



## Kenya Climate Smart Agriculture Sub-project (KCSAP)

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## Environmental and Social Impact Assessment Report of Proposed Sertonje Borehole Sub-project, Mugurin Sub Location, Mugurin Location, Kisanana Ward, Mogotio Sub County, Baringo County

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## CERTIFICATION

This Sub-project Report has been prepared by Laban C Labatt; Environmental impact assessment & Audit lead expert Reg. No.1065. The report has been done with reasonable skills, care, and diligence in accordance with the Environmental Management and Coordination Act CAP 387, and the Environmental (Impact Assessment and Audit), Regulations, 2003. We certify that the particulars given in this Report are correct to the best of our knowledge.

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## Abbreviations/Acronyms

|          |   |
|----------|---|
| CAACs    | Catchment Area Advisory Committees                          |
| CBD      | Convention on Biological Diversity                          |
| CBOs     | Community Based Organizations                               |
| CESSCO   | County Environment and Social Safeguards Compliance Officer |
| CoCs     | Combined oral Contraceptives                                |
| COP      | Conference of Parties                                       |
| COVID 19 | Corona Virus Disease 19                                     |
| CPP      | Consultation, Public Involvement, and Participation         |
| CPs      | Contracting Parties   |
| CRA      | County Revenue Allocation                                   |
| EA       | Environmental Audit   |
| EIA      | Environmental Impact Assessment                             |
| EMCA     | Environmental Management and Coordination Act               |
| ESIA     | Environment and social impact assessment                    |
| ESMP     | Environmental and Social Management Plan                    |
| GBV      | Gender Based Violence                                       |
| GHG      | Greenhouse Gas  |
| GoK      | Government of Kenya   |
| GRM      | Grievance Redress Management                                |
| HIV/AIDS | Human Immune Virus/Acquired Immune Disease Syndrome         |
| IAPs     | Interested and Affected Parties                             |
| KCSAP    | Kenya climate Smart Agriculture Project                     |
| KIHBS    | Kenya Integrated Housing Baseline Survey                    |
| MoF      | Ministry of Finance   |
| MOALF    | Ministry of Agriculture, Livestock and Fisheries            |
| MoLG     | Ministry of Local Government                                |
| MoU      | Memorandum of Understanding                                 |
| MW&I     | Ministry of Water Irrigation                                |
| NEMA     | National Environment Management Authority                   |
| NGOs     | Non-Governmental Organizations                              |
| NWCPC    | National Water Conservation and Pipeline Corporation        |
| SEA      | Sexual Abuse and Exploitation                               |
| SH       | Sexual Harassment   |
| SOP      | Standard Operating Procedure                                |
| Sq. Km   | Square Kilometers   |
| ToR      | Terms of Reference  |
| WA2016   | Water Act 2016  |
| WAB      | Water Appeal Board  |
| WDD      | Water Development Department                                |

|      |                                 |
|------|---------------------------------|
| WHO  | World Health Organization       |
| WRA  | Water Resource Authority        |
| WSB  | Water Services Board            |
| WSP  | Water Services Provider         |
| WSRB | Water Services Regulatory Board |
| WSRS | Water Sector Reform Secretariat |

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## EXECUTIVE SUMMARY

### **Project description**

The Government of Kenya (GoK) through the Ministry of Agriculture, Livestock, and Fisheries (MO ALF), State Department of Agriculture is implementing the Kenya Climate Smart Agricultural Project (KCSAP) in Baringo County. The project is financed by the World Bank.

**The Project Development Objective (PDO)** is “*to increase agricultural productivity and build resilience to climate change risks in the targeted smallholder farming and pastoral communities in Kenya, and in the event of an Eligible Crisis or Emergency, to provide an immediate and effective response.*” The project will have five components, detailed in the sections that follow: (i) Upscaling Climate-Smart Agricultural Practices; (ii) Strengthening Climate-Smart Agricultural Research and Seed Systems; (iii) Supporting Agro-weather, Market, Climate, and Advisory Services; (iv) Coordination and Management; and (v) Contingency Emergency Response. As mentioned, the project focuses on increasing agricultural productivity, enhancing resilience to impacts of climate change and reducing GHG emissions.

Mugurin is in a *rainfed marginal mixed farming livelihood zone* with livestock keeping as the main economic activity. Rainfall is very unreliable in the area, therefore, the community proposed the drilling and equipping of the Sertonje borehole with a submersible pump driven by solar power in order to address the water scarcity problem in the area. Two productive boreholes exist around this place but not within the vicinity of the selected site. These are Magoi Borehole which is 6.5km to the North West and Nambawan borehole 6.6km to the South East. The nearest source of water is a water pan located 5km away.

The proposed Sertonje borehole will be undertaken in Kapkundul primary school in Mugurin sub location, Kisanana ward in Mogotio Sub County at GPS coordinates 0° 4'43" N and 36° 2'57" E; UTM AA77; 5085ft above sea level. An agreement between the community water project on behalf of the community and the school board of management were made on allocation of a piece of land to the water project and the benefitting community individuals gave an authority for wayleave and sites for construction of tanks and watering troughs.

The hydrogeological study for the proposed borehole drilling has already been undertaken. The sub project implemented through the -KCSAP in the third tier at the community level has received counter funding from the Baringo County Government besides the WB financing. The

scope of the proposed sub-project will include the following: drilling of the borehole, installation of a submersible pump, rising main, Elevated water tank (100M<sup>3</sup>), Construction of pump house, construction of a water kiosk, water tanks and cattle water troughs

From the hydrogeological survey, the proposed borehole will be drilled to a depth of **not less than 200m and to a maximum of 220 m bgl.** A sustainable yield of approximately 4m<sup>3</sup>/hr. is expected. The proposed sub project construction cost is Kenya Shillings Fifteen Million, Nine Hundred and eighteen Thousand (**Ksh 15,918,000**). **The cost for the implementation of Environmental and Social Management and Monitoring Plan (ESMMP) is Kenya Shillings Six Hundred and five Thousand (Ksh 1,665,000/=)** which will be included in the contract sum.

The borehole is to supply water within the area for livestock, kitchen gardening (horticulture) and domestic use (2,720 cattle, 9,250 goats and sheep, and 2,950 people with 1,120 direct and 1,775 indirect beneficiaries). The daily water demand in the area is estimated to be **20m<sup>3</sup>/day**. On the basis of geological evidence, from the hydrogeological investigations carried out groundwater prospects for intended purposes (livestock and domestic use) are tenable.

The ESIA was carried out in compliance with the Kenya Government NEMA environmental regulation, section 138 (b) and 58 of the Environmental Management and Coordination Act Cap 387, and the World Bank Environment and Social Safeguards policies. KCSAP (Baringo County) contracted registered experts to carry out the environmental and social impact assessment and prepared this ESIA report.

The ESIA was commissioned in 3/12/2019 by the Proponent to assess the biophysical and human environments, including negative and positive impacts of the proposed drilling and equipping of the borehole and at assessing the socio – economic terrain in the project area. The Environmental and Social Impact Assessment (ESIA) study has been found necessary for this borehole drilling sub-project in order to incorporate environmental and Social issues during planning, design, construction, operation and decommissioning phases. From the screening and scoping results, it was recommended by NEMA that the proposed borehole drilling sub project be subjected to a partial environmental and social impact assessment.

The study was carried out using a number of methods; desk studies and literature review, field visits, Focus Group Discussions and observations, one public participation/sensitization by holding public barazas and two consultative meetings with stakeholders, discussions with technical representatives. The tools used in collection and recording of data were; questionnaires,

interview schedules and checklists. Filled in 27 questionnaires and 11 key informants checklists matrix have been included in the report (refer to annex 7). Community public participation was done through Barazas(refer annex 9).

The scope of this ESIA comprised: The baseline environmental and social status of the area; provisions of the relevant environmental laws; description of the proposed sub-project; public participation/sensitizations (community barazas, stakeholders consultative meetings); focus group discussions to identify any adverse environmental and social impacts from the proposed sub-project and the appropriate mitigation measures; and provision of an environmental management plan.

This ESIA took into consideration all the relevant legal, policy and institutional framework, key among them; the existing environmental regulatory framework EMCA Cap 387 and the Environmental (Impact Assessment and Audit) Regulations of June 2003, the World Bank Environment and Social Safeguards Policy, Occupational Health and Safety Act (2007), the Water Act (2016), wastes disposal regulation of 2006, environmental standards, and sustainable use of natural resources principles. Other relevant legislations to this ESIA that were considered gender promotion, HIV/AIDS prevention and control Act, and sexual Offences Act, among others. Kenya is also a signatory to a number of international conventions such as, framework Convention on Climate Change (UNFCCC) and Conservation of Biological Diversity (UNCBD) that have been evaluated in the study. The proposed borehole sub project through its implementation will trigger the following World Bank safeguard policies Environmental Assessment (OP 4.01) and Indigenous Peoples (OP 4.10). The safeguard policies ***Physical Cultural Resources (OP 4.11), Involuntary Resettlement (OP 4.12)Natural Habitats (OP 4.04), Pest Management (OP 4.09) and the Forests OP/BP 4.36. OP/BP 4.3.6. are not triggered in proposed sub project. This ESIA study has considered all the anticipated adverse impacts from the sub project and provided adequate mitigation measures.***

The stakeholders involved in public participation and consultation during the ESIA study were: Departments of Water and Irrigation; environment, natural resources, tourism, and wildlife; and agriculture and livestock; Water Resource Authority (WRA); local administration; School Board of Management; the Kisanana ward administrator and Mugurin Community members. The main concerns captured from the public participation and stakeholders consultation are: interference with the school learning programme due to noise generation particularly during construction

(drilling); safety of curious pupils wanting to find out about the borehole was raised; issue of water quality; water related conflicts; and sexual exploitation of women. The concerns have been incorporated and fully addressed in the chapters on public participation and consultations and impacts and mitigation measures.

The anticipated environmental and social benefits from the implementation of the proposed sub project are. *Creation of employment, Injection of money into the local and national economy, Increased access to water, Improved nutrition and food security, Increased participation of women in socio-economic development, Improved health and sanitation.*

Anticipated Negative Environmental and Social Impacts; Soil Compaction and Erosion, Groundwater pollution, Risk of Noise and vibrations, Risk of oil spillage/hazardous wastes, *Dust Emissions/Air Quality, Geological risks (Land subsidence, ejection of natural gas and/or hot geysers, Solid and Liquid Waste Generation, Disturbance of vegetation, Risk of accidents and health and safety concerns, Groundwater depletion/lowering of the water table, Change in settlement patterns, Failure of the borehole operation due to mismanagement,*

The socio-economic concerns that may result from the implementation of the proposed borehole sub project include; *Conflict over scarce water commodity, Spread of communicable diseases, STIs and HIV/AIDS and COVID 19, Sexual exploitation and abuse (SEA), Gender-based violence at community level,*

Summary Proposed Mitigation measures: Key mitigation measures proposed in this report to address the predicted environmental and social impacts are: Mitigation of soil, water and air pollution control; drilling to be undertaken during school holidays; ensuring safety of workers, children and public through provision of protective clothing and equipment and first aid kit fencing of the borehole site; sensitization of the public on curbing the spread of HIV/AIDS, COVID 19 and other infectious diseases; testing of water to ensure quality standard is made for livestock and domestic use; and installation of auto-shut water taps to reduce water wastage. Also, sensitization on sexual exploitation and abuse (SEA) and gender based violence (GBV); formation and capacity building of the GRM committee on monitoring and management of SEA/GBV and ensuring that the chosen contractor for the drilling and equipping of the borehole complies with all SEA/GBV measures put in place.

To ensure the effective implementation of these measures and all those contained in the ESMP, the ESMP should be shared with all responsible parties for its implementation including the

chosen contractor to ensure success and monitoring. The environmental and social issues included within the mitigation measures will be monitored and supervised by the project beneficiaries, chosen contractor, engineering team and the KCSAP County Environment and Social Safeguards Compliance Officer (CESSCO) and the Projects Monitoring and Evaluation Officer. Annual environmental, health and safety audits and reviews as required by NEMA will be conducted to assess the performance of the environmental, health and safety policies and operational procedures implemented. The CESSCO is expected to carry out quarterly reporting of the sub project together with the M & E officer. These quarterly reports will form the basis for effective auditing and review of the ESMP of the proposed sub project.

Based on this ESIA study finding this report concludes that the project is environmentally sound and will have insignificant adverse environmental impacts which will be adequately mitigated against. Adherence to the guidelines outlined in the ESMP by the proponent, contractor, beneficiary community and other stakeholders guarantee optimum benefits to the proponent, clients and the environment. Therefore, it is important that the mitigation and monitoring measures recommended in the report are incorporated in the implementation and operation design process. The hired contractor and the supervising officer should ensure that the mitigation measures proposed for the construction phase are adhered to while the proponent is responsible for subsequent monitoring as proposed by the ESMP.

The Proponent has complied with the relevant legal requirements including land acquisition, this ESIA study and preparation of the project designs and plans. In the pre planning phase the community was involved in the identification, prioritization and selection of the project in the participatory integrated community development process. It is also recommended that the necessary permits and permissions should be acquired by the proponent as required under the water act and WRA regulations. This study has addressed and provided mitigation measures for the predicted environmental and social impacts and therefore, recommends approval of this report by NEMA for the implementation of the proposed Sertonje Borehole.

## CHAPTER ONE

### 1.1 Sub-project background

#### General Overview of Proposed sub-project

The proposed Sertonje Borehole drilling sub-project will be carried out under the Kenya Climate Smart Agriculture Programme (KCSAP), herein the Proponent with Co-funding by the Baringo County Government. In the initial environmental and social screening and scoping NEMA recommended for a partial environmental and social impact assessment study to be undertaken by the proponent for the proposed sub project. In account for this KCSAP hired the services of qualified EIA/EA NEMA registered experts for consultancy to undertake this ESIA study.

The proposed borehole drilling sub project is categorised under groundwater development sub programme in the water sector in the county. The sub programme involves drilling and equipping of boreholes with the expected result of improving access to clean and safe water. In the period 2013 to 2018 the Baringo county government drilled and equipped 144 boreholes in the whole county. (Baringo CIDP 2018-2022)

Kisanana ward has 3 operational boreholes, all managed by the community.( Kisanana Ward PDRA 2019). Mugurin location the sub project area has 528 households in a land area of 60.1 sq. km expected to benefit from the sub project directly and indirectly. (KNBS 2019). The proposed sub project ward, Kisanana lies in the Agro-pastoral livelihood zone, a zone characterized by communities keeping livestock (cattle, sheep, goats, bee keeping and poultry) as well as cultivation of crops (maize, beans, millet, sorghum, cassava, groundnuts, and cowpeas) (Kisanana ward PDRA 2019). The hydrogeological survey has already been done for the Sertonje community borehole.

The World Bank Supported Climate-smart agriculture (CSA) is an approach that helps to guide actions needed to transform and reorient agricultural systems to effectively support development and ensure food security in a changing climate. The proposed sub project fits with the WB-CSA goal of attaining food security, productivity and income in the sub project area.

Drought and water scarcity is prioritized as a major problem in Kisanana ward (Kisanana ward PDRA 2019). In Mugurin the main source of water is a water pan located 5km away. In solving the water problem in the area, the community in Sertonje identified and proposed drilling of the borehole for enhancing agricultural productivity and domestic use. The GPS coordinates of the proposed Sertonje Borehole sub-project are 0° 4'43" N, 36° 2'57" E. The proposed sub project is to be undertaken in Kapkundul Primary School.

## 1.2 Mugurin Water Demand

The borehole water is intended to be used for domestic and livestock purposes. The water demand is estimated to be 20m<sup>3</sup>/day. The proposed sub project location is situated in a zone with moderate groundwater potential. On the basis of geological evidence, from the hydrogeological investigations carried out groundwater prospects for intended purposes (livestock and domestic use) are tenable.

## 1.3 Kisanana Ward Water Resources

Kisanana community rely on boreholes, water pans and seasonal rivers as water sources for both domestic and livestock use.

However, majority of water pans have silted up and some boreholes not operational. The table below gives the status of the boreholes and water pans in the ward.

*Table 1: Number and status of Boreholes and water pans*

| Locations   | Boreholes   | Status                       | Water pans | Status                 |
|-------------|-------------|------------------------------|------------|------------------------|
| Molo Sirwe, | 2           | Not equipped                 | 6          | Majority are silted up |
| Kapkechui,  | 2           | 1 non-operational,           | 6          |                        |
| Simatwe,    | 1           | Not equipped                 | 8          |                        |
| Oldebes,    | 2           | Functional                   | 4          |                        |
| Kisanana,   | 5 Boreholes | 3 functional, 2 not equipped | 6          |                        |
| Ng'endalel, | 3 boreholes | All Functional               | 3          |                        |
| Olkokwe,    | 2           | Operational                  | 1          |                        |
| Kapnosgei,  | 3           | Operational                  | 2          |                        |
| Sinende,    | 2           | Operational                  | 3          |                        |
| Kabuswo,    | 1           | Not equipped                 | 0          |                        |
| Koitumet    | 0           |                              | 7          |                        |

Source: Kisanana ward PDRA 2019

Two productive boreholes exist around this place but not within the vicinity of the selected site. Magoi Borehole is 6.5km to the NW while Nambawan borehole is 6.6km to the SE.

The nearest reliable source of water is a water pan 5km away within Mugurin location. For this reason, the community with the help of the proponent has proposed for the drilling and equipping of Sertonje borehole. Mugurin River, a seasonal river, passes 1 km to the west of the site and flows in a northward direction.

#### **1.4 Objectives of the Sub-project**

The overall objective of the sub project is to contribute to poverty reduction and economic growth in Mugurin through enhanced productivity by providing water for livestock use.

The specific objectives are;

- ✓ To increase food security through development of agricultural infrastructure for micro irrigation and growing of drought resistant crops such as millet, sorghum, groundnuts,
- ✓ To Enhance nutrition through the establishment of household kitchen gardens and enhanced fruit growing,
- ✓ To improve household incomes and
- ✓ To provide safe and clean water for domestic use (more importantly the need for water in curbing the COVID 19 disease through promoting personal hygiene).

#### **1.5 Justification**

One of the basic principles of social justice is that all citizens should have access to resources, sufficient to meet their basic needs and live a dignified life. Availability and accessibility to clean and safe water for domestic use and agricultural production are one way of the fulfillment of this principle. The proposed Sertonje borehole sub-project is to supply water for livestock watering, smallholder irrigation and drainage scheme and domestic use in an area that is highly affected by water scarcity.

Environmental services were acquired to carry out this ESIA study for the proposed activity.

It is necessary that environmental planning and management are incorporated in all the phases of the sub-project implementation because this is the only way the needs of the people can be met while ensuring sustainable development is achieved.

The proposed Sertonje borehole is expected to benefit 2,720 cattle, 9,250 goats and sheep, and 2,950 people with 1,120 direct and 1,775 indirect beneficiaries. These are mainly residents' of Sertonje. The proposed sub-project is therefore, justified on socio-economic development and water supply infrastructure improvement grounds and for the fact that it will provide a clean and safe water supply.

Also, through the sub project there will be improvement in personal hygiene through availability and access to safe water for domestic use and in particular during incidences of communicable diseases such as the current COVID-19 era.

## **1.6 The Purpose of this ESIA Study Report**

The purpose of this report is:

- To ensure adequate identification of potential environmental and social impacts.
- To propose an environmental and social management plan to address the perceived negative impacts with adequate mitigation measures.

## **1.7 The Objectives of this Report**

The overall objective of this report is to ensure that all the envisaged environmental and social concerns identified are integrated into the proposed borehole sub-project design, construction and implementation in order to contribute to the sustainable development of the general area. The ESIA has also been conducted to comply with regulatory requirements including requirements of WB environmental and social policies, NEMA regulations and other laws and policies affecting the proposed development.

The specific objectives are as follows: -

- To identify potential environmental and socio-economic impacts, both direct and indirect during the laying out and construction of the borehole;
- To assess the significance of the impacts on the physical and human environment;
- To propose preventive and compensative measures for the significant negative impacts of the sub-project on the physical and human environment;

- To generate baseline data for monitoring and evaluation on the implementation of the mitigating measures during the sub-project cycle;
- To present information and analysis on the impact of site alternatives;
- To ensure compliance with the World Bank Environmental and Social safeguards Policies;
- To ensure compliance with the provisions of the Environment Management and Coordination Act Cap 387 and Environmental (Impact Assessment and Audit), Regulations, 2003, as well as other regulations (statutory requirements);
- To obtain views/opinion of the public and all key stakeholders on the impacts of the project and mitigation measures: and
- To develop an Environmental and Social Management Plan (ESMP) to guide the community in decision making and implementing the sub-project in an environmentally friendly manner and future environmental auditing.

## **1.8 The ESIA Approach and Methodology**

This ESIA began with environmental and social screening, followed by scoping and the actual ESIA study. The study involved the use of several techniques and methodologies. The techniques and methodologies used were necessary for collating baseline information, understanding the legal and policy framework, predicting the potential impacts, assessing the nature of the impacts and determining the order in which the impacts are to be avoided and or mitigated.

### **1.8.1 Environmental and Social Impact Study Methodologies**

The team was guided by the requirement of the National Environmental Management Authority (NEMA) Environmental Impact Assessment Guidelines, section 58 of EMCA Cap 387 and Environmental (Impact Assessment and Audit) Regulations 2003; and the World Bank Environment and Social Safeguards policies Environmental Assessment (OP 4.01), Physical Cultural Resources (OP 4.11), and Pest Management (OP 4.09) in carrying out this ESIA.

The methods used in the study are as discussed in the sections that follow;

#### **1.8.1.1 Desktop study**

This involved documentary review on the nature of the proposed activities, sub-project documents, designs, policy and legislative framework as well as the environmental status of the sub project area, beneficiary areas and adjoining sub locations, land use practices in the area,

development strategies and plans and case study of similar projects as analogues and references.

Key documents reviewed are;

- ✓ The KCSAP project appraisal document
- ✓ Water Act 2016
- ✓ EMCA Cap 387 and EMCA Amendments 2015
- ✓ Baringo County CIDP 2018-2022
- ✓ KCSAP PAD
- ✓ 2019 Census Reports Volumes I and II.
- ✓ The World Bank Environment and Social Safeguard Framework
- ✓ Socio-economic survey reports (Kenya Integrated Household Budget Survey (KIHBS))
- ✓ Kisanana Ward Participatory Disaster Risk Assessment (PDRA) Report June 2019

#### **1.8.1.2 Socio- Economic Survey Information**

The socio economic data used in this report has mostly been obtained from the Kenya Integrated Household Budget Survey (KIHBS, 2018). The Kenya Integrated Household Budget Survey (KIHBS) was conducted over a 12-month period to obtain up-to-date data on a range of socioeconomic indicators used to monitor the implementation of development initiatives. The survey aimed at providing data on key socio-economic aspects of the Kenyan population which include; education, health, energy, housing, vulnerability, water and sanitation. The basic report provides a reflection of the socio-economic status of the Kenyan population. The data from KIHBS together with 2019 population census has been found appropriate for use in this study to understand the socio- economic of Baringo County and the proposed project area.

#### **1.8.1.3 Field Site Assessment**

Site visits and field assessments involving field sample survey of the area, were meant for physical inspections of the site characteristics and the environmental status of the surrounding areas to determine the anticipated impacts, establish part of the environment to be affected and extent of the impacts. The purpose of the field site visits were;

-Obtain available and relevant information and data from the local public offices including Water, WRA, Environment and Natural Resources Agriculture and Livestock and the Local administration.

-Evaluate the environmental setting around the proposed sub project site. Observation focused on topography, land cover, flora and fauna, climate, hydrology of the area and public amenities among others

-Evaluate social, economic and cultural setting in the sub project area

-Undertake a comprehensive consultative public participation exercise to a large section of the affected persons as well as stakeholders.

A total of 35 filled in questionnaires were administered to the community members and 27 were filled in and returned. Due to illiteracy by the community members there was assisted filling in of questionnaires from the literate members of the community through translation.

3 key stakeholders from the community and government departments filled in impact categorization matrix to help in ranking of the identified impacts as low, medium, or high risk.

A total of 11 key informant interviews were carried out. One formal consultation meeting was held for technical persons from the key county and national government departments and another one for the panel of experts.

### **1.8.1.3 Public Participation and Stakeholders Consultation**

Public participation and consultation was achieved through holding one community baraza and two consultative forum with the local stakeholders. Through public participation the sub project was explained to the community members and other local stakeholders in the project area. Oral and written comments were then received about the suitability of the project, concerns about the project that might affect them, the expectations they had about the sub project and their suggestions in addressing what impacts they had pointed out. The public participation Baraza was held on 5-12-2019 where 8 females and 24 males making a total of 32 people (*refer to annex 5 for attendance list and annex 8 & 9 for baraza notification and minutes*).

Public participation and stakeholders consultation was important for also ensuring the project receives a high level of acceptability. The community local language (Tugen) was used together with Swahili to enhance understanding and communication by the community.

World Bank social safeguards OP/BP 4.01 Environmental Assessment emphasizes on stakeholder and public participation to inform decision makers of the nature of environmental and social risks and to increase transparency and participation of stakeholders in the decision-making process.

This report has incorporated all the views and suggestions from public participation as demonstrated in *Chapter 7*.

#### **1.8.1.4 Interview method**

This method was used for key respondents including the officials of the Sertonje Community borehole drilling sub project, the Mogoti sub county water officer from the department of water KFS officer for the Tenges Forset Station, water engineers from the department of water, the local administration including the Chief for Mugurin Sub Location and KCSAP officer incharge of environment and social safeguard and compliance. The aim of the interviews was to;

- Have an understanding of water project implementation in Kisanana, Mugurin Location
- Have an understanding of the designs and technical operation of the project including its feasibility
- Have an understanding of the procedures for the successful implementation of the project and
- Collect their views on the potential impacts of the sub project and ways of addressing the adverse effects

#### **1.8.1.5 Filled in Questionnaires**

This involved the use of a list of questions filled in by the local stakeholders and community members in the project area. The questionnaire checklist where the potential impacts listed were used to assess the nature of the impacts i.e type such as adverse or beneficial (*refer to annex 7*). Farmers and community members in the project site also filled in personal questionnaires to get their views on the sub project such as benefits, potential problems and possible solutions and whether they felt the sub project should be implemented or not (*refer to annex 7*). Some of the respondents were assisted in filling in the questionnaires by translating the questions into the local language by the literate members in the community.

### **1.9 Covid – 19 Infection prevention and control measures**

The review of this ESIA is undertaken during the Coronavirus disease 2019 (COVID-19) pandemic outbreak. The preparation of the ESIA including the relevant consultations have been undertaken in strict compliance with guidelines for infection prevention and control in the country. Additionally, specific mitigation measures have been introduced to prevent the spread of the pandemic during the construction period. Moreover, consultations required as part of the mitigation measures, such as during training on E&S issues, also pose a risk of infection to

communities. For this reason, the risk of contracting the virus during consultations will be avoided, minimized and mitigated with specific measures to ensure national requirements on social distancing and recommendations on how to minimize contact are adhered to.

## **1.10 Chapter Outline**

This ESIA project report has been presented in the format outlined below.

1. Introduction and background information.
2. Environmental and ecological baseline information as well as social.
3. Environmental policy, legal and institutional framework.
4. Nature of the proposed sub-project designs, works activities.
5. Analysis of proposed sub-project alternatives.
6. Environmental and social impacts prediction and recommended mitigation measures as well as social.
7. Public participations and stakeholders` consultations
8. environmental and social management plan and monitoring framework
9. Conclusion and recommendations

## CHAPTER TWO

### ENVIRONMENTAL / ECOLOGICAL AND SOCIAL BASELINE INFORMATION

#### Introduction

This chapter gives a description of the environmental and social setting of the proposed sub-project area and its environs in terms of its physiographic and natural conditions, biological and socio-economic environment.

#### 2.1 Physiographic and Natural Conditions

##### 2.1.1 Site Location

The site is situated within Sertonje area. It is 2.8km to the south-east of the Mugurin market, 6km west of the Ng'endalel market, and 8.7km to the north-west of the Kisanana market. It lies within the 1:50,000 Survey of Kenya topographic Sheet for Solai (No. 105/3), approximately at GPS position UTM 37N 171392, 008981.



Figure 1: Topographical Map Indicating Exact Proposed Borehole Site

##### 2.1.2 Physiography

The area lies at an altitude of about 1550m. It is situated in a relatively flat area generally sloping to the west. An escarpment lies to the east of the area, running in an N-S direction. A seasonal, Mugurin River passes 1 km to the west of the site and flows in a northward direction.

### **2.1.3 Climate**

The climate of this area is of the humid, cool temperate, tropical lower highland type. The average annual rainfall figure for the area is approximately 1200 mm. The rainfall pattern exhibits a bimodal distribution, with wet seasons in March-May and October-December (corresponding to the "long" and "short" rains, respectively). Between 70% and 85% of the precipitation falls during these rainy seasons. Average annual temperatures range from 18 to 20° C, with average minima and maxima of 12-14 and 24-26° C, respectively. The warmest period occurs from January to March. The average potential evaporation is between 1,550 and 2,200 mm per year.

### **2.1.4 Geology and Soils**

#### **2.1.4.1 Geology of the Sertonje Area**

This area is associated with three successions of volcanic activities that occurred between Pliocene to Recent. The oldest rocks that lie at an approximated depth of 250m below ground level are the Miocene lavas comprising of the Elgeyo Porphyritic olivine basalts and the Lower Uasin-Gishu phonolites. These were followed by Pliocene lava flows which comprise of the Kwaibus olivine basalts and the non-porphyritic Lake Hannington phonolites.

On the top are the superficial deposits and alluvium close to the Molo River.

Superficial deposits in the area comprise reddish-brown soils. This forms a moderately thick cover and is geologically mapped sediments at the study site.

The area is cut by numerous fault lines aligned in an N-S direction. The nearest to the site lies 700m to the west. On the eastern side, the nearest is Kisanana fault line, 1600m away.

#### **2.1.4.2 Soils**

The soils are developed on sediments mainly from volcanic flows. The soils formed are a complex of;

- Well-drained, moderately deep to dark brown, friable, and slightly smeary, fine gravely, sandy clay loam to sandy clay, with humic topsoil.
- Imperfectly drained, moderately deep to strong brown, mottled, firm and brittle, sandy clay to clay.

### **2.1.5 Water Resources**

Two productive boreholes exist around this place but not within the vicinity of the selected site. Magoi Borehole is 6.5km to the NW while Nambawan borehole is 6.6km to the SE. There is a water pan located 5km from Sertonje in Mugurin location. Mugurin River, a seasonal river,

passes 1 km to the west of the site and flows in a northward direction. Other boreholes include Kipkitui borehole about 11km away and Mugurin borehole whose yield is 40m<sup>3</sup>. In 1979 a borehole was drilled in the location and the water was found to be hot and not safe for human consumption. There are other boreholes with good yields and fit for consumption, it is with this thrust that the borehole will be productive and meet its purpose.

## **2.1.6 Groundwater recharge**

### **Regional Hydrogeology**

The regional groundwater system in the area is recharged by infiltration of rainwater through the permeable volcanic and sedimentary sequences. Percolation into the deep-lying aquifers is facilitated by open faults and fissure zones acting as groundwater conduits. However, the general observation is that most aquifers in the region are recharged from a distance. Their productivity is also determined by the availability of surface water.

### **Recharge**

The recharge mechanisms (and the rate of replenishment) of the aquifers in this area is rainfall. The two major processes are probably direct recharge at the surface (not necessarily local) and indirect recharge via faults and/or other aquifers. Rainfall on the shoulders of the Rift Valley is high (1,200mm -1500mm).

### **Discharge**

Discharge from aquifers is either through natural processes as base flow to streams and springs or artificial discharge through human activities. A number of boreholes have been drilled in this area though not within the vicinity of the study area; their abstraction significantly contributes to the discharge process. The total effective discharge from the aquifers via either of the above means is not known.

## **2.3 Biological Environment**

### **2.3.1 Flora**

Around Mugurin and Kisanana vegetation is a combination of evergreen deciduous and semi deciduous bushland. Common tree species include: *Acacia tortilis*, *A. seyal*, *A. nilotica*, *A. brevispica*, *A. mellifera* and other *Acacia* species. Other species include *Balanites aegyptica*, *Tarconanthus comphratus* and *Terminalia*. Grasses include *Cynodon*, *Digitaria*, *Hyperhenia* and *Cenchrus sp.*

The vegetation cover of sub-project area comprises of, *Jacaranda mimosifolia*, *Croton dischogamus*, *Zanthoxylum chalybeum*, *Pappea capensis*, *Terminalia brownii*, *Carissa edulis*, *Balanites aegyptica*, *Bersama abyssinica*, *Aloe spp*, *Cissus quadrangularis*, *Tinnea aethiopica* and *Varies spp*.

The specific site for the sub-project has sparse vegetation and therefore, there will be no significant removal to cause high impact.

### **2.3.2 Fauna**

The area has both livestock and wildlife. The livestock kept include; cattle, sheep, goats, donkeys, camels, poultry, rabbits, and honeybees. Wild animals comprise of antelopes, snakes, elephants, leopards, zebras, hyenas, and wild dogs. The proposed sub-project site is not in a protected area and is not home to any threatened or endangered species. The sub-project area is a human settlement and has little biodiversity.

## **2.4 Socio-Economic Environment**

### **2.4.1 Land-use**

Kisanana ward lies in the agro-pastoral livelihood zone, a zone characterized by communities keeping livestock (cattle, sheep, goats, bee keeping and poultry ) as well as cultivation of crops (maize, beans, millet, sorghum, cassava, groundnuts, and cowpeas). A small section of the ward that include lower sections of Molo Sirwe Mukuyuni locations do horticultural crops such as tomatoes, watermelon, butternuts, Kales and kales. Other sources of livelihoods include; quarrying, casual labour and charcoal burning.

Mugurin location with a land area of 60.1 sq. km both crop and livestock production. Livestock production is the main activity carried out in the Mugurin. Marginal mixed crop farming is practised in the area. Crops grown include maize, beans, and pasture grass (*Cenchrus spp*).

### **2.4.2 Demography**

Kisanana ward is 221.6 Sq. Km. Administratively, the ward is composed of the following sub-locations Chebirebei, Waseges, Kiribot, Nyalilbuch, Kabuswo, Kamasai, Kabargei, Koituimet, Ng'endalel, Kisanana, Koisaram, Oldebes, Chomiek, Molo Sirwe, **Mugurin**, Mukuyuni, Turkulu, Kapnosgei, Kipnyung'uny, Ol kokwe, Kibomoi, Chepyuan and Tinosiek.

The ward has a population of 14,103 composed of males 7,158 and females 6,945 with 2,397 households (KNBS, 2019). Mugurin sub location has population of 2,978 with males 1,524 and females 1,454 and 528 households and with a population density of 50 persons per square kilometers.

The ward is predominantly inhabited by Tugen community (*Endorois*). Other tribes that live in the ward include; Kikuyu, Kamba, Kisii, Turkana and Luos (**Kisanana ward PDRA 2019**).

In Baringo 68.4 per cent of households are male headed and 31.6 percent female headed. (KIHBS, 2018)

#### **2.4.2.1 Vulnerable and Marginalized Groups (VMGs)**

The proportion of the population with disability in Baringo is 3.2% of the population translating to 22,528 persons (KIHBS, 2018). The forms of disabilities in Baringo include visual, hearing, speech, physical and mental. Vulnerable beneficiaries (poor, widows/widowers, orphans, physically challenged of the proposed sub project are 55 composed of 30 males and 25 females.

#### **2.4.2.2 Dependency Ratio**

The percentage distribution of the population by broad age group in Baringo is 0-14 years 43.9 percent, 15-64 years 50.7 percent and 65+ years 5.4 percent. In this population the child dependency ratio is 86.6 percent and the old age dependency ratio is 10.7 percent of the total population. The old dependency ratio also represents vulnerable groups that are to be beneficiaries of the proposed sub project. (KIHBS, 2018)

#### **2.4.2.3 Living standards**

Mugurin is categorized as among the ASAL areas in Baringo County. Access to safe water in the area is low contributing to marginal yields and other water-related challenges. Although the poverty level in Mogotio Sub County according to national statistics is 43.7% (KHIS), in Mugurin 58.6% of individuals are below the poverty line. Through the County Revenue Allocation (CRA) policy Mugurin receives equalization funds allocations for water and other key sub-projects, even though, the funds are not enough. The proposed borehole sub-project if drilled will contribute to the uplifting of the living standards of the residents in the area.

## **2.4.3 Social Amenities, Essential Facilities, and Public Utilities**

### **2.4.3.1 Health and Disease Prevalence**

Kisanana ward has two health centers and six dispensaries for health services provision. The Mugurin community relies on Mugurin Dispensary and Kisanana Health Centre. There is an ambulance at Kisanana. According to the KIHBS survey reported sick or injured cases was females 31.4 percent and males 26.2 percent of the population. In the reported cases the highest disease prevalence is flu affecting 38.8 per cent of the population. Other diseases prevalent in the county are malaria/fever (19.2 percent), upper respiratory infection (10.3%), stomach problems (7.4%) and skin infections and backache among others.

### **2.4.3.2 Water sources and sanitation**

Sources of water in Baringo include both improved and unimproved sources. Improved water sources are boreholes, protected wells, protected springs and rainwater collection 23.1 percent of the population has access to the improved water sources with access to boreholes with pumps at 5.7 per cent. (KIHBS, 2018)

The unimproved water sources are unprotected wells, unprotected springs, tanker truck, surface water- rivers, ponds, pans and irrigation canals among others. These sources are used by about 76 percent of population in the county. (KIHBS, 2018)

The nearest improved water source in Mugurin sub location are Magoi and Nambawan both of which are 6.5 km away from the proposed sub project site.

Baringo County does not have a conventional sewerage plant even construction of one is ongoing in Kabarnet and plans are under way to develop another in Koibatek. Latrine coverage in Baringo is 70 per cent comprising ventilated pit latrine (11.7%) and pit latrine with slab (58.5%). (KIHBS, 2018). The availability and accessibility of water from the proposed Sertonje borehole will result in an increase in hand washing places for households necessary in curbing the spread of the COVID 19 disease.

### **2.4.3.3 Solid waste disposal**

Mogotio Sub County has one designated solid waste dumping site in Emining. In the county the most common method of waste disposal is open burning at 80.3 percent. Other disposal methods include dumping in streets, burying, disposal in compound and disposal in latrines. Only 3.9 percent of the solid waste in the county is collected. (KIHBS, 2018)

#### **2.4.3.4 Trade**

Kisanana ward mainly rely on external such as Mogotio market in Mogotio ward, Emining market in Emining ward, Mochongoi market in Mochongoi ward (These are markets within Mogotio Sub County Baringo County. Other markets relied upon include Banita and Solai Markets in Nakuru county.

Trading center in Mugurin sub location is Mugurin trading Centre. This being a local setting, people deal with livestock farming as a livelihood. Shops are there for other consumables like foodstuff and clothes.

#### **2.4.3.5 Religion**

The main religion is Christianity with the churches comprising Africa Inland Church (AIC), Catholic, Kings Outreach and World Wide.

#### **2.4.3.6 Educational Institutions and Literacy**

Kisanana ward has 35 primary schools, seven Secondary schools, 60 Early Childhood Development Center and one vocational training institute distributed in the locations.

Schools in **Mugurin sub location** include Kapkundul Primary School and Mugurin Primary and Secondary Schools. School attendance in Baringo is approximated at 54.9 percent. The attendance as per broad age groups is 3-5 years 100percent (47,000 pupils), 6-13 years 100 percent (159,000) 14- 17 years 89.2 percent (73,000) and 18-24 years (42.9 percent (87,000). The gross attendance ratio is pre- primary males 107.6, females 96.8; primary males 124.8 percent, females 108.5 percent; and secondary males 52.9 percent and females 68.4 percent. (KIHBS, 2018). The proposed sub project is expected to improve the school attendance in the project area.

#### **2.4.3.7 Livestock Facilities:**

Kisanana ward has 16 number cattle dips of which only six are operational. Mugurin sub location has a cattle dip and a water pan about 5km away from project site location and a hay storage facility. The cattle dip is operational.

#### **2.4.3.8 Energy sources**

About 25.5 percent of households in the Baringo County have electricity connections from mains for lighting and with 0.1 percent using it for cooking. The main source of energy for cooking is firewood with 73. 5 percent of households using followed by charcoal with 17 percent of

households. Power coverage in Mugurin is good. The community has proposed the pumping of water from the borehole to be done using solar energy.

#### **2.4.3.9 Roads and Telecommunication Network**

Community rely on Safaricom and Airtel networks for communication although some areas like Koitumet, Simatwe, Kabuswo, Molo Sirwe still have challenges in accessing telecommunication services because of long distance location of the two mast.

The ward is traversed by murrum roads comprising; Kisanana-Olkokwe-Mochongoi road, Mogotio-Mugurin-Majimoto-L. Bogoria (the road is proposed for tarmacking), Mogotio-Kisanana-Olkokwe road, Mogotio-Molo Sirwe-Kamar road and Mugurin-Emsos-Lake Bogoria road. The Mogotio-Mugurin road is 26 km and mainly accessible by a 4WD. The dominant mode of transport is by motor cycles and unreliable motor vehicles.

### **2.5 Conflict and Grievance Resolution Mechanism**

Grievances or disputes refer to conflicts that affected households, including those that do not pertain to the legal system. Baringo County during the KIHBS survey carried out by the Kenya National Bureau of Statistics. Among the main grievances were those involving succession and inheritance, political disagreement, unpaid debts, traffic matters, and criminal matters. ***There were conflicts over natural resources (communal grazing land, water source, misuse of public forests/land), tenancy and labour. Domestic violence relating to sexual exploitation and abuse and gender-based violence was not reported in the survey in Baringo County (KNBS 2018).***

#### Grievances Resolution Mechanism

Several methods were used in resolving these household conflicts as reported during the survey.

The instruments used in the resolution of the reported conflicts were;

- ✓ Chief/Assistant chief Extended family members (45.3%)
- ✓ Directly to the other party (11.6%)
- ✓ Traditional leaders/ Elders (10.2%)
- ✓ Extended Family members (6.9%) and
- ✓ Other National Government Officials such as ACC (3.4%)

Each KCSAP implemented project at the community level has the Grievances and Integrity Committee comprised of five members and is responsible for the management of conflicts that

will arise from the implementation of projects. The mentioned conflict resolution mechanisms will work together with the sub projects grievance committee.

The chief's office is the mostly used and preferred for conflict resolution in Baringo County.

## CHAPTER THREE

### POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

#### **3.1 Introduction**

Environmental and Social Impact Assessment takes place within the legal and/or policy and institutional frameworks established by individual countries and international agencies. ESIA provision and procedure can contribute to the successful implementation of the proposed sub-project if these frameworks are followed by all the parties.

#### **3.2 Policy and Legislations Framework in the Kenyan context**

##### **3.2.1 The Kenyan Constitution**

Section 42 of the Constitution states that every person has the right to a clean and healthy environment, which includes the right a) to have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69, and b) to have obligations relating to the environment fulfilled under Article 70.

Chapter five of the new constitution covers "Land and Environment" and includes the aforementioned articles 69 and 70. This Chapter seeks to eliminate processes and activities likely to endanger the environment. Article 69 states that the State shall a) ensure sustainable exploitation, utilization, management and conservation of the environmental and natural resources, and ensure the equitable sharing of the accruing benefits; b) work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya; c) protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities; d) encourage public participation in the management, protection and conservation of the environment; e) protect genetic resources and biological diversity; f) establish systems of environmental impact assessment, environmental audit and monitoring of the environment; g) eliminate processes and activities that are likely to endanger the environment; and h) utilize the environment and natural resources for the benefit of the people of Kenya. By commissioning this ESIA Study, the project proponent is complying with the constitutional requirements. During the project life cycle

(construction; operation and decommissioning phases); the proponent will be required to put in place mitigation measures against adverse project effects.

*The proposed Sertonje BH sub project is predicted to contribute to both positive and negative environmental and social impacts. The consulting by commissioning this ESIA has taken precautionary measures to make certain that appropriate mitigation measures are provided for the adverse impacts forecasted.*

*This ESIA report has also developed an ESMP for easy of monitoring of the negative impacts to make certain that the identified impacts are fully addressed and that any emerging issues are addressed immediately. The ESMP will be made part of the agreement/ contract with the chosen contractor, and the supervision consult tasked with monitoring compliance*

*The Proponent has therefore, taken necessary measures for eliminating processes and activities that may damage the environment denying the residents of Sertonje their rights as indicated in article 42 of the constitution.*

*The proponent will systematically continue to fulfill all obligations relating to the environment under Article 70 and other relevant legislations in implementing this sub project throughout the whole Sertonje BH sub project cycle.*

### **3.2.2 County Government Act, 2012 (No. 17 of 2012)**

An Act of Parliament to give effect to Chapter Eleven of the Constitution; to provide for county governments' powers, functions, and responsibilities to deliver services and for connected purposes. Part VIII of the Act outlines the Principles of citizen participation in counties as;

- (a) Timely access to information, data, documents, and other information relevant or related to policy formulation and implementation.
- (b) Reasonable access to the process of formulating and implementing policies, laws, and regulations, including the approval of development proposals, sub-projects, and budgets, the granting of permits and the establishment of specific performance standards.
- (c) Protection and promotion of the interest and rights of minorities, marginalized groups and communities and their access to relevant information.
- (d) Legal standing to interested or affected persons, organizations, and where pertinent, communities, to appeal from or, review decisions, or redress grievances, with particular

emphasis on persons and traditionally marginalized communities, including women, the youth, and disadvantaged communities.

(e) Reasonable balance in the roles and obligations of county governments and non-state actors in decision-making processes to promote shared responsibility and partnership, and to provide complementary authority and oversight.

*The Proponent has complied with the outlined principle of citizen participation and those of other stakeholders through the planning, screening, designing and ESIA process. They were involved in the citing, screening meetings as attached in the document and in the designing by the engineers and during this ESIA*

*The Sertonje Borehole sub project committee has been elected.*

### **3.2.3 Water-related Functions of the County Governments**

The Constitution also puts in place the applicable institutional framework. It establishes two levels of government: the national government and county governments. The Fourth Schedule allocates functions to the two levels of government. The county government has the mandate over soil and water conservation and county public works and services including water and sanitation services under which would involve the construction of water pans and small storage facilities for water services purposes.

*The proponent has fully engaged the county government in the whole project cycle from part-funding, planning, screening, ESIA, designing and in the whole processes that will be involved in the implementation and commissioning of the sub project.*

*The county government is the one that chairs the CTAC. As the project organization, CTAC shall be the focal point in all the process. It is them who will be advising the CPSC (county project steering committee) therefore they will be involved in monitoring of the sub project*

### **3.2.4 Vision 2030**

The Vision 2030 is the Country's Economic Blueprint that maps the development agenda by seeking to make Kenya a globally competitive middle-income country by 2030.

Vision 2030 is being implemented through a series of five-year Medium-Term Plans (MTP). The MTP identifies the key policy actions and programmes for each Ministry Department and Agency. The overall goal of the Environment, Water and Sanitation Sector as outlined in the Vision is to attain a "clean, secure and sustainable environment" by 2030. Kenya vision 2030

includes equity as a recurrent principle in economic, social and political programmes. Special attention has been given to investment in arid and semi-arid (ASAL) counties, communities with high incidence of poverty, unemployed youth, women, and all vulnerable groups. Devolution under vision 2030 is expected to play a key and enhanced role in correcting existing economic and social inequalities

*The implementation of the proposed water project is an effort to increase agricultural productivity for smaller holder and pastoral farmers composed of the Endorois and other vulnerable groups through investing in water for livestock and domestic uses. The project is expected to improve the social and economic life of the Endorois if implemented.*

*Implementation of the sub project by the proponent will contribute towards the goal of vision 2030 on water and protection and conservation of the environment.*

### **3.2.5 Environmental Management and Coordination Act CAP 387 and EMCA Amendments 2015**

The Environmental Management and Coordination Act of Cap 387 was enacted to provide an appropriate legal and institutional framework for the management of the environment and for matters connected therewith and incidental thereto. EMCA does not repeal the sectoral legislation but seeks to coordinate the activities of the various institutions tasked to regulate the various sectors. These institutions are referred to as Lead Agencies in EMCA. Lead Agencies are defined in Section 2 as any government ministry, department, parastatals, and State Corporation or local authority in which any law vests functions of control or management of any element of the environment or natural resource.

## **3.3 Environmental Regulatory Framework**

### **3.3.1 ESIA and EA regulations (EIA regulations 2018)**

The prescribed format for Environmental Impact Assessment and Environmental Audit guidelines in Kenya has been developed and gazetted and is fully applied in this exercise in conjunction with all other legal and policy directives provided for in the Kenyan institutions governing environmental conservation. The regulations require that the Environmental Impact Assessment and Environmental Audit be conducted in accordance with the issues and general guidelines spelled out in the second and third schedules of the regulations. These include coverage of the issues on schedule 2 (ecological, social, landscape, land use, and water

considerations) and general guidelines on schedule 3 (impacts and their sources, sub-projects details, national legislation, mitigation measures, a management plan, and environmental auditing schedules and procedures. It finally states that a report, drawn by a qualified expert(s) should then be filed to the National Environmental Management Authority (NEMA).

*In carrying out the ESIA and writing the report the requirements of these regulations and those of the World Bank Social Safeguards were integrated and followed throughout the process. The proponent did the screening and scoping then as advised by the County NEMA office commissioned an ESIA partial study.*

*The proponent shall observe the guidelines as set out in the environmental management plan laid out in the ESIA report as well as the recommendation provided for mitigation, minimization, and avoidance of adverse impacts arising from the sub-project activities.*

### **3.3.2 EMCA (Waste Management Regulations 2006)**

This regulation gives guidelines on both operational and administrative activities that are used in handling, packaging, treatment, condition, storage, and disposal of waste and is implemented by NEMA. It prohibits anyone from disposing of any waste on any part of the environment except in designated waste receptacle or facility provided by the relevant local authority which may be legitimate dumpsites or landfills. Since the proposed sub-project will generate waste in form of waste soils, waste oil and other solid wastes this act provides for the waste generator to be responsible for the collection, segregation at source and proper disposal of their wastes.

*The proponent will comply with the provisions of this act by managing wastes generated by the sub project as stipulated under waste management regulations.*

### **3.3.3 EMCA (Noise & Excessive Vibration Pollution Control Regulations, 2009)**

This regulation prohibits any person from causing unreasonable, unnecessary, or unusual noise which annoys, disturbs, injures, or endangers the comfort, repose, health or safety of others and the environment. Part 11 section 6 (1) provides that no person shall cause noise from any source which exceeds any sound level as set out in the First Schedule of the regulations.

It gives standards for maximum permissible noise levels for construction sites, mines, and quarries. It also gives maximum permissible noise levels for silent zones, places of worship, residential (indoor/outdoor), mixed residential; and commercial.

The proposed sub-project will comprise the construction, water tanks and piping will comply with the following NEMA standards.

Table 2: NEMA Maximum permissible noise levels

| Zone |  | Sound level limits<br>dB(A)<br>(Leq,14h) |       | Noise rating level<br>(NR)<br>(Leq,14h) |       |
|------|--|--|-------|---|-------|
|      |  | Day                                      | Night | Day                                     | Night |
| A    | Silent zone  | 40                                       | 35    | 30                                      | 25    |
| B    | Places of worship  | 40                                       | 35    | 30                                      | 25    |
| C    | Residential: indoor  | 45                                       | 35    | 35                                      | 25    |
|      | Outdoor  | 50                                       | 35    | 40                                      | 25    |
| D    | Mixed residential (with some commercial and places of entertainment) | 55                                       | 35    | 50                                      | 25    |
| E    | Commercial   | 60                                       | 35    | 55                                      | 25    |

### 3.3.4 Environmental Management and Coordination, (Water Quality) Regulations, 2006

These Regulations apply to drink water, water used for industrial purposes, water used for agricultural purposes, water used for recreational purposes, water used for fisheries and wildlife, and water used for any other purposes.

Section 4 of the regulation which focusses on the protection of sources of water states that (1) every person shall refrain from any act which directly or indirectly causes, or may cause immediate or subsequent water pollution, (2) No person shall throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution.

Section 6 (1) of the regulation states that no person shall abstract groundwater or carry out any activity near any lakes, rivers, streams, springs and wells that is likely to have any adverse impact on the quantity and quality of the water, without an Environmental Impact Assessment license issued in accordance with the provisions of the Act; or

The objective of these regulations is to protect human health and the environment.

It is an offense to contravene the provisions of these regulations with a fine not exceeding five hundred thousand shillings. These regulations were found important in this ESIA because of the possibility of surface water contamination.

***The Proponent has adhered to the provisions of this regulation to protect the proposed water resource from all possible sources of pollution during the construction and operation phase by carrying out this ESIA. The proponent will regularly carry out testing of the borehole water to***

*ensure compliance with the set quality standards as outlined in the first and ninth schedule of this Act shown in table 3.2 and 3.3 respectively or as may be required by the Authority.*

Table 3: NEMA QUALITY STANDARDS FOR SOURCES OF DOMESTIC WATER

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

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

**And any other parameters as may be prescribed by the Authority from time to time**

Table 4: NEMA QUALITY STANDARDS FOR IRRIGATION WATER

| <b>Parameter</b> | <b>Permissible Level</b> |
|------------------|--------------------------|
| pH               | 6.5-8.5                  |
| Aluminium        | 5 (mg/L)                 |
| Arsenic          | 0.1 (mg/L)               |
| Boron            | 0.1 (mg/L)               |
| Cadmium          | 0.5 (mg/L)               |
| Chloride         | 0.01 (mg/L)              |
| Chromium         | 1.5 (mg/L)               |
| Cobalt           | 0.1 (mg/L)               |
| Copper           | 0.05 (mg/L)              |
| <i>E.coli</i>    | Nil/100 ml               |
| Fluoride         | 1.0 (mg/L)               |
| Iron             | 1 (mg/L)                 |
| Lead             | 5 (mg/L)                 |

|                               |             |
|-------------------------------|-------------|
| Selenium                      | 0.19 (mg/L) |
| Sodium Absorption Ratio (SAR) | 6 (mg/L)    |
| Total Dissolved Solids        | 1200 (mg/L) |
| Zinc                          | 2 (mg/L)    |

**And any other parameters as may be prescribed by the Authority from time to time**

### **3.3.5 Environmental Management and Coordination Act (Air Quality) Regulations, 2008.**

The regulations provide for compliance with emission standards for various sources of air pollution including mobile sources (e.g. motor vehicles) and stationary sources (e.g. industries) as outlined in the Environmental Management and Coordination Act, CAP 387. Under these regulations, emissions are supposed to be controlled using specified equipment. Cases of malfunctioning air pollution control systems are supposed to be reported to NEMA within 24 hours and corrective measures are taken to NEMA’s satisfaction within 14 days after the occurrence.

*The proponent will ensure compliance with Air quality regulations by enforcing all the proposed preventive and mitigation measures in the ESMP.*

### **3.4 The Legislative Framework**

This section deals with other legislation and policy that are relevant to the proposed sub-project.

#### **3.4.1 The Water Act, 2016 (Water Resources Regulations 2019)**

##### **Water Rights and Water Permit**

Every water resource is vested in the State, but subject to any rights of use granted by or under this Act or any other written law (sect. 3).....The WRMA is established as a body corporate to manage water resources in Kenya; develop principles, guidelines, and procedures for its allocation; monitor the national water strategy adopted under section 11. ....The law gives authority of ownership of all water resources, including groundwater in the state (Republic of Kenya). *Water rights may only be acquired through the Act through water permit (groundwater included).*

##### **Participation of the public in WRM**

The Water Act identifies and highlights the need for

- ✓ Catchment Area Advisory Committees (CAAC)

- ✓ Water Resources Users Associations (WRUAs) People-based representation in sub-catchments for improved management of water resources including groundwater.
- ✓ Sertonje community is not a member to any WRA but they have applied to the existing body by paying a fee.

### **Public-Private Partnership**

- ✓ Private sector participation in groundwater governance has been in the areas of borehole drilling and hydrogeological consultancy services by a hydrogeologist.
- ✓ They are regulated under Part XIII of the Water Act's guidelines that require these qualified water professionals and contractors to be licensed and gazetted by the ministry. The ministry is required to introduce codes of practice (COP) for compliance by the professionals and the contractors.

*The proponent has undertaken necessary measures to maintain and manage the works.*

- ✓ *The Proponent engaged the services of qualified and approved water experts in the development of the designs and carrying out the hydrogeological survey of the borehole.*
- ✓ *The proponent has also complied by engaging the services of qualified EIA/EA consultants to undertake the ESIA and develop this report.*
- ✓ *Assessment of the sub project has been carried out by WRA and their report is attached in this report and the application receipts*
- ✓ *There is already the Sertonje Borehole sub project management committee in place who has been tasked by the community to manage the sub project activities for example application of statutory documents like the WRA licenses.*
- ✓ *The Proponent will implement any other measures necessary for the safe operation management of the waterworks in accordance with the provisions of this Act and any other related legislation and policies.*

### **3.4.2 The Public Health Act (Cap. 242)**

Part IX, section 115 of the Act states that no person/institution shall cause a nuisance or condition liable to be injurious or dangerous to human health. The Act addresses prevention of conditions that will facilitate the breeding or multiplication of pest shall be deemed nuisances.

*The proponent through this ESIA and the ESMP has defined the necessary measures to be taken by the Contractor, borehole management committee and other responsible parties to prevent the occurrence of nuisance or condition liable for injurious or dangerous to human health during the construction and the operation phase of the sub project.*

### **3.4.3 The Physical Planning and Land Use Planning Act, 2019**

The objectives of the Act are to provide the principles, procedures, and standards for the preparation and implementation of physical development plans at the national, regional, county, urban, and rural and cities level and provision of the procedures and standards for development control and the regulation of physical planning and land use.

*The proposed sub-project is in line with the proposed land use for the sub-project site, that is, a public land/utility.*

*The proposed borehole sub-project is a public utility for the benefit of the Mugurin sub-location community.*

*The proponent is in the process of obtaining relevant approvals from WRA, WB, for the sub-project development. The community has applied for them.*

### **3.4.4 The Energy Act, 2019**

The Energy Act, 2019 was enacted in response to calls to consolidate the laws relating to energy; promote renewable energy; promote exploration, recovery, and commercial utilization of geothermal energy; regulate midstream and downstream petroleum and coal activities, among others. The borehole will use submersible pump to pump water.

*The community have proposed to use solar powered water pump this will ensure the promotion of green energy in line with Kenya climate change mitigation and adaptation strategies, socio-economy of the user community and the policies of partners and the CSA objectives.*

### **3.4.5 Penal Code (Cap. 63)**

Section 191 of the Penal Code provides that any person or institution that voluntarily corrupts or fouls water for public springs or reservoirs, rendering it less fit for its ordinary use shall be guilty of an offense. Section 192 also makes it an offense for a person to make or vitiate the atmosphere in any place to make it noxious to the health of persons/institutions, dwelling or business premises in the neighborhood or those passing along public way. Section 193 prohibits the proponent, for the purpose of trade or otherwise, makes a loud noise or offensive or

unwholesome smells in such places and circumstances as to annoy any considerable number of persons in the exercise of their common rights commits an offense and is liable to be punished as for nuisance.

*The proponent has taken all the necessary measures to ensure that the provisions of this Act are complied with. Through this ESIA the proponent has taken precautionary steps towards preventing or reducing adverse effects that might arise from the activities of the proposed Sertonje Borehole sub project in the construction, operation and decommissioning phases.*

*Hence, there is no possibility of the proponent contravening the stipulated conditions of this act.*

### **3.4.6 The Occupational Health and Safety Act, 2007**

The Occupational Safety and Health Act, 2007 require that workplaces be kept safe for workers therein. Workers who are exposed to wet or any injurious or offensive substances are required under Section 101 of the Act to be provided with suitable protective clothing. The Act requires the management to appoint a competent person who is a member of the management staff to be responsible for safety, health, and welfare in the factory or workplace. The Act also generally provides for safety and health policies and programmes, workplace safety health and welfare conditions, occupational health and hygiene and welfare conditions.

This Act was found relevant for reference in this ESIA since the construction phase will involve workers who will be exposed to various occupational hazards.

*This Act was found relevant for reference in this ESIA since the construction phase will involve workers who will be exposed to various occupational hazards.*

*In the ESMP the proponent has put in place measures to be observed by the contractor during the construction phase of the sub project to ensure the health and safety of workers.*

*A comprehensive occupational health and safety audits will be carried out periodically during the construction phase to ensure compliance.*

### **3.4.7 Employment Act, 2007**

Section 3 (1) States that this Act shall apply to all employees employed during the sub-project implementation under a contract of service. Section 5 (3) demand that no employer shall discriminate directly or indirectly, against an employee or prospective employee or harass an employee or prospective employee on grounds of race, colour, sex, language, religion, political

or other opinions, nationality, ethnic or social origin, disability, pregnancy, mental status or HIV status.

*The proponent will make sure that fairness and gender equity are followed during recruitment of the labour force to be used during the construction phase. The contractor shall be required to submit his environmental and social management plan and a copy of this report shall be shared with them. The CESSCO shall ensure that this is followed to latter and submit a report.*

### **3.4.8 Irrigation Act No 14 of 2019**

The provisions of this Act apply to matters relating to the development, management, financing, and provision of support services and regulation of the entire *irrigation* sector in Kenya.

The proposed borehole shall supply water for use for *smallholder irrigation and drainage scheme* that shall be developed, owned, and managed by the community as irrigation water users or as individual farmers.

*The Proponent will ensure that the irrigations comply with the principles and values set out in articles 10, 43, 60 and 232 of this Act. The proponent has achieved this through the predicted impacts and proposed mitigation measures in this ESIA report and the ESMP.*

### **3.4.9 Work injury benefits Act, 2007**

Part 111 section 7. (1) Require that the proponent to obtain and maintain an insurance policy, in respect of any liability that the employer may incur under this Act to any of his employees. Section 10 (1) of the Act entitles an employee involved in an accident resulting in the employee's disablement or death is subject to the provisions of this Act, to the benefits provided for under this Act. (2) An employer is liable to pay compensation in accordance with the provisions of this Act to an employee injured while at work. This was earlier stated under Workmen's Compensation Act, Cap 236.

*The proponent will ensure the engagement of a qualified, registered and licensed contractor for the drilling and equipping of the borehole and the construction of water tank, water kiosk and water trough.*

*Through the ESMP the proponent has defined the measures to be undertaken to prevent or reduce injuries that may occur during the specified work activities for the sub project.*

*All activities involving work activities will also be closely monitored by relevant authorities such as NEMA to enforce compliance by the contractor.*

#### **3.4.10 Trade licensing Act Cap 497**

The proponent is required by section 5 of the Act to purchase the building and any other material to be used in the implementation of the proposed sub-project from licensed suppliers.

*The proponent and the community sub project management committee will be careful about the quality of construction and any other materials used in the sub project by the Contractor.*

#### **3.4.11 National Construction Authority (2011)**

The National Construction Authority Act, Number 41 of 2011 streamlines, overhauls and regulates the construction industry in Kenya. The industry has for many years suffered poor legislative framework and has been dominated by quacks and unqualified persons. All contractors must be registered with the Authority meaning that shoddy contractors and quacks will be locked out of the industry. It is an offense to carry out any construction work without first having been registered with the Authority. The Act contains provisions on the quality and safety standards of any construction work.

*The proponent, the community sub project committee and the supervising engineer will check and verify every step of the work by the Contractor to ascertain that quality and safety standards are met and that the work output does not compromise the set achievements of the sub project.*

*The proponent will ensure that regular site meetings by all the relevant stakeholders are held to oversight the work.*

*Also, a competent, registered and reputable contractor firm will be engaged to implement project.*

#### **3.4.12 Climate Change Act, 2016**

The CCA aims to reduce vulnerability to climate change and improve our country's ability to take advantage of the opportunities that climate change offers. The Act is to be applied for the development, management, implementation, and regulation of mechanisms to enhance climate change resilience and low carbon development for the sustainable development of Kenya.

The Purpose and Objectives Clause of the Act (Part 1, Section 3) provides that-

(2) Without prejudice to subsection (1), this Act shall be applied to all sectors of the economy by the national and county governments to –

(a) Mainstream climate change responses into development planning, decisions making, and implementation;

(b) Build resilience and enhance adaptive capacity to the impacts of climate change.

(c) Formulate programmes and plans to enhance the resilience and adaptive capacity of humans and ecological systems to the impacts of climate change.

(d) Mainstream and reinforce climate change disaster risk reduction into strategies and actions of public and private entities.

(e) Mainstream intergenerational and gender equity in all aspects of climate change responses.

*The development and implementation of the Sertonje Borehole sub-project will contribute towards the stated objectives of the climate change act and enhance the resilience of the community to drought particularly through the availability of water for livestock, micro irrigation and domestic use.*

### **3.5 Relevant National Social Policies**

#### **3.5.1 The Wildlife Policy (Sessional Paper No. 3 of 1975)**

This is the policy that governs wildlife management in Kenya. Its goal is “to optimize returns from this resource, taking into account returns from other land uses”. The policy not only recognizes economic benefits from tourism and consumptive uses but also the intangible benefits that include aesthetic, cultural, and scientific gains that accrue from conservation of ecosystems and biodiversity.

*The site is not a wildlife corridor therefore this will not affect the sub project unless the small wildlife like the lizards and birds*

#### **3.5.2 The National Biodiversity Strategy**

The overall objective of the National Biodiversity Strategy and Action Plan (NBSAP) is to address the national and international undertakings elaborated in Article 6 of the Convention on Biological Diversity (CBD). It is a national framework of action to ensure that the present rate of biodiversity loss is reversed and the present levels of biological resources are maintained at sustainable levels for posterity. The general objectives of the strategy are to conserve Kenya’s biodiversity; to sustainably use its components; to fairly and equitably share the benefits arising from the utilization of biological resources among the stakeholders; and to

enhance technical and scientific cooperation nationally and internationally, including the exchange of information in support of biological conservation. Since the road passes through wildlife dispersal areas, strict implementation of mitigation measures identified in the EMP will result in negligible negative environmental impacts.

### **3.5.3 The National Poverty Eradication Plan (NPEP)**

The objective of the NPEP is to reduce the incidences of poverty in both rural and urban areas by 50 percent by the year 2015, as well as to strengthen the capabilities of the poor and vulnerable groups to earn income. It also aims to narrow the gender and geographical disparities as well as create a healthy, better-educated and more productive population. This plan has been prepared in line with the goals and commitments of the World Summit for Social Development (WSSD) of 1995. The plan focuses on the four WSSD themes of poverty eradication; reduction of unemployment; social integration of the disadvantaged people and creation of an enabling economic, political, and cultural environment which can be achieved through developing the transport and communication sector. The plan is implemented by the Poverty Eradication Commission (PEC) formed in collaboration with Government ministries, Community Based Organizations (CBO), the private sector, Non-Governmental Organizations (NGO), as well as bilateral and multilateral donors. *Through employment opportunities, the contractor is expected to positively contribute to poverty eradication while access to water for livestock will improve productivity and during operation will enhance social integration and growth and all this will lead to economic development of the people.*

### **3.5.4 Kenya National Aids Strategic Plan (KNASP III)**

The communication strategy aims at supporting KNASP III to achieve its results through advocacy, information dissemination and social mobilization. The strategy focuses on communicating KNASP III to stakeholders and providing guidelines for programmatic communication programmes. In this regard, the communication strategy targets a wide range of audiences including policy makers, development partners, implementing organizations, the media and key institutions coordinating the national response.

The key components of this strategy are as follows:

- ✓ KNASP governance, financing and strategic information: This component lays out strategies for communicating KNASP III, the coordination structures and strategic

information, leadership, roles and policies and the KNASP III resources mobilization and allocation.

- ✓ Advocacy, communication and social mobilization for the National HIV and AIDS Programme component which provides guidelines for communication programmes for HIV prevention, treatment and care and social protection programmes.
- ✓ This strategy provides guidelines for development of communication programmes and tools. *The stakeholders should use it as a guide. It is a means to support programming of communication programmes and mainstreaming communication in service provision.*

### **3.5.5 The National Policy on Gender and Development**

The overall objective of the policy is “to facilitate the mainstreaming of the needs and concerns of men and women in all spheres into development process in the country. To this end, the policy identifies eight critical areas of concern: the economy; poverty and sustainable livelihoods; law; political participation and decision-making; education and training; health and population; the media; and policy implementation framework and resource mobilization. The policy has made several important suggestions in respect of legal, regulatory and institutional reforms that can be undertaken to ensure that obstacles to equitable sustainable development are removed. The policy arose from the Government’s realization that without a coherent and comprehensive framework for guiding the different sectors and agencies involved in development, tremendous resources may continue to be lost through duplication unless the thrust of mainstream development directly addresses gender concerns. The Policy recognizes that traditional development theories have not facilitated the participation of women in strategic areas and positions of power and influence because they are based on traditional assumptions of the roles and responsibilities of women and men. The approach also recognizes that without quality gender disaggregated data, the planning and programming process cannot be efficient and productive. With regard to the environment, the policy advocates for programmes that take into consideration environment and natural resource management issues that concern women, men, girls and boys.

The Government realizes that certain environmental issues have specific relevance to women. This could be through the negative effects of some environmental concerns which could have adverse effects on the female population or some special skills and knowledge

women could possess in resolving environmental problems. *For this project, it is foreseen that a majority of jobs would favour men due to the nature of the works (heavy equipment, site clearing, drilling, excavating, blasting and many long hours away from home. Social norms restrict women's sphere of activity but they are also likely to benefit if the contractor employs a quota system that would oversee a certain number of women given employment for unskilled labour. Women are also likely to take advantage of water near their homes hence reduced time spent on water collection; they will spend the saved time on other economic that would boost their economic well-being.*

### **3.5.6 Sexual Offences Act No. 3 of 2006**

This is an Act of Parliament that provides for sexual offences, their definition, prevention and the protection of all persons from harm from unlawful sexual acts, and for connected purposes. The Act on Section 23 states that on any one in a position of authority or holding a public office who persistently makes any sexual advances or requests which are unwelcome, is guilty of the offence of sexual harassment and shall be liable to imprisonment for a term of not less than three years or to a fine of not less than one hundred thousand shillings or both.

This Act therefore gives the public and the workers of the road project the right to report any indecent behavior to a court of law and protects children and young girls from defilement and other adult persons from all forms of harassment and discrimination Further, Section 26(1) of the Act states that any person who, having actual knowledge that he or she is infected with HIV or any other life threatening sexually transmitted disease intentionally, knowingly and willfully does anything or permits the doing of anything which he or she knows or ought to reasonably know –

- (a) Will infect another person with HIV or any other life threatening sexually transmitted disease;
- (b) is likely to lead to another person being infected with HIV or any other life threatening sexually transmitted disease;
- (c) Will infect another person with any other sexually transmitted disease, is guilty of an offence.

The Act prohibits a wide range of sexual offences including rape of all kinds, indecent acts, incest, pornography, child trafficking, etc. *To comply, the proponent and his agents will be advised on the requirements of the Act, not discriminate on the basis sex during hiring*

*of workers, on sexual harassment, and awareness creation among the workers. Also, he shall be provided with this document as part of contract.*

### **3.5.7 The Land Act, 2012 No. 6 of 2012 (The Land Laws (Amendment) Act, 2016 No. 28 of 2016)**

Under section 3.(1) the Act applies to all land declared as— *(a) public land under Article 62 of the Constitution;* (b) private land under Article 64 of the Constitution; and (c) community land under Article 63 of the Constitution and any other written law relating to community land.

In section 8(d) the Commission on behalf of the National or County Government may require the land to be used for specified purposes and subject to such conditions, covenants, encumbrances or reservations as are specified in the relevant order or other instrument.

The land allocated for the intake site falls under the categories of land described in section 12(2) of the Act that is, contain endangered or endemic species of flora and fauna, critical habitats or protected areas.

- ❖ *The proponent through this ESIA and ESMP has developed appropriate measures to ensure that the proposed development is implemented sustainably through the prevention and reduction of adverse impacts.*

### **3.5.8 The National Land Commission Act, 2012 No. 5 of 2012**

Section 5(1) pursuant to Article 67(2) of the Constitution, the functions of the Commission shall be —... (2) in addition to the functions set out in subsection (1), the Commission shall, in accordance with Article 67(3) of the Constitution— ... *(c) ensure that public land and land under the management of designated state agencies are sustainably managed for their intended purpose and for future generations.*

- ❖ *The proponent in this ESIA and the ESMP has outlined measures to ensure that the proposed sub project and the land in use are well managed to bring about environmental, and socio-economic well-being. Examples of measures include catchment protection, waste management, pollution prevention and promotion of SLM among farmers.*

### **3.5.9 Malaria Prevention Act (CAP 246)**

AN ACT of Parliament to repeal and re-enact the Malaria Prevention Act, to establish the National Malaria Prevention and Control Institute, to provide for the prevention and control of malaria and for connected purposes.

- ❖ *The Proponent has adequately provided measures (such as sensitize the community on use of treated mosquito nets, local spraying and bush clearing near households) for the prevention and control of malaria.*

### **3.6 Development Partner Regulations on Environmental and Social Management**

#### **World Bank**

The World Bank Investment project financing department aims to promote poverty reduction and sustainable development of member countries by providing financial and related operational support to specific projects that promote broad-based economic growth, contribute to social and environmental sustainability, enhance the effectiveness of the public or private sectors, or otherwise contribute to the overall development of member states. The Bank assesses the proposed Project based on various country and Project specific considerations, including consistency with the Bank's strategy in support of the country, Project development objectives, taking into account technical, economic, fiduciary, environmental, and social considerations, and related risks.

The applicable environmental and social policies are set out in the following OPs: 4.01, 4.04, 4.09, 4.10, 4.11, 4.12, and 4.36, as appropriate to the sub project. The WB group will therefore demand for accountability and sub project compliance from the time of implementation till the time of commissioning the operation.

#### **OP/BP 4.01 (Environmental Assessment)**

The World Bank has well-established environmental assessment procedures, which apply to its lending activities and to the sub-projects undertaken by borrowing countries. The World Bank follows a relatively standard procedure for the preparation and approval of an environmental assessment study, which:

- Identifies and assesses potential risks and benefits based on proposed activities, relevant site features, consideration of natural/human environment, social and trans-boundary issues
- Compares environmental pros and cons of feasible alternatives
- Recommends measures to eliminate, offset, or reduce adverse environmental impacts to acceptable levels (siting, design, technology offsets)
- Proposes monitoring indicators to implement mitigation measures
- Describes an institutional framework for environmental management and proposes relevant capacity building needs.

The environmental assessment evaluates a sub-project's potential environmental risks and impacts in its area of influence; examines sub-project alternatives; identifies ways of improving sub-project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental and social impacts and enhancing positive impacts; and includes the process of alleviating and managing adverse environmental impacts throughout sub-project implementation.

Environmental Assessment is used in the World Bank to identify, avoid, and mitigate the potential negative environmental associated with Bank lending operations.

*The Proponent undertook screening of the proposed Sertonje Borehole sub project on 12<sup>th</sup> November 2019 as per OP/BP 4.01 (Environmental Assessment)-environmental and social screening checklist.*

*The screening report was submitted to NEMA County Director Environment (Baringo) who indicated a partial ESIA be undertaken for the sub project. Consequently, the proponent commissioned the consultant to take this ESIA study.*

*This ESIA study engaged a wide range of stakeholders to make sure that the views of interested and affected persons are captured early enough in the sub project planning and design.*

*The ESIA has followed WB social safeguards OP/BP 4.01 (Environmental Assessment) and EMCA 387 EIA/EA regulations 2003 set criterion*

*This report has established all the significant impacts that need to be addressed and proposed appropriate measures to prevent or reduce any risk that may be posed to the environment (physical, biological and social).*

*The adverse impacts and their mitigation measures are well outlined in the ESMP including responsible parties, duration and cost in the whole project cycle.*

*The experts also consulted the public in developing this ESIA report as required by this policy.*

#### OP/BP 4.04 (Natural Habitats)

The proposed sub project has been well planned and designed to ensure that ecological processes and ecosystem balance in the sub project site are not interfered with. A careful evaluation of the sub project context has been carried out in the baseline studies to determine if the sub project setting has any natural habitat that may be disrupted due to the implementation of the sub project.

***It was found that the sub project;***

- ✓ *The sub project is proposed to be located in Kapkundul primary school, within a public institution. In Kenya, public institutions are established, owned and operated by the government. The land is administered under the National Land Commission Act and the Land Act. The land for the proposed sub project is not a natural habitat and does not have any sensitive ecological system or threatened or endangered species of flora or fauna.*
- ✓ *The proponent through this ESIA and ESMP has proposed measures for protecting, preserving and conserving the environment in the sub project setting from predicted and emergent adverse impacts.*

#### OP/BP 4.11 (Physical Cultural Resources)

This policy is meant to assist in preserving physical, cultural resources including the movable or immovable (above or below ground, or underwater) objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance including sites and unique natural values.

The objective of this policy is to avoid or alleviate adverse impacts on physical cultural resources from development sub-project.

*The proponent during the environmental and social screening exercise enquired from the community of the possibility of a history of any physical or cultural significance of the proposed sub project site.*

*It was found out from the community that the land for the sub project site has not and is not known to have any physical or cultural object/resource that the proposed development may interfere with.*

*However, as per the requirement of this guideline (OP/BP 4.11 -Physical Cultural Resources) the proponent has outlined precautionary measures to be undertaken in case of chance encounter with any physical or natural resource during the processing of drilling the borehole. (Refer to annex 16 for chance find procedure)*

#### OP/BP 4.12 (Involuntary Resettlement)

The proposed development will entail the construction and equipping of a borehole, water tank, water kiosk and a water trough. The proposed site for the borehole is a public land administered under the National Land Act 2012 and the Land Act 2012.

The other infrastructures, water kiosk, water tank and water trough have been proposed for construction in land donated freely by the benefiting members of the community (*refer to annex 12*) Minutes on Sertonje water committee meeting *Min 3/2019 shows the members who agreed to make the land donations.*

- ✓ *Will not result in loss of the land owners livelihood e.g. farming(crops, fruit trees) or pasture for livestock*
- ✓ *Will not result to any restriction on access to resources - community and households will have access to water for productive use*
- ✓ *Will not lead to displacement of families or businesses*
- ✓ *Will not result in need for any form of resettlement hence a Resettlement Action Plan will not be prepared for the sub-project.*

#### OP/BP 4.36 (Forests)

The policy on forest seeks to realize the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development and protect the vital local and global environmental services and values of forests.

*The proposed sub-project is not in a forested area and therefore, OP/BP 4.36 is not triggered. The proponent though has provided mitigation measures to protect vegetation, particularly indigenous trees in the site during the construction and operation phases.*

#### OP/BP 4.10 (Indigenous Peoples)

This policy contributes to the Bank's mission of poverty and sustainable development by ensuring that the development process fully respects the dignity, human rights, economics, and cultures of indigenous people.

The objective of this policy is to design and implement sub-projects in a way that fosters full respect for Indigenous Peoples' dignity, human rights and cultural uniqueness and so that they receive culturally compatible social and economic benefits and do not suffer adverse effects during the development process.

- ✓ *The ethnic group in the area is the Endorois who are categorized as indigenous persons. The Endorois were fully involved in this ESIA study and the local Endorois language was used during the public participation. The venue of the public participation during the ESIA study was chosen by the Endorois community.*
- ✓ *The community was involved in the sub project through public participation from the planning and design phases in the prescribed culturally appropriate ways. Sertonje borehole project had been proposed by the community to address the water scarcity problem in Mugurin. During the public participation the community explained that they really suffered especially during drought when they have to move for more than 6.5 km in search of water for livestock and domestic use.*
- ✓ *The community has an elected Sertonje Borehole Community sub project committee that will be involved in the implementation of the sub project in the whole sub project cycle*
- ✓ *The community concerns the proposed project have been captured in the chapter on public participation and addressed in the ESMP.*

#### OP/BP 4.09 (Pests Management)

The policy is meant to minimize and manage the environmental and health risks associated with pesticide use and promote and support safe, effective and environmentally sound pest management.

*The proponent through this ESIA and ESMP has identified indirect impacts that might arise from the sub project such as increased use fertilizers and pesticides due to micro irrigation and has outlined measures that will be undertaken for safe, effective and environmentally sound pest management.*

### **3.7 International Conventions and Treaties**

Kenya has ratified or acceded to numerous international treaties and conventions. Those that have implications on sub-project are described below.

#### **3.7.1 Conservation of Biological Diversity (CBD) Regulations 2006**

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

- ✓ *The Proposed sub project site is not habitat to any threatened or endangered species of flora or fauna.*
- ✓ *The sub project does not pose any threat to any plant or animal life in the sub project context*
- ✓ *The Proponent will ensure that great care is exercised in the protection of vegetation during construction by the Contractor.*
- ✓ *In the ESMP the proponent has made provision for the establishment of tree nurseries and promotion of tree growing.*

#### **3.7.2 Sustainable Development Goals**

*Through the implementation of the sub project by the proponent the following SDGs will be achieved in the Sertonje community.*

**Goal 2:** End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

**Goal 6:** Ensure availability and sustainable management of water and sanitation for all;

**Goal 9:** Build resilient infrastructure, promote inclusive sustainable industrialization and foster innovation; and

**Goal 15:** protect, restore, promote sustainable use of terrestrial ecosystems, manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

- ✓ *There is a committee formed at the county level comprising of hydrologist, NEMA, water engineer, CPCU M&E and CESSCO, department of environment, agricultural engineer and a technical officer from agriculture department who shall be regularly do monitoring on the implementation of this ESMP*
- ✓ *Implementing specific measures are specified in the ESMP.*
- ✓ *Monitoring ESMP implementation will be done by the County Environmental Committee, CTAC, CPSC, County Project Implementation Unit and the Community Committee.*
- ✓ *This ESIA and ESMP in particular will be part of the Contractor's contract and that the supervision consultant will be charged with ensuring compliance with the same.*

## CHAPTER FOUR

### NATURE OF THE PROPOSED SUB-PROJECT DESIGNS, WORKS AND ACTIVITIES

#### **4.1 Proposed sub-project overview**

##### **4.1.1 Sub-project Details**

**Name of the proponent:** KCSAP Baringo

**Nature of business:** Borehole drilling and equipping (water tanks, piping, water troughs, water kiosks)

**Date of Assessment:** 4<sup>th</sup> December 2019

**Site Address:** Sertonje Village, Mugurin sub-location, Kisanana Ward, Mogotio Constituency

##### **4.1.2 Proposed Sub-project Ownership**

The sub project site is a public land at Kapkundul Primary School reserved for public purposes. The school management committee and the sub project committee made an agreement through formal letter writing and **minutes (refer to Annex 12)** and the sites for the tanks were freely donated by the benefiting members. The sub-project is owned by the community but implemented through the climate-smart programme and managed through a committee.

##### **4.1.3 Sub-project Area Description**

The sub-project area lies in a sparsely populated area with livestock keeping and crop farming being the main land use. The area is ASAL and lies within a marginal mixed farming livelihood zone. There is a seasonal river (Mugurin River) that runs to the west of the proposed borehole site. The nearest reliable water sub-project is between 5-10km away. The area is sparsely distributed with bush and a few scattered trees.

##### **4.1.4 Sub-project Site Location**

The GPS coordinates of the sub-project site are Latitude 0° 4'43" N, Longitude 36° 2'57" E; UTM AA77; with an elevation of 5085ft. The sub-project area is found in Mugurin sub-location, Mugurin location, and Kisanana ward in Mogotio Sub County. The sub project will be constructed at Kapkundul Primary School. The inhabitants comprise Endorois who are categorized as indigenous persons.

## 4.2 The proposed sub-project designs

### 4.2.1 Groundwater Survey

In compliance with the provisions of the Water Act No. 43 of 2016, Baringo County Government engaged the services of hydrogeologists to carry out a hydrogeological and geophysical survey aimed at selecting a suitable borehole drilling site at Sertonje area in Kisanana Ward, Mogotio Sub- County. The area is situated in a zone with moderate groundwater potential. The study concludes that on the basis of geological evidence, groundwater prospects for intended purposes are tenable to meet the requirement of the Proponent. The report was one of the documents Water Resources Authority required for processing the permit. (Refer to annex 13 & 14)

### 4.2.2 Borehole Drilling

Drilling should be carried out at a diameter of not less than 8", using a rotary type machine. The drilling rig should be able to drill to a depth of at least 350 m, at the specified diameter. The rig and the drilling method adopted must be suitable for drilling through both unconsolidated material, and hard, compact volcanic rocks. ***The proposed borehole is to be drilled to a depth of not less than 200m, to a maximum of 220 m bgl. Sustainable yield of approximately 4m<sup>3</sup>/hr. is expected. The water demand is estimated to be 20m<sup>3</sup>/day.***

Drilling additives to be used (e.g. foam or polymer) must be non-toxic and biodegradable. They should have clear labels for ease reading by the supervising team. In no circumstances will bentonitic additives considered to be acceptable, as they may plug the aquifer zones and are extremely difficult to remove during development.

Geological rock samples should be collected at 2 metres intervals. Water struck and rest levels should be carefully recorded, as well as water quality and estimates of the yield of individual aquifers encountered.

Great care should be taken that the water quality of the different aquifers is accurately determined. Upon the first strike, drilling fluids should be effectively flushed, and after sufficient time, a water sample should be taken off the air-blown (rotary) yield. On-site analysis using an EC meter, and preferably a portable laboratory, is recommended.

Once the borehole has been drilled, testing will be done in order to:

- Confirm yield, efficiency, and performance;
- Investigate water quality;

- Assess whether abstraction can be sustained in terms of yield and quality;
- Identify potential impacts;
- Characterize the aquifer properties such as transmissivity, hydraulic conductivity, and storage.

#### **4.2.3 Water Well Design**

The design of the well should ensure that screens are placed against the optimum aquifer zones. The final design should be made by an experienced hydrogeologist.

#### **4.2.4 Casing and Screens**

The well should be cased and screened, in order to avoid collapsing and sediment intake. Considering the great depth of the borehole, it is recommended to use mild steel casings and gas slotted screens (which are cheaper than machine slotted screens) of 6" diameter. However, the screens should be well done, with a uniform slot size.

#### **4.2.5 Grouting/Gravel Pack**

Grouting is the act of injecting certain substances into the void of earth materials to reduce or eliminate their permeability, consolidate them, or increase their strength. The use of a gravel pack is recommended within the aquifer zone because the aquifer could contain sands or silts which are finer than the screen slot size. A 8" diameter borehole screened at 6" will leave an annular space of approximately 1", which is sufficient to allow the insertion of fine, quartzitic gravel. The grain size of the gravel pack should be within the range of 2 to 5 mm, and granules should be rounded to well-rounded. Over 95% should be siliceous.

The gravel pack should be washed down with copious volumes of water to avoid bridging.

#### **4.2.6 Plumpness and Alignment**

Water well should be both straight and plumb, although in practice any borehole of substantial depth may not be perfectly straight or perfectly plumb. A wellbore may be straight but not plumb. A deviation from plumpness of two-thirds the well's inside diameter per 30 meters is reasonable, considering the difficulties of drilling in earth materials. The straightness of the wellbore is important because it determines whether or not the casings and a properly sized pump can be installed in the well to the desired depth.

#### **4.2.7 Well Construction**

In installing screen and casing, centralizers at 6 metres intervals should be used to ensure centrality within the borehole. This is particularly important to insert the artificial gravel pack all around the screen. If installed, gravel packed sections should be sealed off at the top and

bottom with clay or bentonite seals (2 -3 m).

The remaining annular space should be backfilled with inert material (drill cuttings may be used), and the top three metres grouted with cement to ensure that no surface water at the wellhead can enter the wellbore and thus prevent contamination.

#### **4.2.8 Well Development**

Once the screen, gravel pack, seals and backfill have been installed, the well should be developed. All drilling methods cause some plugging of fractures or crevices in rocks. Borehole development is designed to maximize the good yield.

- Repairing the damage done to the aquifer material during drilling and restore the natural hydraulic properties.

In both cable tool (i.e. percussion) and air hammer drilling, the bit action chips and crushes the rock, and mixes it with water and other fine material into thick mud slurry. The pounding of the bit forces this slurry into the openings in the wall of the borehole, thus blocking the pores and impeding the flow of water from the aquifer. A thick "wall cake" may form, especially when clay additives (such as bentonite) are used during drilling or where natural clays occur in the penetrated formations. This cake, if not removed, may virtually plug the borehole, and significantly reduce the discharge. It should be noted that the maximum yield of a formation can only be realized if all the fractures and crevices are unblocked and able to supply water to the well.

Borehole development techniques are applied to break down and remove the impermeable layer of clayey material from the borehole wall. Swabbing, wall- scratching, airlift rawhiding and polyphosphate dosing are all borehole development techniques.

- Altering the characteristics of the aquifer volume in the vicinity of the borehole, by improving hydraulic contact between the aquifer and the hole. This is essentially aquifer development and is also known as aquifer stimulation.

Polyphosphate dosing, hydro fracturing and acidizing are examples of aquifer stimulation techniques.

The development methods to be applied depend on the available equipment, and differ significantly between percussion and rotary drilling (the latter being superior when it comes to efficiency):

Development with a percussion rig: if a cable tool rig has been deployed the available

development techniques are relatively simple but less effective than the methods used in modern rotary drilling. The following measures are recommended:

- Backwashing and bailing: using a surge block with rubber flaps slightly smaller than the internal diameter of the hole, start near the top of the water-bearing zones and surge downwards (surging upwards may lead to the surge block sand-locking, which can jeopardize the hole). Bail the borehole clean periodically. Repeat this cycle until no more material is brought up, bailed water is clear and electrical conductivity is stable.
- Polyphosphate dosing: percussion equipment does not include mud pumps and drill pipe, so jetting is impossible. Polyphosphate dosing comprises no more than simply pouring water with dissolved sodium hexametaphosphate and calcium hypochlorite into a pipe, the base of which is located near the bottom of the hole.
- The polyphosphate is allowed to act for 12 hours or overnight.
- Repeat the backwashing and bailing cycle until the water is clear and electrical conductivity stable.

#### **4.2.9 Development Methods**

Borehole development methods include over pumping, backwashing, mechanical surging, air development, high-velocity air or water jetting, and a combination of high- velocity water jetting and simultaneous pumping.

If a rotary rig equipped with a strong air compressor is available, more effective development techniques can be applied:

- Airlift rawhiding, into and through the aquifer zones. This should continue until the water lifted is clean and clear, with electrical conductivity stable. Rawhiding comprises cyclic airlifting: once the airlift has been established, the air supply is cut off and water allowed to cascade down the hole. This creates overpressures across the borehole wall, which agitates the formation and enhances cleaning. The airlift is then started again, and the cycle repeated.
- Water jetting with an on-wall velocity of 30 m/s: at least 0.3 m<sup>3</sup> of fluid should be jetted per linear metres of the screen. The water used for jetting must be absolutely clean, and it is dissolved as in the polyphosphate dosing described under Section 4.2. The jetting tool should be so constructed that the jet openings are not more than 1" (25 mm) from the borehole wall. Jetting should start from the top of the water-bearing

formation rotating downwards. After the entire saturated zone has been jetted, the hole should be left for at least 12 hours or overnight, to allow the hexametaphosphate to work on the “wall cake” and any clayey material in the aquifer material.

- Airlift rawhiding again, from the bottom of the hole, until airlifted water is absolutely clean and electrical conductivity stable.

During development, an estimate of the bailed or air-blown yield should be made. This usually gives a fair indication of the final range of abstraction that can be expected from the borehole. The use of over-pumping as a means of development is not advocated since it only increases permeability in zones that are already permeable.

#### **4.2.10 Well Testing/Pumping test data**

After development and preliminary tests, a step-draw down test, and a 24-hour long-duration well test at a constant discharge rate should be carried out. Pumping tests are conducted to determine the performance characteristics of a well, the hydraulic parameters of the aquifer and the specific yield of a particular aquifer or several aquifers during the course of drilling.

Well tests have to be performed on all newly completed wells: apart from providing information on the quality of drilling, design, and development, it also enables the hydrogeologist to compute sustainable abstraction rates, design drawdown, and other important well and aquifer parameters.

The results from properly conducted tests are the most important tool in groundwater investigations.

Measurements of water levels after the pump is stopped (recovery) is extremely valuable in verifying the aquifer coefficients calculated during the pumping phase of the test.

The pumping test should be conducted for a continuous period of 24 to 72 hours, depending on the type of aquifer. The accuracy of drawdown data taken during a pumping test depends on the following: -

- Maintaining a constant yield during the test.
- Measuring the drawdown carefully in the pumping well and in one or two properly placed observation wells.
- Taking draw down readings at appropriate time intervals.
- Determining changes in barometric pressures; stream levels affect the drawdown data.
- Comparing recovery data with drawdown data taken during the pumping portion of the

test.

- Continuing the test for 24hours for a confined aquifer and 72 hours for an unconfined aquifer during constant rate tests level for the borehole must be recorded as well as the intake and the pumping water, levels of the pump during water abstraction.

#### **4.2.11 Pumping Plant**

The proposed borehole will be pumped using an electrical solar submersible pumps preferred for its affordability to the community in terms of operation and maintenance.

#### **Other components of the borehole to include;**

- Rising mains
- Storage tank (100M3)
- Pump house
- Water kiosk

The sub-project will be under the management of an elected committee.

#### **4.2.12 Legal Requirements**

It is a legislated condition imposed by the Water Resources Management Authority (Water Act 2016), that all boreholes in Kenya be equipped with a flow meter and a means by which water levels can be measured. These measures have been designed to allow the collection of data which will enable both the authorities and the borehole operators to learn more about the reliability and limitations of their groundwater resources.

#### **4.2.13 Decommissioning phase**

Decommissioning phase activities will be divided into the following activities.

- Disconnect the water and electricity supply
- Refill the drilled hole
- Restore the site to original status

### **4.3 Materials used in Construction and Sub-project Cost**

#### **Material Input**

The materials to be used fall into two categories: temporary and permanent.

Temporary Materials -materials will include the materials, which will be used to facilitate the drilling work.

### **4.3.1 Temporary materials**

#### **4.3.1.1 Water**

Drilling water should not come from wetlands or seasonal swamps in the environs of the proposed borehole site. This is because these water supplies are likely to harbor pathogenic and iron bacteria and their subsequent growth in the borehole can cause serious problems both on human health and installed equipment in the hole. Water for drilling activities should be clean and of good quality.

#### **4.3.1.2 Drilling foam**

Foam drilling is associated with the introduction, into the air, of a surfactant mixed with water. Anionic soap mainly comprising sodium alkyl ether will be used. The foam is primarily used to enhance the rate of cuttings removal by preventing them from aggregating so that they can be lifted more easily to the surface. The advantages of the foam are:

Higher solids carrying capacity, ability to lift large volumes of water, reduced air volume requirements, reduced erosion of poorly consolidated formations, effective dust suppression, and increased borehole stability.

The foams used are slightly viscous amber colored fluid with a Biological oxygen demand/chemical oxygen demand (BOD/COD) ration greater than 0.1 which is readily biodegradable. 1m<sup>3</sup> of the injection fluid is required per 1m<sup>3</sup> of ground removed.

Lubricants and Diesel will be used to run the engines of the drilling machine, mud pump, and generator just within the period of implementing the sub-project.

### **4.3.2 Permanent Materials**

Permanent materials include the items, which will be installed after completing the drilling of the hole. These include:

#### **4.3.2.1 Casings and Screens**

These will be mild steel pipes. They will be installed in the drilled hole. They are not corrosive hence the least likely to affect the water quality.

#### **4.3.2.2 Gravel Pack**

The grain size should be in the range of 2 to 5 mm, rounded to well granules, which should be 95% siliceous. The material is locally available where sand deposition has taken place such as at banks of rivers. The gravel pack shall be installed in the annular space (1" round space between the borehole wall and the casings) of the borehole. The activity is conducted to ensure the infiltration of sediment and silt free groundwater to the borehole. Any fines in the gravel should be removed by washing or sieving.

#### **4.3.2.3 Bentonite**

The material is mixed with water and will be used in the construction of the borehole in sealing some sections of the annular space for sanitary purposes.

#### **4.3.2.4 Cement**

Cement grout in the annular space and slab on the surface will be used for sanitary purposes.

#### **4.3.2.5 One-meter (1m) steel casing**

This is used for the borehole cap to avoid entry of surface water into the borehole. It will then be fitted with a cap at its top to prevent anybody from throwing foreign material into the hole.

#### **4.3.2.6 Pipes**

These will be class 'C' steel rising main to be connected to the submersible pump and class C steel pipes to connect the water supply to the storage tank.

#### **4.3.2.7 Inert material**

The drilled material will be reused by filling a section of the annual space during the borehole Construction.

#### **4.3.2.8 Dipper line**

It is a legal requirement under the Water Act, 2016 that every borehole sunk should be fitted with a dipper line (I.e. a 25 mm diameter u PVC airline attached to the rising main) in order to monitor the water level using water deeper around seasons and whenever such need arises. This is a long-term exercise and is vital because the owner or any stakeholder can assess the performance of a borehole by observing the pumped water level and static water level after the safe recommended yield is pumped for the recommended length of time.

The pumps shall consist of centrifugal pumps specified by the engineers for this purpose.

## CHAPTER FIVE

### ANALYSIS OF PROPOSED SUB-PROJECT ALTERNATIVES

#### **5.1 Introduction**

This section examines feasible alternatives to the proposed borehole sub-project. The benefits of the proposed sub-project has been considered against any potential environmental cost. The general principle involved in identifying alternative option(s) to a proposed development was to ensure that the option chosen would result in optimal social, environmental, and capital benefits not only for the proponent but also for the general environment in the area. This section is a requirement by NEMA and is critical in consideration of the ideal development with minimal environmental disturbance. This section has explored three alternatives namely, No-action alternative, Relocation alternative and the proposed development as described in this ESIA report.

#### **5.2 “No-action” alternative**

##### **5.2.1 Assessment**

The selection of the “No-action” alternative would mean the discontinuation of the proposed sub-project. Thus, the site is retained in its existing form. If this alternative is selected, the site is unlikely to undergo any changes from its present condition. This option may be based on the principles that the proposed:

- i). Site is environmentally sensitive such as having one or more threatened rare, endangered, endemic, or precious minerals, plant or animal species or any other flora or fauna that is considered for preservation under an Act of Parliament.
- ii). Site is found in an archaeological or historical site or is found to have a historically or archaeologically, or culturally important material; and/or
- iii). The sub-project will have severe implications on the environment if implemented.

##### **5.2.2 Findings**

- a) The proposed development will not be an impediment to any other development in the area since there are other similar sub-projects within the proposed sub-project area
- b) The products of the proposed sub-project will not have serious implications on the environment; instead, it will enhance the livelihoods in the area beside the health.

c) There are no physical, biological, cultural, and socio-economic features of concern at/or near the proposed site.

### **5.2.3 Implications**

- i). Loss by the proponent in terms of financial commitments already made
- ii). There would be loss of income opportunities that the sub-project is envisioned to create
- iii). The borehole as a response strategy to enhance water availability and accessibility would not be achieved and the community will continue to be vulnerable to the effects of drought
- iv). The county and national government will not gain from the tax income that the sub-project would generate if implemented
- v). It would discourage the proponent and any other local and international investors from investing in such a sub-project in the area resulting in a zero development.

## **5.3 Relocation Alternative**

### **5.3.1 Assessment**

This option would mean the transfer of the proposed development to another site. The proponent engaged the services of a hydrogeologist to investigate the site to determine the following parameters

- The thickness of tertiary deposits
- The vertical extent of the water body
- Depth of weathered zones.

The scope of the study was to select the most suitable site for groundwater development, taking into account the prospects for sustainable abstraction, water quality, and economic viability.

If the relocation option is selected the proponent is required to look for an alternative site either within or outside the zone. This option may be based on the principles that the proposed development:

- a) It is a hindrance to existing development.
- b) It is not compatible with other developments in the area, and
- c) As in the no-development option the sub-project site is an ecologically sensitive area.

### **5.3.2 Findings**

- a. The proposed development will not be an impediment to any other development in the area since there are other similar sub-projects within the proposed sub-project area.

- b. The products of the proposed sub-project will not have serious implications on the environment.
- c. There are no physical, biological, cultural, and socio-economic features of concern at/or near the proposed site.

#### **5.4 The Proposed Development as Described in the ESIA Report**

The impacts and mitigation measures for this alternative are discussed in detail throughout this report. The positive impacts have also been identified. The Merits of this alternative are as follows:

- reduced distance to water source
- development of tree nurseries (enhanced growing of trees)
- creation of kitchen gardens (improved food security)
- Improved livestock breeds and livestock diversification e.g. beekeeping.
- Availability and access to a clean and reliable source of water
- Reduced waterborne related diseases.
- Improved domestic water supply infrastructure in the area
- The enhanced adaptive capacity of the community to climate change effects e.g. drought
- Most potential negative impacts would be easily mitigated by the measures proposed in the EMP of this report.

#### **5.5 Borehole Depth Alternative**

##### **5.5.1 Assessment**

This option would mean considering the development of a shallow well instead of the proposed borehole sub-project. A shallow well would mean not been able to reach the underground aquifer and therefore, no water is yielded.

##### **5.5.2 Findings**

The hydrogeological conditions were considered and were found to be determined by geological structures, namely faults that run North-South. The faulted and folded troughs were found to form good aquifers. Therefore, it was found drilling of the borehole to a depth of **not less than 200m, to a maximum of 220 m bgl.** as an appropriate option for maximum water yields.

Sustainable yield of approximately 4m<sup>3</sup>/hr. is expected.

## **5.6 Pumping Plant Alternative**

### **5.6.1 Assessment**

Several options of pumping water from the borehole. This option involves considering the alternative that would meet the water demand and that would be economically viable for the community. The alternatives considered are

- i). Submersible pumps: Currently, these are arguably the most popular borehole pumps in Kenya. Electrical submersibles are efficient and require little maintenance, though of course, they do require electrical power on-site, e.g. from a generator set or the power mains.
- ii). Electrical solar submersible pumps: These are as yet relatively little used in Kenya, mainly because the plant is comparatively expensive.
- iii). Turbine or Mono pumps: Given the yield requirements of the Client, both turbine and Mono-type pumps would be needlessly expensive.
- iv). Reciprocating pumps: Formerly the most popular type of pump used in Kenya. With the introduction of electrical submersibles and modern wind pumps, reciprocating pumps have gradually dropped out of use.

### **5.6.2 Findings**

Considering the options of pumps available and the burden of maintenance on the community and the community choice this report proposes the use of the solar submersible pump as even though the initial cost is high the cost of maintenance will be low for the community.

## **CHAPTER SIX**

### **ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES**

#### **6.0 Introduction**

The environmental baseline information collected, and the sub-project description discussed form the basis for impact identification and evaluation. The impacts that are expected to arise from the sub-project could either be termed as positive or negative, direct, or indirect, short-term, or long-term, temporary or permanent depending on their nature, area of coverage and their duration in the environment and have been identified in all the phases of the proposed sub-project cycle namely, **construction, operational and decommissioning which is discussed individual as indicated below:**

#### **A. Construction Phase**

##### **6.1 Anticipated Positive Environmental and Social Impacts**

###### **6.1.1 Creation of temporal employment**

During the construction stage of the proposed sub-project, there will be direct and indirect employment opportunities for both professionals and unskilled workers.

###### **6.1.2 Injection of money into the local and national economy**

A substantial sum of the sub-project money shall be released into the local economy due to the construction activities. This money will be informed of payments for skilled and unskilled labour; purchases of construction materials; and payments for local provisions including fuel, foods, and accommodation.

###### **6.1.3 Improved businesses**

There will be temporary establishment of business that will benefit the community in supplying of the materials necessary in the sub project as described above. Also the mama uji will get an income by feeding the workers in the sub project.

###### **6.1.4 Skills transfer**

The employment of the skilled personnel will have both from the economic and social point of view. The community members will learn new skills in handling water structures and this will enhance the community skills.

###### **6.1.5 Improved access**

The sub project area is a rural setting where roads are not well maintained, with the introduction of the investment, the roads will regularly be maintained to ease access to the water tanks, water

kiosks, and the water pumping area.

## **6.2 Anticipated Negative Environmental and Social Impacts**

### **6.2.1 Soil Compaction and Erosion**

As machines and people move on the ground the soil is compacted. Compaction has the undesired effect of hindering air and water penetration beneath the soil surface and thus limiting aerobic activities of soil-dwelling organisms. This may have negative consequences on soil productivity on a localized scale. Compaction also enhances run-off during the rainy season resulting in soil erosion.

#### **Mitigation measures**

- a) Strictly control construction vehicles to ensure that they operate judiciously and over designated areas to reduce soil compaction.
- b) Rip off any compacted areas after construction to allow aeration of the soil and ease the infiltration of water into the soil.

### **6.2.2 Groundwater pollution**

Poor water quality could be of great concern to human and animal health. The water that seeps into the ground may be contaminated to some degree and eventually affect the quality of the groundwater and indeed, borehole water. Percolation of water from sanitary systems i.e. toilets and refuse disposal sites pose a serious threat to the preservation of groundwater quality.

The protection of groundwater quality depends on the well design and the methods and materials used to construct the well. Some of the deficiencies in well construction are: -

- a) Insufficient or substandard well casing
- b) Inadequate seal between the well casing and the borehole
- c) Poor welding of casing joints
- d) Lack of sanitary protection at the wellhead.
- e) Use of well pits.

#### **Mitigation measures**

- a) Groundwater quality must be safeguarded by correct spatial planning and protection of surface waters since these are strictly linked to groundwater resources.
- b) Ensure that all potential sources of pollution are eliminated for example by ensuring that sanitary facilities are constructed according to public health requirements

- c) The proponent will adhere to the regulations set by the Water Act 2016 Management and development on the amounts to be extracted from a borehole and the number of pumping hours. This helps to reduce wastage and misuse of this resource.
- d) Use water-based drilling fluid
- e) Case the well as it passes through the water table
- f) Proper housekeeping within and around the rig will be observed before, during and after drilling, while proper cleanup procedures will be undertaken in case of drilling fluid and oil spills.

### **6.2.3 Risk of Noise and vibrations**

Noise is unavoidable during the *construction period*. The drilling works and incoming vehicles to deliver drilling and construction materials and communication among workers will most likely result in noise emissions. The noise could impact negatively on the workers during the construction phase. Noise can also be a nuisance to the local community if construction works begin too early in the day and continue into the night.

The noise generated during any construction is best described as part of a normal occupational hazard that workers in the construction industry face. Noise levels from construction activities exceeding **60 Db (A)** at the construction campsite have a negative impact on the environment.

The effects of noise include:

- a) Noise interferes with communication and can lead to tinnitus (ringing in the ears).
- b) Nuisance.
- c) Fatigue and tiredness, reduced efficiency, low morale, and severe and permanent loss of hearing which may persist for several hours due to prolonged exposure to noise.
- d) Deterioration of the environment within the sub-project site and the surrounding areas through vibrations produced by heavy construction machinery.
- e) The weakening of adjacent buildings resulting in cracking of their walls by vibrations.

### **Mitigation measures**

- a) Adhere to the EMCA (Noise & Excessive Vibration Pollution Control Regulations, 2009) maximum permissible noise levels for silent zones, places of worship, residential (indoor/outdoor), mixed residential; and commercial. **(Refer to chapter 3.4.3)**
- b) Minimize noise at the site and in the surrounding areas through:
  - i. Properly servicing and maintaining and tuning drilling machinery such as generators and other heavy-duty equipment to reduce noise generation; and

- a) Minimize the impacts of temporary drilling noise and vibration by: Planning the drilling work to take place only during the weekends at day time when the neighbours are also at work.

#### **6.2.4 Risk of oil Spillage/Hazardous wastes**

Accidental oil and diesel spills would be caused by leaking of drums holding the diesel and oil that are stored on the site. The machines being used at the site could also cause oil spill especially if they are not well maintained or during regular maintenance. However, the occurrence of these wastes is expected to be minimal. Seepage of hydrocarbon products such as oils, grease, and fuel if not carefully handled will result in the contamination of water thus rendering it unsuitable for both domestic and animal use. During the dry season spilled fuel, oils and lubricants could result in fire risks.

#### **Mitigation measures**

The following mitigation measures should be adopted to limit the impact of hazardous substances on- site.

- i. Make sure that the drilling workforce is aware of the procedures to be followed for dealing with spills and leaks;
- ii. Make sure that spills are immediately removed along with all contaminated material and disposed of at an approved hazardous landfill site;
- iii. Make sure that all contaminated material is stored in a banded area before being disposed of;
- iv. Make sure that a suitable spill kit is available on site, to be applied to all contaminated areas that will absorb / breakdown the spills. The number of such materials shall be able to handle the total volume of the hydrocarbon stored on-site; and
- v. Ensure that all diesel and oil drums are stored in a banded area with the respective tags like “Danger” or its pictorial representation.
- vi. Care to be observed when transporting diesel and oil to, from and within the site. It is recommended that if possible, this be done using qualified oil transporters
- vii. Repairing and maintenance and greasing of vehicles and construction plants must be carried out off the site (petrol station or garage) to avoid fuels and lubricants spill at the sub-project site and contamination of the water

### **6.2.5 Dust Emissions/Air Quality**

The drilling process is expected to cause a lot of dust emissions due to vehicles and trucks driving to and from the site along the rough road leading to the site. Limited dust would be generated by the actual drilling activities. Stockpiles arising from the drilled area could also cause dust emissions if blown away by the wind. Smoke will be generated from the vehicles and the drilling equipment. The magnitude will, however, depend on the condition of the machines and the vehicles during the drilling period.

#### **Mitigation measures**

The following mitigation measures can be adopted to reduce the degradation of air quality by the drilling activities.

- i. Provide dust masks to people visiting the site and have extra ones for site visitors
- ii. Stockpiles of the earth should be watered if dry to minimize dust from blowing
- iii. All fuel-powered equipment including the generator will be serviced and maintained in optimal working conditions to mitigate against exhaust emissions.
- iv. Workers and any other people at the site should wear face masks at all times to avoid carbon monoxide poisoning

### **6.2.6 Solid and Liquid Waste Generation**

The major solid waste will be the drilled cuttings. There will be some solid containers such as cement, bentonite and gravel bags and other packets with materials and equipment to be used during the implementation of the sub-project. Other solid waste will be generated from the composite housing of the drilling crew. At the time of the assessment

#### **Mitigation measures**

The following mitigation measures have been proposed.

- i. Any remaining waste (paper or polythene containers, cement, bentonite and gravel bags, excavation debris, remaining gravel pack, etc.) should be disposed of according to the NEMA's Waste Management Regulations of 2006.
- ii. Some of the drilled materials will be used in the borehole construction by back-filling the annular space. All excavated material from the draining channel will be used to refill it.
- iii. The contractor to be advised to provide waste bins and be collected by the county waste collectors.
- iv. Do not secure a solid waste disposal site within a radius of 50M of the proposed borehole site.

### **6.2.7 Removal of vegetation**

Before the drilling and installation of the boreholes, pipeline works and construction of water kiosks and elevated steel tanks, clearing of part of the existing vegetation cover will be done. This disturbance may cause changes in the natural community ecosystem or lead to invasion by non-native plant species. Loss of plant communities may also result in soil erosion and/or compaction. The loose soil material may also be washed down into the lower areas (streams and valleys).

#### **Mitigation measures**

- i). Ensure proper demarcation and delineation of the sub-project area to be affected by construction works;
- ii). It is recommended that indigenous trees or other fast-growing trees be planted in strategic locations where the vegetation cover will be cleared as part of landscaping initiatives;
- iii). Sub-project implementation plans will be developed such that section excavated are worked on and completed before moving to other areas;
- iv). Re-vegetation of exposed areas around the site will be carried out rapidly in order to mitigate against the erosion of soil through surface water runoff and wind erosion; and
- v). Identify and restrict the movement of vehicles to areas of disturbance

### **6.2.8 Risk of accidents and health and safety concerns**

During construction activities, it is expected that the construction workers may encounter occupational health hazards as a result of coming into contact and handling hazardous waste e.g. engine oil and grease. Because of the clearing of access roads and water pipelines, setting up and operating the drilling machines, workers will be exposed to the risk of accidents and injuries. Such injuries can result from loading and unloading truck-mounted drill rig, transportation of the drill rig, hand tools and cuts from sharp objects, slips and fall hazards, among others. We recommend that necessary safety precautions like defensive driving and putting up signages be taken by the truck drivers and workers to minimize accidents. The public is also potential exposure to risks of safety from the excavated trenches waiting for pipe laying, access to the work areas by unauthorized members of public and potential road safety risks from trucks and vehicles accessing the site.

#### **Mitigation measures**

Ensure compliance with occupational health and safety act, 2007 as indicated below

- i). Ensure that the trenches created are covered before leaving the site
- ii). Ensure workers are provided with first aid kits;

- iii). Ensure all equipment are inspected before use for appropriate safeguards and that the machine operators are trained on machine safety;
- iv). Ensure the working hours are controlled and that employees are not allowed to extend the working hours beyond an acceptable limit for purposes of gaining extra pay;
- v). Ensure appropriate road safety signage are strategically placed and drivers adhere to the requirements of such signage (on speed limits, hoarding at or near school among others);
- vi). Provide adequate manual labor to meet the requirements of the tasks,
- vii). Provide appropriate barriers along the excavated trenches. All construction sites shall be isolated from the children, public and their livestock. This will be done through temporary fencing and fixing appropriate safety signage and information;
- viii). Involve the local people for enhanced ownership and management; and
- ix). Upon completion and commissioning of the works, public safety in regard to water quality will be important. Security to be ensured for the borehole and storage tanks. The involvement of the local community will be enhanced through training and sensitization.
- x). The site should be fenced off from people, children and animals
- xi). Provision of suitable PPEs and procuring insurance for workers and machinery/ vehicles
- xii). The working on the school compound to be limited to very early in the morning, after classes and only weekends and holidays

### **6.2.9 Risk of HIV/AIDS**

The sub-project will attract new people to the sub-project area, and this can lead to several repercussions leading to the spread of the virus. An influx of new people to the sub-project area especially construction workers can affect the number of new cases of HIV because they often interfere with an otherwise stable situation, but the contrary can also happen where the newcomers find themselves at higher risk.

#### **Mitigation measures**

- i). Programs will be developed and integrated into the sub-project implementation for sensitizing the local community and sub-project workers on HIV/AIDS and/or other sexually transmitted diseases (STDs);
- ii). Review the construction activities to integrate with the HIV/AIDS campaigns.
- iii). Develop appropriate training and awareness materials for Information, Education, and Communication (IEC) on HIV/AIDS; and

- iv). Identify other players (local CBOs, NGOs, and government organizations) on HIV/AIDS for enhanced collaboration.
- v). The contractor shall be tasked through the ESMP to comply with the Code of conduct for workers which outlaws sexual relations with underage children

### **The transition phase from construction to operation**

During the transition phase from the completion of the development to the start of operations, the following will be done:

- i. Remove any wastes from the site.
- ii. Rehabilitate any areas adversely affected by the construction through spillages of pollutants: liquids, chemicals, cement, and paint among others at the site and any other areas disturbed as a result of the construction outside the site.
- iii. Plant grasses and ornamental trees at the site.
- iv. Put up fencing around the site for protection from intruders and unauthorized persons and ensure privacy.

## **B. Operation Phase**

### **6.3 Anticipated Positive Impacts**

#### **6.3.1 Increased access to water**

The current water sources rapidly deplete during the dry season. Consequently, the community members have to travel increasingly far distances in search of water. This wastes a lot of time that could have been used for other productive purposes. It is expected that the construction of boreholes will greatly improve access to water in the area.

#### **6.3.2 Permanent employment opportunities**

Permanent employment opportunities are one of the long-term major impacts of the sub-project that will be realized during the operation and maintenance of the borehole. It is expected that some community members will be permanently employed as borehole attendants.

#### **6.3.3 Improved nutrition and food security**

The proposed borehole sub-project is developed to supply water for irrigation and livestock. Reduced livestock distance in search of water will lead to improved livestock health and productivity in terms of milk and meat. Farmers will also be able to engage in smallholder irrigation and growth of a variety of crops. The outcome shall be improved nutrition and food security in the community in the sub-project context.

### **6.3.4 Increased participation of women in socio-economic development**

The proposed borehole when completed will provide a ready and reliable source of water to the community. Women and children will most benefit from this as time spent in searching and fetching water will be reduced. Women will have time to engage in other viable economic activities. Children will have enough time for school. The outcome will be increased household well-being.

### **6.3.5 Improved Health and sanitation**

Positive environmental impact on the community in terms of accessibility to quality water and reduction in waterborne diseases. Increased supply of clean water to the community members will contribute to improved hygiene standards in the project area.

### **6.3.6 Reduced travel times to water points**

From our discussions with community members, most families spend almost 30 min to one hour in search of water. It is expected that the construction of the borehole will lead to significant time savings due to reduced distances to water points. It is expected that the same will improve the economic and social status of women and children since there will be more time for other activities for example for farming.

## **6.4 Negative Impacts**

### **6.4.1 Groundwater depletion/Lowering of the water table**

This may result from the excessive abstraction of the water from the borehole i.e. beyond the permitted limit. This may result in the lowering of the water table.

### **Mitigation measures**

On completion of the drilling and other related works.

- a) The borehole should be installed with a Master Meter and an Airline/Piezometer to monitor groundwater abstraction and to facilitate regular measurements of the static water level in the borehole, respectively
- b) The maximum groundwater abstraction permitted from the borehole is limited to the authorized volume per day for the domestic/irrigation use only subject to availability from 60% of the tested yield for a maximum abstraction period not exceeding ten (10) hours per day
- c) Install auto-shut water taps to reduce water wastage

#### **6.4.2 Risk of water-borne diseases**

Water spillage around the taps during operation may provide a breeding ground for vectors of waterborne diseases such as mosquitos. This may come about as a result of poor management of sanitation and waste water.

#### **Mitigation measures**

- i). The waste water drainage channel be constructed to lead water away from the pump pad;
- ii). The waste water may be used for small gardening initiatives by the communities or directed to soak pits;
- iii). Ensure that any stagnant water is drained
- iv). Conduct continuous maintenance of the borehole, pipework, tank and water kiosk; and
- v). Conduct water sampling at least every 3 months for water monitoring record base on this facility

#### **6.4.3 Change in Settlement patterns**

The construction of the borehole is likely to encourage permanent settlements leading to livestock and human concentration near the water points. A large concentration of domestic animals may result in heavy grazing and accompanying vegetation changes in the vicinity of the boreholes.

#### **Mitigation measures**

Since that the area is already adjudicated land and land ownership is already determined, the community need to be sensitized during their social gatherings on importance of not selling their land to the influx population.

This is further solved through the distributed watering points and water troughs in the sub project area.

#### **6.4.4 Risk of soil erosion**

There are possibilities of soil erosion occurring during the operation of the boreholes which may become serious when the topsoil is left bare and agents of erosion become active. Soil erosion is a serious environmental problem which should be controlled. Lost soil due to erosion is normally deposited elsewhere, and the location of the deposition could alter downstream hydrology and increase flooding. It may also interfere with water quality directly through increasing turbidity levels, siltation and indirectly from contaminants carried with or attached to eroded soil particles. The proposed sub-project is expected to have minimal risk of erosion as the area to be disturbed is quite small.

### **Mitigation measures**

- i). Regularly check and maintain pipes to avoid burst pipes and leakages which can lead to massive water losses (and so revenue) as well as soil loss;
- ii). Apply soil erosion control measures such as levelling the sub-project site to reduce runoff; and
- iii). Ensure compacted areas are ripped off to reduce run-off.

### **6.4.5 Inadequate sub project Management**

The borehole will be the most common source of water in the sub-project area. However, the borehole can be non-operational if there will be no proper community management framework for operation, repair, and maintenance of the same.

### **Mitigation measures**

- i). The sub-project proponent will train the community members on proper operation, management, and maintenance of the borehole to ensure sustainability; and
- ii). The proponent will consult on reasonable water tariffs to sustain the water supply.

### **C. Decommissioning Phase**

There is no anticipation of decommissioning of this sub project. But this team recommends that if decommissioning will be triggered at any point, an ESIA be prepared for the same.

### **6.5 Social Economic Aspects**

Implementation of the proposed borehole sub-project will ease the water problems in the target community. The following social conflicts are expected to arise as a result of the implementation of the sub-project. All activities related to the sub-project will be carried out within a land agreed upon between the proponent and the community members. The sub-project will thus improve the social-economic aspects of potential consumers.

#### **6.5.1 Conflict over scarce water commodity**

There is possibility of community conflicting on the use of this resource here some farmers might have more animals than others for this resource therefore causing conflict

Proposed mitigation

The management committee to provide enough watering troughs at strategic points

Training of the management committee and the community on sustainable use of water

#### **6.5.2 Increase to exposure to communicable diseases including HIV/AIDS & COVID 19**

**a. Health Impact-Increase in incidences of HIV/AIDS and STIs**

The influx of people may bring communicable diseases to the project area, including sexually transmitted diseases (STDs), or the incoming workers may be exposed to diseases to which they have low resistance. This can result in an additional burden on local health resources. Local health and rescue facilities may also be overwhelmed and/or ill-equipped to address the industrial accidents that can occur in a large construction site.

Proposed **mitigation measure** for this is.

- Contractor to sensitize workers and community members on HIV/AIDS Awareness other communicable diseases to be instituted and implemented as part of the Contractor's Health and Safety Management Plan to be enforced by the Supervising Engineer.
- This will involve periodic HIV/AIDS and other communicable diseases Awareness Workshops for Contractor's Staff.
- Controlled access to Contractor's Workforce Camps by outsiders.
- Contractor to provide standard quality condoms at the construction site during the construction period.

**b. Health Impact – Spread of COVID-19 amongst construction workers**

The World Health Organization declared COVID-19 a global pandemic after assessing both its alarming levels of spread and severity, and the alarming levels of inaction. Consequentially, WHO issued various guidance and measures to prevent the spread of the virus. The measures have been adopted worldwide. Similarly, the Kenyan government has since then issued several guidance and directives after the first case was registered on March 13<sup>th</sup>, 2020. These included complete cessation of movement to and from areas considered hot spots and night curfew, social distancing guidelines, closure on non – critical and essential enterprises, closure of places of worship and public gatherings, mandatory use of masks in public places, among others.

During project execution (civil works), large numbers of workers will be required to assemble together in meetings, toolbox talks and even at work sites; varied number of workforce including suppliers of material and services are also expected to come in from various places in the country which may be COVID-19 hot spots; and interaction of workers with the project host community will happen as workers find accommodation close to work sites, and/or return to their homes after works. The potential for the spread of any infectious disease like COVID-19 by projects is high. There is also the risk that the project may experience large numbers of its workforce

becoming ill and will need to consider how they will receive treatment, and whether this will impact on local healthcare services including the project host community. The presence of international workers, especially if they come from countries with high infection rates, may also cause social tension between the foreign workers and the local populations.

Recently, the WHO has warned that the virus is here to stay for a long time and might persist and become our new way. The Government of Kenya has also lifted some of the initial movement controls and allowed the resumption of business, with certain industry specific guidelines being enforced. The duty of care has now been transferred to individual citizens and enterprises. Recognizing the potent risk this may present, it is difficult to clearly outline exhaustive mitigation measures under the mitigation impacts. As such, there is need for the client and the contractor to develop and adopt COVID-19 Standard Operating Procedure (SOPs) in line with the World Bank guidance, Ministry of Health Directives, and site-specific project conditions. These SOPs need to be communicated to all workers and enforced to the latter without fail. In addition to the requirement of the SOPs, the following mitigation measure shall also be adopted: The proposed **Mitigation Measures** against spread of COVID-19 amongst workers are:

- (i) The Contractors will develop SOPs for managing the spread of Covid-19 during project execution and submit them for the approval of the Supervision Engineer and the Client before mobilizing to site. The SOPs shall be in line with the World Bank guidance on COVID-19, Ministry of Health Directives and site-specific project conditions;
- (ii) Mandatory provision and use of appropriate Personal Protective Equipment (PPE) shall be required for all project personnel including workers and visitors;
- (iii) Avoid concentration of more than 15 workers at one location. Where there are two or more people gathered, maintain social distancing of at least 2 meters;
- (iv) All workers and visitors accessing worksites every day or attending meetings shall be subjected to rapid Covid-19 screening which may include temperature check and other vital signs;
- (v) The project shall put in place means to support rapid testing of suspected workers for covid-19;
- (vi) Install handwashing facilities with adequate running water and soap, or sanitizing facilities at entrance to work sites including consultation venues and meetings and ensure they are used;

(vii) Ensure routine sanitization of shared social facilities and other communal places routinely including wiping of workstations, door knobs, hand rails etc.;

**c. Social risk - Spread of COVID-19 amongst community members during consultations**

During implementation of the ESIA, various consultative activities will be undertaken. For efficient and meaningful engagement, a wide range of individual participants, groups in the local community and other stakeholders will be involved. The types of consultations to be used to pass information shall be through public Baraza's, electronic means shall be used where possible and one-on-one basis meetings while observing the COVID-19 mitigation measures to ensure safety stakeholders involved, the community at large and the client. The consultations will involve verification of PAPs covering the occupants of the affected area and vulnerable persons and groups; awareness raising, sensitization of PAPs and gauging attitude to the project; training and capacity building for livelihoods restoration, grievance redress, execution of site - specific surveys among others. If carried out conventionally, these activities would lead to close interaction between the proponent and the community members leading to a high risk of spreading COVID-19 amongst community members during the consultation process.

To minimize the risk of spread of COVID-19 amongst community members, alternative means of consultation will be required as mitigation measures to ensure social distancing and appropriate communication measures. The mitigation measures will be supervised by a communications/ stakeholder engagement / social safeguards expert in the project proponent's team.

The proposed **Mitigation Measures** against spread of COVID-19 amongst community members are.

(i) Electronic means of consulting stakeholders and holding meetings shall be encouraged whenever feasible. One-on-one engagements for the PAPs while observing social distance and adhering to PPE wearing shall be enforced.

(ii) Avoid concentrating of more than 15 community members at one location. Where two or more people are gathered, maintain social distancing of at least 2 meters.

(iii) The team carrying out engagements within the communities on one-on-one basis will be provided with appropriate PPE for the number of people they intend to meet.

- (iv) Use traditional channels of communications (TV, newspaper, radio, dedicated phone-lines, public announcements, and mail) when stakeholders do not have access to online channels or do not use them frequently. Allow participants to provide feedback and suggestions.
- (v) Hold meetings in small groups, mainly in form of FGDs if permitted depending on restrictions in place and subject to strict observance of physical distancing and limited duration.
- (vi) In situations where online interaction is challenging, disseminate information through digital platform (where available) like Facebook and WhatsApp & Chat groups.
- (viii) Ensure online registration of participants, distribution of consultation materials and share feedback electronically with participants.

### **6.5.3 Sexual Exploitation and Abuse (SEA)**

Women and girls are in most cases prone to SEA in most communities especially when they are towards accessing of resources; for example, when they are looking for job opportunities.

#### **Proposed mitigation**

- i. The contractor to Develop and implement an SEA action plan with an Accountability and Response Framework as part of the contract as contained in the ESMP. The SEA action plan will follow guidance on the World Bank’s Good Practice Note for Addressing Gender-based Violence in Investment Project Financing.
- ii. The SEA action plan will include how the project will ensure necessary steps are in place for:
  - prevention of SEA: including CoCs and ongoing sensitization of staff on responsibilities related to the CoC and consequences of non-compliance; project-level IEC materials;
  - response to SEA: including survivor-centered coordinated multi-sectoral referral and assistance to complainants according to standard operating procedures; staff reporting mechanisms; written procedures related to case oversight, investigation and disciplinary procedures at the project level, including confidential data management;
  - engagement with the community: including development of confidential community-based complaints mechanisms discrete from the standard GRM; mainstreaming of PSEA awareness-raising in all community engagement activities; community-level IEC

materials; regular community outreach to women and girls about social risks and their PSEA-related rights;

- management and Coordination: including integration of SEA in job descriptions, employments contracts, performance appraisal systems, etc.; development of contract policies related to SEA, including whistleblower protection and investigation and disciplinary procedures; training for all project management; management of coordination mechanism for case oversight, investigations and disciplinary procedures; supervision of dedicated PSEA focal points in the project and trained community liaison officers.

#### **6.5.4. Gender-based violence at community level**

There is possibility of discrimination on how opportunities are distributed among the community members if care is not taken

##### **Proposed Mitigation**

- i. The contractor will implement provisions that ensure that gender-based violence at the community level is not triggered by the Project, including:
  - effective and on-going community engagement and consultation, particularly with women and girls;
  - Review of specific project components that are known to heighten GBV risk at the community level, e.g. employment schemes for women; community level water management, representation or economic activities etc.
  - Specific plan for mitigating these known risks, e.g. sensitization around gender-equitable approaches to compensation and employment; etc.
- ii. The contractor will ensure adequate referral mechanisms are in place if a case of GBV at the community level is reported related to project implementation

#### **6.5.5 Outbreak of Livestock Diseases**

The coming together and mixing of livestock from different households will increase the chance for the spread and outbreak of livestock pest and diseases. Possible outcome of this if not well managed will be poor animal health, reduced livestock productivity and even livestock loss.

The **proposed mitigation measure** for this is;

- Regular disease surveillance by the veterinary department and community
- Monitoring of the livestock by the community/farmers

- Sensitization of the community on disease spread, monitoring and control
- a livestock disease management plan be put in place by the veterinary department to ensure disease incidences are promptly responded to and addressed

## CHAPTER SEVEN

### PUBLIC PARTICIPATION AND STAKEHOLDERS CONSULTATIONS

#### **7.1 Introduction**

Kenya government has enshrined the need for public involvement in project development in the Constitution of 2010. This has also been set out in the EMCA, CAP 387 and Environmental (Impact and Audit) Regulations, 2003 and is a requisite in all WB funded projects of this magnitude to undergo public participation.

Public participation and stakeholders' consultation is a very important aspect of the ESIA process and community development. This brings out the contentious issues and gives a chance to those who may be affected by the proposed project to give their views. The public participation and stakeholder consultation is the best opportunity to interact with the project components and activities hence ownership is assured and finally leading to sustainability of the project.

#### **7.2 Objectives of Public Consultation**

The main objective of the consultations with stakeholders was to discuss the proposed project environmental and social implications and to identify alternatives for consideration.

Specifically, the consultations sought to achieve the following objectives:

- To provide information about the proposed sub project and its objectives;
- Build up confidence between the stakeholders and the proponent to minimize the risk of delays in the implementation of the sub project.
- To seek views, concerns and opinions of people in the area concerning the sub project;
- To provide forum for discussions on identified concerns;
- To identify and verify significance of environmental, social and health impacts; and
- To inform the process of developing appropriate mitigation and management options.

#### **7.3 Methodology**

The following techniques and instruments were used for public consultations: Conducting a public meeting (barazas) for the Mugurin community, Focus Group Discussion, Interviewing technical persons (informants) from the key departments and community members,

Administering of fill in questionnaires and impacts checklist and a formal meeting for the government departments

A total of 35 filled in questionnaires were administered to the community members and 27 were filled in and returned. Due to illiteracy by the community members there was assisted filling in of questionnaires from the literate members of the community through translation.

3 key stakeholders from the community and government departments filled in impact categorization matrix to help in ranking of the identified impacts as low, medium, or high risk.

A total of 11 key informant interviews were carried out. One formal consultation meeting was held for technical persons from the key county and national government departments and another one for the panel of experts.

Environmental and social screening was also undertaken in the project pre planning phase (Refer to annex 3 for attendance list and annex 4 for Environmental and Social Screening Report). Engagement and feedback from the community and stakeholders was used to inform the scope of the ESIA and in minimization of the significant predicted impacts.

#### **7.4 Public Notice**

A Notice, which aimed at inviting public comments on the proposed sub project, was posted through the chief's office inviting members of the public and other interested parties to a public Baraza to be held on 5<sup>th</sup> December 2019 at proposed borehole site. A copy of the notice is provided as **Annex 8**.

#### **7.5 Stakeholders Consulted**

The stakeholders involved in public participation and consultation during the ESIA study were;

- Department of Water and Irrigation
- Department of environment, natural resources, tourism, and wildlife
- Water Resource Authority (WRA)
- Department of agriculture and livestock
- Local administration (chiefs and sub-chiefs)
- School Board of Management
- Ward administrator
- Location and ward water management committees
- Mugurin Community members; male , a female and a youth
- School head teacher

## 7.6 Outcome of Stakeholder Consultations

### 7.6.1 Details of Concerns, Recommendations and Issues Raised

Table provides the details of the outcome of the stakeholder consultations successfully carried out. Further evidence of stakeholder consultations with the various stakeholders/institutions have been provided as *Annexes 3, 4, & 5*.

*Table 5: Details of Concerns, Recommendations and Issues Raised*

| <b>Stakeholder / Institution</b>  | <b>Contact Person</b>  | <b>Position/ Role</b>  | <b>Concern Raised/Information Received</b>   |
|-----------------------------------|------------------------|------------------------|--|
| Water & Irrigation                | Barnabas Kigen         | SCWO                   | <ul style="list-style-type: none"> <li>• Provided relevant information and background documents on the proposed intake rehabilitation and environmental and social concerns.</li> </ul>  |
| Environment and Natural Resources | Jeniffer Kipkazi       | Director               | <ul style="list-style-type: none"> <li>• Raised concern over the emission of natural gas and hot water as a risk in the project</li> <li>• Raised concern about leadership wrangles in the sub project committee and</li> </ul> <p><b><u>Suggested measures</u></b></p> <ul style="list-style-type: none"> <li>• Proposed training of the sub project committee on leadership management</li> </ul>  |
| Mugurin Community                 | Community participants | Beneficiaries /Farmers | <ul style="list-style-type: none"> <li>• Concerned that after drilling the water may not be suitable for human and livestock consumption</li> <li>• Raised concern over soil erosion</li> <li>• Raised concern over the possibility of sexual exploitation of women and girls coming to draw water by the attendants</li> <li>• Raised concern over water related conflicts especially when animals come to drink water at the cattle troughs</li> </ul> <p><b><u>Suggested measures</u></b></p> <ul style="list-style-type: none"> <li>• Water quality testing will be done. Assured quality expected to be suitable as nearby boreholes Magoi and Nambawan had yielded water meeting required quality for human and livestock</li> <li>• Revegetation will be undertaken at the site to reduce erosion</li> <li>• GBV/SEA management to be incorporated in sub project and capacity building of the grievance committee on the same.</li> <li>• Borehole management committee to be capacity on water conflict management</li> </ul> |
| School management                 | BOM                    | Member                 | <ul style="list-style-type: none"> <li>• Concerned about noise generated during drilling of the well.</li> <li>• Concerned over safety of children</li> </ul> <p><b><u>Suggested Measures</u></b></p> <ul style="list-style-type: none"> <li>• Drilling will be undertaken during school holiday.</li> <li>• Borehole area will be fenced and secured by a gate and lock.</li> </ul>   |

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|  |  |  | <p><b><u>Suggested Measures</u></b></p> <ul style="list-style-type: none"> <li>• Training of farmers on pest management and soil fertility improvement</li> <li>• Draining of stagnant water to control mosquito breeding</li> <li>• Sensitization of community on water treatment</li> </ul> <p><b><u>Expectations</u></b></p> <ul style="list-style-type: none"> <li>• Locals to be given priority in employment during the construction phase</li> <li>• Water will reach all targeted farms (30 acres) of direct beneficiaries</li> <li>• The farmers will listen the recommendations of the best practices to ensure the sustainability of the sub project and benefits of the farmers</li> </ul> |
|--|--|--|--|

**7.7 The following came out clearly during the public participation;**

- ✓ Water availability will increase livestock productivity and kitchen gardening
- ✓ Improved hygiene and reduced human disease incidences
- ✓ creation of employment for locals in all the sub project phases
- ✓ Reduced distance to water sources especially during the dry season
- ✓ Improved living standards
- ✓ Improved nutrition and food security at the household level by enhancing the planting of fruit trees such as mango trees and horticulture such as kales
- ✓ The Endorois who are categorized as Indigenous Peoples were involved in making decision on the choice, planning and design of the proposed water sub project
- ✓ The school board of management was informed and involved in making decision on the proposed location of the sub project
- ✓ Possibility of the implementation of the sub project particularly drilling interfering with the school learning programme.
- ✓ Hydrogeological investigations had been undertaken in the site for the drilling of the borehole and indicated water would be yielded.
- ✓ Magoi and Nambawan boreholes located 6.5 km form the proposed Sertonje boreholes had yielded water safe for livestock and domestic use.
- ✓ Drought being a major hazard in Mugurin the proposed borehole would address the community water needs
- ✓ Safety of curious pupils wanting to find out about the borehole was raised

- ✓ Construction of livestock water troughs
- ✓ The issue of water related conflicts was raised

**Response to concern:**

- ✓ The community members were assured that priority would be given them in hiring of labour and skills that can be obtained locally
- ✓ The stakeholders and members of the community were assured that the implementation of the sub project will be scheduled to be undertaken during school holidays and therefore, the school learning programme will not be interfered with.
- ✓ On the safety of the curious pupils the public was assured that the sub project site will be fenced complete with a gate and lock.
- ✓ The community was assured that construction of livestock watering troughs had been factored in the sub project
- ✓ The ESIA would provide necessary measures to mitigate anticipated impacts.
- ✓ One of the locations have been adjudicated whereas the other is in the process, therefore a member raised the issue of confirming of the land ownership beforehand.
- ✓ The administrators who were present assured that it has been confirmed and has no objection.
- ✓ The stakeholders were informed the drilling would be undertaken during the school holiday to prevent interruption with the school learning programme.
- ✓ The stakeholders were informed that the hydrogeological survey had already been conducted and that there was no indication of gas emission but due diligence would be undertaken to ensure that a geohydrologist is on site during drilling to advice in case of such an incidence
- ✓ Public participants and the stakeholders were informed that water quality testing would be done to determine its quality before use by livestock and humans.
- ✓ To ease water related conflicted the management committee to be put in place will be capacity build on water management and development of user rules.
- ✓ To address cases of sexual exploitation, the grievance committee will be established and capacity build on identification and management of such incidences. All borehole attendants and management committee will also be sensitized on the subject of sexual exploitation and gender based violence.

**No objection to the sub-project was raised during the consultation with the community and the stakeholders.**

## CHAPTER EIGHT

### ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

#### 8.1 Introduction

This chapter presents the Environmental and Social Management Plan (ESMP) that will be implemented by the proponent to prevent or reduce significant negative impacts to acceptable levels. This plan will be fully followed throughout the sub-project life cycle.

- ❖ The purpose of the Environmental and Social Management Plan (ESMP) for the proposed borehole Sub-project is to provide mitigation measures for the significant negative environmental and social impacts. The objectives of the ESMP are:
- ❖ To clearly show how the sub-project will manage the negative impacts while enhancing the positive ones to ensure a sub-project that is economically, socially, and environmentally sustainable.
- ❖ To provide evidence of practical and achievable plans for the management of the proposed sub-project.
- ❖ To provide the Proponent and the relevant Lead Agencies with a framework to confirm compliance with relevant laws and regulations; and

## 8.2 Environment and Social Management Plan (ESMP)

Table 6: Environment and Social Management Plan

| <i>Potential Environmental/Social impacts</i> | <i>Proposed Mitigation</i>   | <i>Indicator</i>  | <i>Responsible Individual/Institution</i>             | <i>Time Frame</i> | <i>Estimated Cost</i> |
|---|--|---|---|-------------------|-----------------------|
| <b>1. Soil Compaction and erosion</b>         | <p>a) Strictly control construction vehicles to ensure that they operate judiciously and over designated areas to reduce soil compaction.</p> <p>b) Rip off any compacted areas after construction to allow aeration of the soil and ease the infiltration of water into the soil.</p>   | <p>a) No. of designated routes used.</p> <p>b) Number of sites rehabilitated.</p>   | Contractor  | 3 months          | 30,000/=              |
| <b>2. Groundwater pollution</b>               | <p>i). Ensure that all potential sources of pollution are eliminated for example by ensuring that sanitary facilities are constructed at a safe distance</p> <p>ii). adhere to the regulations set by the Water Act 2016 Management and development on the amounts to be extracted from a borehole and the number of pumping hours. This helps to reduce wastage and misuse of this resource.</p> <p>iii). Use water-based drilling fluid</p> <p>iv). Case the well as it passes through the water table.</p> <p>v). Proper a soak pit for safe disposal of drilling foam.</p> | <p>a) The distance should be at least 100 metres from the water source.</p> <p>b) type of drilling fluid</p> <p>c) No. of soak pit.</p>                         | Contractor<br>NEMA<br>WRA<br>Dep. of Lands            | 2 months          | 150,000/=             |
| <b>3. Noise and vibrations</b>                | <p>i). Avoid noise above 80db at the sub project site especially during the night.</p> <p>ii). Properly servicing and maintaining and tuning drilling machinery such as generators and other heavy-duty equipment to reduce noise generation; and</p> <p>iii). Minimize the impacts of temporary drilling noise and vibration by:</p>  | <p>a) The noise level</p> <p>b) The records on serving of the machinery</p> <p>c) Time scheduled for drilling</p> <p>d) Duty roster of the works indicating</p> | Contractor<br>Dep. of Environment & Natural Resources | 1 month           | 5,000/=               |

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|   | <ul style="list-style-type: none"> <li>• Planning the drilling work to take place only during the day when the neighbours are also at work.</li> <li>• Maintaining reasonable working hours so as to reduce the number of complaints concerning noise from the workers and neighbours.</li> <li>• Operating shorter shift periods for workers who come in direct contact with high concentrations of noise or other hazards.</li> <li>• Posting notices at the construction site informing the public of the construction activities, time, and day.</li> <li>• Providing ear protective devices to prevent high-frequency noise emitted by the high-frequency machines during the construction phase</li> </ul> | <p>number of shifts each individual is allocated</p> <p>e) No of posters</p> <p>f) Number of workers provided with the PPEs</p> |   |          |          |
| <b>4. Oil spillage/Hazardous wastes</b>     | <p>i) Vehicle/machinery servicing not to be done in the construction area.</p> <p>ii) Immediate scooping of any spillage during construction and safely disposing off.</p>   | <p>a) No of designated storage for fuels and grease</p> <p>b) Presence of designated yards and servicing bays at site</p>       | Contractor<br>NEMA<br>Dep. of Environment & Natural Resources<br>CPCU | 1 month  | 40,000/= |
| <b>5. Dust emissions</b>                    | <p>i) Provision of suitable PPE/C</p> <p>ii) Drivers to avoid unnecessary speeding near settlements in the project areas</p> <p>Apply water sprays and mist by trucks as dust suppression measures on loose soils and stockpiles.</p>  | <p>a) Water sprays and mists</p> <p>b) No of suitable PPE/.</p> <p>c) No of drivers trained/advised</p>                         | Contractor<br>NEMA,<br>CPCU   | 2 months | 20,000/= |
| <b>6. Solid and liquid waste generation</b> | <p>i). Dispose of according to the NEMA's Waste Management Regulations of 2006. Any remaining waste (paper or polythene containers, cement, bentonite and gravel bags, excavation debris,</p>  | <p>Number of wastebaskets.</p>  | Contractor<br>NEMA<br>WRA,<br>CPCU                                    | 2 months | 50,000/= |

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|  | <p>remaining gravel pack, etc.</p> <p>ii). Some of the drilled materials will be used in the borehole construction by back-filling the annular space. All excavated material from the draining channel will be used to refill it.</p> <p>iii). Drilling crew to be encouraged to dump their personal wastes in designated covered wastebaskets.</p> <p>iv). Do not secure a solid waste disposal site within a radius of 50M of the proposed borehole site.</p>  |   |                                 |          |          |
| <b>7. Removal of vegetation</b>                    | <p>i) Ensure proper demarcation and delineation of the sub-project area to be affected by construction works.</p> <p>ii) It is recommended that indigenous trees or other fast-growing trees be planted in strategic locations where the vegetation cover will be cleared as part of landscaping initiatives.</p> <p>iii) Sub-project implementation plans will be developed such that section excavated are worked on and completed before moving to other areas.</p> <p>iv) Re-vegetation of exposed areas around the site will be carried out rapidly in order to mitigate against the erosion of soil through surface water runoff and wind erosion.</p> <p>v) Identify and restrict the movement of vehicles to areas of disturbance.</p> | <p>a) Number of indigenous trees planted</p> <p>b) number of sites re-vegetated</p> <p>c) number of restricted sites</p>                                    | Contractor , CPCU               | 7 months | 20,000/= |
| <b>8. Accidents and health and safety concerns</b> | <p>i) Ensure that the trenches created are covered before leaving the site</p> <p>ii) Ensure workers are provided with first aid kits;</p> <p>iii) Ensure all equipment are inspected before use for appropriate safeguards</p> <p>iv) Ensure the machine operators are trained on machine</p>   | <p>a) Length of trenches filled</p> <p>b) number of workers provided with PPEs</p> <p>c) number of records of inspections</p> <p>d) number of trainings</p> | Contractor , proponent and CPCU | 5 months | 50,000/= |

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|  | <p>safety;</p> <p>v) Ensure the working hours are controlled and that employees are not allowed to extend the working hours beyond an acceptable limit for purposes of gaining extra pay;</p> <p>vi) Ensure appropriate road safety signage are strategically placed and drivers adhere to the requirements of such signage (on speed limits, hoarding at or near school among others);</p> <p>vii) Provide adequate manual labor to meet the requirements of the tasks,</p> <p>viii) Provide appropriate barriers along the excavated trenches. All construction sites shall be isolated from the children, public and their livestock. This will be done through temporary fencing and fixing appropriate safety signage and information;</p> <p>ix) Involve the local people for enhanced ownership and management; and</p> <p>x) Upon completion and commissioning of the works, public safety in regard to water quality will be important. Security to be ensured for the borehole and storage tanks. The involvement of</p> | <p>on machine operation safety and first aid</p> <p>e)the time schedule of activities.</p> <p>f)number of signage's</p> <p>g)number of people employed</p> <p>h)sites fenced and number of sensitization meetings</p> <p>i)type of PPEs and number people on insurance covers</p> |  |  |  |
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|---------------------------------------|--|--|--|----------|----------|
|                                       | <p>the local community will be enhanced through training and sensitization.</p> <p>xi) Ensure the site is fenced off from people, children and animals</p> <p>xii) Ensure provision of suitable PPEs and procuring insurance for workers and machinery/ vehicles</p> <p>xiii) The working on the school compound to be limited to very early in the morning, after classes and only weekends and holidays</p>  |  |  |          |          |
| <b>9.Risk of HIV/AIDS</b>             | <p>a. Develop and integrate into the sub-project implementation Programs for sensitizing the local community and workers on HIV/AIDS and/or other sexually transmitted diseases (STDs).</p> <p>b. Develop appropriate training and awareness materials for Information, Education, and Communication (IEC) on HIV/AIDS.</p> <p>c. Identify other players (local CBOs, NGOs, and government organizations) on HIV/AIDS for enhanced collaboration.</p>    | <p>a)Number of sensitization meeting</p> <p>b)number of materials developed</p> <p>c)Number of partners identified</p> | Contractor<br>CPCU<br>PMC  | 4 months | 60,000/= |
| 10.Spread of COVID-19 amongst workers | <ul style="list-style-type: none"> <li>• The Contractors to develop a SOPs for managing the spread of Covid-19 during project execution in line with the World Bank guidance on COVID-19, Ministry of Health Directives, and site-specific project conditions.</li> <li>• Mandatory provision and use of appropriate Personal Protective Equipment (PPE) for all project personnel.</li> <li>• Avoid concentrating of more than 15 workers at</li> </ul> | Availability of SOP(s), Training material, PPE, sanitizing facilities, installed handwashing equipment etc.            | Supervising Eng. & Contractor, PMC, PUBLIC, department of public | 5 months | 50,000/= |

|   |   |  |  |          |           |
|---|---|--|--|----------|-----------|
|   | <p>one location. Where there are two or more people gathered, maintain social distancing at least 2 meters. All workers and visitors accessing worksites every day or attending meetings shall be subjected to rapid Covid-19 screening which may include temperature check and other vital signs.</p> <ul style="list-style-type: none"> <li>• The project shall put in place means to support rapid testing of suspected workers for covid-19.</li> <li>• Install handwashing facilities with adequate running water and soap, or sanitizing facilities at entrance to work sites including consultation venues and meetings and ensure they are used.</li> <li>• Ensure routine sanitization of shared social facilities and other communal places including wiping of workstations, doorknobs, handrails etc.;</li> </ul> |  | Health   |          |           |
| 11. Spread of COVID-19 amongst community members during consultations processes | <ul style="list-style-type: none"> <li>• Electronic means of consulting stakeholders and, holding meetings, whenever possible, shall be encouraged whenever feasible. One-on-one engagements for the PAPs while observing social distance and adhering to PPE wearing shall be enforced.</li> <li>• Avoid concentrating of more than 15 community members at one location. Where there are two or more people gathered, maintain social distancing at least 2 meters</li> <li>• The team carrying out engagements within the communities on one-on-one basis will be provided with appropriate PPE for the number of people they intend to meet.</li> <li>• Use traditional channels of communications (TV, newspaper, radio, dedicated phone-lines, public</li> </ul>  | <p>Availability of SOP(s), Training material, PPE, sanitizing facilities etc.</p> <p>No. of participants registered online.</p> <p>Attendance registers of all meetings held</p> <p>Evidence of use of electronic media for information dissemination/engagement e.g. printed electronic mails, addresses of video</p> | <p>department of public Health Supervising Eng. &amp; Contractor(s)</p> <p>Communication/engagement expert in the Team</p> | 2 months | 250,000/= |

|                                      |  |  |  |           |          |
|--------------------------------------|--|--|--|-----------|----------|
|                                      | <p>announcements, and mail) when stakeholders do not have access to online channels or do not use them frequently. Ensure to provide and allow participants to provide feedback and suggestions.</p> <ul style="list-style-type: none"> <li>• Hold meetings in small groups, mainly in form of FGDs if permitted depending on restrictions in place and subject to strict observance of physical distancing and limited duration.</li> <li>• In situations where online interaction is challenging, disseminate information through digital platform (where available) like Facebook and WhatsApp &amp; Chat groups.</li> <li>• Ensure online registration of participants, distribution of consultation materials and share feedback electronically with participants.</li> </ul> | links created etc  |  |           |          |
| <b>B. Operation Phase</b>            |  |  |  |           |          |
| <b>1.Lowering of the water table</b> | <p>i) The borehole should be installed with a Master Meter and an Airline/Piezometer to monitor groundwater abstraction and to facilitate regular measurements of the static water level in the borehole, respectively.</p> <p>ii) The maximum groundwater abstraction permitted from the borehole is limited to the authorized volume per day for the domestic/irrigation use only subject to availability from 60% of the tested yield for a maximum abstraction period not exceeding ten (10) hours per day.</p> <p>iii) Install auto-shut water taps to reduce water wastage.</p>  | <p>a)type of water taps installed</p> <p>b)the type of water meter installed</p> <p>c)volume of water abstracted per day</p> | Sub-project Management Committee and WRA | 12 months | 40,000/= |

|   |   |  |  |           |           |
|---|---|--|--|-----------|-----------|
| <b>2. Waterborne diseases</b>               | <ul style="list-style-type: none"> <li>i) The wastewater drainage channel be constructed to lead water away from the pump pad.</li> <li>ii) The wastewater may be used for small gardening initiatives by the communities or directed to soak pits.</li> <li>iii) Sensitize the community on the use of mosquito nets</li> <li>iv) Conduct continuous maintenance of the borehole, pipework, tank, and water kiosk</li> <li>v) Conduct water sampling at least every 3 months for water monitoring record base on this facility.</li> </ul> | <ul style="list-style-type: none"> <li>• No of households with mosquito nets</li> <li>• No of people trained</li> <li>• Record of disease incidence</li> <li>• No of households practicing safety rules</li> <li>• No of households using waste water for gardening</li> <li>• No of times water sampling is done</li> </ul> | Proponent Sub-project Management Committee department of public Health | 12 months | 75,000/=  |
| <b>3. Change in Settlement patterns</b>     | Sensitization of the community on expected social changes<br>Decentralize livestock watering points   | No of community sensitizations<br>No. of livestock watering points   | Dep. of lands  | 12 months | 20,000/=  |
| <b>4. Soil erosion</b>                      | <ul style="list-style-type: none"> <li>a. Regularly check and maintain pipes to avoid burst pipes and leakages which can lead to massive water losses (and so revenue) as well as soil loss.</li> <li>b. Apply soil erosion control measures such as leveling the sub-project site to reduce runoff</li> <li>c. Ensure compacted areas are ripped off to reduce runoff.</li> <li>d. Planting of indigenous trees</li> <li>e. Establishment of pasture farms</li> </ul>  | <ul style="list-style-type: none"> <li>• No of leaking pipes</li> <li>• sites levelled and ripped off</li> <li>• No of trees planted</li> <li>• No of pasture established</li> </ul>   | Contractor Proponent Individual farmers                                | 12 months | 200,000/= |
| <b>5. Inadequate sub project Management</b> | <ul style="list-style-type: none"> <li>i) The sub-project proponent will train the community members on proper operation, management, and maintenance of the borehole to ensure sustainability; and</li> <li>ii) The proponent will consult on reasonable water tariffs to sustain the water supply.</li> </ul>   | <ul style="list-style-type: none"> <li>• No of trainings done</li> <li>• The amount of money charged per 20litre container</li> </ul>  | Proponent and Sub-project Management Committee                         | 6 months  | 145,000/= |

|   |  |   |   |           |           |
|---|--|---|---|-----------|-----------|
|   |  |   | /Sub project committee / contractor   |           |           |
| <b>6.Spread of communicable diseases, STIs and HIV/AIDS</b> | <p>I. Sensitize workers and the surrounding communities on awareness, prevention and management of HIV/AIDS and sexual health and rights through staff training, awareness campaigns, multimedia and workshops or during community Barazas.</p> <p>ii. Use existing clinics to provide VCT services to construction crew and provision of ARVs for vulnerable community members</p> <p>iii Ensure safety of women and girls in provision of VCT services.</p>  | <ul style="list-style-type: none"> <li>•No of persons attending VCT</li> <li>•no of trainings</li> <li>•No of clinics providing VCT and ARVs</li> </ul>   | Proponent and Sub-project Management Committee /sub project committee /contractor department of public Health | 12 months | 50,000/=  |
| <b>7.Sexual exploitation and abuse (SEA)</b>                | <p>i.The SEA action plan will include how the project will ensure necessary steps are in place for:</p> <ul style="list-style-type: none"> <li>• Prevention of SEA: including CoCs(combined oral contraceptives) and ongoing sensitization of staff on responsibilities related to the CoC and consequences of non-compliance; project-level IEC materials;</li> <li>•Response to SEA: including survivor-centered coordinated multi-sectoral referral and assistance to complainants according to standard operating</li> </ul> | <ul style="list-style-type: none"> <li>•SEA Action Plan</li> <li>•Code of Conduct</li> <li>•Number of staff trainings</li> <li>•SEA FP</li> <li>•Community Liaison trained in PSEA</li> <li>•IEC materials for</li> </ul> | Proponent and Sub-project Management Committee CPCU GBV expert  | 12 months | 150,000/= |

|  |   |  |  |  |  |
|--|---|--|--|--|--|
|  | <p>procedures; staff reporting mechanisms; written procedures related to case oversight, investigation and disciplinary procedures at the project level, including confidential data management;</p> <ul style="list-style-type: none"> <li>• Engagement with the community: including development of confidential community-based complaints mechanisms discrete from the standard GRM; mainstreaming of PSEA awareness-raising in all community engagement activities; community-level IEC materials; regular community outreach to women and girls about social risks and their PSEA-related rights;</li> </ul> <p>Management and Coordination: including integration of SEA in job descriptions, employments contracts, performance appraisal systems, etc.; development of contract policies related to SEA, including whistleblower protection and investigation and disciplinary procedures; training for all project management; management of coordination mechanism for case oversight, investigations and disciplinary procedures; supervision of dedicated PSEA focal points in the project and trained community liaison officers.</p> <p>I. Develop and implement an SEA action plan with an Accountability and Response Framework as part of the ESMP. The SEA action plan will follow guidance on</p> | <p>workers' sites and community</p> <ul style="list-style-type: none"> <li>•Discrete SEA reporting pathway</li> <li>•Relevant policies, e.g. investigations and discipline and whistleblower protection</li> </ul> <p>Monthly minutes from SEA coordination meetings</p> |  |  |  |
|--|---|--|--|--|--|

|  |   |   |   |          |           |
|--|---|---|---|----------|-----------|
|  | the World Bank's  |   |   |          |           |
| <b>8. Gender-based violence at community level</b> | <p>The contractor will implement provisions that ensure that gender-based violence at the community level is not triggered by the Project, including:</p> <p>effective and on-going community engagement and consultation, particularly with women and girls;</p> <ul style="list-style-type: none"> <li>• Ensure employment equality schemes for women; community level water management, representation or economic activities etc.</li> <li>• sensitization around gender-equitable approaches to compensation and employment; etc.</li> </ul> <p>The contractor will ensure adequate referral mechanisms are in place if a case of GBV at the community level is reported related to project implementation</p> | <ul style="list-style-type: none"> <li>• Mitigation plan for GBV occurring at the community level because of project implementation</li> <li>• Number of GBV cases happening at the community level that receive survivor-centered referral and care</li> <li>• Number of trainings for PMC, SAIC, CESSCO on GBV and SEA</li> </ul> | Proponent and Sub-project Management Committee /contractor GBV expert | 8 months | 125,000/= |

|  |  |   |   |           |                        |
|--|--|---|---|-----------|------------------------|
| <b>9. Outbreak of Livestock Diseases</b> | <ul style="list-style-type: none"> <li>• Regular disease surveillance by the veterinary department and community</li> <li>• Monitoring of the livestock by the community/farmers</li> <li>• Sensitization of the community on disease spread, monitoring and control</li> <li>• livestock disease management plan be put in place by the veterinary department to ensure disease incidences are promptly responded to and addressed</li> </ul> | <ul style="list-style-type: none"> <li>• Number of disease surveillance</li> <li>• No of Sensitization meetings held</li> <li>• A livestock disease management plan put in place</li> </ul> | Department of livestock and veterinary/ community | 12 months | 65,000/=               |
| <b>TOTAL COST</b>                        |  |   |   |           | <b>1,665,000</b><br>/= |

### **8.3 Implementation and operation of the ESMP**

The implementation and operation of the ESMP require distinct identification of responsibilities that will guide assigning tasks. Those that will be responsible for the implementation of the ESMP include;

- National Environmental Management Authority (NEMA) and the Water Resources Authority (WRA) shall be responsible for surveillance of environmental and social aspects of the sub-project implementation,
- The responsibility of the Community Sub-project Management Committee will be to enforce water quality monitoring and efficient maintenance systems, procedures to minimize interruptions to water supply and ensure accessibility by all consumers. In this regard, appropriate capacity building and skills will be necessary,
- KCSAP will be responsible for the coordination of all the activities and liaisons, particularly concerning the quality control of the works and social issues,
- County Panel of the experts' environment committee,
- The County Government of Baringo,
- The Contractor and
- The local administration.

Other implementation related components include;

- Training and awareness creation,
- Communication,
- Emergency preparedness and response,
- Checking and corrective action
- Review of the ESMP.

#### **8.3.1 Training and awareness creation**

The efficient implementation and operation of the ESMP require competent capacities, wise management, environmentally and socially sound employees.

Each responsible person will be trained and motivated to appreciate the need for the ESMP and how to implement the mitigation measures. Training and awareness will be done in the pre-construction phase in order to have the employees acting as per the stated course of procedures and actions. Adequate training of personnel is also considered as a cost-effective means to reduce impacts.

Training includes communication of the following:

- a. Requirements of the ESMP and the importance of regulatory compliance with policy;
- b. Potential effects of the employee's work, both negative and positive and
- c. Responsibility in achieving compliance with policies, regulations and ESMP requirements.

### **8.3.2 Communication**

Efficient communication should be maintained at both external and internal levels. The overall advantage of this communication program is to ensure that the anticipated adverse impacts and risks can be effectively mitigated.

The proponent will effectively communicate and cooperate on a continuous basis with the related authorities and committee in order to avoid or minimize to the extent possible disruptions.

Communicating internally and externally- if effective- will ensure:

- Better understanding and appreciation of target groups to the proposed sub-project conditions and benefits,
- No or minimum disruption by the sub-project to other developed/under-development sub-projects and vice versa,
- Minimum impacts and risks, and
- Community participation in helping and making choices to develop suitable and acceptable avoidance/mitigation scenarios.

### **8.3.3 Emergency preparedness and response (EPR)**

Emergency preparedness must be given priority during the ESMP implementation and operation and all key procedures reviewed for emergency preparation, including the occupational health and safety programs for the farmers and the workers.

The Contractor is responsible for the preparation of EPR during the pre-construction and implementation in the construction phase.

The Emergency Management Plan will be reviewed and verified by the proponent. Whenever environmental and/or social emergency situation is triggered during the construction phase, the proponent shall directly inform the Contractor requesting him to respond according to the stated plan. Incident occurrence processes will be reported on, reviewed, and modified by the CESSCO. The CESSCO will be responsible for reviewing and verifying the Contractor reports and plan adaptations.

#### **8.3.4 Checking and corrective action**

The ESMP implementation and performance shall be monitored continually; performance, conformance and non-conformance audit will be applied in order to adapt the plan by adopting effective corrections whenever needed. *An environmental audit will be conducted on an annual basis as required by NEMA.* All records will be stored in a well-ordered and easily accessible manner, enabling individual items to be located easily and ensuring that the records are protected. The audit reports will be reported in accordance with the stated reporting structure.

For the purpose of the community water supply sub-project, the audit would cover but not limited to the following changes triggered by the community water sub-project;

- Technical issues related to the community water supply,
- Socio-economic issues and
- Gender and socio-cultural aspects.

The corrective and preventive actions based on audit findings and their consequences will be monitored. The periodic audit findings will be summarized into an audit report and reviewed during the sub-project review meeting by the proponent.

#### **8.3.5 Institutional Arrangement for Monitoring Compliance with ESMP**

The environmental and social issues included within the mitigation measures will be monitored and supervised by the project beneficiaries, chosen contractor, engineering team and the KCSAP County Environment and Social Safeguards Compliance Officer (CESSCO) and the Projects Monitoring and Evaluation Officer.

The importance of monitoring is to ensure that the ESMP has been effectively implemented, furnish information on the progress and results of mitigation and provide early detection of conditions that necessitate particular mitigation measures.

Although the environmental and social impacts are expected to be moderate or low, the potential negative environmental and social impacts are planned to be prevented or mitigated during the construction and operation stages.

Environmental and social monitoring system started from the preparation phase of the sub project and will continue through the operation phase in order to prevent negative impacts of the project and observe the effectiveness of mitigation measures.

The monitoring system will provide technical assistance and supervision when needed, early detection of conditions related to mitigation measures, follows up on mitigation results, and provides information of the project progress.

The ESMP has provided information about the key environmental and social aspects of the sub project including the mitigation measures to be monitored.

The KCSAP Project Coordinating Unit in Baringo will comply with the provisions of any other environmental and safeguard requirement provided by legislation and conditions of the main funding agency (WB).

#### Audits and Reviews

Annual environmental, health and safety audits and reviews as required by NEMA will be conducted to assess the performance of the environmental, health and safety policies and operational procedures implemented.

The CESSCO is expected to carry out quarterly reporting of the sub project together with the M & E officer. These quarterly reports will form the basis for effective auditing and review of the ESMP of the proposed sub project.

## CHAPTER NINE

### CONCLUSION AND RECOMMENDATIONS

#### **9.1 Conclusion**

An Environmental and Social Management Plan provided in chapter eight charts the path for sustainable sub-project implementation. The plan provides strategies and activities that need to be implemented so as to alleviate the negative impacts. Implementation timelines, responsibilities and cost estimates are also provided where applicable.

#### **9.2 Recommendation**

It is recommended that the Proponent, contractor and all the stakeholders mentioned in the ESMP implement the recommendations in the environmental and social management plan. This is to ensure that the potentially affected environment is well managed and that accidents are prevented in the course of sub-project implementation. The Proponent is expected to comply with the relevant legal and policy requirements with regard to sub-project implementation.

During the operation of the borehole, it is necessary that environmental regulations be strictly adhered to. The performance of the borehole will also be monitored against the recommended mitigation measures to ensure sustainability.

#### **9.3 Overall Opinion**

The construction of the borehole will have a far-reaching impact on the community in terms of accessibility to quality water. The sub-project area has water challenges that continue to stifle socio-economic development and threaten livelihoods. It is for this reason that the community members are very supportive of the sub-project. It was also established that all the identified negative impacts will be effectively mitigated through the full implementation of the ESMP. It is therefore, recommended that upon fulfillment of all other legal obligations identified in this report the Proponent be issued with the ESIA license from NEMA.

## References

1. Environmental Management And Co-Ordination Act, Cap 387-
2. The Environmental Management And Coordination (Strategic Assessment, Integrated Impact Assessment And Environmental Audit) Regulations, 2018
3. The Environmental Management and Co-Ordination Act, 1999 No 8 of 1999 Date of Commencement: 14th January 2000.
4. The Community Land Act No. 27 Of 2016
5. The Forest Conservation And Management Act, 2016 No. 34 Of 2016 NAIROBI, 7th September 2016
6. The Health Act No. 21 Of 2017
7. The Land Laws (Amendment) Act, 2016 No. 28 Of 2016
8. The Occupational Safety And Health Act No. 15 Of 2007
9. The Physical And Land Use Planning Act, 2019 No. 13 Of 2019 5<sup>th</sup> August 2019 Printed and Published by the Government Printer, Nairobi
10. Legal Notice No. 101 The Environmental (Impact Assessment And Audit) Regulations, 2003
11. The Constitution Of Kenya Republic Of Kenya 2010
12. Climate Change Act No. 11 Of 2016
13. Legal Notice No. 121 Environmental Management And Co-Ordination (Waste Management) Regulations 2006-  
*29th September 2006*
14. The Water Act (*No. 43 Of 2016*) The National Water Harvesting And Storage Regulations, 2019
15. The Water Act (*No. 43 Of 2016*)The Water Resources Regulations, 2019 Printed and Published by the Government Printer, Nairobi 20<sup>th</sup> September 2016
16. County Governments Act No. 17 Of 2012 Printed and Published by the Government Printer, Nairobi
17. The Fisheries Management And Development Act No. 35 Of 2016
18. The Irrigation Act, 2019 No. 14 Of 2019
19. Third Medium Term Plan 2018 – 2022 *Transforming Lives: Advancing Socio-Economic Development Through The “Big Four”* Government Of The Republic Of Kenya, 2018 Nairobi Kenya
20. Agriculture Act Chapter 318
21. The Environmental Management And Co-Ordination (Amendment) Act 2015 NAIROBI,3rd June,2015 Republic of Kenya Printed and Published by the Government Printer, Nairobi
22. The Environmental Management And Coordination (Noise And Excessive Vibration Pollution) (Control) Regulations, 2009
23. The Wildlife Conservation And Management Act, 2013 2012 Printed and Published by the Government Printer, Nairobi 27<sup>th</sup> December 2013
24. Energy Act Chapter 314 Revised Edition 2012 [2006] Published By The National Council For Law Reporting

- 25.** Republic Of Kenya, Kenya Climate Smart Agriculture Strategy-2017-2026 Government Of The Republic Of Kenya, 2017
- 26.** Public Health Act Chapter 242 Revised Edition 2012 [1986] Published By The National Council For Law Reporting [www.Kenyalaw.Org](http://www.Kenyalaw.Org) 2017 – 2026
- 27.** The Environment Management and Coordination (Air Quality) Regulations, 2014
- 28.** The Environment Management and Coordination (Water Quality) Regulations, 2006
- 29.** Kenya Integrated Household Budget Survey (KIHBS)2015-2016, KNBS 2018
- 30.** Kisanana Ward Participatory Disaster Risk Assessment (PDRA) Report June 2019
- 31.** Kenya National Population Census Report Vol. I & II, KNBS, 2019

## Annexes

### **Annex 1: Terms of References for the Sub-project Report**

The Terms of Reference to prepare sub-project report for the Bore Hole drilling for KCSAP to include the following:

#### ***(1) Purpose of the sub-project report***

- To ensure adequate identification of potential negative environmental impacts.
- To propose workable mitigation measures
- To formulate an Environmental Management Plan (EMP) articulating envisaged impacts.

The Environmental Management Plan will outline the implementation of the mitigation measures; indicate the responsible persons and the required resources as well as the implementation timeframe.

#### ***(2) The objectives***

The overall objective of the sub-project report, on the other hand, is to ensure that all the negative environmental concerns are integrated into the development proposals and the activities in order to contribute to the sustainable development of the Sertonje Area. Specifically, the objectives are: -

- (i) To identify both direct and indirect potential environmental impacts on the proposed sewer treatment plant.
- (ii) To assess the significance of the impacts of the proposed private borehole on to the natural and human environment.
- (iii) To assess the relative importance of the impacts of the site plans, designs, and the relevant drawings.
- (iv) To propose preventive mitigating and compensative measures for the significant negative impacts of the borehole on the immediate environment.
- (v) To generate environmental baseline data to provide parameters to monitor and to evaluate the implementation of the mitigating measures during the sub-project cycle.
- (vi) To document and present environmental baseline information on the impact of alternative development sites.
- (vii) To present the results of this sub-project report, that will guide informed decision making on the development of the proposed sub-project, and

(viii) To prepare an Environmental Management and Monitoring Plan for the proposed groundwater abstraction sub-project.

**(3) Legal statutes**

The report will further ensure that the proposed residential development complies with the following statutes.

- Environment Management and Co-ordination Act Cap 387 and the Environmental (Impact Assessment and Audit), Regulations of 2003.
- Physical Planning Act (Cap 286), on change of user of land.
- Water Act 2016, Part IV, on the water supply and sewerage on the legal framework
- Public Health Act (Cap 242); on sanitation and waste management
- Occupational Health and Safety Act (2007)
- 5.3.3 EMCA (Noise & Excessive Vibration Pollution Control Regulations, 2009) Legal Notice 61
- EMCA (Waste Management Regulations 2006)
- Environmental Management and Coordination (Water Quality) Regulations, 2006
- Environmental Management and Coordination Act (Air Quality) Regulations, 2008.

**(4) Public consultation**

In conducting this Environmental Impact Assessment (EIA) for the proposed sub-project, it is a requirement that a public consultation process be instituted in accordance with the laid down legislative framework and statutes. The public consultation for the construction of the proposed sub-project was therefore done in compliance with the provisions Environmental Management and Coordination Act 1999, the Environmental (Impact Assessment and Audit) Regulations of June 2003, the Environmental Management and Coordination Act (Water Quality) Regulations 2006 and the Environmental Management and Coordination Act (Waste Management) Regulations 2006 as well as the other regulatory requirements.

## Annex 2: Selected site photos (ESIA Field Pictures)



*Photo 1: Opening of the ESIA public participation process*



*Photo 2: Different community members giving their comments during their ESIA process*



*Photo 4: The community responding to a question during the ESIA*



*Photo 3: Water engineers and community members collecting data and taking GPS position of the proposed borehole*



*Photo 5: Members of public filling in questionnaires and having a Focused Group Discussion*





*Photo 6: Typical vegetation in the surrounding and location of the proposed borehole*



*Photo 7: Mugurin River, a seasonal river 1km to the west of the borehole site*

Annex 3: Attendance List for Environmental and Social Screening Checklist

**KENYA CLIMATE SMART AGRICULTURE PROJECT (KCSAP)**

**ATTENDANCE LIST**

ACTIVITY: Screening Sertouje water project

DATE: 12/11/2019

| S.No | Name               | Age (Years) | Gender | Female | Position      | Status   | Phone number | Signature   |
|------|--------------------|-------------|--------|--------|---------------|----------|--------------|-------------|
| 1    | SAMUEL KIPLAGAT    |             | ✓      | ✓      | Chairman      | Subur    | 0712345678   | [Signature] |
| 2    | PHILEMON KAPSABIT  |             | ✓      | ✓      | ASSOCIATE     | Kapungu  | 0720986777   | [Signature] |
| 3    | Samuel Toroitich   |             | ✓      | ✓      | SECRETARY     | ILAKGEO  | 07205550     | [Signature] |
| 4    | JUSTICE W. KIPKOR  |             | ✓      | ✓      | asst. chair   | Kilgore  | 07204777     | [Signature] |
| 5    | Dr. TOR K. TITIMET |             | ✓      | ✓      | ASST CHIEF    | Kilgore  | 0720179161   | [Signature] |
| 6    | ALFRED KUMORONG    |             | ✓      | ✓      | AGRICULTURIST | MUSUMU   | 07304777     | [Signature] |
| 7    | MARGARET CHEPCHOP  |             | ✓      | ✓      | MEMBER        | KAPKUNDA | 07127157     | [Signature] |
| 8    | Shain Cherunch     |             | ✓      | ✓      | Vice-Chairman | Kapungu  | 0700332205   | [Signature] |
| 10   | IRINE J. KOTIANY   |             | ✓      | ✓      | Treasurer     | Kapungu  | 07683016     | [Signature] |
| 11   | HILDAN CHEPCHOT    |             | ✓      | ✓      | MEMBER        | KAPKUNDA | 07205552     | [Signature] |
| 12   | CHRISTINE KAMEN    |             | ✓      | ✓      | MEMBER        | KAPKUNDA |              | [Signature] |
| 13   | MARGARET KIPKELLES |             | ✓      | ✓      | MEMBER        | KAPKUNDA | 07163222     | [Signature] |
| 14   | Samson T. KIPKOU   |             | ✓      | ✓      | MEMBER        | KAPKUNDA | 073535184    | [Signature] |
| 15   | PIKSTIMO K. KAPKOR |             | ✓      | ✓      | MEMBER        | KAPKUNDA | 071407500    | [Signature] |
| 16   | JACKSON K. KIPKOU  |             | ✓      | ✓      | MEMBER        | KAPKUNDA | 071234567    | [Signature] |
| 17   | SAMSON C. KIPKOTI  |             | ✓      | ✓      | SECRETARY     | KAPKUNDA | 072045571    | [Signature] |
| 18   | MARON K. KIPKOR    |             | ✓      | ✓      | V. SECRETARY  | KAPKUNDA | 07174570     | [Signature] |
| 19   | WILLY ROTO         |             | ✓      | ✓      | MEMBER        | KAPKUNDA | 07204777     | [Signature] |
| 20   | CHEPCHOP CHEPCHOT  |             | ✓      | ✓      | MEMBER        | KAPKUNDA | 07205552     | [Signature] |
| 21   | REGINA KIPKOR      |             | ✓      | ✓      | MEMBER        | KIPTURU  | 0702509077   | [Signature] |
| 22   | ALFRED CHEPCHOT    |             | ✓      | ✓      | MEMBER        | KAPKUNDA | 07205552     | [Signature] |
| 23   | Ronald Oussel      |             | ✓      | M      | SCW           | MUSUMU   | 07205552     | [Signature] |
| 24   | Hala Kudra         |             | ✓      | F      | MEMBER        | KAPKUNDA | 07205552     | [Signature] |
| 25   | Philip Nandwa      |             | ✓      | M      | SECRETARY     | Kapungu  | 07205552     | [Signature] |

## Annex 4: Environmental and Social Screening Checklist

- 0° 4' 42.52" N  
36° 2' 56.56" E  
5085.30 FC

**ENVIRONMENTAL AND SOCIAL SCREENING CHECK LIST**

(Sub-projects screening process by benefitting communities/Agencies)

**Section A: Background information**

|   |  |                         |
|---|--|-------------------------|
| Name of County  | Barotsi                                    |                         |
| Name of CPCU/Monitoring Officer/Researcher                  | Philip Nyanwa                              |                         |
| Sub-project location  | Simonsi/Barotsi/Kapika/primary beneficiary |                         |
| Name of CBO/Institution                                     | Sartonye water project                     |                         |
| Postal Address  | Box 135 Mojoho                             |                         |
| Contact Person  | 077 05424                                  | Cell phone: Harua Gesso |
| Sub-project name  | Sartonye water project                     |                         |
| Estimated cost (KShs.)                                      | 15M  |                         |
| Approximate size of land area available for the sub-project | 1.5 ha                                     |                         |
| Objectives of the sub project                               | water for livelihood                       |                         |
| Activities/enterprises undertaken                           | water supply, irrigation, crop farming     |                         |
| How was the sub-project chosen?                             | CBP  |                         |
| Expected sub project duration                               | 6 months                                   |                         |

**Section B: Environmental Issues**

| Will the sub-project:   | Yes                                 | No                                  |
|---|-------------------------------------|-------------------------------------|
| Create a risk of increased soil erosion?  | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| Create a risk of increased deforestation?   | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| Create a risk of increasing any other soil degradation soil degradation?                                  | <input type="checkbox"/>            | <input type="checkbox"/>            |
| Affect soil salinity and alkalinity?  | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| Divert the water resource from its natural course/location?   | <input type="checkbox"/>            | <input type="checkbox"/>            |
| Cause pollution of aquatic ecosystems by sedimentation and agro-chemicals, oil spillage, effluents, etc.? | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| Introduce exotic plants or animals?   | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| Involve drainage of wetlands or other permanently flooded areas?  | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| Cause poor water drainage and increase the risk of water-related diseases such as malaria?                | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Reduce the quantity of water for the downstream users?  | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| Result in the lowering of groundwater level or depletion of groundwater?                                  | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| Create waste that could adversely affect local soils, vegetation, rivers and streams or groundwater?      | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| Reduce various types of livestock production?   | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| Affect any watershed?   | <input type="checkbox"/>            | <input type="checkbox"/>            |
| Focus on Biomass/Bio-fuel energy generation?  | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |

*If the answers to any of the above is 'yes', please include an EMP with sub-project application.*

**Section C: Socio-economic Issues**

| Will the sub-project:  | Yes                      | No                                  |
|--|--------------------------|-------------------------------------|
| Displace people from their current settlement?                                 | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Interfere with the normal health and safety of the worker/employee?            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Reduce the employment opportunities for the surrounding communities?           | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Reduce settlement (no further area allocated to settlements)?                  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Reduce income for the local communities?                                       | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Increase insecurity due to introduction of the project?                        | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Increase exposure of the community to HIV/AIDS?                                | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Induce conflict?   | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Have machinery and/or equipment installed for value addition?                  | <input type="checkbox"/> | <input type="checkbox"/>            |
| Introduce new practices and habits?  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Lead to child delinquency (school drop-outs, child abuse, child labour, etc.)? | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Lead to gender disparity?  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Lead to poor diets?  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Lead to social evils (drug abuse, excessive alcohol consumption, crime, etc.)? | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

*If the answers to any of the above is 'yes', please include an EMP with sub-project application.*

**Section D: Natural Habitats**

| Will the sub-project:   | Yes                      | No                                  |
|---|--------------------------|-------------------------------------|
| Be located within or near environmentally sensitive areas (e.g. intact natural forests, mangroves, wetlands) or threatened species? | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Adversely affect environmentally sensitive areas or critical habitats - wetlands, woodlots, natural forests, rivers, etc.)?         | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Affect the indigenous biodiversity (Flora and fauna)?   | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Cause any loss or degradation of any natural habitats, either directly (through project works) or indirectly?                       | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Affect the aesthetic quality of the landscape?  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Reduce people's access to the pasture, water, public services or other resources that they depend on?                               | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

| Will the sub-project:  | Yes                      | No                                  |
|--|--------------------------|-------------------------------------|
| Involve the use of pesticides or other agricultural chemicals, or increase existing use? | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Cause contamination of watercourses by chemicals and pesticides?                         | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Cause contamination of soil by agrochemicals and pesticides?                             | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Experience effluent and/or emissions discharge?  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Export produce? Involve annual inspections of the producers and unannounced inspections? | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

|   |                          |                                     |
|---|--------------------------|-------------------------------------|
| Require scheduled chemical applications?  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Require chemical application even to areas distant away from the focus?   | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Require chemical application to be done by vulnerable group (pregnant mothers, chemically allergic persons, elderly, etc.)? | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Use irrigation system in its implementation?  |                          |                                     |

If the answers to any of the above is 'yes', please include an EMP with sub-project application.

**Section E: Pesticides and Agricultural Chemicals** N/A

This questionnaire will be used with the farmers groups for purpose of implementing the IPMF

**1) Pest Control practices**

a) Do you use any pesticides to control pests (insects, diseases, weeds) of crops each season?

| Yes <input checked="" type="checkbox"/><br>No <input type="checkbox"/><br>If yes, name them: | Name of pesticide | Name of pest, disease, weed controlled | Number of times applied/season | When did you apply (growth stage or month)<br>Quantity purchased |
|--|-------------------|--|--------------------------------|--|
|  |                   |  |                                |  |
|  |                   |  |                                |  |

If No, WHY?

b) If you use any of the above pesticide types, do you keep records of the:

Application location Yes  No

Date of application Yes  No

Pesticide product trade name

Yes  No

Operator name Yes  No

If No, WHY?

c) How do you decide when to use the pesticides (tick all that apply)?

- (i)  We use pesticides at regular intervals throughout the season (calendar)
- (ii)  We use pesticides when we see pests in the field (control)
- (iii)  We use pesticides after field sampling and finding a certain number of pests or a certain level of damage (scouting)
- (iv)  Told by someone to apply (specify who) \_\_\_\_\_
- (v)  Other (specify) \_\_\_\_\_

d) Do you use a knapsack sprayer? Yes  No

If yes,

(i) Do you own it Yes  No

(ii) Do you rent it Yes  No

(iii) Do you borrow it Yes  No

e) From your experience, are there any negative/harmful effects of using pesticides?

Yes  No

f) If yes, list the negative effects:

- (i) .....
- (ii) .....
- (iii) .....
- (iv) .....
- (v) .....

g) Do you use any kind of protective clothing while applying or handling pesticides? Yes  No   
Why? \_\_\_\_\_

a) If YES, what kind? \_\_\_\_\_

**2. Knowledge of pesticide handling and storage (tick one in each row)**

a) Do you read labels on the pesticide container before using?  
Sometimes  Always  Never

b) How often do you wear protective clothing and other accessories like nasal mask, eye goggles, and boots when applying the pesticides?  
Sometimes  Always  Never

c) Do you mix pesticides with your hands?  
Sometimes  Always  Never

d) Do you observe the pre-harvest waiting periods after applying the pesticides?  
Sometimes  Always  Never

e) After spraying, do you wait 12 hours before entering the field?  
Sometimes  Always  Never

f) Do you store pesticides in a secure, sound and well-ventilated location?  
Sometimes  Always  Never

g) Do you make a cocktail before applying the pesticides? (i.e., mix more than one chemical and apply them at once?)  
Sometimes  Always  Never

h) Where do you store your pesticides? \_\_\_\_\_  
Why do you store them there? \_\_\_\_\_

i) What do you do with your pesticide containers after they are empty? \_\_\_\_\_  
\_\_\_\_\_

j) Do you know of any beneficial insects (insects that eat harmful insects)?  
Yes..... No

k) If yes, name them:

- i) \_\_\_\_\_
- ii) \_\_\_\_\_

**3. Pesticides and Health**

a) Do you find that pesticide application is affecting the health of: Persons regularly applying pesticides?

Sometimes \_\_\_\_\_ Always \_\_\_\_\_ Never \_\_\_\_\_  
 Persons working in fields sprayed with pesticides  
 Sometimes \_\_\_\_\_ Always \_\_\_\_\_ Never \_\_\_\_\_  
 Persons harvesting the produce  
 Sometimes \_\_\_\_\_ Always \_\_\_\_\_ Never \_\_\_\_\_

**4. Options to Pesticides**

a) From your experience, are you aware of other methods for controlling insect's diseases and/or weeds besides pesticides?

Yes..... No .....

b) If yes, describe these practices:

i) \_\_\_\_\_

ii) \_\_\_\_\_

iii) \_\_\_\_\_

iv) \_\_\_\_\_

**5. Information**

a) What information do you think you need for improving your crop production and marketing?  
 \_\_\_\_\_

**6. Training**

a) Have you ever received any training on any of the following topics related to crop production?

b) Integrated Pest Management Yes..... No .....

c) No. of times/past yr. ....

d) b).Pesticide Usage Yes..... No .....

e) No. of times/past yr. ....

f) Pesticide Safety Yes..... No .....

g) No. of times/past yr. ....

h) Insect Identification Yes..... No .....

i) No. of times/past yr. ....

j) Disease Identification Yes..... No .....

k) No. of times/past yr. ....

l) Quality aspects of production Yes..... No .....

m) No. of times/past yr. ....

7) Is there anything else that you want us to know about your crop production?  
 \_\_\_\_\_

If the answer to the above is 'yes', please consult the IPM that has been prepared for the project.

**Section F: Vulnerable and Marginalized Groups meeting requirements for OP 4.10**

| Are there:   | Yes                      | NO                       |
|--|--------------------------|--------------------------|
| People who meet requirements for OP 4.10 living within the boundaries of, or near the project? | <input type="checkbox"/> | <input type="checkbox"/> |
| Members of these VMGs in the area who could benefit from the project?                          | <input type="checkbox"/> | <input type="checkbox"/> |
| VMGs livelihoods to be affected by the sub project?  | <input type="checkbox"/> | <input type="checkbox"/> |

*If the answer to any of the above is 'yes', please consult the VMGF that has been prepared for the project.*

**Section G: Land Acquisition and Access to Resources**

| Will the sub-project:  | Yes                      | No                                  |
|--|--------------------------|-------------------------------------|
| Require that land (public or private) be acquired (temporarily or permanently) for its development?  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Use land that is currently occupied or regularly used for productive purposes (e.g. gardening, farming, pasture, fishing locations, forests) | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Displace individuals, families or businesses?  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Result in temporary or permanent loss of crops, fruit trees and pasture land?  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Adversely affect small communal cultural property such as funeral and burial sites, or sacred groves?  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Result in involuntary restriction of access by people to legally designated parks and protected areas?                                       | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Be on monoculture cropping?  | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

*If the answer to any of the above is 'yes', please consult the mitigation measures in the ESMF, and (if needed) prepare a (Resettlement Action Plan) RAP.*

**Section H: Proposed action**

| (i) Summarize the above:  | (ii) Guidance  |
|---|--|
| <input type="checkbox"/> All the above answers are 'No'         | <ul style="list-style-type: none"> <li>• If all the above answers are 'No', there is no need for further action;</li> </ul>                        |
| <input checked="" type="checkbox"/> There is at least one 'Yes' | <ul style="list-style-type: none"> <li>• If there is at least one 'Yes', please describe your recommended course of action (see below).</li> </ul> |

**(iii) Recommended Course of Action**

If there is at least one 'Yes', which course of action do you recommend?

- CPCUs and County Director of Environment (CDE) will provide detailed guidance on mitigation measures as outlined in the ESMF; and
- Specific advice is required from CDE and CPCUs regarding sub-project specific EIA(s) and also in the following area(s)

- All sub-project applications/proposals MUST include a completed ESMF checklist. The KCSAP-CPCU and CDE will review the sub-project applications/proposals and the CDEs will sign off.
- The proposals will then be submitted to KCSAP PIU for clearance for implementation by communities in the proposed subprojects.

**Expert Advice**

- The National Government through the Department of Monuments and Sites of the National Museums of Kenya can assist in identifying and mapping of monuments and archaeological sites; and
- Sub-project specific EIAs, if recommended, must be carried out by experts registered with NEMA and be followed by monitoring and review. During the process of conducting an EIA the proponent shall seek views of persons who may be affected by the sub-project. The WB policy set out in OP 4.01 requires consultation of sub-project affected groups and disclosure of EIA's conclusions. In seeking views of the public after the approval of the sub-project, the proponent shall avail the draft EIA report at a public place accessible to project-affected groups and local NGOs/CSOs.

EIA/Audit Expert; Philip Nandwa; Reg. No. 1108 - *PLP*

Completed by:

Name: *Mr. Haron K. Lassa*

Position / Community: *Chairperson (Sertonye Water Project)*

Date: *12/11/2019*

Field Appraisal Officer (CDE):

Signature: *[Signature]*  
 Date: *15/11/2019*

**Note:**

| Project category | Characteristics   |
|------------------|---|
| A                | Full and extensive EIA needed- irreversible environmental impacts; impacts not easy to pick or isolate and mitigation cost expensive; EMP design not easily done; Must have the EIA done and future annual EAs instituted |
| B                | Site specific environmental impacts envisaged; mitigation measures easy to pick, not costly and EMP design readily done; need an EIA and future EAs   |
| C                | Have minimal or occasionally NO adverse environmental impacts; exempted from further environmental processes save environmental audits  |

*Recommendation:*  
 As per 2nd schedule (SSR (1) (4)) the project is included in the mandatory lists of projects to undergo EIA. Therefore, it is recommended that Sertonye Brookside water project be subjected to EIA.  
 - Philip Nandwa (EIA/Audit Expert) NEMA  
 Exact Registration NO. 1108

**Annex 5: Attendance list for ESIA Public Participation**

**KENYA CLIMATE SMART AGRICULTURE PROJECT (KCSAP)  
BARINGO COUNTY**



Attendance list

ACTIVITY: ESIA AT MIGAMA SUB-LOCATION, KISALAMA WARD, BARINGO COUNTY.

DATES: 5/11/2019

| S/N | Name              | PIN/ID     | Age |     | Sex |   | Design              | IC | Signature |
|-----|-------------------|------------|-----|-----|-----|---|---------------------|----|-----------|
|     |                   |            | <35 | >35 | M   | F |                     |    |           |
| 1   | Pius K Chebon     | 2010050120 |     | >   | M   |   | Investor            | N  |           |
| 2   | DICKSON K. ANTONY | 1390012730 |     | ✓   | ✓   |   | Dist officer        | L  |           |
| 3   | MURRAY MURIEL     | 609201241  | ✓   |     | ✓   |   | WVSP                | K  |           |
| 4   | JANE J. CHESTER   | 2010080899 |     | ✓   |     | ✓ | IOAEO               | R  |           |
| 5   | AMBERSE KETER     | 2336073    |     | >   | ✓   |   | Director of project | K  |           |
| 6   | HARON K. LEBO     | 9493102    |     | ✓   | ✓   |   | Project Clr         |    |           |
| 7   | CHEMUN CHEMUNJI   | 650257     |     | ✓   | ✓   |   | Project member      |    |           |
| 8   | HARON KIRIANGI    | 93363822   | ✓   |     | ✓   |   | Project member      |    |           |
| 9   | MARICA CHEMUNJI   | 2468883    |     | ✓   | ✓   |   | Member              |    |           |
| 10  | MURRAY KEGAN      | 2415125    |     | ✓   | ✓   |   | Member              |    |           |
| 11  | Prisca Simba      | 28423487   |     | ✓   | ✓   |   | Member              |    |           |
| 12  | JOHN CHEMUNJI     | 2813172    |     | ✓   | ✓   |   | Member              |    |           |
| 13  | RICHARD KIRIA     | 6330566    |     | ✓   | ✓   |   | Member              |    |           |

10/10

|    |                 |                         |   |   |        |     |
|----|-----------------|-------------------------|---|---|--------|-----|
| 14 | Arissa Simons   | 6591536                 | ✓ | ✓ | MEMBER | the |
| 15 | Kyranne C. Brin | 31446369                | ✓ | ✓ | MEMBER | the |
| 16 | William Keith   | 8331004                 | ✓ | ✓ | MEMBER | the |
| 17 | Jason Rosta     | 12076122                | ✓ | ✓ | MEMBER | the |
| 18 | Maria Kuznetsov | 7534858                 | ✓ | ✓ | MEMBER | the |
| 19 | Kieran Webb     | 4021025                 | ✓ | ✓ | MEMBER | the |
| 20 | Jackson Smith   | 072002007               | ✓ | ✓ | MEMBER | the |
| 21 | Laura Chapman   | 2025 02 07<br>342463524 | ✓ | ✓ | MEMBER | the |
| 22 | Hilina Clayton  | 10316107                | ✓ | ✓ | MEMBER | the |
| 23 | Shari Chetani   | 36313331                | ✓ |   | MEMBER | the |
| 24 | Mary Marie      |                         |   | ✓ | MEMBER | the |
| 25 | Rebecca Warren  | 28350750                |   | ✓ | MEMBER | the |
| 26 | Mark J. Keener  | 28802463                |   | ✓ | MEMBER | the |
| 27 | Kathryn Sam     | 30566 PM                | < | ✓ | MEMBER | the |
| 28 | Priya Prasad    | 3621924                 | > | ✓ | MEMBER | the |
| 29 | John King       | 11847041                |   | ✓ | MEMBER | the |
| 30 | Jennifer King   |                         |   |   |        |     |
| 31 | John L. King    | 0720 360074             | ✓ | ✓ | MEMBER | the |
| 32 | John L. King    | 32210366                | ✓ | ✓ | MEMBER | the |
|    |                 |                         |   |   |        |     |
|    |                 |                         |   |   |        |     |
|    |                 |                         |   |   |        |     |
|    |                 |                         |   |   |        |     |

**Annex 6: Customized questionnaire for FGD- stakeholder participation**

FGD

**STAKEHOLDERS' PERCEPTIONS ON THE POTENTIAL SOCIAL ENVIRONMENTAL IMPACTS OF THE PROPOSED PROJECT AT BARINGO COUNTY**

**SUB-COUNTY:** Wajir **WARD:** Karuri **PLOT NUMBER:** ..... **LOCATION:** Simsire **SUB-LOCATION:** Baringok

This project is anticipated to have effects on the physical, biological and socio-economic environments of the surrounding area and the community. It is important, therefore, to determine these impacts and public participation is a requirement of Environmental Management and Coordination Act, 1999 (Section 58 on Environmental Impact Assessment) in this process. Therefore, as a key stakeholder (i.e. local leader/ surrounding institution or organization/ interested person or group), we request for your comments on the potential socio-economic and environmental impacts of the

- Are you a resident of the proposed project area? Yes  No
- How far is your place of residents from the proposed project area? 2km
- For how long have you resided in this area? More than 10 yrs
- Are you aware of the proposed project? Yes  No
- a) do you anticipate any conflict or complains against the project with respect to
  - land/soils Yes  No  If yes indicate .....
  - water Yes  No  If yes indicate .....
  - Human health/Life Yes  No  If yes indicate .....
  - loss of life Yes  No  If yes indicate .....
  - wild life Yes  No  If yes indicate .....
  - air quality Yes  No  If yes indicate .....
  - culture and religion Yes  No  If yes indicate .....
  - education Yes  No  If yes indicate .....
- b) If any in 5(a) is yes above how well could they be mitigated? .....

6. In your view, What are the socio-economic and environmental impacts (i.e. to people, land/soil, water, forest, air, wetlands, Investock, wildlife, fish, etc) do you anticipate from the project?

a) Positively - Reduce distance - Increase in Agricultural Product  
Employment - Increased income - Establishment of fish pond  
more trees and bushes - improve health standard of people - Employment increase

b) Negatively - Noise - drilling - Love affair  
Conflict may arise - When to drill the tank water stops - Boiler failure  
Soles may be over - pollution may occur by some holes - may cause

c) How can the negative impacts be mitigated?  
Enforcing the commands by leaders  
Temporary signs to reduce the accidents

- Should the project be implemented? Yes  No   
if no, why? No
- Respondent Name Mr. K. K. K. K. ID No/phone No. 0720047930  
 sign [Signature] date 12-2-2019

**THANK YOU FOR YOUR COOPERATION**

# Annex 7: Community Filled-in Questionnaires

④

**STAKEHOLDERS' PERCEPTIONS ON THE POTENTIAL SOCIAL ENVIRONMENTAL IMPACTS OF THE PROPOSED ... PROJECT AT BAKINGO COUNTY**

SUB-COUNTY: Mogotio, WARD: Kibwaro, LOT NUMBER: \_\_\_\_\_, LOCATION: Sub-Location: Kibwaro

This project is anticipated to have effects on the physical, biological and socio-economic environments of the surrounding area and the community. It is important, therefore, to determine these impacts and public participation is a requirement of Environmental Management and Coordination Act, 1999 (Section 56 on Environmental Impact Assessment) in this process. Therefore, as a key stakeholder (i.e. local leader/representing institution or organization/interested person or group), we request for your comments on the potential socio-economic and environmental impacts of the \_\_\_\_\_

- Are you a resident of the proposed project area? Yes , No
- How far is your place of residence from the proposed project area? 1600
- For how long have you resided in this area? 24 years
- Are you aware of the proposed project? Yes , No
- Do you anticipate any conflict or complaints against the project with respect to:
  - land/soils Yes , No . If yes indicate: \_\_\_\_\_
  - water Yes , No . If yes indicate: \_\_\_\_\_
  - Human health/Life Yes , No . If yes indicate: \_\_\_\_\_
  - loss of life Yes , No . If yes indicate: \_\_\_\_\_
  - wild life Yes , No . If yes indicate: \_\_\_\_\_
  - air quality Yes , No . If yes indicate: \_\_\_\_\_
  - culture and religion Yes , No . If yes indicate: \_\_\_\_\_
  - education Yes , No . If yes indicate: \_\_\_\_\_

b) If any in 5(a) is yes above how well could they be mitigated?

N/A

6. In your view, What are the socio-economic and environmental impacts (i.e. to people, land/water, forest, air, wildlife, livestock, wildlife, fish, etc) do you anticipate from the project?

a) Positively: People will benefit from the above subject because residents will start their Agricultural Process well.

b) Negatively: N/A

How far do you estimate the impact?

N/A

Signature: Shari Gwathoni Date: 5/12/2019 Phone: 263331 070522205

STAKEHOLDERS' PERCEPTIONS ON THE POTENTIAL SOCIAL ENVIRONMENTAL IMPACTS OF THE PROPOSED SURTONIA WATER PROJECT AT BARINGO COUNTY

SUB-COUNTY SURTONIA WARD KISUMU PLU# NUMBER \_\_\_\_\_ LOCATION SURTONIA SUB-LOCATION KISUMU

This project is anticipated to have effects on the physical, biological and socio-economic environments of the surrounding area and the community. It is important, therefore, to determine these impacts and public participation is a requirement of Environmental Management and Coordination Act, 1999 (Section 58 on Environmental Impact Assessment) in this process. Therefore, as a key stakeholder (i.e. local leader/ surrounding institution or organization/ interested person or group), we request for your comments on the potential socio-economic and environmental impacts of the SURTONIA WATER

- 1. Are you a resident of the proposed project area? Yes  No
- 2. How far is your place of residence from the proposed project area? 1KM
- 3. For how long have you resided in this area? 20 yrs
- 4. Are you aware of the proposed project? Yes  No

- 5. a) Do you anticipate any conflict or complaints against the project with respect to:
  - land/soils Yes  No  If yes indicate \_\_\_\_\_
  - water Yes  No  If yes indicate \_\_\_\_\_
  - Human health/Life Yes  No  If yes indicate \_\_\_\_\_
  - loss of life Yes  No  If yes indicate \_\_\_\_\_
  - wild life Yes  No  If yes indicate \_\_\_\_\_
  - air quality Yes  No  If yes indicate \_\_\_\_\_
  - culture and religion Yes  No  If yes indicate \_\_\_\_\_
  - education Yes  No  If yes indicate \_\_\_\_\_

b) If any in 5(a) is yes above how well could they be mitigated?

6. In your view, What are the socio-economic and environmental impacts (i.e. to people, land/soil, water, forest, air, wetlands, livestock, wildlife, fish, etc) do you anticipate from the project?

a) Positively It will help people to practice fishing, conservation of the environment, and livestock production

b) Negatively NA

c) How can the negative impacts be mitigated?

7. Should the project be implemented? Yes  No   
If no, why?

8. Respondent Name CHRISTA BUNDIRI Telephone No. 0193536  
sign [Signature] date 22/2/19

THANK YOU FOR YOUR COOPERATION

STAKEHOLDERS' PERCEPTIONS ON THE POTENTIAL SOCIAL ENVIRONMENTAL IMPACTS OF THE PROPOSED WATERBURY WAREHOUSE PROJECT AT BARINGO COUNTY

SUB-COUNTY Mohale, WARD Khamea PLOT NUMBER..... LOCATION Susobane SUB-LOCATION Susobane

This project is anticipated to have effects on the physical, biological and socio-economic environments of the surrounding area and the community. It is important, therefore, to determine their impacts and public participation is a requirement of Environmental Management and Coordination Act, 1999 (Section 58 on Environmental Impact Assessment) in this process. Therefore, as a key stakeholder (i.e. local leader) surrounding institution or organization/ interested person or group, we request for your comments on the potential socio-economic and environmental impacts of the.....

1. Are you a resident of the proposed project area? Yes , No
2. How far is your place of residence from the proposed project area? 1km
3. For how long have you resided in this area? 20 years Yes , No
4. Are you aware of the proposed project? Yes , No
5. Do you anticipate any conflict or complaints against the project with respect to:
  - land/soils Yes , No  If yes indicate.....
  - water Yes , No  If yes indicate.....
  - Human health/Life Yes , No  If yes indicate.....
  - loss of life Yes , No  If yes indicate.....
  - wild life Yes , No  If yes indicate.....
  - air quality Yes , No  If yes indicate.....
  - culture and religion Yes , No  If yes indicate.....
  - education Yes , No  If yes indicate.....

b) If any in 5(a) is yes above how well could they be mitigated? N/A

6. In your view, What are the socio-economic and environmental impacts (i.e. to people, land/water, forest, air, wetlands, livestock, wildlife, fish, etc) do you anticipate from the project?

- a) Positively for business, tourism and irrigation purposes  
for vegetable production  
for the use of land
- b) Negatively N/A

How can the negative impacts be mitigated? N/A

Signature of respondent William Ross

Date 5/12/2014 ID No 8721602

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STAKEHOLDERS' PERCEPTIONS ON THE POTENTIAL SOCIAL ENVIRONMENTAL IMPACTS OF THE PROPOSED PROJECT AT BARINGO COUNTY

SUB-COUNTY Makindu WARD Kisumu PLOT NUMBER..... LOCATION S. P. 186 SUB-LOCATION Mashurur

This project is anticipated to have effects on the physical, biological and socio-economic environments of the surrounding area and the community. It is important, therefore, to determine these impacts and public participation is a requirement of Environmental Management and Coordination Act, 1999 (Section 58 on Environmental Impact Assessment) in this process. Therefore, as a key stakeholder (i.e. local leader/ surrounding institution or organization/ interested person or group), we request for your comments on the potential socio-economic and environmental impacts of the

- Are you a resident of the proposed project area?  Yes [ ], No [ ]
- How far is your place of residents from the proposed project area? S.K.M.
- For how long have you resided in this area? Since birth
- Are you aware of the proposed project?  Yes [ ], No [ ]
- do you anticipate any conflict or complains against the project with respect to:
  - land/soils Yes [ ], No [ ] If yes indicate.....
  - water Yes [ ], No [ ] If yes indicate.....
  - Human health/Life Yes [ ], No [ ] If yes indicate.....
  - loss of life Yes [ ], No [ ] If yes indicate.....
  - wild life Yes [ ], No [ ] If yes indicate.....
  - air quality Yes [ ], No [ ] If yes indicate.....
  - culture and religion Yes [ ], No [ ] If yes indicate.....
  - education Yes [ ], No [ ] If yes indicate.....

b) If any in 5(a) is yes above how well could they be mitigated? N/A

6. In your view, What are the socio-economic and environmental impacts (i.e. to people, land/soil, water, forest, air, wetlands, livestock, wildlife, fish, etc) do you anticipate from the project?

- Positively There will be an improvement in the livelihoods of the residents of the area.
- Negatively due to availability of water within the area.
- How can the negative impacts be mitigated? N/A

7. Should the project be implemented?  Yes [ ], No [ ]  
If no, why?

8. Respondent Name Jane chege ID No/phone No. 9101595  
sign Jane chege date 5/12/2019

THANK YOU FOR YOUR COOPERATION

(17)

STAKEHOLDERS' PERCEPTIONS ON THE POTENTIAL SOCIAL ENVIRONMENTAL IMPACTS OF THE PROPOSED PROJECT AT BARINGO COUNTY

SUB-COUNTY: Mogadio WARD: Kisumu PLUJ NUMBER: ..... LOCATION: Simegi SUB-LOCATION: Mubiani

This project is anticipated to have effects on the physical, biological and socio-economic environments of the surrounding area and the community. It is important, therefore, to determine these impacts and public participation is a requirement of Environmental Management and Coordination Act, 1999 (Section 58 on Environmental Impact Assessment) in this process. Therefore, as a key stakeholder (i.e. local leader/ surrounding institution or organization/ interested person or group), we request for your comments on the potential socio-economic and environmental impacts of the .....

1. Are you a resident of the proposed project area? Yes , No
2. How far is your place of residents from the proposed project area? 100 meters
3. For how long have you resided in this area? 6 years
4. Are you aware of the proposed project? Yes , No
5. a) do you anticipate any conflict or complaints against the project with respect to:
  - land/soils Yes , No . If yes indicate .....
  - water Yes , No . If yes indicate .....
  - Human health/Life. Yes , No . If yes indicate .....
  - loss of life Yes , No . If yes indicate .....
  - wild life Yes , No . If yes indicate .....
  - air quality Yes , No . If yes indicate .....
  - culture and religion Yes , No . If yes indicate .....
  - education Yes , No . If yes indicate .....

b) If any in 5(a) is yes above how well could they be mitigated? N/A

6. In your view, What are the socio-economic and environmental impacts (i.e. to people, land/soil, water, forest, air, wetlands, livestock, wildlife, fish, etc) do you anticipate from the project?

a) Positively: Urban water for households

b) Negatively: N/A

c) How can the negative impacts be mitigated? N/A

7. Should the project be implemented? Yes , No . If no, why?

8. Respondent Name: MUSA SHAMU ID No/phone No: 0726367432  
sign: MS date: 5/12/2019

THANK YOU FOR YOUR COOPERATION

STAKEHOLDERS' PERCEPTIONS ON THE POTENTIAL SOCIAL ENVIRONMENTAL IMPACTS OF THE PROPOSED Saxi Lualaba M.S. 100 PROJECT AT BARINGO COUNTY

SUB-COUNTY Meluhia WARD Kakara PLOT NUMBER \_\_\_\_\_ LOCATION Gondoma SUB-LOCATION Muguna

This project is anticipated to have effects on the physical, biological and socio-economic environments of the surrounding area and the community. It is important, therefore, to determine these impacts and public participation is a requirement of Environmental Management and Coordination Act, 1999 (Section 58 on Environmental Impact Assessment) in this process. Therefore, as a key stakeholder (i.e. local leader/ surrounding institution or organization/ interested person or group), we request for your comments on the potential socio-economic and environmental impacts of the \_\_\_\_\_

1. Are you a resident of the proposed project area? yes Yes , No
2. How far is your place of residence from the proposed project area? 2.5 km
3. For how long have you resided in this area? 35 yrs
4. Are you aware of the proposed project? yes Yes , No
5. a) Do you anticipate any conflict or complaints against the project with respect to:
  - land/soils Yes , No  If yes indicate \_\_\_\_\_
  - water Yes , No  If yes indicate \_\_\_\_\_
  - Human health/Life Yes , No  If yes indicate \_\_\_\_\_
  - loss of life Yes , No  If yes indicate \_\_\_\_\_
  - wild life Yes , No  If yes indicate \_\_\_\_\_
  - air quality Yes , No  If yes indicate \_\_\_\_\_
  - culture and religion Yes , No  If yes indicate \_\_\_\_\_
  - education Yes , No  If yes indicate \_\_\_\_\_
- b) If any in 5(a) is yes above how well could they be mitigated?

N/A

6. In your view, What are the socio-economic and environmental impacts (i.e. to people, land/soil, water, forest, air, wetlands, livestock, wildlife, fish, etc) do you anticipate from the project?

- a) Positively \_\_\_\_\_
- b) Negatively N/A
- c) How can the negative impacts be mitigated? N/A

7. Should the project be implemented? Yes , No . If no, why? \_\_\_\_\_

8. Respondent Name Victor U. 427 ID No/phone No 2061525  
sign [Signature] date 06/12/2019

THANK YOU FOR YOUR COOPERATION

STAKEHOLDERS' PERCEPTIONS ON THE POTENTIAL SOCIAL ENVIRONMENTAL IMPACTS OF THE PROPOSED PROJECT AT BARINGO COUNTY

SUB-COUNTY... WARD... PLOT NUMBER... LOCATION... SUB-LOCATION...

This project is anticipated to have effects on the physical, biological and socio-economic environments of the surrounding area and the community. It is important, therefore, to determine these impacts and public participation is a requirement of Environmental Management and Coordination Act, 1999 (Section 58 on Environmental Impact Assessment) in this process. Therefore, as a key stakeholder (i.e. Social leader/ surrounding institution or organization/ interested person or group), we request for your comments on the potential socio-economic and environmental impacts of the...

- 1. Are you a resident of the proposed project area? Yes [X], No [ ]
2. How far is your place of residents from the proposed project area? 1 km
3. For how long have you resided in this area? 45 years
4. Are you aware of the proposed project? Yes [X], No [ ]
5. do you anticipate any conflict or complains against the project with respect to:
- land/soils Yes [ ], No [X] If yes indicate
- water Yes [ ], No [X] If yes indicate
- Human health/Life Yes [ ], No [X] If yes indicate
- loss of life Yes [ ], No [X] If yes indicate
- wild life Yes [ ], No [X] If yes indicate
- air quality Yes [ ], No [X] If yes indicate
- culture and religion Yes [ ], No [X] If yes indicate
- education Yes [ ], No [X] If yes indicate
b) If any in 5(a)is yes above how well could they be mitigated? N/A

6. In your view, What are the socio-economic and environmental impacts (i.e. to people, land/soil, water, forest, air, wetlands, livestock, wildlife, fish, etc) do you anticipate from the project?

a) Positively For irrigation purpose, For household use for livestock e.g. watering dairy cows

b) Negatively N/A

c) How can the negative impacts be mitigated? N/A

7. Should the project be implemented? Yes [X], No [ ] If no, why? N/A

8. Respondent Name JONGICHI DICKO ID No/phone No 193635/0725846057 sign date 31/12/2019

THANK YOU FOR YOUR COOPERATION

Annex 7: Key informants -Impact Assessment matrix

ENVIRONMENTAL IMPACT ASSESSMENT CHECKLIST FOR WATER BOREHOLE AT Serton

County \_\_\_\_\_ Sub-County \_\_\_\_\_ Ward \_\_\_\_\_ Location \_\_\_\_\_ Sub-Location \_\_\_\_\_ No. \_\_\_\_\_  
 Date \_\_\_\_\_

Project Construction Phase

| Potential Environmental Impact   | Positive Impacts |       |       | Negative Impacts |       |       |
|--|------------------|-------|-------|------------------|-------|-------|
|  | None             | Minor | Major | None             | Minor | Major |
| <b>Impacts on Air Quality and Climate</b>  |                  | ✓     |       |                  |       | ✓     |
| • Noise  |                  |       |       |                  |       | ✓     |
| • Particulates matter(dust)  |                  |       |       |                  |       | ✓     |
| • Gaseous emission   |                  |       |       |                  |       | ✓     |
| <b>Impacts on Water Resources</b>  |                  |       |       |                  |       |       |
| • Contamination of surface water   |                  |       |       |                  |       | ✓     |
| • Contamination of ground water  |                  |       |       | ✓                |       |       |
| • Change to sewage systems   |                  |       |       | ✓                |       |       |
| • Abandonment material accidents and spillage                                      |                  |       |       | ✓                |       |       |
| <b>Impacts of Soil</b>   |                  |       |       |                  |       |       |
| • Contamination of soil through deposition of contaminated industrial solid wastes |                  |       |       | ✓                |       |       |
| • Soil erosion   |                  |       |       |                  |       | ✓     |
| • Soil toxicity due to leachates from waste dumps                                  |                  |       |       | ✓                |       |       |
| <b>Impacts on Human Environment</b>  |                  |       |       |                  |       |       |
| • Creation of employment opportunities   |                  | ✓     |       |                  |       |       |
| • Introduction of secondary business   |                  | ✓     |       |                  |       |       |
| • Improvement of infrastructural services and facilities                           |                  |       | ✓     |                  |       |       |
| • Increase in wealth and hence improvement of social status                        |                  |       | ✓     |                  |       |       |
| • Change of facilities due to corrosion and degradation of cultural sites          |                  |       |       |                  |       | ✓     |
| • Displacement of the local people   |                  |       |       |                  |       | ✓     |
| • Conflicts with existing land uses  |                  |       |       |                  |       | ✓     |
| • Social-cultural disruption of the local population                               |                  |       |       |                  |       | ✓     |
| • Labour conflicts between existing labour Project and Industrial                  |                  |       |       |                  |       | ✓     |
| • Impacts on public health and safety  |                  |       |       |                  |       | ✓     |

|  |  |  |  |  |  |  |  |   |   |
|--|--|--|--|--|--|--|--|---|---|
| • Respiratory problems   |  |  |  |  |  |  |  |   |   |
| • Skin and eye problems  |  |  |  |  |  |  |  |   |   |
| • Chemical/industrial accidents  |  |  |  |  |  |  |  | ✓ | ✓ |
| • Spread of sexually transmitted diseases(STD's) and other communicable diseases |  |  |  |  |  |  |  | ✓ | ✓ |
| • Gender characteristics   |  |  |  |  |  |  |  |   |   |
| • Conflicts in resource use  |  |  |  |  |  |  |  | ✓ | ✓ |
| • Stress on existing social amenities  |  |  |  |  |  |  |  | ✓ | ✓ |
| • Increase foreign exchange earnings   |  |  |  |  |  |  |  |   | ✓ |

**Operational Phase**

| Potential Environmental Impact   | Positive Impacts |       |       | Negative Impacts |       |       |
|--|------------------|-------|-------|------------------|-------|-------|
|  | None             | Minor | Major | None             | Minor | Major |
| <b>Impacts on Air Quality and Climate</b>  |                  |       |       |                  |       |       |
| • Noise  |                  |       |       | ✓                |       |       |
| • Particulates matter (dust)   |                  |       |       | ✓                |       |       |
| • Gaseous emission   |                  |       |       | ✓                |       |       |
| <b>Impacts on Water Resources</b>  |                  |       |       |                  |       |       |
| • Contamination of surface water   |                  |       |       | ✓                |       |       |
| • Contamination of ground water  |                  |       |       | ✓                |       |       |
| • Damage to sewage systems   |                  |       |       | ✓                |       |       |
| • Hazardous material accidents and spillage  |                  |       |       | ✓                |       |       |
| <b>Impacts on Soil</b>   |                  |       |       |                  |       |       |
| • Contamination of soil through deposition of contaminated industrial solid wastes |                  |       |       | ✓                |       |       |
| • Soil erosion   |                  |       |       |                  |       | ✓     |
| • Soil toxicity due to leachates from waste dumps                                  |                  |       |       |                  |       | ✓     |
| <b>Impacts on Human Environment</b>  |                  |       |       |                  |       |       |
| • Creation of employment opportunities   |                  |       |       |                  |       |       |
| • Introduction of secondary business   |                  |       |       |                  |       |       |
| • Improvement of infrastructural services and facilities                           |                  |       |       |                  |       |       |
| • Increase in wealth and hence improvement of social status                        |                  | ✓     |       |                  |       |       |
| • Damage of facilities due to corrosion and degradation of cultural sites          |                  |       |       |                  |       | ✓     |
| • Displacement of the local people   |                  |       |       |                  |       | ✓     |
| • Conflicts with existing land uses  |                  |       |       |                  |       | ✓     |

|   |  |  |  |  |  |  |  |  |  |
|---|--|--|--|--|--|--|--|--|--|
| • Social and economic disruption of the local population                        |  |  |  |  |  |  |  |  |  |
| • Labour conflicts between existing labour project and industrial               |  |  |  |  |  |  |  |  |  |
| • Impacts on public health and safety   |  |  |  |  |  |  |  |  |  |
| • Physical problems   |  |  |  |  |  |  |  |  |  |
| • Site and open problems  |  |  |  |  |  |  |  |  |  |
| • Chemical laboratory accidents   |  |  |  |  |  |  |  |  |  |
| • Spread of sexually transmitted diseases (STD) and other communicable diseases |  |  |  |  |  |  |  |  |  |
| • Gender discrimination   |  |  |  |  |  |  |  |  |  |
| • Effects on sensitive sites  |  |  |  |  |  |  |  |  |  |
| • Threat on existing social amenities   |  |  |  |  |  |  |  |  |  |
| • Increase in job and wage earnings   |  |  |  |  |  |  |  |  |  |

Disseminating

| Potential Environmental Impact  | Positive Impacts |       |       | Negative Impacts |       |       |
|---|------------------|-------|-------|------------------|-------|-------|
|   | None             | Minor | Major | None             | Minor | Major |
| <b>Impacts on Air Quality and Climate</b>   |                  |       |       |                  |       |       |
| • Noise   |                  |       |       |                  |       |       |
| • Particulate emissions   |                  |       |       |                  |       |       |
| • Carbon emissions  |                  |       |       |                  |       |       |
| <b>Impacts on Water Resources</b>   |                  |       |       |                  |       |       |
| • Contamination of surface water  |                  |       |       |                  |       |       |
| • Contamination of ground water   |                  |       |       |                  |       |       |
| • Damage to sewage systems  |                  |       |       |                  |       |       |
| • Hazardous material accidents and spills   |                  |       |       |                  |       |       |
| <b>Impacts of Soil</b>  |                  |       |       |                  |       |       |
| • Contamination of soil through deposition of contaminated leachate or solid wastes |                  |       |       |                  |       |       |
| • Soil erosion  |                  |       |       |                  |       |       |
| • Soil toxicity due to leachates from waste dumps                                   |                  |       |       |                  |       |       |

| Impacts on Human Environment  |   |   |  |   |   |
|---|---|---|--|---|---|
| • Creation of employment opportunities  |   | ✓ |  |   |   |
| • Introduction of secondary business  |   | ✓ |  |   |   |
| • Improvement of infrastructural services and facilities                        | ✓ |   |  |   |   |
| • Increase in wealth and hence improvement of social status                     |   | ✓ |  |   |   |
| • Change of facilities due to corrosion and degradation of cultural sites       |   |   |  |   |   |
| • Displacement of the local people  |   |   |  | ✓ |   |
| • Conflicts with existing land uses   |   |   |  |   |   |
| • Social/cultural disruption of the local population                            |   |   |  |   | ✓ |
| • Labour conflicts between existing labour Project and industrial               |   |   |  | ✓ | ✓ |
| • Impacts on public health and safety   |   |   |  |   |   |
| > Respiratory problems  |   |   |  | ✓ |   |
| > Skin and eye problems   |   |   |  | ✓ |   |
| > Chemical/industrial accidents   |   |   |  | ✓ |   |
| • Spread of sexually transmitted diseases(STDs) and other communicable diseases |   |   |  |   | ✓ |
| • Gender characteristics  |   |   |  |   | ✓ |
| • Conflicts in resource use   |   |   |  | ✓ |   |
| • Stress on existing social amenities   |   |   |  |   | ✓ |
| • Increase foreign exchange earnings  | ✓ |   |  | ✓ | ✓ |

Community representative

Name: Harold K. LESO

Position: Chair person

Signature: [Signature]

Phone: 0721664241

**Annex 8: Baraza Notification**



**Kenya Climate Smart Agriculture Project  
(KCSAP)**  
Office of the county Project coordinator, Baringo County

---

THROUGH

THE ASSISTANT CHIEF

**BARAZA BARAZA BARAZA**

This is to inform you that there will be a public baraza for **Sertonje borehole project on THURSDAY 5/12/2019 At kapkundul** primary school. The EIA experts and technical officers will be visiting the area on public participation before the project is allowed to proceed as required by EMCA 1999 and Environmental ACT 387.

All are INVITED to attend. Thanking you in advance

Yours faithfully

**John Kiprop**

**DATE: 18/12/2019**

County environment and social safeguard officer

For the coordinator

CC

**CPC BARINGO COUNTY**

**CHIEF**

**PROJECT CHAIRMAN**

**Annex 9: Minutes of Record of Public Participation**

**MINUTES OF THE ESIA PUBLIC PARTICIPATION ON THE PROPOSED SERTONJE BOREHOLE SUB-PROJECT HELD AT KAPKUNDUL PRIMARY SCHOOL on 5/12/2019**

**Attendance** *(see attached signed list of attendance in Annex 5)*

**AGENDA**

1. Opening prayers and introductions
2. A brief overview of the ESIA process and public participation
3. Public participation on the Proposed Sertonje Borehole Sub-project
4. Way forward

**Min1/12/2019 Preliminaries**

Meeting began with prayers from a community member. The sub-location chief thanked all and invited the ESIA team. The lead consultant introduced his team. Technical officers from the county government and the KCSAP team also made introductions.

**Min 2/12/2019 Brief overview of the ESIA process and public participation**

The consultant briefed the community members present on EIA and its importance to sub-project planning and implementation. He explained to the community why they needed to be open and confident when giving their views.

**Min3/12/2019 The public participation process**

The public was taken through the questionnaire by the consultant in whom they gave their understanding of the sub-project, anticipated positive and negative outcomes and the measures to reduce the negative impacts. The questionnaires were also distributed to the community in which they individually filled and those in attendance to the meeting approved by show of hands and in writing.

**Min4/12/2019 Way forward**

The community members had no objection to the sub-project's pointing that the negative impacts adequately could be mitigated and that the sub-project should be implemented.

The location chief gave his closing remarks and the meeting came to end with prayers.

**Minutes confirmed by.**

**Chairman.....date.....**

**Secretary..... date.....**

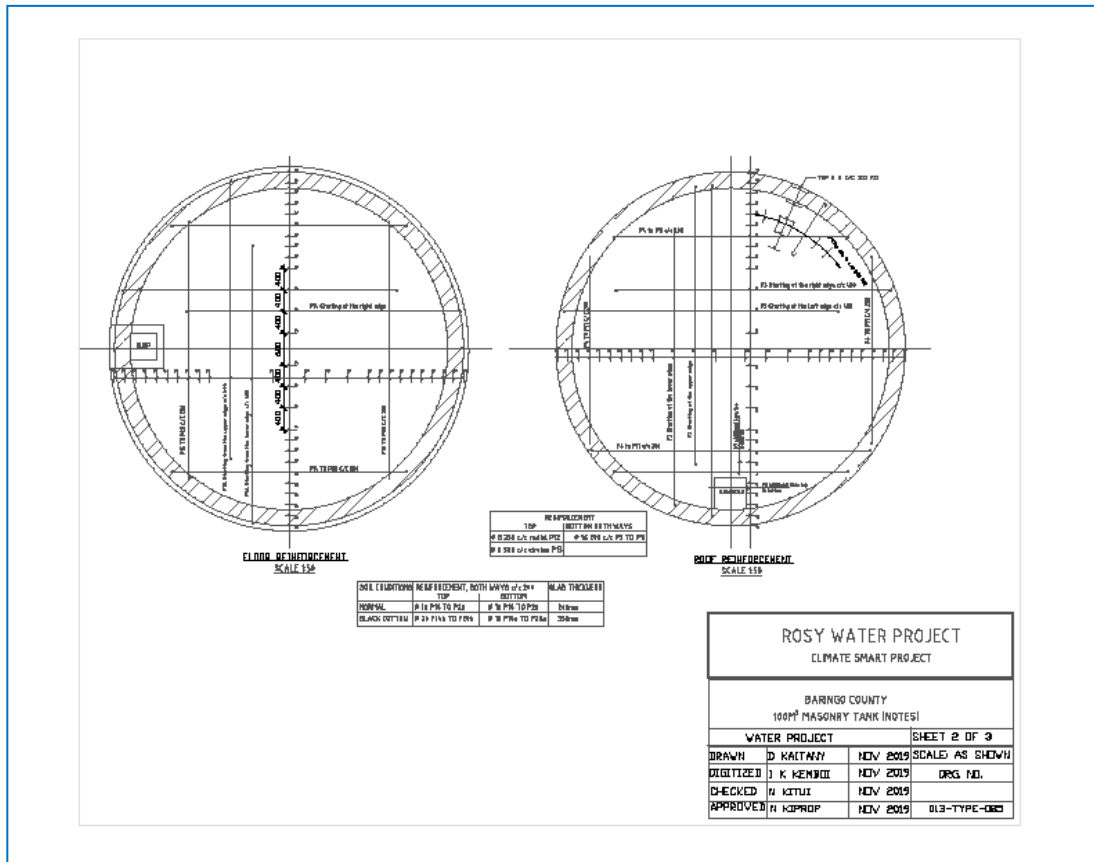
## Annex 10: Bill of Quantities for SERTONJE WATER SUB-PROJECT

### BILL NO.1 - PRELIMINARIES & GENERAL

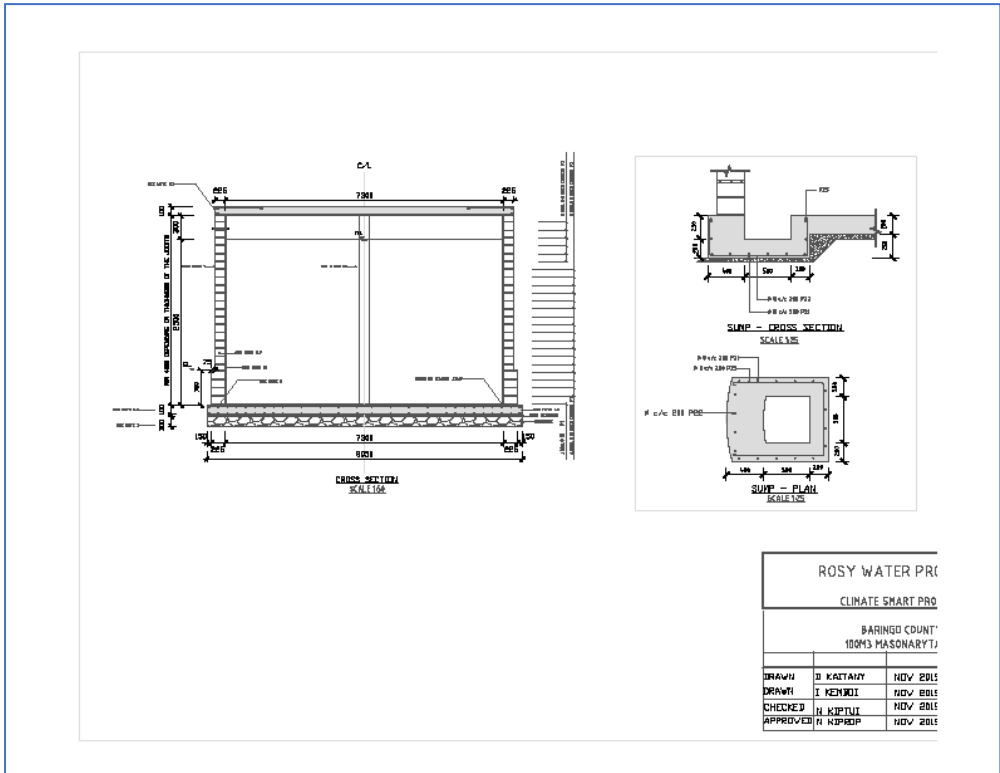
| ITEM       | DESCRIPTION   | UNIT | QUANTITY | RATE (KSh.) | AMOUNT (KSh.)     |
|------------|---|------|----------|-------------|-------------------|
| <b>1.1</b> | <b>Signboards</b>   |      |          |             |                   |
|            | Provision, erection and maintenance of sub-project signboards in accordance with the Specifications.  | No.  | 1        | 20,000.00   | 20,000.00         |
| <b>1.2</b> | <b>Supervision of works by Engineers</b>  |      |          |             | -                 |
| 1.2.1      | Provide Prime Cost for supervision to be expended as directed by Engineer to include air time, Progress reports, photographs and Publicity. | L/S  | 1        | 150,000.00  | 150,000.00        |
|            | Sub Total   |      |          |             | 170,000.00        |
| 1.2.2      | Add percent on Item 1.7.1 for overheads and profits   | %    | 15%      |             | 25,500.00         |
|            | Allow Provisional sum for contingencies to be expended by Engineer only when approved   | Item | 1.00     | 65,000.00   | 65,000.00         |
|            |   |      |          |             |                   |
|            | <b>TOTAL CARRIED OVER TO GRAND SUMMARY</b>  |      |          |             | <b>260,500.00</b> |

# Annex 11: Borehole Designs

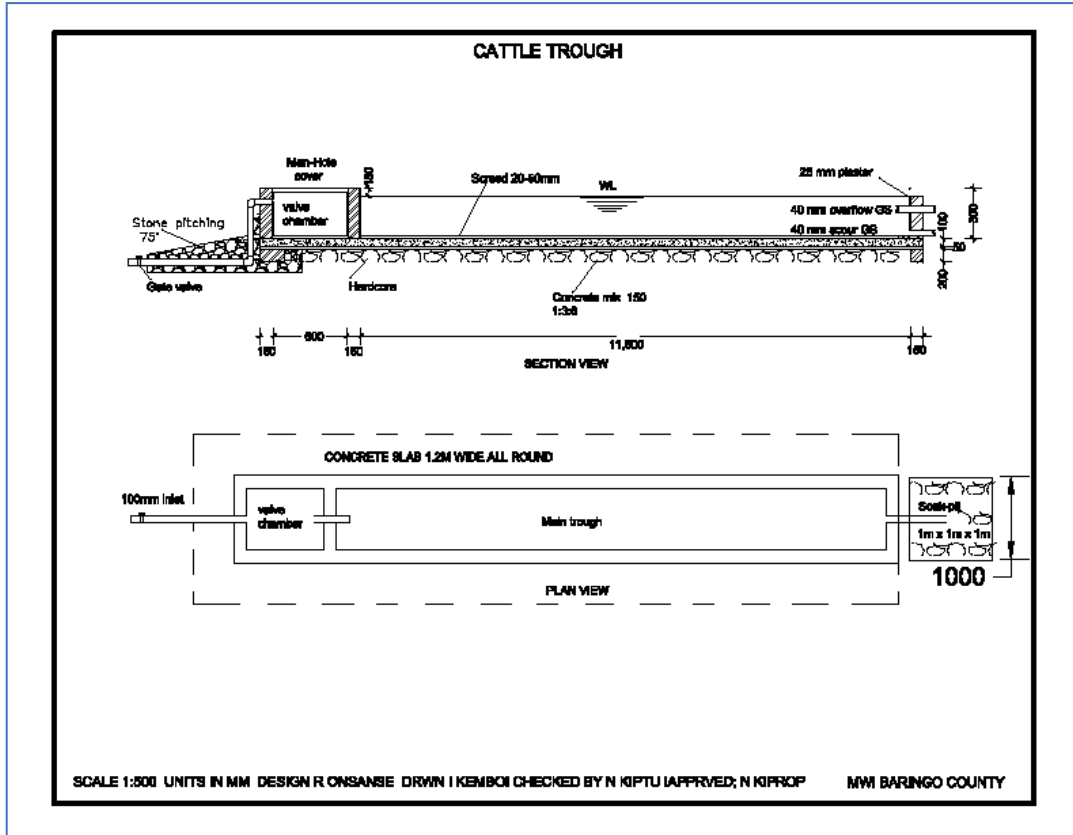
## 100M<sup>3</sup> MASONRY TANK



# 100M<sup>3</sup> MASONRY TANK



# CATTLE TROUGH





Annex 12: Community land agreement

BOM.  
KAPKUNDUL PRI. SCHOOL  
P. O. BOX 135  
05/3/2019

SERTONJE WAICR PROJECT  
P. O. BOX 135  
MOGOTIO

Dear Sir,

RE: ACCEPTANCE FOR DRILLING OF BOREHOLE SITE IN THE SCHOOL COMPOUND

On behave of the BOM, Kapkundul in a meeting agreed to accepted to give Serjonte water project to drill borehole in the school compound. The present members also agreed give portion of land and road to the site.

We are looking forward the good development in the community and the school community of Kapkundul.

Thank you.  
Yours faithfully  
BOM Secretary

05/10/2020  
HIT

KAPILUNDUC PRI. SCHOOL

P.O. Box 135

05/3/2020

The following are BOM. members present

1. JACOB KIPNLOK - BOM - secretary
2. HARON LISO - BOM - DH/Chairperson
3. ALFRED CERONO - BOM - Chairperson
4. SHAIN CHEPTO - PTA - Chairperson
5. LINA CHEPKUNGA - Member/Sponsor
6. PRIZILLAR KIPNLOKICH - Sponsor
7. JOSEPH CHAMITOT - C.K.B Rep.
8. IRINE KEITANY - Member
9. WESLEY LAKTANO - " "
10. MAGDALENE KIPTOO - " "
- 11.

WITH APLOGY

1. MILLICENT LEMISO

05/3/2020  
HIT

SERTONJE WATER PROJECT,

P.O BOX 135,

Mogotio.

12/5/2018

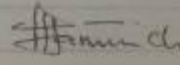
BARINGO COUNTY GOVERNMENT,  
THROUGH PUBLIC PARTICIPATION COMMITTEE,  
KISANANA WARD  
P.O BOX  
KABARNET

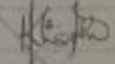
Dear Sir/Madam

RE: REQUEST FOR FUNDS FOR DRILLING BOREHOLE  
FOR SERTONJE WATER PROJECT

The Sertonje water project interim committee upon agreement with Simutwee locational development committee are making a kind request for funds for drilling a borehole for Sertonje water project as proposed through the public participation held at Kisanana on

We are looking forward for your consideration in funding this community project

Interim Chairperson Haron Ieso 

Interim Secretary Haron Kipturget 



5

MINUTES OF SERTONJE WATER PROJECT MEE  
HELD ON 12/05/2018 AT KAPKUNDUL PRIMARY  
SCHOOL AT 2:00PM

MEMBERS PRESENT

1. Haron Ieso - Chairperson
2. Irine Keitany - Treasurer
3. Haron Kipturmet - Secretary
4. Shain Cherutich - Vice chairperson
5. Vincent Kigen - Member
6. John Cheruget - "

MEMBERS ABSENT

1. Samson Kipkoti

AGENDA

1. Preliminaries
2. Confirmation of the previous Minutes
3. Request for funds from Baringo County government
4. Adjournment

MIN 1/5/2018: PRELIMINARIES

The Meeting was opened with a prayer from Irine Keitany. Member was welcome by chairperson to the Meeting.

MIN 2/5/2018: CONFIRMATION OF THE PREVIOUS MINUTES

The Minute of the previous Minute was confirmed by Vincent Kigen.

13/5/2018

MIN 3/5/2018: REQUEST FOR THE FUNDS FROM  
BARINGO COUNTY GOVERNMENT

The Committee wrote a letter to the county government of baringo to request for funding of the drilling of borehole for Sertonje water project. The letter to be presented to baringo county government through Kisanang Waid public participation by the chairperson of Sertonje water project.

MIN 4/5/2018: ADJOURNMENT

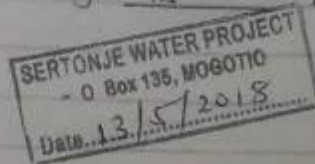
The next meeting will be communicated by the chairperson through the secretary after public participation. The meeting was adjourned at 4:00pm, with a prayer from Haron Kipturmet.

Minutes taken by  
Haron Kipturmet  
Secretary

Sign Kipturmet Date 06/06/2018

Confirmed by  
Haron leso  
Chairperson

Sign Annah Date 06/06/2018



MINUTE OF SERTONJE WATER  
PROJECT MEETING HELD ON 5<sup>TH</sup> DEC. 2019  
AT KAPKUNDOL PRIMARY SCHOOL AT 2:30 PM

MEMBERS PRESENT

- |            |                              |
|------------|------------------------------|
| 1. Harou   | Lesso - Chairperson          |
| 2. Shain   | cherutich - vice chairperson |
| 3. Harou   | Kipturmet - Vice-Secretary   |
| 4. Irine   | Kestany - Treasurer          |
| 5. John    | Cherniyat - Member           |
| 6. Vincent | Kigen - Member               |

WITH APOLOGY

1. Samson Kipkoti

WITHOUT APOLOGY

1. Magdaline Rotich

AGENDA

1. Preliminaries
2. Confirmation of previous minutes
3. Donation of land
4. Adjournment

MINI/2019: PRELIMINARIES

The meeting was opened by a prayer from Shain Cherutich

## MIN 2/2019: CONFIRMATION OF PREVIOUS MINUTE

The minutes of the previous meeting were read by the vice-secretary and confirmed by the chairperson as the true minutes of the previous meeting.


## MIN 3/2019: DONATION OF LAND

The members of the community of Sertonje water project sat down and discussed at length on who to donate the land for tank construction and water kiosk site, after the discussion some of the members of Sertonje water project were able to agree and donate a small piece of land to Sertonje water project to be used by the community as water kiosk site and tank construction. as follows,

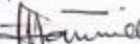
1. Francis Chepkonga - Tank construction - Sertonje
2. William Rono - Water kiosk - Metibelian
3. Kipkoti Chebet - Water kiosk - ~~Kipsonoyan~~ KIPSONOYAN
4. Bundotich Cheptoo - Water kiosk - Kabarbesi
5. Kiptulme Water Band - water kiosk - Kiptulme
6. Chebet Kipkamei - water trough - Kipsonoyan

## MIN 4/2019: ADJOURNMENT

As there was no any other issue to be put on the table for discussion the meeting was closed by a prayer from Irine Kertany

Haron Kipturmet  
Vice-Secretary  
Signature 



Haron Lesso  
Chairperson  
Signature 

05/12/2019.

| NAME                   | SIGN        |
|------------------------|-------------|
| 1. HARON KIPTURMET     | [Signature] |
| 2. VINCENT KIGEM       | [Signature] |
| 3. ALFRED CHEROKIT     | [Signature] |
| 4. JOHN CHEBET         | [Signature] |
| 5. KIRIANGUT SIRMA     | [Signature] |
| 6. CHEPTOO BUNDOTICH   | [Signature] |
| 7. JOSEPH. RUT O       | [Signature] |
| 8. CHEPONO CHERVICH    | [Signature] |
| 9. MUSA SIRMA          | [Signature] |
| 10. EVELYNE TOROTICH   | [Signature] |
| 11. SUTAIN CHEROTICH   | [Signature] |
| 12. JAROK KORIR        | [Signature] |
| 13. JACKON MEN FICH    | [Signature] |
| 14. RICHARD KIPN FOK   | [Signature] |
| 15. ANGELINE KHEPTOO   | [Signature] |
| 16. BRIAN KIPTURMET    | [Signature] |
| 17. WILLIAM CHEPKOIT   | [Signature] |
| 18. LINATH CHEPKON FIA | [Signature] |
| 19. IRINE KANROGO      | [Signature] |
| 20. CAROLINE TOROTICH  | [Signature] |
| 21. REGINA CHEBON      | [Signature] |
| 22. ARON LESSO         | [Signature] |
| 23. KIPKOTI CHEBET     | [Signature] |
| 24. ALFRED KONDENG     | [Signature] |
| 25. S. KIKSAD MANGICH  | [Signature] |

Confirm list of Members.  
 Daniel  
 SAMUEL KIPKABATI



## Annex 13: Assessment of Proposed Sertonje Borehole at Kapkundul Primary School

### 2. ASSESSMENT OF PROPOSED SERTONJE BOREHOLE AT KAPKUNDUL PRI. SCHOOL

INTRODUCTION: The proposed borehole site was visited on 7/1/2020 for assessment. It is located in Mugurin location, Kisanana ward in Baringo County. The GPS coordinates of the proposed Sertonje Borehole project are  $0^{\circ} 4'43''$  N,  $36^{\circ} 2'57''$  E, at Kapkundul Primary School which is on a public land/public utility. The nearest water reliable source is a water pan 5km away within Mugurin location. For this reason, the community with the help of the proponent has proposed for the drilling of the Sertonje borehole. Mugurin River is a seasonal river which passes 1 km to the west site and flows in a northward direction.

The borehole water will be used for domestic, livestock and minor irrigation in the area. The community of the area has elected the management committee for the sub project and they waiting for the drilling rig since the hydrogeological report had to be done. The water will be pumped to high ground for the water to be gravitated to supply area. Upon the completion of the sub project will enhance the live hood of the community in the area. Ease them the burden of travelling far distance to fetch water which is also time consuming



Figure 4 The chairman of sub project briefing the WRA staff on the progress of sub project



Figure 5 The peg site for drilling of the borehole at Kapkututai pri.school

### Conclusion

The management committee was advised to apply for permit before the drilling of the borehole, the necessary forms before the commencement of the drilling of the borehole.

## Annex 14: Payment of Water Application Permit Fees for, Sertonje Borehole Drilling Sub Project



### WATER RESOURCES AUTHORITY

Sub Regional Manager,  
Water Resources Authority,  
Kabarnet Sub - Region,  
P.O. BOX 544 - 30400,  
KABARNET

Tel: 053-21125  
Cell: 0726 764 107  
Email: kabarnetwrma@yashoo.com

RE: WRA/LBB/SRO/REV/VO 3 (98)

Date: 08/01/2020

County Project Coordinator

Kenya Climate smart Agr. Project

Baringo County

P.O Box 4 - 30400

KABARNET

**RE: PAYMENT OF WATER APPLICATION PERMIT FEES FOR ROSSY COMMUNITY WATER PROJECT, SERTONJE BOREHOLE AND KABARBESI WATER PAN.**

Please note that the water application authorization fee was paid by Kenya Climate Smart Agriculture project Baringo county on behalf of respective management committees.

Below is the breakdown per sub project.

| No | Name of Sub Project               | Amount          |
|----|-----------------------------------|-----------------|
| 1  | Rosy Water Project                | 17,000/=        |
| 2  | Kabarbesi Water Pan               | 5000/=          |
| 3  | Sertonje water project (Borehole) | 5000/=          |
|    | <b>TOTAL</b>                      | <b>27,000/=</b> |

  
Walter Tanui

Sub Regional Manager



Water Resources Management Authority

**COMMENTS BY WRUA ON  
APPLICATION FOR WATER PERMIT**

|   |                             |
|---|-----------------------------|
| NAME OF WRUA                                    |                             |
| PARTICULARS OF PERMIT APPLICANT                 |                             |
| 1. Full name of applicant(s) (In Block Letters) | SHAIN KIMOI CHEBUTCH        |
| 2. WRMA ID Number of Applicant                  | 26313531                    |
| 3. Box Number                                   | 135 MEGAFLO                 |
| 4. Town   | NAIROBI                     |
| 5. Telephone Contact (Landline)                 | 0700532205                  |
| 6. Telephone Contact (Mobile)                   | 0700532205                  |
| 7. Email Contact                                | SHAIN.KIMOICHEBUTCH@WRMA.KE |

**WATER RESOURCE DETAILS**

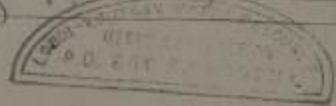
Name of Body of Water or Aquifer where water is to be diverted, abstracted or stored: BORRHOLE / SERTONJE WATER PROJECT

| Type of Water Use | Surface Water |             |                 |         | Groundwater  |                                     | Effluent Discharge | Swamp Drainage |
|-------------------|---------------|-------------|-----------------|---------|--------------|-------------------------------------|--------------------|----------------|
|                   | Diversion     | Abstraction | In-stream Works | Storage | Shallow well | Borchole                            |                    |                |
| Tick Box          |               |             |                 |         |              | <input checked="" type="checkbox"/> |                    |                |

| WRUA COMMENTS  | ANSWER / COMMENTS   |
|--|---|
| 1. Application was discussed by WRUA on (date)   | 24/01/20  |
| 2. Is proposed application for water use likely to severely impact dry season flows?   | <input checked="" type="checkbox"/> YES                                     |
| 3. Is proposed application for water use likely to severely impact water quality?  | <input checked="" type="checkbox"/> YES                                     |
| 4. Is proposed application for water use likely to put public at risk?   | NO  |
| 5. Is proposed application likely to increase the risk of water use conflicts?   | NO  |
| 6. Is proposed application for water use considered beneficial to the public?  | YES   |
| 7. Is there an alternative water source for the applicant that should be considered? (provide details)                               | NO  |
| 8. WRUA Conclusion (Objection, No objection, or Conditional No-Objection, or unable to make a conclusion due to lack of information) | No objection from the community is needed                                   |
| 9. Reasons for Objection or Conditions for No-Objection  | There is no any bore hole around the place, the community is ready if water |

**SIGNATURE BY TWO WRUA OFFICIALS**

|                            |                      |  |
|----------------------------|----------------------|--|
| Name of WRUA Official      | SHAIN KIMOI CHEBUTCH |  |
| Position                   | TREASURER            |  |
| Signature of WRUA Official | SEREMITH ICUBETASI   |  |
| Date of Signature          |                      |  |



## **HYDROGEOLOGICAL SURVEY REPORT**

**CLIENT: Sertonje Community Borehole,  
Kisanana Ward,  
Baringo County**

**SUB-PROJECT: PUBLIC LAND**

**LOCALITY: 37N, 171392, 008981 (GPS UTM37N)  
MOGOTIO**

*Compiled by;*

ENOCH K. KIPSEBA,  
JUDITH J. KOTUT  
MGSK, R. Geologists,  
P.O. BOX 30009-00100

*Reviewed and edited by;*

DIXON KIPTANUI  
Registered Hydrogeologist:  
WD/WRP/269  
P. O. BOX 16097 – 00610,  
NAIROBI

May 2019

## SUMMARY

The present report describes the results of borehole site investigations for Sertonje area, in Kisanana Ward of Mogotio Sub-County. The borehole water is intended to be used for domestic and livestock purposes. The water demand is estimated to be 20 m<sup>3</sup>/day.

The area is situated in a zone with moderate groundwater potential. The study concludes that on the basis of geological evidence, groundwater prospects for intended purposes are tenable. The site is underlain by volcanic rocks. In this area the volcanic rocks comprise mainly the trachyte and volcanic lapilli, tuffs, blocks and bombs.

The hydrogeological conditions are considered to be determined by geological structures, namely faults that run North – South. The faulted and folded troughs form good aquifers. The proposed borehole should be drilled to a depth of **not less than 200m, to a maximum of 220 m bgl**. A sustainable yield of approximately 4m<sup>3</sup>/hr. is expected.

The water quality of the proposed borehole is expected to be chemically and bacteriologically satisfactory except for fluoride content that is exceptionally high in this area. The water could also be relatively warm due to geothermal activities within the vicinity of this area.

Recommendations are given for borehole construction and completion methods. The importance of correct and comprehensive techniques in this particular aspect seldom receives the attention it deserves.

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## ABBREVIATIONS AND GLOSSARY OF TERMS

ABBREVIATIONS: (NOTE: SI spellings used throughout).

|        |   |
|--------|---|
| km     | kilometers  |
| m      | metres  |
| m bgl  | metres below ground level   |
| m amsl | metres above mean sea level   |
| swl    | static water level (in m bgl) (the piezometric level or water table, see below) |
| wsl    | water struck level (in m bgl)   |
| wrl    | water rest level  |

GLOSSARY OF TERMS: (> refers to another entry in this Glossary)

|                          |  |
|--------------------------|--|
| Aquifer                  | A geological formation or structure which transmits water, and which may supply water to wells, boreholes or springs.  |
| Confined                 | aquifers are those in which the piezometric level is higher (i.e., at a greater elevation relative to sea level) than the elevation at which the aquifer was encountered.  |
| Intercalated             | Interbedded - a lava flow may occur between layers of sediment, or vice-versa.   |
| Old Land Surface erosion | Old Land Surfaces (OLS's) is the term given to ancient surfaces now covered by younger surface material. In hydrogeology, OLS's frequently make good aquifers, especially where the erosion debris left behind is coarse in nature.                                    |
| Phenocrysts these are    | The larger crystals in > porphyritic rocks. In phonolites, usually crystals of the minerals orthoclase and nepheline.  |
| Porphyritic a finer      | A rock containing large crystals (> phenocrysts) in groundmass. Recharge   |
|                          | The general term indicating the process of transport of water from surface sources (i.e., from rivers or rainfall) to the groundwater. Unconformable, The representation in physical geology (i.e., in the rock record) of a break in the ordered succession of rocks. |

## 1 INTRODUCTION

In the Financial year 2019/2020, Baringo County Government, herein the client, engaged the services of hydrogeologists to carry out a hydrogeological and geophysical survey aimed at selecting a suitable borehole drilling site at Sertonje area in Kisanana Ward, Mogotio Sub- County. The address of the Client is:

**Baringo County Government**  
**P.O. Box 53 – 30400**  
**Kabarnet.**

The Client intends to drill a borehole within the area for domestic and livestock purposes. The daily water demand is estimated to be 20m<sup>3</sup>/day. The scope of the present study was to select the most suitable site for groundwater development, taking into account the prospects for sustainable abstraction, water quality and economic viability. For this purpose, the relevant geological and hydrogeological information of the area has been analysed and evaluated.

## 2 BACKGROUND INFORMATION

### 2.1 Location

The site is situated within Sertonje area. It is 2.8km to the south-east of Mugurin market, 6km west of Ng'endalel market, and 8.7km to the north-west of Kisanana market. It lies within the 1:50,000 Survey of Kenya topographic Sheet for Solai (No. 105/3), approximately at GPS position UTM 37N 171392, 008981.



Figure 1. Location of the proposed borehole plotted on Eming and Solai topo maps.

### 2.2 Physiography

The area lies at an altitude of about 1550m. It is situated at a relatively flat area generally sloping to the west. An escarpment lies to the east of the area, running in a N-S direction. Mugurir river passes 1 km to the west of the site and flows in a northward direction.

### **2.3 Soils**

The soils are developed on sediments mainly from volcanic flows. The soils formed are a complex of;

- well drained, moderately deep to dark brown, friable and slightly smeary, fine gravely, sandy clay loam to sandy clay, with a humic top soil.
- Imperfectly drained, moderately deep to strong brown, mottled, firm and brittle, sandy clay to clay.

### **2.4 Climate**

The climate of this area is of the humid, cool temperate, tropical lower highland type. The average annual rainfall figure for the area is approximately 1200 mm. The rainfall pattern exhibits a bi-modal distribution, with wet seasons in March-May and October-December (corresponding to the "long" and "short" rains, respectively). Between 70 and 85% of precipitation falls during these rainy seasons.

Average annual temperatures range from 18 to 20 °C, with average minima and maxima of 12-14 and 24-26 °C, respectively. The warmest period occurs from January to March. Average potential evaporation is between 1,550 and 2,200 mm per year.

### **2.5 Water Demand**

Over the years rainfall pattern and intensity has changed. Therefore, reliable and sufficient water supply has become a problem. Residents over the years have developed alternative sources, in most cases by drilling boreholes to complement the existing dams and springs for both domestic and small-scale irrigation.

## **3 GEOLOGY**

### **3.1 Regional Geology**

The geology of the area comprises, mainly, Tertiary and Quaternary Volcanic Rocks and Associated Volcanic Sediments formed at different phases of eruptions. The rocks have been classified as follows, (McCall, 1967):-

#### **1) The older volcanic rocks (Miocene)**

These include Uasin Gishu phonolites, Tinderet volcanics, Samburu Basalts, Simbara Basalts, Rumuruti Phonolites, Thomson's Falls Phonolites, Phonolites to the north of Olkari, Satima lavas, Laikipia Basalts, Rumuruti Forest Basalts, and Ol Donyo Oliop Basalts. The oldest volcanic rocks exposed in the area are basalts. The lavas of the Samburu group are predominantly basaltic but ultrabasic variants are not uncommon. They are believed to be well over a thousand feet thick; though like all the volcanic formations of the rift valley they thicken and thin out rapidly. Agglomerates are absent as far as is known, Tuffs light in colour, well stratified and pumiceous, and occasionally with diatomite, are found at the top of the series and intercalated in the lavas. The basaltic rocks of this group underlie the Rumuruti Phonolites in the escarpment at Moera, Lelumwa, Kaon, and the Ngosur River.

#### **2) The Pliocene volcanic Rocks**

These comprise Mau Tuffs, Kwaibus and Goitumet Basalts, Dispei-Lake Hannington Phonolites, Lower Menengai Volcanics, Sirrkon Volcanics, and Bahati and Kinangop Tuffs and associated lavas. The geological formations in this group include;

(i) Central volcanoes

(ii) Lava flows extruded from fissure sources.

(iii) Thick and widespread tuff formations, including sub-aqueous tuffs deposited in the lakes.

(iv) Welded Tuffs and “ignimbrites” (widespread deposits, typically represented by the “claystones”).

### 3) The Lower/Lower Middle Pleistocene Succession

These comprise Willan’s Farn Porphyritic Trachyte, Nakuru Lake Syndicate Quarry Phonolite, Mbaruk Basalt, Gilgil Trachyte, Ronda Phonolites and Phonolitic Trachytes, and Lacustrine Sediments.

### 4) Late Pleistocene and Recent Volcanic Rocks

These comprise Elementeita Tuffs Cones, Elementaita Basalts, and Quaternary Eruptions of Menengai.

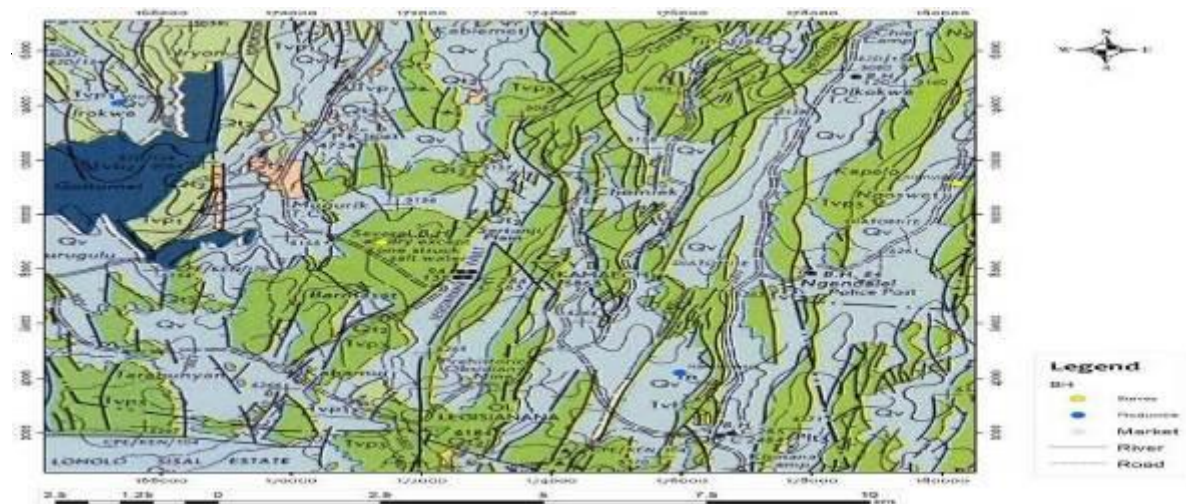
### 5) Quaternary Sediments and Shore-lines (and associated tuffs)

These comprise Nakuru, Elementaita Basin, Larmudiac Beds, and Solai Basin.

## 3.2 Geology of the Sertonje Area

This area is associated with three successions of volcanic activities that occurred between Pliocene to Recent. The oldest rocks that lie at an approximated depth of 250m below ground level are the Miocene lavas comprising of the Elgeyo Porphyritic olivine basalts (Tvb ) and the Lower Uasin-Gishu phonolites (Tvp ). These were followed by Pliocene lava flows which comprise of the Kwaibus olivine basalts (Tvb<sub>3</sub>) and the non-porphyritic Lake Hannington phonolites (Tvp<sub>4</sub>).

On the top are the superficial deposits (Qv) and alluvium close to Molo River.



## 3.3 Recent deposits

Superficial deposits in the area comprise reddish brown soils. These form a moderately thick cover and are geologically mapped sediments at the study site.

## 3.4 Structures

The area is cut by numerous fault lines aligned in a N-S direction. The nearest to the site lies 700m to the west. On the eastern side, the nearest is Kisanana faultline, 1600m away.

# 4 HYDROGEOLOGY

## 4.1 Introduction

The hydrogeology of an area is determined by the nature of the parent rock, structural features, weathering processes and precipitation patterns. This area is underlain exclusively by

volcanic formations, covered by a thin layer of soils and local alluvial deposits. Unaltered volcanic rocks, such as trachyte (common around the study area), or migmatites, are generally hard and compact, and possess no primary porosity. Whereas sedimentary deposits of pure, unconsolidated sands are highly transmissive, the permeability rapidly decreases in the presence of clays, even if their portion is very small. Heavy clays, which may be marked by porosity as high as 50%, are generally impermeable.

#### **4.2 Regional Hydrogeology**

The regional groundwater system in the area is recharged by infiltration of rainwater through the permeable volcanic and sedimentary sequences. Percolation into the deep lying aquifers is facilitated by open faults and fissure zones acting as groundwater conduits. However, the general observation is that most aquifers in the region are recharged from a distance. Their productivity is also determined by the availability of surface water.

#### **4.4 Recharge**

The recharge mechanisms (and the rate of replenishment) of the aquifers in this area is rainfall. The two major processes are probably direct recharge at surface (not necessarily local) and indirect recharge via faults and/or other aquifers. Rainfall on the shoulders of the Rift Valley is high (1,200mm -1500mm).

#### **4.5 Discharge**

Discharge from aquifers is either through natural processes as base flow to streams and springs or artificial discharge through human activities. A number of boreholes have been drilled in this area though not within the vicinity of the study area; their abstraction significantly contributes to the discharge process. The total effective discharge from the aquifers via either of the above means is not known.

#### **4.6 Water Quality**

Practically all types of water, i.e. runoff water, groundwater and even rainwater, contain some dissolved salts and impurities. If certain elements are present in high concentrations, the application of the water for domestic use or any other purpose may be limited. The quality of water within this area is expected to be satisfactory except for the exceptionally high level of fluoride. W.H.O. and E.C. guideline concentrations are included for reference in appendix I.

#### **4.7 Existing boreholes**

Two productive boreholes exist around this place but not within the vicinity of the selected site. Magoi Borehole is 6.5km to the NW while Nambawan borehole is 6.6km to the SE.

### **5 GEOPHYSICAL FIELDWORK, RESULTS AND EVALUATION.**

#### **5.1 Field work**

A visit to the site was made on Thursday 12<sup>th</sup> April 2019. One Vertical Electrical Sounding (VES) was carried. A Garmin Global Positioning device was used to obtain accurate coordinate of the VES location. The geophysical investigations were mainly aimed at the determination of the following parameters

- Thickness of tertiary deposits
- Vertical extent of the water body
- Depth of weathered zones.

#### **5.2 Geophysical Sounding.**

Vertical electric sounding (VES) was done at site using SCINTREX terameter to locate the aquifers. The measurement were executed in an expanding Schlumberger array with electrode spreads  $AB/2 = 250$  m.

### Field Data

| AB/2   | MN/2  | Resistivity( $\rho$ ) |
|--------|-------|-----------------------|
| 1.60   | 0.50  | 90.16                 |
| 2.00   | 0.50  | 82.64                 |
| 2.50   | 0.50  | 71.22                 |
| 3.20   | 0.50  | 58.69                 |
| 4.00   | 0.50  | 50.43                 |
| 5.00   | 0.50  | 45.27                 |
| 6.30   | 0.50  | 41.46                 |
| 8.00   | 0.50  | 39.42                 |
| 10.00  | 0.50  | 39.35                 |
| 13.00  | 0.50  | 40.35                 |
| 16.00  | 0.50  | 45.72                 |
| 20.00  | 0.50  | 57.88                 |
| 25.00  | 0.50  | 61.01                 |
| 32.00  | 0.50  | 77.69                 |
| 32.00  | 10.00 | 69.06                 |
| 40.00  | 10.00 | 77.10                 |
| 50.00  | 10.00 | 85.66                 |
| 63.00  | 10.00 | 83.61                 |
| 80.00  | 10.00 | 91.27                 |
| 100.00 | 10.00 | 113.90                |
| 130.00 | 10.00 | 82.69                 |
| 145.00 | 10.00 | 93.82                 |
| 160.00 | 10.00 | 86.51                 |
| 180.00 | 10.00 | 76.34                 |
| 200.00 | 10.00 | 65.20                 |
| 225.00 | 10.00 | 98.62                 |
| 250.00 | 10.00 | 97.11                 |

### 5.3 Interpretation and analysis.

#### VES graph

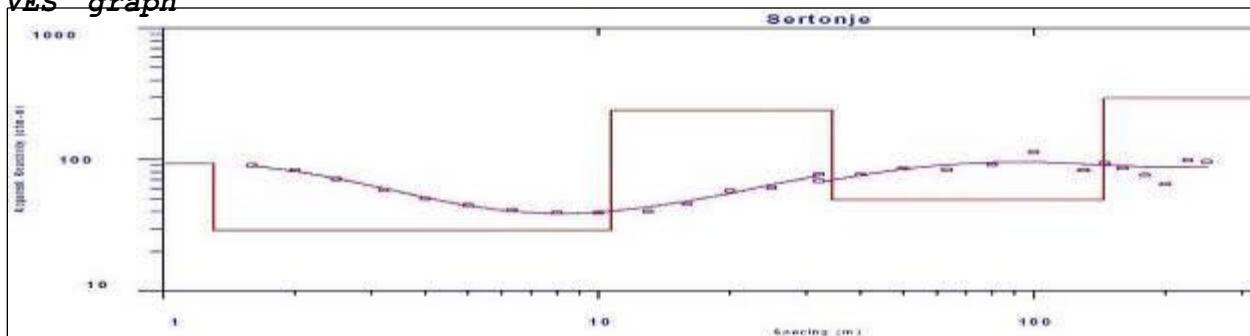


Table 1 hydrogeological interpretation of VES

| Depth (m) | Resistivity (Ohm.) | Interpretation  | Remarks                  |
|-----------|--------------------|---|--------------------------|
| 0 – 1.3   | 92.6               | Loosely compacted and dry poorly sorted reddish-brown top soil. | Moist due to run-off     |
| 1.3– 10.6 | 29.0               | Loosely compacted and wet poorly sorted reddish-brown top soil. | Moist                    |
| 10.6 – 34 | 235.8              | Phonolites  | Dry                      |
| 34 – 144  | 49.6               | Fractured phonolite with tuffs                                  | Moist with wet fractures |
| 144 –     | 292.0              | Phonolite with some fractures                                   | Dry, wet from 170m       |

## 6 CONCLUSIONS AND RECOMMENDATIONS

Sertonje area is situated in a zone with medium groundwater potential.

The investigated plot is underlain by volcanics. A number of aquifers are commonly encountered within these volcanics, although their productivity and prospects for sustained abstraction differ significantly. The hydrogeological conditions are considered to be approximately the same all over the plot. At the recommended site, the proposed borehole should be drilled at a diameter of not less than 8", to a minimum depth of **200 m**, and a maximum of **220 m** bgl. A sustainable yield of approximately 4m<sup>3</sup>/hr. is expected.

It is recommended to use mild steel casings and machine slotted screens during borehole installation, in order to prevent the hole from collapsing and avoid sediment ingress. This will increase the lifespan of the borehole and reduce pump damages and maintenance costs. The water quality of the proposed borehole is expected to be chemically and bacteriologically satisfactory except for the fluoride levels and slight warmth.

### Additional Recommendations and Legal Requirements

- The borehole hydraulically properties and aquifer characteristics should be determined during a step-drawdown test, followed by a 24-hour constant discharge test. After stopping the pump, recovery of the water level should be measured for 12 hours, or, alternatively, return to the static level. Using test pumping results, the sustainable yield can be calculated. The maximum discharge is restricted to 60% of the rate applied during the constant discharge test.
- Samples taken during test pumping must be submitted to a recognized laboratory for chemical analysis.
- A dipper line tube should be installed in the boreholes to make a provision for water level monitoring.
- It is strongly recommended to engage the services of an experienced hydro geologist during drilling, installation, and testing of the borehole. Apart from inspecting the quality of materials and ensuring that the drilling depth and quantities of billed materials reported by the Contractor are correct, the main task of the supervisor is to guarantee that the borehole is completed according to sound professional standards.

7

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## APPENDIX 1

### APPENDIX II - Acceptable Ionic Concentration - Various Authorities

|   |                     | World Health Organization:<br>1983     |  | European Community:<br>EC Directive 1980 relating to the quality<br>of water intended for human consumption: |  |            |
|---|---------------------|--|--|--|--|------------|
|   |                     | Guidelines;<br>Guideline<br>Value (GV) | Standards;<br>Upper limit<br>(HL), (tentative) | Guide Level<br>(GL)  | Max. Admissible<br>Concentration (MAC) |            |
| <b>Inorganic Constituents of health significance;</b> |                     |  |  |  |  |            |
| Antimony  | Sb                  |  |  |  |  |            |
| Arsenic   | As                  | 0.05                                   | 0.05   |  | 0.01                                   |            |
| Cadmium   | Cd                  | 0.005                                  | 0.01   |  | 0.05                                   |            |
| Chromium  | Cr                  | 0.05                                   | 0.05   |  | 0.005                                  |            |
| Cyanide   | CN                  | 0.10                                   | 0.05   |  |  |            |
| Fluoride  | F                   | 1.5                                    | 1.7  |  |  |            |
| Lead  | Pb                  | 0.05                                   | 0.10   |  | 0.05                                   |            |
| Mercury   | Hg                  | 0.001                                  | 0.001  |  | 1.5                                    |            |
| Nickel  | Ni                  |  |  |  | 0.05                                   |            |
| Nitrates  |                     | 10 (as N)                              | 45 ( as NO <sub>3</sub> )                      |  | 0.001                                  |            |
| Selenium  | Se                  |  | 0.01   | 25 (as NO <sub>3</sub> )   | 0.05                                   |            |
|   |                     |  |  |  | 50 (as NO <sub>3</sub> )               |            |
|   |                     |  |  |  | 0.01                                   |            |
| <b>Other Substances</b>                               |                     |  |  |  |  |            |
|   |                     | GV:<br>Desirable<br>Level:             | Highest<br>Permissible<br>Level:               | Maximum  | GV:                                    | MAC:       |
| Aluminium   | Al                  | 0.20                                   |  |  |  |            |
| Ammonium  | NH <sub>4</sub>     |  |  |  |  |            |
| Barium  | Ba                  |  |  |  |  |            |
| Boron   | B                   |  |  |  | 0.05                                   | 0.20       |
| Calcium   | Ca                  |  |  |  | 0.05                                   | 0.50       |
| Chloride  | Cl                  | 250                                    |  |  | 0.10                                   |            |
| Copper  | Cu                  |  |  |  | 1.0                                    |            |
| Hydrogen  |                     |  |  | 50   | 100                                    |            |
| Sulphide  | H <sub>2</sub> S    | ND                                     | 75   | 600  | 25                                     |            |
| Iron  | Fe                  | 0.30                                   | 200  |  | 0.10                                   |            |
| Magnesium   | Mg                  | 0.10                                   | 0.05   |  |  |            |
| Manganese   | Mn                  | 0.10                                   |  |  |  |            |
| Nitrite   | NO <sub>2</sub>     |  |  |  |  | ND         |
| Potassium   | K                   |  |  | 1.0  | 0.05                                   | 0.20       |
| Silver  | Ag                  |  | 0.10   | 150  | 30                                     | 50         |
| Sodium  | Na                  | 200                                    | 30   | 0.50   | 0.02                                   | 0.05       |
| Sulphate  | SO <sub>4</sub>     | 400                                    | 0.05   |  |  | 0.10       |
| Zinc  | Zn                  |  |  |  | 10                                     | 12         |
| Total Dissolved Solids                                |                     | 1000                                   |  |  |  | 0.01       |
| Total Hardness as CaCO <sub>3</sub>                   |                     | 500                                    |  |  | 20                                     | 175        |
| Colour  | °Hazen              | 15                                     |  | 400  | 25                                     | 250        |
| Odour   |                     | Inoffensive                            |  | 15   | 0.10                                   |            |
| Taste   |                     | Inoffensive                            |  | 1500   |  | 1500       |
| Turbidity   | (JTU)               | 5                                      |  | 500  |  |            |
| pH  |                     | 6.5 - 8.5                              |  | 50   | 1                                      | 20         |
| Temperature   | °C                  |  |  |  |  | 2 or 3 TON |
| EC  | uS/cm               |  |  |  |  | 2 or 3 TON |
| Notes   | ND - Not Detectable |  | IO - Inoffensive                               |  |  |            |
|   | GL - Guide Level    |  | UO - Unobjectionable                           |  |  |            |

(Based on Table 6.1, in Twort, Law & Crowley, 1985 - Water Supply, Edward Arnold, London).

## **APPENDIX III - Drilling**

### **Drilling technique**

Drilling should be carried out at a diameter of not less than 8", using a rotary type machine. The drilling rig should be able to drill to a depth of at least 350 m, at the specified diameter. The rig and the drilling method adopted must be suitable for drilling through both unconsolidated material, and hard, compact volcanic rocks.

Drilling additives to be used (e.g. foam or polymer) must be non-toxic and biodegradable. In no circumstances will bentonitic additives be considered acceptable, as they may plug the aquifer zones and are extremely difficult to remove during development.

Geological rock samples should be collected at 2 metres intervals. Water struck and rest levels should be carefully recorded, as well as water quality and estimates of the yield of individual aquifers encountered.

Great care should be taken that the water quality of the different aquifers is accurately determined. Upon the first strike, drilling fluids should be effectively flushed, and after sufficient time, a water sample should be taken of the air-blown (rotary) yield. On-site analysis using an EC meter, and preferably a portable laboratory, is recommended.

### **Well Design**

The design of the well should ensure that screens are placed against the optimum aquifer zones. The final design should be made by an experienced hydrogeologist.

### **Casing and Screens**

The well should be cased and screened, in order to avoid collapsing and sediment intake. Considering the great depth of the borehole, it is recommended to use mild steel casings and gas slotted screens (which are cheaper than machine slotted screens) of 6" diameter. However, the screens should be well done, with uniform slot size.

### **Gravel Pack**

The use of a gravel pack is recommended within the aquifer zone because the aquifer could contain sands or silts which are finer than the screen slot size. A 8" diameter borehole screened at 6" will leave an annular space of approximately 1", which is sufficient to allow the insertion of fine, quartzitic gravel. The grain size of the gravel pack should be within the range of 2 to 5 mm, and granules should be rounded to well-rounded. Over 95% should be siliceous. Gravel pack should be washed down with copious volumes of water to avoid bridging. The best method, which is unfortunately rarely used, involves the insertion with a tremie pipe.

### **Well Construction**

In installing screen and casing, centralizers at 6 metres intervals should be used to ensure centrality within the borehole. This is particularly important to insert the artificial gravel pack all around the screen. If installed, gravel packed sections should be sealed off at the top and bottom with clay or bentonite seals (2 -3 m).

The remaining annular space should be backfilled with inert material (drill cuttings may be used), and the top three metres grouted with cement to ensure that no surface water at the well head can enter the well bore and thus prevent contamination.

### **Well Development**

Once screen, gravel pack, seals and backfill have been installed, the well should be developed. Development is the term used to describe the procedures designed to maximize well yield. Although an expensive element in the completion of a well, the additional costs are usually justified by longer well-life, greater efficiencies, lower operational and maintenance costs and a more constant yield.

Development has two broad objectives, which can be divided into *borehole* and *aquifer* stimulation:

- To repair the damage done to the aquifer material during drilling and restore the natural hydraulic properties. In both cable tool (i.e. percussion) and air hammer drilling, the bit action chips and crushes the rock, and mixes it with water and other fine material into a thick mud slurry. The pounding of the bit forces this slurry into the openings in the wall of the borehole, thus blocking the pores and impeding the flow of water from the aquifer. A thick "wallcake" may form, especially when clay additives (such as bentonite) are used during drilling or where natural clays occur in the penetrated formations. This cake, if not removed, may virtually plug the borehole, and significantly reduce the discharge. It should be noted that the maximum yield of a formation can only be realized if all the fractures and crevices are unblocked and able to supply water to the well. Borehole development techniques are applied to break down and remove the impermeable layer of clayey material from the borehole wall. Swabbing, wall-scratching, airlift rawhiding and polyphosphate dosing are all borehole development techniques.

- To alter the characteristics of the aquifer volume in the vicinity of the borehole, by improving hydraulic contact between the aquifer and the hole. This is essentially aquifer development and is also known as aquifer stimulation. Polyphosphate dosing, hydrofracturing and acidizing are examples of aquifer stimulation techniques.

The development methods to be applied depend on the available equipment, and differ significantly between percussion and rotary drilling (the latter being superior when it comes to efficiency): Development with a percussion rig: if a cable tool rig has been deployed the available development techniques are relatively simple, but less effective than the methods used in modern rotary drilling. The following measures are recommended:

- Backwashing and bailing: using a surge block with rubber flaps slightly smaller than the internal diameter of the hole, start near the top of the water bearing zones and surge downwards (surging upwards may lead to the surge block sand-locking, which can jeopardize the hole). Bail the borehole clean periodically. Repeat this cycle until no more material is brought up, bailed water is clear and electrical conductivity is stable.

- Polyphosphate dosing: percussion equipment does not include mud pumps and drill pipe, so jetting is impossible. Polyphosphate dosing comprises no more than

simply pouring water with dissolved sodium hexametaphosphate and calcium hypochlorite into a pipe, the base of which is located near the bottom of the hole. The polyphosphate is allowed to act for 12 hours or overnight.

- Repeat the backwashing and bailing cycle until the water is clear and electrical conductivity stable. If a rotary rig equipped with a strong air compressor is available, more effective development techniques can be applied:

- Airlift rawhiding, into and through the aquifer zones. This should continue until the water lifted is clean and clear, with electrical conductivity stable. Rawhiding comprises cyclic airlifting: once the airlift has been established, air supply is cut off and water allowed to cascade down the hole. This creates overpressures across the borehole wall, which agitates the formation and enhances cleaning. The airlift is then started again and the cycle repeated.

- Water jetting with an on-wall velocity of 30 m/s: at least 0.3 m<sup>3</sup> of fluid should be jetted per linear metre of screen. The water used for jetting must be absolutely clean, and it is dissolved as in the polyphosphate dosing described under Section 4.2. The jetting tool should be so constructed that the jet openings are not more than 1" (25 mm) from the borehole wall. Jetting should start from the top of the water bearing formation rotating downwards. After the entire saturated zone has been jetted, the hole should be left for at least 12 hours or overnight, to allow the hexametaphosphate to work on the "wallcake" and any clayey material in the aquifer material.

- Airlift rawhiding again, from the bottom of the hole, until airlifted water is absolutely clean and electrical conductivity stable. During development, an estimate of the bailed or air-blown yield should be made. This usually gives a fair indication of the final range of abstraction that can be expected from the borehole. The use of over pumping as a means of development is not advocated, since it only increases permeability in zones which are already permeable.

### **Well Testing**

After development and preliminary tests, a step-drawdown test and a 24-hour long-duration well test at constant discharge rate should be carried out. Well tests have to be performed on all newly-completed wells: apart from providing information on the quality of drilling, design and development, it also enables the hydrogeologist to compute sustainable abstraction rates, design drawdown, and other important well and aquifer parameters. During the test, the well is pumped from a measured static water level (SWL) at a known yield. Simultaneously, the discharge rate and the pumped water level (PWL) as a function of time are recorded. After stopping the pump, recovery is measured until the water level has returned within 5% of the original level, in comparison with the total pumped drawdown. The specific capacity and the efficiency of a borehole are determined during a step-drawdown test. Simultaneously, target yields for the constant discharge test can be set. The step-drawdown test usually comprises 4 to 6 steps of 60 to 90 minutes each. The pumping rates are increased step-by-step, e.g. by gradually opening a gate valve. Recovery may be measured after the last step, but this is not really necessary if a constant discharge test is conducted as well. However, before starting the constant discharge test, 95% of the pumped drawdown must be recovered, or, alternatively, no increase in level must be observed for a period of more than 4 hours. The constant discharge test allows calculation of specific aquifer

parameters, such as transmissivity, hydraulic conductivity and storage coefficient. In addition, the sustainable volume of abstraction, the design drawdown and the final pump specification and setting can be determined. The minimum duration of the test should be 24 hours, followed by 12 hours of recovery observations, or alternatively until 95% of the total drawdown has been regained.

### **Legal Requirements**

It is a legislated condition imposed by the Water Resources Management Authority (through the Water Amendment Bill 1992), that all boreholes in Kenya be equipped with a flow meter and a means by which water levels can be measured. These measures have been designed to allow the collection of data which will enable both the authorities and the borehole operators to learn more about the reliability and limitations of their groundwater resources.

Flow meters are readily available in Kenya, e.g. of the helical-flow type such as manufactured by Kent (UK) or Arad (Israel). The easiest method of water level monitoring is through a narrow (1.25" to 2") dipper line which is installed along the rising main.

### **Pumping Plant**

Several options are open to the Client:

- a) Submersible pumps: Currently, these are arguably the most popular borehole pumps in Kenya. Electrical submersibles are efficient and require little maintenance, though of course they do require electrical power on site, e.g. from a generator set or the power mains.
- b) Electrical solar submersible pumps: These are as yet relatively little used in Kenya, mainly because the plant is comparatively expensive. Generally, solar pumps are not routinely stocked by the main pump suppliers.
- c) Turbine or Mono pumps: Given the yield requirements of the Client, both turbine and Mono-type pumps would be needlessly expensive.
- d) Reciprocating pumps: Formerly the most popular type of pump used in Kenya. With the introduction of electrical submersibles and modern wind pumps, reciprocating pumps (e.g. manufactured by Deming, Southern Cross, etc.) have gradually fallen out of favour. However, when it comes to simplicity and robustness, coupled with a wide range of power plant (almost any suitable diesel driving belt), there is little to beat a reciprocating pump.

To avoid sediment ingress and ensure a long lifespan of both the borehole and the pumping unit, the permanent pump should be installed at least 2 m above, and certainly not within, the screen section.

## Annex 16: Chance Find Procedure

### 1. Purpose of the chance find procedure

The chance find procedure is a project-specific procedure that outlines actions required if previously unknown heritage resources, particularly archaeological resources, are encountered during project construction or operation. A Chance Find Procedure, is a process that prevents chance finds from being disturbed until an assessment by a competent specialist is made and actions consistent with the requirements are implemented.

### 2. Scope of the chance find procedure

This procedure is applicable to all activities conducted by the personnel, including contractors, that have the potential to uncover a heritage item/site. The procedure details the actions to be taken when a previously unidentified and potential heritage item/site is found during construction activities. Procedure outlines the roles and responsibilities and the response times required from both project staff, and any relevant heritage authority.

### 3. Induction/Training

All personnel, especially those working on earth movements and excavations, are to be inducted on the identification of potential heritage items/sites and the relevant actions for them with regards to this procedure during the Project induction and regular toolbox talks.

### 4. Chance find procedure

If any person discovers a physical cultural resource, such as (but not limited to) archaeological sites, historical sites, remains and objects, or a cemetery and/or individual graves during excavation or construction, the following steps shall be taken:

1. Stop all works in the vicinity of the find, until a solution is found for the preservation of these artefacts, or advice from the relevant authorities is obtained;
2. Immediately notify a foreman. The foreman will then notify the Resident/Supervising Engineer and the Environment Officer (EO)/Environmental Manager (EM);
3. Record details in Incident Report and take photos of the find;
4. Delineate the discovered site or area; secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities take over;
5. Preliminary evaluation of the findings by archaeologists. The archaeologist must make a rapid assessment of the site or find to determine its importance. Based on this assessment the appropriate strategy can be implemented. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage such as aesthetic, historic, scientific or research, social and economic values of the find;
6. Sites of minor significance (such as isolated or unclear features, and isolated finds) should be recorded immediately by the archaeologist, thus causing a minimum disruption to the work schedule

of the Contractor. The results of all archaeological work must be reported to the National Museums of Kenya (NMK), once completed.

7. In case of significant find the National Museums of Kenya (NMK) should be informed immediately and in writing within 7 days from the find.

8. The onsite archaeologist provides the NMK with photos, other information as relevant for identification and assessment of the significance of heritage items.

9. The NMK must investigate the fact within 2 weeks from the date of notification and provide response in writing.

10. Decisions on how to handle the finding shall be taken by the responsible authorities. This could include changes in the layout (such as when finding an irremovable remain of cultural or archaeological importance) conservation, preservation, restoration and salvage;

11. Construction works could resume only after permission is granted from the responsible authorities.

12. In case no response received within the 2 weeks' period mentioned above, this is considered as authorization to proceed with suspended construction works.

One of the main requirements of the procedure is record keeping. All finds must be registered. Photo log, copies of communication with decision making authorities, conclusions and recommendations/guidance, implementation reports - kept.

## 5. Additional information

### Management options for archaeological site

- a) **Site avoidance.** If the boundaries of the site have been delineated attempt must be made to redesign the proposed development to avoid the site. (The fastest and most cost-effective management option)
- b) **Mitigation.** If it is not feasible to avoid the site through redesign, it will be necessary to sample it using data collection program prior to its loss. This could include surface collection and/or excavation. (The most expensive and time-consuming management option.)
- c) **Site Protection.** It may be possible to protect the site through the installation of barriers during the time of the development and/or possibly for a longer term. This could include the erection of high visibility fencing around the site or covering the site area with a geotextile and then capping it with fill. The exact prescription would be site- specific.

### Management of replicable and non-replicable heritage

Different approaches for the finds apply to replicable and non-replicable heritage.

#### Replicable heritage<sup>1</sup>

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<sup>1</sup> Replicable cultural heritage is defined as tangible forms of cultural heritage that can themselves be moved to another location or that can be replaced by a similar structure or natural features to which the cultural values can be transferred by appropriate measures. Archaeological or historical sites may be considered replicable where the particular eras and cultural values they represent are well represented by other sites and/or structures.

Where tangible cultural heritage that is replicable and not critical is encountered, mitigation measures will be applied. The mitigation hierarchy is as follows:

- a) Avoidance;
- b) Minimization of adverse impacts and implementation of restoration measures, in situ;
- c) Restoration of the functionality of the cultural heritage, in a different location;
- d) Permanent removal of historical and archaeological artefacts and structures;
- e) Compensation of loss - where minimization of adverse impacts and restoration not feasible.

#### **Non-replicable heritage<sup>2</sup>**

Most cultural heritage is best protected by in situ preservation, since removal is likely to result in irreparable damage or even destruction of the cultural heritage. Nonreplicable cultural heritage must not be removed unless all of the following conditions are met:

- a) There are no technically or financially feasible alternatives to removal;
- b) The overall benefits of the project conclusively outweigh the anticipated cultural heritage loss from removal; and
- c) Any removal of cultural heritage must be conducted using the best available technique advised by relevant authority and supervised by archaeologist.

#### **Human Remains Management Options**

The handling of human remains believed to be archaeological in nature requires communication according to the same procedure described above. There are two possible courses of action:

- a) **Avoid.** The development project is redesigned to completely avoid the found remains. An assessment should be made as to whether the remains may be affected by residual or accumulative impacts associated with the development, and properly addressed by a comprehensive management plan.
- b) **Exhume.** Exhumation of the remains in a manner considered appropriate by decision makers. This will involve the predetermination of a site suitable for the reburial of the remains. Certain ceremonies or procedures may need to be followed before development activities can recommence in the area of the discovery.

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<sup>2</sup> Nonreplicable cultural heritage may relate to the social, economic, cultural, environmental, and climatic conditions of past peoples, their evolving ecologies, adaptive strategies, and early forms of environmental management, where the (i) cultural heritage is unique or relatively unique for the period it represents, or (ii) cultural heritage is unique or relatively unique in linking several periods in the same site. Examples of non-replicable cultural heritage may include an ancient city or temple, or a site unique in the period that it represents.

**Annex 17. ESIA Practicing License**

FORM 7 0,1520



**nema**

**NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)**  
THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

**ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE**

License No. NEMA/EIA/ESPL/10341  
Application Reference No. NEMA/CA/EL/14517

M/S. **Laban Chersiyot Labett**  
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is licensed to practice in the  
capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert**  
registration number **1065**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **4/9/2019** Expiry Date: **12/31/2019**

Signature.....  
  
(Seal)  
**Director General**  
The National Environment Management  
Authority

P.T.O.



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