

# ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT STUDY REPORT

THE CONSTRUCTION OF A 30,000M<sup>3</sup> UFUNGUO WATERPAN  
IN MWAGWEDE VILLAGE, BUGHUTA SUB LOCATION,  
KASIGAU WARD OF VOI SUB-COUNTY.



FEBRUARY 2019

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## **DECLARATION**

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On behalf of the Proponent, the ESIA/EA Expert submits this Environment Impact Assessment And Audit for the proposed construction of Ufunguo Water Pan (Designs attached) on a community land in Bughuta- Kasigau Ward, Voi Sub-County in Taita Taveta County. The Environment and Social Impact Assessment has been carried out in accordance with the Environmental Management and Co-ordination Act, 1999 (Revised in 2015) and Environmental (Impact Assessment and Audit) Regulations, 2003.

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## ACRONYMS AND ABBREVIATIONS

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AIDS	Acquired Immune Deficiency Syndrome
CDE	County Director of Environment
CIDP	County Integrated Development Plan
dBA	Decibels
EHS	Environment Health and Safety
EMCA	Environmental Management and Coordination Act
ESIA	Environment and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESSO	Environment Social Safeguard Officer
GAP	Good Agricultural Practices
HIV	Human Immunodeficiency Syndrome
IFM	Integrated Fertilizer Management
IPM	Integrated Pest Management
KCSAP	Kenya Climate Smart Agriculture Project
NEMA	National Environment Management Authority
NGO	Non Governmental Organization
OSHA	Occupation Safety and Health Administration
SHG	Self Help Group
TOR	Terms of Reference

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There were many community respondents who assisted us get pertinent information about the benefits of this project, to them, I am grateful too. I also wish to thank the diverse people who provided very important reference material used in the assessment without which the report would not have been complete.

I cannot list all the people and organizations that have helped us in one way or another to realize this detailed report; I can only say thank you to all who have made it a success.

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## EXECUTIVE SUMMARY

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This Environment Impact Assessment project report has been prepared in accordance with the National Environmental Management Authority (NEMA) requirements for the proposed construction of a water pan by the Kenya Climate Smart Agriculture Project at Mwagwede village, Bughuta Sub location, Kasigau Ward of Voi Sub-County. It describes the project including project inputs, activities and possible environmental impacts likely to arise from the construction and operation of the water pan. In addition, the report proposes appropriate mitigation measures where negative impacts are likely to occur and ways to enhance the positive impacts if any. A detailed environmental management plan has also been developed to help the proponent take care of any impacts that may arise. The study findings show that the potential negative environmental impacts are minimal both in magnitude and scope. These impacts include: risk of spread of malaria and other water borne diseases, the risk of drowning of people especially children and livestock, loss of vegetation cover, livestock-crop conflict arising from crop damage by unattended animals among others. This calls for putting up mitigation measures to adequately and promptly address the risk and dangers that these impacts pose to the community and the environment. The proponent has integrated the measures within the project components and hence there will be minimal added cost to the implementation of the environmental management plan outlined in this report. There are also inherent positive impacts in the project that include among which: - provision of water for domestic, agriculture and livestock; improved food security; job creation, control of surface water erosion and catchment protection. In general the potential negative impacts of the project are low and easy to mitigate, therefore they should not prevent the project from proceeding. Moreover the KCSAP project has a strong environmental protection and resilience component that is expected to actively implement the proposed mitigation measures. The positive impacts and the benefits to the community are immense and welcomed. It is recommended therefore that the project proceed with the outlined mitigation measures put in place.

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## CHAPTER ONE

### 1.0 BACKGROUND INFORMATION

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This ESIA study has been conducted with respect to the proposed construction of a 30,000m<sup>3</sup> water pan on an 8 acre plot belonging to Ufunguo Women Group where the contact person is Ms Umazi Mwarua Makata, tel 0713129271. The area is not yet adjudicated, but the Kasighau location lands committee had given the 8 acres to Ufunguo women group to be utilized for development projects. It is located in Buguta sub-location, Kasigau ward in Voi sub County of Taita Taveta County. The area can be accessed from Maungu town about 20km away through Maungu-Kasigau and Buguta road.

The main objective is to enhance the availability of water for domestic use, livestock watering and for small scale irrigation. The project was selected through public participation during the CIDP meetings. According to physical planning, such a project is considered as a rural development.

According to the 2<sup>nd</sup> Schedule, 9 (1) of section 58 of Environmental Management and Co-ordination Act (EMCA) No. 8 of 1999, water pans are among those specified as requiring Environmental and Social Impact Assessment (ESIA). Further, according to the Environmental (Impact Assessment and Audit) regulation, 2003, new projects must undergo environmental impact assessment. ESIA's are undertaken for proposed activities that are likely to have a significant adverse or positive impact on the environment and are subject to a decision of a competent national authority, in this case in Kenya, it is the National Environment Management Authority (NEMA). This process ensures that, all developments within urban centers and other areas (in this case a rural set up) take into account the needs of environmental conservation and social considerations that is achieved through careful planning and establishment of appropriate management systems. As part of the ESIA process, it is necessary to devise alternatives to avoid undesirable impacts. Besides the alternative, identification of impacts may also lead to the development of mitigation measures i.e. means of reducing the impacts. As a tool of environmental planning, ESIA is therefore precautionary in nature and not anti-development. It does not stop actions which impact the environment and the community socially but rather requires that those impacts be considered. If environmental and social impacts are ignored, the project may not be sustainable in the long-run, in which case the money invested in it will have been wasted.

#### 1.1 TERMS OF REFERENCE FOR CONDUCTING THE ESIA STUDY

The ESIA study has been carried out as per the following categorized terms of reference listed below:

##### a) Project activities

The main activities that the ESIA study will be engaged in during the project preparation, construction and operation phase will be:

- i. Site clearing
- ii. Mechanical and partially manual land excavation of the pan hole.
- iii. Backfilling around the excavated area
- iv. Delivery of building materials and machines/equipments to the site
- v. Construction of the animal water trough
- vi. Construction of a domestic watering point
- vii. Construction of three door abolition structure with two latrines and one bathroom

- viii. Construction of an inlet channel
- ix. Construction of a spill way
- x. Fencing

## **b) Objective of the Environmental and Social Impact Assessment**

The overall objective of the environmental and social impact assessment study shall be to:

- i. Providing a concise description of the project area and its activities by focusing on potential impacts to the surrounding environment and community socially.
- ii. Carrying out a systematic ESIA for the project through following the required regulations.
- iii. Developing an ESIA report that identifies specific impacts and recommend appropriate mitigation measures.
- iv. Developing a detailed Environment and Social Management Plan for the project.
- v. Show the economic as well as social benefits of the project in the area.

## **c) Scope of ESIA Study**

The lead ESIA expert will undertake an Environment and Social Impact Assessment study on the intended site for Ufunguo water pan and prepare an ESIA study report as per the guidelines provided under the Environmental (Impact Assessment and Audit) regulations, 2003. The ESIA study report shall therefore provide details on the following aspects:

- i. The proposed location of the project
- ii. The objectives of the project
- iii. The technology, procedures and processes to be used, in the implementation of the project
- iv. The materials to be used in the construction and implementation of the project
- v. The products, by-products and waste generated by the project
- vi. A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project
- vii. The environmental effects of the project on the biological diversity, ecosystem maintenance, surface water quality, ground water quality, soil contamination, social consideration such as economic impacts, social cohesion or disruption, effects on human health including air and noise qualities, landscape entailing compatibility with the surrounding area including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated
- viii. Analysis of alternatives including project site, design and technologies and reasons for preferring the proposed site, design and technologies
- ix. An environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment; including the cost, time frame and responsibility to implement the measures
- x. The measures to prevent health hazards and to ensure security in the working environment for employees and for the management of emergencies
- xi. An indication of whether the environment of any other state is likely to be affected and the available alternatives and mitigating measures and
- xii. Such other matters as the Authority may require including public consultation with various stakeholders through focus group meetings.

#### **d) Issues of concern during the project cycle**

The ESIA study shall address, but not be limited to the following issues which are considered significant during construction, operation and commissioning stages:

- i) Bush clearing- Involving clearing of bushes, removal of trees, stumps, roots; and disposal safely.
- ii) Management of solid waste- During construction a lot of unwanted soil and debris will be generated thus to be removed and disposed off or placed for re-use appropriately.
- iii) Excavation of reservoir area – Excavation and movement of soil so as to attain the required depth and levels. An earth moving machinery is required preferably a crawler.
- iv) Construction of embankment – This will involve placing of appropriate soil in layers of 300 mm, moistening and compacting round the pan. This is to continue until the desired height is attained to crest level round the pan with some allowance for settlement.
- v) Noise, vibration and dust emissions- As a result of machinery works
- vi) Installation of draw-off system (communal tap and cattle trough) – This is piping system drawing water from the upstream to the downstream. This will take care of contamination of drawing water from the reservoir and even watering the animals from the reservoir directly.
- vii) Fencing – this will involve establishment of a fence of barbed wire, chain link and posts so as to prevent entry to the reservoir since it may cause accidents or even contamination of the water.
- viii) Health and safety of workmen on site
- ix) Handling, use and storage of hazardous materials during water use i.e. fertilizer and chemicals and
- x) Drainage of surface run-off and
- xi) Social issues associated with the construction of the water pan

#### **e) Expected Outputs**

The outputs from the ESIA study will be an environmental and social impact assessment study report

#### **f) Responsibilities of the Client**

The project proponent will be required to provide the following;

- i. Architectural drawings for the proposed water pan
- ii. Land ownership documents
- iii. Site history.
- iv. Pay prescribed project fee
- v. Any other information or responsibilities deemed necessary for the sturdy

#### **h) Proposed Work Plan and Time Frame for the ESIA Study**

The ESIA sturdy is expected to be done as per the indicated timeline below;-

<b>S/No.</b>	<b>Activity</b>	<b>Period</b>	<b>Methodology</b>
1.	Sign TOR	1 day	Meeting
2.	Technical committee constitution	2 days	Vetting and invitation of technical experts to a meeting
3.	Legal frame work review	5 days	Sturdy of the various related Acts of parliament/ County Assembly.

4.	Development of sturdy tools	3 days	Sturdy/review and vetting-out of appropriate sturdy tools.
5.	Field sturdy	21days	1) Observation 2) Interview 3) Questionnaire
6.	Literature review	7 days	Sturdy of the primary and any necessary information
7.	Questionnaire administration	7 days	One on one interviewing and administration of a questionnaire.
8.	Biophysical analysis	5 days	Observation Literature review
9.	Interview with farmers	7 days	Personal interview
10.	Interview with government and organization	7 days	Personal interview
11.	Data analysis	7 days	Descriptive
12.	Report writing	14 days	Contributive
13.	Final report preparation and presentation	3 days	Meeting

## 1.2 METHODOLOGY:

### 1.2.1 Approach and Methodology

The ESIA study process entailed the following steps:

- i. Desk top study of documents pertinent to the proposed project
- ii. Field survey including interviews, focus group discussions with all levels of stakeholders and administration of a questionnaire.
- iii. Experts' site/field environmental and social sturdy and analysis i.e. biodiversity analysis
- iv. Preparation of ESIA study report

### 1.2.2 Screening

The environmental law (EMCA, 1999) provides that all projects that fall under second schedule must be subjected to an ESIA. Thus screening was done to establish whether or not an Environment and Social Impact Assessment was necessary. Since the proposed project was of significant importance as an intervention to supplement water for both domestic and irrigation, it was deemed necessary to conduct a project report for the assessment of its likely impacts on the environment and the community socially. The screening took place on 15th February 2019. The screening team was composed of the Environmental and Social Safeguards Officer (ESSO), County Director of Environment, Sub County Water officer, Ward Livestock Officer and the Ward Agricultural Officer

### 1.2.3 Scoping

This process was undertaken aiming at two main goals;

- a. To identifying significant issues allied with the project and
- b. To identify reasonable and feasible project alternatives.

The result of this process helped the assessors to intelligently focus resources on the assessment of those issues and alternatives. This involved identifying relevant stakeholders mainly government

ministries relevant in giving an input or intervention in the project at any of its stage of development. It was followed with developing information on the resources to be affected. This led to identifying potential concerns about the project thus sorting for project alternatives.

3 methodologies were deployed in the scoping process;-

- Discussions with the proponent,
- Face-to-face interviews with the identified stakeholders and
- Survey of the site.

#### **1.2.4 Assessment of the Biophysical Environment**

The biophysical environment was assessed first by reviewing the already documented works on the environment within the project area. This included previous reports and other documentaries. Thereafter a field investigation and collection of baseline data on the current environmental conditions was targeted in the following sequential manner:

- Analytic assessment of the current state of the environment in the project area
- Identification, prediction and evaluation of positive and negative environmental impacts.

#### **1.2.5 Field Survey Techniques**

The field survey adopted various techniques of baseline collection on the existing environmental and social conditions, namely

- 1) An open public baraza to establish community feelings about the project
- 2) Field observations and recordings including photography.
- 3) Administering a questionnaire in focused group discussion.
- 4) Discussions with neighbors, i.e. other people working in the area.

### **1.3 PROJECT OBJECTIVES**

The project is aimed at achieving the following:

- i. Constructing of a 30,000m<sup>3</sup> water pan in accordance with Kenyan laws and regulations
- ii. Provision of cost effective agricultural, livestock and domestic hygiene purpose water to over 2,000 residents through road run-off harvesting.{{Direct beneficiaries: Total-20: Male-0, Female-20); (Indirect beneficiaries:Total-905: Male-365, Female-540); (Vulnerable beneficiaries (poor, widows -30/widowers 0; orphans-12; physically challenged -7; elderly-7; HIV/AIDs affected/infected-Total 110: Male- 61, Female-49)}}.
- iii. Improvement of sanitation, crop and livestock production and livelihood resilience to climate change.
- iv. Creation of jobs for the local community from agricultural labor (consider youth, women and vulnerable) as a result of increased agricultural income generating activities around the pan.
- v. Operating the pan with consideration of Environmental Health and Safety (EHS) systems commiserating to the project and the environment.

### **1.4 PROJECT ALTERNATIVES:**

The process of deciding where the pan was to be constructed was analyzed during the screening stage against the list in Taita Taveta CIDP II of proposed water pans in the Ward. There were two other proposed sites that include Makokoro and Maghanga water pans.



#### **1.4.1 Alternative 1- Makokoro Water pan**

The pan is located 3 kms from the village center. It was built by the Coast Water Service board in 2017. It was design to hold 60,000m<sup>3</sup> but they managed to construct a 20,000 m<sup>3</sup> pan. The proposed action in the CIDP II was to rehabilitate and expand its capacity. However the project was found not suitable as compared to Ufunguo because it had very sandy porous soils hence could not hold water. The pan would therefore require lining it and this would have prompted extra cost to the project.

#### **1.4.2 Alternative 2- Maghanga Water Pan**

Maghanga water pan was built in 2015 through funding from By World Vision through cash for asset fund. The pan is currently holding water and required rehabilitation and expansion. It has a capacity 10,000m<sup>3</sup>. It however it was opted out against the Funguo water pan due to it being located too far from the village center i.e.18Km. The community considered close proximity to a water source as one of the major priority factors to consider for funding a project.

- ❖ Generally, apart from the technical issues concerning the above two pan that prevailed against them being opted for construction, Ufunguo water pan was within the targeted Mwangwede community village. Further, there existed a better, well organized, active, in operation women group on the ground called Ufungo women SHG that was ready to take up management of the pan during its operation as compared to the other two alternatives.

#### **1.4.3 Alternative 3 - No action Alternative**

In this alternative, it opts for no implementation of the project. This will mean losing the positive impacts associated with the project i.e. demonstrate to the community how they can harness/harvest water from run-off water; provide to the community a source of irrigation water to their arable land; sensitize the community to adopt water harvesting technologies in their farms; lack of contract to the development consultants, contractors and suppliers of materials and thus the economy of the of the area will be retarded. However, from an environmental management perspective, this alternative will be beneficial in the sense that any potential negative impacts associated with the project will be avoided. This alternative should not be adopted as agricultural development particularly the harnessing of water for crop production is one of the most significant contributors in a farming community and country's agricultural economy, and particularly in Bughuta village. The faster we encourage investment in this sector, the faster will the livelihood of the community in this village grow

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## CHAPTER TWO

### 2.0 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

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#### 2.1 GENERAL OVERVIEW

ESIAs are carried out in order to identify potential positive and negative impacts associated with the proposed project with a view to taking advantage of the positive impacts and developing mitigation measures for the negative ones. The guidelines on ESIAs are contained in Sections 58 to 67 of the Act. According to Section 68 of the Environmental Management and Coordination Act (EMCA) 1999, the Authority shall be responsible for carrying out environmental audits on all activities that are likely to have a significant effect on the environment. The government has established regulations to facilitate the process on ESIAs and environmental audits. The regulations are contained in the Kenya Gazette Supplement No. 56, Legislative Supplement No. 31, and Legal Notice No. 101 of 13<sup>th</sup> June 2003. In the past, the government has established a number of National policies and legal statutes to enhance environmental conservation and sustainable development.

##### 2.1.1 Policy Framework

It aims to integrate environmental issues into the country's development plans. Its main objectives include:

- a) Meeting of national and international goals through conservation of bio-diversity, prevention of desertification, protection of ozone layer and mitigation of disaster.
- b) Sustainable use of natural resources as well as water resources to improve the quality of human environment.
- c) Integrating environmental conservation into economic activities to the process of sustainable development.
- d) Optimization of use of natural resources in improving the quality of human environment.

Some of the applicable policies in this case are;

- a. National Environmental Action Plan (NEAP- 1994)
- b. National Policy on Water Resources Management and Development (1999)
- c. Policy Paper on Environment and Development (Sessional Paper No. 6 of 1999):

##### 2.1.2 The legal framework

The applicable laws relating to irrigation projects include those on:

- i. Soil erosion
- ii. Public health
- iii. Endangered species
- iv. Protected areas
- v. Water quality
- vi. Water rights
- vii. Cultural, historical, scientific and archeological sites.
- viii. Land use and resettlement
- ix. Air quality

Through the enactment of Environmental Management and Coordination Act (EMCA) of 1999, the legal and institutional framework for environmental management was strengthened. The Act provides

for the establishment of a National Environment Management Authority (NEMA). It became operational in July of year 2002. The Authority is a statutory body mandated to coordinate all environmental related activities.

The Environmental Impact and Assessment guidelines and regulations of year 2003 provide the basis and procedures of carrying out ESIA's and EA's.

***The proponent will need to observe the provisions of the various statutes that are aimed at maintaining a clean, healthy and sustainable environment.***

Some of the policy and legal provisions are briefly presented in the following sub-Sections

## **2.2 POLICIES**

### **2.2.1 National Environmental Action Plan (NEAP- 1994)**

According to the Kenya National Environment Action Plan (NEAP, 1994) the Government recognized the negative impacts on ecosystems emanating from industrial, economic and social development programs that disregarded environmental sustainability. Following on this, establishment of appropriate policies and legal guidelines as well as harmonization of the existing ones have been accomplished and/or are in the process of development. Under the NEAP process Environmental Impact Assessments were introduced targeting the industrialists, business community and local authorities.

### **2.2.2 National Policy on Water Resources Management and Development (1999)**

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

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

In addition, the policy provides for charging levies on wastewater on the basis of quantity and quality. The "polluter-pays-principle" applies in which case parties contaminating water are required to meet the appropriate cost of remediation. The policy provides for establishment of standards to protect water bodies receiving wastewater, a process that is ongoing.

### **2.2.3. Policy Paper on Environment and Development (Session Paper No. 6 of 1999):**

The key objectives of the Policy include: -

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

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

## **2.3 LEGAL ASPECTS**

The key national laws that govern the management of environmental resources in the country have been briefly discussed in the following paragraphs. Note that wherever any of the laws contradict each other, the Environmental Management and Coordination Act 1999 prevails.

### **2.3.1 Environmental Management and Coordination Act (1999)**

The Act came into force in January, year 2000. It aims to among others:

- a. Provide a framework registration for other statutes that contain environmental provisions in the laws of Kenya.
- b. To provide guidelines for ESIA, EA and monitoring environmental quality standards as well as environmental protection orders.
- c. To provide guidelines for the establishment of an appropriate legal and institutional framework for management of environment in the country.

According to the EMCA Act, section 58, all the projects that are listed in the second schedule of the act must submit a project report to NEMA.

### **2.3.2 The Agriculture Act**

Cap 318 of this Act provides a legislative control over soil conservation and land management. The clearing of vegetation for steep slopes or in areas next to water courses without authorization is strictly forbidden. The Ministry of Agriculture can impose land conservation orders to control cultivation, grazing and clearing of vegetation.

#### **Basic land usage rules**

The rules apply to plots and land used for cultivation. They cover areas such as protection of sloppy land, water courses and against soil erosion by run-off water. They states that:

- a. Protection of land with slope exceeding 12%  
Any person who cultivates any land of which the slope exceeds 12% and does not exceed 35%, when the soil is not protected against erosion shall be guilty of offence.
- b. Protection

Any person who cultivates and destroys the soil or cuts down any vegetation or dispastures by livestock on any land lying within 2m of a watercourse or in the case of a watercourse more than 2m wide within a distance equal to the width of that watercourse to a maximum of 30m shall be guilty of offence.

### **2.3.3 Crop production and livestock Act CAP 321**

The purpose of the crop production and Livestock Act is to regulate the quantity of land that can be utilized for food crops or livestock production; what type of crops to be grown in which areas, etc.

### **2.3.4 The Water Act**

Cap 372 is pivotal for irrigation projects and activities. It provides for the conservation, control, apportionment and use of available water resources. It provides for:

- a) Provision of sufficient drainage works for the delivery of used and unused water to a water course or body from irrigated land.
- b) Obtaining of water permits for irrigation.
- c) Revision or variation and cancellation of water permits.
- d) Penalty for waste dumping
- e) Penalties for polluting water used for human consumption.

### **Draft Water Rules 2006**

To operationalize the Water Act 2002, the Water Resources Management Authority is in the process of developing water rules and regulations. It has already come up with the draft water rules, which are due for gazettelement. The rules cover the following areas:

- a) The reserve, protected areas, swamps, wetlands and riparian areas. They have also incorporated the means through which we can protect these fragile water resources and related environment.

Other areas that these rules cover include:

- b) Threshold levels for water allocation.
- c) Harmonization of water permitting fees and water use charges for different permits.
- d) Provide the Water Resources Management Authority (WRMA) with powers to place control orders, to stop destruction and anti-social behavior which are detrimental to our water resources.
- e) Formulation of Catchments Management Strategies (CMS) including the zoning of catchments
- f) Re-enforce and separate functions between different water sector institutions.
- g) Promote decentralization of decision making
- h) Promote participation and offer channels through which civil rights issues can be addressed.

### **2.3.5 Land Act**

#### **Draft land policy 2006**

This draft policy is currently undergoing review. The public has already been requested to read and contribute. The policy is a result of extensive consultation and deliberation between the Ministry of lands, other Government Departments and other Non-State stakeholders for over two years.

#### **History**

Kenya has not had a clearly defined or codified National Land Policy since independence. This, together with the existence of many land laws, some of which are incompatible, has resulted in a complex land management and administration system.

### **Community Interest and Benefit Sharing**

To protect community interests over land based Natural Resources and facilitate benefit sharing:-

- A legal framework shall be established for recognizing community and private rights over natural resources and put in place procedures for use of and access to these resources by communities and private entities;
- Devise and implement participatory mechanisms for compensation for loss of lives and damage to property occasioned by wild animals;
- Establish mechanisms for the sharing of benefits emanating from natural resources by the people of Kenya and by use of participatory methods, define benefit sharing criteria for natural resources within the jurisdiction of local communities;
- Ensure that the management and utilization of land based natural resources by community entities take into account the need to share benefits with contiguous communities and that such communities are fully involved in the management and development of the resources;
- Encourage the development of wildlife sanctuaries and conservancies and involve local communities in the co-management of parks with communities living contiguous to the parks and protected areas. It shall also provide mechanism for resolving grievances of communities arising from human-wildlife conflict; and
- Recognize and protect the rights of forest dependent or other Natural Resources dependent communities and facilitate their access, co-management and derivation of benefits from the Resources.

### **2.3.6 The Registered Land Act CAP 300**

Under the Registered Land Act, any person may acquire absolute ownership to any land once he has been registered as the absolute owner. On registration, such a person acquires freehold interests on the land. A subsequent buyer of the same land acquires the same rights as enjoyed by the previous owner.

### **2.3.7 Land Control Act, Cap 302**

The Land Control Act was enacted to regulate the sale and sub-division of agricultural land. The Constitution gives powers to the officers of the land Control Board to refuse to grant consent for transfers or sub-divisions of agricultural land into uneconomic units.

### **2.3.8 The Land Acquisition Act, Cap 295**

The Land Acquisition Act reinforces the provisions of the constitution on compulsory acquisition, and consequently gives powers to the government to acquire any persons land for public utilities such as roads, hospitals, schools, dispensaries, etc. The only requirement by both the constitution and this act is that once such is acquired, prompt and full compensation be paid to the owner. However, the Act does not provide for the involvement of the land owners in determining the level and the mode of compensation.

### **2.3.9 The Chiefs' Authority Act Cap 128**

Section 10 parts (f), (g), (h), (i) and (o) of The Chiefs' Act Cap 128 states:

Any Chief may from time to time issue orders to be obeyed by the persons residing or being within the local limits of his jurisdiction for any of the following purposes;

- a) Preventing the pollution of the water in any stream, watercourse or water-hole, and preventing the obstruction of any stream or watercourse;
- b) Regulating the cutting of timber and prohibiting the wasteful destruction of trees;
- c) Preventing the spread of disease, whether of human beings or animals;
- d) Prohibiting any act or thing that may cause damage to any public road or to any work constructed or maintained for the benefit of the community; and
- e) Regulating the use of artificial water supplies constructed from public funds

### **2.3.10 Cooperative Societies Act**

This is an Act of parliament Cap 490 of 1997 which relates to the constitution and regulation of cooperative societies which covers: interpretation of the Act, establishment of officers responsible for the growth and development of cooperative societies, procedures for registration, privileges of registered societies, rights and liabilities among members, duties of cooperative societies, rights and obligations, property, funds and settlement of disputes among others.

### **2.3.11 The Lakes and Rivers Act**

Cap 409 makes the provision for the protection of birds and other wildlife in the lakes or rivers.

### **2.3.12 The Public Health Act**

Cap 242, section 115 states that, no person or institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires local authorities take all lawful action, necessary and reasonably practicable measures to maintain in their jurisdiction, clean and sanitary conditions to prevent occurrence of a nuisance or conditions liable to be injurious to human health. Any noxious matter or waste water flowing or discharged from any premises into a public street or into the gutter or side channel, water course, irrigation channel or bed not approved for discharge is so deemed as a nuisance. Others include accumulation of materials or refuse, which in the opinion of the medical officer of health is likely to harbor rats or vermin.

Section 129 of the Act states that "it shall be the duty of every local authority to take all lawful, necessary and reasonably practicable measures for preventing any pollution dangerous to health of any water supply in which the public within the district has a right to use and does use for drinking or domestic purposes.

Section 136 states that all collections of water, sewage, rubbish, refuse and other fluids, which permit or facilitate the breeding or multiplication of pests, shall be deemed to be nuisances and are liable to be dealt with as provided in the Act.

### **2.3.13 The pest control Act**

All the chemicals used in any agricultural undertaking must be registered by the Pest Control and Products Board (PCPB). All pest control products sold in Kenya must bear a label showing a PCPB

registration number. Cap 346 of the Act provides banned in Kenya. All pesticide storage and handling arrangements must be inspected and licensed under this Act.

### **2.3.14 Other relevant registration**

- Irrigation Act Cap 320
- Penal code Cap 63
- Food, drugs and other chemical substances Act Cap 254
- Seeds and plant varieties Act Cap 326
- Agriculture produce and marketing Act Cap 320
- Fertilizer and food stuffs Act Cap 345
- Use of poisonous substances Act Cap 247
- Malaria prevention Act Cap 246
- Local Government Act Cap 265

### **2.3.15 Administrative framework**

#### **a) The National Environmental Management Authority (NEMA)**

It exercises general supervision and coordination over all matters relating to the environment and is the principal organ of government in implementation of all policies relating to the environment. The EMCA Act provides for the establishment of Standards and Enforcement Review Committee (SERC)

#### **b) The National Environmental Council (NEC)**

It's responsible for policy formulation and direction. The council also sets national goals and objectives and determines priorities for protection of the environment.

#### **c) County and Sub-County Environment Committees**

They are decentralized structures involved in environmental stewardship. They enable the local community participation. They have diverse membership.

#### **d) Public Complaints Committee**

The EMCA act provides for its establishment and the administrative mechanism for addressing environmental issues. It has a mandate of investigating complaints relating to environmental damage and degradation. It has diverse membership.

### **2.3.16 Regulatory framework**

#### **2.3.16.1 The Environmental Impact Assessment and Audit Regulations**

They state in Regulation No. 3 that "the regulations shall apply to all policies, plans, programs, projects and activities specified in Part IV, V and the second schedule of the Act.

Regulation 4 subsection 1 states that no proponent shall implement a project where:

- It's likely to have negative environmental impacts.
- And for which an ESIA is required under the Act or these regulations.

#### **2.3.16.2 Standards and Enforcement**

This is the duty of the SERC. It's responsible for drawing up the standards on the following

- Chemicals



- Land use
- Biodiversity
- Water quality
- Waste quality
- Economic instruments

It's important to note that some of these standards have been gazetted i.e. on water quality.

### **Standards**

To operationalize the Water Act 2002, the rules being developed by the Water Resources Management Association (WRMA) have addressed the guidelines for developing water quality standards for domestic water sources and for irrigation waters.

### **2.3.16.3 Euro Retailer Produce Good Agriculture Practice (EUREPGAP)**

This is a private standard that is applicable to production of all kinds of agricultural products inclusive of livestock and flowers worldwide and Europe in particular. These are standards aimed at enhancing food and other products safely, through promotion of sound agricultural production methods by taking into consideration of hygiene, safety and quality.

These standards were to come into force in January, 2005 in Kenya, but the European Union extended it to 2007 to enable the local farmers enforce these standards. Producers receive their EUREPGAP approval through verification by an independent EUREP approved body i.e. AB cert, EUROCERT, ICM, Lloyds register QA, SGS Agro-control. The EUREPGAP protocol (2004) for the production of fruits and vegetables covers the following:

1. Traceability
2. Record keeping
3. Varieties and root stalks
4. Site history and site management
5. Soil and substrate management
6. Fertilizer usage
7. Irrigation
8. Crop protection
9. harvesting
10. Post-harvest treatment
11. Waste and pollution management, recycling and reuse
12. Worker health, safety and welfare
13. Environmental issues
14. Complaints procedures
15. Internal audits

For benefit of local farmers, they can participate in benchmarking schemes as equivalence with EUREPGAP requirements for development of regionally adjusted and integrated crop management systems.

### **2.3.16.4 ISO 14001 certification**

International Standards Organization (ISO) is a worldwide federation of national bodies. It aims to contribute to making development, manufacturing and supply of products and services more

efficient, safer and cleaner. It's good technical base for countries on health, safety and environmental legislation.

Its main aim is support in environmental protection and protection against pollution, balanced with socio-economic needs of countries. Its main goals include:

- Continuous improvement of environment management system and environmental performance of organizations.
- Compliance with legislation and demands set by the organization

ISO 14001IS is a voluntary standard that provides guidance on the development and introduction of that system. Within the standards are the Environmental Management Systems (EMS), which is a part of an overall management system consisting of:

- a. Organizational structure
- b. Planning activities
- c. Responsibilities
- d. Practices
- e. Procedures
- f. Processes and resources for:
  - i. Developing
  - ii. Implementing
  - iii. Reviewing and
  - iv. Maintaining the environmental policy

**The EMS should therefore cover:**

- a) Environmental policy
- b) Planning, implementation and operation corrective actions
- c) Management review

The EMS is supported by the following procedures and instructions:

Organizational responsibilities, communication, training, management manual, production of registers, non-compliance and corrective actions, complaints records and archiving and document control. Therefore, an organization wishing to have ISO 14001 provides written evidence showing that each of the above procedures is operational and established.

### **2.3.16.5 International Treaties and Conventions**

Kenya has ratified numerous international treaties and conventions. The relevant treaties include, but are not limited to:

- a) Convention on wetlands of international importance and water fowl habitat. This dictates wise use of wetlands and their resources
- b) Vienna convention for the protection of ozone layer. It encourages intergovernmental cooperation on research, systematic observation of the ozone layer, monitoring of CFC's production and exchange of information.
- c) Montreal protocol on substances that deplete the ozone layer. It gives guidelines on phase out of ozone depleting substances on the basis of periodic scientific and technological assessments.

- d) Kyoto protocol. In this protocol, the developed nations agreed to limit their greenhouse gas emissions, relative to 1990 levels and are pursuant to the United Nations Framework Convention on Climate Change of 1992.
- e) The International Trading Rules and Persistent Organic Pollution Convention (POP's). It identifies twelve groups of substances which have been either banned or whose use or production is severely restricted.
- f) Convention on Biological Diversity. It aims at conservation of biological diversity and sustainable use of its components, fair and equitable sharing of benefits accruing from utilization of genetic resources.
- g) African Convention on the Conservation of Nature and Natural Resources

Generally;

The convention established on African Convention on the Conservation of Nature and Natural resources.

Main requirements

- Improved soil conservation and introduce improved farming methods, which will ensure long term productivity of the land.
- Control erosion caused by various forms of land use which may lead to loss of vegetation cover.
- Prevent and control water pollution
- Protect flora and ensure best utilization and development and conserve threatened and or special scientific or aesthetic value, plant species or communities.

For protection of fauna resources, Kenya is required to manage wildlife populations inside designated areas and manage aquatic environment with a view of minimizing deleterious effects of any water.

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## **CHAPTER THREE:**

### **3.0 BASELINE INFORMATION.**

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#### **3.1 PROJECT ENVIRONMENT**

##### **3.1.1 Conceptualization of the project.**

This project will be implemented through funds from the Kenya Climate Smart Agriculture Project which is funded by the Government of Kenya and the World Bank with 20% of the total cost of the project contributed by the County Government of Taita Taveta.

The idea of constructing or expanding existing water pan within Bughuta Sub-location was conceived in September 2018. This was during the public participation meetings in Bughuta trading centre in process of developing the Taita Taveta CIDP II in January 2018. The pan was proposed by the community through a self help group by the name Ufunguo Women SHG. There is an existing water pan on this site and needed expanding and rehabilitation to cater for expanding needs for domestic, agricultural and livestock water predisposed by the fast growing population. Therefore the project was suitable for a water pan development. Land available for development is 8acres, however, the area is not yet been adjudicated. However, the Kasighau locational lands committee had given the land to Ufunguo women group to be utilized for development projects.

The main purpose of the pan is to harvest water for domestic use, crop and livestock production. The pan targets to serve about 2,000 households in an area of about 5km<sup>2</sup>.

##### **3.1.2 Location**

Ufunguo water pan is located in Magwede village, Bughuta sub-location in Kasigau ward Voi Sub-County. The pan will be constructed in a 8acre community land handed over to Ufunguo Women SHG who will be tasked to manage the pan during operation. The site is about 7Km from Buguta shopping center and 12km from Kasigau ward headquarters in Rukanga where it hosts the Kasigau chief's camp and ward administrator. It is 63 Km South East of Voi town which is the Sub-County headquarters. The area can be accessed from Maungu town about 20km away through Maungu-Kasigau and Buguta road.

##### **3.1.3 Climate**

The area can be classified as low potential with an average rainfall of between 500-700mm per annum while the average temperature is about 32°C. Rainfall in the area is bimodal coming in two distinct seasons, the long rains come from March to April and the short rains from November to December. Short rains have more surface run-off. However, rainfall patterns are currently unpredictable due to global climatic changes.

##### **3.1.4 Topography**

The area is generally undulating at an average 4% slope from Kasigau hills towards the low lying lands of Kasigau plains. The pan sits at the Kasigau plain that form Magwede water catchment area.

### **3.1.5 Vegetation**

Natural vegetation in this area comprises of indigenous acacia shrubs and euphorbia family trees. Trees and shrubs are very scattered all over the plains. A few trees are found in farm lands with *Cassia samea* as the most common. Very little if not agro-forestry is being practiced in the area. The surrounding Kasigau hills are almost bare. A significant part the area is covered with fodder grass- *Panicum maximum* and *Cynodon eragrostis* suitable for livestock keeping. Due to poor precipitation, felling of trees for timber, charcoal burning among other factors, indigenous trees count has drastically fallen to minimal count paving way to some few exotic species that take relatively a shorter time to mature even though they do not perform well in such harsh environs.

### **3.1.6 Drainage**

The area has very few if not seasonal rivers. These are located at the foothills of Kaisgau hills which are over 8km away from Magwede village. The pan site is situated in the Kasigau plains that are traversed with seasonal water ways that cut dip trenches due to the sandy nature of the soils. Along the main murrum road from Maungu Center to the all weather roads of Bughuta, side drains have been deeply cut by fast streaming road run-off water during wet season. Ufunguo pan is fed by harvesting this road run-off water.

### **3.1.7 Soils and geology**

The project area has mainly red sandy-loam soils. They have a fair amount of murrum that makes them fairly friable.

## **3.2 SOCIAL ECONOMICS**

### **3.2.1 Agriculture**

According to the ESIA questionnaire, the main economic activity of the area is farming and livestock keeping. Agricultural activity in the area is mainly small scale subsistence, rain fed farming consisting of maize, green grams, cow peas, pigeon peas, cassava and ground nuts (currently picking as a commercial crop). There are no soil and water conservation structures thus contributing to the high levels of surface run-off/sheet erosion. Farmers also keep livestock mainly in a free range system. Commercial hay making is a big potential that has not been exploited in spite of the presence of vast grasslands. Thus there is enough fodder for animals but little water for them. There is no cattle trough constructed at the existing pan. Animals are sent into the pan hole to access water which in turn destroys the already dilapidated walls of the pan and also contaminating the water with animal droppings. There are no modern livestock keeping or even agriculture technologies friendly to the environment that are being practiced by the community such as drip irrigation and zero grazing. According to the results received from ESIA field sturdy and social impact questionnaire administration, agricultural and livestock activities become challenging due to poor availability of water, poor transport net work, farm inputs are expensive, lack of capital and poor veterinary services among other challenges.

According to the community, the construction of the water pan will assist alleviating the above challenges especially in making available water to irrigate their farms. More so, it will also assist in sensitizing farmers on good water use practices.



Livestock scaling the dilapidated pan walls to access water



A woman (far right) drawing mucky water for domestic use

### 3.2.2 Transport and communication

The project area is accessible by means of public and private vehicles and motorcycles that ply the dry all weather roads criss-crossing the area. The road network in the area is poor. The nearest tarmac road is the Mombasa-Nairobi highway which is about 20km away from the site. The road between Maungu and Mwangwede village is dilapidated mainly by water erosion during rainy season. It is exacerbated by the nature of soils that are sandy-loam and friable. There is no land line telephone service though communication in the area has been complimented by the fair network coverage of the mobile telephony.

### 3.2.3 Administration

The area falls under the jurisdiction of Kaisigau ward whose administration contact person is the area chief and ward administrator 12 kms away at Rukanga trading center. A police post is also located at this center. The Sub-County headquarters is in Voi Town, over 63 km away. Human wildlife conflicts have been minimally reported.

### 3.2.4 Education

Within Bughuta sub-location are Sasenyi primary school and Mwanganga pre-school. There are no colleges or tertiary institutions in the Sub-location. However, during the scooping exercise, it was realized that literacy levels are very low i.e. most of the people beyond 40yrs of age cannot read and write. Generally, about 3 in 5 people cannot read or write. Children of school going age are seen loitering around or some tending to animals during week days, indicating high school drop outs or even low school enrollment

### 3.2.5 Health facilities

According to the ESIA study, the following are the most common diseases manifested in Mwangwede village;-

Type	When common	Common/Remedy applied	Source of remedy
a. Diarrhea and vomiting (amoeba)	Dry season	Drugs	Bughuta Dispensary
b. Malaria	Rainy season	Drugs	Bughuta Dispensary
c. Skin disease	Always	Drugs	Bughuta Dispensary
d. Typhoid	Dry season	Drugs	Bughuta Dispensary

The health facilities that the villagers of Mwagwede access are;

Name of dispensary/hospital	Distance (Km)
a) Bughuta Dispensary	7

According to the Social impact survey conducted by the Lead expert, the most common diseases are diarrhea and malaria in wet season while skin diseases are prevalent throughout the year. There are no sanitation blocks around the pan or nearby rendering those utilizing the pan to take long and short calls just nearby the pan. This is danger of development of vector borne diseases such as cholera and bilharzia. Worse is the fact that, there are no domestic water drawing points at the existing pan but both human and animals draw or drink their water from one accessible point. However, it also revealed that the community is sensitized on health issues as they prefer to access modern medical attention from Bughuta dispensary that serve over 10,000. Parts of their medicine are bought across the counter from simple shops around. Cases of drug abuse are reported with young men preferring to chew khat (mungukaa) in their free time and even working hours. This also applies to alcohol abuse.

### 3.2.6 Commerce and Industries

There are no industries in the area except a posho mill that is located at Bughuta market 7 km away. Some community members are also involved in small cottage industries i.e. self help groups in various agricultural related activities. Others have stalls in the market centers to sell farm produce and other fast moving consumer goods. However, from the field sturdy and the questionnaire administered during the sturdy, other destructive industrial activities like timber sales and charcoal burning feature in the location which are destructive to the environment. Other small scale industrial activities found in the area are brick making which involves quarrying clay in the area and thus leaving holes that are breeding ground for pest like snakes or mosquitoes during wet seasons. These activities need to be controlled so as to avoid further destruction of the environment.

Generally, there is the challenge of poor markets/marketing of their produce, lack of start-up capital, lack of tools/machines and the appropriate technologies, poor road infrastructure that would make their produce reach the final destination among others.

### 3.2.7 Groups Formation

There are very few organized social groups in Bughuta Sub-location. Around the pan is the Ufunguo Self Help Group. This is the identified group that will be closely involved in running the pan. The group is very active in agricultural related activities. It is registered with the department of Social Services. It is expected that the group should address the sustainability issues concerned with the running of the project. About 25Km away, live a group of people called the Wathe who are believed to emanate from neighboring countries from the Southern part of Africa. They also keep livestock that they water

them at Ufungo pan during dry season. There are also some other vulnerable groups like the old, widows and widowers and disabled.

### **3.2.8 Socialization and Gender Issues**

There are several cases of early marriages probably associated with high poverty rates among the society members. Generally are large families of about 7 and above also associated with their economic status. There are several reported case of domestic violence hence marriage instability that occur partly as a result of water inadequacy. Gender roles are not properly defined. In the few groups that exist, it was observed that, leadership is a preserve for men. Women seem to be overloaded with almost all domestic chores. Illicit brews are rampant in the areas which the area chief is busy fighting against.

## **3.3 HYDROLOGY**

### **3.3.1. Rainfall**

Kasigau Ward is regarded as a semi arid region due to its low amounts of precipitation that has resulted to its vegetation being scanty. The average annual rainfall of Kasigau Ward is below 500mm in less than 45 days per year. It receives two season per year, i.e. Long rains between March and May and short rains between October and December. Rainfall is unreliable, unpredictable and erratic. Due to the low amounts of precipitation it is mainly a livestock producing zone with agriculture at subsistence level.

### **3.3.2 Ground Water Sources**

Ground water in the area has not been fully exploited either by the government agencies that have tried exploiting this water e.g. Ministry of Water, Ministry of Agriculture, Member of Parliament Constituency Development Fund or CBOs and NGOs like World Vision and the Kenya Red Cross who have been working in with the community before in trying solve issues related with water. These agencies have made an effort of exploit ground water through projects involving digging of shallow wells and bore holes. Some of the bore holes are still serving the community. The nearest bore holes to the site area are over 3km away. Even more challenging is that, the water from these boreholes are saline hence not so fit for human consumption.

On the other hand, these NGOs encountered some challenges during implementation mainly poor organization skill, low capital, lack of tools and labor to maintain these bore holes and such projects. They overcame the problem by organizing the community into self help groups that can be focused and take care ground water projects through training by the relevant government officers.

### **3.3.3 Surface Water**

Generally, there is very poor surface water formation in the area. Around Bughuta area, water trekking distances continue to increase from 20-30Km. Hence there is an increase in the cost of water with time. The targeted catchment area is estimated to be about 2Km of road run-off water originating from the Bughuta trading center- Mwangwede village all weather road. The Mwangwede community has been accessing the domestic, livestock water from the current small sized Ufunguo water pan which is currently murky and dirty due to among other factors, absence of silt traps and animals drinking directly from pan water. Another pan called Makokoro is about 2kms away near



Bughuta village and serves them during wet season. However, it's dry during dry season due to it being sandy and porous. Agriculture has been mainly rain-fed. There is seasonal stream about 12kms away from Mwagwede village called Makwasinyi at the foot hills of the Kasigau hills. Other sources of water for domestic and livestock is the Maghanga water pan over 18kms. A great percentage of surfaces run off in the area during rainy season especially the road run off go to waste without being harnessed thereby prompting the need to construct the water pan.

### 3.3.4 Other sources

Other sources of water are from rainwater harvested from roof catchments and diverted into storage tanks. The cost of providing all households with tanks of reasonable capacity is too high for the residents considering that most of them live below the poverty line.

## 3.4 WATER DEMAND AND APPLICATION

### 3.4.1 Consumer projections

- The project target population is 2,000 persons within an area of 5 kms<sup>2</sup>.
- Pan capacity 30,000m<sup>3</sup>.

#### Water Demand

##### ❖ Livestock water demand

- Indigenous cows- 3,000
- Shoats- 1,000
- Total water demand for livestock unit;
  - ✓ Indigenous cows  $-3,000 \times (50/3) = 50,000$  litres/day.
  - ✓ Shoats  $-1000 \times (50/15) = 3,340$  litres/day.
  - ✓
  - ✓ Hence total water demand per livestock unit is;  $=50,000$  litres/day +  $3,340$  litres/day  $=53,334$  litres/day
  - ✓ Total water demand per month  $-53,334$  litre/day  $\times 30$  days =  $1,600,020$  litres per month =  $1,600$ m<sup>3</sup>/ month
  - ✓

##### ❖ Human water demand

- Human population  $-2,000 \times (50) = 100,000$  litres/ day
- Total water demand for human per month  $=3,000$  m<sup>3</sup>/ month
- Total  $-1,600 + 3,000 = 4,600$  m<sup>3</sup>/ month

##### ❖ Total pan volume = 30,000m<sup>3</sup>

- To determine the number of months in which water will be stored in the pan;
  - $=30,000\text{m}^3/4,600\text{m}^3/\text{month}$
  - $=6.5$  months
  - Say 6 months due to evaporation losses

### 3.4.2 Design period.

The design period is 25 yrs with regular maintenance.

### 3.4.3 Irrigation/ water application

The water will be used mainly for drip irrigation of horticultural small plots through a pressurized system by a peddle pump or even bucket irrigation system. Irrigation water will be managed by the

Ufunguo Women SHG. The duration and frequency of water supply and application will depend on the crop type, stage of growth, soil type, irrigation run, slope and sprinkler type. During low water levels of the pan i.e. dry seasons, rotation method of application will be used.

#### 3.4.4 Drainage for irrigation water

Apart from the valley where the catchment forms, the gradient range in the project area is averagely 4-10%. Since the soils have a good percentage of sand, it is expected that drainage of excess irrigation water in the project area will not be a challenge as there will be deep percolation without damaging the root system of the crops to be planted for demonstration purposes. Drip irrigation system which is expensive to install, is expected to take center stage in farms irrigated by this water than any other system.

#### 3.4.5 Crop analysis

Implementation of the project will enable farmers to grow horticultural crops such as kales, black night shade, amaranths,(and other traditional high value vegetables) chilies, onions, tomatoes, cabbages and a variety of other horticultural produce. With availability of enough water, farmers may also be able to irrigate some field crops like maize, beans, green grams, and cowpeas.



The County Social Services Coordinator Mr. Mwadime conducting a focus group discussion on Social issues



Madam Wanjiku(ESSO) in a focus group discussion on livelihoods and project design



The ESIA Lead Expert Mr. Ngati addressing beneficiaries in the initial baraza before a focused



The ESIA Lead Expert Mr. Ngati leading a focused group discussion on environmental impacts

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## **CHAPTER FOUR**

### **4.0 PROJECT DESCRIPTION**

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#### **4.1 NATURE, DESIGN AND DESCRIPTION OF THE PROJECT**

The project will mechanically excavate 30,000m<sup>3</sup> water pan. The project involves expanding and renovating an already existing smaller and dilapidated water pan called Ufunguo water pan. The pan will be recharged by road runoff water from Bughuta trading center-Mwagwede village road. This road empties its side drain water into various adjacent farms for a length of about 2.5km. Once full the spillway will direct the discharge back to the side drain.

The main use of the water harnessed will be for domestic water consumption. A water drawing-off point will be constructed complete with taps at the point where the community will collect water in containers. A water trough for use by livestock will be constructed outside the pan area. This will provide a ready and convenient watering point for the animals. Sanitation blocks will be constructed to address water hygiene issues like water related diseases i.e. diarrhoea and cholera brought about by contamination by fecal matter. The pan excavation is expected to last for 1 month.

#### **4.2 SITTING/POSITIONING OF THE PAN**

- The pan will be located at an 8acre community land handed to Ufungu Women SHG that is located in Mwagwede village, Bughuta Sub location, Kasigau ward of Voi Sub-County.
- It will be a suitable site because it is in a depression where there already exists a small pan called Ufunguo water pan.
- Water is from the road run-off of Bughuta trading center-Mwagwede village road that gets into the site through an inlet that also is designed as a spill way. The fairly far surrounding side of the pan on the upper side is some small undulating Kasigau hills.
- The pan will be about 7 km from the nearest Bughuta market, and about 12 kms from the ward headquarters in Rukanga center.

#### **4.3 MAJOR PROJECT PARTS**

- The possible pan capacity will be 30,000m<sup>3</sup>.
- Inlet from the Bughuta trading center-Mwagwede village road that flows into the site to harvest water from, that stretches for about 2km from the upper side of the catchment.
- 1 silt trap will be constructed along the intake.
- The spill way which is also the inlet will empty the pan overflow back to the road side drain.
- There will be a cattle trough constructed on the lower side adjacent to the water pan some 10 meters away that livestock will access it through a cleared path into it.
- A domestic water drawing point will also be constructed by the side of the pan.

#### **4.4 DESCRIPTION OF CONSTRUCTION WORKS**

Excavation works will be done under the supervision of the Department of Water, Department of Agriculture, and Department Livestock who will ensure the following;-

- Procurement of standard materials and tools from approved suppliers and dealers for excavation and construction purposes.

- Site preparation i.e. site identification, survey and layout. Clearing of pan, spillway, and inlet area of bushes and trees.
- Excavation and transportation of soil using mechanical equipments and manual labor (to create jobs and reduce negative impacts including excessive noise and dust) as per the design of the pan. Excavated soil will be deposited as a dyke at specified distance round the pan to form a barrier against runoff water intruding into the pan from the non designated points. It will also act as a barrier against traffic by humans (especially school children) and animals.
- Fencing of the pan to control traffic and general access to it.
- Construction of the inlet and spillway to the pan.
- Construction of the cattle trough and domestic water drawing point.
- Landscaping works around the pan to rehabilitate the site to a good aesthetic value.
- Completion of construction.

#### **4.4.1 Excavation**

The project will mechanically excavate 30,000m<sup>3</sup> water pan. External dimensions 157.5m by 77.5m and depth 3m. Internal dimensions will be 142.5 by 62.5m and side slopes of gradient 1: 2.5. The pan will cover an area of 2acres with a depth of about 4m. The excavation and scooping of the soil will be done mechanically by a crawler. The contractor will use hand tools for simple works like moving small amounts of soil where the machine cannot reach, removal of roots to avoid decomposing and creating holes in the pan walls. The activity is expected to generate a lot of dust.

#### **4.4.2 Free Board**

There will be placement of 0.5m high free board to ensure no over topping on the edges of the water pan during recharge. The height is adequate to prevent overtopping during flood discharge and from waves.

#### **4.4.3 Intake and Spillway Channel**

An intake channel will also be the spill way designed to return water to the road side drain when the pan water has reached the maximum height at the lower point of the free board point. The intake channel will be about 30m long by about 2m wide and will be graded at not more than 0.4%. To avoid scoring the walls of the channel by the velocity of the water, the walls and the floor of the channel will be constructed minimum 200mm thick stone pitching jointed in 1:3 c/s mortar

#### **4.4.4 Silt Trap**

One of the major challenges in the maintenance of a water pan is siltation. 1 silt trap of dimensions 10m x 10m x 2m will be installed at the water intake channel to limit dam siltation and hence give the water pan longer life. This will provide for easy cleaning when and if the need arise. The walls and the floor of the silt trap will be also be constructed minimum 200mm thick stone pitching jointed in 1:3 c/s mortar

#### **4.4.5 Draw off System- For Domestic Water Use**

The main use for the pan will be for domestic water use to solve the problem of the community traveling over 10kms in searching for water during dry season. The design for the draw off system involve a standard intake tower perforated 4" GI pipes with mesh wire screens 3m high using concrete mix 1:2:4 (cement, sand, ballast) providing a dead storage of 0.5m in the pipe. There will be a connection to intake tower with 25m of 4" pipes including fittings for draw off system at downstream end from intake tower to off-take chamber. Some excavation will be undertaken so as to construct a lockable off-take chamber with internal dimensions 1m x 1m x 4m. To draw water from the off-take chamber, 2 manual hand pumps of reliable quality will be installed for drawing water from the off-take chamber

#### **4.4.6 Livestock Water Trough**

Animals in the community drink water off from the pan by directly entering into the pan hole. To correct this, a livestock trough will be constructed that will receive water from the off-take chamber. A 50m long cattle water trough will be constructed in mass concrete 1:2:4 with riprap surround. One inlet system with regulator will be used to allow water into the trough.

#### **4.4.7 Abolition Structure**

At the pan site, a 3 door abolition structure with 2 latrine and 1 bathroom will be constructed to attend to hygiene issues

#### **4.4.8 Fencing**

It is expected that the proponent will have budgeted for this activity. There is risk of humans and particularly children getting access and playing in the water pan or animals wander into the pan in search for drinking water directly from the water pan. If it is left unprotected, this could lead to some of them drowning. Therefore, the pan will be fenced-off using 4 strand galvanized barbed wired with 14 gauge chain link fencing, erected on 2.1m treated posts of minimum 0.15m diameter. These posts will be spaced at 3m centers mortised in 0.6m deep mass concrete surround. A steel gate will be erected strategically to access the inside of the pan.

### **4.5 INPUTS**

#### **a) Capital**

It is assumed that the proponent has set aside adequate finances to enable timely implementation of the project. The estimated cost of the project is KSHS.15,741,218, with an addition 10% of the total cost to be contributed by the County Government of Taita Taveta.

#### **b) Tools and equipments**

The proponent is expected to tender for construction from the public through an open tender. The contractor who will win the tender is thus expected to provide all the machines (crawler) and tools like machete, spades etc during construction.

**c) Labor**

All the technical labor (plant operators) is expected to be provided by the contractor. In case of a need for manual work like bush clearing, the contractor is expected to provide for through employment of casual laborers.

**d) Construction raw materials**

These include soil, cement, stones, crushed rock (gravel), et al. all these materials will be obtained from authorized dealers(if not naturally available from the site) and in particular, those that have complied with Environmental Management guidelines and practices. These materials will be used singly or in combination.

**e) Water**

Moderate volumes of water will be required in constructing the silt traps, pan water inlet reception point, cattle trough and domestic water access point using concrete. It will be sourced from the nearby water source without constraining the supply.

## CHAPTER 5

### 5.0 SCOPING OF POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

#### 5.1 SCOPING MATRIX

**Table 1: Scoping Matrix for Potential Environmental Impacts**

Parameters	Components	Construction Phase		Decommissioning/ Transitional Phase (Operation and Maintenance)	
		Positive	Negative	Positive	Negative
<b>Atmosphere</b>	Dust and atmospheric status		X		
<b>Land</b>	Vegetation cover/ Biodiversity		X		
	Catchment			X	
	Human and animal road traffic and infrastructure				X
<b>Water</b>	Water course		X		
	Source of water for the community			X	
	Surface water destruction control			X	
<b>Aesthetic environment</b>	Aesthetic/visual intrusion			X	
<b>Public health and dangers</b>	Water borne diseases				X
	Drowning				X
	Waste disposal and contamination by agricultural chemicals and fertilizers				X
	Water borne diseases i.e. typhoid and diarrhea			X	
	Water borne disease- malaria and amoebiosis				X
	Noise pollution		X		
<b>Social-Economic</b>	Livestock crop conflict				X
	Agricultural development and crop and animal production			X	
	Asset/land ownership conflict				X
	Nutritional status			X	
	Farming skill			X	
	Employment status, Household incomes			X	
	Literacy levels			X	
	Communal leaving and cross cultural relations,			X	
	Water related conflicts			X	
	Vulnerable groups,			X	
	Local trade and industry.			X	
	Rural morality				X
	Social diseases i.e. HIV/AIDs				X
	Outsiders/strangers accessing the pan				X



## **5.2 SCOPING RESULTS**

The following are summary of identified environment and social aspects of on which the project could have significant impacts.

### **5.2.1 Potential Positive Impacts**

#### **A. During Construction**

- 1) Employment opportunities,
- 2) Surface water destruction control- erosion

#### **B. During Operations**

- 1) Reliable source of domestic, livestock and agriculture water for the community,
- 2) Catchment protection and conservation of environment,
- 3) Crop production and food security improvement,
- 4) Nutritional status improvement,
- 5) Water borne diseases i.e. typhoid and diarrhea reduction,
- 6) Employment opportunities,
- 7) Household incomes increased,
- 8) Literacy levels improvement,
- 9) Communal leaving and cross cultural relations,
- 10) Water related conflicts reduction,
- 11) Vulnerable groups inclusion,
- 12) Local trade and industry boost.
- 13) Micro climate modification

### **5.2.2 Potential Negative Impacts**

#### **A. During Construction**

- 1) Dust emission
- 2) Vibration and noise pollution
- 3) Vegetation cover and biodiversity loss
- 4) Natural water course deviation
- 5) Accidents during construction
- 6) Ownership conflict
- 7) Soil and water contamination by waste/chemicals/oils

#### **B. During Operations**

- 1) Water borne disease- malaria and amoebiosis
- 2) Soil and water contamination by waste/chemical/fertilizer
- 3) Danger of drowning
- 4) Livestock/ crop conflict
- 5) Rural morality decay
- 6) Social diseases i.e. HIV/AIDs increase
- 7) Outsiders/strangers accessing the pan

- 8) Increase on human and animal road traffic
- 9) Pressure on local infrastructure
- 10) Structural failure

### **5.2.3 Mitigation Measures**

#### **A. During Construction**

- 1) Acquiring/signing all necessary legal documents with the community and the relevant authorities.
- 2) Community awareness of the project
- 3) Establishment of project management committee
- 4) Occupational Safety and Health Administration (OSHA)
- 5) Establishment of a materials storage to avoid accidental spills and littering
- 6) Minimal destruction of vegetation (especially indigenous) and habitats for fauna.
- 7) Solid waste management i.e. stones and debris
- 8) Waste water management i.e. discharge of construction water
- 9) Erosion control
- 10) Control of noise and air pollution
- 11) Sanitation during construction and building of the abolition blocks at safe distance from the pan
- 12) Site restoration
- 13) Environmental emergency procedures
- 14) Spillway to ensure that water flows back to its original course

#### **B. During Operations**

- 1) Establishment of crop demonstration plots
- 2) Establishment of a tree nursery
- 3) Planting of trees
- 4) Erosion control
- 5) Management of the irrigation water
- 6) Community sensitization and awareness creation.
- 7) Installation of environmental friendly technologies
- 8) Establish a pan management committee.
- 9) Sanitation during construction and building of the abolition blocks at safe distance from the pan
- 10) Fencing off the water pan
- 11) Monitoring and maintenance plan

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## **CHAPTER 6**

### **6.0 ANALYSIS OF ANTICIPATED IMPACTS**

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#### **6.1 ANALYSIS OF POTENTIAL NEGATIVE IMPACTS**

##### **6.1.1 Dust Pollution**

During the excavation of the pan and the subsequent spreading and compaction of the soil, a lot of dust will be raised. The dust will be a hazard to those who will be working in the pan and those in proximity of the project area. Dust masks to workers at the pan should be provided. They should also sprinkle water on the soil during the spreading and compaction to reduce the amount of dust generated. Dust screens can be put up around the pan area.

##### **6.1.2 Vibration and Noise Pollution**

Noise is a major negative impact during any construction activity due to its nuisance and difficulty in mitigating. In this project noise will emanate from use of machinery and vehicles. The National Environmental Management Authority (NEMA) standard for noise emissions from construction equipment prohibits vibration exceeding 0.5cm/sec beyond and source property boundary or 30m from any moving source. The maximum noise level permitted (Leq) as measured from within the construction facility is 75dBA for day and 65dBA for night. The accepted range of noise that a normal human being can withstand is gauged at 80dBA. This impact is moderately high during construction. However, the contractor can mitigate this through ensuring regular and continuous use of well maintained equipment and machinery that produces noise of accepted range. Workers should practice Occupational Safety and Health Administration (OSHA) by wearing ear plugs in cases of operating machines producing sound beyond the Leq limits i.e. hard rock drilling. He should also restrict noisy construction activities within 8am-5pm. He should also inform the community of this impact and request of their tolerance well before working hours. Engines should be shut off when not in operational and avoid unnecessary hooting.

##### **6.1.3 Vegetative Cover and Biodiversity Loss**

During the construction of the water pan an area equivalent to 2 acre will be cleared off vegetation to pave way for water pan and the demonstration plots. This however will have minimal negative impact on biodiversity as there are no established endangered plant species in the project area that are unique to the site. However, in general the cleared trees, bushes and grasses will contribute to loss in vegetation cover. There could be some species of fauna such as minute insects or fauna i.e. grasses or small plants that contribute to the total biodiversity mix. The contractor should avoid as much as possible unnecessary cutting down trees and clearing bushes to preserve habitats to fauna and vegetation cover. The cleared trees and bushes can be recycled into construction of a tree nursery structures such as nursery beds and shades. In the same vein, the project should contribute to improvement of vegetation cover in the adjacent areas and farms by establishing a tree nursery and promoting agro-forestry. The project should endeavor to establish trees that are tolerant to the local conditions and other indigenous species. The pan management committee in this case Ufunguo Women SHG will be trained on tree establishment and management of the trees on the farms and on the catchment to ensure their survival after transplanting. There is also a community training

component within the project that will improve farmers' skills. A buffer zone can be established around the pan planted with grasses and trees.

#### **6.1.4 Habitat Loss**

Trees, bushes, grass, soil structure are home to flora and fauna of different species. Clearing of bushes and excavation of soil during construction may expose fauna such as termites and earth worms that build their homes in the soil. The contractor should therefore avoid unnecessary clearing of trees and bushes and excavation of areas that construction won't take place. He should strive to restore the site after construction to give room for animals to re-establish their habitats.

#### **6.1.5 Water Borne Disease**

The water body created will act as a breeding ground for mosquitoes which are the vectors of malaria. For any household near the pan i.e. at radius of 2km, it is prudent to make sure that they do not get infected by the disease. This is by putting up mitigation measures such as creating awareness and campaigns on malaria prevention and provision of mosquito nets. The Public Health Department through the Bughuta dispensary should take measures of enhanced provision of free mosquito nets to the community and other measures towards control of malaria. The other potential disease is amoebiasis as there is a likelihood of the community using the water for domestic and drinking purposes. The community should be sensitized on water treatments e.g. boiling it to reduce risk of infection. The proponent should also consider Introduction of mosquito larvae eating fish species

#### **6.1.6 Natural Water Course Deviation**

The project entails harvesting road run-off from during the rainy season for a length of about 25km. This will however, capture a very small percentage of the total run-off and hence will have little impact for farmers further down the slope. In fact, during the field study, farmers in the vicinity of the water pan site which is on a lower point than the rest of the surrounding farms, attested to avoiding the water flowing into their farms as it was too much and destructive to their crops. It is therefore obligatory to have in place a proper outflow mechanism (spillway) to ensure the overflow water is returned to the original course so that the discharge does not cause soil erosion in the adjacent areas. A proposal can also be put forth to the adjacent farm on the lower side of the pan that they construct retention ditches to receive water from the pan spill way since this water will come out of the pan controlled, it can assist in further irrigating their farms.

#### **6.1.7 Soil and Water Contamination by Waste/Chemical/Fertilizer**

At construction stage, machinery and plant may have leakages which result to oil and fuel spills either accidentally or even out of maintenance negligence. Soil contamination may also emanate from poorly disposed chemical containers and unmanaged waste receptacles. Contaminated soil cannot be used for crop production. Fertilizer, manure and chemical residues from the increased agricultural activities and feed lots around the pan are also point and non point sources of pollution to land and water. During wet season rain water may leach down into ground water while on the other hand surface flow may carry these contaminants into bodies of water. Eutrophication and contaminated water related diseases like lead poisoning and blue babies may occur. The contractor will mitigate by proper disposal of chemical containers and proper maintenance of machinery and plant. The site engineer should identify the specific location for disposing the contaminated soil, prompt site

clearance, avoid stock piling at the site, and monitor areas of exposed soil especially during wet season. Soil from the excavation can be used to construct the embankment and the rest used for landscaping. On the other hand, farmers through agricultural extension officers should be trained on safe use of chemicals and pesticides, plant nutrition, Integrated Pest Management (IPM), Integrated Fertilizer Management (IFM) and soil and water conservation. The Department of Physical planning can consider securing a managed damp site. Crop demonstration site should be established so as to train farmers on Good Agricultural Practices (GAP), Integrated Fertilizer Management (IFM) and safe use of pesticides and chemicals.

#### **6.1.8 Accidents During Construction**

During the construction phase, due to workers use and operation of machinery/plant and interaction between workers and materials and normal movement of the staff and materials etc, accidents are bound to happen. The site Engineer should design and practice Occupational Safety and Health Administration (OSHA). All workers should adhere to this plan to the later. All workers on site should wear protective gear like safety helmet, gloves, safety boots, reflector jackets etc. In case of any accident type of an accidents, proper procedure for each case i.e. first aid procedures should be followed to save lives and avoid further recurrence of such accidents.

#### **6.1.9 Danger of Drowning**

This is a real hazard associated with the pan. Children are the most vulnerable to drowning if they resort to drawing water directly from the pan or go. The proponent has to undertake fencing off the water pan to mitigate this hazard. A strategic gate will be located and kept under lock and key by the pan management committee for access into the pan during maintenance. Water should piped out from the draw of tower to a watering point where the farmers can access the water instead of drawing it directly from the pan. This also applies to livestock who are expected to consume water from a constructed water trough. Before construction of the pan, animals used to go into the pan from any side and destruct the pan walls through trampling and soil erosion and further endangering them to drown. The same case applies to community members in accessing domestic water from the pan. A fence will mitigate this impact.

#### **6.1.10 Livestock Crop Conflict**

The Magwede community has fairly diverse types of livestock ranging from cows, sheeps, goats and donkeys. It is therefore possible for animals left un-attended to stray into farmer's plots and damage or graze on the crops. This may generate conflicts between livestock herders and crop farmers. To avoid this conflict, proper animal routes into the pan area and correct placement of the livestock water trough beside the pan is crucial. Grazing/browsing of livestock around the pan area should be avoided. The livestock department should promote environmental technologies i.e. zero grazing. The area chief assistance should be sought in enforcing and solving these conflicts. The crop demonstration plots should also be fenced.

#### **6.1.11 Asset Ownership Conflict**

Due to the land being public one, while the community at large will be expected to access and use the water pan, a conflict may also arise on the use of this resource. The proponent should spearhead a signing of a memorandum of understanding between Ufunguo Women SHG and the community

where the local leaders can declare the project as a communal project run by Ufunguo Women SHG and giving access rights to other water users without bias or discrimination. A project management committee should be established to oversee the development of the project during construction phase on behalf of the community. The committee will cease to exist after the pan has been handed to the women group to manage it. The women group is expected to charge a very small agreed fee for the pan maintenance. The memorandum should be witnessed by the local administration.

#### **6.1.12 Increase on Human & Animal Road Traffic- Pressure on Local Infrastructure**

The rehabilitation of the pan will attract people coming from outside the community to utilize the water, especially during the dry season. More people will come from a larger radius beyond Bughuta Sub-location which arid to access water for domestic use and livestock drinking water. As a result more people will be accessing infrastructure facilities like roads, toilets, dispensaries, etc than the designed capacity putting pressure on such infrastructure facilities. In particular roads will undergo a faster degradation than before the implementation of the project due to the increase in the number of animals using it. This can be mitigated by the proponent in collaboration with the Chiefs and local leaders to informing and educate the community towards embracing these new members of the community. Departments of infrastructure especially the Roads Department should expand narrow roads and paths linked to the pan site. Further, a shorter time for routine maintenance of roads should be put in place.

#### **6.1.13 Rural Morality Decay and Social Diseases**

It is expected that the project will stir-up the local economy and thus attract people from different communities or tribes to come do business, trade or even settle in Mwagwede village. The village may very fast upgrade to a trading center. Along with this will come different cultures and other trades like prostitution that may degrade the social morality of the community. Social diseases like HIV/AIDs, gonorrhoea and syphilis are expected to be on the rise. Public Health department should consider stepping up comprehensive health awareness campaigns. Health facilities to be equipped with drugs and measures against these diseases i.e. distribution of condoms and stocking of ARVs and antibiotics.

#### **6. 1.14 Structural failure**

The pan should be surveyed and designed correctly by the irrigation engineer to the required standards. The contractor is expected to construct the pan according to the engineering designs and specifications and follow this to the later without compromising on materials used or structural design. There should be a monitoring and maintenance plan to be implemented during the lifetime of the pan. The pan management committee should be briefed about it and should include an engineer or a technical person as part of the routine monitoring and maintenance activity

### **6.2 ANALYSIS OF POSITIVE ENVIRONMENTAL IMPACTS**

#### **6.2.1 Reliable Source of Domestic, Livestock and Agriculture Water**

Water is one of the most limiting resources in the area. The pan will provide a readily available and convenient source of water both for crop production, livestock production and domestic use. The proposed water trough for livestock will give an alternative watering point and hence the animals will not be going all the way down to the river or other seasonal sources.

### **6.2.2 Catchment Protection and Conservation of Environment**

To reduce siltation of the water pan the proponent is expected to introduce a water catchment protection around the pan. This is an environmental conservation component. The proponent should mobilize the farmers to plant trees raised in the nursery on their farms and around the water pan to increase vegetation cover and reduce soil erosion. The trees in the nursery should include indigenous varieties that can withstand the climatic conditions of the project area. The catchment will improve the scenery and the natural beauty of the project area.

### **6.2.3 Surface Water Destruction Control**

By harnessing the road run-off, the project will have reduced the amount of water hence hydro energy building down the road and the catchment at large. As a result, less destruction from this water in terms of erosion, plucking or felling trees and creation of gullies

### **6.2.4 Crop Production and Food Security Improvement**

One of the main goals of constructing the pan is harnessing water for crop production. Mwangwe village is in a semi-arid region whose crop production is rain fed. However, the annual rainfall is very low- less than 500mm. Clearly water is major constraint in crop production. The water harnessed will supplement the low amounts of rainfall. It is expected to impact positively on crop production hence food security. The proposed demonstration plots are supposed to train farmers to improve their production

### **6.2.5 Nutritional Status Improvement**

The component on introduction and growing of horticultural crops with availability of water for crop production in the area will go a long way in improving the diet and hence the nutritional status of the community. Vegetables and fruits are in short supply in the area and have to be sourced from far away. The project will enhance local supply and availability of the same.

### **6.2.6 Water Borne Diseases i.e. Typhoid, Cholera and Diarrhea Reduction**

Some water diseases like typhoid, amoboeasis, cholera and diarrhea are related to low availability of amounts of water in the community i.e. low sanitation levels. This is may be due to things like utensils, raw consumed foods like fruits and salads that are not cleaned well before consumption. The project will make available enough water to improve sanitation levels in the village.

### **6.2.7 Employment Opportunities**

During construction phase of the project, there will be required skilled and unskilled workers who are expected to be sourced locally. Further, the pan is expected to expand economic activities in the area such as increase in the size of land under cultivation, creation of middlemen to trade the agricultural produce, transporters of produce to the markets etc. Important is the creation of self employment through enhanced agricultural activities around the pan. Employment during construction should consider the youth, women and the vulnerable groups

### **6.2.8 Household Incomes Increased**

With the increase of trade and commerce around the pan as indicated above, profits emanating from the business created will go a long way in increasing the incomes of the household of Mwagwede village. New types of business are expected to be created along value chains of crops to be grown especially in the horticulture sector.

### **6.2.9 Literacy Levels Improvement**

One of the biggest challenges in the area is low levels of literacy. The social impact survey done during ESIA scoping exercise reveal that low incomes from their economic livelihood activities i.e. subsistence farming and free range livestock keeping has contributed to inability to send their children to school. Dynamically, some of the children do not go to school just to attend to household chores on the part of the girl child while tending to animals on the part of the boy child. With the expected increase in household incomes from improved agricultural and livestock keeping activities, parents will be able to afford school uniform, shoes, transport means, lunch etc to send their children to school. One of the activities expected to be part of the project is the sensitization aspects on different topics and areas i.e. public health, agriculture and commerce. This is also part of upgrading the community education on social economic matters.

### **6.2.10 Communal Living and Cross Cultural Relations,**

Sharing of a big, essential and common resource like a water pan by over 2,000 will improve their social bond. Just 20km away is the cosmopolitan and commercial Maungu township with Taita, Borana, Samburu, Kambas and other tribes living in harmony. Mwagwede village is mainly composed of the Aduruma people. Business men and general public from Maungu are bound to come knocking doors in the business created in Mwagwede as a result of the pan construction. Bughuta Sub location is a livestock zone whose animals are raised in a free range. Thus there will be a cross cultural relation of people in the village and will automatically live communally for these commerce to thrive.

### **6.2.11 Water Related Conflicts Reduction**

There have been very few reported serious cases of water related conflicts in the village. However, it is reported during the scoping stage that there has been growing tension over the number of livestock drinking directly into the pan that may develop into water related conflict. Some herders bring into the pan large number of livestock that compete with the human water/domestic water demand and further dirtying the water with animal droppings. It may develop into farmers against livestock conflict of the scarce water that is familiar in the Tana River region. During dry season, the Mwagwede community goes sourcing water from the Makokoro dam and domestic water points at the foothills of the Kasigau hills. However, according to the community, sometimes taps in these points are intentionally closed in spite of the plight they are facing back at their villages. They therefore have to resort to begging them to open the taps for them to collect water for drinking, which they feel is a bit demeaning. The pan is expected to improve quantities of water in the village and at least ease such tension.



### **6.2.12 Vulnerable Groups Inclusion**

The Ufungo Women SHG and the community can resort in allocating some resources or running of small projects like tree nursery to vulnerable groups like the old and disable. Improved livelihood in the community will allow it leave in harmony with isolated groups like the Waathe people who live beyond Bughuta since there may be enough for them to share. Further, sensitization on gender equity by proponents and other change argents will be a clarion to inclusion of the vulnerable groups into the social day to day activities in the community.

### **6.2.13 Local Trade and Industry Boost.**

The pan is expected to boost both agricultural and livestock business. Excess products from these industries are expected to feature in both the local and regional markets. As a result, trading in the area is expected to be boosted.

### **6.2.14 Micro climate modification**

From the existence of a large water body in the area, amount of water evaporated into the atmosphere will increase the relative humidity especially considering the high average temperatures (32oC) of the area. Part of the pan impacts is promoting increase in vegetation cover through tree planting. Therefore the area around the pan will become humid with average temperatures slightly lower than areas far from the pan to the advantage of the surrounding vegetation.

## CHAPTER 7

### 7.0 RELATING IMPACT TO MITIGATION MEASURES

**Table 2: Relating Impacts to Mitigation Measures**

Project Phase	Positive Impacts	Activities	Negative impacts	Mitigating measures of negative impacts
<b>Construction Phase</b>	1) Employment opportunities 2) Surface water destruction control- erosion	Site clearing	1) Vegetation cover and biodiversity loss 2) Habitat loss 3) Dust emission 4) Accidents during construction	1) Minimal destruction of vegetation (especially indigenous) and habitats for fauna i.e. termite mounds. 2) Cut trees for tree nursery construction 3) Establishment of a tree nursery 4) Provision of dust masks to workers 5) Sprinkling of water and compaction dusty spots 6) Dust screen around the pan 7) Community training on biodiversity conservation 8) Re-vegetate /Vegetative buffer zone around the pan 9) Community awareness the project 10) Occupational Health and Safety Administration (OSHA) i.e. erection of signs, first aid kit, etc 11) Workers to wear protective gear i.e. safety boots, safety helmets, reflector jacket etc 12) Establishment of a materials storage to avoid accidental spills and littering 13) Solid waste management i.e. stones and debris 14) Erosion control 15) Site restoration 16) Environmental emergency procedures
			5) Ownership conflict	1) Acquiring and signing all the necessary legal documents with the community and the relevant authorities. 2) Community awareness of the project 3) Establish project management committee to oversee construction on behalf of the community
			6) Vibration and noise pollution	1) Community awareness of the project 2) Occupational Health and Safety Administration (OSHA) 3) Control of noise and air pollution i.e. avoid unnecessary hooting 4) Workers operating machines or plants for than 8hrs that produce over 80dBA of sound to wear ear muffs 5) Regular inspection of machines and plant 6) Restrict noisy construction activities within 8am-5pm 7) Inform community request of their tolerance

		Removal of topsoil	1) Vibration and noise pollution	<ol style="list-style-type: none"> <li>1) Daytime operation when ambient noise level is high</li> <li>2) Control of noise and air pollution i.e. avoid unnecessary hooting</li> <li>3) Workers operating machines or plants for than 8hrs that produce over 80dBA of sound to wear ear muffs</li> <li>4) Regular inspection of machines and plant</li> <li>5) Restrict noisy construction activities within 8am-5pm</li> <li>6) Inform community request of their tolerance</li> </ol>
			<ol style="list-style-type: none"> <li>2) Vegetation cover and biodiversity loss</li> <li>3) Habitat loss</li> <li>4) Accidents during construction</li> <li>5) Soil and water contamination by waste/chemicals /oils</li> </ol>	<ol style="list-style-type: none"> <li>1) Minimal destruction of vegetation (especially indigenous) and habitats for fauna i.e. termite mounds.</li> <li>2) Cut trees for tree nursery construction</li> <li>3) Establishment of a tree nursery</li> <li>4) Community training on biodiversity conservation</li> <li>5) Re-vegetate /Vegetative buffer zone around the pan</li> <li>6) Community awareness of the project</li> <li>7) Occupational Health and Safety Administration (OSHA) i.e. erection of signs, first aid kit, etc</li> <li>8) Workers to wear protective gear i.e. safety boots, safety helmets, reflector jacket etc</li> <li>9) Establishment of a materials storage to avoid accidental spills and littering</li> <li>10) Solid waste management i.e. stones and debris</li> <li>11) Erosion control</li> <li>12) Site restoration</li> <li>13) Environmental emergency procedures</li> <li>14) Maintenance of machinery and plant.</li> <li>15) Identification of appropriate location for disposing chemicals, their containers and contaminated soil &amp; water.</li> <li>16) Prompt site clearance, avoiding on-site stock piling,</li> <li>17) Monitor exposed soil especially during wet season.</li> </ol>
			6) Dust emission	<ol style="list-style-type: none"> <li>Machines to be well serviced</li> <li>18) Occupational Health and Safety Administration (OSHA)</li> <li>19) Provision of dust masks to workers</li> <li>20) Sprinkling of water and compaction dusty spots</li> <li>21) Dust screen around the pan</li> </ol>
		Excavation of reservoir	1) Vibration and noise pollution	<ol style="list-style-type: none"> <li>1) Control of noise and air pollution i.e. avoid unnecessary hooting</li> <li>2) Workers operating machines or plants for than 8hrs that produce over 80dBA of sound to wear ear muffs</li> <li>3) Regular inspection of machines and plant</li> <li>4) Restrict noisy construction activities within 8am-5pm</li> <li>5) Inform community request of their tolerance</li> </ol>

			<ul style="list-style-type: none"> <li>2) Habitat loss</li> <li>3) Natural water course deviation</li> <li>4) Accidents during construction</li> <li>5) Soil and water contamination by waste/chemicals /oil</li> </ul>	<ul style="list-style-type: none"> <li>22) Minimal destruction of vegetation (especially indigenous) and habitats for fauna i.e. termite mounds.</li> <li>23) Cut trees for tree nursery construction</li> <li>24) Establishment of a tree nursery</li> <li>25) Community training on biodiversity conservation</li> <li>26) Re-vegetate /Vegetative buffer zone around the pan</li> <li>6) Solid waste management i.e. stones and debris</li> <li>7) Erosion control</li> <li>8) Site restoration</li> <li>9) Environmental emergency procedures</li> <li>10) Occupational Health and Safety Administration (OSHA) i.e. erection of signs, first aid kit, etc</li> <li>11) Workers to wear protective gear i.e. safety boots, safety helmets, reflector jacket etc</li> <li>12) Maintenance of machinery and plant.</li> <li>13) Identification of appropriate location for disposing chemicals, their containers and contaminated soil &amp; water.</li> <li>14) Prompt site clearance, avoiding on-site stock piling,</li> <li>15) Monitor exposed soil especially during wet season.</li> </ul> <p>Establishment of a materials storage to avoid accidental spills and littering</p>
			6) Dust emission	<ul style="list-style-type: none"> <li>1) Provision of dust masks to workers</li> <li>2) Sprinkling of water and compaction dusty spots</li> <li>3) Dust screen around the pan</li> </ul>
		Fencing	1) Noise pollution	<ul style="list-style-type: none"> <li>1) Control of noise and air pollution i.e. avoid unnecessary hooting</li> <li>2) Workers operating machines or plants for than 8hrs that produce over 80dBA of sound to wear ear muffs</li> <li>3) Regular inspection of machines and plant</li> <li>4) Restrict noisy construction activities within 8am-5pm</li> <li>5) Inform community request of their tolerance</li> </ul>

			<ul style="list-style-type: none"> <li>2) Habitat loss</li> <li>3) Accidents during construction</li> </ul>	<ul style="list-style-type: none"> <li>1) Minimal destruction of vegetation (especially indigenous) and habitats for fauna i.e. termite mounds.</li> <li>2) Cut trees for tree nursery construction</li> <li>3) Establishment of a tree nursery</li> <li>4) Community training on biodiversity conservation</li> <li>5) Re-vegetate /Vegetative buffer zone around the pan</li> <li>6) Solid waste management i.e. stones and debris</li> <li>7) Waste water management i.e. discharge of construction water</li> <li>8) Erosion control</li> <li>9) Site restoration</li> <li>10) Environmental emergency procedures</li> <li>11) Occupational Health and Safety Administration (OSHA) i.e. erection of signs, first aid kit, etc</li> <li>12) Workers to wear protective gear i.e. safety boots, safety helmets, reflector jacket etc</li> </ul>
		Cattle trough and domestic water draw off	<ul style="list-style-type: none"> <li>1) Dust emission</li> <li>2) Noise</li> <li>3) Accidents during construction</li> </ul>	<ul style="list-style-type: none"> <li>1) Provision of dust masks to workers</li> <li>2) Sprinkling of water and compaction dusty spots</li> <li>3) Dust screen around the pan</li> <li>4) Solid waste management i.e. stones and debris</li> <li>5) Waste water management i.e. discharge of construction water</li> <li>6) Occupational Health and Safety Administration (OSHA) i.e. erection of signs, first aid kit, etc</li> <li>7) Workers to wear protective gear i.e. safety boots, safety helmets, reflector jacket etc</li> </ul>
<b>Operational phase</b>	<ul style="list-style-type: none"> <li>1) Reliable source of domestic, livestock and agriculture water for the community,</li> <li>2) Catchment protection and conservation of environment,</li> <li>3) Crop production and food security improvement,</li> <li>4) Nutritional</li> </ul>	Pan in operation	<ul style="list-style-type: none"> <li>1) Water borne disease- malaria and amoebiosis</li> </ul>	<ul style="list-style-type: none"> <li>1) Community sensitization and awareness creation i.e. water treatment, clearing of bushes around homesteads</li> <li>2) Sanitation during construction and building of the abolition blocks at safe distance from the pan</li> <li>3) Provision of free Insect treated Nets(ITNs)</li> <li>4) Health education</li> <li>5) Introduction of mosquito larvae eating fish species</li> </ul>
			<ul style="list-style-type: none"> <li>2) Soil and water contamination by waste/chemical/ fertilizer</li> </ul>	<ul style="list-style-type: none"> <li>1) Community sensitization and awareness creation.</li> <li>2) Management of the irrigation water</li> <li>3) Establishment of crop demonstration plots</li> <li>4) Establishment of a tree nursery</li> <li>5) Planting of trees</li> <li>6) Erosion control</li> <li>7) Installation of environmental friendly technologies i.e. drip irrigation</li> <li>8) Train on safe use of pesticides and chemicals, Integrated Pest Management (IPM), Integrated Fertilizer Management(IFM), and Soil &amp; Water Conservation(S&amp;WC)</li> </ul>

<p>status improvement, Water bornediseases i.e. typhoid and diarrhea reduction,</p> <p>5) Employment opportunities,</p> <p>6) Household incomes increased,</p> <p>7) Literacy levels improvement,</p> <p>8) Communal leaving and cross cultural relations,</p> <p>9) Water related conflicts reduction,</p> <p>10) Vulnerable groups inclusion,</p> <p>11) Local trade and industry boost.</p> <p>12) Micro climate modification</p>		3) Danger of drowning	<p>1) Community sensitization and awareness creation.</p> <p>2) Fencing off the water pan</p> <p>3) Establish a pan management committee.</p> <p>4) Employ a guard</p> <p>5) Construction of domestic water drawing point and a cattle trough.</p>
		4) Livestock/ crop conflict	<p>1) Community sensitization and awareness creation.</p> <p>2) Animal water trough construction</p> <p>3) Installation of environmental friendly technologies i.e. zero grazing and green houses</p> <p>4) Establish a pan management committee.</p> <p>5) Committee to ensure equitable water distribution</p> <p>6) Operational rules</p> <p>7) Proper animal routes and holding grounds</p> <p>8) Avoid grazing animals around the pan</p> <p>9) Chief, local administration and pan committee enforce rules</p>
		5) Rural morality decay and Social diseases i.e. HIV/AIDs increase	<p>1) Community sensitization and awareness creation on comprehensive health care</p> <p>2) Formal education enrolment campaigns</p> <p>3) Gender mainstreaming campaigns</p> <p>4) Equip local dispensaries with drugs</p> <p>5) Measurers against social diseases i.e. free condoms and ARVs</p>
		6) Outsiders/strangers accessing the pan	<p>6) Community sensitization and awareness creation towards embracing new members of the community</p> <p>7) Establish a pan management committee.</p>
		7) Increase on human and animal road traffic and Pressure on local infrastructure	<p>1) Community sensitization and awareness creation.</p> <p>2) Establish a pan management committee.</p> <p>3) Expand new roads and infrastructure capacity</p> <p>4) Routine maintenance of infrastructure</p>

			8) Structural failure	<ol style="list-style-type: none"> <li>1) Review of pan design by independent panel of experts</li> <li>2) Emergency preparedness plan</li> <li>3) Community sensitization and awareness creation.</li> <li>4) Establish a pan management committee.</li> <li>5) Proper engineering design</li> <li>6) Contractor to abide to engineering design provide quality works</li> <li>7) Proper supervision of the works</li> <li>8) Monitoring and maintenance plan</li> <li>9) Implementation of monitoring and maintenance plan</li> <li>10) Planting of trees</li> <li>11) Erosion control</li> </ol>
			9) Deviated natural water flow	<ol style="list-style-type: none"> <li>1) Spill way designed to return water to its natural flow</li> <li>2) Construction of retention ditches by farms on the lower side of the pan</li> </ol>
<b>Decommissioning stage</b>	The project should have achieved its goal of provision of domestic, agriculture and livestock water to the Mwangwede villagers.	Pan decommissioned	1) Water use conflicts	<ol style="list-style-type: none"> <li>1) Committee to ensure equitable water distribution</li> <li>2) Operational rules</li> </ol>
			2) Excess soil material	<ol style="list-style-type: none"> <li>1) To be used in landscaping at an appropriate site</li> </ol>
			3) Erosion	<ol style="list-style-type: none"> <li>1) Plant grass and trees around the pan area</li> <li>2) Erosion control</li> </ol>

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## **CHAPTER 8**

### **8.0 PROPOSED ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)**

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#### **8.1 Objectives of ESMP**

The narrative in the Environmental and Social Management Plan (ESMP) is to describe all the possible environmental issues that can be associated with the project. It broadly outlines management strategies that will be employed to mitigate potential adverse environmental impacts. Further, it highlights the project's environmental and social constraints. As such, the main objectives of the ESMP are;

1. To outline the mitigating, monitoring, consultative and institutional measures required to prevent, minimize, mitigate or compensate for adverse environmental and social impacts, or enhance the projects beneficial impacts,
2. To make the project comply with the applicable national environmental, social and legal requirements,
3. To address capacity building requirements of the implementing parties to achieve sustainable compliance.



**Table 3: Environmental and Social Management Plan**

Activities	Potential impact	Mitigation measure	Responsibility	Action time frame	Targets to achieve	Monitorable indicator	Estimated Cost
<b>Site Clearing and removal of top soil, fencing,</b>	1) Vegetation cover and biodiversity loss 2) Habitat loss	1) Minimal destruction of vegetation (especially indigenous) and habitats for fauna i.e. termite mounds. 2) Cut trees for tree nursery construction 3) Establishment of a tree nursery 4) Community training on biodiversity conservation 5) Re-vegetate /Vegetative buffer zone around the pan 6) Community awareness the project 7) Establishment of a materials storage to avoid accidental spills and littering 8) Solid waste management i.e. stones and debris 9) Erosion control 10) Site restoration 11) Environmental emergency procedures	Propone nt & farmers representives	During construct ion	<ul style="list-style-type: none"> <li>▪ 1 fruit/forest tree nursery</li> <li>▪ 5,000 tree seedlings in the nursery</li> <li>▪ 2,000 seedlings planted quarterly at least for 5 years.</li> <li>▪ 500 member sensitized</li> <li>▪ 1 material store</li> <li>▪ Environmental emergency plan</li> </ul>	<ul style="list-style-type: none"> <li>▪ No. fruit/forest tree nursery</li> <li>▪ No.r of seedlings raised</li> <li>▪ No. of seedlings transplanted</li> <li>▪ No. of farmers sensitized</li> <li>▪ No. of materials store</li> <li>▪ No. of environmental emergency plan</li> </ul>	In the budget
<b>Site Clearing, removal of top soil and excavation of reservoir, cattle trough and domestic water draw of point construction</b>	Dust emission	1) Provision of dust masks to workers 2) Sprinkling of water and compaction dusty spots 3) Dust screen around the pan	Propone nt & farmers	During construct ion	<ul style="list-style-type: none"> <li>▪ 300 dust masks</li> <li>▪ Damp soil during construction phase</li> <li>▪ Erect dust screens</li> </ul>	<ul style="list-style-type: none"> <li>▪ No of masks distributed</li> <li>▪ Damp soil</li> </ul>	15,000

<b>Site Clearing and removal of top soil and excavation of reservoir, fencing, cattle trough and domestic water draw of point construction</b>	Accidents during construction	<ol style="list-style-type: none"> <li>1) Occupational Health and Safety Administration (OSHA) i.e. erection of signs, first aid kit, etc</li> <li>2) Workers to wear protective gear i.e. safety boots, safety helmets, reflector jacket etc</li> </ol>	Workers and supervising staff	During construction	<ul style="list-style-type: none"> <li>▪ Accidents put to a minimal as possible</li> <li>▪ Implement OSHA</li> </ul>	<ul style="list-style-type: none"> <li>▪ Nol of accidents and nature</li> <li>▪ Workers wearing protective gear.</li> <li>▪ Work time table.</li> <li>▪ Erected guard rails and warning signs</li> <li>▪ Emergency response plan in place</li> </ul>	20,000
<b>Site Clearing</b>	Ownership conflict	<ol style="list-style-type: none"> <li>1) Acquiring and signing all the necessary legal documents with the community and the relevant authorities.</li> <li>2) Community awareness of the project.</li> <li>3) Establish project management committee to oversee construction on behalf of the community</li> </ol>	Propone nt and Pan manage ment committ ee	Impleme ntation & transitio ning phase	<ul style="list-style-type: none"> <li>▪ Acquisition of all relevant ownership documents</li> <li>▪ No public complaint/conflict</li> <li>▪ Pubic sensitized on ownership</li> </ul>	<ul style="list-style-type: none"> <li>▪ All relevant ownership documents</li> <li>▪ No. of complaints from the public</li> <li>▪ No. of community members sensitized</li> </ul>	In the budget

<b>Site Clearing, removal of top soil, Excavation of reservoir, fencing, cattle trough and domestic water draw of point construction</b>	Vibration and noise pollution	<ol style="list-style-type: none"> <li>1) Community awareness of the project</li> <li>2) Occupational Health and Safety Administration (OSHA)</li> <li>3) Control of noise and air pollution i.e. avoid unnecessary hooting</li> <li>4) Workers operating machines or plants for than 8hrs that produce over 80dBA of sound to wear ear muffs</li> <li>5) Regular inspection of machines and plant</li> <li>6) Restrict noisy construction activities within 8am-5pm</li> <li>7) Inform community request of their tolerance</li> </ol>	Workers and supervising staff	During construction	<ul style="list-style-type: none"> <li>▪ Controlled noise and vibration</li> <li>▪ Implementation of OSHA</li> <li>▪ Community awareness of the project</li> </ul>	<ul style="list-style-type: none"> <li>▪ Work time table</li> <li>▪ Idle engines switched off</li> <li>▪ No. of public complaints</li> <li>▪ Use of ear muffs</li> <li>▪ Machine inspection reports</li> </ul>	10,000
<b>Removal of top soil and Excavation of reservoir</b>	Soil and water contamination by waste/chemicals/oils	<ol style="list-style-type: none"> <li>1) Maintenance of machinery and plant.</li> <li>2) Identification of appropriate location for disposing chemicals, their containers and contaminated soil &amp; water.</li> <li>3) Prompt site clearance, avoiding on-site stock piling,</li> <li>4) Monitor exposed soil especially during wet season.</li> </ol>	Workers and supervising staff	During construction	<ul style="list-style-type: none"> <li>▪ Reduced soil and water contamination</li> <li>▪ Proper disposal of contaminated soil and water</li> </ul>	<ul style="list-style-type: none"> <li>▪ Report on no., amount/size/area and serverity of contamination</li> <li>▪ Disposal sites</li> </ul>	15,000

<b>Pan operation</b>	Water borne disease- malaria and amoebiosis	<ol style="list-style-type: none"> <li>1) Community sensitization and awareness creation i.e. water treatment, clearing of bushes around homesteads</li> <li>2) Sanitation during construction and building of the abolition blocks at safe distance from the pan</li> <li>3) Provision of free Insecticide Treated Nets(ITNs)</li> <li>4) Health education</li> <li>5) Introduction of mosquito larvae eating fish species</li> </ol>	Propone nt and Public Health departm ent, Pan manage ment committ ee	Within 1 <sup>st</sup> month of pan use	<ul style="list-style-type: none"> <li>▪ Reduced water borne diseases</li> <li>▪ 500 community members sensitized</li> <li>▪ Sanitation blocks constructed</li> <li>▪ ITNs distributed</li> <li>▪ Mosquito larvae eating fish introduced into the pan</li> </ul>	<ul style="list-style-type: none"> <li>▪ Disease prevalence reports</li> <li>▪ No. of beneficiaries capacity built</li> <li>▪ Sanitation blocks</li> <li>▪ No. of ITNs distributed</li> </ul>	30,000
<b>Pan operation</b>	Soil and water contamination by waste/chemical /fertilizer	<ol style="list-style-type: none"> <li>1) Community sensitization and awareness creation.</li> <li>2) Management of the irrigation water</li> <li>3) Establishment of crop demonstration plots</li> <li>4) Establishment of a tree nursery</li> <li>5) Planting of trees</li> <li>6) Erosion control</li> <li>7) Installation of environmental friendly technologies i.e. drip irrigation</li> <li>8) Train on safe use of pesticides and chemicals, Integrated Pest Management (IPM), Integrated Fertilizer Management(IFM), and Soil &amp; Water Conservation(S&amp;WC)</li> </ol>	Propone nt and Departm ent of Agricultu re, Pan manage ment committ ee	Through out the pan operatio n	<ul style="list-style-type: none"> <li>▪ 200 farmers sensitized</li> <li>▪ Farmers trained on Good Agricultural Practices</li> <li>▪ Increased tree cover</li> <li>▪ Farmers trained and install environmental friendly technologies</li> <li>▪ Reduced chemicals and fertilizers contaminating soil and water</li> </ul>	<ul style="list-style-type: none"> <li>➤ No. of farmers trained</li> <li>➤ Adaptation of environmental friendly technologies</li> <li>➤ Water and soil tests</li> </ul>	20,000

<b>Pan operation</b>	Danger of drowning	<ol style="list-style-type: none"> <li>1) Community sensitization and awareness creation.</li> <li>2) Fencing off the water pan</li> <li>3) Establish a pan management committee.</li> <li>4) Employ a guard</li> <li>5) Construction of domestic water drawing point and a cattle trough.</li> </ol>	Propone nt and Farmers	On completi on of excavati on	<ul style="list-style-type: none"> <li>▪ Protect the vulnerable(people/livestock)</li> <li>▪ No deaths</li> </ul>	<ul style="list-style-type: none"> <li>▪ Fence in place</li> <li>▪ Guard in place</li> <li>▪ Water trough and domestic water drawing point constructed</li> </ul>	In the budget
<b>Pan operation</b>	Livestock/ crop conflict	<ol style="list-style-type: none"> <li>1) Community sensitization and awareness creation.</li> <li>2) Animal water trough construction</li> <li>3) Installation of environmental friendly technologies i.e. zero grazing and green houses</li> <li>4) Establish a pan management committee.</li> <li>5) Committee to ensure equitable water distribution</li> <li>6) Operational rules</li> <li>7) Proper animal routes and holding grounds</li> <li>8) Avoid grazing animals around the pan</li> <li>9) Chief, local administration and pan committee enforce rules</li> </ol>	Propone nt, Departm ents of Agriculture and Livestock .	Through out Impleme ntation	<ul style="list-style-type: none"> <li>▪ Reduced herders/farmer conflict</li> <li>▪ Reduction of crop damage cases</li> </ul>	<ul style="list-style-type: none"> <li>▪ Community sensitization reports</li> <li>▪ Adaptation of environment friendly technologies</li> <li>▪ Enforcement of pan use rules</li> <li>▪ Fence in place</li> </ul>	15,000
<b>Pan operation</b>	Rural morality decay and Social diseases i.e. HIV/AIDs increase	<ol style="list-style-type: none"> <li>1) Community sensitization and awareness creation on comprehensive health care</li> <li>2) Formal education enrolment campaigns</li> <li>3) Gender mainstreaming campaigns</li> <li>4) Equip local dispensaries with drugs</li> <li>5) Measurers against social diseases i.e. free condoms and ARVs</li> </ol>	Propone nt and Social Services Departm ent , Public health departm ent	Through out Impleme ntation	<ul style="list-style-type: none"> <li>▪ Reduced social diseases</li> <li>▪ Reduced immorality in the community</li> </ul>	<ul style="list-style-type: none"> <li>▪ Public Health reports</li> <li>▪ Social services reports</li> </ul>	20,000

<b>Pan operation</b>	Outsiders/strangers accessing the pan	<ol style="list-style-type: none"> <li>1) Community sensitization and awareness creation towards embracing new members of the community</li> <li>2) Establish a pan management committee.</li> </ol>	Propone nt, Chiefs, Local Leaders, Pan Management Committ ee	Within 1 <sup>st</sup> month of pan operatio n	<ul style="list-style-type: none"> <li>▪ Reduced conflicts between locals and visitors</li> </ul>	<ul style="list-style-type: none"> <li>▪ Chiefs reports on conflict occurrence</li> </ul>	5,000
<b>Pan operation</b>	Increase on human and animal road traffic and Pressure on local infrastructure	<ol style="list-style-type: none"> <li>1) Community sensitization and awareness creation.</li> <li>2) Establish a pan management committee.</li> <li>3) Expand new roads and infrastructure capacity</li> <li>4) Routine maintenance of infrastructure</li> </ol>	Pan manage ment committ ee and Departm ents involved in infrastruc ture develop ment i.e. roads departm ent	Through out the pan operatio n	<ul style="list-style-type: none"> <li>▪ Sustainable infrastructure facilities offering services to all plus the increase in population</li> </ul>	<ul style="list-style-type: none"> <li>▪ Infrastructure rehabilitation reports</li> </ul>	10,000

<b>Pan operation</b>	Structural failure	<ol style="list-style-type: none"> <li>1) Review of pan design by independent panel of experts</li> <li>2) Emergency preparedness plan</li> <li>3) Community sensitization and awareness creation.</li> <li>4) Establish a pan management committee.</li> <li>5) Proper engineering design</li> <li>6) Contractor to abide to engineering design provide quality works</li> <li>7) Proper supervision of the works</li> <li>8) Monitoring and maintenance plan</li> <li>9) Implementation of monitoring and maintenance plan</li> <li>10) Planting of trees</li> <li>11) Erosion control</li> </ol>	Workers and Pan management committee.	Through out the pan operation	Water pan structure monitored and in good condition	<ul style="list-style-type: none"> <li>▪ Structure constructed as per approved design.</li> <li>▪ Monitoring records</li> <li>▪ Repair records</li> </ul>	10,000
<b>Pan operation</b>	Deviated natural water flow	<ol style="list-style-type: none"> <li>1) Spill way designed to return water to its natural flow</li> <li>2) Construction of retention ditches by farms on the lower side of the pan</li> </ol>	Proponent and Farmers	Through out the pan operation	Excess water is returned to its natural course	<ul style="list-style-type: none"> <li>▪ Spill way designed to return water to its natural course</li> <li>▪ Farmers downstream construction of retention ditches</li> </ul>	In the budget

Pan decommissioned	Water use conflicts	1) Committee to ensure equitable water distribution 2) Operational rules	Department of Internal Affairs/chiefs and Pan management committee	Pan decommissioning stage	<ul style="list-style-type: none"> <li>▪ No conflicts occur as a result of pan decommissioning</li> </ul>	<ul style="list-style-type: none"> <li>▪ Chiefs reports</li> </ul>	5,000
	Excess soil material	To be used in landscaping at an appropriate site	Pan management committee	Pan decommissioning stage	<ul style="list-style-type: none"> <li>▪ No misplaced excess soil and debris</li> </ul>	<ul style="list-style-type: none"> <li>▪ Decommissioning report on materials disposed</li> </ul>	30,000
	Erosion	1) Plant grass and trees around the pan area 2) Erosion control	Department of Agriculture, Pan management committee and farmers	Pan decommissioning stage	<ul style="list-style-type: none"> <li>▪ No occurrence /controlled soil erosion around the pan</li> </ul>	<ul style="list-style-type: none"> <li>▪ Department of agriculture report on soil and water conservation in at the pan site.</li> </ul>	20,000



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## **CHAPTER 9**

### **9.0 MONITORING GUIDELINES**

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There must be continuous monitoring and follow-up on the project activities to ensure that the environmental and social management plan (ESMP) is implemented and that its objectives are achieved. The implementing staff and the community supervisors should ensure that the mitigation measures are put in place as outlined in the ESMP. Monitoring guidelines can be based on the following parameters.

- Public and workers safety
- Malaria and other diseases prevention and control
- Livestock/crop conflict reports
- Improved vegetation cover
- Safety of equipments and property
- Capacity building and skills improvement
- Structural integrity of the pan

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## **CHAPTER 10**

### **10.0 THE MINISTRY'S ENVIRONMENTAL POLICY**

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Environment protection and Conservation of the natural resource base for sustainable agriculture is one of the 5 pillars in the ministry of agriculture strategic plan. This is to be achieved through soil and water conservation, promotion of agro-forestry, river banks protection and land rehabilitation for improved agricultural production. The ministry also strives to train the farmers on the best land use practices, integrated crop pest and disease management and safe use of chemicals. This broadly covers all the key areas to ensure that agricultural development is both environmentally friendly and sustainable.

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## **CONCLUSION AND RECOMMENDATIONS**

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The environment impact from the implementation of this project are minimal and can be addressed by putting in place mitigation measures to ensure that they pose no threat to the environment or no danger to the community. These measures are part of the project component and will bring no added cost in the implementation process. There will be no abstraction of water from any natural water course but is essentially a water conservation structure. The advantages of placing the structure are enormous and it will address chronic problems that have affected the community for a long time. Establishment of a tree nursery and the protection of the catchment area are positive impacts on the environment. The livestock crop conflict will be mitigated by the area chiefs and local administration assisted by the pan management committee enforcing pan water use rules. Water borne diseases that may occur include malaria as the pan may act as breeding site of mosquitoes, and therefore calls for creation of awareness to the public on prevention and control of the diseases. Further, adult literacy classes should be put up to address the low levels of literacy in the village. Zero grazing dairy cows, improved variety of birds/chicken, drip irrigation system and drought resistant varieties like sorghum among other modern technologies should be advocated so as to improve the household incomes with emphasis on empowerment for all agendas. These technologies can be promoted through establishment of agricultural demonstration plots around the pan.

Generally the potential negative impacts of the project are few and achievable to mitigate, therefore they should not prevent the project from proceeding. Moreover the KCSAP project has a strong environmental resilient component that aims is expected to take into consideration the proposed mitigation measures. The positive impacts and the benefits to the community are immense and welcomed. It is recommended therefore that the project proceeds as planned with the mitigation measures integrated in the implementation.

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**BIBLIOGRAPHY:**

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1. Agricultural Act CAP 318
2. County Integrated Development Plan II-2017-22 (CIDP II)
3. District Environmental Action Plan, Taita District 2008-2011
4. Farm Management Guidelines for Taita District July 2007
5. Local Government Act CAP 265 of 1981
6. Ministry of Agriculture Strategic Plan 2006-2011
7. Range Management Handbook of Kenya VOL.II 9
8. Soil and Water Conservation Manual of Kenya 1997
9. Taita District Development plan 2008-2012
10. Water Act 2002
11. Water Resource Management Draft Rules

## APENDICES

### Appendix 1: EIK Membership Certificate



**Appendix 2: NEMA Lead Expert Practicing License**

FORM 1

12/2015



**NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)  
THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT**  
CERTIFICATE OF REGISTRATION AS AN ENVIRONMENTAL IMPACT ASSESSMENT/  
AUDIT EXPERT

Certificate No: NEMA/DIA/RG/3314

Application Reference No: NEMA/DIA/ER/1156

This is to certify M/s **ANDREW QUENTIN NGATI** of  
P.O. Box 42027- 803100 MOMBASA (Address) has been registered as an Environmental  
Impact Assessment Expert in accordance with the provisions of the Environmental Management and  
Coordination Act Cap 387 and is authorized to practice in the capacity of a Lead Expert/Associate  
Expert/Firm of Experts (Type) **Lead Expert**

Expert Registration No: **1587**

Issued Date : **4/20/2018**

Signature

(Seal)

Director-General  
The National Environmental Management Authority



## **Apendix 3: Minutes of ESIA Public Participation**

## **Apendix 4: Attendance Lists - ESIA Public Participation**





THE PRESIDENCY

MINISTRY OF INTERIOR AND CO-ORDINATION OF NATIONAL GOVERNMENT

OFFICE OF THE CHIEF

KASIGAU LOCATION

P.O. Box 1-80300

NOI

19.03.2019

Telegrams: "DISTRICTER" .....

Telephone: .....

E-mail: .....

When replying please quote

Ref. No. ....  
and date

TO WHOM IT MAY CONCERN

RE: TATARI WATER PAN:

The above waterpan is situated in Mungwede village in Bgata Sublocation.

The plot on which this pan rests belongs to the entire community and it was set aside for the purpose of the dam/waterpan.

Ufunguo women group was mandated by the community to maintain it.

Kindly assist us as a community to either expand or disilt it.

Thank you in advance

CHIEF  
KASIGAU LOCATION  
Cell: 0721 673 999

Johnne Mwangi

## Appendix 6: Pan Design Drawings