ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT STUDY REPORT

REHABILITATION OF NJORO KUBWA CANAL IN BOMENI-MBOGHONI WARDS OF TAVETA SUB-COUNTY.

FEBRUARY 2019

CLIENT
Kenya Climate Smart Agriculture Project
P.O. Box 1035 – 8030
WUNDANYI
TAITA TAVETA

EIA LEAD EXPERT
QUENTIN NGATI
REGISTRATION NUMBER 1587
TEL: 0722-797326
WUNDANYI

DECLARATION

On behalf of the Proponent, the ESIA/EA Expert submits this Environment Impact Assessment and Audit for the proposed Rehabilitation of Njoro Kubwa canal (Designs attached) in Bomeni and Mboghoni Ward of Taveta Sub-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.

Lead Expert:

Andrew Quentin Mwakilanga Ngati

Registration Number: 1587

E.mail: qngati@gmail.com

Mobile: 0722797326

P.O. Box 1035 – 80304

Wundanyi

Sign……Date……..

Proponent:

Sign For: Kenya Climate Smart Agriculture Project

P.O. Box 1035 – 80304

Wundanyi

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ACRONYMS AND ABBREVIATIONS

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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I am grateful too all community members who were respondents in get pertinent information about this project. 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.

EXECUTIVE SUMMARY

In recognition of the requirements of the Environmental Management and Coordination Act (EMCA) 1999, the Kenya Climate Smart Agricultural Project- Taita Tavet County commissioned an Environment Impact Assessment (ESIA) study of rehabilitation of Njoro Kubwa canal in Bomeni and Mboghoni wards. This involved mainly de-silting of the canal, construction of retaining walls to control storm water, rehabilitation of Kamleza intake, rehabilitation of Kwa-Katwange flume, and rehabilitation of Riata-Ndogo bridge. The goal of the project is to provide sufficient water for irrigation thus addressing food insecurity, alleviate poverty and create jobs for economic development. An ESIA was done to determine the current status of the environment, environmental considerations for the project in the design phase, operation phase and decommissioning phase. The ESIA evaluated the effectiveness of the environmental considerations undertaken by the project proponents in safeguarding the environment to ensure its sustainability and reduce conflicts with the stakeholders. To this end an initial site survey was done that was followed by a face to face interview of stakeholders and community members. A scoping and biodiversity evaluation was undertaken to determine the anticipated environmental and social impacts. The project was found not to adversely impact the environment but rather it is anticipated to impact positively towards rehabilitating the canal that is seriously bushy, dilapidate and having low water flows than designed. Rehabilitation of the canal will also assist in imparting of irrigation related technologies with enhanced income generating activities. Health issues were fairly negatively impacted (mainly vector bone diseases like malaria and schisostome expected to rise) with soil erosion during the first few months increasing due to the general nature of the project. However, the environment and social management plan(ESMP) has laid out the various measures (both enhancing and downplaying), towards the expected impacts of the project to the environment, as such, when well followed to the latter, will make the project achieve its objectives with minimal negative impacts to the environment and enhance the positive impacts. It was therefore recommended that the project should be carried out as planed to the benefit of the farmers in the 3 irrigation scheme served by the canal i.e. Kamleza, Mrabani and Kitobo irrigation schemes.

CHAPTER ONE: PROJECT BACKGROUND.

Njoro Kubwa canal was constructed during colonial administration purposely for irrigation. It stretches from Njoro to Kitobo Location. This ESIA study has been conducted with respect to the proposed rehabilitation of Njoro Kubwa canal. It is stretched across two wards- Bomeni and Mboghoni Ward in Taveta Sub County of Taita Taveta County. It is located on community land at coordinates S 03^0 26 090' E $037^0$37 709'. The canal covers 12.5 km from start to the end.. It is divided into the following sections: Ibura, Kiwalwa, Shamba la AFC, Mrabani and Kitobo with each section under a management committee. Schemes using the canal include: Ibura, Kamleza, Mrashiani, Moya Moya, Mrabani, Kitobbo 'A', Kitobo 'B' and Water pump users.

The project is managed by an umbrella committee composed of all the user groups .These groups included the three major irrigation schemes namely Kamleza, Mrabani and Kitobo and the user groups farming the former Taveta Estate. Executive members from all the groups and schemes form the umbrella committee which also elects its office bearers from its members. The umbrella committee overseas the control of the main gates, the canal water distribution and the regular maintenance of the canal

The first 300m of the canal from the springs to the control gates passes through a very hard rock. The characteristics of the canal at this section are deep at more than 5m and wide at 7m. The rest of the canal is just in cut and in soft ground. The canal was re-commissioned by the President in 2007 after a prolonged closure for construction and lining. The canal is now lined for a section of about 1km in the troublesome section next to Ibura area. In the area next to the Riata hill, the canal gets silted up during the wet seasons due runoff from the hill. The banks of the canal have been weaken by uncontrolled breaching resulting in seepage loses such that the downstream users hardly get water. The canal is also losing its shape due to the siltation and poor maintenance. The main objective of this project is to enhance the availability of water for irrigation along the canal and to ensure that the canal area is conserved.

1.1 TERMS OF REFERENCE FOR CONDUCTING THE ESIA STUDY

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

a) Project activities

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

i. Earthworks (De-silting)
ii. Construction of retaining walls to control storm water
iii. Rehabilitation of Kamleza intake
iv. Rehabilitation of Kwa-Katwange flume

v. Rehabilitation of Riata-Ndogo bridge

These activities therefore will generally involve;

i. Site clearing
ii. Mechanical and partially manual land excavation,
iii. Backfilling around the excavated area
iv. Delivery of building materials and machines/equipments to the site
v. Reinforced and non-reinforced concrete/cement works
vi. Building block works
vii. Erection of gabions

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 of rehabilitating Njoro Kubwa canal 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) De-silting of the canal– Excavation and movement of soil out of the canal channel so as to attain the required depth and levels inside the canal. An earth moving machinery is required preferably an excavator,
ii) Excavation works –Excavation either mechanically or manually around sections that may require works of reinforced/non-reinforced concrete, forming, block, or installation of gabions. An earth moving machinery may be required preferably an excavator,
iii) Bush clearing- Involving clearing of bushes, removal of trees, stumps, roots; and disposal safely,
iv) 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,
v) Installation of gabion – This will involve placing of appropriate stones in gabion boxes in rows or layers to stagnate soil avoiding erosion or creating soil embankment walls,
vi) Noise, vibration and dust emissions- As a result of machinery works,
vii) Health and safety of workmen on site,
viii) Handling, use and storage of hazardous materials during water use i.e. cement, paint etc,
ix) Drainage of extra unwanted water and fluids, and
x) Social issues associated with the rehabilitation of the canal.

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 canal rehabilitation

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;-

Table 1: Proposed Workplan and Time Frame for ESIA

S/No.	Activity	Period	Methodology
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 DEPLOYED IN THE ASSESSMENT

To ensure that the project proponents complied with EMCA (1999), the following steps were deployed during the assessment but not limited to:

- Preliminary visits to the site.
- Review of licenses and permits.
- Extensive literature review pertaining to the current study.
- Legal assessment to determine whether the project required an ESIA study by liaising with the local NEMA office.

- Scoping, which determined the environmental risk posed to the environment in rehabilitating the canal.
- Interviews with the local community, the project proponents, other stakeholders and administration of questionnaires.
- Subsequent visits and inspection of the project site and reconnaissance survey to determine the biophysical and socio-economic aspects of the area and its environs.
- Preparation of the final ESIA report.

The ESIA process evaluated all the relevant processes associated with the rehabilitation and operations of the Njoro Kubwa canal. The developed terms of reference were used to steer and guide the ESIA process, which ensured that all the environmental concerns were addressed.

Literature review pertaining to the kind of structures to be constructed/repaired and de-silted was conducted to familiarize to assessors with the operations of the irrigation scheme once it is complete. This included the review of the EMCA (1999), Environmental Impact Assessment guidelines, Water Act 2002 and relevant studies. Reports on physical and biological data were also reviewed, as well as other relevant literature.

During the initial stage of the assessment, the proponent and the ESIA assessor visited the site at Bomeni and Mboghoni Wards. As was evidenced, the likely negative impacts perceived through physical assessment are likely to be low.

During field investigations, the assessor walked with the project proponent and a reconnaissance survey done on the site and the immediate neighboring lands in order to collect information on the biophysical and socio-economic environment of the canal location and its environs. The survey was made on aspects including geological, soils and likely presence of pollutants nearby that would affect the water quality.

A systematic approach was followed to determine the extent to which the site will be impacted by construction and the future operations of the canal. This helped in determining the positive and negative environmental attributes of the project. The phases included:

1.2.1 Desk Study and Site Walk Assessment

A site walk survey was conducted along the canal and the surrounding areas. This involved a systematic inventory survey of likely impact indicators regarding:

- Existing sensitive potential pollution sources
- Likely spillage around the canal area and during operation phase of the project.
- Identification of land use within the project site and vicinity.
- System of management to be put up for managing the water from the canal.

- Local capacity built by the management committee to manage the canal and irrigation as a whole during its use after rehabilitation.

1.2.2 Questionnaire Administration

A detailed Social Impact Assessment (SIA) questionnaire was administered to the stakeholders including the local residents to obtain baseline information relating to the rehabilitation and use of the canal i.e. socio- economic and environmental considerations, which are envisaged not to be significant.

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 documents. 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.

1.3 SPECIFIC PROJECT OBJECTIVES

Rehabilitation of Njoro Kubwa canal is aimed at achieving the following:

1. To provide sufficient water for irrigation- The project was aimed at addressing the problem of lack of availability of irrigation water.
2. To address the problem of food security
3. To alleviate the level of poverty in the region

4. To creation of jobs for the local community from agricultural labor (consider youth, women and vulnerable) as a result of increased agricultural income generating activities in the irrigation scheme.
5. Operating the canal and the irrigation scheme in consideration of Environmental Health and Safety (EHS) systems commiserating to the project and the environment.

1.4 PROJECT ALTERNATIVES:

1.4.1 Alternative A- Construction of s Water Pan

In the CIDP II, there was an option of constructing a water pan in the Riata area. However, this option was analyzed during a public meeting against rehabilitation of the canal. It was found that, the pan would serve very few people as compared to the canal that serves over 3 irrigation schemes. Further, the source of water for the pan would be more challenging and exposed to fluctuations of weather in the area hence not solve adequately the problem of water scarcity. As result, this option was not opted for compared to the rehabilitation of the Njoro Kubwa canal.

1.4.2 Alternative B- 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 for irrigation; provide to the community a source of irrigation water to their arable land; demonstrate and train at the demonstration sites various agricultural technologies allied to water harvesting; 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 is a significant contributor to the economy of a farming community like that of Bomeni and Mboghoni wards.

CHAPTER TWO: POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

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 13th 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 ESIAs 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 ESIAs 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 that 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 gazettement. 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, though 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 heath, 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 14001certification

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 mange aquatic environment with a view of minimizing deleterious effects of any water.

CHAPTER THREE: BASELINE INFORMATION

3.1 PROJECT ENVIRONMENT

3.1.1 Conceptualization of the Project.

Rehabilitation of Njoro Kubwa canal 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 rehabilitating the canal was conceived during the process of developing the Taita Taveta CIDP II in January 2018. Through the canal management committee, the communality identified the project after experiencing challenges in the canal through repeated silting and damage to canal infrastructure after every wet season. The committee thus invited the irrigation officer to visit the project site find ways to assist resulting to a survey of areas along the canal that need rehabilitation.

Upon rehabilitating the canal, it is expected to benefit directly over 529 people (Males- 404; Females-125) while indirectly over 2,645 people (Male-1,190 and female-1,455). Land under irrigation will increase from approx. 1,200ha to approx. 2,000ha thereby increasing crop production, food security and household income. Vegetation cover will increase proportionately and thus reduce GHG emissions. Therefore the project stands to benefit a large number of peoples' livelihoods making it viable.

3.1.2 Location

It is located in Bomeni and Mboghoni wards of Taveta sub-county. The canal is 12 km long starting from the Njoro Kubwa springs in Bomeni ward about 3 km south of Taveta town to Njoro Kitobo in Mboghoni ward about 8 km southwest of Taveta town. It is located on community land at coordinates S $03^0$26 090' E $037^0$37 709'. The site is about 12km East of the Sub-County headquarters in Taveta Town.

3.1.3 Climate

The canal is found in the Ecological zone LM5 which is semiarid with an annual rainfall average of 600mm per annum. 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. Long rains have more surface run-off and more reliable. However, rainfall patterns are currently unpredictable due to global climatic changes. Average temperatures are above 25^{o}c in most of the times of the year with evapo-transpiration at about 5.5mm per day.

3.1.4 Topography

The canal is located in a fairly flat land. In the command area, gradients perpendicular to the canal range from 0.02% to 0.07%. There exist a hill in the vicinity of the area called Riata hill. In the area next to the Riata hill, the canal gets silted up during the wet seasons due runoff from the hill. Along the canal the gradient is higher in the first 500m-about 0.1%, but eases out to 0.05% in the rest of the canal.

3.1.5 Vegetation

Natural vegetation in this area comprises of acacia shrubs- mainly by the evasive *Prosopis juliflora* commonly known as Mathenge shrub and euphobia family trees. Fig trees and shrubs are very scattered all over the plains. A few trees are found in farm lands mostly *Croton megalocapus* (Paper tree) and *Cassia samea* . Very little if not agro-forestry is being practiced with farms (mangoe and avocado trees being common), instead, a majority of the land is covered with farm crops like maize, beans, sweet potatoes, sugar cane and cucumber as it is under the irrigation. The rest of the area is covered with grass

3.1.6 Drainage

The project area is not near any environmentally sensitive areas, but the source of the water is from the Njoro Kubwa springs which need conservation to sustain the water availability. It is from this spring that the whole area has been put under a network of open canal irrigation system. Due to the area being relatively flat, water flowing from the slopes of Riata hills tends to flow to the nearest low land as result are several natural water ways that traverse the area resulting to deep trenches. This further manifested itself by the several seasonal water crossing points along the all weather roads towards the irrigation area that would direly need construction of drifts. Farmers have attested to challenges of crossing such areas during wet season.

3.1.7 Soils And Geology

The soils found in the area of the canal range from red loam to black cotton soils. The canal passes through deep loam soils which are easily erodible and which provide for rapid growth of weeds. They also allow deep seepage of water. There are no rocky out crop around the area despite being in the vicinity of the volcanic Mt. Kilimanjaro.

3.2 SOCIAL ECONOMICS

3.2.1 Agriculture

The questionnaire administered to the community revealed that, the main agricultural activity in the area is mixed irrigated commercial farming consisting of both dairy and meat livestock keeping and cultivation of maize, cassava, sweet potatoes and beans. The community also cultivates mangoes and avocadoes cash crop. Horticultural farming is done mainly on bananas, onions,

tomatoes, water melon, and cucumber. The main commercial crop is bananas mostly giant cavendish variety. There appear to be a fairly developed value chain in bananas, tomatoes and onions crops as observed by the several collection centers along the farm roads. Agricultural activities are almost entirely dependent on the irrigation system. However, water drawing system into irrigating the crops is through pumps that are doted all over the area. There is a significant application of chemicals; pesticides and fertilizer regularly to crops during their production in the irrigation scheme. Some of the pesticides used to control common emerging pests and diseases include but not limited to;- Duduthrin, Prove, Bestox, for control of fall army warm; and Almatix for control of ticks. With increase in cultivation of horticultural crops in the irrigation schemes, concurrently will be the increase of chemicals and fertilizer use. This is of environmental concern.

Farming activities on the other hand are encountered with several problems as reported by the community, among which;- inadequate water for irrigation brought about by the canal not being efficient due to siltation from flash flood from Riata hills and by livestock who when drinking water go directly into the canal. The channel ferrying water to the farm land is bushy and water flow is obstructed and there are no trench lines in the farms for water conservation. Noticeable is the poor farm management and agronomic practices. Rainfall is not reliable hence critical dependency on the Njoro Kubwa canal system; poor transport/road network resulting to their produce not reaching the markets especially during rainy season; crop and livestock diseases, expensive farm inputs, lack of proper market for their produce i.e. price exploitation by middlemen; and inadequate accessibility of certified seeds.

The community feels that, the rehabilitation of the canal will alleviate the above problems through availability of enough water for farming, livestock keeping and domestic use. It will also tame down some diseases of crops that are related to insufficient crop water, assist establish green houses and ponds thus overall improvement of the livelihood of the community members.

3.2.2 Transport and Communication

The project area is accessible by means of public and private vehicles that ply the all weather roads traversing the area. There are few ox or donkey-drawn carts for transporting the farm produce. It is very common to see women carrying over 4 bunch of bananas or crates of tomatoes and sacks of onions on their backs and heads transporting their produce to collection centers. The main challenge is due to the poor road conditions especially considering the black cotton soils which are known to be notorious in getting vehicles stuck in their mud. There is no land line telephone service though communication in the area has been complimented by the good network coverage of the mobile telephony.

3.2.3 Administration

The area falls under the jurisdiction of Bomeni and Mboghoni Chiefs, The main rehabilitaton site is in Kitobo Location in Mboghoni Ward whose area chief whose recently built office is at Kitobo area. He is located at about 7km away from the site. The head quarters are situated in Taveta Townhip where the Sub-County Commissioner for Taveta Sub-County sits. A police post is also located at this not far from the chiefs office. Due to Taveta being a boarder town, there are several police road block check points within the main farm/rural access roads to curb illegal trading/contraband into the country.

3.2.4 Population

The population that benefits from this canal amounts to more than a third of Taveta sub-county population. The three irrigation schemes and the farmers in the former Taveta estate are drawn from all the wards in the sub-county. Approximately more than 30,000 persons benefit directly and indirectly from this canal.

3.2.5 Education

Within the irrigation scheme are 5 primary school;- Kiwalwa, Njoro, Mrabani, Kitobo and Riata Primary Schools. Secondary Schools found in the irrigation scheme are Njoro, Kitobo and Kiwalwa Secondary Schools. There are no tertiary colleges within the location. However, a land area near Taveta township has been allocated to building of a university college. Around the same area also is an already built Kenya Medical Training College that is yet to admit students. These two colleges are over 12kms from the project site. During the public participation exercise, it was realized that literacy levels are fairl ok i.e. most of the people beyond 40yrs of age can read and write. Generally, about 3 in 5 people can read or write. There is however notable number of children below 15years particularly boys from the Maasai community who are seen tending to animals during week days, indicating high low school enrollment for children among this community.

3.2.6 Health Facilities

According to the ESIA study, below are the most common water related diseases and their remedies;-

Table 2: Diseases, When Conmon and Source of Remedy

Type	When common	Common/Remedy applied	Source of remedy
a. Malaria	Rainy season	Drugs,Herbs(Neem tree-*Azadirachta indica*)	Dispensaries, Neem tree
b. Typhoid	Wet and dry season	Drugs	Dispensaries
c. Diarrhea	Rainy season	Cleaning the environment Treat stagnant water	
d. Amoeba	All year around	Boiled water	Hospital treatment

e. Bilharzia	Rainy season	Drugs	Hospital
f. Pneumonia	Rainy season	Drugs	Hospital

Below are the the health facilities that the community accesses and their distances from the site;

Name of dispensary/hospital	**Distance (Km)**
a) Kitobo Dispensary	5
b) Eldoro Dispensary	8
c) Taveta District Hospital	12

The most accessed health facility is Kitobo dispensary that is 5km away and it always busy serving the community. From table 2, it shows that the community has been well sensitized on access of modern medicine as they seek for medical attention in dispensaries and hence have access to modern medicine. Therefore, negative health impacts related to the construction of the water i.e. the rise in water borne diseases like malaria, typhoid, amoebic dysentery etc can be intervened timely. HIV/ AIDS is also a concern in among the community members.

3.2.7 Commerce and Industries

The study reveals that the community is engaged in some small scale commerce activities like sell of farm products, transport business in boda-boda taxi. Some members are employed as casual laborers in the irrigation farms. Around the irrigation site, the most obvious commercial activity is selling of bananas. The farmers in the community are involved in;- management and operations of the canal through the umbrella committee drawn from all the benefiting user groups; carrying out management and manual maintenance activities on their own, which they are very willing to contribute in all unskilled labor activities; and understanding that operation and maintenance of the canal is and will always continue to be their responsibility.

Challenges that are encountered by the community in performing their main livelihood activities are but not limited to:

a) Inadequate water for irrigation hence poor crop performance
b) Poor transport/road network
c) Lack of employment
d) Lack of capital
e) Expensive inputs
f) Un-organized market
g) Lack of employment and poor salaries
h) Lack of trained manpower

There are no industries in the area except a posho mill that are located at Kitobo market center. 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.

3.2.8 Canal Management

The canal has an umbrella management committee composed of all the user groups. These groups include the three irrigation schemes namely Kamleza, Mrabani and Kitobo and the user groups farming the former Taveta estate. The executive members from the user groups and schemes, form the umbrella committee which also elects its executive office bearers from its members. The umbrella committee oversees the control of the main gates, the canal water distribution and the regular maintenance of the canal.

3.2.9 Operation and Maintenance

A communal working day is set aside by the umbrella committee to de-silt and clear vegetation in the canal by all farmers' failure of which a fine is imposed on the user group. This is set out in the existing bylaws. However, this has not been followed to the later to the detriment of the canal carrying capacity. Abstraction fees per user group forms the bases of funds for operation and management (O&M)

3.3 HYDROLOGY

3.3.1 Ground Water Sources

Ground water in the area has not been fully exploited by either the government or any NGO. Some two organizations have been involved in sinking bore holes and wells i.e. World vision and TTAP project. There is an indication ground water potential in the area for domestic use as explained by the community access water from wells and springs which are averagely 1km away. Due to the volcanic nature of the geology, there are a lot of underground water systems that have also developed to the Njoro springs which is currently the source of the canal water.

3.3.2 Surface Water

The source of this canal is the Njoro Kubwa springs. These springs have a yield of more than 5m3/s of which the canal abstracts 2.4 m3/s. The Taveta-Lumi water project abstracts 0.035 m3/s and the rest of the water flows to river Lumi through the spillway. The yield from the springs does not fluctuate significantly but is about constant through all seasons. Separating the springs and the

river is a dyke. The increasing flood flows from the river spill over the dyke into the springs depositing silt which in turn affects the yield of the springs.

The irrigation site is part of a complex of natural water way due to surface run-off flow from the adjacent Riata hills. The nature of this catchment is expected to have water enough to recharge the Njoro Springs. During wet season, a lot of streams and natural water ways form within the catchment. These streams drain water into the Kitobo river. However, a big percentage of the drainage water goes to a waste either through seepage, evaporation or run-off into the Kitobo river. The runoff water therefore needs to be harnessed for positive use mainly in the farms, therefore the being of the project.

The main challenges face by organizations that have been involved in intervention in water are;- local material supply, poor roads, lack of skilled personnel, poor baseline data/research data, conflict of interest upon the recipients, heavy initial capital required, not enough water to meet the community demands. However, they addressed the challenges through women group and local residents being involve in the program; Self help group formation to take care of projects and community sensitization on interventions.

3.4 WATER DEMAND AND APPLICATION

3.4.1 Consumer Projections

The project target population is 529 people with within an araea of about 2,000ha. Upon rehabilitation, sand under irrigation will increase from approx. 1,200 ha to approx. 2,000 ha thereby increasing crop production, food security and household income.

3.4.2 Design Period.

The design period is taken is taken to be 25ys, as long as the canal is managed.

3.4.3 Irrigation/ Water Application

The water will be used mainly for sprinkler irrigation of already established farm plots of crops such as bananas and vegetables through a pressurized system by a peddle pump. 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.

3.4.4 Drainage for Sprinkler Irrigation

The slopes in the project area have an average slope of 0.1 %. These slopes are not steep enough to provide good natural drainage. Thus there is a challenge of salinazation in the irrigation schemes.

3.4.5 Crop Analysis

The major crop enterprises grown in the schemes include maize, bananas, tomatoes, onions, beans, water melon, cassava, sweet potatoes, mangoes, avocadoes, sugar cane and cucumber. Implementation of the project will enable farmers to grow other horticultural crops such as kales, passion fruits, tree nurseries, and spinach and a variety of other horticultural produce.

CHAPTER FOUR: PROJECT DESCRIPTION

4.1 NATURE, DESIGN AND DESCRIPTION OF THE PROJECT

The project will involve de-silting through excavation of the 12km canal. The project involves expanding and renovating already existing structures. Some parts of the canal will involve construction of retention walls, rehabilitating intake and flume structures and also rehabilitation of a bridge's upstream and downstream walls. The canal will be recharged by Njoro Springs and excess water will pour back into Kitobo river. The main use of the water harnessed will be for enhanced irrigation of horticultural crops more so bananas which is the main crop in the irrigation system. The project is expected to be implemented for 3 months before its handed back to the community.

4.2 SITTING/POSITIONING OF THE CANAL

Njoro Kubwa canal as located in Bomeni and Mboghoni wards of Taita Taveta County. It is located on community land at coordinates S 030 26 090' E 037037 709'. The site is about 12km East of the Sub-County head in Taveta Town. The canal is 12 km long starting from the Njoro Kubwa springs in Bomeni ward about 3 km South of Taveta town to Njoro Kitobo in Mboghoni ward about 8 km Southwest of Taveta town.

4.3 PROJECT CONSTRUCTION

i. Earthworks (De-silting) - Mechanical dredging using excavator 140hp including dry rate working 160hrs. This will involve an excavator.
ii. Construction of retaining walls to control storm water- At Riata Ndogo 100m, Kwa Miriam 25m and at Diversion 50m.
iii. Rehabilitation of Kamleza intake- Construction of buttress walls and extension of existing ones
iv. Rehabilitation of Kwa-Katwange flume- Rehabilitation of broken column, slab, wing walls and including new gabion wall
v. Rehabilitation of Riata-Ndogo bridge- Repair of upstream and downstream wing wall

The Kwa Katwange flume as seen from upstream

The Riata bridge. The embankment on both sides of the bridge are washed away.

The Kamleza intake. Walls left without backing material after it was washed away

The end point of Njoro Kubwa pouring water into Kitobo River

4.4 PROJECT INPUTS

Project inputs include the following;-

4.4.1 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.

4.4.2 Construction Machines and Tools

There will be machines used to do over 90% of all the work. A few part of the construction like bush clearing will be done manually using tools like, machete, pick axe, shovel, mattocks, jembes,

masons harmer, bits, wheel barrows, Water will be delivered to the farm plots through peddle pump, sprinklers and later using drip irrigation equipment.

4.4.3 Labor

This will consist largely of skilled labor in operating plants for excavation with some few cases of skilled labor during the construction of minor concrete structures and installation of equipments. Unskilled labor mainly will be involved in minor activities like bush clearing and removal of debris during the mechanical excavation.

4.4.4 Water

Moderate volumes of water will be required in constructing the concrete works. Prior arrangements for sourcing of water should be made before the start of construction works.

4.5 CONSTRUCTION ACTIVITIES.

The excavation works will be done under the supervision of the Sub-County Irrigation Officer- 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
- Excavation and transportation of soil by the excavator and trucks to the designated site as per the design of the irrigation canal. Excavated soil will be deposited as a dyke at specified distance along the canal to form a burier against runoff water intruding into the canal from the non designated points. It will also act as a barrier against traffic by humans (especially school children) and animals.
- Excavation and construction of retaining walls to control storm water, buttress walls and extension of existing ones, broken columns, slab, wing walls and including new gabion wall and upstream and downstream wing walls a bridge.
- Completion of construction.
- Operations phase of the canal will start as soon as the canal is rehabilitated.

4.6 PROJECT BUDGET

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.12,131,717 with an addition 10% of the total cost to be contributed by the County Government of Taita Taveta.

CHAPTER FIVE: SCOPING OF POTENTIAL ENVIRONMENTAL IMPACTS

5.1 SCOPING MATRIX

Table 3: Scoping Matrix for Potential Environmental Impacts

Parameters	Components	Construction Phase		Decommissioning/ Transitional Phase (Operation and Maintenance)	
		Positive	Negative	Positive	Negative
Atmosphere	Dust and atmospheric status		X		
Land	Vegetation cover/ Biodiversity		X		
	Catchment			X	
	Human and animal road traffic and infrastructure				X
Water	Water course		X		
	Source of water for the community			X	
	Surface water destruction control			X	
Aesthetic environment	Aesthetic/visual intrusion			X	
Public health and dangers	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		
Social-Economic	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 canal				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 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 and social diseases i.e. HIV/AIDs increase
6) Increase on human and animal road traffic
7) Pressure on local infrastructure
8) 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 campaigns
12) Site restoration
13) Environmental emergency procedures
14) Ensure that water flows back to its original course

B. During Operations

15) Establishment of crop demonstration plots
16) Establishment of a tree nursery
17) Planting of trees
18) Erosion control
19) Management of the irrigation water
20) Community sensitization and awareness creation.
21) Installation of environmental friendly technologies
22) Establish/enhance irrigation canal management committee capacity.
23) Sanitation campaigns
24) Monitoring and maintenance of the canal

CHAPTER SIX: GENERAL OVERVIEW OF ANTICIPATED IMPACTS

6.1 ANALYSIS OF POTENTIAL NEGATIVE IMPACTS

6.1.1 Dust Pollution

During the de-silting and excavation works and the subsequent transporting of soil to the allocated sites, a lot of dust will be raised. The dust will be a hazard to those who will be working in the canal rehabilitation and those in proximity of the project area. Dust masks to workers at the canal should be provided. They should also sprinkle water on the soil during the earth works to reduce the amount of dust generated. Dust screens can be put up around the construction area.

6.1.2 Vibration and Noise Pollution

Machines operating in the construction site will generate noise. 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 required imits. 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

Construction and rehabilitation of the cannal 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 any cleared trees, bushes and grasses will contribute to loss in vegetation cover. 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 irrigation management committee should be trained on on-farm tree establishment and

management and 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 along the canal planted with grasses and trees to prevent destruction of its banks.

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 funa 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

After rehabilitation of the canal, the volume water held within the canal will increase. As a result, the canal water will act as a breeding ground for mosquitoes which are the vectors of malaria. For any household near the canal 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 Kitobo 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 amoebiosis 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 rehabilitating the canal that will take water from Njoro springs that naturally are supposed to flow into Kitobo river. This will however, capture a significant percentage of the total spring water and hence will have impact for farmers further down the slope. It is therefore obligatory to have in place a proper outflow mechanism 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 farms of the canal that they construct retention ditches to retain surface run-off during wet season so as to assist in further irrigating their farms.

6.1.7 Soil and Water Contamination by Waste/Chemical/Fertilizer

At construction/de-silting 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 soils that will have been excavated from the canal, 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 canal 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. 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 along the canal 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 canal. Children are the most vulnerable to drowning if they resort to drawing water directly from the canal or go. Currently animals go into the canal for drinking and destruct the dyke 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 can. The community should be sensitized about the dangers of drowning. The excavated soil should be used to construct the embankment /dykes along the canal and trees and grass planted to stabilize it.

6.1.10 Livestock Crop Conflict

The Kitobo 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 and correct placement of the livestock

water trough beside the canal is crucial. Grazing/browsing of livestock near the canal 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.

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 canal wate, a conflict may also arise on the use of this resource. The proponent should spearhead a signing of a memorandum of understanding between members of the irrigation scheme. 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 canal has been rehabilitated and handed to the community. An irrigation water management/use program should be put in place.

6.1.12 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 Kitobo. The sub-location 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 community members. Social diseases like HIV/AIDs, gonorrhea and syphilis are expected to be on the rise. Public Health department should consider stepping up comprehensive health awareness campaigns. Health facilities should be equipped with drugs and measures against these diseases i.e. distribution of condoms and stocking of ARVs and antibiotics.

6. 1.13 Structural Failure

The irrigation canal should be surveyed and designed correctly by the irrigation engineer to the required standards. The contractor is expected to de-silt and construct/rehabilitate structures 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 canal. The umbrella irrigation 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 canal will provide a readily available and convenient source of water both for crop production and livestock production. 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 canal the proponent is expected to introduce a water catchment protection around the irrigation scheme. This is an environmental conservation component. The proponent should mobilize the farmers to plant trees raised in the nursery on their farms 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 water from the springs, excess water during wet season. Further, the proposed sensitization of farmers along the canal on water harvesting techniques will harness surface run-off that will eventually control soil erosion. 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 rehabilitating Njoro Kubwa canal is increasing water for crop production. Clearly water is major constraint in crop production as seen by the crop on the ground. The canal is bushy, blocked and water is not flowing. The extra water that will flow will supplement the low amounts of water flowing in the canal. 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 variety are in short supply in the area and have to be sourced from far away and even from neighboring country. 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 canal rehabilitation 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 canal. 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 irrigation indicated above, profits emanating from the business created will go a long way in increasing the incomes of the household of beneficiaries in the Njoro irrigation scheme. 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

The social impact survey done during ESIA scoping exercise reveal that low incomes form their economic livelihood activities has contributed to challenges to send their children to school. Dynamically, some of the children are do not go to school just to attend to house hold chores on the part of the girl child while tending to animals on the part of the boy child especially the Maasai community. With the expected increase in house hold incomes from improved agricultural and livestock keeping activities, parents will be able 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 Leaving and Cross Cultural Relations,

Sharing a common resource like a irrigation water by over 529 peoople will improve their social bound. Just 12km away is the cosmopolitan and commercial Taveta town a mixture of several tribes. Bussiness men and general public from Taveta and its environs are bound to come do business in the created commerce. 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 irrigation scheme. However, it is reported during the scoping stage that there has been growing tension over the number of livestock drinking directly into the canal that destroy it and may develop into water related conflict. Some herders bring into the canal large number of livestock that compete with the

irrigation water demand and further dirtying the water with animal droppings. It may develop into farmers against livestock conflict of the reducing irrigation water. During dry season, the community goes sourcing water from the canal for domestic purposes. The project is expected to improve quantities of water along the canal hence in the scheme and atleast ease such tension.

6.2.12 Vulnerable Groups Inclusion

The irrigation management commitee 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 such isolated groups. 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 rehabilitation of the canal 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 increase of amounts of water in the canal, amount of water evaporated into the atmosphere will increase the relative humidity especially considering the high evapo-transpiration at about 5.5mm per day. Part of the canal impacts is promoting increase in vegetation cover through tree planting. Therefore the area around the irrigation scheme will become humid with average temperatures slightly lower than areas far from the canal to the advantage of the surrounding vegetation.

CHAPTER SEVEN: RELATING NEGATIVE IMPACTS TO MITIGATION MEASURES

Table 4: Relating Negative Impacts to Mitigation Measures

Project Phase	Positive Impacts	Activities	Negative impacts	Mitigating measures of negative impacts
Construction Phase	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 canal 7) Community training on biodiversity conservation 8) Re-vegetate /Vegetative buffer zone along the canal 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

		Excavation/de-silting of the canal	1) Vibration and noise pollution	1) Control of noise and air pollution i.e. avoid unnecessary hooting 2) Workers operating machines or plants for than 8hrs that produce over 80dBA of sound to wear ear muffs 3) Regular inspection of machines and plant 4) Restrict noisy construction activities within 8am-5pm 5) Inform community request of their tolerance
			2) Habitat loss 3) Natural water course deviation 4) Accidents during construction 5) Soil and water contamination by waste/chemicals /oil	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 canal 6) Solid waste management i.e. stones and debris 7) Erosion control 8) Site restoration 9) Environmental emergency procedures 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) Maintenance of machinery and plant. 13) Identification of appropriate location for disposing chemicals, their containers and contaminated soil & water. 14) Prompt site clearance, avoiding on-site stock piling, 15) Monitor exposed soil especially during wet season. Establishment of a materials storage to avoid accidental spills and littering
			6) Dust emission	1) Provision of dust masks to workers 2) Sprinkling of water and compaction dusty spots 3) Dust screen around the canal
		▪ Construction of retaining walls ▪ Rehabilitation of Kamleza intake	1) Noise pollution	1) Control of noise and air pollution i.e. avoid unnecessary hooting 2) Workers operating machines or plants for than 8hrs that produce over 80dBA of sound to wear ear muffs 3) Regular inspection of machines and plant 4) Restrict noisy construction activities within 8am-5pm 5) Inform community request of their tolerance

		▪ Rehabilitation of Kwa-Katwange flume ▪ Rehabilitation of Riata-Ndogo bridge	2) Habitat loss 3) 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) Community training on biodiversity conservation 5) Re-vegetate /Vegetative buffer zone along the canal 6) Solid waste management i.e. stones and debris 7) Waste water management i.e. discharge of construction water 8) Erosion control 9) Site restoration 10) Environmental emergency procedures 11) Occupational Health and Safety Administration (OSHA) i.e. erection of signs, first aid kit, etc 12) Workers to wear protective gear i.e. safety boots, safety helmets, reflector jacket etc
			4) Dust emission	1) Provision of dust masks to workers 2) Sprinkling of water and compaction dusty spots 3) Dust screen around the canal
Operational phase	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, Water borne diseases i.e. typhoid and	Canal in operation	1) Water borne disease- malaria and amoebiosis	1) Community sensitization and awareness creation i.e. water treatment, clearing of bushes around homesteads 2) Sanitation campaingsl 3) Provision of free Insect treated Nets(ITNs) 4) Health education 5) Introduction of mosquito larvae eating fish species in the canal
			2) Soil and water contamination by waste/chemical/ fertilizer	1) Community sensitization and awareness creation. 2) Management of the irrigation water 3) Establishment of crop demonstration plots 4) Establishment of a tree nursery 5) Planting of trees 6) Erosion control 7) Installation of environmental friendly technologies i.e. drip irrigation 8) Train on safe use of pesticides and chemicals, Integrated Pest Management (IPM), Integrated Fertilizer Management(IFM), and Soil & Water Conservation(S&WC)
			3) Danger of drowning	1) Community sensitization and awareness creation. 2) Building of embankments along the canal 3) Establish/enhancing capacity of irrigation management committee. 4) Employ a scouts 5) Construction of cattle troughs strategically.

	diarrhea reduction, 5) Employment opportunities, 6) Household incomes increased, 7) Literacy levels improvement, 8) Communal leaving and cross cultural relations, 9) Water related conflicts reduction, 10) Vulnerable groups inclusion, 11) Local trade and industry boost. 12) Micro climate modification		4) Livestock/ crop conflict	1) Community sensitization and awareness creation. 2) Animal water trough construction 3) Installation of environmental friendly technologies i.e. zero grazing and green houses 4) Establish/enhance capacity of irrigation management committee. 5) Committee to ensure equitable water distribution 6) Operational rules 7) Proper animal routes and holding grounds 8) Avoid grazing animals near the canal 9) Chief, local administration and irrigation committee enforce rules
			5) Rural morality decay and Social diseases i.e. HIV/AIDs increase	1) Community sensitization and awareness creation on comprehensive health care 2) Formal education enrolment campaigns 3) Gender mainstreaming campaigns 4) Equip local dispensaries with drugs 5) Measurers against social diseases i.e. free condoms and ARVs
			6) Structural failure	1) Review of canal design by independent panel of experts 2) Emergency preparedness plan 3) Community sensitization and awareness creation. 4) Establish/enhance irrigation management committee. 5) Proper engineering design 6) Contractor to abide to engineering design provide quality works 7) Proper supervision of the works 8) Monitoring and maintenance of the canal 9) Implementation of monitoring and maintenance plan 10) Planting of trees 11) Erosion control
			7) Deviated natural water flow	1) Canal designed to return water to its natural flow 2) Construction of retention ditches by farms along the canal
Decommissioning stage	The project should have achieved its goal of provision of domestic, agriculture and livestock water to the Mwagwede villagers.	Canal decommissioned	1) Water use conflicts	1) Committee to ensure equitable water distribution 2) Operational rules
			2) Excess soil material	1) To be used in landscaping at an appropriate site
			3) Erosion	1) Plant grass and trees around the canal area 2) Erosion control

CHAPTER EIGHT: ENVIRONMENTAL AND SOCIAL MANAGEMENT/MONITORING PLAN

Table 5: Environment and Social Management/Monitoring Plan

Activities	Potential impact	Mitigation measure	Responsibility	Action time frame	Targets to achieve	Monitorable indicator	Estimated Cost
Site Clearing	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 along the canal 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	Proponent & farmers representatives	During construction	▪ 1 fruit/forest tree nursery ▪ 5,000 tree seedlings in the nursery ▪ 2,000 seedlings planted quarterly at least for 5 years. ▪ 500 member sensitized ▪ 1 material store ▪ Environmental emergency plan	▪ No. fruit/forest tree nursery ▪ No. of seedlings raised ▪ No. of seedlings transplanted ▪ No. of farmers sensitized ▪ No. of materials store ▪ No. of environmental emergency plan	In the budget

Site Clearing, Construction of retaining walls; Rehabilitation of Kamleza intake;Rehabilitation of Kwa-Katwange flume;Rehabilitation of Riata-Ndogo bridge	Dust emission	1) Provision of dust masks to workers 2) Sprinkling of water and compaction dusty spots 3) Dust screen around the canal	Proponent & farmers	During construction	▪ 300 dust masks ▪ Damp soil during construction phase ▪ Erect dust screens	▪ No of masks distributed ▪ Damp soil	15,000
Site Clearing, Construction of retaining walls; Rehabilitation of Kamleza intake;Rehabilitation of Kwa-Katwange flume;Rehabilitation of Riata-Ndogo bridge	Accidents during earth works and construction	1) Occupational Health and Safety Administration (OSHA) i.e. erection of signs, first aid kit, etc 2) Workers to wear protective gear i.e. safety boots, safety helmets, reflector jacket etc	Workers and supervising staff	During construction	▪ Accidents put to a minimal as possible ▪ Implement OSHA	▪ Nol of accidents and nature ▪ Workers wearing protective gear. ▪ Work time table. ▪ Erected guard rails and warning signs ▪ Emergency response plan in place	20,000
Site Clearing	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	Proponent and irrigation management committee	Implementation & transitioning phase	▪ Acquisition of all relevant ownership documents ▪ No public complaint/conflict ▪ Pubic sensitized on ownership	▪ All relevant ownership documents ▪ No. of complaints from the public ▪ No. of community members sensitized	In the budget

Site Clearing, Construction of retaining walls; Rehabilitation of Kamleza intake;Rehabilitation of Kwa-Katwange flume;Rehabilitation of Riata-Ndogo bridge	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	Workers and supervising staff	During construction	▪ Controlled noise and vibration ▪ Implementation of OSHA ▪ Community awareness of the project	▪ Work time table ▪ Idle engines switched off ▪ No. of public complaints ▪ Use of ear muffs ▪ Machine inspection reports	10,000
Construction of retaining walls; Rehabilitation of Kamleza intake;Rehabilitation of Kwa-Katwange flume;Rehabilitation of Riata-Ndogo bridge	Soil and water contamination by waste/chemicals /oils	1) Maintenance of machinery and plant. 2) Identification of appropriate location for disposing chemicals, their containers and contaminated soil & water. 3) Prompt site clearance, avoiding on-site stock piling, 4) Monitor exposed soil especially during wet season.	Workers and supervising staff	During construction	▪ Reduced soil and water contamination ▪ Proper disposal of contaminated soil and water	▪ Report on no., amount/size/area and severity of contamination ▪ Disposal sites	15,000

Canal in operation	Water borne disease- malaria and amoebiosis	1) Community sensitization and awareness creation i.e. water treatment, clearing of bushes around homesteads 2) Sanitation campaigns 3) Provision of free Insecticide Treated Nets(ITNs) 4) Health education 5) Introduction of mosquito larvae eating fish species	Proponent and Public Health department, Irrigation management committee	Within 1st month of canal use	▪ Reduced water borne diseases ▪ 500 community members sensitized ▪ ITNs distributed ▪ Mosquito larvae eating fish introduced into the canal	▪ Disease prevalence reports ▪ No. of beneficiaries capacity built ▪ No. of ITNs distributed	30,000
Canal in operation	Soil and water contamination by waste/chemical/fertilizer	1) Community sensitization and awareness creation. 2) Management of the irrigation water 3) Establishment of crop demonstration plots 4) Establishment of a tree nursery 5) Planting of trees 6) Erosion control 7) Installation of environmental friendly technologies i.e. drip irrigation 8) Train on safe use of pesticides and chemicals, Integrated Pest Management (IPM), Integrated Fertilizer Management(IFM), and Soil & Water Conservation(S&WC)	Proponent and Department of Agriculture, Irrigation management committee	Throughout when the canal is operational	▪ 200 farmers sensitized ▪ Farmers trained on Good Agricultural Practices ▪ Increased tree cover ▪ Farmers trained and install environmental friendly technologies ▪ Reduced chemicals and fertilizers contaminating soil and water	➢ No. of farmers trained ➢ Adaptation of environmental friendly technologies ➢ Water and soil tests	20,000

Canal in operation	Danger of drowning	1) Community sensitization and awareness creation. 2) Establish/enhance capacity of irrigatioon management committee. 3) Employ scouts 4) Construction a cattle trough.	Proponent and Farmers	On completion of excavation/de-silting	▪ Protect the vulnerable(people/ livestock) ▪ No deaths	▪ Scouts in place ▪ Water trough and domestic water drawing point constructed	In the budget
Canal in operation	Livestock/ crop conflict	1) Community sensitization and awareness creation. 2) Animal water trough construction 3) Installation of environmental friendly technologies i.e. zero grazing and green houses 4) Establish/enhance irrigation management committee. 5) Committee to ensure equitable water distribution 6) Operational rules 7) Proper animal routes and holding grounds 8) Avoid grazing animals along the canal 9) Chief, local administration and Irrigation committee enforce rules	Proponent, Departments of Agriculture and Livestock.	Throughout Implementation	▪ Reduced herders/farmer conflict ▪ Reduction of crop damage cases	▪ Community sensitization reports ▪ Adaptation of environment friendly technologies ▪ Enforcement of irrigation water use rules	15,000

Canal in operation	Rural morality decay and Social diseases i.e. HIV/AIDs increase	1) Community sensitization and awareness creation on comprehensive health care 2) Formal education enrolment campaigns 3) Gender mainstreaming campaigns 4) Equip local dispensaries with drugs 5) Measurers against social diseases i.e. free condoms and ARVs	Proponent and Social Services Department , Public health department	Throughout Implementation	▪ Reduced social diseases ▪ Reduced immorality in the community	▪ Public Health reports ▪ Social services reports	20,000
Canal in operation	Structural failure	1) Review of canal design by independent panel of experts 2) Emergency preparedness plan 3) Community sensitization and awareness creation. 4) Establish/enhance capacity of irrigation management committee. 5) Proper engineering design 6) Contractor to abide to engineering design 7) Provide quality works 8) Proper supervision of the works 9) Monitoring and maintenance plan 10) Implementation of monitoring and maintenance plan 11) Planting of trees 12) Erosion control	Workers and irrigation management committee.	Throughout the canal operation	Canal structure monitored and in good condition	▪ Structure constructed as per approved design. ▪ Monitoring records ▪ Repair records	10,000

Canal in operation	Deviated natural water flow	1) Canal designed to return excess water to its natural flow 2) Construction of retention ditches by farms along the canal	Proponent and Farmers	Throughout the canal operation	Excess water is returned to its natural course	▪ Canal designed to return water to its natural course ▪ Farmers along canal construct retention ditches	In the budget
Canal decommissioned	Water use conflicts	1) Committee to ensure equitable water distribution 2) Operational rules	Department of Internal Affairs/chiefs and Irrigation management committee	Canal decommissioning stage	▪ No conflicts occur as a result of canal decommissioning	▪ Chiefs reports	5,000
Canal decommissioned	Excess soil material	To be used in landscaping at an appropriate site	Irrigation management committee	Canal decommissioning stage	▪ No misplaced excess soil and debris	▪ Decommissioning report on materials disposed	30,000
Canal decommissioned	Erosion	1) Plant grass and trees around the canal area 2) Erosion control	Department of Agriculture, Irrigation management committee and farmers	Canal decommissioning stage	▪ No occurrence /controlled soil erosion around the canal	▪ Department of agriculture report on soil and water conservation along the canal/farms.	20,000

CHAPTER NINE: ENVIRONMENTAL MONITORING PLAN

Environmental monitoring is the collection of data and information concerning the project characteristics, quantities and functioning of environmental variables over time and space. This is a process that begins with establishing the environmental baseline studies, carrying out an audit, implementation of mitigation measures and monitoring the success of those measures.

9.1 RECORD KEEPING

The basic activities for a sound monitoring program for this irrigation scheme should include the following parameters: Collection and analysis of relevant environmental data of the site, which includes: - evapo-transpiration rates, geo-tech survey; all permits; and water harvesting records.

9.2 INTERNAL AUDIT

This is the operations monitoring in order to sustain a healthy environment in the project area and its environs that the irrigation management committee shall undertake to monitor the quality of environment around the irrigation scheme voluntarily as well as the project proponents. Monitoring in this case will involve measurements, observations, evaluations, assessments and reporting on:

i. Health and safety implications of the canal/irrigation scheme
ii. Water harvesting rates from the canal
iii. Contraction of safety audits any time there is a possibility of an emergency after completion of rehabilitation of the canal.

9.3 CANAL MAINTENANCE

After the completion of the canal rehabilitation project, there shall be regular inspection and maintenance by the community to ensure that cases of breakdown or flooding will not occur during the lifetime of the canal. It is therefore imperative that the following measures shall be implemented to increase the economic life of the canal:

- Removal of silt from the reservoir using manual labor shall be organized during the dry season as a measure of prolonging lifescanal of the canal.
- No livestock shall be allowed to graze near the canal.
- The end point of the canal exuding water into Kitobo river should be kept clear of any vegetation as this impedes the discharge capacity of the canal. This shall be done before onset of rainy season. Grassing of the this point will be necessary to prevent erosion.

- Any population of rodents shall always be removed because they constitute a serious risk for the water tightness and stability of the canal embarkments.
- There should be observation for excessive seepage, wet patches or small mud slides on the banks of the canal.
- Re-vegetation of the canal rehabilitated sites and all through the canal banks shall always be an ongoing concern.
- Establishment of a tree nursery should be done as soon as canal is operational and trees planted along the canal at a safe distance to prevent erosion and restore the natural beauty of the place.

CONCLUSION

Rehabilitating an irrigation canal of this magnitude is a viable venture that should be given due support by considering the fact that there will be minimal negative impacts to the environment and its potential to contribute to the rise in economic status of the farmers in Njoro irrigation scheme who will benefit from it. It should be noted that, the canal was used for an environmentally negative activity such as livestock direct access to water and growth of bushes along it. Thus rehabilitating the canal will turn the economic value of the canal significantly positive. The proponent has taken all due regard in relation to laws and procedures of the county and country at large in setting up of the project. It will contribute to the economy of the county in regard to poverty eradication. Other included positive impact include; generation of employment, provision of cost effective water for irrigation and local home use as well as promotion of livestock rearing, optimal use of the irrigation infrastructure and water therein, thereby increasing the utility value of the irrigation scheme.

Due to the impacts of development projects to the environment, whereby some developers have not been taking environmental considerations in their activities, there is a need for education, which will raise the level of awareness about the need to take care of these considerations. However the project proponent has incorporated environmental concerns in his activities as evidenced by this report.

Stakeholder assessment was done to gauge the perception of residents on pertinent environmental issues and socio-economics of this project. This was done through a mainly verbal interviews and questionnaire administration at random. Insightful findings were got from this assessment that will shape the future planning for a similar project. Due diligence has been performed in carrying out the assessment and the information contained in this report is correct and factual.

GENERAL RECOMMENDATIONS

- There should be a concerted effort to sensitize the community along the canal about the negative impacts of watering animals directly into the canal.
- There should be construction of a pathway both for animals and people to reduce conflicts and organic pollution into the irrigation water.
- Health education should be provided to this community by the community health workers to sensitize people on ways of preventing and managing water borne diseases like malaria, typhoid and amoebiasis.
- Farm land within the irrigation scheme should strive practicing agro-forestry, construction of soil and water conservation, and water harvesting to prevent soil erosion. The community living near the site should be encouraged to do the same for their own benefit and to prevent rapid siltation of the canal and subsequent reduction in its carrying capacity and lifescanal.
- Monitoring and control of pollution in this canal should be undertaken by the County Environmental Officer in collaboration with the Irrigation Management Committee to ensure the quality of water in these canals is maintained as 'good'.
- Future plans should be made in consultation with the beneficiary community to rehabilitate the canal by implementation of erosion control measures in the area. De-silting must also be considered which can be done periodically during the dry season.
- There should be construction of multiple cattle troughs points to prevent excessive erosion and environmental degradation caused by livestock when they congregate on one area persistently.
- The community should ensure a speedy implementation of this project before the onset of next rain season to prevent amplification of adverse effects when construction is done during the rain periods.
- The project should be undertaken as planned and the Environment Management Plan implemented to the later.

BIBLIOGRAPHY:

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

Apendix 1: Environment Intitute of Kenya Certificate

Apendix 2: National Environment Management Authority Certificate of Practice

FORM 5

nema

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/EIA/RC/3311
Application Reference No: NEMA/EIA/ER/7156

This is to certify M/s ANDREW QUENTIN NGATI of

P.O. Box 82027- 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

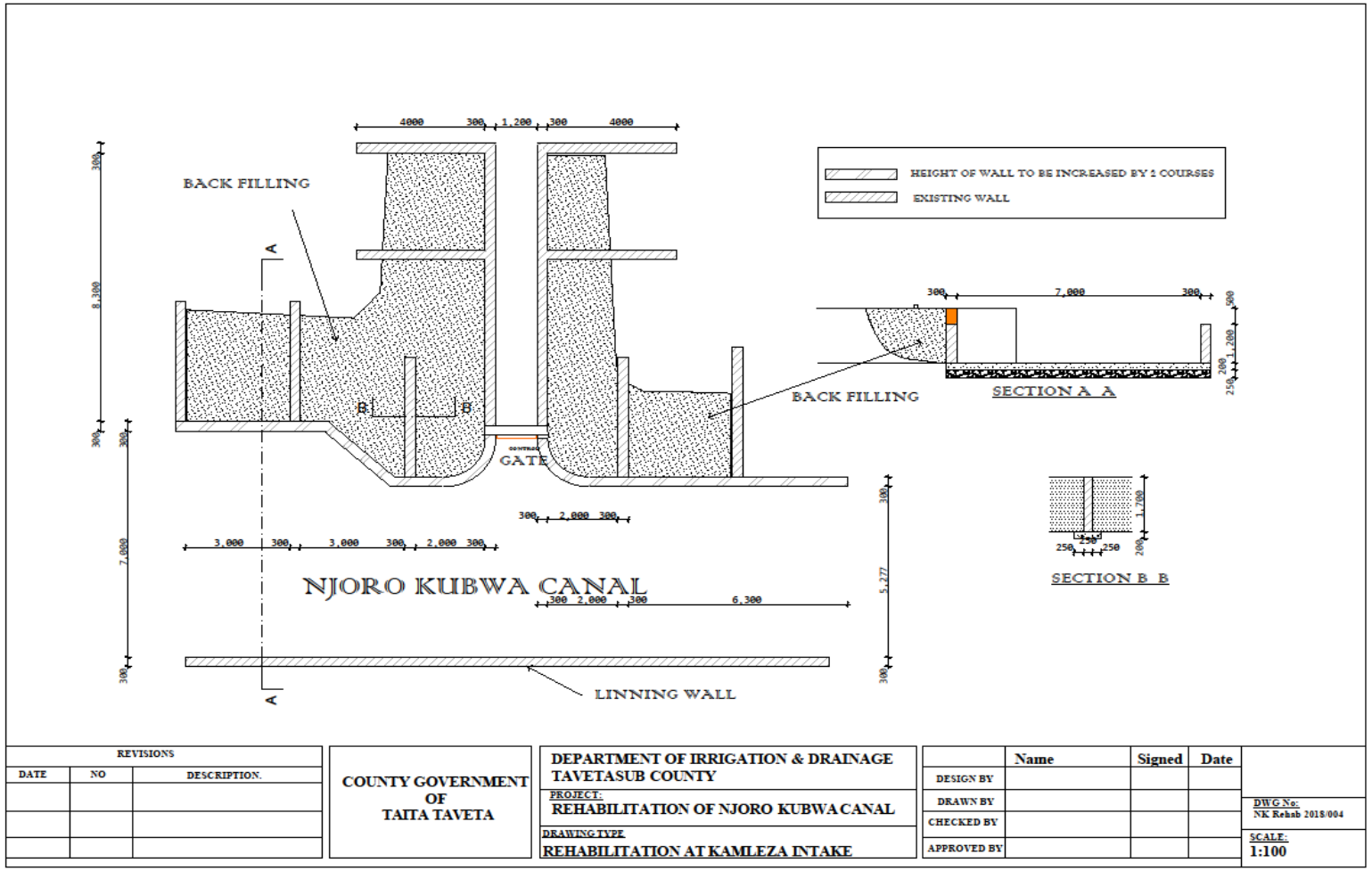
(Seal)

Director-General
The National Environmental Management Authority

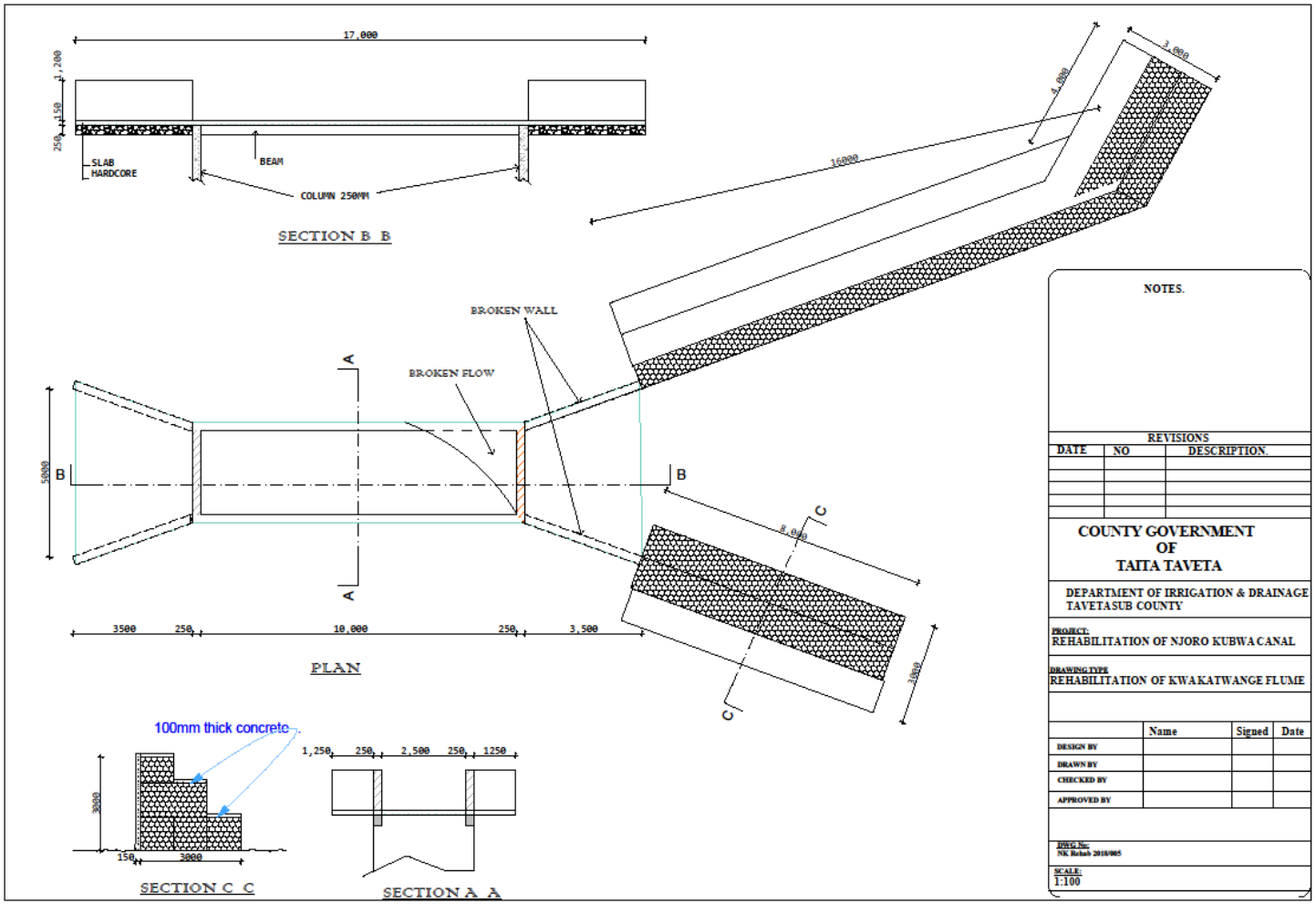
P.T.O.

ISO 9001: 2008 Certified

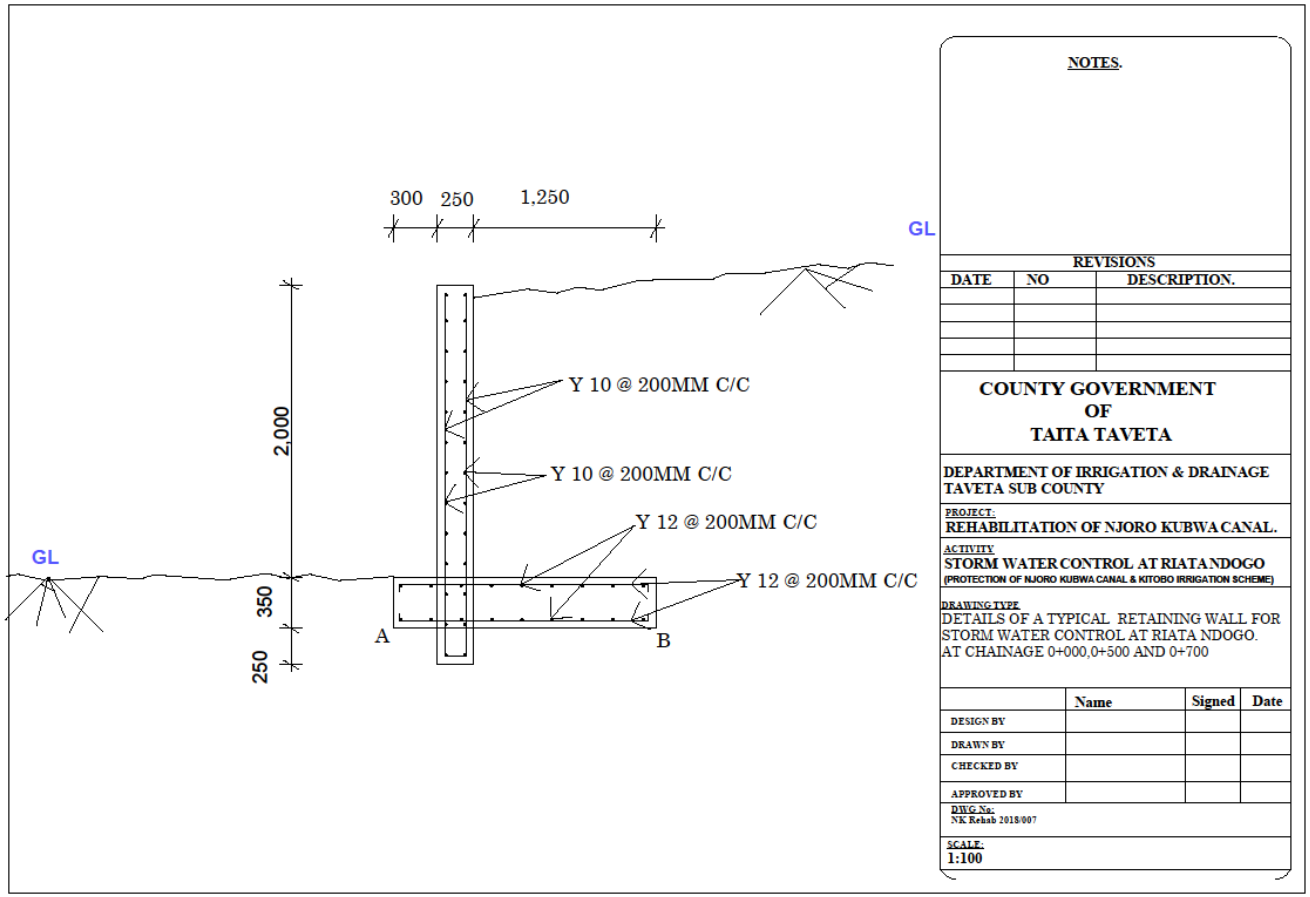
Apendix 3: Kamleza Intake Design Drawings



Apendix 4: Katwange Flume Design Drawings



Apendix 5: Retaining Wall Section Design Drawings



NOTES.

REVISIONS		
DATE	NO	DESCRIPTION.

COUNTY GOVERNMENT OF TAITA TAVETA

DEPARTMENT OF IRRIGATION & DRAINAGE
TAVETA SUB COUNTY

PROJECT:
REHABILITATION OF NJORO KUBWA CANAL.

ACTIVITY
STORM WATER CONTROL AT RIATA NDOGO
(PROTECTION OF NJORO KUBWA CANAL & KITOBO IRRIGATION SCHEME)

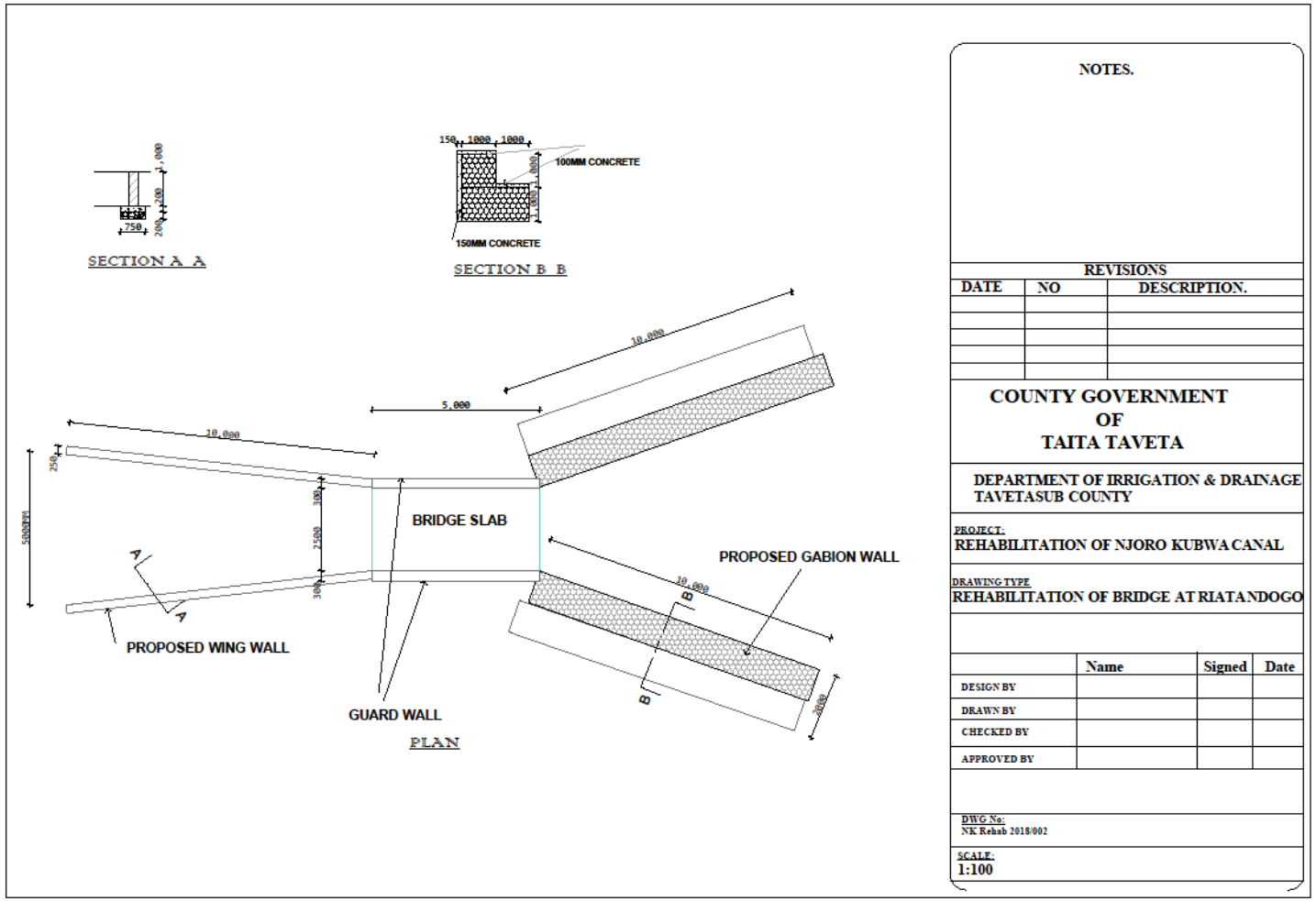
DRAWING TYPE
DETAILS OF A TYPICAL RETAINING WALL FOR STORM WATER CONTROL AT RIATA NDOGO. AT CHAINAGE 0+000,0+500 AND 0+700

	Name	Signed	Date
DESIGN BY			
DRAWN BY			
CHECKED BY			
APPROVED BY			

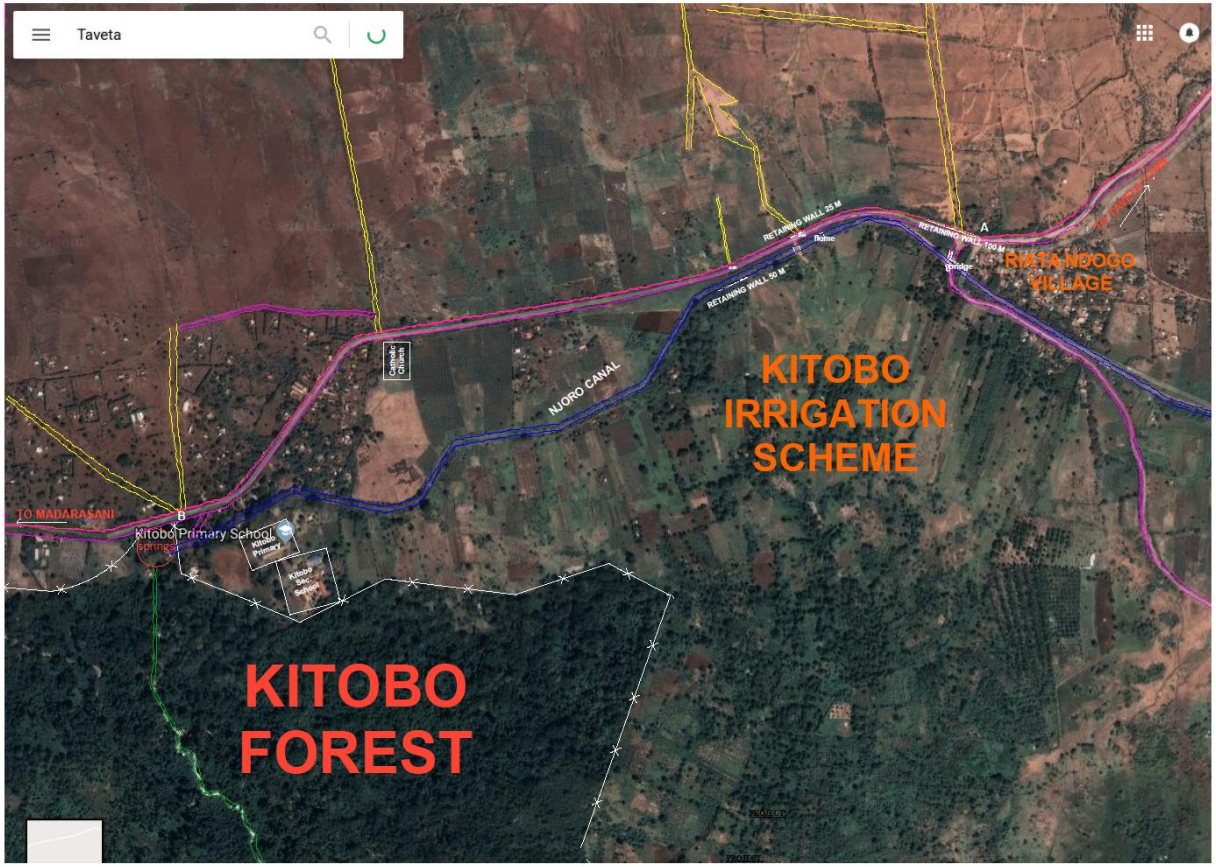
DWG No:
NK Rehab 2018/007

SCALE:
1:100

Apendix 6: Riata Bridge Design Drawings



Apendix 7: Topo-map of Njoro Kubwa Canal



REVISIONS		
DATE	NO	DESCRIPTION

KEY	
ITEM	DESCRIPTION
	RIVER
	CANYON
	ROAD
	CANAL
	DRAIN

COUNTY GOVERNMENT
OF
TAITA TAVETA
DEPARTMENT OF IRRIGATION & DRAINAGE
TAVETA SUB COUNTY

PROJECT
REHABILITATION OF NJORO KUBWA CANAL.
ACTIVITY
STORM WATER CONTROL AT RIATA NDOGO
(PROTECTION OF NJORO KUBWA CANAL & KITOBO IRRIGATION SCHEME)
DRAWING TYPE
TOPO-MAP

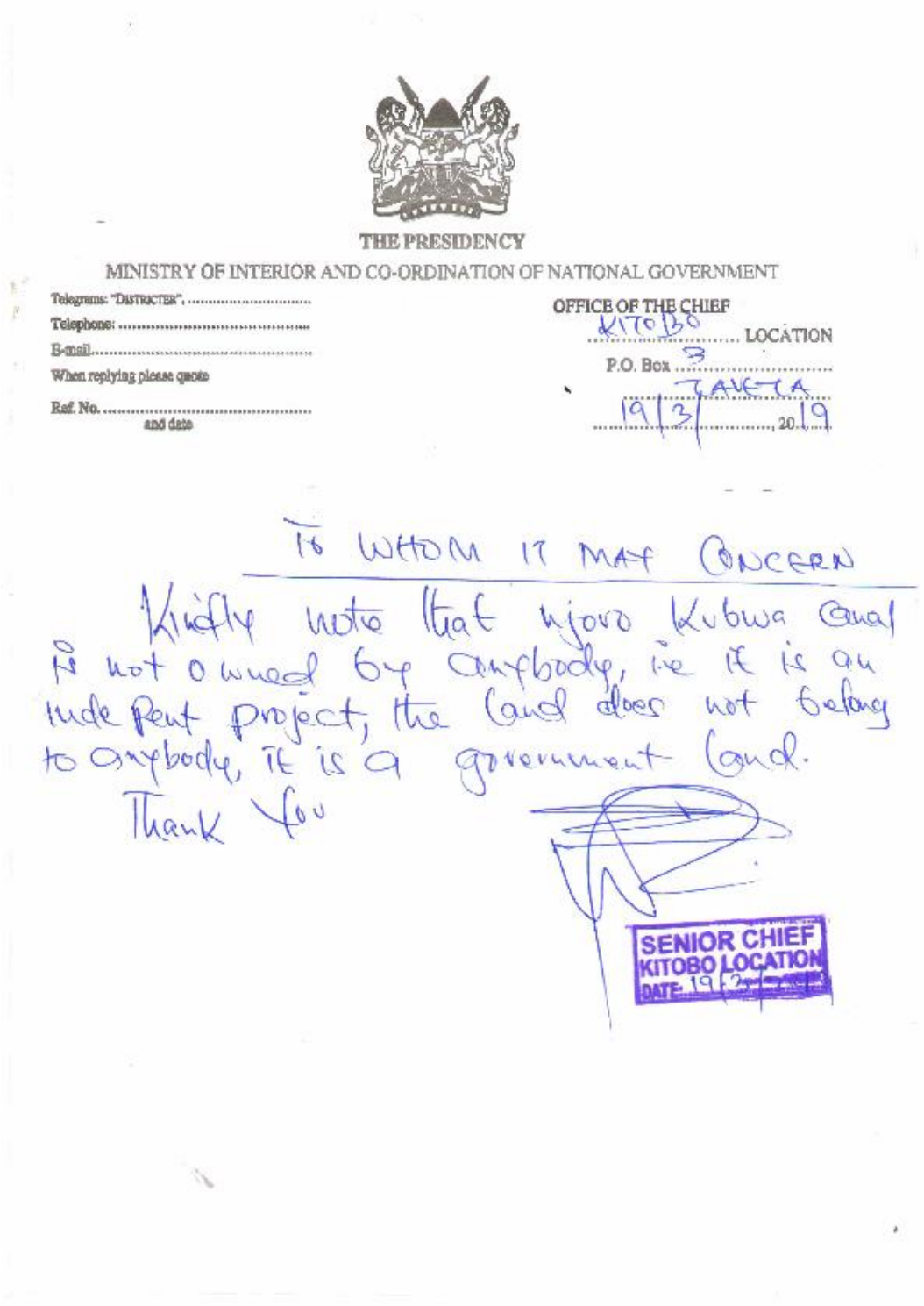
	Name	Signed	Date
DESIGN BY			
DRAWN BY			
CHECKED BY			
APPROVED BY			

DWG No. NK Rehab 2018/006
SCALE: 1:200

Apendix 8: Attendance List ESIA Public Participation

Apendix 9: Minutes to ESIA Public Participation

Apendix 10: Land Ownership Document



THE PRESIDENCY

MINISTRY OF INTERIOR AND CO-ORDINATION OF NATIONAL GOVERNMENT

Telegrams: "DISTRICTER", ...
Telephone: .....
E-mail.....
When replying please quote
Ref. No. .....
and date

OFFICE OF THE CHIEF
KITOBO ..... LOCATION
P.O. Box 3
GAVETA
19/3/ 20.19

TO WHOM IT MAY CONCERN

Kindly note that Njoro Kubwa Canal is not owned by anybody, ie it is an independent project, the land does not belong to anybody, it is a government land.

Thank You

SENIOR CHIEF
KITOBO LOCATION
DATE 19/3