travel within the PAI is along footpaths. The anticipated level of traffic as a result of project activities was determined and analyzed on a case by case basis. This was then used to discuss the likely increase in traffic in the area. Professional judgment of the consultants, an understanding of the communities and experience from similar projects was used to assess increase in traffic from the current baseline as a result of the project activities.

7.4.7.1 Construction Phase

The current traffic level on the road network within the project area is low, the additional traffic will be noticeable to the local community members and is likely to interfere with their regular movements through closure or diversion of roads during construction of the access roads. Furthermore, increased traffic and transportation of heavy loads may damage the newly rehabilitated earth road within the area leaving it in a worse state.

The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures

- Use well maintained and serviced vehicles to maintain efficiency;
- Prohibit off-road driving and use of vehicle horns should be reserved for safety considerations and not used as a common communication method;
- Travel in convoys and at designated times to decrease the risk of accidents and traffic nuisance to the community;

- Journey-specific risk assessments which will include the identification of potentially sensitive receptors along the access routes will be conducted.
- When travelling in community areas, speed limits on transportation routes will be 35km/hr for light vehicles and 20km/hr for heavy vehicles;
- Only approved drivers will be allowed to operate vehicles;
- Materials should wherever possible be preferentially sourced locally in a manner that reduces environmental and social impacts (e.g. transport distances) and maximises local economic development opportunities;
- Each construction site should have a traffic controller or signal person to monitor and direct traffic flow;
- All staff will undergo the proponent's EHS induction process which includes rules for safe driving, including speed limits in community areas. All recruited drivers will be able to read;
- The number of vehicles that will be used will be kept to a minimum all the time; and
- The construction equipment will be kept on site until the construction is complete.

With implementation of these mitigation measures, the residual impact severity will reduce to minor.

7.4.7.2 Operation Phase

Traffic will mainly consist of light vehicles transporting operations and maintenance workers to and from the site. This impact has therefore been considered insignificant for proposed project and has not been assessed further.

7.4.8 Impacts on vegetation

The analysis of the impact discussed in this section is related to the possibility that existing vegetation will need to be cleared for the construction of the project component.

Project activities which may cause the loss of vegetation were identified. These activities were evaluated to determine the likely extent to which vegetation will be lost. Professional judgment of the consultants and experience from similar projects was used to assess changes in vegetation from the current baseline as a result of project activities. Reference was also made to the conservation status of the vegetation and flora species that would need to be cleared.

This impact is applicable to the construction phase only, since no additional vegetation is anticipated to be cleared in the operations phase.

7.4.8.1 Construction Phase

The vegetation structure where the Khalala Hydropower Project is to be located is comprised of a number of floristic habitats such as river-rine vegetation, abandoned lands, and cultivated farmlands. It includes woody trees, shrubby, herby and weedy plant species. No plant species, identified as globally or locally threatened were observed in the project footprint.

To a great extent, the vegetation within the project footprint has been highly modified by human activities with a number of crop gardens present. It is likely therefore, that the vegetation within the project area has been lost due to cultivation of crops.

Most of the project infrastructures are located within community land where cultivation is the main land use practice, the overall sensitivity of the receptor (vegetation) is considered to be medium.

The intensity of this impact is low and the sensitivity of the receptor is medium resulting in a moderate impact severity before mitigations.

Proposed mitigation measures

- Following the construction phase, the affected areas will be restored and only indigenous vegetation replanted;
- Prevent vegetation trampling by restricting access to the site along a designated route.
- The contractor will avoid locating temporary project infrastructure such as, access roads, quarries, construction camps, storage areas, in sensitive ecosystems;
- The site clearing exercise will be controlled and limited to only that which is required for the project components;
- Carry out a pre-ground-break survey at the start of construction works to ensure that environmental conditions have remained the same as the baseline conditions presented in this ESIA;
- Areas for biodiversity offsets should be identified and vegetation planted to replace the one that will be lost to the project. This includes supporting afforestation activities within the project area and beyond;
- Movement of equipment (vehicles, contractors and the entire construction crew) will be limited to the designated access roads – off-road driving will be prohibited; and
- Movement of equipment (vehicles, contractors and the entire construction crew) must follow designated pathways or agreed upon access routes.

With implementation of the above mitigation measures, the residual impact severity will reduce to minor.

7.4.9 Impact on fauna

The analysis of the impact discussed in this section is related to the possibility that the project could potentially lead to loss of fauna within the project area. This is closely related to vegetation impacts since removal of vegetation will lead to destruction of microhabitat and fragmentation of habitats. Similarly, noise and vibrations within the proposed Khalala Hydropower area generated due to vehicle movement and construction related activities are likely to hinder/ interfere with free movement of wild fauna.

At the proposed site, there area has undergone human interference through agricultural activities and hence probability of finding a wide range of fauna was minimal. The domestic fauna includes; cattle, sheep, goats and dogs.

7.4.9.1 Construction Phase

Construction activities will involve vegetation clearance, excavations and levelling of the project footprint area (access road, intake weir, headrace channel, forebay, penstock, powerhouse and worker's camp). All these activities will be carried out, to a great extent, in a highly disturbed area and noise will be generated which may disrupt the limited fauna within the project area.

The intensity of this impact is very low and the sensitivity of the receptor is medium resulting in minor impact severity before mitigations.

Proposed mitigation measures

- Use well maintained and serviced equipment that generates low noise levels;
- Unnecessary noise from the construction workers (such as loud vocalisations and music) will be prohibited;
- Idling of vehicles and machinery will be prohibited unless necessary;
- Off-road driving will be prohibited. The use of vehicle horns will be reserved for safety considerations, and not used as a common communication method;
- Equipment will be operated with all noise-reducing components (hoods, screens) in the correct position;
- During construction, habitat disturbance should be minimised by restricting the project activities to only the maximum area required; and
- Unnecessary cutting of vegetation should be avoided.

With implementation of these mitigation measures, the residual impact severity will remain to minor.

7.4.9.2 Operation Phase

In comparison to the construction phase above, activities during the operations phase will be of a low magnitude and they will involve running and maintenance of the hydropower project. However, terrestrial fauna within the project footprint may also be killed while using the access roads and as a result of drowning in the open headrace channel.

The intensity of this impact is very low and the sensitivity of the receptor is medium resulting in minor impact severity before mitigations.

Proposed mitigation measures

- Monitor operation activities at the open headrace; and
- Undertake periodic monitoring of the headrace canal.

With implementation of the above mitigation measures, the residual impact severity will remain to minor.

7.4.10 Sedimentation and siltation of downstream water sources

The analysis of the potential project impact discussed in this section is based on the possibility that during the implementation of the proposed project activities, organic

matter and other soil components will be released into the river and streams within the project area and cause sedimentation and siltation downstream.

7.4.10.1 Construction Phase

Construction activities will include clearing of vegetation, stream crossings, operation of large equipment and equipment lay down which all have the potential to result in soil disturbance at the construction sites, potentially resulting in soil erosion, degradation of affected areas and hence sedimentation of the water courses.

The intensity of this impact is medium and the sensitivity of the receptor is medium resulting in a moderate impact severity before mitigations.

Proposed mitigation measures

- Install soil erosion control structures at all construction sites;
- Install and regularly empty, sediment traps in surface drains, along roads and construction areas;
- Proper design for storm water drainage facilities and maintenance during the construction phase are critical for mitigation;
- Construction during heavy rains should be avoided as much as is possible as water logged soils are easily eroded;
- Disposal of cut top soil should be undertaken outside fragile ecosystems and water sources downstream, under the direction of the resident engineer who should approve disposal sites; and
- Following completion of construction works, top soil removed and stockpiled should be used in restoration; vegetation native to the area will be re-established to ensure stabilisation of project area and its surroundings.

With implementation of the above mitigation measures, the residual impact severity will remain moderate.

7.4.10.2 Operation Phase

There are no noticeable sources of sedimentation materials during the operations phase. Therefore, this impact is considered insignificant during the operations phase, and has therefore not been assessed further.

7.4.11 Impact on downstream river flows and community water sources

The analysis of the potential project impact discussed in this section is based on the fact that during the implementation of the proposed project activities, a portion of water will be diverted from its normal course for use in power generation which will result in a reduction in the downstream river flow and therefore, the amount of water available for community water use along the river downstream.

7.4.11.1 Construction phase

No water will be diverted during the construction phase. This impact is therefore not applicable to the construction phase, and has therefore not been assessed further

7.4.11.2 Operations phase

During the operations phase, water will be regulated at the weir, diverted through the intake structure to the headrace for use in the generation of power. This will result in a fluctuation in the volume of water left to continue flowing normally through the existing watercourse particularly for the section between the intake weir and powerhouse.

Abstraction of water from River Nzoia for power generation will therefore reduce the amount of water available for the water users especially during the minimum river flows experienced in the dry season. This has the potential to impact on the aquatic biodiversity within the river and community water users around the river. However, the weir is designed to include an un-gated opening for uninterrupted environmental flow release for downstream users as well as the supporting ecosystem (flora and fauna) along the river up to tailrace end.

The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures

- Maintain at all times, and more especially during critical low flow periods, the stipulated minimum flow in the river section between the intake works and point of return of flow to the River Nzoia for purposes of in stream water use;
- Manage operations to avoid rapid fluctuations in downstream flow;
- Provide an alternative water source for example by constructing protected springs for the community members whose water sources will be affected; and
- There should be periodic monitoring of water flow between the weir and powerhouse and downstream of the powerhouse.

With implementation of these mitigation measures, the residual impact severity will be reduced to minor.

7.4.12 Impacts on surface water quality

The analysis of potential project impacts discussed in this section is related to the possibility that during the implementation of the proposed project, transportation of contaminants from the project site by natural flow (in the case of a spill), or by storm water to surface water bodies may occur and negatively impact surface water quality.

The results of the water quality laboratory analysis indicate that the water quality parameters of the samples collected at the selected sites were not within the recommended WHO/ KEBS potable water standards except for Msabale community spring.

The potential for the planned hydropower project activities to further degrade the water quality of the river within the project is assessed below.

Sources of potential surface water contaminants were identified and analyzed on a case by case basis. These were then used to discuss the likely surface water contamination as a result of the hydropower project activities.

7.4.12.1 Construction Phase

Sources of water contaminants during the construction phase include minor (small scale) spillage of fuels, lubricants and other toxic materials such as sulfuric acid used in equipment and machinery. Discharge of silt laden run-off and the disposal of waste and wastewater from the worker's camp.

During the construction of the weir, channel deepening and widening is likely to result into increased turbidity and change the colour of the Nzoia River waters. In addition, the materials used in the establishment of the weir such as cement may result in increased concentration of ions above the recommended national limits for (untreated) potable water available for water consumers.

Inappropriate disposal of waste and wastewater from the camp site also has the potential to have negative effects on water quality. Waste generated from the proposed construction camp site could also have a negative impact on water quality. However, the extent of this potential impact will also vary depending on the location of discharge points and the dilution/ mixing regime possible in the receiving waters.

Impacts on the water body downstream will include; reduction in dissolved oxygen levels, nutrient loading causing increased algal growth, and the spread of pathogenic disease vectors. Uncontrolled discharge of waste would have a moderate adverse effect on water quality but this can be mitigated if appropriate measures are put in place. Nzoia River is fast flowing and the release of contaminants into it will further degrade the water quality, which is already poor.

The intensity of this impact is medium and the sensitivity of the receptor is high resulting in major impact severity before mitigations.

Proposed mitigation measures

- Detailed design of spillway to manage the temperature and oxygenation of releases to the river including preventing anoxic discharges;
- Install treatment facilities and/or oil/water separators to remove oil and grease from drainage water prior to discharge to adjacent water courses;
- Install wastewater treatment facilities to treat wastewater from the project campsite and other construction facilities;
- Develop and implement a site construction waste and wastewater management plan;
- The construction vehicles and equipment will be regularly maintained from a recognised garage off-site thus minimising the potential for leakages;
- Secondary containment measures in areas where fuels, oils, lubricants and construction materials such as cement are stored and loaded or unloaded, including fueling points will be installed;
- In case of oil pollution, sedimentation and siltation, the contractor should halt construction activities immediately and recover the pollutant before it reaches the receiving water sources. In addition, the contractor should avoid washing construction equipment at the water pump or transfer station to avert pollution of receiving water sources;

- Design and install a septic tank system for human sanitary purposes at the campsite;
- Provide disposal facilities for wastes at the campsite and properly allocate the dumping site; and
- Undertake regular water quality monitoring in the reservoir, and water body downstream to include dissolved oxygen, nutrients (N & P), pesticides, exchangeable ions and nuisance plants.

With implementation of the above mitigation measures, the residual impact severity will reduce to moderate.

7.4.12.2 Operation Phase

The sources of surface water contaminants during the operations phase will be from the maintenance activities of the project infrastructure like the intake weir, headrace, forebay, penstock and powerhouse. In addition, the installed equipment such as the welded steel-piped penstock and turbines may slowly dissolve in the water. Of special concern are the turbines, which will be constantly turned by moving water. Turbines and the penstock will be made of steel, which does not oxidize easily in water, however the steel wears with time. Other noticeable sources of water contaminants during the operations phase include minor (small scale) spillage of fuels, lubricants and other toxic materials from operation and maintenance vehicles and the disposal of waste and wastewater from the worker's camp.

The intensity of this impact is very low and the sensitivity of the receptor is medium resulting in a minor impact severity before mitigations.

Proposed mitigation measures

- The project infrastructure such as the weir, penstock and the turbines which will be in contact with water will either be made out of insoluble material or coated with insoluble material;
- Regular and routine monitoring and maintenance will be undertaken to ensure that all project equipment is in good working order at all times;
- A site operation waste and wastewater management aimed at minimizing environmental damage from operations and maintenance activities, will be developed and implemented; and
- The operations vehicles should be regularly maintained from a recognized garage off-site thus minimizing the potential for leakages.

With implementation of the above mitigation measures, the residual impact will remain minor.

7.4.13 Impacts on tourism and cultural resources

The analysis of the potential project impact described in this section is based on the possibility that during the implementation of the proposed project, resources such as cultural or sacred sites used by the community members as their cultural practices may be impacted on.

7.4.13.1 Construction Phase

During construction activities, excavations will be carried out within the project footprint. These excavations are likely to result in destruction of any artifacts if any, that may be located within the project footprint. Also cultural practices of the construction team might 'water down' the traditional cultural practices of people in the area.

During the construction phase, this impact will be highly noticeable if the majority of the construction crew are from outside the project area, freely interact with the local community members, attach less value and de-campaign some of the traditional cultural practices and make attempts to promote their own culture. However, the majority of the construction crew from outside the proposed project area will be housed in the workers camp with their movements controlled and restricted.

Conversely, the development of this project might result to positive outcome as has been the case in other projects where such infrastructures are utilized for academic purposes.

The intensity of this impact is thus low and the sensitivity of the receptor is medium resulting in a moderate impact severity.

Proposed mitigation measures

- The proponent and its contractors will exercise care so as not to damage any artifacts or fossils uncovered during excavation operations;
- Before commencement of the construction works, the contractor will be taken on a guided tour of the site to get acquainted with the physical cultural resources;
- A "Chance find" procedure will be developed and used during the construction phase;
- All the construction team members will be inducted upon arrival at the work camp; and
- All the foreign construction team members will be accommodated at the workers camp and their movements controlled to avoid any negative influence on local community cultural practices.

With the implementation of the above mitigation measures, the residual impact severity will reduce to minor.

7.4.13.2 Operation Phase

No earthworks are planned on new areas during the operations phase, therefore it is envisaged that no more cultural sites – especially those that are buried will be affected during this phase. Therefore, during the operations phase, in light of the fact that no further excavations will be undertaken and given the small number of employees from outside the project area that might influence the local culture, this impact is considered insignificant and has therefore not been assessed further.

7.4.14 Increased spread of sexually transmitted diseases and other communicable diseases

The analysis of the potential impact discussed in this section is related to the possibility that during the development of the proposed project, there may be increased spread of sexually transmitted diseases.

7.4.14.1 Construction Phase

Physical and social interactions between the construction workers and locals may negatively impact on public health. Usually, activities such as the one which is proposed are often associated with an increase in the spread of sexually transmitted infections (STI), and HIV/AIDS in particular, as a result of the socialisation between the locals and workers, and boosted prostitution.

The construction workers from outside the area will be accommodated at the workers camps and their movements controlled.

The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures

- Special specifications in the contract documents should stipulate the need for HIV/AIDS Awareness and sensitisation campaigns;
- Ensure that the workers camp and construction areas are open only to formal employees;
- Provide the workforce with access to primary health care onsite, insecticide-treated mosquito nets, prescriptions, prophylactics and condoms, and basic testing for TB, STDs and HIV/AIDS;
- Engage an NGO to prepare community institutions for any influx of in-migrants (for example, by developing by-laws and community policing systems for larger numbers of in-migrants);
- Support local healthcare facilities through training of local healthcare professionals, regular supply of medical supplies and up to date equipment;
- Establish a community health programme including providing support to existing or new local programmes such as mother and child nutrition, community health awareness, HIV/AIDS awareness, hygiene and immunisation, malaria control measures (indoor spraying of insecticides, personal protection measures, and control of mosquito larvae), and local Voluntary Counselling and Testing (VCT) programmes.
- The proponent, Contractor and its sub-contractors will put in place an STI and HIV/AIDS awareness campaign and services for the construction crew to promote safe sex practices and other control measures in order to reduce this anticipated negative outcome;
- Workers with the exception of local workers, who will return to their homes, will be housed in the workers camp and will have access to health services; and

- All workers will be inducted in relevant codes of conduct that minimise exposure to risky life styles including unsafe sex practices.

With implementation of these mitigation measures, the residual impact severity will reduce to minor.

7.4.14.2 Operation Phase

During the operations phase, there will be very few people on site for operation and maintenance purposes. It is assumed however, that by this stage, the local community members will have already been sensitised during the construction phase and thus aware of the dangers of unsafe sexual practices including the necessary prevention measures. Therefore, this impact is considered to be insignificant during this phase and has not been assessed further.

7.4.15 Physical resettlement of people and associated impacts

The analysis of the potential project impact discussed in this section is related to the fact that during the implementation of project activities, the human settlements within the proposed project footprint might have to be relocated/ resettled to another place to pave way for project activities.

The baseline information indicates that the project components are located along community roads and footpaths as well as scattered households/ farmlands.

The settlement pattern within the project impact area was explored and analysed. The settlements within the project footprint that will be affected by the proposed project were established. This was then used to discuss the possibility of the need for relocation/ resettlement and associated nuisance impacts as a result of the project. Knowledge of the communities, the requirements of the proposed project and experience from similar projects was used to assess the need for resettlement as a result of the proposed project activities. This impact is applicable to the construction phase only, as it is assumed that no other land will need to be acquired during the operations phase.

7.4.15.1 Construction Phase

The proposed project will result in the need for resettlement of some homesteads within the project footprint for the establishment of project structures. In addition, some of the homesteads on the lower side of project footprint might have to be resettled to avoid the effects noise from the powerhouse during the operations phase. At the proposed power house location there three homesteads.

Physical resettlement of homesteads has far reaching impacts. In addition to relocation to a new place, especially if people are resettled into different communities that are reasonably far away from their original area of residence. This can result in the breakdown of existing social networks, loss of access to cultural and social centres and increased vulnerability of the relocated homesteads especially if the new areas have fewer opportunities than the former.

The acquisition of land is a willingness basis and thus all the households to be resettled will be given compensation for them to decide where to resettle or acquire land elsewhere.

The intensity of this impact is medium and the sensitivity of the receptor is high resulting in major impact severity before mitigations

Proposed mitigation measures

- The proponent will develop a thorough Resettlement Action Plan (RAP) and implement this plan in accordance with the Kenyan laws and donor agency guidelines such as World Bank Group and its Safeguard Policies;
- A comprehensive RAP should be conducted before the commencement of the construction phase for the proposed project;
- Where physical displacement is necessary, the developer will agree compensation with the affected person(s) and in accordance with County rates and guidance;
- Following agreement with regards to compensation, any required economic and physical displacement must take place prior to construction phase;
- Limit the project activities to the footprint of the required area;
- A grievance mechanism will be in place to ensure that grievances from displaced persons are handled carefully and in a manner that promotes confidence and trust;
- The affected communities should be fully sensitized and the homesteads to be resettled given options before the commencement of the construction phase;
- Land surveying and property Valuation will be undertaken by competent authorities such as Certified Valuers and Land Surveyors. Negotiations with land and property owners will be in compliance with local market prices and government rates so as to establish rational figures for compensation and subsequent resettlement of the affected persons;
- The PAPs will be individually notified about the compensation amount to be paid. They may then accept or refuse the compensation proposed depending on the damages incurred; and
- The number of PAPs to be physically resettled will be minimised through redesign.

With implementation of the above mitigation measures, the residual impact severity will be reduced to moderate.

7.4.15.2 Operation Phase

All the activities that require resettlement of homesteads will occur during the construction phase. Therefore, this impact will not occur during the operations phase and has not been assessed further.

7.4.16 Vehicular and other equipment emissions

Operation of equipment and machinery such vehicles will produce emissions, which could impact on the ambient air quality. The baseline ambient air quality in the larger part of the proposed project area is that of an unindustrialised and typical rural area, characterised by good air quality. There are no major industrial developments in the area. Sources of emissions were identified and analysed on a case-by-case basis. These were then used to discuss the likely quantity and quality of emissions that will be produced. The professional judgment of the consultants and experience from similar projects was used to determine if there would be significant air quality degradation from the current baseline as a result of the project activities.

7.4.16.1 Construction Phase

The most significant sources of gaseous emissions are expected to be from operation of vehicles and equipment. The gaseous emissions caused by the project based on the above listed equipment, are expected to include CO₂, NO₂, SO₂, and volatile organic compounds since most of the construction equipment and machinery will be powered by diesel engines.

Significant receptors in as far as any changes in ambient air quality are concerned will be the local community members settled within the proposed project area. It is also important to note that, gaseous emissions are not restricted to the emission sources; they can spread to a wider area as determined by the direction of wind.

The intensity of the impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures

- Vehicles and machinery will be fitted with appropriate exhaust systems and devices;
- Efforts will be made to use fuel-efficient and low emissions machinery and vehicles, which will be serviced regularly and in accordance to the manufacturers' specifications to maintain efficiency;
- All emission-producing equipment will be operated only when necessary and unnecessary idling of equipment will be avoided;
- A grievance mechanism will be put in place to address air quality grievances from local stakeholders; and
- Journey management will be undertaken in order to ensure that only the necessary trips required for the construction activities are made.

With implementation of the above mitigation measures, the residual impact severity will reduce to minor.

7.4.16.2 Operation Phase

During the operations phase, emissions will be restricted to light vehicles transporting operation and maintenance crew to and from site. These emissions are considered insignificant and have therefore not been assessed further.

7.4.17 Increased dust levels (particulate matter)

Dust will be generated during construction activities, and may temporarily hinder visibility for workers and local communities; Cover vegetation surfaces including crops in the surroundings, in so doing slowing down the rate of photosynthesis and affecting the quality of forage for animals; and affect respiratory health of workers and potentially local community members.

Baseline information indicates that the proposed project area can be described as generally rural with interfaces of natural vegetation, cultivated lands and lands under fallow. The area is largely vegetated and therefore the dust nuisance in Sitikho is insignificant. Transport in the PAI is mainly by foot or motorcycles along community access roads and footpaths with low dust levels. After analysis, the professional

judgment of the consultants and experience from similar projects was used to determine if there would be significant degradation of baseline conditions as a result of the proposed project activities.

7.4.17.1 Construction Phase

Construction activities will result in dust emissions as a result of vegetation clearance at the proposed project site for establishment of the different infrastructure components and along the access roads. Dust will also be generated during the transportation of required construction materials from the different source points to the construction sites.

The project infrastructure falls within community land mainly used for agriculture and settlement. Dust emissions at the proposed project site and majorly along the access roads that will be used to access the sites during construction are likely to pose a nuisance to local community members.

The intensity of the impact is medium and the sensitivity of the receptor is high resulting in a major impact severity before mitigations.

Proposed mitigation measures

- All unpaved haul roads will be continuously watered by watering trucks or constant misting, so that surfaces remain damp at all times when in use during construction;
- Gravel cover shall be applied to unpaved surfaces which are regularly used;
- All truck loads that enter or leave the site will be covered and if required, rumble grids will be installed at site exit points to minimise dust along community roads;
- Clearing of land will be carried out systematically - with clearing restricted to only the required areas so as to minimise disturbed and exposed areas;
- Stockpiles of construction materials will be shielded from wind using bins and monitored daily during the construction phase;
- All vehicle movements will be subject to risk assessment (which therefore allows for the incorporation of project-specific controls) and all drivers will be inducted in health, safety and social and environmental issues;
- A speed limit of 35km/hr for light vehicles and 20km/hr for heavy vehicles will be maintained on routes used to access the construction sites;
- Community awareness and sensitisation about the proposed project will be created prior to construction activities so that community members become more vigilant and are aware of what to expect in terms of potential nuisances; and
- A grievance mechanism will be put in place to address grievances from local communities.

With implementation of the above mitigation measures, the residual impact severity will reduce to moderate.

7.4.17.2 Operation Phase

The likely increment in dust levels during the operations phase will be insignificant since during this phase, emissions will be restricted to light vehicles transporting the operation

and maintenance crew to and from site. This impact has therefore not been assessed further.

7.4.18 Noise effect and vibrations on local communities

Noise will be generated from project activities and could become a nuisance to the local stakeholders within the vicinity of the project site at nearby human settlements and the larger community area neighbouring the proposed project. The proposed project features such as the forebay, power house and the weir are closer to settlements. These settlements are likely to be affected by noise generated from the project activities. Baseline noise levels at the proposed project site were determined. The baseline noise levels were then used to assess the likely increase in noise levels as a result of the proposed project activities.

7.4.18.1 Construction Phase

The major sources of noise and vibration during the construction of the proposed project will be mainly from moving vehicles, operation of construction equipment, and noise generated by the construction workforce. The maximum noise level recorded was 106.9 dB (A), at the weir and the minimum was 31.7dB (A) along the headrace canal and adjacent to a homestead approximately 500m from the proposed weir location. Most of the average noise levels at the nearby sensitive receptors were within the permissible limits.

The noise created at the sites during construction is not expected to noticeably alter baseline noise levels, but it is possible that some events may result in noise levels that exceed the maximum permissible noise levels for construction sites. Noise levels generated will be more disturbing if construction activities take place at night. However, based on current planning this is not envisaged. In addition, noise along the proposed access roads will be generated by project vehicles during their construction and during the transportation of equipment and other required materials to the site. The noise created along the access roads during the construction phase will alter baseline noise levels but it is unlikely that noise levels will exceed the maximum permissible noise levels for construction sites.

It is important to note however, that, noise levels generated tend to reduce exponentially with increasing distance from the source, and therefore irrespective of the sensitivity of the receptor, it is the intensity of the impact that influences the severity of the noise impact. The intensity of the impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures

- Prior notice will be given to the local community members to keep them informed of what will take place;
- Noise events will be scheduled for appropriate times of the day to avoid disturbance of community gatherings;
- Adherence to national noise regulations as stipulated in the EMC (Noise and Excessive Vibration Pollution Control) Regulations, 2009 will be ensured;
- Construction activities will be limited to only day time hours;
- Use of well - maintained and serviced equipment that generates low noise levels;

- Prohibit off-road driving;
- Unnecessary noise from the construction crew (such as loud vocalisations and music) will be prohibited;
- A grievance mechanism will be established to enable local people express their concerns;
- Noise monitoring will be undertaken within the area and at nearby sensitive receptor sites during construction;
- Prohibit idling of machinery including vehicles, unless necessary;
- The use of horns should be reserved for safety considerations, and not used as a common communication method;
- Acoustic insulation (e.g. screens or bunds) will be deployed when necessary, especially on compressors, when possible. Equipment will be operated with all noise-reducing components (hoods, screens) in the correct position; and
- Noisy equipment will be sited with regard to or away from sensitive receptors whenever possible.

With implementation of the above mitigation measures, the residual impact severity will reduce to minor.

7.4.18.2 Operation Phase

Noise emissions and vibrations during the operations phase will be from the installed machinery at the powerhouse and operation and maintenance vehicles. However, the powerhouse should be insulated and access to these structures restricted thus preventing exposure of the community members to the noise emitted.

The intensity of the impact is very low and the sensitivity of the receptor is high resulting in a minor impact severity before mitigation.

Proposed mitigation measures

- The powerhouse shelter will be insulated to minimise the level of noise emitted;
- A reasonable safety perimeter will be established around the powerhouse where access by community members will be highly restricted; and
- Only monitoring site visits necessary for proper running of the hydropower project will be conducted.

With implementation of the above mitigation measures, the residual impact will remain minor.

7.4.19 Poor sanitation due to poor domestic waste management

The analysis of the potential project impact discussed in this section is related to the possibility that during the implementation of project activities, wastes generated may be poorly handled and disposed of.

7.4.19.1 Construction Phase

Domestic wastes that may include food waste, food packaging and materials brought to site by construction workers among others, will be generated during the construction. If not properly handled, they may turn out to be a sanitation hazard as well as attract vermin such as rodents. This is expected mainly at the project facilities and camp sites.

The intensity of this impact is low and the sensitivity of the receptor is medium resulting in a moderate impact severity before mitigations.

Proposed mitigation measures

- The proponent should ensure that all waste will be removed from site and transported by a licensed waste carrier for proper disposal. Biodegradable and non-biodegradable wastes will be properly segregated during collection;
- During activities, the first priority will be to reduce, re-use and recycle waste in preference to disposal.
- All organic waste generated at the campsite such as food stuffs shall be collected and transported by the contractor to designated landfills/composting sites within the project area;
- All plastic waste generated at the campsite and in the course of undertaking works such as mineral water bottles, polythene bags, jerry cans, should be collected in mobile vans and adequately disposed of and some reused where possible;
- All waste generated from demolition of built up structures should be sorted (biodegradable, non-biodegradable, Metals, Glasses) by the contractor and disposed of appropriately at designated waste disposal sites;
- A mobile toilet for use by the construction personnel will be in place at the construction sites and the work camps, and emptied regularly by a licensed waste contractor; and
- Anti-vermin safeguards (such as covering bins with lids) will be put in place.

With implementation of these mitigation measures, the residual impact severity will reduce to minor.

7.4.19.2 Operation Phase

During this phase it is envisaged that project site will have very few workers and the waste management infrastructure will be in place. The impact during this phase is considered insignificant and is therefore not assessed further.

7.4.20 Effects of blasting

The analysis of the potential project impact discussed in this section is related to the possibility that during the development of the proposed project, the local community will be affected as a result of blasting activities.

7.4.20.1 Construction Phase

Controlled blasting of rocks will be conducted during construction of the weir and diversion canal and this is anticipated to have a negative impact on both animals and

human beings. The animals including birds, however, are most likely to be displaced from the surrounding area due to sudden noise caused by blasting. The intensity of the impact is medium and the sensitivity of the receptor is high resulting in a major impact severity before mitigations.

Proposed mitigation measures

- The day, time, hour and the minute at which the actual blasting will be conducted must be communicated to all the surrounding communities;
- Uncoordinated and haphazard blasting will not be tolerated. A properly agreed upon blasting time table should be developed and adhered to; and
- As a precautionary measure, sirens must be sounded prior to blasting in order to prepare/forewarn the community.

After the implementation of the above mitigation measures the residual impact severity will reduce to moderate.

7.4.20.2 Operation Phase

No blasting is expected during the operations phase of the proposed project and therefore this impact has not been assessed further.

7.4.21 Introduction of invasive plant species

The proposed project activities are likely to result in the introduction and/or increase in the number and density of invasive plant species. All plant species encountered were checked to determine if they are invasive. Professional judgment of the consultants and experience from similar projects was used to assess the likely introduction and/or increase in the number and density of invasive plant species from the current baseline as a result of the project activities.

7.4.21.1 Construction Phase

The use of murrum obtained from elsewhere in to construct the site may result in the introduction of invasive plant species. Construction equipment that are not properly cleaned and sterilized has the potential to transport seeds of invasive species from other parts of project operations.

Invasive plant species have the potential of spreading quickly and inhibiting the growth of native vegetation reducing plant species diversity. Inhibition of crop growths in the surrounding cultivated lands could also result in lowering crop yield. However we do believe that the client and the Prime Contractor will undertake due diligence during material acquisition as well as mobilization of machinery so that potential invasive species from other areas are not introduced in the project area.

The intensity of this impact is low and sensitivity of the receptor is medium, resulting in a moderate impact severity before mitigations.

Proposed mitigation measures

- Potential quarry locations for murrum will first be inspected for the presence of invasive species and if any are found, these sources will not be excavated;
- Thorough cleaning of machinery and equipment before demobilization to the site;

- Invasive species will be monitored and if they appear along the access road or at the site will be recorded and reported to allow further management of the species; and
- Murram and subsoil will be sourced from NEMA licensed quarry.

After application of the above mitigation measures, the residual impact severity reduces to minor.

7.4.21.2 Operation Phase

Impacts associated with the invasive plant species are anticipated to be significant during the construction phase only.

7.4.22 Increased Pressure on the social service sector

During the implementation of project activities, the local social service sector will be overwhelmed by the presence of project employees who may be in need of these services.

7.4.22.1 Construction Phase

If the project leads to in-migration, it will increase pressure on the already strained social service infrastructure like housing, health, water sources and sanitation facilities in the area when people move into the community in anticipation of employment opportunities. The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures

- Non-native workers during the construction phase will be housed in the temporary workers' camp while the local workers will return to their homes in the local communities. The camp will have the necessary social service amenities like health, water and sanitation facilities for the workers.

With the implementation of the above mitigation measures, the residual impact severity will remain to be moderate.

7.4.22.2 Operation Phase

The cause of increase in pressure on the social service sector during the operations phase will be the same as that of the construction phase. The operation phase will require only a small workforce.

The intensity of this impact is very low and the sensitivity of the receptor is high resulting in a minor impact severity before mitigations.

Proposed mitigation measures

The mitigation measures implemented during the operations phase are the same as those applied during the construction phase.

With the implementation of the mitigation measures, the residual impact severity will remain minor.

7.5 UNPLANNED (CONTINGENCY) IMPACTS OF THE PROPOSED KHALALA HYDROPOWER PLANT

Non routine events and unplanned impacts (also known as Contingency Impacts), have also been considered in this ESIA. These include events such as:-

- Floods (Section 7.6.1);
- Failure hazards (Weir break) (Section 7.6.2);
- Riots/demonstrations /protests (Section 7.6.3);
- Accidents (Section 7.6.4); and
- Susceptibility of the project to Climate Change (Section 7.6.5).

7.5.1 Floods

Increased storm water could cause unexpected flooding, severe erosion, and water course degradation. Increases in water velocity and volume also result in soil being carried down the slopes and into streams causing siltation and damage to aquatic life and habitats. Flood risks may occur at the weir due to malfunctioning or dam failure, at the forebay, if the spillway discharge channels are not properly directed and in the tailrace water discharge point which extends below the powerhouse.

Proposed mitigation measures

- Re-vegetate cleared up areas;
- Encourage ground cover with deeper roots;
- Respect natural contours so that the construction e.g. of the access roads follows natural contours and avoids natural drainage areas, as these areas are likely to be flooded and cause runoff to be displaced to other sites downstream; and
- Construct project access roads parallel to the contour of the land to minimise erosion and reduce the runoff rate more effectively.

7.5.2 Failure hazards/ geological hazards e.g. earthquake, faulting

Failure hazards can be due to; the use of inappropriate construction materials, imbalanced mixture or poor mixture of cement, and use of unqualified engineers employed to carry out the construction works or due to natural disasters such as earthquakes and collapsing.

Proposed mitigation measures

- The proponent will recruit qualified and experienced civil and structural engineers to undertake the construction works;
- The proponent shall undertake a geotechnical survey to inform the design and selection of appropriate technology; and
- Structural designs will be developed in accordance with the building standards.

7.5.3 Riots/ demonstrations /protests

Riots are bound to be expected from the casual labourers if the working conditions will not be favourable. Riots might bring work to a halt and thus need for proper grievance

redress mechanism so that issues at the site will be amicably resolved without impact on the project progress.

Proposed mitigation measures

- Assign representatives for casual labourers; and
- Appropriate working conditions should be offered.

7.5.4 Accidents

During both construction and operational phases, there is potential for incidents and accidents being reported. This will be mainly from traffic accidents along the routes that will be used to access the sites and construction and operations accidents. Construction works will involve a number of activities, operations and machinery that could injure workers. Other risks may arise from moving machine parts on unguarded machines, moving construction vehicles, electrical current etc.

The major causes for the accidents will be improper use of Personal Protective Equipment (PPE), mechanical faults in equipment or vehicles, health of workers, lack of team coordination, third party interference and careless driving on roads. Injuries could range from those which are minor to possible loss of life.

Proposed mitigation measures

- Health and Safety induction before commencing work on site to all workers;
- Personnel will only undertake tasks for which they are trained/ qualified and a formal permit to work' system will be in place;
- Routine toolbox talks will be conducted on different topics for all workers;
- All accidents, near misses and incidents will be recorded and such records maintained as part of a health and safety management programme;
- The required/ appropriate PPE will be provided and will be worn by personnel; and
- Drivers to observe Journey Management Plans.

7.5.5 Susceptibility of the project to Climate Change

Changes in climate can have major implications for the safety and performance of hydropower projects. When the severity and frequency of droughts increases it results to a reduction of the hydropower production capacity and may increase reservoir sedimentation over the long term.

Proposed mitigation measures

- The design parameters will include provision for the worst possible maximum flood event that may occur over a number of years; and
- Design of the project catered for seasonality so as to ensure that power is generated throughout the year.

7.6 CUMULATIVE IMPACTS

Cumulative (such an impact results from the aggregated effect of more than one project occurring at the same time, or the aggregated effect of sequential projects. A cumulative impact is “the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions”).

Cumulative impacts are divided into two categories; additive and in combination.

Additive impacts – these are impacts that may result from the combined or incremental effects of present and future activities. While a single activity may itself result in an insignificant impact, it may, when combined with other impacts (significant or insignificant) in the same geographical area and occurring at the same time, result in a cumulative impact that is significant.

In-combination impacts – occur where different types of impact from the project being considered are likely to affect the same environmental or socioeconomic features. For example, a sensitive receptor being affected by both noise and dust during construction could potentially experience a combined effect greater than the individual impacts in isolation.

7.6.1 Assessment of potential additive impacts

Additive impacts that may arise as a result of the project activities are explained as follows:

The combined impacts on terrestrial environment and vegetation clearance would be of moderate significance given the construction work will concentrate on the defined right of way. However, the proponent and the contractor should liaise with the stakeholders/ land owners in the project area to eliminate any conflicts that might arise as a result of land use.

Negative effects on air quality may occur from dust generated by project traffic and construction related activities, but these will be of low significance, given the temporary nature of the construction work in a one given area and the limited amount of additional traffic generated. An increase in traffic along the roads could lead to an increased risk of traffic accidents.

There is potential for cumulative beneficial impacts arising from employment of local people, but the overall impact will be low as the majority of the workforce needed require skills not available locally.

7.6.2 Assessment of ‘in-combination’ impacts

The assessment of the combined effects of individual impacts of a project relies on a qualitative assessment of potential interactions using available information and professional judgment and experience. Some types of impact are considered to have direct inter-relationships that could potentially occur interactively to generate a combined effect on sensitive receptors. For example, noise, vibration, traffic, dust and visual intrusion occurring together during construction have a combined effect. Some other types of impact have limited or no potential to have a combined impact on sensitive receptors. If this occurs, they could potentially experience a combination of temporary effects associated with increased noise, vibration, localised dust generation, visual intrusion and risk of accidents with construction traffic. Specifically, Cumulative Impact Assessments (CIA) are typically expected to:

- Assess impacts over a larger (i.e. "regional") area that may cross jurisdictional boundaries (includes impacts due to natural perturbations affecting environmental components and human actions);
- Assess impacts during a longer period of time into the past and future;
- Consider impacts on Valued Ecosystem Components (VECs) due to interactions with other actions, and not just the impacts of the single action under review;
- Include other past, existing and future (e.g., reasonably foreseeable) actions; and
- Evaluate significance in consideration of other than just local, direct impacts.

During the cumulative impact assessment of the proposed project is that the proposed project is to be located along River Nzoia on the right bank but in close proximity to the existing Mwikhupo Hydropower Project that is located downstream of the proposed project, on the left bank of the river land has already been fenced by unidentified developer who equally need to initiate a hydropower generation plant on the river. For the two proposed projects along the river but on the different banks, if the construction phases of both projects occur simultaneously in the project area, there could be cumulative impacts linked to unidentified effects on communities and habitats as well as displacements. In that, disturbed conditions observed may have stabilised or returned to normal, but increasing numbers of construction activities undertaken sequentially or with temporal and spatial coincidence may result in cumulative adverse effects. It is therefore important that appropriate mitigation measures are put in place.

Currently in the project area, there is the construction of the earth road from Webuye to the project site (Webuye to Sitikho). Additional construction activities are likely to increase dust levels as well as increase traffic on the road. On the other hand, there is Pan Paper Mills water abstraction upstream of the proposed project site that also might impact on the amount of water received at the site in the event the milling company comes back to full production capacity.

7.7 SUMMARY OF IMPACTS

Table 7-2: Khalala Hydropower Impacts Summary

Impact	Phase	Before Mitigation			After Mitigation		
		Intensity	Sensitivity	Severity	Intensity	Sensitivity	Severity
Impact on Nzoia River Ecology	Construction	Low (2)	Medium (3)	Moderate(6)	Very Low (1)	Medium (3)	Minor (3)
	Operations	Very Low (1)	Medium (3)	Minor (3)	Very Low (1)	Medium (3)	Minor (3)
Loss of crops and property	Construction	Low (2)	High (4)	Moderate(8)	Very Low (1)	High (4)	Minor (4)
	Operations	Not applicable					
Land take/ loss	Construction	Low (2)	High (4)	Moderate(8)	Very Low (1)	High (4)	Minor (4)
	Operations	Not applicable					
Soil erosion	Construction	Low (2)	High (4)	Moderate(8)	Very Low (1)	Medium (3)	Minor (3)
	Operations	Not assessed					
Soil contamination	Construction	Low (2)	High (4)	Moderate(8)	Very Low (1)	High (4)	Minor (4)
	Operations	Not assessed further					
Increased diseases vector populations as a result of changes in water ecology	Construction	Not applicable					
	Operations	Low (2)	High (4)	Moderate(8)	Very Low (1)	High (4)	Minor (4)
Increased traffic	Construction	Low (2)	High (4)	Moderate(8)	Very Low (1)	Medium (3)	Minor (3)

Impact	Phase	Before Mitigation			After Mitigation		
		Intensity	Sensitivity	Severity	Intensity	Sensitivity	Severity
	Operations	Not assessed further					
Vegetation impacts	Construction	Low (2)	Medium (3)	Moderate(6)	Very Low (1)	Medium (3)	Minor (3)
	Operations	Not applicable					
Fauna impacts	Construction	Low (2)	Medium (3)	Moderate(6)	Very Low (1)	Medium (3)	Minor (3)
	Operations	Very Low (1)	Medium (3)	Minor (3)	Very Low (1)	Medium (3)	Minor (3)
Sedimentation and siltation	Construction	Medium (3)	Medium (3)	Moderate(9)	Low (2)	Medium (3)	Moderate(6)
	Operations	Not assessed further					
Impact on downstream river flows and community water sources	Construction	Not assessed further					
	Operations	Low (2)	High (4)	Moderate(8)	Very Low (1)	High (4)	Minor (4)
Impacts on surface water quality	Construction	Medium (3)	High (4)	Major (12)	Low (2)	Medium (3)	Moderate(6)
	Operations	Very Low (1)	Medium (3)	Minor (3)	Very Low (1)	Low (2)	Minor (2)
Impacts on tourism and cultural resources	Construction	Low (2)	Medium (3)	Moderate(6)	Very Low (1)	Medium (3)	Minor (3)
	Operations	Not assessed further					
Increased spread of STD's and other communicable diseases	Construction	Low (2)	High (4)	Moderate(8)	Very Low (1)	High (4)	Minor (4)
	Operations	Not assessed further					

Impact	Phase	Before Mitigation			After Mitigation		
		Intensity	Sensitivity	Severity	Intensity	Sensitivity	Severity
Physical resettlement of people and associated impacts	Construction	Medium (3)	High (4)	Major (12)	Low (2)	High (4)	Moderate(8)
	Operations	Not assessed further					
Vehicular and other equipment emissions	Construction	Low (2)	High (4)	Moderate(8)	Very Low (1)	High (4)	Minor (4)
	Operations	Not assessed further					
Increased dust levels	Construction	Medium (3)	High (4)	Major (12)	Low (2)	High (4)	Moderate(8)
	Operations	Not assessed further					
Noise effect and vibrations	Construction	Low (2)	High (4)	Moderate(8)	Very Low (1)	High (4)	Minor (4)
	Operations	Very Low (1)	High (4)	Minor (4)	Very Low (1)	High (4)	Minor (4)
Poor sanitation due to poor domestic waste practices	Construction	Low (2)	Medium (3)	Moderate (6)	Very Low (1)	Medium (3)	Minor (3)
	Operations	Not assessed further					
Effects of blasting	Construction	Medium (3)	High (4)	Major (12)	Low (2)	High (4)	Moderate(8)
	Operations	Not assessed further					
Invasive plant species	Construction	Low (2)	Medium (3)	Moderate(6)	Very Low (1)	Medium (3)	Minor (3)
	Operations	Not assessed further					
Increased Pressure on the social service sector	Construction	Low (2)	High (4)	Moderate(8)	Low (2)	Medium (3)	Moderate (6)
	Operations	Very Low (1)	High (4)	Minor (4)	Very low (1)	Medium (3)	Minor (3)

CHAPTER EIGHT

8. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

8.1 INTRODUCTION

An Environmental Management Plan (EMP) is a detailed plan and schedule of measures necessary to minimize, mitigate, etc. any potential environmental impacts identified by the EIA (World Bank, 1999) which has been modified to ESMP due to the project nature. As part of the ESMP, a number of standard plans and operating procedures are proposed to be put in place geared towards addressing environmental protection for the operations in Webuye West Sub-county, specifically in Sitikho sub-location where the PAPs are found. These procedures are referred to where appropriate in this ESIA, and form part of the management regime under which the proposed Khalala Hydropower Project will be undertaken. The assessment process reported in this ESIA has identified the need for additional, specific mitigation measures to ensure that the proposed Khalala Hydropower Project has minimum adverse environmental and social impacts. The Environmental and Social Monitoring Plan (ESMP) for the proposed Khalala Hydropower Project will therefore incorporate the following elements:

- Operations wide documents; reference
- Project specific measures identified by the ESIA.

The specific measures to be undertaken during the mobilisation and implementation activities of the proposed Khalala Hydropower Project are included in the table for both the construction phase and operations phase. The tables also include monitoring measures designed to ensure that compliance with the plans can be checked and recorded during implementation, and assign responsibility for these actions.

8.2 ENVIRONMENTAL MONITORING

Environmental monitoring is the systematic measurement of key environmental indicators over time within a particular geographic area (World Bank, 1999). Monitoring should focus on the most significant impacts identified in the ESIA. The main aim of ESIA monitoring is to provide the information required to ensure that project implementation has the least possible negative environmental impacts on the people and environment. Various types of monitoring activity are currently in practice. During the ESIA study baseline Monitoring on basic environmental parameters in the PAI was conducted. Subsequent monitoring would help assess the changes in those parameters over time against the baseline. Other main types of environmental monitoring that will be conducted are briefly described below:

Impact Monitoring: The biophysical and socio-economical (including public health) parameters within the PAI, must be measured during the project construction and operational phases in order to detect environmental changes, which may have occurred as a result of project implementation e.g. air emission, dust, noise, water pollution etc. (European Commission, 1999).

Compliance Monitoring: This form of monitoring employs a periodic sampling method, or continuous recording of specific environmental quality indicators or pollution levels to ensure project compliance with recommended environmental protection standards.

This type of monitoring should be regular and performed over a long period of duration so as to gather sufficient data to draw accurate conclusion concerning project impact.

8.3 MONITORING AND EVALUATION OF PC&D

Most ESIA projects usually have no monitoring systems of PCs built into their structure. Monitoring and Evaluation (M&E) assess the quality of public consultations in the ESIA process. Techniques for monitoring and evaluating PCs include confirmation that participants understood the consultation content (correct language, level of technicality), and assessment of stakeholders’ opinions of PC effectiveness and PC impact on project design and implementation. Through appropriate use of M&E, public consultation strategies can be adjusted during the project cycle to improve stakeholder participation, information dissemination strategies, and mechanisms for integrating participant feedback into project design and implementation, Khalala Hydropower Kenya Limited will have to integrate this in its programs for effective and responsive measures being implemented.

Table 8-1: Construction phase Environmental and Social Management/ Monitoring Plan

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
Pre-construction issues	<ul style="list-style-type: none"> ✓ Sensitisation of the local communities on the planned hydropower project in order to avoid public anxiety and speculation. 	<ul style="list-style-type: none"> ✓ Number of sensitisation meetings ✓ Minutes of sensitisation meetings. ✓ Availability of a sensitisation programme 	Proponent Local Administration	One-off	200,000
Impact on Nzoia River	<ul style="list-style-type: none"> ✓ Develop adaptive land use management and monitoring plans; ✓ Sensitise communities, workers, and migrants to avoid further damage to Nzoia River; ✓ Enhance riparian protection; ✓ Affected areas will be re-vegetated to prevent soil erosion; and ✓ Initiate river catchment 	<ul style="list-style-type: none"> ✓ Availability of Land use plan ✓ Availability of monitoring data ✓ Number of sensitisation meetings 	NEMA and WRA NGOs Community representatives	Continuous	300,000

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
	protection programmes				
Land take	<ul style="list-style-type: none"> ✓ Land acquisition and compensation should follow the established process of land acquisition; ✓ Land survey and valuation of the land and property for project affected persons should be undertaken by competent authorities; ✓ Site clearance for project components and support structures will be restricted to the required area ✓ Sensitise project affected persons (PAPs) on the intentions of land acquisition to give people sufficient time for planning and proper assessment; ✓ Project affected persons should be individually notified about the compensation amount; 	<ul style="list-style-type: none"> ✓ Compensation records and RAP monitoring reports ✓ Area covered by project components and support structures ✓ Sensitisation meeting minutes and stakeholder engagement plan ✓ Resettlement and Community Development Action Plan 	Proponent and Local Administration	One off	To be determined

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
	<ul style="list-style-type: none"> ✓ Prepare a thorough Resettlement and Community Development Action Plan and implement this plan in accordance with Kenyan and donor requirements 				
Loss of crops and property	<ul style="list-style-type: none"> ✓ A comprehensive property impact survey should be conducted which should indicate all affected properties within the right of way; ✓ Prior to compensating the affected persons, adequate community sensitisation meetings should be carried out to ensure that the PAPs are aware of the entire program ✓ Limit the footprint area 	<ul style="list-style-type: none"> ✓ Survey strip maps and valuation reports ✓ Minutes of sensitization meetings ✓ Area taken up by project components 	Proponent and Local Administration	One off	To be determined
Increased soil erosion and landslide potential	<ul style="list-style-type: none"> ✓ Disposal of cut soil and debris trapped by the sediment traps will be done outside the fragile 	<ul style="list-style-type: none"> ✓ Areas devoid of vegetation ✓ Existence of efficient drainage 	Proponent Health and Safety Advisor	Continuous	500,000

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
	<p>ecosystems</p> <ul style="list-style-type: none"> ✓ Limit the area under tree clearance; ✓ An efficient drainage system will be incorporated in the design; ✓ Where possible, construction activities will not take place during heavy rains; ✓ Affected areas will be re-vegetated to prevent soil erosion. 	<p>channels and number of culverts installed</p> <ul style="list-style-type: none"> ✓ Project implementation Schedule ✓ Existence of project Environmental monitoring team 	Environment Officer		
Soil contamination	<ul style="list-style-type: none"> ✓ Ensure that all wastes generated during construction activities are appropriately disposed of; ✓ All organic waste generated at labour campsites such as food stuffs shall be collected and transported by a licensed waste collection entity; 	<ul style="list-style-type: none"> ✓ Good housekeeping and general cleanliness at the construction site. ✓ NEMA certified waste collector ✓ Waste collection receipts ✓ Existence of a 	<p>Proponent</p> <p>Health and Safety Advisor</p> <p>Environment Officer</p>	Continuous	200,000

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
	<ul style="list-style-type: none"> ✓ All plastic waste generated such as mineral water bottles, polythene bags, etc. will be collected and disposed of safely or reused where possible; ✓ Fueling will be carefully undertaken at designated and well maintained fuelling centres; ✓ Collect and dispose of all waste generated from project activities in accordance with EMC (Waste Management) Regulations 2006 	<ul style="list-style-type: none"> registered waste collector ✓ Contact with a registered waste collector 			
Increased traffic	<ul style="list-style-type: none"> ✓ Raise awareness about road safety among vehicle drivers; ✓ A traffic management plan will be in operation ✓ Speed limits will be enforced for construction vehicles involved in 	<ul style="list-style-type: none"> ✓ Number of road safety awareness meetings/clinics held. ✓ A traffic management plan will be in operation ✓ Speed Governors 	Proponent Local Community Leadership	Continuous	1,000,000

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
	construction work; ✓ Prohibit off-road driving; ✓ Use well maintained and serviced vehicles to maintain efficiency; ✓ Travel in convoys and at designated times to decrease the risk of accidents and traffic nuisance to the community	fitted in the vehicles ✓ Driver traffic safety sensitization records ✓ Maintenance records for vehicles. ✓ Journey management/traffic plans			
Impacts on vegetation	✓ Affected areas will be restored with indigenous vegetation; ✓ Limit the areas to be cleared during construction; ✓ Contractors vehicles are limited to the designated access roads only; ✓ Carry out a pre-ground-break survey at the start of	✓ Designated access routes. ✓ Presence of native vegetation in restored areas ✓ Size of the area cleared	Proponent Health and Safety Advisor Environment Officer	Continuous	300,000

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
	construction;				
Impacts on fauna	<ul style="list-style-type: none"> ✓Use well maintained and serviced equipment with low noise levels; ✓Prohibit unnecessary noise from construction workers; ✓Keep noise records and will be adhered to noise Regulations; ✓Equipment will be operated with all noise-reducing components in position; ✓Unnecessary cutting of vegetation should be avoided; ✓To minimise death of fauna, vegetation clearance will be undertaken first; ✓Sensitize workers on importance and need for biodiversity protection. 	<ul style="list-style-type: none"> ✓Equipment maintenance records ✓Noise monitoring records. ✓Induction records for drivers ✓Presence of noise suppression equipment ✓Extent of area occupied by project infrastructure. ✓Extent of vegetation clearance ✓Site clearance schedule ✓Biodiversity toolbox talks 	<p>Proponent</p> <p>Health and Safety Advisor</p> <p>Environment Officer</p>	Continuous	200,000

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
Impact on surface water quality	<ul style="list-style-type: none"> ✓ Install treatment facilities and/or oil/water separators to remove oil and grease prior to discharge; ✓ Install waste collection and wastewater treatment facilities in the campsite; ✓ Provide disposal facilities for wastes at the campsite; ✓ Undertake regular water quality monitoring in the reservoir, and water body downstream; ✓ Install soil erosion control structures 	<ul style="list-style-type: none"> ✓ Presence of oil/water separators ✓ Presence of waste treatment and waste segregation facilities ✓ Waste segregation bins and disposal sites ✓ Availability of water quality assessment certificates ✓ 	Proponent Health and Safety Advisor Environment Officer Resident Engineer	Continuous	1,000,000
Sedimentation and siltation of downstream water sources	<ul style="list-style-type: none"> ✓ Install and regularly empty, sediment traps in surface drains; ✓ To prevent sedimentation of streams during construction of the diversion channel; ✓ Proper design for storm 	<ul style="list-style-type: none"> ✓ Presence of soil erosion control structures ✓ Presence of sediment traps. ✓ Presence of storm water drainage 	Proponent Health and Safety Advisor Environment Officer Resident Engineer	Continuous	1,200,000

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
	water drainage facilities and maintenance; ✓ Construction during heavy rains will be avoided; ✓ After construction completion, top soil removed and stockpiled will be used in restoration;	channels ✓ Construction schedules ✓ Site Restoration plan			
Impact on downstream river flows and community water sources	✓ Adherence to stipulated environmental flow as presented in this ESIA or stipulated by WRA. ✓ Provide an alternative water source for example by constructing protected springs for the community; ✓ Periodic monitoring of water flow between the weir and powerhouse and downstream of the powerhouse; ✓ Water quality will be monitored to determine any pollutants.	✓ Installation of flow sluices at the intake weir. ✓ Presence of alternative water source in the community. ✓ Periodic monitoring record ✓ Water monitoring records.	Proponent Health and Safety Advisor Environment Officer Resident Engineer	Continuous	1,500,000

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
Impact on cultural resources	<ul style="list-style-type: none"> ✓ Before commencement of the construction works, the contractor will scouting of the site ; ✓ Contractor will exercise care so as not to damage any artefacts or fossils uncovered during excavation operations; ✓ All members will be inducted upon arrival at the work camp 	<ul style="list-style-type: none"> ✓ Scouting report ✓ Presence of a change find procedure ✓ Cultural Induction records 	<p>Proponent</p> <p>Community Liaison Officer</p>	One-off	200,000
Physical resettlement of people and associated impacts	<ul style="list-style-type: none"> ✓ Develop a thorough Resettlement Action Plan (RAP) and implement it; ✓ A comprehensive RAP should be conducted before the commencement of the construction phase; ✓ Following agreement with regards to compensation, any required economic and physical displacement; ✓ A grievance redress 	<ul style="list-style-type: none"> ✓ Evidence of RAP implementation ✓ RAP study for Khalala ✓ Property valuation records ✓ Compensation payment records ✓ Record of grievances handled 	<p>Proponent</p> <p>Community Liaison Officer</p> <p>Local Administration</p>	One-off	To be determined

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
	mechanism will be in place				
Increased risk of spread of HIV/AIDS and STI	<ul style="list-style-type: none"> ✓ Special specifications in the contract documents should stipulate the need for HIV/AIDS Awareness; ✓ Ensure that the workers camp and construction areas are open only to formal employees; ✓ Provide the workforce with access to primary healthcare onsite; ✓ Establish a community sensitization health programme. 	<ul style="list-style-type: none"> ✓ Specifications spelled out in the contractors contract ✓ Workers camp access records ✓ A record of workforce access to health services ✓ Number of community health programmes in place 	Proponent Health and Safety Advisor Community Liaison Officer	Continuous on monthly basis	500,000
Vehicular and other equipment emissions	<ul style="list-style-type: none"> ✓ Vehicles and machinery will be fitted with appropriate exhaust systems; ✓ Efforts will be made to use fuel-efficient and low emissions machinery; ✓ All emission-producing equipment will be operated 	<ul style="list-style-type: none"> ✓ Equipment procurement specification ✓ Vehicle speeds within the project area set ✓ Presence of Journey Management 	Proponent Health and Safety Advisor Resident Engineer Transport Coordinator	Continuous	500,000

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
	<p>only when necessary;</p> <p>✓Journey management will be undertaken</p>	Plan.			
Increased dust levels (particulate matter)	<p>✓Watering of unpaved access roads and restrict clearance;</p> <p>✓All truck loads that enter or leave the site will be covered</p> <p>✓Stockpiles of construction materials will be shielded from wind and monitored;</p> <p>✓All vehicle movements will be subject to risk assessment;</p> <p>✓Community awareness and sensitisation about the project;</p> <p>✓A grievance redress mechanism will be put in place</p>	<p>✓Road watering program</p> <p>✓Number of vehicle fitted with dust suppression covers</p> <p>✓Area devoid of vegetation</p> <p>✓Stability of soil stockpiles</p> <p>✓Vehicular movement risk assessment registers</p> <p>✓Speed limit signage and driving patterns in the area</p> <p>✓Stakeholder</p>	<p>Proponent</p> <p>Health and Safety Advisor</p> <p>Resident Engineer</p>	Continuous	1,000,000

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
		engagement plan ✓ Number of grievances filed/reported			
Noise effect and vibrations on local communities	<ul style="list-style-type: none"> ✓ Noise events will be scheduled for appropriate times of the day to avoid disturbances; ✓ Construction activities will be limited to only day time hours; ✓ Community awareness of the project activities; ✓ Noise monitoring will be undertaken within the area and at nearby receptors; ✓ Use well maintained and serviced equipment that generates low noise levels; ✓ Noisy equipment will be sited with away from sensitive receptors whenever possible. 	<ul style="list-style-type: none"> ✓ Project formal working hours ✓ Noise monitoring records ✓ Health and safety awareness records 	Proponent Health and Safety Advisor Resident Engineer Community Liaison Officer	Continuous	1,200,000

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
Poor Sanitation due to poor domestic waste management	<ul style="list-style-type: none"> ✓ All waste generated should be sorted and disposed of appropriately; ✓ Toilet facilities for use by the construction personnel will be in place at the construction sites and the work camps; ✓ Anti-vermin safeguards should be issued; ✓ Waste management in line with the waste hierarchy 	<ul style="list-style-type: none"> ✓ Presence of a Waste management plan ✓ Presence of adequate sanitation facility ✓ Work place hygiene records ✓ Cleaner production practices 	Proponent Health and Safety Advisor Environment Officer	Continuous	1,000,000
Effects of Blasting	<ul style="list-style-type: none"> ✓ The day and time at which the actual blasting will be conducted must be communicated; ✓ The contractor should work with the local leaders and properly plan for the blasting of rocks; ✓ Uncoordinated and haphazard blasting will not be tolerated 	<ul style="list-style-type: none"> ✓ EMP for blasting; blasting schedule which has been communicated to the relevant persons and associated records ✓ Level of local community awareness of the time schedule for 	Proponent Health and Safety Advisor Resident Engineer Community Liaison Officer	Continuous during the blasting process	1,200,000

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
		blasting			
Occupational health and safety of employees and local communities	<ul style="list-style-type: none"> ✓ Standard health and safety measures should be adhered to; ✓ Workers should be provided with PPEs and used as directed; ✓ Stop operations in case of an imminent and serious danger; ✓ Provide adequate and well-stocked first aid box; ✓ Adequate toolbox talks and training to all workers; ✓ Adequate warning / inductions and instruction signs must be prominently displayed; ✓ All construction machines/ equipment must be operated by experienced personnel and regularly serviced. 	<ul style="list-style-type: none"> ✓ Evidence of compliance with the requirements of the OSHA 2007 ✓ Signage measures and notices put in place and evidence of communication ✓ Requisite PPE provided and workers properly utilising it 	Proponent Health and Safety Advisor Environment Officer Resident Engineer	Continuous	1,000,000

Table 8-2: Operational phase Environmental and Social Management/ Monitoring Plan

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
Soil contamination	<ul style="list-style-type: none"> ✓ All the waste collected from the headrace system at the time of cleaning will be disposed of appropriately at designated waste disposal sites 	<ul style="list-style-type: none"> ✓ Agreement with a NEMA registered waste collection, transportation and disposal entity. ✓ Records of waste collection and disposal 	Proponent Environment Officer Resident Engineer	Continuous	500,000
Increased disease vector populations as a result of changes in water ecology	<ul style="list-style-type: none"> ✓ Safe supply of potable water, and water purification education programs; ✓ To have a health program in place geared towards community protection; 	<ul style="list-style-type: none"> ✓ Evidence of community health campaign records. ✓ Availability of health awareness and training records delivered to community health workers 	Proponent Health and Safety Advisor Environment Officer Resident Engineer	Continuous	1,000,000
Impacts on fauna	<ul style="list-style-type: none"> ✓ Monitor operation activities at the open headrace 	<ul style="list-style-type: none"> ✓ Operation and Maintenance records. 	Proponent Environment Officer	Continuous	500,000

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
Impacts on surface water quality	<ul style="list-style-type: none"> ✓The project infrastructure that will be in contact with water will be made of insoluble material or coated with insoluble material; ✓Regular and routine monitoring and maintenance ✓A site operation waste and wastewater management plan in order to minimise environmental damage; ✓The operations vehicles will be regularly maintained from a recognised garage off-site thus minimising the potential for leakages. 	<ul style="list-style-type: none"> ✓Equipment specifications. ✓Monitoring and maintenance records of project equipment. ✓Presence of a waste and wastewater management plan. ✓Training records of operations and maintenance staff ✓Maintenance records of operations vehicles 	Proponent Environment Officer Resident Engineer	Quarterly	500,000
Noise effects and vibrations on local communities	<ul style="list-style-type: none"> ✓The powerhouse shelter should be insulated to minimise the level of noise emitted; ✓A reasonable safety 	<ul style="list-style-type: none"> ✓Acoustics at the powerhouse shelter ✓Presence of 	Proponent Health and Safety Advisor Resident Engineer	Annually	500,000

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
	<p>perimeter will be established around the powerhouse where access by community members will be highly restricted;</p> <p>✓ Only monitoring site visits necessary for proper running of the hydropower project will be conducted.</p>	<p>safety perimeter</p> <p>✓ Monitoring records</p>	<p>Community Liaison Officer</p>		
<p>Impacts on aquatic ecology and biodiversity</p>	<p>✓ Implement soil erosion control measures and reduce soil disturbance during construction;</p> <p>✓ Proper design for storm water drainage facilities and maintenance during the construction phase are critical for mitigation;</p> <p>✓ Design and implement agreed seasonal compensation flow regime during operation;</p>	<p>✓ Soil erosion control measures installed</p> <p>✓ Presence of designs for management of storm water</p> <p>✓ Presence of river flow regime</p> <p>✓ Presence of land use management and monitoring plans</p>	<p>Proponent</p> <p>Environment Officer</p> <p>Community Liaison Officer</p>	<p>Annually</p>	<p>1,000,000</p>

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
	<ul style="list-style-type: none"> ✓ Develop adaptive land use management and monitoring plans; ✓ Sensitise communities, workers, and migrants to avoid further damage to Nzoia River; ✓ Initiate river catchment protection programmes 	<ul style="list-style-type: none"> ✓ Number of sensitization meeting conducted 			
Floods	<ul style="list-style-type: none"> ✓ Minimise cut and fill for new development; ✓ Respect natural contours so that new development follows natural contours and avoids natural drainage areas as these areas are likely to be flooded and cause runoff; ✓ Construct project access roads parallel to the contours of the land to minimize erosion and to reduce the runoff rate 	<ul style="list-style-type: none"> ✓ Minimal cases of cut and fill on sloppy grounds ✓ Undisturbed natural contours and drainages ✓ Parallel contours roads 	Proponent Health and Safety Advisor Environment Officer Resident Engineer	Undefined	500,000

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Monitoring Frequency	Estimated Cost (Kshs)
	more effectively.				
Weir and intake failure hazard	<ul style="list-style-type: none"> ✓Contract qualified and experienced civil engineers (contractor) for the construction works; ✓Carry out soil test for the proposed site to determine its bearing capacity; ✓Technical consideration will be taken during construction work 	<ul style="list-style-type: none"> ✓Qualified and experienced contractor engaged ✓Availability of soil bearing test ✓Availability of structural designs conforming to requirements 	Proponent Health and Safety Advisor Resident Engineer	Undefined	To be determined
Impact on cultural resources	<ul style="list-style-type: none"> ✓All the operations team members will be inducted on communal culture prior to the commencement of the operations phase. 	<ul style="list-style-type: none"> ✓Evidence of staff induction 	Proponent Health and Safety Advisor Community Liaison Officer	One off	100,000

8.4 OTHER ENVIRONMENTAL AND SOCIAL MANAGEMENT PLANS

The Social and Environmental Management /Monitoring Plans (ESMP) proposed in Tables 8-1 and 8-2 specify the mitigation measures and monitoring actions required in order to track progress and the resulting effects on the environment, resulting from the proposed project. Also included in the ESMP are the time frames, specific responsibilities assigned and possible necessary follow-up actions required.

Monitoring will commence right away and continue throughout both the construction and operations phases. An important aspect of monitoring is to assess the effectiveness of the recommended mitigation measures and where these are found lacking; other appropriate actions to mitigate against adverse effects will be undertaken.

Some of the ESIA findings will be utilized during the design stage, proposed mitigation measures should be incorporated in design and tender documents. The contractual agreement should also include articles to enforce environmental aspects.

Mitigation measures proposed for socio-economic issues such as compensation for loss of land or properties that may be damaged during the execution of the works will be handled by a Certified and Registered Property Valuer.

Environmental issues during the operations phase of the power plant shall be handled by Khalala Hydropower Kenya Limited. The company representative shall acquire some specialized knowledge and skills in environmental monitoring activities for them to effectively assume this responsibility.

8.5 HEALTH, SAFETY AND ENVIRONMENTAL MANAGEMENT PLAN

The Prime Contractor will develop and maintain an HS&E Management System that is project specific and aligns with Khalala Health Safety and Environment (HSE) Management Plan-MP 6. The objective of this plan will be to ensure that project activities comply with regulatory, reporting, operational and document control requirements. The plan should include the following components:

- The HS&E Policy
- HS&E target and objectives
- Organization and responsibilities
- HS&E documents and communication
- HS&E operation control
- Training, awareness and competence
- Management of change
- Monitoring, compliance audit and corrective actions
- Management review

HS&E Policy

The Contractor will commit to achieving the required standards of health, safety, environment within its operational areas for the construction period. The Employer's needs and expectations for this period are anticipated and will be met through safe and

timely operating procedures, actions and solutions that will minimize risk of accidents and harm to people and the environment.

Documentation and records for this project should meet the requirements of the contract. Records and documents shall ensure verification of project compliance including training, audits, inspections, incident reports, reviews, meetings, risk management studies and management of change. Where required obsolete documents will be removed or updated in line with the Document Control Procedures.

A communication policy will be developed for effective record keeping and for easy accessibility. All HS&E meetings will be recorded as formal minutes of meetings, which will be made available promptly for review by the proponent. Communication with communities is also important with particular respect to specific issues. The official project language will be English. HS&E signage will be posted in the both English and Swahili.

Responsibility

The Plant Manager and the Contractor in conjunction with the Site Environment, Health and Safety Advisor will be responsible for the implementation of the plan while the Corporate Environmental, Health and Safety Manager will have responsibility of verifying its implementation. All supervisors should be sensitised and trained on how to achieve the plan. In implementing the plan, the hydropower contractor will:

- Provide adequate resources to facilitate the implementation of the plans
- Identify hazards, assess, and control the risk
- Develop, maintain, implement safe working procedures
- Provide training, information and instruction to employees

Employee Responsibilities

- Employees must cooperate with the Contractor to implement this plan
- Employees must follow the correct work procedures
- All sub-contractors either on the camp site or at any other location are required to comply with requirements of this plan.

Safety Meetings

There will be safety meetings to reinforce safe practices and review the progress of implementation of this plan once every week.

Training Plan

The Sites Environmental, Health and Safety Advisor will conduct safety awareness program for the site supervisory staff before deployment. The officer will also provide induction safety induction to all workers and records. Weekly toolbox talks will be conducted as required while daily work instruction to the workmen will consist of hazards likely encountered while executing work and precautions to be taken.

Tool box talk

They will be carried out on daily basis and the briefings will focus on health and safety precautions conducted by supervisors and foremen to their respective workforce. The EHS Advisor will maintain a record of the meetings for the job specific hazards and precautions to be taken. Subjects to be covered will include:

- Unsafe working conditions and safe acts noted during the previous day
- Lessons learnt from the near misses, accidents if any
- Safety precautions to be taken in the future
- Safety checklists
- Role of employees in preventing accidents
- Personal Protection Equipment (PPE) use

Other precautions include

- Electrical safety requirements
- Fire precautions
- Working at heights
- Safe use of scaffolds, ladders, power tools
- Safe usage of hand tools
- Safe handling of mechanical materials
- Safety rules related to housekeeping and tidiness
- Safety access to the workplace
- Emergency evacuation procedures
- Materials storage and transportation requirements
- Safety during excavation
- Working near construction equipment and machinery
- Health hazards

Control and Use of Personal Protective Equipment

The Contractor will provide the following Personal Protective Equipment (PPE) to workers:

- Head protection gear
- Goggles for eye protection
- Muffs for hearing protection
- Boots for foot protection
- Gloves for hand protection
- Shields (i.e. for grinding and welding)
- Mask for respiratory protection
- Helmets
- High visibility vests
- Life jackets
- Heavy lift jackets

The PPE will be supplied free of charge to all Contractor's personnel on the project. The PPE should be: suitable for intended use; clean and replaced when damaged or no longer effective; and should be properly used and maintained by personnel. Personnel will be

provided with training, information and instruction on PPE use and maintenance and will be supervised to ensure that it is used correctly. Sub-contractors shall also be required to provide appropriate PPE to their workers.

STDs, HIV/AIDS, and Welfare of Workers

Prior to the commencement of construction work, hygiene awareness will be carried out. The workers will be sensitised on health risks associated with the HIV/AIDS pandemic.

Work method statement

The Contractor shall complete a Work Method Statement for all works. This document will be used to describe the job to be carried out; steps involved, the hazards associated, and the controls to be implemented to ensure that the work is completed safely. Permits will be given for hot work and confined work, fire equipment impairment notices and hazardous work referred as "Permit for Work"

Fire Protection

The Contractor shall provide up to date safety data sheet (MSDSs) for all chemicals used on site or brought onto the site and stored at the site. The Contractor will include all chemicals that they store permanently on the site in the chemical register. The chemicals will be stored in a manner that is: secure in position from unauthorised people; free from risk of falling and being knocked over; away from food; and appropriately labelled.

Project Equipment

For all equipment on site the contractor must ensure that:

- The employees to use the equipment are licensed and have competency based training.
- No electric operated equipment/tools will be used during working hours without permission.
- All equipment should be operated without risk to employees or the public.
- Equipment should be stored, operated, and maintained in accordance with the national legislation.
- Equipment should not be left unattended to
- Noise levels from equipment and working areas should in accordance with Noise regulations.

Accident, Incident, and Near Miss Investigation and Reporting

All accidents, incidences and "near-misses" shall be recorded, investigated and reported. Hazards including fire, electric shock, and hygiene related hazards should have the following precautions:

- All electrical connections should be routed through the earth leakage circuit breaker.
- Make shift wiring will not be allowed at camp site.

- Fire extinguishers are supposed to be provided in all buildings and will be inspected by the EHS Advisor every month to keep them in good working condition
- Disposable wastes which can cause fire will not be allowed close to fire places.
- Dustbins will be provided in all working areas and rest areas to prevent employees from disposing waste materials indiscriminately.

8.6 WASTE MANAGEMENT PLANS- WMP

Khalala Hydropower Kenya Limited has a Waste Management Plan-MP 12. The primary objective of this plan is to limit the amount of generated construction waste on this project by requiring all subcontractors and material suppliers to limit quantities of materials and packaging to only those necessary for the project. The Prime Contractor will thus come up with a Project Specific Waste management Plan in line with Khalala's Waste Management Plan-MP 12.

Specifically the purpose of the WMP is to:

- Identify the different types of waste likely to be generated by the Khalala construction and operation activities.
- Define their segregation methods.
- Provide information on local waste transportation and disposal regulations and permitting requirements;
- Define responsibility for waste management handling including safe disposal; and
- Comply with environmental requirements, policies and procedures
- Establish a system of colour coded bins to segregate waste at its source.

Proper waste management will be accomplished through:

- Reduction
- Reuse
- Recycling
- Recovery
- Treatment; and
- Responsible disposal

Responsibility

The Contractor should ensure the health, safety and welfare of its employees, sub-contractors, and members of the public in achieving sustainable environmental objectives at all sites. During implementation, the Contractor will be responsible for the collection, storage, treatment and transportation of all types of waste generated during the course of project activities. The Contractor will provide all the necessary planning, materials, equipment, tools and training required to ensure appropriate project waste management. For project activities in the field, all waste generated will be collected and brought back to the camp site before final disposal.

Waste Management Guidelines

The Contractor shall be committed to integrated waste management and aware that consent may be required for any discharge or disposal of waste. As a result the Contractor will put in place the following measures:

- Encouraging re-use of materials where possible
- Separating re-usable and recyclable materials from non-recyclable materials prior to disposal
- Providing adequate space on-site for storage of separated material
- From time to time, undertaking a review of waste stream to identify the types and quantities of wastes generated
- Monitoring waste stream to minimise unnecessary waste and to reduce the cost of oversupply and waste disposal
- When purchasing materials and equipment, the Contractor will take into account the cost of disposing of additional or unnecessary packaging, as well as the type of packaging.
- The Contractor will purchase materials that have recyclable content where possible.
- Avoid discharging of waste to sewerage or storm water drainage systems where possible.

Waste Minimization

The Contractor's waste management plan will be in compliance with the applicable Kenyan regulations.

Waste Reduction and Disposal

The contractor will ensure that the collection, recycling, recovery, treatment and disposal of wastes have positive and no adverse effects on the environment. A reduction in waste volume will reduce the scale and intensity of those effects.

The Contractor will ensure that solid waste volumes are reduced by:

- Reduction in the volume of solid waste generated.
- Reduced consumption and reduced waste of resources.
- Reduction in environmental pollution and land contamination through better management and disposal of solid waste
- Recovery of resources that will yield economic and social benefits to the community
- Appropriate siting, design and management of waste management facilities.
- Practices that reduce the volume of solid waste generated and disposed of in an environmentally friendly manner should be promoted.
- Waste should be minimised where possible, or re-used or recycled.

- Encouraging community involvement and private enterprise participation in the reduction, and recycling of solid waste.

The Contractor shall sub-contract a NEMA licenced contractor for solid waste collection, recycling, recovery, transfer, treatment and disposal operations. This is aimed at minimizing the social and environmental impacts. To achieve this, the Contractor will ensure that solid waste collection, recycling, recovery, storage, treatment and disposal activities are properly sited, designed and managed to avoid, remedy or mitigate adverse effects on the environment and amenity values.

The disposal options for major regulated waste streams that are likely to be generated at the project are as outlined below.

Disposal of chemical containers and leftover chemicals will be an important consideration in the granting of environmental approval. If possible the need to dispose of containers should be totally eliminated by using bulk systems (e.g. for oils, acids, reagents and detergents).

The Contractor will keep a database of all chemicals and this is used to assist in the management of chemicals on site. The database will be held in the Environment, Health and Safety Department. This system will be supplemented by regular inspections to ensure chemicals are correctly stored, labelled, transported and disposed.

Oil waste

The primary emphasis will also be on minimising the generation of oily waste. Strategies should be developed to assist this process include:

- Bulk storage of lubricating, hydraulic and gear oils to eliminate the need for drums.
- The use of water-based, quick-break degreasers and detergents that effectively clean and enable oil/water separator systems to work effectively
- Storage of all oils that are being used in concrete bunded areas to minimise the potential of contaminating soil with oil
- Orderly storage of oils in stores yard i.e. no leaking drums, no storage of drums on its side, wooden pallets in good condition.

Recycling/Disposal of Waste oil

Waste oil will be removed from machinery and a mixture of hydraulic, lubrication and gear oils will be combined in waste oil tanks situated in selected bunded areas. The oil will be periodically collected by the supplying oils companies.

Oily Rags and Oil Filters

Oily rags and oil filters will be placed into labelled drums. They will be disposed off in consultation with County Director of Environment-Bungoma County and preferably they will be taken for incineration.

Medical Waste

Medical waste that will be generated from the project or onsite treatment will be placed in labelled medical waste containers by the Medical staff. Disposal of medical waste will be via burning in an incinerator (under supervision of Medical staff at a given incinerator location).

Batteries

The Contractor will produce a limited number of used batteries each year. However, measures should be in place to recycle the batteries in approved centres

Tyres

All used tyres will be collected by a designated local waste contractor.

Sewerage

Sewage disposal will be through a Sewerage Treatment Plant installed on the site. No sewage or any other untreated waste water will be discharged into the surrounding streams and environment.

Food wastes will be generated from different project sites including canteens and field sites. These wastes will be put in labelled containers and disposed of to a given municipal disposal facility.

Non-Hazardous Recyclables

All non-hazardous materials with the potential for recycling will be segregated and either recycled on-site or sent off-site.

Cardboard/Paper

Cardboard and paper will be placed into labelled and colour-coded bins. As a result this material will be burned to prevent it being scattered outside of the rubbish tip.

Wood

The main source of waste wood is packing crates and pallets. Wood will be collected into bins and sold or given away to the local community.

Scrap Metal

Scrap-metal will be separated and put in labelled and colour-coded scrap metal bins and will be periodically collected by a designated local contractor who will be advised to take it for recycling (scrap for cash).

Non-Hazardous Non-Recyclables

General non-hazardous waste not suitable for recycling includes general litter and a range of plastic wrappings. These items will be placed in general refuse bins and disposed of at appropriate designated sites.

Information, Advocacy and Education

The Contractor will:

- Provide information to encourage, promote and support waste minimization.
- Increase public awareness of ways to reduce waste disposal and increase diversion.
- Promote waste management guidelines for non-residential activities.
- Increase public awareness of appropriate disposal of building and demolition materials.

8.7 POLLUTANT SPILL CONTINGENCY PLAN

Khalala Hydropower Kenya Limited has a Spill Management Plan-MP 11. The objective of the plan is to handle recovered oil, oily debris, and contaminated sand/dirt resulting from an oil spill so that the wastes do not cross-contaminate other areas that are clean and to ensure that all recovered oil and oiled debris are managed in accordance with applicable regulations. The Prime Contractor will thus be required to develop and implement a Pollutant Spill Contingency Plan (PSCP) which shall provide procedures for proper handling of pollutants and the procedures to be taken in the event of a spill.

The scope of the PSCP will be to minimise the risk of spills during project construction activities as well as to provide information about equipment and materials available to undertake immediate remedial actions.

PSCP will cover all the actions that should be taken by all workers in the event of an accidental release of hazardous substances, fuels or any other potentially polluting materials. These actions include:

- Materials needed to contain and clean-up spilled hazardous materials, which will be maintained on-site at all times. A material quality sufficient to contain and clean the spilled materials will be available.
- All weather sealed containers will be used to store hazardous materials. These containers will be colour coded and labelled as Hazardous Material Spill Supplies.
- All containers will be labelled in relation to their contents.
- Earth and/ or water contaminated by the spilled hazardous materials will be secured in all-weather sealed containers for transport to an approved waste receptor site.

Responsibilities

The Contractor will be responsible for the implementation of the PSCP while the project Environmental, Health and Safety Advisor will have the responsibility to verify its implementation. All supervisors should be made aware of and sensitised about this plan.

The specific objectives of this plan are to:

- define areas of responsibility of the parties to the Plan;
- determine the extent of co-operation for the implementation of the plan between the responsible authorities, at the operational level;

- specify the type of assistance which might be provided and the conditions under which it will be provided;
- divide the responsibilities and to provide for the transfer of responsibilities;
- Establish the principles of command and liaison, and to define the corresponding structures.

Communications Arrangements

For effective communication, record keeping and easy accessibility, English language shall be used in all communications related to the implementation of the plan.

Deciding upon the response strategy to be applied in each particular pollution incident and planning of specific operations shall be the responsibility of Environmental, Health and Safety Advisor.

Response Operations

For the purpose of this Contingency Plan, pollution response operations shall be divided into three distinct phases of: Notification; Evaluation and activation of the plan and response operations. It is understood that according to circumstances, entire phases or parts thereof, may take place concurrently with one or more other phases.

Spill Monitoring

The monitoring of the spill and its movement and transmission of relevant reports is the responsibility of the contractor. Following the activation of the plan this responsibility rests with EHS Advisor, who shall take all necessary measures to ensure regular monitoring of the spill and its movement and behaviour, in order to properly assess the situation and decide on adequate response measures.

Reporting

Any polluting incident presenting a potential threat shall be reported to the proponent immediately after its occurrence.

Post incident reports will include description of the pollution incident and development of the situation; description of response measures taken; description of assistance rendered; assessment of the complete response operation; assessment of assistance rendered by others; costs incurred during the response; an estimate of environmental and economic damage; description and analysis of problems encountered in responding to the pollution incident; recommendations regarding possible improvement of existing arrangements and, in particular, provisions of the Plan.

8.8 TRAFFIC MANAGEMENT PLAN

The proponent has a Vehicle Safety Plan- MP 5 that provides safety guidelines during driving or riding in a motor vehicle, in and of itself, places workers at increased risk of suffering serious injury or death. In an effort to reduce the potential for vehicle accidents, all motor vehicles shall be kept in good operating condition and shall be equipped with appropriate safety equipment. This document however does not address traffic issues adequately. The proponent in partnership with the Prime Contractor' shall develop a Traffic Management Plan (TMP) which will include among other recommended practices for moving equipment and persons to, and from power site. The TMP will specify the procedures for monitoring construction-generated traffic movements, and associated environmental problems. Drivers and passengers must obey all traffic laws when operating or riding in a vehicle.

The TMP shall contain procedures for:

- Parking on site traffic movement;
- Training, testing, of heavy equipment operators and drivers, including vision tests, and record training; and
- Use of project vehicles to transport workers

Purpose

The scope of the TMP should cover the actions to be taken by both the Proponent and Prime Contractor's project personnel (including Sub-contractors personnel) involved in the operation of motor vehicles. The plan shall provide measures to be implemented to ensure safety of the project personnel and the public.

Responsibility

The Environmental, Health and Safety Advisor will have the following responsibilities:

- Check and ensure the drivers have the right qualifications and experience
- Ensure lane closures against traffic flows which can unduly affect capacities to an unacceptable level
- Ensure works are undertaken in a safe manner by having a guide to manage traffic flows
- Ensure that a 35km/hr speed restriction is imposed at the work site and in accordance with traffic guides
- Ensure that the traffic control layout at each work site location is detailed in the traffic control plans.

Traffic Assessment

The works should be undertaken during the day from 0800 to 1700 hours.

Traffic Management Implementation

Sequence and Staging

Traffic management requirements will be observed at all times as indicated in the TMP. Details will be provided for all activities relating to installation, staging and removal of signage, lane closures and work activities. These activities will be recorded in the daily diary detailing the time at which they occur.

- Erection approach and departure advisory signage on approaches to site;
- Road closure;
- Undertake and complete installation of cables;
- Removal of delineation devices and reopening of closed roads;
- Removal approach and departure advisory signage; and
- Installing road condition advisory signature.

Risk Control

The contractor will eliminate all potential hazards associated with the interaction of road traffic and work site personnel through speed restrictions, road closures and delineation devices to ensure that hazards associated with the mingling of this traffic and work will not occur. All project vehicles and equipment will be fitted with flashing amber warning lamps and hazard lights, and will be required to have reversing alarms for operations within the project site. Work sites and access roads will be cordoned off from traffic by the placement of cones and signage in accordance with traffic act.

The following measures will be undertaken:

- Speed limits shall be put in place where required.
- Safe working procedures will be followed by vehicles required to enter and leave the construction site.
- Traffic control plans and instruction for the setting out, maintenance and removal of signage, cones and other traffic control devices will be prescribed.
- All workers will be required to wear high visibility protective clothing and reflective vests.
- Where Traffic controllers are used, they are to be relieved at four hourly intervals and are to be in two-way communication with each other for the duration of the work shift.

Temporary Signs and Delineation

Requirements for signage

All signs used shall conform to the designs and dimensions and the national and International traffic standards and codes. Prior to installation, all signs and devices shall be checked to ensure that they are in good condition and meet the following requirements:-

- Mechanical condition – Items that are bent, broken or have surface damage shall not be used.
- Cleanliness – Items will be free from accumulated dirt, road grime or other contamination
- Colour of fluorescent signs – Fluorescent signs whose colour has faded to a point where they have lost their daylight impact shall be replaced.
- Retro reflectivity – Signs for night time use whose retro - reflectivity is degraded either from long use or surface damage and does not meet the national standards shall be replaced.
- Battery Operated Devices – shall be checked for lamp operation and battery condition
- All signs shall be positioned and erected such that they:- are properly displayed and securely mounted; are within the driver’s line of sight; and cannot be obscured from view; do not obscure other devices from the driver’s line of sight; do not become a possible hazard to workers or vehicles; and do not deflect traffic into an undesirable path.
- Signs shall be placed clear of the travel path and erected in accordance with the installation plans.

Daily Routine Tasks and Record Keeping

The Environmental, Health and Safety Advisor will ensure that all temporary signs, devices and controls are maintained at all times. The monitoring program shall incorporate inspections; before the start of work activities on site; during working hours and at the end of the working period.

Where an incident is observed or reported associated with the site incident reporting and investigation procedures; the incident will be instigated in accordance with the Project Health and Safety Management Plan.

Contingency Arrangements

Road accidents or vehicle breakdown within the project area will be attended to immediately and remedial measures taken. Road works that may impact on any services requiring access to the project area will be cleared from the area as quickly as necessary. Project traffic controllers, supervisors and foreman will be equipped with mobile communications to advise and/or liaise with emergency services to ensure a prompt response will the need arise.

Pedestrian Access

- Location of access roads/ detours shall be done in consultation with the local community;
- Pedestrian access will be restricted at times throughout the proposed works.
- Designated walkways must be used to prevent contact with mobile project equipment such as forklifts and vehicles.

Public Awareness

The Contractor will undertake public awareness prior to commencement of the works to advise all road users of the forthcoming works, the likely timeframe of the works and road conditions likely to be encountered. This should be broad enough to reach the general public in the PAI.

8.9 HAZARDOUS MATERIALS MANAGEMENT PLAN (HMMP)

Khalala Hydropower Kenya Limited has a Hazardous Material Management Plan-MP 10. This plan is aimed at used to reducing the risk of spill or other accidental exposure of hazardous materials. The Prime Contractor shall thus develop a Hazardous Materials Management Plan (HMMP) whose aim is to:

- ensure safe and proper use of hazardous chemicals;
- provide personnel with a program to reduce the risk of accidents involving hazardous chemicals and/or wastes; and
- describe the process of how the contractor will provide and maintain a safe and supportive environment for workers and those providing services for the project.

The Contractor is also required to commit to maintaining programs designed to prevent and reduce the risks on workers, visitors and the community by ensuring proper handling and disposal of hazardous materials and wastes.

A hazardous waste is an unwanted substance that can damage the environment and pose a threat to human safety. Hazardous wastes come in many physical shapes and forms, from PCBs to battery acid, paints and solvents. They may be wastes left over from a complex manufacturing process such as making plastic or chemicals. They could be fluids used in electrical transformers. Hazardous wastes cannot be recycled, reused or safely disposed of in industrial or municipal landfills.

Responsibilities

The Contractor is responsible for the implementation of the HMMP. All supervisors will be made aware of and sensitised to this plan.

Procedure

The Contractor should be committed to safeguarding worker rights and will implement good practice in relation to labour and working conditions of the project. The following presents the minimum requirements to ensure safe and proper use of hazardous and non-hazardous chemicals and to provide employees and non-employee workers of the project with a program to reduce the risk of accidents involving hazardous chemicals and/or wastes.

Management of Hazardous Materials

For proper management of hazardous materials the Contractor will first, determine how much hazardous waste is generated each month in order to determine how much to store and how long to store it. The following practices will be undertaken:

The Contractor will at all times maintain proper storage in compatible containers by:

- Maintaining containers in good condition
- Prevent leaks, ruptures and accumulation of rainwater on tops of drums

- Transferring waste to a new container in case of leakage
- Keeping containers closed. Self-closing funnels will be used when adding waste. Wastes will not be allowed to evaporate by covering them properly.
- Making sure that wastes must be compatible with the container. For example, use high density polyurethane plastic containers for corrosive wastes.
- Making sure that incompatible wastes (e.g., acids and bases) are not put together in same container to avoid chemical reactions from taking place.
- Storage of Hazardous Materials
- The Contractor will ensure proper storage of hazardous materials through the following:
 - Maintaining adequate aisle space between container rows to allow inspection for leaks and damages.
 - Storing ignitable and reactive wastes at least 50 feet from property boundaries.
 - Storing containers with incompatible wastes in separate areas.
 - Minimizing inventory and use a "first-in, first-out" system to prevent the need for disposal of unused materials.
 - Putting a sign indicating; "Do not discharge hazardous wastes to the ground surface or into STP".
 - Managing wastes in an appropriate manner to prevent discharges to the environment by keeping containment structure valves closed.
 - Keeping soiled towels in a clearly labelled, closed container.
 - Storing partially used absorbents in closed, labelled containers for reuse.
 - Use drip pans under leaking cars, machinery and pipes or under removed parts rather than cleaning them up with absorbents.
 - Pre-cleaning parts with a squeegee, rag or wire brush. This approach helps minimize or possibly eliminate the use of hazardous solvents and prolongs the life of cleaning solutions.
 - Having a contract with approved recycling services for used antifreeze, lead-acid batteries, used oil and oil filters
 - Using separate receptacles for draining used oil and antifreeze.
 - Educating employees about recommended maintenance schedules and replacing fluids only when necessary.

Preventive Measures

This checklist will help in preventing the most common hazardous waste violations. The Contractor will facilitate training of the employees to reduce hazardous wastes through sensitising and training on the following list of preventive measures:

- Saving money on waste management costs

- Reducing concerns about penalties and liability
- Creating a safer, healthier workplace
- Promoting positive public relations with clients, customers and the local community
- The Project manager and Supervisors must be committed to waste minimization and pass that commitment on to the employees.
- Evaluate where wastes are generated or originating from and identifying areas where changes can be made.
- Involving employees in designing and implementing pollution prevention measures.
- Reducing or eliminating solvent use by determining whether cleaning is really necessary.
- Using a multi-purpose solvent to reduce the types of hazardous waste that need to be managed.
- Substituting detergent-based solution for caustic solution when cleaning; substitute water-based cleaners for solvent cleaners.
- Considering switching to a water-based cleaner instead of using chlorinated spray cans of brake cleaner or carburettor cleaner.
- Using solvent sinks properly: using drip trays, allowing more drainage time, using filters to prolong solvent life and keep lids closed when not in use.
- Replacing solvent only when necessary.
- Using dedicated equipment to minimize cross-contamination.
- Keeping used oil and other vehicle fluids segregated from solvent wastes and carburettor cleaner.
- Storing large quantities of batteries in an isolated area with no floor drains.
- Storage area should be sealed with an acid-resistant material.
- Labeling containers clearly to prevent contamination of non-hazardous wastes.
- Leaving containers that contain explosive material open
- Keeping accurate inspection records
- Identifying and recording quantities of hazardous waste monthly.
- Use proper containers to collect and store wastes or products.
- Labeling all containers whether product or waste as to their contents.
- Keeping all hazardous waste or products containing regulated solvents closed at all times unless when actively removing from or adding to it.
- Posting emergency information near each phone.

- Develop a contingency plan for emergencies.
- Using manifests for all waste transported for disposal.

Receiving and Delivering

The Contractor will maintain a Hazardous Materials Management Plan and will also ensure delivery of all chemicals and hazardous materials in compressed gases. The Contractor will ensure that damaged materials are not delivered to the project site and no storage of damaged materials in receiving area for more than 6 hours.

Transportation

The Contractor will transport hazardous materials in accordance with Hazardous Material Transportation regulations and maintain policies and procedures for the same. Employees will also be trained in the requirements of hazardous material transportation.

Storage and Disposal

The Contractor will not purchase excessive quantities of hazardous materials but will properly store hazardous materials and chemicals. The Contractor will not dispose of hazardous materials in the drainage systems.

The Contractor will make sure that the following are followed:

- Making sure that transport and disposal facility have identification numbers
- Use manifests for all hazardous wastes shipped off-site. Keep the manifests on-site
- Inspecting containers at least once a week and keep a written log of container inspections
- Keeping a record of larger spills and use this information to identify the spill prevention options that might help to reduce related impacts.
- Keeping training and inspection records for three years
- Keeping manifests and shipping receipts for three years
- Labeling every container with the type of waste and whether it is hazardous or non-hazardous or used oil.
- Training all employees to identify, reduce and properly handle wastes.
- Training new employees before they handle hazardous wastes.

Personnel Training

The Contractor will ensure personnel training in their area in the receiving, transportation, proper storage, handling, disposal and use of hazardous materials in accordance with the requirements of this plan.

Hazardous Materials Handling

The Contractor will:

- Ensure that hazardous wastes they are dealing with are made public and more importantly to the County Public Health.

- ii. Ensure that hazardous and infectious materials are labelled so that adequate instructions and standard danger symbols on them are visible, clear, and appropriate.
- iii. Ensure that all people involved in transport and storage of hazardous wastes are adequately trained and protected and made aware of the dangers involved and how to mitigate them.
- iv. Provide appropriate safety wear for people handling hazardous wastes in the various places of the project.
- v. Treat the infected workers to stop spread of diseases and disinfect contaminated places and materials.
- vi. Regular medical check-ups for the staff are mandatory.
- vii. Immunization against Hepatitis B and other blood borne diseases is mandatory.

Security Measures

All chemical storage areas should be kept locked when unattended.

Hazard labelling

The only hazard warning labels on chemical containers are those that the manufacturers/suppliers place on the containers.

The Manufacturer/Supplier may place identification labels on some containers.

The Manufacturer/Supplier may place Hazardous Material Identification System Labels on some containers.

Transportation hazard Class Labels may be on containers and packages as sent by the manufacturer/supplier.

Hazardous waste containers are labelled as specified by a given Hazardous Waste Program.

Warning Signs

Hazardous waste will have warning signs depending on the type as is appropriate.

Inspections

The frequency of hazardous materials storage area inspections will be specified in the appropriate document. These inspections should be undertaken every week and whenever there is need.

Records

Environmental Health and Safety Department shall maintain all hazardous material inspection records.

Emergency Equipment

In the case of large quantities of hazardous wastes, the Contractor will have a written plan that should include:

- Emergency response arrangements with police, fire, hospitals and emergency response contractors

- Emergency coordinator's name, address and phone number
- On-site emergency equipment descriptions and locations
- Evacuation plan and routes, including a site diagram.
- Spill reporting procedures
- Post Emergency Information
- Post the following information near every telephone:
 - Fire department phone number
 - Locations of fire alarms and extinguishers
 - Locations of spill control materials

Emergency Coordinator

This person must know what to do in case of fire, spill or other emergency and must be on the premises or on call 24 hours a day.

Disposal of Used Oils and Other Contaminants

The Contractor will make sure that rags contaminated with used oil or solvents that may be hazardous waste are discharged to a publicly-owned sanitary sewer, not in storm sewer, or cesspool. Used oil that is not recycled or is rendered un-recyclable will be regulated as a hazardous waste. To avoid ground water contamination problem the Contractor will ensure that oil spilt on the ground is cleaned up immediately.

8.10 EMERGENCY RESPONSE PLAN

Khalala Hydropower Kenya Limited has an Emergency Preparedness and Response-MP 7 whose objective is to reduce the frequency and severity of consequences from emergency incidents.

It will be the responsibility of the project Contractor to prepare a site specific Emergency Response Plan (ERP) which shall be agreed with the proponent. All construction and operation members of the Khalala Hydropower will need to receive appropriate training on the implementation of the Emergency Response Plan. The ERP will be used to reinforce and compliment the ESMP.

This ERP shall be designed and written to assist the power station's management, employees, local communities and outside responding agencies or stakeholders through emergency response actions at the power station. It is recognized that this plan alone is not "all inclusive" of the actions which occur in all emergencies, but if used properly in conjunction with emergency response training and rational decisions, it will lessen the impact of emergencies on human life, environmental and power plant property.

The following is a list of the types of emergencies that can occur at the Khalala Hydropower Facility:

- Fire
- Major electricity accident endangering many company workers, neighbouring communities and outsiders;

- Death of a company worker (depending on circumstances);
- Rape (depending on circumstances);
- Suicide;
- Shooting or stabbing;
- Widespread power outage especially at night;
- Natural disaster such as earth quake, lightening;
- Large-scale hazardous material spill;
- Major weather emergency;
- Mass casualties;
- Health epidemics;
- Rapture or leak of equipment;
- Mobile equipment accident.

Communication Strategy

The probable emergencies communication shall be categorized into two, internal and external. The internal communication strategy will be used in communicating internal emergencies. The recipients will therefore mainly be employees on site who comprise of unskilled, semi-skilled and skilled labour. External communication will be needed for emergencies which have an impact on external individuals or where their involvement is deemed necessary to effectively handle an emergency.

Reporting

All accidents, incidents and near misses shall be reported, recorded and investigations carried out to ascertain their causes within the project and in the communities. Any pollution incident presenting a potential threat, shall be reported to the proponent as soon as possible.

8.11 STAKEHOLDER ENGAGEMENT PLAN

Khalala Hydropower Kenya Limited has a Community Relations Management Plan-MP 3 whose main objective is that for all community involvement activities during the project development the community shall be informed of what's going on at the site and they will be welcomed to give their input.

For purposes of Khalala Hydropower Kenya Limited, the Contractor shall develop a Stakeholder Engagement Plan. This plan will guide is the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a project's environmental and social impacts in relation to both the local community and lead agencies. In line with the requirements of IFC PS 1, stakeholder engagement should be an ongoing process that involves the following elements; stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, grievance mechanism and ongoing reporting to affected communities.

The purpose of this plan will be to:

- To prepare communities on potential emergency scenarios that could be caused by the project and can affect the community.
- To build a trusting relationship with the affected communities and other interested stakeholders based on a transparent and timely supply of information and open dialogue.
- To ensure effective engagement with local communities and other key stakeholders throughout all phases of the project.
- To actively build and maintain productive working relationships, based on principles of transparency, accountability, accuracy, trust, respect and mutual interests with affected communities and other stakeholders.

Stakeholder Analysis and Engagement Planning

Stakeholder analysis can be defined as the process of determining stakeholders who will be affected directly or indirectly, positively or negatively by the proposed project and who can contribute to, or hinder its success. All stakeholders need to be kept informed during project implementation so as to accord the necessary support and advice. A stakeholder engagement plan (Table 8.3) has been developed to ensure the full involvement of the proposed project site.

Information sharing and disclosure/ communication strategy

All the relevant stakeholders will be kept informed and up to date on issues pertaining to the project activities especially those which affect them or where they have influence (See Table 8.3).

Table 8-3: Stakeholder Engagement Plan

Target Group	Tasks/Methods	Frequency	Responsibility	Project Phase
Displaced/affected Households/ PAPs	Compensation; Working Group Meetings; regular household visits; and monitoring the livelihoods of displaced persons.	Quarterly	Khalala Hydropower Kenya Limited	All phases
Directly and Indirectly affected Persons.	Appraise and educate Local Communities on health and safety, cultural and environmental issues related to the project. Health promotion and awareness program	As required	Khalala Hydropower Kenya Limited	All phases
County and National Government agencies	Provision of regular updates and submission of monitoring reports to relevant agencies as required. Payment of attention to the licences required for the project	As required	Khalala Hydropower Kenya Limited	All phases
Community consultation	Continuous consultations with the community members.	As required	Khalala Hydropower Kenya Limited	All phases
Non-Government Organisations	Regular updates on the key project information	As required	Khalala Hydropower Kenya Limited	All phases
Vulnerable groups	Identify support that may be required to ensure vulnerable people can access project benefits.	As required	Khalala Hydropower Kenya Limited	

CHAPTER NINE

9. CONCLUSION AND RECOMMENDATIONS

9.1 CONCLUSIONS

Two of the foundations for Kenya's socio-economic transformation as identified by Vision 2030 are: efficient physical infrastructure and energy. Interventions in this area are based on the realization that effective and reliable energy infrastructure is critical in promoting the country's competitiveness at the national, regional and global levels.

The proposed Khalala Hydropower Project is therefore in line with and forms an integral component of Government of Kenya effort to improve physical infrastructure and in particular renewable energy efficiency and development as per the Vision 2030.

The proposed Khalala Hydropower Project at Sitikho shall be located in the upper reaches of Nzoia River with the weir and intake located at Khalala Bridge. The project is owned and operated by Khalala Hydropower Kenya Limited.

The main potential negative impacts associated with the proposed project are land take/displacement, loss of crops and property and environmental pollution. The impacts pertaining to the proposed project have been thoroughly assessed and adequate mitigation measures proposed in the ESMP in order to ensure minimum risk to safety of people, property, river ecology and the ecosystem where the project features will be located.

The project will also ensure that the directly and indirectly affected people are adequately sensitized and where resettlement is effective compensation as per the World Bank Group safeguard policies and Kenyan laws.

By applying best practice in terms of project execution, material and or equipment selection, project design and operational procedures, Khalala Hydropower Kenya Limited; the project proponent, endeavours to undertake the project under the utilization of the best practicable environmental measures as well as operate within the most stringent environmental health, safety and quality standards typical of IFC financed project facilities and to be in compliance with Kenya's legislation.

9.2 RECOMMENDATIONS

The proponent shall be committed to putting in place several measures to mitigate the negative environmental, safety, health and social impacts associated with the life cycle of this kind of project. It is recommended that in addition to this commitment, the proponent shall focus on implementing the measures outlined in the ESMP as well as adhering to all relevant applicable national and international environmental, health and safety standards, policies and regulations that govern establishment and operation of such projects.

It is also recommended that the positive impacts that will emanate from the proposed project shall be enhanced as much as possible. It is expected that these measures will go along way in ensuring the best possible environmental management and compliance with relevant legislations and standards. Key elements involved in environmental management include: leadership and commitment; policy and objectives; organisation, resources and documentation; evaluation and risk management; planning;

implementation and monitoring; auditing and review. These make up an effective management systems. The proponent is thus committed for continuous improvement through minimizing the environmental impact of project operations and complying with applicable environmental laws or statutes and providing adequate staff training.

The ESMP developed in this ESIA report is rigid and we expect alterations would be made as work proceeds and relevant changes proposed which should be as per the required standards of operations and those that promote best practices for environmental management. For this case, the document is not a stand-alone, there is need to undertake the work in reference to other statutory legislations and industry codes as well as other client management policies that relate to effective and proactive project execution. However, the document is at the centre of the ESIA process and its implementation during the project lifecycle will greatly improve the operational efficiency of Khalala Hydropower Project.

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APPENDICES



No. PVT-DLUBEEM

CERTIFICATE OF INCORPORATION

I hereby **CERTIFY** that,

KHALALA HYDRO POWER KENYA LIMITED

is on this date 29 Mar 2018 Incorporated under the Companies Act, 2015 and that the Company is a **PRIVATE LIMITED COMPANY**.



.....
Registrar Of Companies

This is a system generated certificate. To validate this document send the word **BRS** to **21546**



www.kra.go.ke

PIN Certificate

For General Tax Questions
Contact KRA Call Centre
Tel: +254 (020) 4999 999
Call: +254(0711)099 899
Email: callcentre@kra.go.ke

Certificate Date : 03/04/2018

Personal Identification Number

P061689297K

This is to certify that taxpayer shown herein has been registered with Kenya Revenue Authority

Taxpayer Information

Taxpayer Name	KHALALA HYDRO POWER KENYA LIMITED
Email Address	KHALAHDROPOWER@YAHOO.COM

Registered Address

L.R. Number : 209/245	Building : MILLENIUM HOUSE
Street/Road : OFF KAMITI ROAD	City/Town : NAIROBI
County : Nairobi	District : Kasarani District
Tax Area : Roysambu	Station : North of Nairobi
P. O. Box : 632	Postal Code : 00618

Tax Obligation(s) Registration Details

Sr. No.	Tax Obligation(s)	Effective From Date	Effective Till Date	Status
1	Income Tax - Company	03/04/2018	N.A.	Active

The above PIN must appear on all your tax invoices and correspondences with Kenya Revenue Authority. Your accounting end month is December unless a change has been approved by the Commissioner-Domestic Taxes Department. The status of Tax Obligation(s) with 'Dormant' status will automatically change to 'Active' on date mentioned in "Effective Till Date" or any transaction done during the period. This certificate shall remain in force till further updated.

Disclaimer : This is a system generated certificate and does not require signature.

FORM 7

(r.15(2))



**NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)
THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT
ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE**

License No : NEMA/EIA/ERPI/8802

Application Reference No: NEMA/EIA/EL/12305

M/S Ecotech Engineering Limited
(individual or firm) of address

P.O. Box 70491-00400 Nairobi


is licensed to practice in the


capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Firm of Experts**
registration number **8215**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **1/9/2019**

Expiry Date: **12/31/2019**

Signature... 

(Seal)
 **Director General**
**The National Environment Management
Authority**



FORM 7



(r.15(2))

**NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)
THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT**

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/8800

Application Reference No: NEMA/EIA/EL/12303

M/S **MOSES ULANGA MUISYO**
(individual or firm) of address

P.O. Box 70491-00400, Nairobi


is licensed to practice in the


capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert**
registration number **7688**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

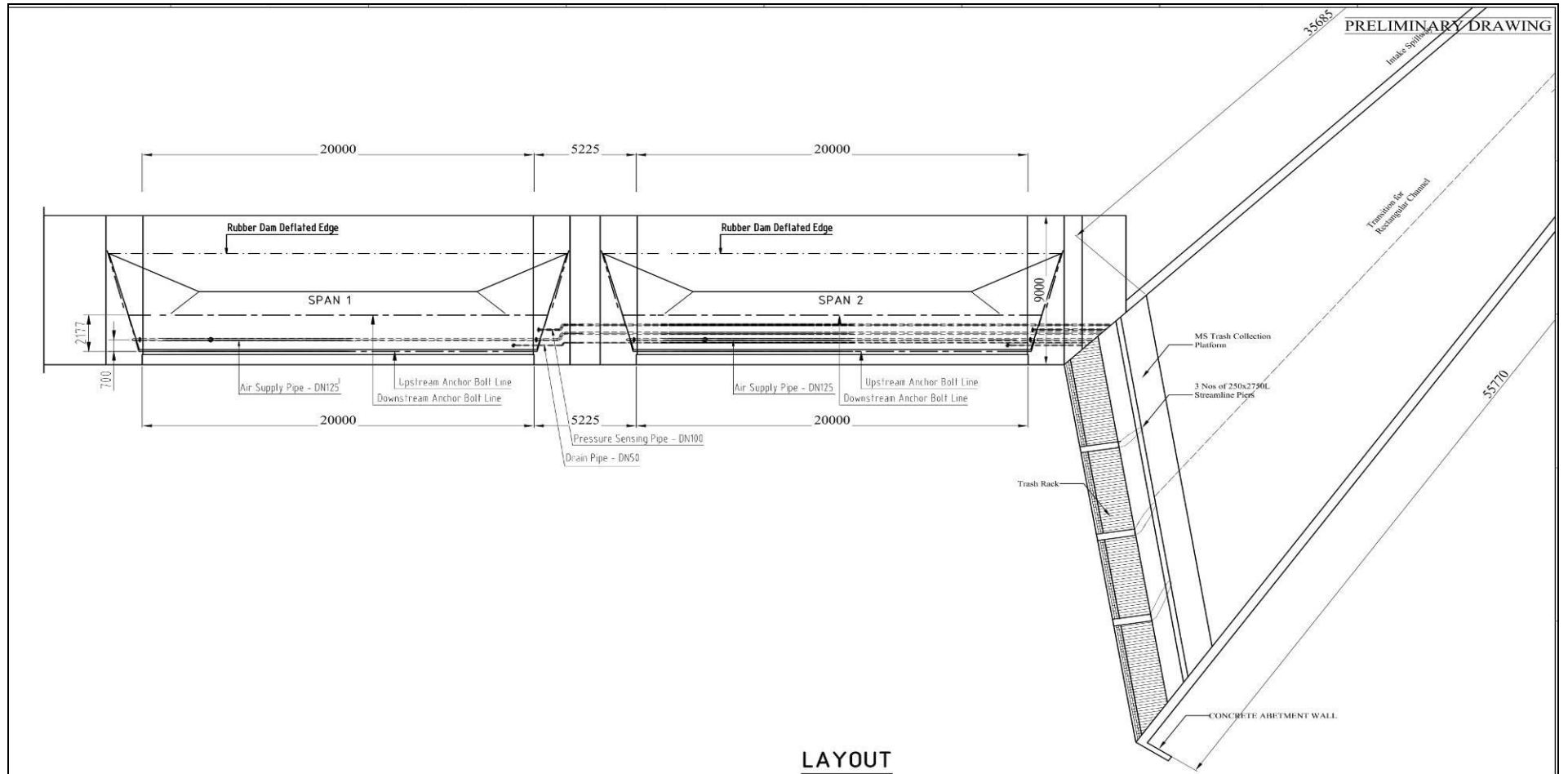
Issued Date: **1/9/2019**

Expiry Date: **12/31/2019**

Signature..... 

(Seal)
 **Director General**
**The National Environment Management
Authority**

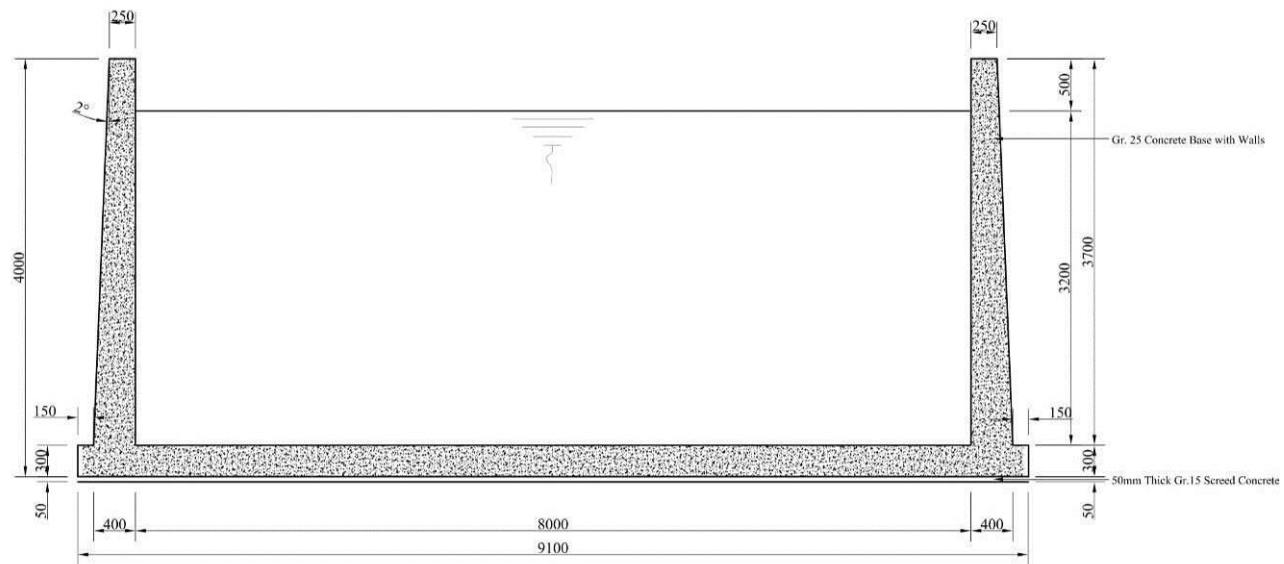
PROJECT LAYOUT DRAWINGS



LAYOUT

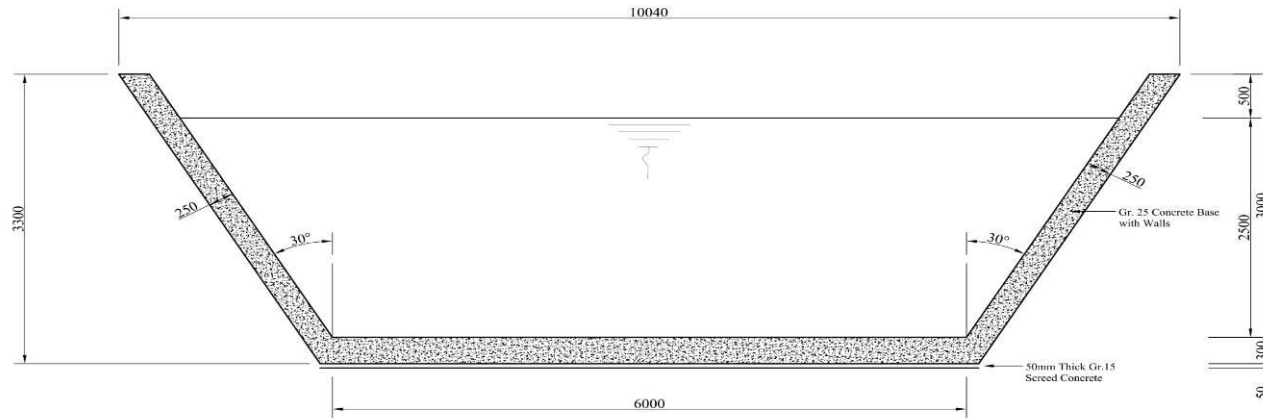
Revision		No.	Date	Made by	Client	Project	
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					EPC Contractor	Title LAYOUT DETAIL OF WEIR	
					VS Hydro Pvt. Ltd.	Drg.No.	VSC/KHLL/WER/LAY/003
					Design Engineer	Design	Ranga
					VS Consulting Pvt. Ltd.	Drawn	Prasad
						Checked	
						Approved	
						Scale	1 : 200
						Date	07/12/2018

PRELIMINARY DRAWING



HEADRACE CHANNEL DETAILS - TYPE 1

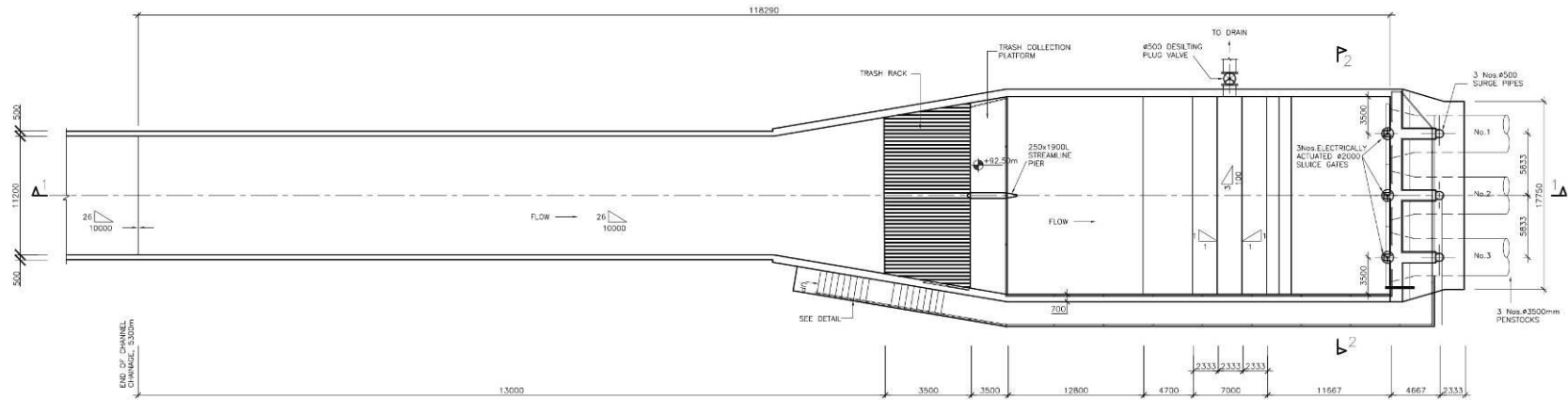
- Note:
HEADRACE CHANNEL
01. ALL DIMENSIONS ARE IN MILLIMETERS
 02. ALL R/C CONCRETE TO BE TYPE GR25(20mm) UNLESS OTHERWISE SPECIFIED.
 03. ALL SCREED/PAVIL CONCRETE TO BE TYPE 13(125mm) UNLESS OTHERWISE SPECIFIED.
 04. CANAL BED LEVEL SHALL BE MAINTAINED ACCURATELY, AS SPECIFIED.
 05. COVER TO MAIN RIFT (VERTICAL) 50mm, minimum cover 40mm.
 06. REER SHALL BE PROVIDED MONOTONICALLY WITH THE BASE SLAB.
 07. LAP LENGTHS & ANCHORAGE LENGTHS AS PER BS 8110.
 08. SURFACE FINISH OF THE INTERNAL FACE OF THE CANAL CLASS F3 FINISH
 09. REINFORCEMENT LAPPING PLACES AND LAP LENGTHS SHALL BE APPROVED BY THE ENGINEER.
 10. REFER TO CANAL L/S DRAWING FOR INVERT & WALL TOP LEVELS.



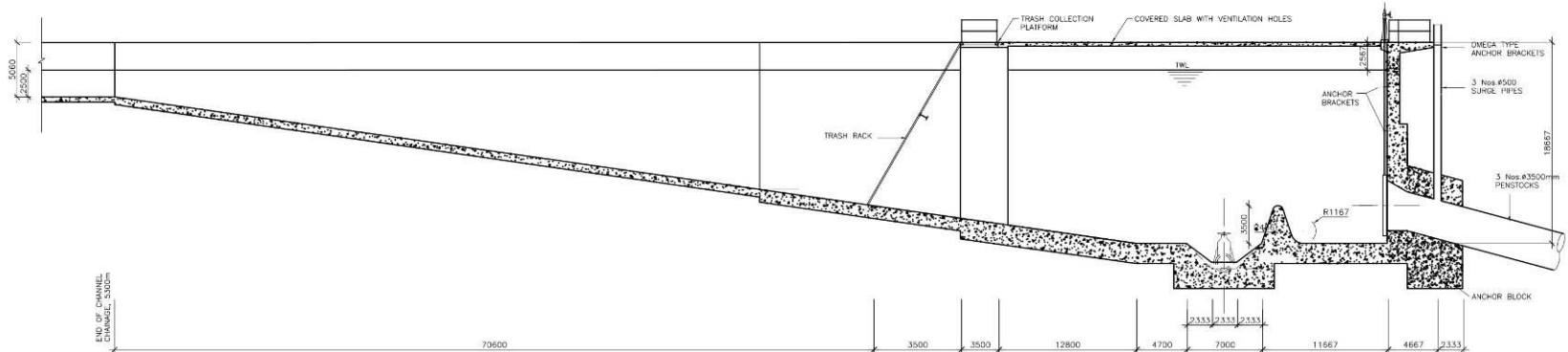
HEADRACE CHANNEL DETAILS - TYPE 2

- Notes:**
HEADRACE CHANNEL
 01. ALL DIMENSIONS ARE IN MILLIMETERS.
 02. ALL R/R CONCRETE TO BE TYPE GR.25(20mm) UNLESS OTHERWISE SPECIFIED.
 03. ALL SCREED/INFL. CONCRETE TO BE TYPE 1:3&25(5mm) UNLESS OTHERWISE SPECIFIED.
 04. CANAL BED LEVEL SHALL BE MARKED ACCURATELY, AS SPECIFIED.
 05. COVER TO MAIN R/R (VERTICAL) SHALL BE 40mm.
 06. BRIS SHALL BE PROVIDED MECHANICALLY WITH THE BASE SLAB.
 07. LAP LENGTHS & ANCHORAGE LENGTHS AS PER R/S 11.05.
 08. SURFACE FINISH OF THE INTERNAL FACE OF THE CANAL-CLASS F3 FINISH.
 09. REINFORCEMENT LAPPING PLACES AND LAP LENGTHS SHALL BE APPROVED BY THE ENGINEER.
 10. REFER TO CANAL L/S DRAWING FOR INVERT & WALL TOP LEVELS.

Revision		No.	Date	Made by	Client	Project
					VS Hydro Pvt. Ltd.	KHALALA HYDROPOWER PROJECT
					Client's Engineer	Title TYPICAL CHANNEL SECTION - TYPE 2
					EPC Contractor	Drg.No. VSC/KHLL/HRC/DTL/001
					Design Engineer	Scale 1 : 50
					VS Consulting Pvt. Ltd.	Date 07/12/2018
2	3	4	5	6	7	8



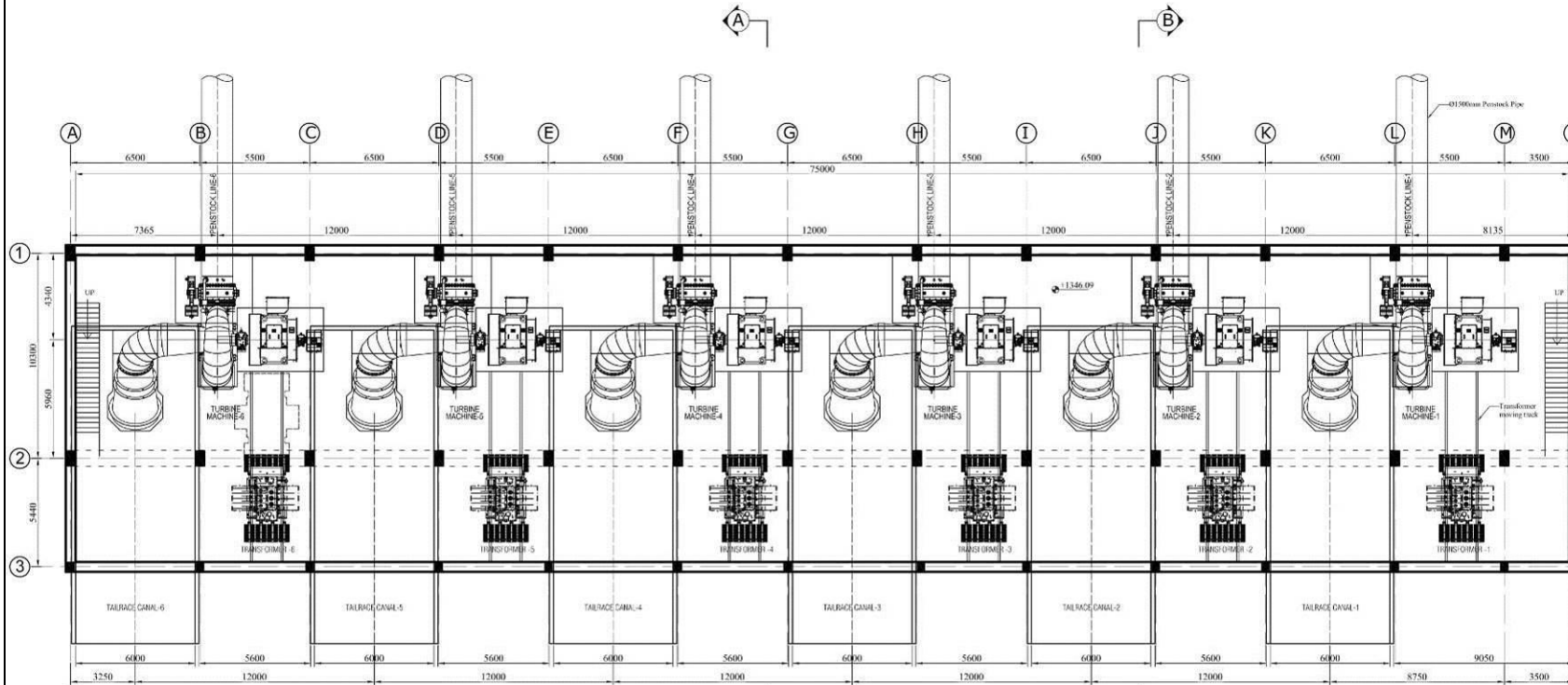
PLAN
SCALE 1:100



SECTION 1-1
SCALE 1:100


Revision				No.	Date	Made by	Client	Project
							Client's Engineer	KHALALA HYDROPOWER PROJECT
							EPC Contractor	Title LAYOUT DETAIL OF FOREBAY TANK
							Design Engineer	Drg.No. VSC/KHLL/FBY/LAY/001
								Design Ranga
								VS Hydro Pvt. Ltd.
								VS Consulting Pvt. Ltd.
							Design Engineer	Approved
							Drawn Prasad	Scale 1 : 400
							Checked	Date 07/12/2018

PRELIMINARY DRAWING



MACHINE FLOOR LAYOUT
(Level=1413.73)

Revision	No.	Date	Made by	Client	Project
				Client's Engineer	KHALALA HYDROPOWER PROJECT
				EPC Contractor	Title POWER HOUSE - BASEMENT FLOOR
				VS Hydro Pvt. Ltd.	Drg.No. VSC/KHLL/PHS/LAY/003
				Design Engineer	Approved
				VS Consulting Pvt. Ltd.	Scale 1 : 200
					Checked Date 07/12/2018

	WATER RESOURCES AUTHORITY	
	TITLE: Water Sample Analytical Certificate – Physical Chemical Results	REF. NO : F/9/1/3
		ISSUE NO : 04
	DEPARTMENT: Technical	REV. NO : 03
	ISSUED BY: DTCM	DATE OF ISSUE: 15 th April 2013
AUTHORISED BY : TCM	Page : 2 of 2	

Comments by Head of Laboratory

Coloured turbid water with high iron content . Treatment is recommended

Name: MARGARET WATURU
ATCM-CENTRAL WATER TESTING LABORATORIES

Signature: *M. Waturu* Date: 07/04/2013



Issued by: *[Signature]*
(Deputy Technical Coordination Manager)

Approved by: *[Signature]*
(Technical Coordination Manager)



WATER RESOURCES AUTHORITY

TITLE: Water Sample Analytical
Certificate – Physical Chemical Results

REF. NO : F/9/1/3

ISSUE NO : 04

DEPARTMENT: Technical

REV. NO : 03

ISSUED BY: DTCM

AUTHORISED BY : TCM

Page : 1 of 2

Serial No:

Sample No: 1371

Name of Customer: ECOTECH ENGINEERING LTD

Address:

Purpose of Sampling: DOMESTIC

County: BUNGOMA

Date Sampled: 13/12/2018

Date Received: 17/12/2018


Source: KHALALA MSABALE POWER HOUSE

Date Compiled: 07/01/2019

RIVER WP 248 WS - 001, WEBUYE WEST

PARAMETERS	UNIT	RESULTS	WHO STANDARDS	KEBS(KS 459-1:2007) STANDARDS
pH	pH Scale	6.88	6.5-8.5	6.5-8.5
Colour	mgPt/l	350	Max 15	Max 15
Turbidity	N.T.U	298	Max 5	Max 5
Conductivity (25 ⁰ C)	μS/cm	97.3	Max 2500	-
Iron	mg/l	2.39	Max 0.3	Max 0.3
Manganese	mg/l	<0.01	Max 0.1	Max 0.5
Calcium	mg/l	9.6	Max 100	Max 150
Magnesium	mg/l	2.92	Max 100	Max 100
Sodium	mg/l	3.2	Max 200	Max 200
Potassium	mg/l	4.3	Max 50	-
Total Hardness	mgCaCO ₃ /l	36	Max 500	Max 300
Total Alkalinity	mgCaCO ₃ /l	52	Max 500	-
Chloride	mg/l	3	Max 250	Max 250
Fluoride	mg/l	0.21	Max 1.5	Max 1.5
Nitrate	mgN/l	3.50	Max 10	-
Nitrite	mgN/l	0.058	Max 0.1	Max 0.003
Sulphate	mg/l	<0.3	Max 450	Max 400
Free Carbon Dioxide	mg/l	12	-	-
Total Dissolved Solids	mg/l	60.33	Max 1500	Max 1000
Arsenic	μg/l	-	Max 10	Max10
Others		-		

Name of Analyst: JORAM KIHUMBA **Signature:** 

	WATER RESOURCES AUTHORITY	
	TITLE: Water Sample Analytical Certificate – Physical Chemical Results	REF. NO : F/9/1/3
		ISSUE NO : 04
	DEPARTMENT: Technical	REV. NO : 03
	ISSUED BY: DTCM	DATE OF ISSUE: 15 th April 2013
AUTHORISED BY : TCM	Page : 2 of 2	

Comments by Head of Laboratory

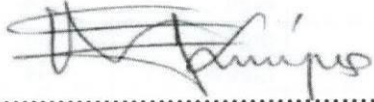
Coloured turbid water with high Iron content. Treatment is recommended to make the water suitable for domestic use.....

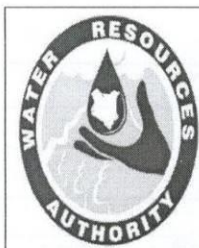
Name: MARGARET WATURU
 ATCM-CENTRAL WATER TESTING LABORATORIES

Signature:  Date: 07/01/2019

Issued by: 
 (Deputy Technical Coordination Manager)



Approved by: 
 (Technical Coordination Manager)



WATER RESOURCES AUTHORITY

TITLE: Water Sample Analytical
Certificate – Physical Chemical Results

REF. NO : F/9/1/3

ISSUE NO : 04

DEPARTMENT: Technical

REV. NO : 03

ISSUED BY: DTCM

AUTHORISED BY : TCM

Page : 1 of 2

Serial No:

Sample No: 1373

Name of Customer: ECOTECH ENGINEERING LTD

Address: -

Purpose of Sampling: DOMESTIC

County: BUNGOMA

Date Sampled: 13/12/2018

Date Received: 21/12/2018

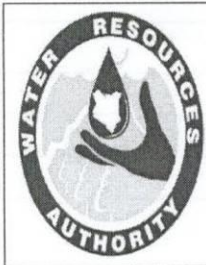
Source: KHALALA BRIDGE RIVER NZOIA AT

Date Compiled: 07/01/2019

INTAKE POINT WP 260 WS - 004 WEBUYE WEST

PARAMETERS	UNIT	RESULTS	WHO STANDARDS	KEBS(KS 459-1:2007) STANDARDS
pH	pH Scale	7.46	6.5-8.5	6.5-8.5
Colour	mgPt/l	350	Max 15	Max 15
Turbidity	N.T.U	328	Max 5	Max 5
Conductivity (25 ^o C)	µS/cm	102.3	Max 2500	-
Oil & Grease	mg/l	2.56	Max 0.3	Max 0.3
Manganese	mg/l	0.02	Max 0.1	Max 0.5
Calcium	mg/l	11.2	Max 100	Max 150
Magnesium	mg/l	2.44	Max 100	Max 100
Sodium	mg/l	3.4	Max 200	Max 200
Potassium	mg/l	4.4	Max 50	-
Total Hardness	mgCaCO ₃ /l	38	Max 500	Max 300
Total Alkalinity	mgCaCO ₃ /l	34	Max 500	-
Chloride	mg/l	3	Max 250	Max 250
Fluoride	mg/l	0.21	Max 1.5	Max 1.5
Nitrate	mgN/l	3.68	Max 10	-
Nitrite	mgN/l	0.076	Max 0.1	Max 0.003
Sulphate	mg/l	<0.3	Max 450	Max 400
Free Carbon Dioxide	mg/l	4	-	-
Total Dissolved Solids	mg/l	51.65	Max 1500	Max 1000
Arsenic	µg/l	-	Max 10	Max10
Others		-		

Name of Analyst: JORAM KIHUMBA **Signature:** 



WATER RESOURCES AUTHORITY

TITLE: Water Sample Analytical
Certificate – Physical Chemical Results

REF. NO : F/9/1/3

ISSUE NO : 04

DEPARTMENT: Technical

REV. NO : 03

ISSUED BY: DTCM

DATE OF ISSUE: 15th April 2013

AUTHORISED BY : TCM

Page : 2 of 2

Comments by Head of Laboratory

Coloured turbid water with high iron content . Treatment is recommended

Name: MARGARET WATURU
ATCM-CENTRAL WATER TESTING LABORATORIES

Signature: 

Date: 07/01/2019


Issued by:

(Deputy Technical Coordination Manager)

Approved by:

(Technical Coordination Manager)



	WATER RESOURCES AUTHORITY	
	TITLE: Water Sample Analytical Certificate – Physical Chemical Results	REF. NO : F/9/1/3
	DEPARTMENT: Technical	ISSUE NO : 04
	ISSUED BY: DTCM	REV. NO : 03
	AUTHORISED BY : TCM	Page : 1 of 2

Serial No:

Name of Customer ECOTECH ENGINEERING LTD

Purpose of Sampling: DOMESTIC

Date Sampled: 13/12/2018

Source: SITIKHO, RIVER NZOIA WP 254, WS - 003, WEBUYE WEST

Sample No: 1374

Address: -


County: BUNGOMA

Date Received: 17/12/2018

Date Compiled: 07/01/2019

PARAMETERS	UNIT	RESULTS	WHO STANDARDS	KEBS(KS 459-1:2007) STANDARDS
pH	pH Scale	7.30	6.5-8.5	6.5-8.5
Colour	mgPt/l	425	Max 15	Max 15
Turbidity	N.T.U	329	Max 5	Max 5
Conductivity (25 ⁰ C)	μS/cm	105.9	Max 2500	-
Iron	mg/l	2.23	Max 0.3	Max 0.3
Manganese	mg/l	0.04	Max 0.1	Max 0.5
Calcium	mg/l	9.6	Max 100	Max 150
Magnesium	mg/l	3.89	Max 100	Max 100
Sodium	mg/l	3.27	Max 200	Max 200
Potassium	mg/l	4.4	Max 50	-
Total Hardness	mgCaCO ₃ /l	40	Max 500	Max 300
Total Alkalinity	mgCaCO ₃ /l	48	Max 500	-
Chloride	mg/l	5	Max 250	Max 250
Fluoride	mg/l	0.20	Max 1.5	Max 1.5
Nitrate	mgN/l	4.13	Max 10	-
Nitrite	mgN/l	0.068	Max 0.1	Max 0.003
Sulphate	mg/l	<0.3	Max 450	Max 400
Free Carbon Dioxide	mg/l	8	-	-
Total Dissolved Solids	mg/l	65.66	Max 1500	Max 1000
Arsenic	μg/l	-	Max 10	Max 10
Others		-		

Name of Analyst JORAM KIHUMBA Signature 

	WATER RESOURCES AUTHORITY	
	TITLE: Water Sample Analytical Certificate – Physical Chemical Results	REF. NO : F/9/1/3
		ISSUE NO : 04
	DEPARTMENT: Technical	REV. NO : 03
	ISSUED BY: DTCM	DATE OF ISSUE: 15 th April 2013
AUTHORISED BY : TCM	Page : 2 of 2	

Comments by Head of Laboratory

The water is chemically suitable for domestic use as per parameters tested.

Name: MARGARET WATURU
 ATCM-CENTRAL WATER TESTING LABORATORIES

Signature: *M. Waturu* Date: 7/01/2019



Issued by: *[Signature]*

(Deputy Technical Coordination Manager)

[Signature]

Approved by:

(Technical Coordination Manager)



Kenya Agricultural & Livestock Research Organization
National Agricultural Research Laboratories
 P. O. Box 14733, 00800 NAIROBI
 Tel: 020-2464435
 Email: soilabs@yahoo.co.uk



SOIL TEST REPORT

Name	Khalala Hydro-Power Limited
Address	P. O. Box 77 - 00618, Ruaraka
Location of farm	Sitikho, Webuye West, Bungoma
Crop(s) to be grown	
Date sample received	20-Dec-18
Date sample reported	10-Jan-19
Reporting officer (through Director NARL)	A. Chek

Soil Analytical Data								
Field	4							
Lab. No/2018	8216							
Soil depth cm	top							
Fertility results	value	class	value	class	value	class	value	class
* Soil pH	4.77	strong acid						
Exch. Acidity me%	0.6	high						
* Total Nitrogen %	0.10	low						
* Total Org. Carbon %	0.83	low						
Phosphorus ppm	10	low						
Potassium me%	0.10	low						
Calcium me%	1.0	low						
Magnesium me%	1.56	adequate						
Manganese me%	0.64	adequate						
Copper ppm	1.45	adequate						
Iron ppm	86.0	adequate						
Zinc ppm	5.28	adequate						
Sodium me%	0.18	adequate						

* ISO/IEC 17025 accredited

Interpretation and Fertilizer Recommendation

The soil pH acidic for crops' growth. Acidifying fertilizers like DAP and urea should be avoided. Nitrogen, phosphorus, potassium and calcium are deficient. Soil organic matter content is low. **Recommendations:** To raise the soil pH and calcium content liming with 300 kg/acre of agricultural lime is recommended 4 weeks before planting. At land preparation apply 4 tons/acre of well decomposed manure or compost. Mix well with the soil. At planting time apply 150 kg/acre of compound fertilizer N:P:K 17:17:17. Top dress with 100 kg/acre of CAN.

NOTE: Test results are based on customer sampled sample(s).
 Methods used: Information is given out on client's request.



Kenya Agricultural & Livestock Research Organization
National Agricultural Research Laboratories
 P. O. Box 14733, 00800 NAIROBI
 Tel: 020-2464435
 Email: soilabs@yahoo.co.uk



SOIL TEST REPORT

Name	Khalala Hydro-Power Limited
Address	P. O. Box 77 - 00618, Ruaraka
Location of farm	Sitikho, Webuye West, Bungoma
Crop(s) to be grown	
Date sample received	20-Dec-18
Date sample reported	10-Jan-19
Reporting officer (through Director NARL)	A. Chek

Soil Analytical Data								
Field	3							
Lab. No/2018	8215							
Soil depth cm	top							
Fertility results	value	class	value	class	value	class	value	class
* Soil pH	5.81	medium acid						
* Total Nitrogen %	0.06	low						
* Total Org. Carbon %	0.57	low						
Phosphorus ppm	5	low						
Potassium me%	0.10	low						
Calcium me%	0.6	low						
Magnesium me%	2.44	adequate						
Manganese me%	0.31	adequate						
Copper ppm	1.26	adequate						
Iron ppm	80.2	adequate						
Zinc ppm	5.00	adequate						
Sodium me%	0.24	adequate						

* ISO/IEC 17025 accredited

Interpretation and Fertilizer Recommendation

The soil pH satisfactory for crops' growth. Acidifying fertilizers like DAP and urea should be avoided. Nitrogen, phosphorus, potassium and calcium are deficient. Soil organic matter content is low. **Recommendations:** At land preparation apply 4 tons/acre of well decomposed manure or compost. Mix well with the soil. At planting time apply 50 kg/acre of CAN and 150 kg/acre of compound fertilizer N:P:K 17:17:17. Top dress with 100 kg/acre of CAN.

NOTE: Test results are based on customer sampled sample(s).
 Methods used: Information is given out on client's request.



Kenya Agricultural & Livestock Research Organization
National Agricultural Research Laboratories
 P. O. Box 14733, 00800 NAIROBI
 Tel: 020-2464435
 Email: soilabs@yahoo.co.uk



SOIL TEST REPORT

Name: Khalala Hydro-Power Limited
 Address: P. O. Box 77 - 00618, Ruaraka
 Location of farm: Sitikho, Webuye West, Bungoma
 Crop(s) to be grown:
 Date sample received: 20-Dec-18
 Date sample reported: 10-Jan-19
 Reporting officer (through Director NARL): A. Chek

Soil Analytical Data								
Field	1		2		5			
Lab. No/2018	8213		8214		8217			
Soil depth cm	top		top		top			
Fertility results	value	class	value	class	value	class	value	class
* Soil pH	4.03	extreme acid	4.81	strong acid	4.43	extreme acid		
Exch. Acidity me%	1.0	high	0.5	adequate	0.8	adequate		
* Total Nitrogen %	0.12	low	0.08	low	0.06	low		
* Total Org. Carbon %	1.07	low	0.66	low	0.46	low		
Phosphorus ppm	5	low	5	low	10	low		
Potassium me%	0.35	adequate	0.29	adequate	0.06	low		
Calcium me%	0.4	low	0.8	low	0.4	low		
Magnesium me%	0.10	low	0.21	low	0.02	low		
Manganese me%	0.11	adequate	0.93	adequate	0.60	adequate		
Copper ppm	1.60	adequate	1.23	adequate	1.30	adequate		
Iron ppm	116	adequate	104	adequate	76.1	adequate		
Zinc ppm	5.53	adequate	5.94	adequate	5.17	adequate		
Sodium me%	0.30	adequate	0.18	adequate	0.10	adequate		

* ISO/IEC 17025 accredited

Interpretation and Fertilizer Recommendation

All fields have similar soil fertility status. The soil pH acidic for crops' growth. Acidifying fertilizers like DAP and urea should be avoided. Nitrogen, phosphorus, potassium, calcium and magnesium are deficient. Soil organic matter content is low. **Recommendations:** To raise the soil pH, calcium and magnesium content liming with 400 kg/acre of dolomitic lime (dolmax or magmax) is recommended 4 weeks before planting. At land preparation apply 4 tons/acre of well decomposed manure or compost. Mix well with the soil. At planting time apply 150 kg/acre of compound fertilizer N:P:K 17:17:17. Top dress with 100 kg/acre of CAN.

NOTE: Test results are based on customer sampled sample(s).
 Methods used: Information is given out on client's request.

BUNGOMASTAKEHOLDER CONSULTATION SHEET FOR THE PROPOSED KHALALA HYDROPOWER PROJECT











Venue: Elegant Hotel Date: 19th December, 2018

S/N	Name	Institution/Department	Designation	Contact	Sign
1	Michael Ngunji	Lands	Works Officer	0722851514	
2	Hastings Khush	Lands	Physical Planner	0711588727	
3	DAVID WAKWABUSI	Bungoma Town	Businessman	0714696233	
4	Tom D. Obunga	County Govt (West)	Adm. Officer	0726445822	
5	JERRY KAPULA	GREEN ENERGY	PLANNING	0795095022	
6	ISAIAH LUSWETI	KHALALA HYDRO	ADM.	0720958706	
7	JOSEPH MBUGUA	KHALALA HYDRO	CO-ORDINATOR	0738545434	
8	Thomas WANDERA	MIN ENVIRONMENT	Environmental Office Nairobi	0710518927	
9	BIFWOLI BENJAMIN	TAREK	DRIVER	0716713022	
10	Evans Wacfula Makori	Kenya Human Rights	ACTIVIST	0713744612	

SHEETS

KAKAMEGA STAKEHOLDER CONSULTATION SHEET FOR THE PROPOSED KHALALA HYDROPOWER PROJECT

Venue: Highway Guest House Date: 20th December, 2018

S/N	Name	Institution/Department	Designation	Contact	Sign
1	Zablon W. Shuleyo	Department of Environment + KKG	Director Environment	0722362233	
2	John-K Gichy	Department of water CGK	SCWO	0722-569156	
3	HANNINGTON MAINA	MINISTRY OF LANDS KAKAMEGA	ADMIN OFF	0724622355	
4	DAISIE OKUMU	MINISTRY OF LANDS KAKAMEGA COUNTY	ADMINISTRATOR	0721732495	
5	HENRY S. NAYTO	DOP	SNR ASSTANT	0717408877	
6	ABUBAKAR M. NANDIKOVE	DOP	SNR CHIEF	0722673344	
7	STEPHEN K. MUNDUA	D.O.P	ASST	0727947839	
8	JOSEPH MBUGUA	V.S HYDRO	COORDINATOR	0738545484	
9	ISAIAH LUSWETI	V.S HYDRO	OPS	0720-958706	
10	FRANCIS M. MURRAY	CGK - Public Works	Director - Energy	0721732078	

BUNGOMASTAKEHOLDER CONSULTATION SHEET FOR THE PROPOSED KHALALA HYDROPOWER PROJECT

Venue: Elegant Hotel Date: 19th December, 2018

S/N	Name	Institution/Department	Designation	Contact	Sign
1	DEHMUS HGEYWA NATHOTHU	OHE ACRE FUND	FIELD OFFICER	0719255072	
2	ANNE WILSON	INTERIOR	AD I	0728345893	
3	Belvaud Namukhaya	Btm County	Office of the CECM Office of National Resour	07244-345069	
4	Benard Wangala	NEMA	O/A	0720870984	
5	Seolastica Mukoya	Trade Engery & Industrialisation	DDA	0722618355	
6	Oyesmyns Makhanu	Agriculture Department	CDA	0713419039	
7	ALLAN MURORO	BGMKOTI - MINISTRY OF WATER.	EDG.	0705800825	
8	HENRY KERE	M.O.A	DAVEN	0722551119	
9					
10					

SAMPLES OF PUBLIC PARTICIPATION SHEETS

MUSABALE, 10/12/2018

2:pm-5pm

Stakeholder contacts Sheet-Bungoma

S/N	Name	Contact	Area/Village
1	Gladys Namalwa Murutu		Musabale
2	Janet Manyasa		Musabale
3	DORICAN N. SIFUNA	0729667248	"
4	Electine Murutu	0796185156	"
5	Kurera M Murutu		"
6	ANDREW W Kurya	0727 618835	Okhanyu
7	HELLEN N WADILA		"
8	Pauline N Buluma	0796734550	Musabale
9	Emilia M MANYASA	0798025067	"
10	Jane Njiride		"
11	Brendah Muchuku		"
12	Catherine Wafu	0714727202	"
13	Larino Muchuku		"
14	Sikuku Michael	0799029756	"
15	EDWARD W. WANJALA	0711205441	"
16	Jackline W. Wajula	071120571441	"
17	DEMMIS WANJALA	0723590938	"
18	SHEIKHA SIMILE	0702602692	"
19	Joseph W Muturu	0775694411	Musabale
20	Peter Muchuku	0790656711	"
21	Eliud MASIBO	0700436270	Siranyatu
22	Christopher Khisa	0702602692	Musabale
23	George Wexesa	0717555225	Siranyatu
24	Siranos M Murutu	0723718196	Musabale
25	EVANS W. NTONGES	0715158443	Nambindo
26	Winstone Muchuku	074432236	Musabale
27	John Wekulo Murutu	07	"
28	Nickson Sifuna Okumu	0715922949	Siranyatu
29	Pastor Okoth		Musabale
30	Michael Wanjala	0706436454	Nambindo
31	John Nyongesa	0705758349	Musabale
32	Patricia Owino	0700475486	Musabale
33	Valentine Wajula	0716476903	Musabale
34	Jane N. Masenle	0704055847	Musabale
35	Martin Wanjama	0799630360	Musabale
36	Rosemary Mayabi	07	Musabale
37	Hilary M Mayabi	0798167508	"
38	David Wafu	0702068250	Nambindo
39	Samuel Otieno	0790259159	Musabale
40	Bernard Wabwile	0708958946	Nambindo
41	David Makhanu	0726785011	Nambindo

MUSABALE, 10/12/2018, 2 pm - 5 pm

Stakeholder contacts Sheet-Bungoma

S/N	Name	Contact	Area/Village
1.	EMILIO W. K. K. W. K.	0704587174	Musabale
2	WYCLIFFE S MURITU	0711197340	MUSABALE
3	TARIPI W MURITU	0714727299	MUSABALE
4	WILSON MUKHWANA	0719406750	MUSABALE
5	COLIN J SIKUKU	0711197340	MUSABALE
6	Clady mwata	0704587174	Musabale
7	James Wabwile Muchangi	---	Sirangitu
8	Benedict Bwansa	---	Nambindo
9	Anthony Chuska	---	Musabale
10	Dismas Nyongesa	0719406750	Musabale
11	Edward Bansi Masibo	0719130882	Nambindo
12	Raphael Oketo	0701149032	Musabale
13	James Wanyang'	---	Sango
14	ERIC SIFUNA	0719662501	NDAKARA
15	Peter Wabwile	---	Musabale
16	Rashid Wanyang'	0710726553	Nambindo
17	Edward Nyongesa	---	Nambindo
18	Mike Bukhebi	---	Nambindo
19	ISAAC MASIBO	0707863423	---
20	Allan Oketch	0746025171	Musabale
21	ALEX ODHAMBU	---	Nambindo
22	Domnick Wanyang'	0797188986	Musabale
23	WAFIKA WAFIKA	---	---
24	JOHN JIMATI	070283800	SPURK
25	Jylia SIKUKU	0745925283	Musabale
26	Nelson Wikefa	0716335978	Nambindo
27.	Ezekiel Wanjala Simijo	0706060135	Nambindo

BUNTOH AP CAMP; - 11/12/2018

Stakeholder contacts Sheet-Bungoma

S/N	Name	Contact	Area/Village
1	LENN ETUMBI	0714090938	MORONO
2	MERCY ETUMBI	0707091420	II
3	GLADYS MUKOBI	0712329285	*
4	JANE M & SIMLYU	0736636048	SINDIRO
5	KERRECCA WETIBA	0786365852	MURONO
6	EUNICE WANJALA	0761251124	HOSPITAL
7	EVERLYNE TEMBU	07	MURONO
8	John W. Okun	0702183815	KHALALA WEST
9	Wycliffe M. KHAFERA	0710462253	KWYWA
10	SAMUEL W-RAMBANYA	0701073408	MWEMBULA
11	TEMBU GOLDMAN	0712887721	MURONO
12	SARAH WABIKLE	0706649114	MWEMBULA
13	GEORGE WAFULA	0717366464	SITIKHO
14	Joseph MURATA KAPWILE	0723060839	MWEMBULA
15	JAFAR MUSA MWITERI	0726249989	MWEMBULA
16	JANE WANJALA	07	BUKHOLI
17	Athight waswa	0718881060	MWEMBULA
18	GLADYS NAFULA	0799054519	MWEMBULA
19	EMMACULATE SKIKVA	0707853298	MWEMBULA
20	EMELDAH SIMLYU	07	MORONO
21	SARAH NYONGEKA	0723059722	BUKHOLI
22	RUTH WAFULA	07903751520	II

SITIKHO

Stakeholder contacts Sheet-Bungoma

S/N	Name	Contact	Area/Village
1	JOSEPH B. MACHELE	0716200265	NAMBINDO
	THOMAS W MAINA	0722773276	KISENGWA
	RIPSON M. WAKOU	0701303050	Welemba
	Christine M. trabwile	0701628639	Welemba
	Alfred M. Mung'ali	0715451062	KISENGWA
	Humphrey W. Chumurgu	-	SITIKHO
	JOSHUA W. MUKHANA	0711450900	SITIKHO
	Peter S. Wanjala	0725366663	SITIKHO
	Wanjala Bonface	0703337641	SITIKHO
	ABRAHAM MALAYA	0717367134	SITIKHO
	Dominic WANJALA	0712453099	SITIKHO
	STANLEY WANYONYI	0714994677	KISENGWA
	BONFACE WEKESA	0791378256	SITIKHO
	WILLIAM WANJWE	0720586478	WELEMBWA
	CLYTON WANJALA	0711339030	JELIMINYI
	CALEB WANJALA	0703192861	SITIKHO
	JOSEPH WANAMBUKO	0718617726	KHALALA EAST
	BONFACE NYARAKA BEN	0713122696	SPAX Jeliminyi
	Josephat Bitonyake	0705352606	Jeliminyi
	MARK SIMIYU	0715695194	SITIKHO
	Leonard Manyasi	0745136023	SITIKHO
	PATRICK MAKHETI	0729535975	KISENGWA
	JOSEPH SIMIYU	0711472028	WELEMBWA
	FRANCIS N. WALUMBE	0718582702	MILGLE
	Charles Munkata	-	SUKALU FAN
	Benjamin Wamakwa	0723662554	KISENGWA
	SAMSON SIFUNA	0718944224	MUMEMBULE
	Misiko M. Albert	0713589781	Welembwa
	John Sifung Misiko	0708767120	Welembwa
	Felix Nabwile Welulu	0795301106	SITIKHO
	Abraham Wanjala Maina	0703322913	KISENGWA

SITIKHO

Stakeholder contacts Sheet-Bungoma

S/N	Name	Contact	Area/Village
1	Erind Wacoli	0704920424	Welenba
2	Peter Mandila	079509402	KISENGWA
3	Funice Chinyingi		KISENGWA
4	Zipporah Mandila	0734604245	KISENGWA
5	JADE M. KENDU	0717757875	KISENGWA
6	Juma Wanjala	0902531491	CHELIMINYI
7	EDWARDA W. WANGAIA	0911205144	CHELIMINYI
8	ROBERT WANGAIA	074445999	MWEMBULA
9	PETER WAMUKOIA	0798035401	MWEMBULA
10	BEATRICE SAMBURUMA	0712215754	KISENGWA
11	BENARD -M. MULAMA	0716292445	KISENGWA
12	Lakoli Tala	0740881179	Welenba
13	MARITA MORAA	0722686859	CHELIMINYI
14	DANIEL S. BARASA	0714129054	CHELIMINYI
15	MOSES K. KUBUNDA	0718491908	EWELEMBIA
16	PETER DENNIS WANYAMA	0724306322	WELCMBIA
17	Joseph Kubingile	0721222761	Welenba
18	Evans Ouko Sinyu	0713951723	Welenba
19	Robert Masing	0726396689	Sipaki
20	Kilbest Wabwile Makanya	0725170472	Kisengwa
21	Josephant Wechuli	0715882146	Khalala West
22	Jane Kasambeli	—	Milele
23	Catherine Sifuna	0788571860	Milele
24	Job Wanjala	0728323042	Milele
25	Delix Wechuli	0795301106	Sitikho
26	Wycliffe Waanga	0713122696	Sipaki
27	Jarius Makab	0710851098	Milele
28	Patrick Wanjala	0745996872	MWEMBULA
29	Patrick Wanjala	0701981040	CHELIMINYI
30	Michael Wanjala	0700834984	MUSABALE
31	Albert Muziko	0713589781	Welenba
32	John Sifuna	0708767120	Welenba
33	Peter Barasa	0710374422	Kisengwa
34	Richard Khiso	0713780918	Welenba
35	Nyehffee Boraga	0724023831	Welenba
36	Oliver Wacoli	0733811664	Welenba
37	Humphrey Sifuna	0740114269	Kisengwa
38	Andrew Wanjala Muntu	0704587974	MUSABALE
39	Dickson S. Wanjala	—	Welenba
40	Morris J. Khayembu	0717820461	Sipaki
41	Agnes Chinyingi	—	Welenba
42			

SITIKHO

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S/N	Name	Contact	Area/Village
1	Joel Ombati Mwangi	0750716739	Social sefengwa
2	Brian Osore	0721204196	Social Ecogrowth
3	Edward Mungu Kimani	0710785077	Environmentalist
4	JOSEPH MBUGUA	0725381212	Social
5	MOSES MUNITA	0721171916	ENVIRONMENTALIST
6	JOHN W. MURUDU - MCHIE	0720350955	AREA MCHIE
7	HENRY WANYONYI	0718880282	KISENGWA
8	STEPHEN MAYARI	0707951227	CHELIMINYI
9	JOEL WETCHULI	0700294808	CHELIMINYI
10	JOSEPH Bitonyake Wanjala	0705307220	CHELIMINYI
11	JOHAM BURITIBI	0726714425	WELIMBA
12	MATHEW WANYONYI	0791290947	KISENGWA
13	Patrick Wakesa	0729871331	Welemba
14	MUSA WAWIRE	-	II
15	SAKARIA SIFUNA	0712978807	KISENGWA
16	AMOS M. NAMUNYU	0211653878	KISENGWA
17	JACOB W. SIFUNA	0717367215	KISENGWA
18	SIFUNA WANJALA	0720954981	CHELIMINYI
19	Timona Wakesa Opicho	0710820005	KISENGWA
20	Donald Wakhunga Wabusoba	0723867013	KISENGWA
21	Emmanuel Wanjala	0708147996	Chelimity
22	HUMPHREY SIFUNA	0740114264	KISENGWA
23	Havison Muehuru	0710502223	
24	Easter Seita	0708635295	KISENGWA
25	Annah Wanyama	0729494699	Welemba
26	Sarah Atieno	0706811303	KISENGWA
27	ABREY SIFUNA	0713241033	MWERE
28	philimon W Chinyingi	0706257932	KISENGWA
29	DAVID OKUMU OKIMA	0757315906	cheliminyi
30	Ben N Namasaka	0796227966	Welemba
31	protus Simiyu	0748509292	Welemba
32	Paul Simiyu Okumu	0716773483	II
33	Ben Sifuna Namunyu	0727877676	KISENGWA
34	Shimalei Seita	0715346997	II
35	Carolyn Wanjala	0791210923	SITIKHO
36	Rose Jomo		SITIKHO
37	BENSON WANJAMA	071707008	CITIKHO
38	WILBERT CHAKA	0710676978	SPARKI
39	DICKSON SIEKISA	0725020867	CITIKHO
40	Nelson W Wangwe	0720989410	Welemba
41	Haron W Njaranje	0718652974	Welemba
42	Abraham W Mwangi	0724938833	Welemba

**ECOTECH ENGINEERING LIMITED***Environment-Cum-Engineering Company.*

To Whom It May Concern,

Dear Sir/Madam,

Re: Environmental and Social Impact Assessment/ RAP Study for Khalala Hydropower in Bungoma County

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Hydropower is generated wherever a flow of water descends from a higher level to a lower level. The head can also be created artificially by constructing a weir to create a barrier to water flow, raising the upstream water level to the desired elevation and construction of other project features.

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Email: ecotechengineeringlimited@gmail.com

Yours sincerely,
Moses Muisyo,

Lead Consultant and Team Leader

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Received
Muisyo
BUNGOMA COUNTY ADMINISTRATOR
WEBUYE WEST SUB-COUNTY
10 DEC 2018
BUNGOMA COUNTY
Box 586-50205, WEBUYE

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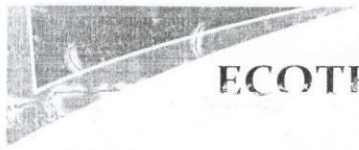
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ecotech

5th December, 2018

07 DEC 2018

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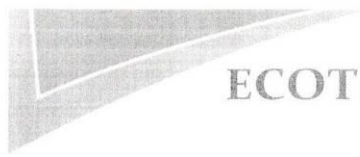
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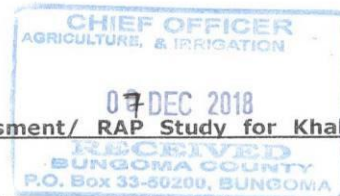


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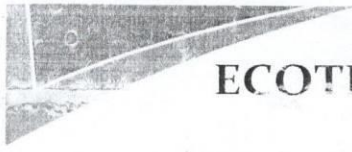
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Your views will form part of the ESIA report and recommendations thereof will be part of the Environmental and Social Management plan (ESMP), for the project in Sitikho, Webuye West Sub-County. Thanking you in advance and looking forward to the opportunity to meet with you;

Contact: (+254)721-171-916/ (+254)736-876-437
Email: ecotechengineeringlimited@gmail.com

Yours sincerely;
Moses Muisyo,

Lead Consultant and Team Leader

P. O. Box 70491-00200 Nairobi, Kenya | Tel: +254 721 171 916, +254 736 876 437
Email: ecotechengineeringlimited@gmail.com | www.ecotechengineeringlimited.com

5th December, 2018

To Whom It May Concern,

Dear Sir/Madam,

Re: Environmental and Social Impact Assessment/ RAP Study for Khalala Hydropower in Bungoma County

Khalala Hydropower Kenya Ltd is a company licensed by the Ministry of Energy to carry out hydropower potential assessment and development activities in the middle reaches of Nzoia River located in Sitikho Sub-location, Webuye West Sub-County, Bungoma County. The Environmental Management and Coordination Act, 2015 requires that before any project is implemented, an Environmental and Social Impact Assessment (ESIA) must be carried out in the intended project area to ascertain the environmental and social impacts such a project might have on the surrounding area.

Ecotech Engineering Limited is a firm licensed by NEMA to carry out Environmental and Social Impact Assessments with a speciality in a wide array of sectors inclusive of renewable energy development. The company has been commissioned to conduct an ESIA and RAP for the proposed 28MW Khalala Hydropower Plant on behalf of Khalala Hydropower Kenya Ltd.

Hydropower is generated wherever a flow of water descends from a higher level to a lower level. The head can also be created artificially by constructing a weir to create a barrier to water flow, raising the upstream water level to the desired elevation and construction of other project features.

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ECOTECH ENGINEERING LIMITED

Environment-Cum-Engineering Company.



5th December, 2018

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Moses Muisyo,

Lead Consultant and Team Leader



7/12/018

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Moses Muisyo,

Lead Consultant and Team Leader

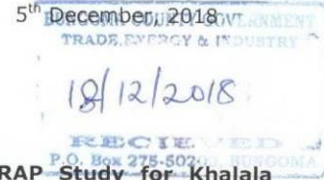
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ECOTECH ENGINEERING LIMITED

Environment-Cum-Engineering Company.



ecotech



To Whom It May Concern,

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Re: Environmental and Social Impact Assessment/ RAP Study for Khalala Hydropower in Bungoma County

Khalala Hydropower Kenya Ltd is a company licensed by the Ministry of Energy to carry out hydropower potential assessment and development activities in the middle reaches of Nzoia River located in Sitikho Sub-location, Webuye West Sub-County, Bungoma County. The Environmental Management and Coordination Act, 2015 requires that before any project is implemented, an Environmental and Social Impact Assessment (ESIA) must be carried out in the intended project area to ascertain the environmental and social impacts such a project might have on the surrounding area.

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MINUTES OF THE PUBLIC MEETING HELD ON 19/12/2018 AT ELEGANT HOTEL IN KANDUYI FOR THE PROPOSED KHALALA HYDROPOWER PROJECT ON RIVER NZOIA

DATE: 19/12/2018

TIME: 10:00 am-13: 00 pm

VENUE: Elegant Hotel, Kanduyi Town

Members Present

S/N	NAME	INSTITUTION/ORGANIZATION
1	Dennis Ngeywa Wanyonyi	One Acre Fund
2	Anne Wilson	State Department of Interior Coordination
3	Bernard Namukhaywa	Ministry of Water and Natural Resources, Bungoma County
4	Bernard Wangala	National Environment Management Authority, Bungoma County
5	Scolastica Mukoya	Ministry of Trade Energy and Industrialization, Bungoma County
6	Onesmus Makhanu	Department of Agriculture, Bungoma County
7	Allan Mulongo	Ministry of Water, Bungoma County
8	Henry Kere	Ministry of Agriculture, Bungoma County
9	Michael Ngunji	Ministry of Lands, Bungoma County
10	Hastings Khisu	Ministry of Lands, Bungoma County
11	David Wakwabubi	Businessman
12	Tom Obunga	County Administrator, Webuye Sub-County
13	Jesse Wafula	Trade Energy
14	Isaiah Lusweti	Khalala Hydro
15	Joseph Mbugua	Khalala Hydro
16	Thomas Wandela	Ministry of Environment, Bungoma County
17	Bifwoli Benjamin	Tared
18	Evans Wafula	Kenya Human Rights Commission

Agenda

1. Project brief
2. Project impacts
3. Concerns/comments raised
4. Responses to concerns/comments
5. Meeting Adjournment

Minute 1: Project Brief

The meeting started with Mr. Erick Ochieng; Social Expert giving a brief description of the proposed project. He informed the members that Khalala Hydropower has proposed to establish a 28MW Khalala Hydropower Project along River Nzoia to be fed into the national grid. Mr. Ochieng explained that Ecotech Engineering Limited had been consulted by the proponent; Khalala Hydropower Kenya Limited to conduct an Environmental and Social Impact Assessment study and a Resettlement Action Plan for the project. He also gave an overview of the relevant laws and regulations as well as the methodology adopted by Ecotech for the proposed project.

Mr. Moses Muisyo; the Project Team Leader informed the members of the proposed site location in Sitikho area and justified the project stating it would increase power supply in the country and is geared towards reducing climate change as recommended by IPCC. He further elaborated on the key project features and their specific location details.

Minute 2: Project Impacts

Ecotech Limited team explained to the community that the proposed project will have both positive and negative impacts.

Some of the positive impacts associated with the proposed project include;

- Creation of direct and indirect employment opportunities
- Opening up of Khalala area and Webuye area to investment opportunities/ Economic growth of the project area
- Generation of more power to be fed into the national grid
- Development of local infrastructure e.g. access roads
- Revenue generation to the National Government and County Government of Bungoma

Some of Negative impacts associated with the proposed project include;

- Displacement/ disruption of people's livelihood means
- Vegetation clearing and disturbance and waste generation
- Increased vehicle and equipment movement
- Influx of people in the project area leading to pressure on existing social infrastructure
- Disruption of fishing areas along River Nzoia

However, the Ecotech ESIA team stated that mitigation measures would be developed for the anticipated negative impacts associated with the proposed Khalala Hydropower Project.

Mr. Moses Muisyo then invited the members to give comments or concerns regarding the proposed project.

Minute 3: Issues raised

Issues and concerns raised are outlined below

a) Public participation

The stakeholders present wanted to know if public and the local community members had been met and what the response was. The ESIA team responded to the concern by telling them that the community response was positive and they welcomed the project.

b) Community livelihood disruption

The representatives from the community social services wanted to know how compensation and resettlement approaches resulting will be addressed.

c) Development Program

A member wanted to know the amount of water that will be diverted or abstracted and if the proponent had liaised with the County and National Departments of Water to learn of development program in the area. The proponent representative responded to this by letting the members aware that the project as its initial stages and at the right time then the relevant lead agencies will be aged at a later time.

The representative from the Department of Energy wanted to know if the proponent had engaged the County Government as they were not aware of the proposed project prior to the ESIA study. The client representative assured the stakeholders that they have a planned schedule of events and when the time comes they will be engaged.

Members were concerned as how the project will affect agriculture. The members were assured that in case of any destruction to crops then compensation will be effected. This would cover both crops grown on loan basis and those established by the farmers themselves. A member wanted to know if there were plans to incorporate Sitikho falls to the future plans. However, the proponent representative in the meeting clarified that there were no plans to integrate the same in the design.

d) Environmental flow

A representative wanted to know the Environmental Flow allocated to the project. This was not answered in the stakeholder forum as the hydro-geological report was not yet shared to the ESIA team. The members also wanted the water users association in the project area to be engaged. However, from the findings of the ESIA study, we established that there is no formal Water Resource Users Association in the area.

e) NEMA Licensing

A member wanted to know when the project will be issued with a license. The NEMA Environmental Officer present in the forum, indicated that the project is categorized under the Second schedule of EMCA cap 387 and the same will be used in licensing the project as per the timelines.

Minute 4: Meeting adjournment

Mr. Moses Muisyo thanked the members for participating in the meeting and adjourned the meeting at 1:00 PM.

MINUTES OF THE PUBLIC MEETING HELD ON 20/12/2018 AT FRESH HIGHWAY GUEST HOUSE IN AMALEMBA, KAKAMEGA FOR THE PROPOSED KHALALA HYDROPOWER PROJECT ON RIVER NZOIA

DATE: 20/12/2018

TIME: 11:00 am-13.00 pm

VENUE: Highway Guest Hotel, Kakamega Town

Members Present

S/N	NAME	INSTITUTION/ORGANIZATION
1	Zablon W. Shilenje	Department of Environment, Kakamega County
2	John K. Gichu	State Department of Water, Kakamega County
3	Hannington Maina	Ministry of Water and Natural Resources, Bungoma County
4	Caleb Okumu	Ministry of Lands Kakamega
5	Henry S. Nauto	Ministry of Lands Kakamega
6	Abubakar. M Nandikove	Office of the President, Senior Chief
7	Stephen K. Muanga	Office of the President
8	Joseph Mbugua	Khalala Hydropower
9	Isaiah Lusweti	Khalala Hydropower
10	Francis M. Mwangi	Publics Works, Director Energy, Kakamega County Government

Agenda

1. Project brief
2. Project impacts
3. Concerns/comments raised
4. Responses to concerns/comments
5. Meeting Adjournment

The meeting was called to order by an opening prayer from Mr. Muisyo.

Minute 1: Project Brief

The meeting started with Mr. Eric Ochieng giving a brief description of the proposed project. He informed the members that Khalala Hydropower has proposed to establish a hydropower project along River Nzoia that would generate 28MW to be fed into the national grid. Mr. Ochieng explained that Ecotech Engineering Limited has been consulted to conduct an Environmental Social Impact Assessment study and a Resettlement Action Plan for the project. He gave an overview of the relevant laws and regulations to the proposed project.

Mr. Moses Muisyo informed the members of the proposed site location in Sitikho area and justified the project stating it would increase power supply in the country and is geared towards reducing climate change as recommended by the Intergovernmental Panel on Climate Change (IPCC).

Minute 2: Project Impacts

Ecotech Limited team explained to the community that the proposed project will have both positive and negative impacts.

Some of the positive impacts associated with the proposed project include;

- Creation of direct and indirect employment opportunities
- Opening up of Khalala area and Webuye area to investment opportunities
- Generation of more power to be fed into the national grid
- Development of local infrastructure e.g. access roads
- Revenue generation to the National Government and County Government of Bungoma

Some of Negative impacts associated with the proposed project include;

- Displacement of people
- Vegetation clearing
- Waste generation
- Influx of people in the project area
- Disruption of fishing areas along River Nzoia

However, the ESIA team stated that mitigation measures would be developed for the anticipated negative impacts associated with the proposed project.

Minute 3: Issues raised

Mr. Moses Muisyo from Ecotech invited the members to give comments or concerns regarding the proposed project. Issues and concerns raised are outlined below;

- ✓ Cumulative Impacts of the project.
- ✓ Feasibility study done in 2015.
- ✓ Impacts of the project on the livelihood of people in the project area.
- ✓ Number of people affected by the project and compensation arrangements.
- ✓ Benefits of the project to the local people (CSR).
- ✓ How will the project cover the power deficit in the country
- ✓ Water quality status
- ✓ Time frame of the project

Minute 4: Response to public issues/concerns

Cumulative Impacts of the project

The cumulative impacts have been assessed in the current ESIA and mitigation measures provided for the same. This was guided by the identification of the existing water abstractors in the project area.

Feasibility study done in 2015

A pre-feasibility study was undertaken in 2015 but this might not be for the proposed Khalala Hydropower Project.

Impacts of the project on the livelihood of people in the project area

The client representative noted in the meeting that any land acquired will be on willing seller and buyer basis. He also added that any damages to crops and infrastructure will also be in line with relevant laws and compensation will be effected.

Number of people affected by the project and compensation arrangements

The total number of PAPs affected was subject to confirmation from the client updated list but the acreage was approximately 202 but this was still under review with the client.

Benefits of the project to the local people (CSR)

The client representative in the forum indicated that the relevant CSR for the community will be determined at a later date in partnership with the local administration as well as the County Government.

How will the project cover the power deficit in the country?

The implementation of the project will help lessen the gap of the current deficit in Kenya

Lack of Title deeds

Most of the PAPs have no registered title deeds. The project proponent thus has to engage the local administration for the relevant approach in addressing the land issues during acquisition.

Water quality status

Relevant Samples were collected and monitoring will be undertaken through collection of samples.

Time frame of the project

The project time line will be depended on the time the relevant approvals are obtained.

Minute 5: Meeting adjournment

Mr. Moses Muisyo thanked the members for participating in the meeting and offered a closing prayer.

MINUTES OF THE PUBLIC MEETING HELD ON 10/12/2018 AT SITIKHO CENTRE FOR THE PROPOSED KHALALA HYDROPOWER PROJECT IN WEBUYE WEST SUB-COUNTY OF BUNGOMA COUNTY

Present

1. Assistant Chief Sitikho Sub-Location (John Murutu)
2. Village elders
3. Khalala Hydropower Project Representatives
4. Ecotech Engineering Limited
5. Community members from Kisengwa, Welemba and Cheliminyi villages

Opening prayers and remarks

The meeting started with opening remarks by the Assistant Chief, Mr. John Murutu and a prayer by one of the community members. The chief then invited the Khalala Hydropower representative to sensitize the community about the proposed project.

Project Brief

Mr. Joseph Mbugua, the proponent's representative, informed the community that the project proponent has proposed to establish a hydropower project along River Nzoia that would generate 28MW to be fed into the national grid. He stated that the project is currently seeking approvals from relevant Government authorities and would kick off once all approvals are acquired.

Environmental Impact Social Impact Assessment (ESIA)

The consultant explained that all development projects like the proposed Khalala Hydropower Project must be subjected to an Environmental Social Impact Assessment as stipulated in Environmental Impact Assessment/ Environmental Audit Regulations, 2003. The team explained that they would therefore be conducting the ESIA for the proposed project to determine its environmental, socioeconomic and cultural impacts and how negative impacts would be mitigated.

Public Participation

The consultant informed to the community members that the Constitution of Kenya requires that the members of the public be consulted before implementation of any project in their area. The community members were requested to fill the public participation questionnaires and meeting attendance sheet as proof that they were consulted. The community members were also given a chance to raise comments and issues regarding the proposed project.

Anticipated Project Impacts

The Environmental Social Impact Assessment team explained to the community that the proposed project will have both positive and negative impacts.

Some of the positive impacts associated with the proposed project include;

- Creation of direct and indirect employment opportunities
- Opening up of Khalala area and Webuye area to investment opportunities
- Generation of more power to be fed into the national grid
- Development of local infrastructure e.g. access roads

- Revenue generation to the National Government and County Government of Bungoma

Some of Negative impacts associated with the proposed project include;

- Displacement of people
- Vegetation clearance
- Waste generation
- Influx of people in the project area in search of employment opportunities
- Disruption of fishing areas along River Nzoia

However, the ESIA team stated that adequate mitigation measures would be developed for the anticipated negative impacts associated with the proposed project.

Resettlement Action Plan

The community members were made aware that the proposed project would traverse private land and may result into displacement of people and disruption of livelihood activities. The community was assured that people whose land and property will be affected by the project will be compensated after making an agreement with the land owners. A Resettlement Action Plan/Land Acquisition and Compensation Plan will be developed to guide the compensation process for the affected land and property.

Public concerns/comments and responses

- **Employment Opportunities**

The community urged the project proponent to make sure locals are given priority when offering employment opportunities. Some members reported that they had a history of projects employing people from other regions and they would not like that to happen during implementation of Khalala Hydropower Project.

The proponent representative assured the community that priority for employment opportunities would be given to the locals especially for unskilled labour. Recruitment will be conducted in a transparent manner and will involve the area Chief and village elders.

- **Commitment of proponent to implement the project**

It was reported that other proponents with similar hydropower projects had consulted the public but the projects never kicked off. The community members were sceptical about the commitment of the proponent to implement the Khalala Hydropower Project and needed an assurance from the proponent.

The proponent representative emphasized the level of seriousness that the proponent has towards the implementation of the proposed project. He further informed the community that the project would begin immediately upon receipt of all the required approvals and compensation made to those whose property/land will be affected.

- **Compensation**

The residents sought clarification on how compensation would be made to those whose land or property will be affected by the project.

They were informed that compensation will be paid to all people whose land/property will be affected by the project. Compensation will be made only when the proponent enters

into agreement with land owners. The Resettlement Action Plan report will document all affected properties and appropriate valuation to be paid to the owners.

- **Free electricity**

The community members requested the proponent to consider providing free electricity to the locals within a 5 km radius of the project area. They alleged that some of the previous similar project proponents who had come to the area had promised to supply free electricity to the residents within a 5km radius.

It was clarified that according to the Kenyan laws, an electricity generating company is not mandated to distribute electricity, a function that is currently a preserve of the Kenya Power Company. The community was therefore advised to liaise with the Rural Electrification Authority through their area Member of Parliament to facilitate power connection.

Meeting adjournment

The chief thanked the community for participating in the meeting and urged the proponent to implement the project as soon as possible. The meeting ended at 12:30PM with a prayer from a community member.

MINUTES OF THE PUBLIC MEETING HELD ON 11/12/2018 AT BUKHOOLI ASSISTANT CHIEF CENTRE FOR THE PROPOSED KHALALA HYDROPOWER PROJECT IN WEBUYE WEST SUB-COUNTY OF BUNGOMA COUNTY

Present

6. Assistant Chief Sitikho Sub-Location (John Murutu)
7. Village elders
8. Khalala Hydropower Project Representative
9. Ecotech Engineering Limited
10. Community members: Mwembula village, Murono Village and Sitikho village

Opening prayers and remarks

The meeting commenced with the Assistant Chief's brief remarks, and a prayer by one of the community members. The chief then invited Khalala Hydropower representative to sensitize the community members about the proposed project.

Project Brief

Mr. Joseph Mbugua, proponent's representative in the meeting informed the community that the company has proposed to establish a hydropower project along River Nzoia that would generate 28MW to be fed into the national grid. He stated that the project is currently seeking approvals from relevant Government authorities and would kick off once all approvals are acquired.

Environmental Impact Social Impact Assessment (ESIA)

Ecotech Engineering Limited explained to the community that development projects like the proposed Khalala Hydropower Project must be subjected to an Environmental Social Impact Assessment as stipulated in Environmental Impact Assessment/Environmental Audit Regulations, 2003. The team explained that they would therefore be conducting the ESIA for the proposed project to determine its environmental, socioeconomic and cultural impacts and how negative impacts would be mitigated.

Public Participation

Ecotech Limited explained to the community members that the Constitution of Kenya requires that the members of the public be consulted before implementation of any project in their area. The community members were requested to fill the public participation questionnaires and meeting attendance sheet as proof that they were consulted. The community members were also given a chance to raise comments and issues regarding the proposed project.

Anticipated Project Impacts

The Environmental Social Impact Assessment team explained to the community that the proposed project will have both positive and negative impacts.

Some of the positive impacts associated with the proposed project include;

- Creation of direct and indirect employment opportunities
- Opening up of Khalala area and Webuye area to investment opportunities
- Generation of more power to be fed into the national grid
- Development of local infrastructure e.g. access roads

- Revenue generation to the National Government and County Government of Bungoma

Some of Negative impacts associated with the proposed project include;

- Displacement of people
- Vegetation clearing
- Waste generation
- Influx of people in the project area
- Disruption of fishing areas along River Nzoia

However, the ESIA team stated that mitigation measures would be developed for the anticipated negative impacts associated with the proposed project.

Resettlement Action Plan

The community members were made aware that the proposed project would traverse through private land and would result to displacement of people. The community members were assured that people whose land and property will be affected by the project must be compensated after making an agreement with the land owners. A Resettlement Action Plan will be compiled to help make compensations for the affected land and property.

Public concerns/comments/feedback

- **Employment Opportunities**

The community urged the project proponent to make sure locals are given priority when offering employment opportunities. Some members reported that they had a history of projects employing people from other regions and they would not like that to happen during implementation of Khalala Hydropower Project.

The proponent representative assured the members that priority for employment opportunities would be given to the locals especially for unskilled labour. Employment will be conducted in a transparent way and will involve the area Chief and village elders.

- **Commitment of proponent to implement the project**

It was reported that other proponents with similar hydropower projects had consulted the public but the projects have never been implanted. The community members were sceptical about the commitment of the proponent to implement Khalala Hydropower Project and needed an assurance from them.

The proponent representative explained that the proponent is very committed to implement the project. The proponent will begin as soon as all the approvals are acquired and compensation made to all whose property/land will be affected.

- **Compensation**

The residents needed clarification on how compensation would be made to those whose land or property will be affected by the project.

Compensation will be paid to all people whose land/property will be affected by the project. Compensation will be made only when the proponent enters into agreement with

land owners. The Resettlement Action Plan report will document all affected properties and appropriate valuation to be paid to the owners.

- **Free electricity**

The community members requested the proponent to consider providing electricity for the locals within 5km radius at no cost. They stated that previous proponents who had come to the area with a similar project had promised to connect the locals within a 5km radius at no cost.

The proponent is not mandated to connect the locals with power but only to generate power and pass it to Kenya Power for distribution. Therefore the community should liaise with Rural Electrification Authority through their area Member of Parliament to facilitate power connection.

Meeting adjournment

The chief thanked the community for participating in the meeting and urged the proponent to implement the project as soon as possible. The meeting ended at 12:30PM with a prayer from a community member.

MINUTES OF THE PUBLIC MEETING HELD ON 10/12/2018 AT MUSABALE CENTRE FOR THE PROPOSED KHALALA HYDROPOWER PROJECT IN WEBUYE WEST SUB-COUNTY OF BUNGOMA COUNTY

Present

11. Assistant Chief Sitikho Sub-Location (John Murutu)
12. Village elders
13. Khalala Hydropower Project Representative
14. Ecotech Engineering Limited
15. Community members: Musabale village, Nambindo Village and Siranjofu village

Opening prayers and remarks

The meeting started with opening remarks by the Assistant Chief, Mr. John Murutu and a prayer by one of the members. The chief then invited the Khalala Hydropower Limited representative to sensitize the members about the proposed project.

Project Brief

Mr. Joseph Mbugua from Khalala Hydropower Limited explained that the company has proposed to establish a hydropower project along River Nzoia that would generate 28MW to be fed into the national grid. He stated that the project is currently seeking approvals from relevant Government authorities and would kick off once all approvals are acquired.

Environmental Impact Social Impact Assessment (ESIA)

Ecotech Engineering Limited explained that all development projects like the proposed Khalala Hydropower Project must be subjected to an Environmental Social Impact Assessment as stipulated in Environmental Impact Assessment/Environmental Audit Regulations, 2003. The team explained that they would therefore be conducting the ESIA for the proposed project to determine its environmental, socioeconomic and cultural impacts and how negative impacts would be mitigated.

Public Participation

Ecotech Limited explained to the community members that the Constitution of Kenya requires that the members of the public be consulted before implementation of any project in their area. The community members were requested to fill the public participation questionnaires and meeting attendance sheet as proof that they were consulted. The community members were also given a chance to raise comments and issues regarding the proposed project.

Project Impacts

The Environmental Social Impact Assessment team explained to the community that the proposed project will have both positive and negative impacts.

Some of the positive impacts associated with the proposed project include;

- Creation of direct and indirect employment opportunities
- Opening up of Khalala area and Webuye area to investment opportunities
- Generation of more power to be fed into the national grid
- Development of local infrastructure e.g. access roads

- Revenue generation to the National Government and County Government of Bungoma

Some of Negative impacts associated with the proposed project include;

- Displacement of people
- Vegetation clearing
- Waste generation
- Influx of people in the project area
- Disruption of fishing areas along River Nzoia

However, the ESIA team stated that mitigation measures would be developed for the anticipated negative impacts associated with the proposed project.

Resettlement Action Plan

The community members were made aware that the proposed project would traverse through private land and would result to displacement of people. The community members were assured that people whose land and property will be affected by the project must be compensated after making an agreement with the land owners. A Resettlement Action Plan will be compiled to help make compensations for the affected land and property.

Public concerns/comments

- **Fishing activities**

Local fishermen in the project area were concerned that the project would interfere with their fishing activities and needed an assurance that they will be allowed to continue fishing.

The project will not restrict people from fishing in the river. However, some fishing grounds may be disrupted during project implementation. The fishermen and sand harvesters will continue with their activities during and after project implementation.

- **Employment Opportunities**

The community urged the project proponent to make sure locals are given priority when offering employment opportunities. Some members reported that they had a history of projects employing people from other regions and they would not like that to happen during implementation of Khalala Hydropower Project.

The proponent representative assured the members that priority for employment opportunities would be given to the locals especially for unskilled labour. Employment will be conducted in a transparent way and will involve the area Chief and village elders.

- **Gender Equity and Equality during Employment**

A number of women sought to know whether employment opportunities would be available for them during project implementation.

Women will be given equal opportunities with men for employment opportunities. The women were also advised that they could operate food businesses during construction phase to feed the construction workers.

- **Compensation**

The residents needed a clarification on how compensation would be made to those whose land or property will be affected by the project.

Compensation will be paid to all people whose land/property will be affected by the project. Compensation will be made only when the proponent enters into agreement with land owners. The Resettlement Action Plan report will document all affected properties and appropriate valuation to be paid to the owners.

- **Commitment of proponent to implement the project**

It was reported that other proponents with similar hydropower projects had consulted the public but the projects have never been implanted. The community members were sceptical about the commitment of the proponent to implement Khalala Hydropower Project and needed an assurance from them.

The proponent representative explained that the proponent is very committed to implement the project. The proponent will begin as soon as all the approvals are acquired and compensation made to all whose property/land will be affected.

Meeting adjournment

The chief thanked the community for participating in the meeting and urged the proponent to implement the project as soon as possible. The meeting ended at 5:30PM with a prayer from a community member.