



MINISTRY OF AGRICULTURE, LIVESTOCK AND FISHERIES
STATE DEPARTMENT OF CROPS
Kenya Climate Smart Agricultural Project

**ENVIRONMENTAL AND SOCIAL IMPACT
ASSESSMENT (ESIA) PROJECT REPORT**
FOR PROPOSED REHABILITATION AND EXPANSION OF
MAKERE YA GWANO SOLAR SMALL-SCALE IRRIGATION
SCHEME IN MAKERE VILLAGE, KINAKOMBA WARD, TANA
RIVER-SUB COUNTY IN TANA RIVER COUNTY



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DECEMBER, 2019

DOCUMENT AUTHENTICATION

Certification by Proponent (client)

This report was prepared for and on behalf of:

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TANA RIVER

The County Project Coordinator, Kenya Climate Smart Agriculture Project (KCSAP), hereby confirm that the contents of this EIA project report are true to the best of my knowledge and that I shall implement the mitigation measures proposed in this report and undertake to implement further instructions as NEMA may deem appropriate in relation to the findings of this project report and from time to time as inspections may inform

Signed by:- Peter Munyoki

Institution:- County Project Coordinator (CPC)

Signature:-

Date: - 28th December, 2019

Certification by EIA & EA Lead Expert

Fredrick Onyango Aloo EIA lead expert registered and licensed by the National Environment Management Authority (License No. 9049) and also are members of Environmental Institute of Kenya (EIK) confirms that the contents of this report are a true representation of the Environmental Impact Assessment (EIA) study of the proposed rehabilitation and expansion of Makere Ya Gwano solar small-scale irrigation scheme in Makere village, Kinakomba ward, tana river-sub county in The study of the report was done under my supervision and that the assessment criteria, methodology and content reporting conforms to the requirements of the Environmental Management and Coordination Act (EMCA, 1999), Environmental (Impact Assessment and Audit) Regulations.2.

Signed by the EIA/EA LEAD EXPERT.9049

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Signature:- 

Date:- 16th December, 2019

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We would like to affirm our appreciation to entire project personnel who offered assistance enabling carrying out the exercise smoothly. Special thanks to The County Project Coordinator Tana River County Mr Peter Munyoki, George Wasonga the project Social Safeguards officer and Engineer William Jillo Soye of the department of irrigation for providing the design and feasibility study of the proposed project. We would also like to thank ward administration and Makere Ya Gwano village elder who is also the chairman of Ghbafala Community based organization Mr Martin Kofa for providing logistical support during the participants meeting. Without them public participation would not have been successful.

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EXECUTIVE SUMMARY

Project Description

The environmental study report has been prepared in pursuant to Environmental Management and Coordination Act 1999, section 58(1) the environment Impact Assessment and Audit Regulations. The Kenya Climate Smart Project hereby referred to as the proponent has proposed to undertake rehabilitation and expansion of Makere Ya Gwano Solar Small-Scale Irrigation Scheme. The proposed project site is in Kinakomba ward, Tana River sub county, Tana River County.

The primary beneficiaries of the project are residents of Makere Ya Gwano villages and by extension Kinakomba ward, Tana River County. Residents are the Pokomo community and neighboring Orma community. There are no members of other ethnic groups in the area, save for few professionals like teachers and nurses who work in the area.

Makere is one of the sub-locations in Wenje Division. It has a population of approximately **people** of whom 350 are males and 150 are females distributed in 60 households with approximately 6 persons per household. The community rely on rain-fed agriculture, irrigated agriculture is practiced at very low level due to inadequate skills and lack of irrigation facilities.

The project is expected provide appropriate irrigation infrastructural facilities. The project is expected to enhance food security status and improve livelihood of the community members through increased food production. Frequent crop failures which has been caused by delay in the onset and early cessation of rains accompanied by poor temporal and spatial distribution. At times there are rainfall failures. There are no feasible alternative sources of crop production apart from the permanent river Tana. The water will be conveyed to the irrigation plots about 750m away through a 6' diameter Upvc pipeline and channeled through canals into the plots.

Project Rationale

Rain-fed crop production is no longer sustainable because of the unpredictable weather patterns compounded by issues of climate change over the years. Household food insecurity have increased due to frequency of recurring droughts that occur almost in every three years.

Rehabilitation and expansion of the Makere Ya Gwano irrigation in the area will significantly enhance household food availability, promote appropriate land use, and reduce conflicts over land use. Among the main challenges are lack of food and school going pupils spend more time

Commented [KT3]: Number of people

tethering land hence low school attendance rate and increased absenteeism in classes. Household food availability is inadequate or not available. Unplanned land use systems resulting in severe land degradation. The main source of food crops in the village is the irrigation facilities along the river Tana.

Justification for Environmental Social Impact Assessment (ESIA)

Environmental Management and Coordination Act (EMCA), 2015 requires that such projects undertake an Environmental Impact Assessment (EIA) and that environmental concerns need to be part of the planning and development process and not an afterthought. This Environmental Impact Assessment (EIA) aims at ensuring that environmental concerns are incorporated as required.

The objectives of the EIA are to identify and evaluate the environmental and social effects, which could arise from the proposed construction and operation of the project's activities.

OP/BP 4.01 (Environmental Assessment)

The World Bank has well-established environmental assessment procedures, which apply to its lending activities and to the projects undertaken by borrowing countries, in order to ensure that development projects are sustainable and environmentally sound. This is a World Bank supported project and triggers OP 4.01 (Environmental Assessment), which requires preparation of Environmental Impact Assessment or Environmental and Social Management Plan.

The study team, consulted with a wide range of stakeholders including the Government authorities, community leaders, relevant organizations and interest groups involved directly and indirectly with the proposed project in order to seek their views on the impacts of the proposed project on the environment and socio-economic characteristics of the project area.

The methodology underlying the preparation of the EIA included a multi-stage approach, namely the preparation of a biophysical and social scoping review, including consultative meetings with government departments e.g. National and County Government and local communities

Against the above positive benefits brought about by the project, there will be some negative impacts emanating from both the construction and operation activities of the proposed project.

The proposed project triggers Bank safeguards policies on Environmental Assessment (OP

2

Environmental and Social Impact Assessment (ESIA) Project for proposed rehabilitation and expansion of Makere Ya Gwano Solar Small-Scale Irrigation Scheme in Makere Village, Kinakomba Ward, Tana River-Sub County In Tana River County

4.01). The following negative impacts that is likely to occur during various stages of the project:

- **Terrestrial flora and fauna:** - This project may have some impact on the terrestrial flora and fauna due to **devegetation** cutting of trees and excavating the sites for irrigation canals and water collection.
- **Soil erosion:**-Soil erosion is likely to occur in the project area during the excavation and construction of the pan. The presence of loose earth (resulting from the above activities) coupled with occasional rains could lead to acute and chronic soil erosion problems in the project area;
- **Debris:**-Some of the excavated sediments from the project site and the construction spoils emanating from excess excavated material and construction debris are likely to impart negatively on the environment of the project area
- **Increased noise levels:**-Noise levels are likely to increase in the project but only during construction of the proposed project.
- **Air emissions:**-Pollution through air emissions in the project area will emanate from construction activities especially from exhaust pipes for vehicles and machinery used.
- **Dust pollution:**-Construction activities have the potential to generate levels of dust in the project area especially where construction is taking place.
- **Social Impacts:**-encompass the likely increase child labor,
- **Increased run off** :-from excavated areas and canals
- **Solid waste** :- generation (disposal of cleared bushes)

Proposed Mitigation Measures of Environment and Social Impacts

Table 1: Proposed Mitigation Measures of Environment and Social Impacts

Potential Impacts	Mitigation measures
Construction phase	
Loss of flora and fauna	<ul style="list-style-type: none"> • Retention of vegetation where possible. Undertake planting of existing indigenous plants species along the riverine like <i>Chlorophora excelsa</i>, <i>Manilkara zasibarensis</i>, <i>Brachilina brichantha</i>, <i>Terminalia spinosa</i>., grasses like <i>Digitaria milinjiana</i>, <i>Panicum infestum</i>, <i>Cynodon dactylon</i> • Avoidance of vegetation clearing along riparian land • Sensitization of construction work-force on environmental conservation and ecological protection
Interference with the physical setting	<ul style="list-style-type: none"> • Adequate survey be done on the water pipeline and canal channels • Engagement shall be done to asses whether there are grievances

3

Noise pollution and vibration	<ul style="list-style-type: none"> • Noise maintained in accordance to the manufacturer's specifications • Operation to put on ear masks to prevent direct noise from the machinery • Machines that are less vibrating to be used • When high vibration needed, to be done during the day
Slope instability	<ul style="list-style-type: none"> • Use of manual labour for trenching and backfilling • Construction activities to be conducted during dry season
Soil erosion	<ul style="list-style-type: none"> • Loose soils to be used to fill back excavated/disturbed areas. • Loose soils (<i>Vertisols</i>) to be compacted at the embankments of canals with a mechanical roller so as to avoid erosion by wind or water. • Minimize soil erosion on the embankments and catchment areas by covering soil mould with vegetation
Air Quality Degradation Dust Emissions	<ul style="list-style-type: none"> • Supply and construction vehicles will only use the designated transport routes. The drivers will also be advised to stick to prescribed speed limits • The contractor will ensure proper repair and maintenance of vehicles and equipment to minimize exhaust gases • The contractor shall ensure the appropriate speed limits are observed at along all roads sections that will be used by construction vehicles on a needs basis to eliminate the creation of dusts • Construction workers will be provided with dust masks to mitigate
Workers Accidents and Hazards during Construction	<ul style="list-style-type: none"> • Construction to adhere to Occupational Health and Safety rules and regulations as stipulated in the Occupational Safety Act of Kenya 2007 and revised 2010 • Employers must provide and maintain clothing and appliance that are adequate, effective and suitably protective, including where necessary, suitable gloves, footwear, goggles and head coverings. • In case of accidents, injured persons should be given first aid and immediately taken to the hospital • Investigation on cause of accidents done and adequate conclusion to be arrived at
Extraction and use of Construction Materials	<ul style="list-style-type: none"> • The construction extraction site should be backfilled to help retain the value of the land resource • Fencing to be done before backfilling to prevent accidents of human and livestock
Generation of Liquid and Solid Waste	<ul style="list-style-type: none"> • Provision of solid waste collection facilities (waste bins) • Constructing licensed solid waste handlers • Sensitization of construction workers on proper disposal of solid wastes • The contractor will maintain all site vehicles and equipment in a serviceable state • Temporary latrines will be provided on site to be used by construction workers • Oils and greases emanating from repair and maintenance activities will be collected in containers to avoid entry into local drainage channels • Water from cleaning of equipment will be utilized within the project site and will not be discharged into water courses
Visual Impact	<ul style="list-style-type: none"> • Minimize destruction of vegetation. • Replanting of vegetation after completion of works e.g pasture development and conservation "in-situ" • Avoid having open trenches in an area for a long period of time, to minimize impacts on the soil in control erosion measures in case of erratic rains • Improve impeded drainage through landscaping and filling in the created depressions and trenches.

Increased Vehicular and Human Traffic	<ul style="list-style-type: none"> • Transportation of construction material to specific sites will be done through existing local roads • The contractor will rehabilitate the local roads that will be damaged during construction activities • Consultations with the local communities on planned and road diversions if any • Restriction of vehicular and Human Traffic to the road reserve where possible • Sensitization of drivers to comply with prescribed speed limits
Occupational Health and Safety	<ul style="list-style-type: none"> • Continuous supervision of occupational, health and safety management to ensure compliance • Occupational Safety and Health Training for contractor's staff • Conduct orientation talks and visits
Operation Phase	
Increase in waterborne diseases	<ul style="list-style-type: none"> • Choice of irrigation system that is efficient in water use • Removal of any stagnant water • Use of nets in homes • Use of gumboots in irrigated fields
Slope instability	<ul style="list-style-type: none"> • Repair and maintenance of the canals and pipeline sections to be worked on to avoid spillage of water • Pipeline leakages or bursts shall be swiftly be attended to
Water use conflicts	<ul style="list-style-type: none"> • Water abstraction laws followed • Farmers trained on water use • Enforcement of Water Act 2016 • Establishment of an irrigation Water Use Committee
Pollution of Water	<ul style="list-style-type: none"> • Machines used during operation maintained in good condition (Solar panels raised above ground and kept clean) • Oils and grease emanating from repair and maintenance activities will be collected in containers to avoid entry into local drainage channels • All polluted water treated before discharging to water bodies
Increase of invasive species (Propospis Juliflora) Mathenge	<ul style="list-style-type: none"> • Manual and mechanical removal of the invasive species • Usage of invasive species through charcoal burning • Usage of invasive species pods as a mixture of animal feeds
Soil erosion siltation of surface water resources	<ul style="list-style-type: none"> • Use excavated earth material for backfilling • Sprinkling of backfilled trenches with water • Compaction of backfilled trenches • Revegetation of excavated areas • Channeling of surface water runoff from irrigation channels and pipelines
Health and safety Hazards	<ul style="list-style-type: none"> • Train all workers on Health, Safety and Environmental (HSE) with an aim of improving awareness • The proponent will erect appropriate safety signage during repair and maintenance activities • The proponent shall provide first aid facilities for residence and management staff • Proponent's staff will be required to personal protective equipment during work
Decommissioning Phase	
Reduced availability of irrigation water to users	The proponent shall provide alternative source of irrigation water to then users of the project
Slope instability	<ul style="list-style-type: none"> • Use of manual labour for excavation and backfilling

5

Commented [KT4]: The river is permanent and water plenty, project cannot reduce its availability

Environmental and Social Impact Assessment (ESIA) Project for proposed rehabilitation and expansion of Makere Ya Gwano Solar Small-Scale Irrigation Scheme in Makere Village, Kinakomba Ward, Tana River-Sub County In Tana River County

	<ul style="list-style-type: none"> • Avoid utilization of heavy machinery near steep landscapes • Decommissioning activities to be conducted during rainy season
Soil erosion and siltation of surface water resources	<ul style="list-style-type: none"> • Use excavated earth materials for backfilling • Sprinkling of backfilled trenches with water • Compaction of backfilled trenches • Re-vegetation of excavated areas • Channeling of surface water runoff away from the pipeline route
Air Quality Degradation/Dust emission	<ul style="list-style-type: none"> • Excavation vehicles will only use the designated transport routes. The drivers will also be advised to stick to prescribed speed limits • The contractor will ensure proper repair and maintenance of vehicles and equipment to minimize exhaust gases • The contractor shall ensure recommended speeds on road sections that will be used by construction vehicles are adhered to on a needs basis to reduce the creation of dust • Construction workers will be provided with dust masks to mitigate
Interpretation of existing infrastructure and socio-economic activities	<ul style="list-style-type: none"> • The proponent will liaise with KURA and county government for authorization to cut through feeder roads that fall under their jurisdiction • The contractor will immediately restore damaged section of roads and water supply networks to pre-construction condition
Impact of Socio-economic activities	<ul style="list-style-type: none"> • Notification to local community members whose farms have encroached on the reserve will be notified of pending decommissioning activities
Loss of flora and fauna	<ul style="list-style-type: none"> • The proponent will ensure minimal clearing of vegetation • Transportation of decommissioning wastes to be done through existing local roads • Sensitization of decommissioning work-force on environmental conservation and ecological protection
Increased vehicular and human traffic	<ul style="list-style-type: none"> • Transportation of decommissioning wastes to specific sites will be done through existing local roads • The contractor will rehabilitate the local roads that will be damaged during decommissioning activities • Consultation with the local communities on planned road diversions • Restriction of Vehicular and Human Traffic to the road reserve where possible • Sensitization of driver to comply with prescribed speed limits
Generation of solid and liquid waste	<ul style="list-style-type: none"> • Provision of solid waste collection facilities(waste bin) • Contracting solid waste handlers • Sensitization of construction workers on proper disposal of solid wastes • The contractor will maintain all site vehicles and equipment to a serviceable state • Oils greases emanating from repair and maintenance activities will be collected in containers to avoid entry into local drainage channels • Water from cleaning of equipment will be utilized within the project site and will not be discharged into water course
Health and safety	<p>Continuous supervision of occupational, health and safety management to ensure compliance</p> <p>Occupational safety and Health training for contractor's staff</p> <p>Orientation talks and visits</p>

Environmental and Social Management/Monitoring Plan

Environmental and Social Management Plan (ESMP), including monitoring plan, has been identified as an important process in the protection of environment of the project area. The monitoring program will involve the following:

- Collection and analysis of appropriate environmental data;
- Preparation of periodic reports including an annual environmental and social performance report and liaison with other relevant bodies such as NEMA and the County Government;
- Identification of unexpected environmental impacts; and
- Formulation of mitigation measures for the unexpected negative impacts.
- Key environmental and social variables to be regularly monitored include resource utilization, waste generation, incidences of accidents due to open trenches, soil erosion and siltation, noise levels, changes in socio-economic status of affected communities among other variables.
- The overall responsibility for the implementation of the ESMP lies with the proponent (KCSAP/CPC).

Consultations and Disclosure

Public consultations were held at various stages during the EIA process including screening and scoping as well as impact identification. The consultants and proponent met the county government officials and local communities.

During the stakeholders meetings, the consultant introduced the proposed project to participants. The benefits as well as environmental impacts of the project were explained. The consultants recorded the views and concerns aired out regarding the proposed project. Minutes for these meetings are attached to this report (see Annex 1).

Generally speaking, the community is very positive about the project and they welcomed its implementation. They felt that the proposed project will go a long way in solving their chronic food insecurity that have haunted them for years. They however requested cooperation between the proponent and their leaders so as to ensure smooth implementation.

Project Budget

Construction of the proposed expansion and rehabilitation of irrigation facility (covering excavation, bush clearing, ring fencing and construction of canals) will be at a cost of approximately **Kshs31, 000,000**

Conclusion

Based on the findings, it is evident that rehabilitation, construction and operations of the proposed irrigation project will result in overall economic growth and development as a result of improvement in the availability of water for agricultural use within the project area. As is indicated in Chapter 9, the potential negative impacts can be easily mitigated without any major effect to the environment. However, some important resources may be affected negatively such as flora, fauna and water resources within the project area. These impacts vary from temporary to short term impacts. These impacts can however be mitigated as indicated in the Environmental and Social Management Plan(ESMP) discussed in Chapter 10 of this report

Recommendations

- The proponent needs to support the implementation of environmental management (including mitigation plan and monitoring) in order to protect the environment of the project area from the negative impacts of project implementation.
- Priority for project should be given to the local community including **women and youth**. This will enhance social economics status of the community.
- The proponent should adopt a participatory and collaborative approach during all the phases of the project. This will ensure active participation of all key stakeholders towards success and sustainability of the project.

It is recommended that the project be allowed to proceed on condition that the mitigation measures outlined in this report are adhered to and the Environmental Management Plan (EMP) is implemented as prescribed

ACRONYMS / ABBREVIATIONS

ASALS	Arid and Semi-Arid Lands
A.S.L	Altitude above sea level
CBD	Convention on Biological Diversity
CDIP	County Development Integrated Plan
EA	Environnemental Audit.
EIA	Environnemental Impact Assissent.
EMCA	Environmental Management Coordination Authority.
EMP	Environmental Management Plan.
EMPs	Environmental Management Plans.
FGD	Focused Group Discussion
KFS	Kenya Forest Services
KWS	Kenya Wild services
NEMA	National Environmental Management Authority.
NEAP	National Environmental Action Plan.
NPEP	National Poverty Eradication Plan
PAPs	Project Affected Persons (PAPs)
KCSAP	Kenya Climate Smart Agriculture Project
OSH	Occupational, Safety and Health
OSHA	Occupational, Safety and Health Act.
ASALs	Arid and Semi-Arid Lands
ToR	Terms of Reference.

TABLE OF CONTENTS	PAGES
DOCUMENT AUTHENTICATION.....	ii
ACKNOWLEDGEMENT.....	iii
EXECUTIVE SUMM ARY	1
ACRONYMS / ABBREVIATIONS	9
CHAPTER ONE: INTRODUCTION	17
1.1 EIA Expert Assignments and Terms of Reference	18
1.1.2 Terms of Reference	18
1.2 Justification	21
1.2.1 Objective of EIA.....	22
1.2.2 Target group for the EIA study	23
1.3 Study Methodology and Field Findings	23
1.4 Data Collection	24
1.4.1 Primary data.....	24
1.4.2 Secondary data.....	24
1.4.3 EIA field visit.....	25
1.5 Data analysis	25
1.6 Data presentation	25
1.7 Structure of the report	25
CHAPTER TWO: POLICY, LEGAL AND REGULATORY FRAMEWORK	27
2.0 Introduction	27
2.1 Policy Framework	27
2.1.1 National Water Policy.....	27
2.1.2 Policy on Environment and development	28
2.1.3 Kenya ASAL Policy-Sessional Paper No. 8 of 2012	28
2.1.4 Vision 2030 Development Strategy for Northern Kenya and other Arid Lands.....	28
2.1.5 National Poverty Eradication Plan (NPEP), 1999.....	29
2.1.6 National Land Policy (2009).....	29
2.1.9 Agricultural Sector Transformation and Growth Strategy 2019-2029	29
2.2 Legal Framework	30
2.2.1 Constitution of Kenya 2010.....	30
2.2.2 Environmental management and coordination ACT (EMCA), Cap 387	30
2.2.3 Water Act No. 43 of 2016.....	31
2.2.4 Water Quality Regulations, 2006, (Legal Notice No 121).....	32
2.2.5 Water Resource Management Rules, 2007	33

2.2.6 National Irrigation and Drainage Development Policy	34
2.2.7 Irrigation Act (CAP 347)	34
2.4 Environmental policy and Regulatory framework	35
2.4.1 Environmental Management & Coordination Act Cap 387	35
2.4.2 The Environmental (Impact Assessment and Audit) Regulations 2003.....	36
2.4.3 Environmental Management and Coordination (Conservation of biological diversity (BD) Regulations 2006	36
2.4.4 Environmental Management and Coordination (Wetlands, Riverbanks, Lakes Shoers and Sea Shore Management) Regulations 2009	37
2.4.5 Environmental Management and Coordination (Controlled Substances) Regulations 2007.....	37
2.4.6 Environmental Management and Coordination (Water Quality) Regulations 2006	37
2.4.7 Environmental Management and Coordination (Waste Management) Regulations 2006	38
2.4.8 Environmental Management and Coordination (Fossil Fuel Emission Control) Regulations 2006	38
2.4.9 Environmental Management and Coordination (Noise and Excessive Vibration Pollution) Regulations 2007.....	39
2.5 Land Policy and Regulatory Framework	40
2.5.1 The land Act, 2012 (Legal Notice 6)	40
2.5.2 National Land Commission Act (2012)	40
2.5.3 County Government Act 2012	40
2.5.4 Forest Act.....	41
2.5.5 Agriculture and Food Authority (AFA) Act No. 13 of 2013 (revised 2015)	41
2.5.6 The Community Land Act, 2016.....	42
2.6 Health Policy and regulatory framework	42
2.6.1 Occupational Health and Safety Act, 2007	42
2.6.2 Public Health Act (Cap 242)	42
2.6.3 Work Injury Benefits Act (WIBA), 2007	43
2.6.4 HIV /AIDS Prevention and Control Act 2006 and Gender Mainstreaming:	44
2.7 Institutional Framework	44
2.7.1 The National Environmental Council	44
2.7.2 The National Environmental Management Authority	44
2.7.3 The Standards and Enforcement Review Committee.....	44
2.8 World Bank Environmental safeguards	45
2.8.1 OP/BP 4.01 (Environmental Assessment)	45
2.8.2 OP/BP 4.04 (Natural Habitats)	46

2.8.3 OP/BP 4.09 (Pests Management)	47
2.8.4 OP/BP 4.10 (Indigenous Peoples).....	47
2.8.5 OP/BP 4.11 (Physical Cultural Resources)	48
2.8.6 OP/BP 4.12 (Involuntary Resettlement).....	49
2.8.7 OP/BP 4.36 (Forests).....	49
2.8.8 Activities Triggering World Bank Safeguards	50
2.9 International Conventions.....	51
2.9.0 Introduction.....	51
2.9.1 The World Commission on Environment (the Brundtland Commission of 1987).....	51
2.9.2 The Ramsar Convention on Wetlands of International Importance	51
2.9.2 Convention on Biological Diversity (CBD)	52
2.9.3 Rio Declaration on Environment.....	52
2.9.4 United Nations Framework Convention on Climate Change	53
2.9.5 United Nations Convention to Combat Desertification 1994:.....	53
2.9.6 Sustainable Development Goals.....	53
CHAPTER 3: DESCRIPTION OF THE EXISTING ENVIRONMENT.....	53
3.1 Location and size.....	53
3.2 Physical and Topographic Features	55
3.3 Soils	55
3.4 Ecological and Climatic Conditions	55
3.5 Vegetation Conditions	56
3.6 Demographic attributes.....	56
3.7 Infrastructural access	56
3.8 Land Use	56
3.8.1 Crop production.....	56
3.8.2 Environmental Degradation.....	57
3.8.3 Climate change effects	57
CHAPTER FOUR: PROJECT DESCRIPTION.....	57
4.0 Introduction.....	57
4.1 Overview	58
4.1.1 Project Cost	58
4.1.2 Project design	58
4.1.3 Design Calculations.....	58
4.1.4 Design data	59
4.1.5 Crop and Irrigation Water Design.....	60

4.1.6 Design of the Pipe System.....	61
4.1.7 Determination of Sizes for Infield Water Distribution Chambers	62
4.1.8 Summary Report.....	63
4.1.9 Design and layout of the Irrigation infrastructure and scheme as per specifications	63
4.2 Construction phase	65
4.2.1 Support infrastructure	65
4.3 Materials and Equipment Needed	65
4.4 Proposed Project Activities	66
4.4.1 Planning Phase Activities	66
4.4.2 Construction Phase Activities	66
4.4.2 Operation Phase Activities	66
4.4.2 Decommissioning Phase Activities.....	66
4.5 Types of waste to be generated	67
CHAPTER FIVE: PROJECT ALTERNATIVES	67
5.0 Introduction.....	67
5.1 No Project Alternative.....	67
5.2 Alternative Project site	68
5.3 Relocation Option	68
5.4 Analysis of Alternative construction Materials and Technology.....	69
5.4.1 Irrigation Technology Options	69
CHAPTER SIX: PUBLIC CONSULTATIVE PROCESS AND DISCLOSURE	73
6.1 Introduction.....	73
6.2 Objectives of the Public Consultations/meetings	73
6.3 Participation Consultation/Interviews	74
6.3.1 Sources of Information	75
6.3.2 Key issues arising from public participation meetings.....	76
6.3.3 Perceived Benefits	76
6.3.4 Issues of concern.....	78
6.4.1 Questionnaires Summary	79
CHAPTER SEVEN: IMPACT IDENTIFICATION AND MITIGATION MEASURES.....	82
7.1 Impact Classification and Mitigation Measures.....	82
7.1 Construction phase	88
7.1.1 Anticipated Positive impacts during Construction phase.....	88
a) Employment opportunity.....	88
7.1.2 Anticipated Negative Impacts during Construction phase	89

7.2 Operation Impacts during the Operation phase	91
7.2.1 Positive Impacts.....	91
7.2.2 Negative Impacts during operation phase	92
7.2.3 Summary of potential Impacts.....	96
7.3 Anticipated Impacts during the decommissioning phase	97
7.3.1 Decommissioning activities.....	97
7.3.2 Positive Decommissioning Impacts.....	98
7.3.3 Negative Decommissioning Impacts	98
CHAPTER EIGHT: MITIGATION MEASURES AND MONITORING PROGRAMS	98
8.1 Construction related impacts	98
8.2 Operation phase impacts	102
8.3 Decommissioning Phase Impacts	105
CHAPTER NINE: ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN (EMMP)	106
9.1 Responsibilities	106
9.2 EMMP monitoring	107
9.3 Design and Construction Phase	107
9.4 Environmental Management and monitoring plan during operation phase	110
9.5 Environmental monitoring	115
9.5.1 Monitoring water quality	115
9.5.2 Monitoring Soil quality.....	116
9.5.3 Monitoring Soil Erosion	117
9.5.4 Monitoring invasive species.....	117
9.6 EMMP for the Decommissioning phase	119
9.6 INTERNAL AUDIT/ENVIRONMENTAL SOCIAL MONITORING	121
CHAPTER TEN: CONCLUSIONS AND RECOMMENDATIONS	123
10.1 Conclusion & Recommendations	123
11.0 KEY REFERENCES	125
11.0 ANNEX 1: MINUTES OF THE COMMUNITY CONSULTATION MEETINGS	126
11.1 ANNEX II LIST OF PARTICIPANTS	130
11.2 ANNEX III: PUBLIC CONSULTATION QUESTIONNAIRE	132
11.3 ANNEX IV: SAMPLE QUESTINNAIRE FILLED BY RESPONDENT	133
11.4 ANNEX V: PHOTOS ON PUBLIC CONSULTATION AND FILLING OF QUESTINNAIRE	136
11.5 ANNEX VI: IRRIGATION INFRASTRUCTURE DESIGN	137

11.6 ANNEX VII: COMMUNITY RESOLUTION AGREEMENT	138
11.7 ANNEX VIII EIA CERTIFICATE AND PRACTISING LICENCE	140
11.8 ANNEX XI EIK MEMBERSHIP CERTIFICATE	142

LIST OF TABLES

Table 1: Proposed Mitigation Measures of Environment and Social Impacts	3
Table 2: Activities Triggering World Bank Safeguards	50
Table 3: Data acquisition and hydrological modelling	59
Table 4: Crop and Irrigation Water Design	60
Table 5: Pipe sizing	61
Table 6: Head losses	61
Table 7: Power Requirements	62
Table 8: Sizes of infield water chambers	62
Table 9: Summary Report	63
Table 10: Materials and Equipment Needed	65
Table 11: Types of waste generated	67
Table 12: Impact Classification and Mitigation Measures	82
Table 13: Summary of Key potential positive and negative impacts	96
Table 14: Environmental management and monitoring plan during construction and operation phase	108
Table 15: Environmental Management and Monitoring plan for operation phase	111
Table 16: Monitoring water quality	115
Table 17: Monitoring river flow quantity	116
Table 18: Monitoring Soil quality	116
Table 19: Monitoring Soil Erosion	117
Table 20: Monitoring invasive species	117
Table 21: EMP for decommissioning phase of proposed project	119
Table 22: Internal Audit/Environmental Social Monitoring	121

LIST OF FIGURES

Figure 1: Map of Kenya Indicating the Location of Tana River County	54
Figure 2: Google earth map indicating the site of proposed Makere Ya Gwano Irrigation Scheme	55
Figure 3: Makere Ya Gwano Contouring	63
Figure 4: Makere Ya Gwano Plot Layout	64
Figure 6: Public participation, participants filling questionnaire	75
Figure 7: Summary of Respondent's years (age) as residents	79
Figure 8: Respondents awareness about the proposed water pan	80
Figure 9: Respondents comments on benefits of the project	80
Figure 10: Respondents comments on negative impacts of the project	80
Figure 11: Proportion of respondents on mitigation measures	81
Figure 12: Proportion of respondents by gender either Male or Female	81

CHAPTER ONE: INTRODUCTION

1.0 Introduction

Kenya has a history of periodic droughts whose magnitude, severity and frequency has increased in the recent past due to global climate change with the counties in Arid and Semi-Arid lands (ASALs) most affected. The droughts have caused negative economic and social consequences including threat to livelihoods.

Tana River County is located in the coastal region of Kenya. The county borders Kitui County to the West, Garissa County to the North East, Isiolo County to the North, Lamu County to the South East and Kilifi County and Indian Ocean to the South. The county straddles between latitudes 000°53" and 200°41" South and longitudes 380 30' and 40015' East and has a total area of 38,862.20 Km². The county has a coastal strip of only 76 Km.

The land in the county is largely non-arable covering 29,798.7 km². The rest is either under forest 3,457 km², arable land covering 2,547 km², and 3,059.5 km² under national reserves.

Tana River County is endowed with great Irrigation potential. The County irrigation potential Areas range between 180,000ha - 200,000ha, out of which only 2% has been put under irrigation development. On the other hand, about 10% of the exploited potential is under the large scale irrigation schemes (Bura, Hola and Tana Delta).

Out of all area identified and developed for Irrigation, only about 50% is under effective and efficient Irrigation agriculture. Most of the on-going irrigation practice in Tana River County is group based, under the pump-fed group irrigation category, where by groups of between 10- 200 households have been formed and have invested in irrigation. Most of these groups cannot afford to develop their farms due to high cost associated.

Previous efforts by the county and other development partners, irrigation development has produced inconsistent results due to various socio-economic problems which need to be overcome. The main socio-economic problems and constraints which hinder irrigation development are issues related to; skills, weak farmers organizations, infrastructure, resource use conflicts, drought and floods, gender, and dependency syndrome. The negative impact of drought on agriculture has multiple implications including: Chronic food insecurity, disrupted

livelihoods, malnutrition and generally low economic development. Rain fed agriculture is therefore one key drivers of vulnerability for small scale farmers in this country.

Irrigated agriculture has been presented as one of the key strategies to address this challenge. Currently the total irrigated (about 6 percent) area is still inadequate and falls short of the National Water Master Plan 2030. This calls for increased investment in irrigation infrastructure by the national and county government. In addition, existing irrigation scheme have deteriorated over time and therefore characterized by significant inefficiencies while some have become non-operational. Rehabilitating such schemes in most instances provide a less costly and effective avenue for increasing irrigated agriculture. It is against this background that the Ministry of Agriculture Livestock & Fisheries through the Kenya Climate Smart Project (KCSAP) has sought to improve agricultural production among small scale farmers through rehabilitation and or construction of irrigation schemes in Kenya.

The Kenya Climate Smart Project (KCSAP) World Bank Funded was conceived by the Government of Kenya (GoK) and builds on the success of Kenya Agricultural Productivity Project (KAPP). The project aims at improving agricultural production through climate smart agricultural practices in 44 counties. In addition to improved irrigation infrastructure, the project. Also focuses on agro weather services, improved access to markets, capacity building, research and innovations among others.

Makere Ya Gwano irrigation Scheme lies along the River Tana in Wenje Division within the Tana Basin. The main source of water for the project is from River Tana. The targeted command area is 30 ha which is expected to benefit 500 small holder farmers of which 150 are males and females are 350.

The project is anticipated to cost a total of Kshs **31,000,000**. KCSAP grant 32,070,000

Commented [KT5]: Total project cost 49,149,200

Commented [KT6]: KCSAP grant 32,070,000

1.1 EIA Expert Assignments and Terms of Reference

The Ministry of Agriculture Livestock and Fisheries. The World Bank Kenya Climate Smart Agriculture Project in Tana River County contracted **Mr Fredrick Aloo Lead Expert No 9049** among others to carry out Environmental Social Impact Assessment (ESIA) for Makere Ya Gwano Irrigation Scheme project in accordance with the Environmental Impact and Audit Regulations 2003 and international guidelines for ESIA and submit a report to NEMA for approval.

1.1.2 Terms of Reference

Environmental and Social Impact Assessment (ESIA) Project for proposed rehabilitation and expansion of Makere Ya Gwano Solar Small-Scale Irrigation Scheme in Makere Village, Kinakomba Ward, Tana River-Sub County In Tana River County

The following TORs were provided to guide the ESIA study and development of a report:

- I. Description of the project background. This includes providing a contextual background of the proposed rehabilitation and expansion of Makere Ya Gwano Irrigation Scheme and justification for undertaking Environmental and Social Impact Assessment (ESIA). The expert will provide information on major components of the project., implementing agencies and scope of the project including specific project components at construction, operation and decommissioning phase, target beneficiaries, project affected persons and project cost
- II. Environmental assessment study, standard environmental impact assessment techniques will be used including site reconnaissance; desktop research; field work-household interviews, focused group discussions with community representatives, Key informant interviews, stakeholder consultative workshops, observations and measurements; data analysis and presentation according to NEMA guidelines. In order to undertake a comprehensive study the following task will be performed:
- III. Description of the Environment. An evaluation of baseline data on environmental characteristics of Tana River County and more especially the project area. This include information on any changes anticipated before the programme commences (e.g agricultural use and value). i.e :
 - a. Physical environment: Geology (general description for overall study area); topography, soils and erosion patterns; Climate including rainfall and runoff characteristics; surface and ground water hydrology; identity of streams lakes and receiving water quality).
 - b. Biological environment: flora (e.g types and diversity, weeds; fauna e.g movements including migration); rare or endangered species within or in areas adjacent to programme- related development sites; sensitive habitats including wetlands, parks or reserves, significant natural habitats within or near programme-related development areas; species of commercial importance areas affected by the project
 - c. Social cultural environment (both present and programmed): e,g population (i.e full time or seasonal); land use(i.e year round and seasonal); Planned development activities; community structure; employment and labour market; distribution of income, goods and services; recreation; public health; education; cultural properties(.g archeological and historically significant sites); Indigenous peoples and traditional tribal lands ; customs, aspirations and attitudes.

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- IV. Legislative and regulatory considerations: Describe the pertinent laws, regulations and standards governing environmental quality, health and safety, protection of sensitive areas and endangered species, siting land use control, etc at international, regional and local levels.
- V. Determination of the potential impacts of the proposed project: Identify all significant changes that the project is likely to generate. This may include, but not limited to, changes in land cover and land use, changes in soil structure and composition, loss of natural habitat and other vegetation; unintended effects of agrochemical use, access to shared resources particularly the water resources grazing areas, loss of land/displacement and noise.
- VI. In this analysis, distinguish between significant positive and negative impacts, direct, indirect and cumulative impacts, and the immediate and long term impacts. Identify impacts that are unavoidable or irreversible. Wherever possible, describe impacts quantitatively in terms of environmental and social costs and benefits and assign economic values when feasible.
- VII. Characterize the extent and quality of available data, explaining significant information deficiencies and any uncertainties associated with predictions on impact. For information not to be obtainable until after project execution, provide terms of reference for studies to monitor operations over a given period and to modify designs and/or operational parameters based upon updated impact analysis.
- VIII. Analysis of alternatives to the proposal project: The ESIA should include analysis of reasonable alternatives to meet the ultimate project objectives. This analysis may suggest designs that are more sound from an environmental perspective than the originally proposed project. Include the “no action” alternative (not developing the project) to demonstrate environmental conditions without it. Describe how the alternatives compare in terms of potential environmental impacts; capital and operational costs; suitability under local conditions (e.g. skill requirements, political acceptability, public operations etc); and institutional training, and monitoring requirements. When describing the impacts of alternatives, indicate which impacts would be irreversible or unavoidable and which may be mitigated.
- IX. Public participation. The consultant will engage project affected persons and relevant government and non-government entities throughout the ESIA process. The methods to be used for public participation will include: household survey in the project area; focused group discussion with community representatives; key informant interviews

and stakeholder workshops. Public participation process, groups and the issues raised in the various forums will be documented in the study report.

- X. Impact identification and analysis. An assessment of the potential changes on the biological, physical, social, cultural and economic due to the proposed project activities at the construction, operation and decommissioning phase. Impact analysis to determine the nature, significance and likelihood of the identified impacts
- XI. Development of an Environmental Mitigation Plan: This will include identification of the preventive actions and/or mitigation measures recommended to eliminate, reduce or mitigate the potential adverse environmental and social impacts of the project, as well as who will be responsible for implementing such measures how much they will cost etc
- XII. Development of monitoring plan: Preparation of a detailed plan to monitor the implementation of mitigating measures and the impacts of the project during construction and operation. Include in the plan an estimate of capital and operating cost and a description of other inputs (such as training and institutional strengthening) needed to carry it out.
- XIII. To determine the training needs for community and stakeholders for implementation of mitigation measures

1.2 Justification

There is a growing concern in Kenya and at global level that many forms of development activities cause damage to the environment. This has been aggravated by lack of awareness and inadequate information amongst the public on the consequences of their interaction with the environment. In addition there is limited local communities' involvement in participatory planning and management of the environment and natural resources.

Recognizing the importance of natural resources and the environment in general. The Kenyan Government has put in place wide range of policy, institutional and legislative frameworks to address the major causes of environmental degradation and negative impacts on ecosystems emanating from industrial and economic development programmes. It is now accepted that development projects must be economically viable, socially acceptable and environmentally sound. It is a condition of the Kenya Government to conduct Environmental Impact Assessment (EIA) on development projects such as the one proposed by the Ministry of Agriculture Livestock and Fisheries and state department for crop development in Tana River County. EIA assesses the impacts of a proposed project before commencement of

implementation. In addition to helping formulate proper development policy, EIA provides for public participation in the decision making process in respect of a given proposed project. EIA serves the following process:

- a. Integration of environment issues into planning and decision making process
- b. Anticipation, minimization and mitigation of environmental damage and recommendations of alternatives
- c. Public participation in decision making and environmental conservation

The steps included in EIA are contained in the Environmental management and Coordination (Amendment) Act No 8 of 2015 at section 58 and 138 and the Environmental Impact Assessment and Audit Regulations (Legal No 101 of 2003). All undertakings enumerated in the Second Schedule of EMC (amendment) Act requires an Environmental Impact Assessment Project/study report prepared and submitted to the National Environmental Management Authority (NEMA) for review and eventual licensing before the development commences

1.2.1 Objective of EIA

The aim of this assessment will be to identify significant potential impacts of the proposed project to environment, social, economic and health aspects and formulate recommendations to ensure that the project takes into consideration appropriate measures to mitigate any likely adverse impacts to the environment and people's health livelihood through all phases of its construction and implementation.

The specific objectives are:-

- Collect and analyze baseline information for physical, biological and socio-economic environments in the project area of the proposed rehabilitation and construction irrigation project.
- To discuss the policy legal and regulatory issues associated with proposed project
- Establish environmental baseline conditions of the project area and review all available information and data related to the proposed project.
- Predict and assess the potential impacts of the project
- Evaluate social- economic conditions and human health. This would include but not limited to issues such as archeology, cultural heritage, landscape aspects, recreational, social, economic aspects, land use, infrastructure, agricultural development, and human health.
- Propose appropriate mitigation measures for any negative impacts envisaged and promote measures for positive impacts resulting from implementing the project
- Allow for public participation in order to incorporate the views of stakeholders during

project implementation

- Prepare Environmental Management Plan for the three stages of the project which will also be used for subsequent yearly audits
- Prepare an ESIA study report in accordance with the environmental legislation guidelines and submit to NEMA for further instructions and / or approval.
- Facilitate the management control of environment practice in a sustainable manner.
- To highlight environmental issues with a view to guide policy makers, planners, project clients, stakeholders and government agencies to help them understand the implications of the EIA Reports and make the necessary decisions concerning the proposed project and future planning scenarios.
- To establish benchmarks for the various environmental aspects relating to the proposed projects.

1.2.2 Target group for the EIA study

This EIA Study Report has been prepared for use by different stakeholders to be involved in the project. The report contains useful information on policies and procedures to be adhered to, implementation modalities, analysis of potential environmental and social impacts and suggested mitigation measures at various stages of the project activities. The information will be useful in planning, implementation, management and maintenance of the proposed small scale irrigation project infrastructure after decommissioning.

The EIA study report will be useful to the following stakeholders/partners: -

- **NEMA** monitoring and compliance section;
- Contractor engaged in the construction works for the irrigation project Funding agencies and donors for the proposed project; (Kenya Climate Smart Project (**KCSAP**))
- The potential project affected persons (**PAPs**) living within the project community area; and beneficiaries of the project both at local and the County Government.

1.3 Study Methodology and Field Findings

Appropriate methods and approaches for the data collection and analysis is critical in obtaining accurate and reliable information, which can be used as a basis for decision- making. Carrying out of ESIA's requires accurate information to help in decision making. It is in line with this, the following methods were used:

- Site reconnaissance and visual survey to determine baseline information on the project
- Comparative study of the project with existing land uses in the locality

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- Analysis of the project documents
 - Discussion with proponent
 - Assessment of the site to detail the various existing and likely impacts of the project environment
 - Photographs within the project indicate some aspects of site captured during site investigation
 - Assessment of health safety issues and conservation concerns
 - Extrapolating and inferring environmental conditions and responses from baseline information or from other similar cases where actual data is lacking
 - Public consultation to allow for public participation in planning and development and
 - Preparation and submission of reports to NEMA

1.4 Data Collection

1.4.1 Primary data

Primary data was collected using the following methods:

- Direct field observation through site walks, to identify land uses, topography, soil types the state of environment and other key environmental issues
- Administration of questionnaire
- Group discussion with members of the community on the proposed project and general life
- Interviews with neighbors, the provincial administration and institutions near proposed site of the project
- Discussion with field officers and their experiences in the proposed area as this is their working area

This was the initial site acquaintance visit whose main aim was to understand the project site coverage, identify site constraints, and develop impressions on topography, environment, soils, existing developments and practicality of establishing an irrigation project in the proposed site.

1.4.2 Secondary data

Secondary data was obtained from public documents, government documents (sub county reports) and design documents. This was necessary to help fill gaps the existed in the already gathered information

Detailed desktop studies were conducted on reports from all the specialized sectors integrated with the project. The information were obtained from the following partners: Department of Social services, Department of Public Health, Departments of Agriculture and Irrigation

Environmental and Social Impact Assessment (ESIA) Project for proposed rehabilitation and expansion of Makere Ya Gwano Solar Small-Scale Irrigation Scheme in Makere Village, Kinakomba Ward, Tana River-Sub County In Tana River County

Livestock, Kenya Wildlife Services in Tana River county, County NEMA office also provided the needed information coupled with the County Government who provided the detailed County Integrated Development Plan (CIDP). Also had a meeting with the client (proponent) the County Project Coordinator (CPC) to obtain more and relevant literature on the project operation in the county.

1.4.3 EIA field visit

The EIA field studies, desk data collection, community participatory meeting and analysis were undertaken from 11th December, 2019 to 23th December, 2019. The purpose was to generally evaluate the types, mode of action, dynamics and magnitude of the specific projected effects and impacts, both favorable and detrimental to the environment and natural resources at the project site

1.5 Data analysis

All data and information collected during the process of assessment was processed and analyzed to extract useful information. It involved extraction of relevant information from the filled questionnaire, interviews with people on site and the prevailing conditions on the state of the environment

1.6 Data presentation

After data analysis, presentation of data was undertaken. This entailed the tabulation of data showing the findings of the study, description of the gathered data and coming up with an environment management plan to address the negative impacts identified for the proposed project. In addition, data was presented in the form of photographs to help emphasize certain key issues

1.7 Structure of the report

Structure of this report is as follows:

Executive Summary

Chapter 1: Introduction: This chapter gives the background information relevant to the project and describes the objectives and requirements of the study

Chapter 2: Policy, Legal and regulatory framework: This chapter outlines Government policy on the environment, the relevant legislation relating to natural resource management and

environmental protection and the institutions that deal with various aspects of environmental management

Chapter 3: Description of the existing environment: Provides a description of the existing environment to achieve an understanding of the bio-physical and social environment setting

Chapter 4: Project Description: Describes the project design, project construction and operation

Chapter 5: Project Alternatives: The alternative consists of the proponent's final proposal with inclusion of the NEMA guidelines and regulations and procedures. This is as stipulated in the Environmental Management Plan and Co-ordination Act (EMCA) of 1999, which aims at reducing environmental impacts to the minimum extent practicable

Chapter 6: Public consultation: Describes the consultation process, views of stakeholders and future consultations

Chapter 7: Potential Impacts and mitigation measures: Identifies the potential impacts on the bio-physical and socio-economic environment, together with appropriate mitigation measures to minimize and manage the effect on the environment

Chapter 8: Mitigation measures and Monitoring Programme: The purpose of such a program is to establish actions required to prevent mitigate, and control possible negative impacts of the project on the environment

Chapter 9: Environmental Management Plan: The EMP provides framework within which identified negative environmental impacts would be mitigated and monitored. In addition the EMP assigns responsibilities of actions to various actors and provides a timeframe for the implementation of mitigation measures and monitoring

Chapter 10: Conclusions and Recommendation: Provides a brief non-technical summary of the report findings and recommendations

CHAPTER TWO: POLICY, LEGAL AND REGULATORY FRAMEWORK

2.0 Introduction

Kenya has a policy, legal and administrative framework for environmental management. Under the framework, the Environmental Management Authority (NEMA) is responsible for ensuring that environmental impact assessments (EIAs) are carried out for new projects and environmental audits on existing facilities as per the Environmental Management and Coordination Act (Cap 387)

EIAs are carried out in order to identify potential positive and negative impacts associated with the proposed project with view to taking advantage of the positive impacts and developing mitigation measures for the negative ones. The guidelines on the EIAs are contained in section 58 to 67 of the Act. According to section 68 of the Environmental Management and Coordination Act (Cap 387), 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 EIAs and environmental audits. Proponents will need to observe the provisions of the various statutes that are aimed at maintaining clean and healthy environment. Some of the policy and legal provisions are briefly presented in the following sub sections

2.1 Policy Framework

The Kenya Government has in place an environmental policy for harmonizing conservation with its development plans. Using this combination, it becomes easy to sustainably use available natural resources to better quality of life. It is aimed at conserving biodiversity, arresting desertification and mitigating effects of disasters all of which are aimed at maintaining an ecological balance. The balance will lead to food self-sufficiency and quality of life for man and other animals.

2.1.1 National Water Policy

The National Policy of Water which was promulgated in April 1999 as Sessional Paper No. 1 of 1999 calls for decentralization of operational activities from the central government to other sectors, including local authorities, the private sector and increased involvement of communities in order to improve efficiency in service delivery. It also tackles issues pertaining to water supply and sanitation facilities development, institutional framework and financing of the sector. The overall objective of the National Water policy is to lay the foundation for the rational and efficient framework for meeting the water needs for national economic development, poverty alleviation, environmental protection and social wellbeing of the people through sustainable water resource management.

2.1.2 Policy on Environment and development

In the Sessional Paper No. 6 of 1999 on Environment and Development, the overall goal is to integrate environmental concerns into the national planning and management process and provide guidelines for environmentally sustainable development. The key objective is to ensure all development policies, programs and projects take environmental considerations into accounts, and to enhance, review regularly, harmonize, implement and enforce laws for the management, sustainable utilization and conservation of natural resources.

Under this policy, broad categories of development issues have been covered that require sustainable approach which encompasses the use of Sustainable Land Management. The policy enhances participation of stakeholders in the management of natural resources within their respective localities.

2.1.3 Kenya ASAL Policy-Sessional Paper No. 8 of 2012

The national policy titled ‘Releasing our full potential’, has five key elements among them affirmative action that equitable development needs the support of all Kenyans; an enabling environment for accelerated investment in ‘foundations’ to reduce poverty and build resilience & growth; a responsive government to the uniqueness of arid lands which include ecology, mobility, population distribution, economy and social systems.

The policy also focuses on building resilience in order to realize full potential of the Arid and Semi-Arid Lands and it aims at developing measures to manage drought & strengthen livelihoods. The proposed irrigation scheme addresses the policy by food and nutrition security through crop production.

2.1.4 Vision 2030 Development Strategy for Northern Kenya and other Arid Lands

The strategy was developed to complement Vision 2030 by explaining how its goals would be realized in the specific context of Northern Kenya and other ASALs. The main policy challenge is to ensure food and nutrition security in a sustainable manner in environments that are prone to drought, insecure access to and control over livelihood resources such as land, and where climate change increase unpredictability.

The strategy envisions a holistic and sustainable management of land and natural resources across the ASALs to allow for maintenance of their traditional movement arrangements. The proposed interventions include: *The irrigation scheme ensure food and nutritional security by providing a conducive environment for crop and livestock production through a sustainable land management.*

2.1.5 National Poverty Eradication Plan (NPEP), 1999

The **NPEP** has the objective of reducing the incidence of poverty in both rural and urban areas as well as strengthening the capabilities of the poor and vulnerable groups to earn income. *The proposed Makere Ya Gwano expansion and construction of irrigation scheme project to be initiated will contribute to poverty eradication through provision of food crops and livestock in addition to employment creation.*

2.1.6 National Land Policy (2009)

The overall objective of the National Land Policy is to secure rights over land and provide for sustainable growth, investment and the reduction of poverty. The key thrust of the policy is to ensure that; citizens have opportunity to access and beneficially occupy and use land; equitable and sustainable use of land; efficient, effective and economical operation of land markets; efficient and effective utilization of land and land-based resources; and efficient and transparent land dispute resolution mechanisms.

The policy adopts a plural approach, in which different systems of tenure coexist and have equal guarantees of tenure security. *Measures to secure livelihoods and tenure of land are proposed which ensures that all land use practices conform to the principles of sustainable resource management. The irrigation scheme project would conform to the principles of sustainable resource management.*

2.1.9 Agricultural Sector Transformation and Growth Strategy 2019-2029

The importance of agriculture has been emphasized in Kenya through Vision 2030 and the Medium Term Plan III and most recently the President's Big Four priority agenda for 2017-2022, which emphasizes the importance of 100% food and nutrition security for all Kenya. To transform Kenya's agricultural sector and make it a regional powerhouse, the Government has formulated the Agricultural Sector Transformation and Growth Strategy (ASTGS). The Strategy is based on the belief that food security requires a vibrant, commercial and modern agricultural sector that supports Kenya's economic development sustainably and its commitments to regional and global growth. *Nine flagships that serve as the core of our 10-year Agricultural Sector Growth and Transformation Strategy (ASTGS) have been developed. The flagships were drawn on the status of our agriculture today, a rigorous and thorough review of data, lessons from global best*

practices, and our local realities. Among the key flagships is support to irrigation infrastructure. Achieving our potential in agriculture will achieve food and nutrition security, improve our farmer and local community incomes, lower the cost of food, increase employment (particularly for women and youth).

2.2 Legal Framework

There are several pieces of legislation and policy documents related to this kind of development in Kenya. These include, but not limited to the Constitution of Kenya 2010, the Environmental Management and Coordination Act (No 8 of 1999), Sessional Paper No 9 of 1999 on Environment and Development, Physical Planning Act (Cap. 286), the Panel code (Cap 63), the Public Health Act (Cap.242) the County Government Act (No 17 of 2012), the Factories and Places of Work Act (Cap.514), the Community Land Act (No 27 of 2016), National Environmental Action Plan (NEAP), Sustainable Development Goals (SDGs), Millennium Declaration and Brundtland Commission Report (“Our Common Future”) of 1987

2.2.1 Constitution of Kenya 2010

The constitution is the supreme law of the republic and binds all persons and all state organs at all levels of government. In relation to the environment, article 42 of chapter one, The Bill of Rights, confers to every person the right to a clean and healthy environment, which includes the right to have the environment protected for the benefit of present and future generations through, legislative measures, particularly those contemplated in Article 69 and have obligations relating to the environment fulfillment under Article 70.

Chapter 5 of the document provides the main pillars on which the 77 environmental statutes are hinged.

Part 1 of the Chapter dwells on land, outlining the principles informing land policy, land clarification as well as land use and property.

The second part of this chapter directs focus on the environment and natural resources it provides a clear outline of the state’s obligations with respect to the environment.

The proposed project conformed to the constitution of Kenya 2010 which lays emphasis on a clean and a healthy environment. Irrigation projects utilize natural resources hence the need to develop an elaborate EMP so as to contain adverse effects.

2.2.2 Environmental management and coordination ACT (EMCA), Cap 387

Part II of the Environmental Management and Coordination Act entitles every person in Kenya a clean and healthy environment. It seeks to safeguard and enhance sustainability of the environment. The act is a consolidation of the various sectoral laws on the environmental conservation, which had hitherto made it difficult to coordinate environmental protection. In the

act are provided guidelines on issues of environment and stipulates offences and penalties for failure to adhere to the act. The proposed project has been researched, compiled and written in accordance with the Environmental Impact Assessment and Audit regulations, 2003, regulation 7(1) and the second schedule. It will be submitted to NEMA which has the overall responsibility of enforcing this act. The Act also lists the type of projects which must be subjected to the EIA process. *The proponent appoints EIA experts to conduct the EIA and produce a project report to comply with and meet the requirements of this legislation*

2.2.3 Water Act No. 43 of 2016

The Act provides for the regulation, management, development and use of water resources, and water and sewerage services. It has provisions for formulation of five-year integrated water services strategy with plans, programs for protection, conservation, control and management of water resources; establishment of water sector institutions which include Water Resources Authority (in place of Water Resources Management Authority) to regulate water rights and works; the National Water Harvesting and Storage Authority (in place of National Water Conservation and Pipeline Corporation); the Water Services Regulatory Authority (in place of Water Services Regulatory Board); Water Works Development Agencies (in place of Water Services Boards); the Water Sector Trust Fund (in place of Water Services Trust Fund) to enhance water services; the Water Services Regulatory Authority to control water service providers, and the Water Tribunal (in place of Water Appeals Board) for dispute resolution.

In Kenya water is regarded as a natural resource and is therefore owned by the state for and behalf of the people (Section 3). Thus, the Minister in charge of water is empowered under the Act to control, plan and regulate the use of water. Further the Minister is vested with the duty to promote investigations, conservation and proper use of water.

Part VII Section 35 requires an **acquisition of permit where provision of water for irrigation** exceeds two acres in the extent. Section 36 requires applications for permit made in case of proposed diversion, abstraction, obstruction, storage or use of water from a water body.

The water Act protects water bodies and sources from pollution and controls their use by the project. It ensures that the project require amount of water that can be provided for by the existing water system and that the project design will work to conserve the available water resources both during construction and operation phase.

The proponent will be required to complete and file with the Water Apportionment Board for application of a permit

Relevance to the proposed project

The proposed small scale irrigation scheme will have to adhere to the regulations in the water act. The act addresses issues on conservation of water, water abstraction rights and water harvesting and storage to satisfy crop production, human and livestock needs, and to protect ecosystems to secure ecologically sustainable development, including the responsibilities of county governments and public private partnerships.

2.2.4 Water Quality Regulations, 2006, (Legal Notice No 121)

Water Quality Regulations apply to water used for domestic, industrial, agricultural and recreational purposes; water used for fisheries and wildlife purposes and water used for any other purposes.

No person is allowed to abstract water from a natural water body for irrigation purposes unless such water meets the standard set out in the Ninth Schedule (Annex 3) to these regulations.

These regulations provide for the protection of lakes, rivers, streams, springs, wells and other sources. The overriding objective of the regulations is to protect human health and environment. Proper enforcement of the regulations can lead to marked reduction in water borne diseases. The regulations provide guidelines and standards for the discharge of poisons, toxins, radioactive and other pollutants into the aquatic environment. Standards have also been set for discharge of effluent into the sewer and aquatic environment, The National Environment Management Authority regulates discharge into the aquatic environment.

The regulations provide for creation of a buffer zone for irrigation schemes of at least fifty (50) meters in width between the irrigation scheme and the natural water body. The first and Ninth Schedule of the Regulations stipulates standards for sources of domestic water supply and irrigation water respectively. Persons (real or legal) discharging effluent into the environment are required to submit quarterly discharge monitoring records to NEMA

Relevance

The proponent will ensure that sources of water for Makere Ya Gewno Irrigation Scheme meet the specified standards provided in these regulations (see annex 3). The Ministry of Agriculture Livestock and Fisheries will liaise with WRA and NEMA to ensure farmers maintain the minimum 50 meters buffer.

2.2.5 Water Resource Management Rules, 2007

The project will be required to submit authorization to the Water Resource Authority within 12 months of the commencement of the rules as stated in Part II Section 17(1). Failure to submit the documents may be used as basis for revocation, variation or cancellation of the permit or authorization.

Part VII Section 97 of the Rules states that the Authority shall, where applicable require an application to show evidence of compliance with provisions of EMCA, Section 99 states the need for controlling and measuring devices for accurate measurement of the water abstracted.

The WRM Rules 2007, Part VIII Section 104, states that the Authority shall be paid for water abstracted by any person in possession of a valid water permit or supposed to have a valid water permit. Section 107 states that the Authority may with good cause or at the request of the land owner demarcate the riparian boundary of any water course or body on any land at its own cost. Part IX of the WRM Rules, 2007 gives guidance on conservation of riparian land and catchment areas. Riparian area (according to the Rule Part 1) is land in respect of which management obligations are imposed on the owner by the authority due to its proximity to a water body. It does not imply change of ownership but imposes management for preservation of quality (and quantity) of the water resource. In the allocation of water for irrigation, the Authority shall give priority to substance irrigation; and be guided by crop water requirements in the area and the efficiency of water use.

It also provides guidelines for establishment of a WRUA:

- 1) For a WRUA to be considered for registration by the Authority, it should be legally registered, have a constitution conducive to collaborative management of water resources of a particular resource and which promote public participation, conflict mitigation, gender mainstreaming and environmental sustainability.
- 2) Any WRUA that meets the prescribed conditions may seek to register with the Authority, by submitting the prescribed Form WRMA 018 set out in Twelfth Schedule
- 3) The Authority shall respond in writing within thirty days of the receipt of the application by the WRUA
- 4) Upon registration the Authority shall issue the WRUA with a certificate of registration.
- 5) The Authority may enter a Memorandum of Understanding with a WRUA for purpose of collaborative water resource management of the water resources

Relevance

Water availability is the driving force behind any irrigation project. The main source of water in the proposed scheme is River Tana whose exploitation should be regulated to control amount of water used since there are users downstream at the Tana Delta. The proponent will undertake the initiative of promoting conservation of the riparian area along River Tana during project construction and operation

2.3 Irrigation policy and Regulatory framework**2.2.6 National Irrigation and Drainage Development Policy**

The policy seeks to stimulate irrigation development through targeted technical support effective co-ordination of the sector, institutional reforms, and the enactment of a comprehensive legal framework for irrigation development. It intends to guide, coordinate and harmonize sustainable sector development. The policy with its corresponding instruments anchors strategic interventions and legal safeguards, which in turn support and fast track policy implementation for the growth and sustainability of irrigation, drainage and water storage in Kenya.

The proponent will endeavor to promote the conservation and rehabilitation of the project area, and seek to improve the socio-economic conditions of the residents.

And be sued and capable of purchasing

2.2.7 Irrigation Act (CAP 347)

This Act of parliament provides for the development, control and improvement of irrigation schemes 3(1), part II of the Acts grants legal establishment of the Ministry of Agriculture with the powers to sue and be sued and capable of purchasing or otherwise, acquiring, holding, managing and disposing of any property movable or immovable, entering into contracts and doing all things necessary for the proper performance of its duties and discharge of its functions under this Act and any subsidiary legislation made

The Act gives the Minister powers to designate any area of land as a national irrigation scheme. Apart from irrigation carried out through designated irrigation schemes, private individuals engage in irrigated agriculture are required to apply for, and obtain a permit for water abstraction, following the permit application procedures that apply to abstraction for any other use.

The proponent will ensure compliance with the stipulated guidelines as provided for by the act in acquiring the relevant permits in regard to water abstraction.

2.4 Environmental policy and Regulatory framework

National Environment Action Plan Framework, 2009 -2014

The National Environmental Action Plan Framework is the second national policy after the 1994 National Environmental Action Plan (NEAP). The development of NEAP is provided for by EMC (amendment) act 2015 which requires preparation of Environmental Action Plan at different levels; County, and national levels. The framework recognizes the intertwined linkages between economic growth and environment in Kenya. It highlights priority themes and activities for the country towards achieving sustainable environment

Relevance

The proponent shall ensure the proposed rehabilitation and expansion of Makere Ya Gwano solar small-scale irrigation scheme promotes sustainable environment.

2.4.1 Environmental Management & Coordination Act Cap 387

This Act of parliament, EMCA 1999 and the subsequent amendments, is the parent Act of parliament that provides for the establishment of appropriate legal and institutional frameworks for the management of the environment and for matters connected therewith and incidental thereto.

EMCA, in its 13 interrelated parts provide regulatory provisions for all levels of environmental conservation and management. The first one part provides legislative guidelines on administrative and planning components of the environmental management. They include; (1); General principles (II); Administration (III); Environmental planning (IV); Protection and Conservation of the environment. Part five and seven focus on field management of the environment as an integral component of actual or proposed projects. (V), Environmental Impact Assessments (EIA), audits and monitoring (VI); Environmental and Audit Monitoring (VII); Environmental quality standards. The last five parts of the act regulate on enforcement of provisions outlined in the Act and recognition of international agreements along which EMC (amendment) Act 2015 has been established. They are; (VIII); Environmental Restoration orders, Environmental Easements (IX); Inspections analysis and records (IX); International Treaties, Conventions and Agreements (XI) National Environmental Tribunal (XII); Environmental Offences (XIII).

All chapters 1 to 13 apply to the project at one stage or the other and therefore the project proponent is required to understand and conform with the Act accordingly. One such are is environmental and social Impact assessment. This is expressly stated in section 58(2) of the Act.

Relevance

The proponent of a project shall undertake or cause to be undertaken at his own expense an environmental social impact assessment study and prepare a report thereof where the

authority, being satisfied after studying the project report under sub-section (1), that the intended project may or is likely to have a significant impact on the environment so directs.

2.4.2 The Environmental (Impact Assessment and Audit) Regulations 2003

This is supplementary legislation to the EMC (amendment) Act. It gives additional punch by providing guidelines for conducting Environmental Impact Assessments and Audits. It offers guidance on fundamental aspects in which emphasis must be laid during field study and outlines the nature and structure of Environmental Impact Assessments and Audit reports. The legislation further explains the legal consequences of partial or non-compliance to the provisions of the Act.

Irrigation infrastructure development is one of the activities listed on section 86 in the second schedule of Environmental Management and coordination (amendment) Act 2015 as among projects that require Environmental Impact Assessment before commencement. The project cannot start before the license is granted upon conducting the ESIA. For this reason, this report provides the legal requirements for the project approval. Impacts of irrigation projects, involves major elements of the environment, including land, water, human health and safety.

2.4.3 Environmental Management and Coordination (Conservation of biological diversity (BD) Regulations 2006

These regulations are described in Legal Notice No 160 of Kenya Gazette Supplement No. 84 of December 2006. These Regulations apply to conservation of biodiversity which includes conservation of threatened species, Inventory and monitoring of biological diversity and protection of environmentally significant areas, access to genetic resources benefit sharing, offences and penalties. This legislation takes cognizance of the need to promote integrity of biodiversity so as to promote their integrity. Most of the biological diversity is highly threatened by development in the current world and there is an apparent need to enhance their integrity. Section IV, prohibits any activity which may have adverse effects on the ecosystem.

Relevance

The rehabilitation and expansion of the irrigation scheme may lead to an introduction of new crops that are not indigenous. There is need to promote these regulations so as to enhance the integrity of these biological diversity. The proponent will therefore seek to ensure and promote the management and conservation of biodiversity in the area by employing environmentally sound mechanisms during and after the establishment of the project.

2.4.4 Environmental Management and Coordination (Wetlands, Riverbanks, Lakes Shoers and Sea Shore Management) Regulations 2009

These regulations provide for the protection and management of wetlands, riverbanks, lakeshores and sea shore management and detail guidelines on the same

Relevance

The irrigation project when in operation will abstract water from River Tana resulting on increase and for water which may degrade the riparian areas. It is important that this legislation be enacted during the planning, construction and operation of the project

2.4.5 Environmental Management and Coordination (Controlled Substances) Regulations 2007

These Regulations aim to regulate the production, trade and use of controlled substances and products, provide for a system of data collection to facilitate compliance with relevant reporting requirements under the Montreal Protocol on Substances that deplete the Ozone Layer; promote the use of ozone friendly substances, products, equipment and technology; and ensure the elimination of substances and products that deplete the ozone layer.

Relevance

The proponent will ensure that the wastes w produced in the irrigation scheme will be safely disposed in a way not to pose a threat to the ozone layer.

2.4.6 Environmental Management and Coordination (Water Quality) Regulations 2006

Described in Legal Notice No 120 of Kenya Gazette Supplement No 68 of September 2006, these regulations apply to drinking water, water used for industrial purposes, agricultural purposes, recreational purposes dis and wildlife and any other purposes. The Regulations outline various water quality standards in relation to use and discharge.

Regulations 20 of these regulate ons provide for compliance with water quality standards for irrigation. It states that where the Minister, in exercise of his powers conferred under section 42(3) has issued an order for the management of natural water body, no person shall abstract water from such body for irrigational purposes unless such water meets the standards set out in the Ninth Schedule to these Regulations.

Regulations 21 of these regulations requires the creation of a buffer zone between an irrigation scheme and a natural water body and its states ‘ Any owner or operator of an irrigation scheme shall create a buffer zone of at least 50 meters in width between the irrigation scheme and the natural water body into which scheme discharges its waters’.

The regulations invest in the authority NEMA in consultation with WRMA, the powers to maintain water quality monitoring for sources of domestic water at least twice every calendar year and such monitoring records shall be in the prescribed form as stipulated out in the second schedule to these regulations

Relevance

The propose irrigation project will abstract water from Tana River. It is thus fundamental to conform the buffer zone specifications of atleast 50meters and also regularly analyze water qualities and quantities at the intake points and check to prevent the discharge of toxic waste waters for conformity to stipulated irrigation standards in the supplementary legislation.

2.4.7 Environmental Management and Coordination (Waste Management) Regulations 2006

Regulations guiding waste management are described in Legal Notice No 121 of Kenya Gazette Supplement No 69 of September 2006. They offer legal provisions on handling of a variety of wastes emanating from various projects and activities. The waste categories covered by the regulations include;

- Industrial Waste
- Hazardous and toxic wastes
- Pesticides and toxic substances
- Biomedical wastes Environmental Management and Coordination (Controlled Substances) Regulations 2007
- Radio-active substances

These Regulations outline requirements for handling, storing, transporting and treatment/disposal of all waste categories as provided therein. Part V section 34 requires that pesticides or toxic substances be disposed at designated site or plant approved by the authority

Relevance

The proposed project once operational will involve the use of pesticides and chemical fertilizers. Wastes resulting from the use of these products may contaminate River Tana and there should be strict observations of these regulations in dealing with all these wastes

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

These Regulations are described in Legal Notice No 131 of Kenya Gazette Supplement No 74 of October 2006 and will apply to all internal combustion engine emissions standards, emission inspections, the power of emission inspectors, fuel catalyts, licensing to treat fuel, cost of clearing pollution and partnership to control fossil fuel emissions

Relevance

The fossil fuels considered are petrol, diesel Kerosene. This will be applicable to equipment and machinery used in the project during constructing and operation phases of the project

2.4.9 Environmental Management and Coordination (Noise and Excessive Vibration Pollution) Regulations 2007

This is covered under the legal notice number 61. These Regulations under part II section 3 prohibit making or causing any loud, unreasonable, unnecessary or unusual noise which annoys disturbs, injures or endangers the comfort, repose, health or safety of others and the environment

Section 4 prohibits excessive vibrations and excessive which annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment; or excessive vibrations which exceed 0.5 centimeters per second beyond any source property boundary or 30 meters from any moving source

Operations of machineries that produce excessive noise are also prohibited under section II including:

Operating or repair of any machinery, motor vehicle, construction equipment or other equipment, pump, fan, air conditioning apparatus or similar mechanical device; or engaging in any commercial or industrial activity, which is likely to emit noise or excessive vibrations that exceed the levels prescribed in the First Schedule (See annex) to these Regulations

The legal notice also prohibit construction at night except for purposes specified in sub-Regulations (2) which include road and other public utilities. Section 15 calls for an EIA to be carried out by any person intending to carryout construction, demolition, mining or quarrying work to do an EIA studies to identify natural resources, land uses or activities which may be affected by noise or excessive vibrations from the construction, demolition mining or quarrying;

Determine the measures which are needed in the plans and specifications to minimize or eliminate adverse construction, demolition, mining or quarrying noise or vibrations impacts; and incorporate the needed abatement measures in the plans and specifications

Relevance

Under the regulation the contractor is prohibited from producing excessive noise and vibrations which may annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment or excessive vibrations which exceed 0.5 centimeters per second beyond any source property boundary or 30 meters from any moving source. Under the regulations the contractor the will be required to undertake daily monitoring of the noise levels within the project area during construction period to ensure compliance.

2.5 Land Policy and Regulatory Framework

2.5.1 The land Act, 2012 (Legal Notice 6)

This is an act of parliament to give effect to Article 68 of the constitution to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land based resources, and for connected purposes. The Act applies to all land declared as: (a) public land under Article 62 of the constitution ; (b) private land under Article 64 of the constitution; and (c) community land under article 63 of the constitution and any other written law relating to community land. The utilization of land resources under this category of land provided in the constitution, this act or any other written law is guided by the following values and principals of land management and administration

- a) Equitable access to land
- b) Security of land rights
- c) Sustainable and productive management of land resources**
- d) Transparent and cost effective administration of land
- e) Conservation and protection of ecologically sensitive areas
- f) Elimination of gender discrimination in law, customs and practices related to land property inland

The proposed Makere Ya Gwena Irrigation project is a central development activity that utilizes sensitive components of the land hence the need to adhere to the values and principals of Sustainable and productive management of land resources. Gender issues will be addressed by ensuring that women are given an opportunity in the management and use of the Irrigation scheme

2.5.2 National Land Commission Act (2012)

To resolve any conflicts that may arise during the acquisition of land for this project, Article 16 authorizes the commission to establish committees for the better ed of their functions among them compulsory acquisition process as outlined in the Land Act (2012). This is further cascaded to the counties according to article 18 by establishing the County Land management Boards, in consultation with national and county governments.

If conflicts on the acquisition of land, the proponent will adhere to the guidelines on the establishment of committee for resolution provided by the Act

2.5.3 County Government Act 2012

The act gives effect to Chapter Eleven of the Constitution, which provides the county governments the powers to function and take responsibilities for the delivery of services within their designated counties including management of environment and natural resources among other responsibilities. The functions provided for in Article 186 of the constitution as assigned in the Fourth Schedule of the Constitution.

Relevance

This include management of natural resources, biodiversity, forests and water resources among others. The county government will therefore have responsibility in management of the proposed rehabilitation of the small irrigation scheme

2.5.4 Forest Act

The forest Act, 2005 recognizes that forest play a vital role in the stabilization of soils and ground water, thereby supporting the conduct of reliable agricultural activity and that play a crucial role in protecting water catchment in Kenya and moderating climate by absorbing greenhouse gases. The act recognizes that forest provide the main locus of Kenya's biological diversity and major habitat for wildlife.

The vegetation is Bush shrub grassland having a composition of Hyphaene Coriacea(Doum Palm), Acacia Elatior and common rangeland grasses such as Chloris roxburgiana, Chloris pycnothrix. If the trees are cut to open up the area then planting of similar indigenous trees must be done around the catchment areas upstream and downstream

2.5.5 Agriculture and Food Authority (AFA) Act No. 13 of 2013 (revised 2015)

This Act provides for consolidation of the laws on the regulations and promotion of agriculture generally, to provide for the establishment of the Agriculture and Food Authority. It also makes provision for the respective laws of National and County Governments in agriculture, excluding livestock and fisheries and related matters in furtherance of the relevant provisions of the 4 schedule of the Constitution and for connected purposes. The Act provides for formulation of policy guidelines on development, preservation and utilization of agricultural land; noxious and invasive weeds; and responsibilities of county governments.

Relevance

Since agricultural production is a function of the county government under Schedule 4 of the constitution control of noxious and invasive plants such as Prosopis juliflora (mathenge) shall be undertaken with support from the county government

2.5.6 The Community Land Act, 2016

The Act was enacted (pursuant to Article 63 (5) of the Kenya Constitution 2010) to provide for the recognition, protection and registration of community land rights; management and administration of community land; to provide for the role of county governments in relation to unregistered community land and for connected purposes.

The Community Land Act (2016) also provides that the County governments shall hold in trust all unregistered community land on behalf of the communities. This provision does not however give the County Governments any authority to dispose off any Community Land. This part would be contradictory to the provision vesting the land with the Community and needs careful management. The County Government is simply expected to protect the Community Land against annexation while at the same time receiving financial compensation for any community land that may be taken out for infrastructure development or mining after adequate discussions and agreement by the respective community.

Relevance of the Acts to the proposed project

The proposed small scale irrigation development project, recognizes that for the community members to utilize their land sustainably, they must have ownership of the land.

2.6 Health Policy and regulatory framework

2.6.1 Occupational Health and Safety Act, 2007

The Act provides for the safety, health and welfare of workers and all persons lawfully present at work place, as well as the establishment of the National Council for Occupational Safety and Health and for connected purposes. **Section 3(1) and (2)** of the Act explains that it applies in all workplaces where any person is at work, either temporarily or permanently. It expounds on the purpose, which is to secure the safety, health and welfare of persons at work as well as protecting persons other than persons at work against risks resulting from, or connected to, activities at workplace. Further, sections 43 and 44 of part V give regulations on registration of work places

Relevance to the proposed project

The irrigation project will require significant manpower to drive and will thus result in employment of quite a number of people. There will also be need for designated workplace for operation

2.6.2 Public Health Act (Cap 242)

This Act makes provision for securing and maintaining health. Part III and IV of the Act focuses on notification, prevention and suppression of infectious diseases, including inspection, disinfection and provision of medical aid to affected parties in case of outbreaks of infectious diseases. Part IX regulates on sanitation and housing, granting health authorities powers to prevent or remedy any dangers to health arising from poor handling of sanitation issues as well as improper housing and nuisances arising there from. Besides, regulations governing prevention and destruction of mosquitoes, encompassing due maintenance of yards, premises, wells, cesspits and identification and destruction of breeding places are entailed in part XII. Also disposal of wastes.

Relevance to the proposed project

Sanitation and waste disposal, built structures, disease outbreaks and communal resource sharing are obvious issues in project during construction and implementation phase. The Public Health Act provides the necessary legal guidelines regulating measures aimed at effective control and management of the said issues is adhered to avoid break down of communicable and other diseases. During the commissioning phase there may be increased incidences of malaria due to large standing water mass hence the need to undertake capacity building on appropriate hygiene sanitation and provision of mosquito nets.

2.6.3 Work Injury Benefits Act (WIBA), 2007

The **WIBA** Act provides for compensation to employees for work related injuries and diseases contracted in the course of their employment in work places and for connected purposes.

Section 7(a) of the Act, on the obligations of the employer, requires an employer to obtain and maintain an insurance policy with an insurer approved by the State in respect of any liability that the employer may incur under this Act to any of his employees.

Section 10(1) States that an employee who is involved in an accident resulting in the employee disablement or death is subject to the provisions of this Act, and entitled to the benefits provided for under this Act. It also states expressly that an employer is liable to pay compensation in accordance with the provisions of this Act to an employee injured while at work.

On First Aid covered in **section 45(1)**, an employer is supposed to provide and maintain such appliances and services for the rendering of first aid to his employees in case of any accident as may be prescribed in any other written law in respect of the trade or business in which the employer is engaged.

Relevance to the proposed project

As workers are employed by the project contractors during the construction works, they may face myriad of challenges to their health, safety and security, either from the equipment of use or work processes. WIBA offers legal backing on the incidents or accidents at the workplace or while on duty, including First Aid and compensation aspects. It is thus important to integrate the relevant provisions of this Act in the proposed irrigation scheme development project Activities by the contracting agency.

2.6.4 HIV /AIDS Prevention and Control Act 2006 and Gender Mainstreaming:

It creates public awareness on causes, modes of transmission, consequences and means of prevention and control of HIV and AIDS. It protects the rights of the infected and affected and outlaws discrimination in all its forms against persons living with HIV and AIDS or those perceived or suspected to have HIV and AIDS.

Relevance to the project

It addresses the gender issues in sexual and reproductive rights which is the unequal social relations between men and women that give rise to gender inequalities in health. One of the key challenges identified is the inadequate integration of reproductive health and HIV and AIDS services. It proposes to ensure integration of HIV and AIDS information and services into reproductive health services at all levels and ensure adequate capacity for provision of the integration at all levels. The project is anticipate to create awareness on HIV/AIDs and gender issues in all the stages of implementation.

2.7 Institutional Framework**2.7.1 The National Environmental Council**

The Act (EMCA) has established a public Complaints Committee, which provides the administrative mechanism for addressing environmental harm. The committee has the mandate to investigate complaints relating to environmental damage and degradation. Its members include representatives from the Law Society of Kenya, NGO and the business community.

2.7.2 The National Environmental Management Authority

The responsibility of the National Environmental Management Authority (NEMA) is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of the government in implementation of all policies relating to the environment

2.7.3 The Standards and Enforcement Review Committee

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

2.8 World Bank Environmental safeguards

2.8.1 OP/BP 4.01 (Environmental Assessment)

The World Bank has well-established environmental assessment procedures, which apply to its lending activities and to the projects undertaken by borrowing countries, in order to ensure that development projects are sustainable and environmentally sound. Although its operational policies and requirements vary in certain respects, the World Bank follows a relatively standard procedure for the preparation and approval of an environmental assessment study, which:

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

The environmental assessment evaluates a project's potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. The assessment takes into account: the natural environment (air, water, and land); human health and safety) social aspects (involuntary resettlement, indigenous peoples, and physical cultural resources); and trans-boundary and global environmental aspects. Preventive measures are favored over mitigation or compensatory measures, whenever feasible. This approach is universally applied in many institutional projects.

The World Bank considers environmental impact assessment (EIA) as one among a range of

instruments for environmental assessment. Other instruments used by the World Bank include regional or sectoral environmental assessment, strategic environmental and social assessment (SESA), environmental audit, hazard or risk assessment, environmental management plan (EMP) and environmental and social management framework (ESMF). The Bank undertakes environmental screening of each proposed project to determine the appropriate extent and type of environmental assessment. Proposed projects are classified into one of three categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts:

- Category A: The proposed project is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. For a Category A project, the Proponent is responsible for preparing an EIA report.
- Category B: The proposed project has potential adverse environmental impacts on human populations or environmentally important areas such as wetlands, forests, grasslands, and other natural habitats - but these are less adverse than those of Category A projects. These impacts are site specific; few if any of them are irreversible; and in most cases, mitigation measures can be designed more readily than for Category A projects. Like Category A the environmental assessment examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.
- Category C: The proposed project is likely to have minimal or no adverse environmental impacts. Beyond screening, no further environmental assessment action is required for a Category C project.

Environmental Assessment is used in the World Bank to identify, avoid, and mitigate the potential negative environmental associated with Bank lending operations. The purpose of Environmental Assessment is to improve decision making, to ensure that project options under consideration are sound and sustainable and that potentially affected people have been properly consulted.

The magnitude of the proposed project falls under category B.

2.8.2 OP/BP 4.04 (Natural Habitats)

Environmental and Social Impact Assessment (ESIA) Project for proposed rehabilitation and expansion of Makere Ya Gwano Solar Small-Scale Irrigation Scheme in Makere Village, Kinakomba Ward, Tana River-Sub County In Tana River County

The policy is designed to promote environmentally sustainable development by supporting the protection, conservation, maintenance and rehabilitation of natural habitats and their functions. The policy seeks to ensure that World Bank-supported infrastructure and other development projects take into account the conservation of biodiversity, as well as the numerous environmental services and products, which natural habitats provide to human society. The policy strictly limits the circumstances under which any Bank-supported project can damage natural habitats (land and water area where most of the native plant and animal species are still present).

This project has no notable interaction with notable natural habitat apart from limited opening up of the site by cutting trees to allow for the expansion and rehabilitation of the irrigation project. After construction indigenous trees will be planted around the project area. Wild ungulates coexist with the members of the community and will have to be allowed to access water in the river Tana

2.8.3 OP/BP 4.09 (Pests Management)

The policy is meant to minimize and manage the environmental and health risks associated with pesticides use and promote and support safe, effective and environmentally sound pest management. *This project will promote integrated pest management approaches which is mainly biodegradable in order to avert the use of pesticides and hazardous chemicals .*

2.8.4 OP/BP 4.10 (Indigenous Peoples)

This policy contributes to the Bank's mission of poverty and sustainable development by ensuring that the development process fully respects the dignity, human rights, economies and cultures of indigenous peoples. For all projects that are proposed for Bank financing and affect indigenous peoples, the Bank requires the borrower to engage in a process of free, prior, and informed consultation. The broad support of the project by the affected Indigenous Peoples such as Bank-financed projects includes;

- Preventive measures to adverse effects to the indigenous cultures and practices,
- Avoid potential adverse effects on the Indigenous Peoples' communities;
- When avoidance is not feasible, minimize, mitigate, or compensate for such effects.

Bank-financed projects are also designed to ensure that the Indigenous peoples receive social and economic benefits that are culturally appropriate and gender and inter-generationally inclusive.

The objective of this policy is to design and implement projects in a way that fosters full respect for Indigenous Peoples' dignity human rights and cultural uniqueness and so that they receive

culturally compatible social and economic benefits and do not suffer adverse effects during the development

Process. Space intensive sub-projects such as solid waste dumping sites, wastewater disposal areas and commuter rail stations has a potential for disruption of indigenous people. Improved Social and economic systems across the metropolitan leads to potential intrusion to existing cultures.

The project site is inhabited by the Pokomo community. It is a crop and livestock keeping area and the design takes full consideration of the inhabitants who are indigenous and will actually benefit directly since the irrigation facility will actually provide food crops and pasture water for both livestock and human

2.8.5 OP/BP 4.11 (Physical Cultural Resources)

This policy is meant to assist in preserving physical cultural resources including the movable or immovable (above or below ground, or under water) objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance including sites and unique natural values. Physical cultural resources are important as sources of valuable scientific and historical information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices.

The objective of this policy is to avoid or mitigate adverse impacts on physical cultural resources from development projects.

- Identify Category A (any project involving significant excavations, demolition, movement of earth, flooding, or other environmental changes) and/or B (any project located in, or in the vicinity of, a physical cultural resources site) projects that fall under this OP policy
- Identify the likely physical cultural resources issues, if any, to be taken into account by the EA and develop the ToRs for the EA.
- If the project is likely to have adverse impacts on physical cultural resources, identify appropriate measures for avoiding or mitigating these impacts as part of the EA process. These measures may range from full site protection to selective mitigation, including salvage and documentation, in cases where a portion or all of the physical cultural resources may be lost.

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- Develop a physical cultural resources management plan that includes measures for avoiding or mitigating any adverse impacts on physical cultural resources and provisions for managing chance find.

2.8.6 OP/BP 4.12 (Involuntary Resettlement)

The policy states that “Where large-scale of population displacement is unavoidable, a detailed resettlement plan, timetable, and budget are required. Resettlement plans should be built around a development strategy and package aimed at improving or at least restoring the economic base for those relocated. Experience indicates that cash compensation alone is normally inadequate. Voluntary settlement may form part of a resettlement plan, provided measures to address the special circumstances of involuntary resettles are included. Preference should be given to land-based resettlement strategies for people dislocated from agricultural settings. If suitable land is unavailable, non-land based strategies built around opportunities for employment or self-employment may be used”.

Involuntary resettlement is triggered in situations involving involuntary taking of land and involuntary restrictions of access to legally designated parks and protected areas. The objective of this policy is to avoid or minimize involuntary resettlement, though participation in resettlement planning and implementation and, where this is not feasible, to assist displaced persons in improving or at least restoring their livelihoods and standards of living in real terms relative to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.

The policy prescribes compensation and other resettlement measures to achieve its objectives and requires that borrowers prepare adequate resettlement planning instruments prior to Bank appraisal of proposed projects.

The residents are actually farming within their homesteads and therefore there will be no involuntary resettlements. Construction of the irrigation scheme as a water harvesting structure will actually promote sustainable land management and utilization.

2.8.7 OP/BP 4.36 (Forests)

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

principles is to screen as early as possible for potential impacts on forest health and quality and on the rights and welfare of the people who depend on them. *The existing riverine forest in the project area will be maintained. Since the existing vegetation does promote soil protection and the project takes cognizance of the riverine vegetation*

2.8.8 Activities Triggering World Bank Safeguards

The schedule below justifies the extent to which the World Bank safeguards apply to the implementation of the proposed project implementation. This implies, further investigations may be necessary to ensure compliance with the World Bank requirements.

Table 2: Activities Triggering World Bank Safeguards

Policy	Criteria in the Project area	Discussions
Environmental Assessment (OP 4.01, BP4.01, GP 4.01)	Yes	The project triggers OP. 4.01
Forestry (OP4.36, GP 4.36)	Yes	The riverine vegetation shall be maintained, since it is far from the farming areas. There is further to promote tree planting along the catchment areas
OP/BP 4.04 (Natural Resource Habitats)	Yes	There are indigenous wild ungulates such as the endangered Columbus monkeys that only feed on local indigenous trees not on crops at all antelopes wathhogs, kudus and dik dik
Involuntary Resettlement (OP4.12, BP 4.12)	No	There will be no displacement the land is communally owned and the community has consented to the construction
Physical Cultural Resources (OP/BP 4.11)	No	There are no physical cultural resources at the project site
Indigenous Peoples Policy OP/BP 4.10	No	All the community members in the area are categorized as vulnerable and marginalized groups according to the Constitution of Kenya (COK) 2010.
OP/BP 4.09 (Pests and control management)	No	The project shall promote integrated pest management and there shall be NO use of pesticides hence not triggered
OP/BP 4.37 (Safety of Dams)	No	There is no dam construction. Canals will be constructed and appropriate catchment protection measures by planning of indigenous trees and shrubs within the catchment area and along the embankments.

2.9 International Conventions

2.9.0 Introduction

Kenya is a signatory to a number of conventions on sustainable development and is a member of various bilateral and multilateral organizations. This EIA study is also based on internationally respected procedures recommended by the World Bank in the World Bank Operational directives 4.01 and Environmental Source Book Volume II, which provides the relevant sectoral guidelines. Some of the relevant international treaties and conventions which are related to the project are mentioned in the subsequent items

2.9.1 The World Commission on Environment (the Brundtland Commission of 1987)

The international policy recommends development that produces no lasting damage to the biosphere and to particular ecosystems. Economic sustainable development is the development for which progress towards environmental and social sustainability occurs within available financial resources: Kenya is ratified or acceded to numerous international treaties and conventions. Those that have implications on the project are described below

2.9.2 The Ramsar Convention on Wetlands of International Importance

Kenya ratified in June 1990. The Ramsar Convention on wetlands is primarily concerned with the conservation and management of wetlands. Parties to convention are also required to promote wise use of wetlands in their territories and to take measures for the conservation by establishing nature reserves in the wetlands, whether they are included in the Ramsar list or not. Wetlands are defined in the Ramsar convention as “ areas of marsh, fen, peat or water, whether natural or artificial, permanent or temporary with water that is static or flowing fresh brackish or salty, including areas of marine water depth of which at tide does not exceed 6 meters.

The National wetland standing committee of Kenya’s Inter-Ministerial Committee on Environment (IMCE) defines wetlands as “areas of land that are permanently, seasonally or occasionally water logged with fresh saline, brackish or marine water, including both natural and man-made areas that support characteristic biota” while EMCA defines wet as “an area permanently or seasonally flooded by water plants and animals have become adapted.

Relevance

The riverine vegetation along the river is a wildlife habitat area and due to the nature of the soils during rains stagnant water is common in lower areas. For this reason, the proposed irrigation project is expected to strictly observe the Ramsar Convention’s principles of wise use of wetlands in the project areas

2.9.2 Convention on Biological Diversity (CBD)

The CBD is one of the outcomes of the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992. The CBD establishes a global legally binding framework for the conservation of biodiversity, the sustainable use of its components and the fair and equitable sharing of benefits arising out of utilization of genetic resources. *The provisions of this convention should be taken into account in the conservation of various species of plants, animals and the variety of ecosystems in the project area by any development agency/sector/Government.*

2.9.3 Rio Declaration on Environment

The Rio Declaration on Environment and Development often shortened to Rio Declaration, was a short document produced at the 1992 United Nations “Conference on Environment and Development” (UNCED), informally known as the earth summit. The Rio declaration consisted of 27 principles intended to guide sustainable development around the world.

A few of the relevant principles include:

Principle 4: Environmental Protection in the Development Process

In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.

Principle 10: Public Participation

Environmental issues are best handled with participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities including information on hazardous materials and activities in their communities and the opportunity to participate in decision making process. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided.

Principle 22: Indigenous Peoples have a Vital Role

Indigenous people and their communities and other local communities have a vital role in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development

2.9.4 United Nations Framework Convention on Climate Change

The framework sets an ultimate objective of stabilizing greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (Human Induced) interference with the climate system. *Development projects in Kenya such as the proposed project are expected to take climate change considerations into account, to the extent possible, in their relevant social, economic and environmental policies and actions*

2.9.5 United Nations Convention to Combat Desertification 1994:

The convention addresses the problem of the degradation of the land by desertification and the impact of drought particularly in arid and semi -arid and dry semi-arid humid areas.

This convention is domesticated in EMCA 1999 via Section 46 where Sub county Environmental committees are required to identify areas that require re-forestation or afforestation as well as to mobilize locals to carry these activities.

Relevance

The project area is in the lowlands zone under agro-climatic zone 5 and sub county environmental committees will mobilize the locals to undertake afforestation programmes along the river Tana along the catchment areas both upstream and downstream.

2.9.6 Sustainable Development Goals

On September 25th 2015, countries adopted a set of goals to **end poverty, protect the planet, and ensure prosperity for all** as part of a new sustainable development agenda. Each of the 17 goals has specific targets to be achieved over the next 15 years. *The proposed irrigation project is aligned to the goals of SDGs 1, 2, 5,12,13,14 ending poverty, zero hunger, gender equality, clean water and sanitation, responsible consumption and production, climate action, life below water and life on land*

CHAPTER 3: DESCRIPTION OF THE EXISTING ENVIRONMENT

This section describes the project area's physical, biological and socio-economic environments. The project needs to put into consideration various environmental aspects as it shall make utility of environmental resources.

3.1 Location and size

The proposed Makere ya Gwano Irrigation Project is located in Makere Village (S01° 51.023' E040°06.565'), Makere Sub Location, Gwano Location of Wenje Division, Kinakomba ward in Tana River Sub-County. The project site is 44km South of Hola town along the Hola-Wenje earth road (popularly known as barabara ya Mtoni). The Makere Irrigation Farm Community **land** is estimated to be over 20ha. The net area being proposed for pilot development is 12ha

Commented [KT7]: Family private land

(30acres) situated at $-2^{\circ} 9' 7''$ South $40^{\circ} 6' 22''$ East, $-2^{\circ} 9' 11''$ South $40^{\circ} 6' 29''$ East, $-2^{\circ} 8' 58''$ South $40^{\circ} 6' 32''$ East, $-2^{\circ} 8' 59''$ South $40^{\circ} 6' 40''$ East



Figure 1: Map of Kenya Indicating the Location of Tana River County

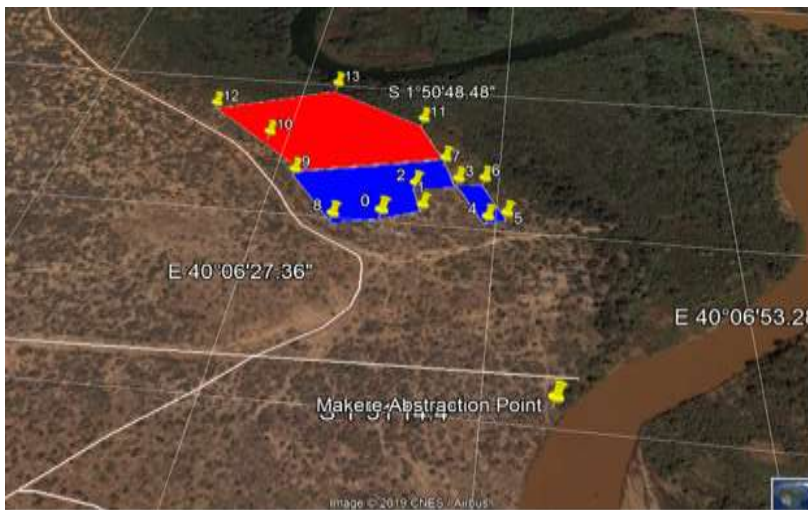


Figure 2: Google earth map indicating the site of proposed Makere Ya Gwano Irrigation Scheme

3.2 Physical and Topographic Features

The area stands at an average altitude of 40m above sea level within a gently dipping terrain. Geological formation of the area is dominated by Sedimentary plains of upper river terraces. The project site is fairly flat with a gentle slope allowing for smooth surface water canals. The gradient makes the land suitable for closed-surface irrigation system. Slopes are within the range of 0.05%-0.15% with local surface undulations.

3.3 Soils

To determine the soil texture, a catwalk was undertaken in and around the proposed irrigation facility. It was noted that the soil texture is uniform in the said area and the soil profile was indicative of moderately calcareous. To determine the soil texture further below depth texture, a trial pit was dug to a depth of 1.2m deep. The soils are moderately well drained, very deep, dark reddish brown, firm moderately calcareous, moderately to strongly saline, strongly sodic, sandy to clay:levee complex(orthic SOLONETZ, saline phase: with orthic SLONCHAKS, sodic phase).

3.4 Ecological and Climatic Conditions

The area is a lowland ecological zone which is semi-arid. The climate is strongly influenced by the altitude and physical features. Wenje division as whole falls within has three agro-climatic zones namely; CL3, CL4, and CL5 semi-humid, Semi-arid to arid. These zones are characterized by scarce rainfall ranging between 300mm-600mm per annum. The rainfall is erratic and unreliable resulting in persistent moisture stress in the soil profile. The proposed project site is in Ecological zones V-VI and is within an altitude of about 40m above sea level. Rainfall is bimodal; with long rains expected in the months of April to May while the short rains are received in the months of October to November. Rainfall expected per year ranges between 300mm and 600mm. Temperatures are high all year round ranging from 27° and 30°. These high temperatures result in high evaporative demand and high moisture stress making rain-fed agriculture impractical and insignificant. The weather conditions exhibit very high evaporation demand. From wood-head maps, the average evapo-transpiration during the dry and sunny months, with a crop factor of 1.2 is 5.61mm/day. The zone is mainly used for irrigated agriculture, grazing fields for wildlife livestock by pastoral communities.

3.5 Vegetation Conditions

The area occupies Agricultural Ecological Zone IV and gradually changes to V and VI as one moves away from that forest niche which enjoys coastal influence. The proposed project area is dominated by complex ecosystem of high canopy riverine forests, wooded bush land and thickets as well as the grasslands. The species that are dominant in high canopy forest area along the riverine include *Chlorophora excelsa*, *Penicum spp*, *Manilkara zasibarensis*, *Brachilina brichantha*, *Terminalia spp*.

Wooded bush is dominated by *Hyphaene coriacea*, *Terminalia spinosa*, *Digitaria milinjiana*, *Panicum infestum*. Grassland is dominated by *Echinochika spp*, *Sporobolus halvolus*, *Panicum spp*, *Cynodo dactylon*. In the dry lands dominant species include the *Acacia spp*, *Dobera glabla*, *Salvodora persica* and the invasive *Prosopis spp*.

3.6 Demographic attributes

Makere Ya Gwano village is in Wenje in Kinakombe ward in Tana River Sub County, Gwano is one of the sub-locations in Wenje Division. The Village has a population of about 500 people of whom 150 are males and 350 are females distributed in 60 households with approximately 7 people per household as per projections of 2017 from the 2009 KNBS census.

3.7 Infrastructural access

Makere location has poor road infrastructure. This project is 44km South of Hola town along the Hola-Wenje earth road (popularly known as Barabara ya Mtoni). Beside there are feeder roads whose maintenance remains poor. The Location has no electricity supply and there is low utilization of other sources of energy like solar and wind. There is no telecommunication network. Housing and shelter largely is traditional. A high percentage of the population live in Grass thatched mud houses, few in semi-permanent houses that seldom have access to essential basic services and infrastructure thereby leading to insecure and unsafe living environment. The most or notable infrastructure included a primary school, dispensary at Wenje about 8km from Makere Village, borehole, Church and Mosque.

3.8 Land Use

Land ownership is under communal land and is managed by communities. Land is not registered. Only about 4.3 per cent of the land in the county has title deeds. Most land owners have no title deeds since the land is community land held in trust by the Government of Kenya. The main land use practices is crop and livestock production. The mean holding land size is 4ha with irrigation schemes having between 0.6 ha and 3 ha.

3.8.1 Crop production

Farmers in the county mainly rely on rain fed and flood recession farming systems with only a few practicing irrigated farming. Crops to be grown include maize, cow peas, green grams, pumpkins, and vegetables. Irrigation is also practiced by individual small holders, growing vegetables in nearby villages like Kipendi, Vukoni, and Bububu. This critically emphasizes the need for expansion and construction of an irrigation scheme and management strategies to boost crop production. The changing climate, frequent droughts and over reliance on rain fed agriculture has resulted in massive crop failures. Hence the need for irrigated crop production.

3.8.2 Environmental Degradation

About 50 % of the area lies within the fragile arid semi humid agro climatic zone. Given that over 90 % of the human population relies on land to support livelihood, activities such as crop production result in overutilization of land, has contributed to degradation of the environment.

3.8.3 Climate change effects

The evidence of climate change in the locality and the entire County has been observed in terms of increase in variability of erratic rainfall. Rainfall periods have become shorter and unpredictable in areas which previously received adequate rainfall, prolonged droughts that are more frequent and severe leading to crop failure and increased variability to food insecurity, conflicts from livestock keepers who water their livestock at the river severely affects livelihood. This has worsened the problems of water resource conflicts at the few existing (*Malkas*) access to the main water source.

Climate change mitigation strategies which aim at reducing the emission of greenhouse gases (GHGs) from human induced activities need to be put in place. The strategies include: increase in ground cover by planting food crops, quality palatable pastures and fodder that will enhance carbon sinks and also provide high quality animal feeds. Adaptation measures undertaken include promotion of drought tolerant crops, palatable perennial pastures, diversification of livelihoods and improvement of crop husbandry practices that efficiently utilize water and lead to low methane emissions.

CHAPTER FOUR: PROJECT DESCRIPTION

4.0 Introduction

The chapter describes the project and major activities that will be involved during project implementation, the materials that will be used and the possible alternatives detailed in the next section

4.1 Overview

The 2003/2004 poverty mapping exercise suggests that Tana River County is one of the areas stricken by poverty in Kenya. Being sparsely populated, the county experiences inadequate rainfall thus crop failure. Therefore, this area has prioritized interventions in agriculture that seek to improve crop production since agriculture is the mainstay of production. Increasing the irrigated land in the county will ensure a secure production of staple as well as high value crops that increase the farmers' income.

- No. of beneficiaries: 500; Male 150, Female 350
- Direct beneficiaries: 85- Male 24, Female 61
- Indirect beneficiaries: 415 Male- 126 Female, 289 Male
- Vulnerable beneficiaries (poor, widows/widowers, orphans, physically challenged, elderly, HIV/AIDs affected/infected: Male 3 Female 7

The Makere ya Gwano Small Scale Irrigation Project will basically consist of a solar powered pump, a pontoon system, a conveyance system, and infield distribution chambers. The water will be conveyed to the irrigation plots about 750m away through a 6' diameter Upvc pipeline. Water application in the farm will be through gravity flow through infield pipelines which will in turn discharge water through riser pipes into distribution chambers and off takes.

4.1.1 Project Cost

The project will have total investment cost of Kshs31,000,000

Commented [KT8]: 49,149,200

4.1.2 Project design

The years 2018 and 2019 have respectively been assumed as the present and initial stages of the project while, the years 2027 and 2037 are the future and ultimate stages respectively.

In this project there will be a detailed topographical survey and on the map precisely locating the rehabilitation and expansion site to enable one to exactly calculate its storage capacity and the piping system. This will lead to design of the foundation, Project will basically consist of a solar powered pump, a pontoon system, a conveyance system, and infield distribution chambers. The water will be conveyed to the irrigation plots about 750m away through a 6' diameter Upvc pipeline. Water application in the farm will be through gravity flow through infield pipelines which will in turn discharge water through riser pipes into distribution chambers and off takes.

4.1.3 Design Calculations

- Water Demand Areas

Based on the water needs of Makere Ya Gwano village community, Water demand has been classified into the following categories

- Household/ domestic water demand,

- Institutional water demand
- Crop water demand
- Livestock Water demand
- Commercial and Cultural water demand.

➤ **Consumer Population Projections**

The projection of human population figures was based on the growth rate of 4.1% pa and is informed by the 2009 national population census figures. Livestock population has been projected at the annual growth rate of 1% pa.

➤ **Per Capita Consumption Rates**

Due to the fact that the village has no development plan that classifies it either as high class, low class etc. a blanket service type for 100% of population taking this area as a low potential rural area and corresponding per capita water consumption rates guidelines, as contained in “**the Practice Manual for the Provision of Water Services in Kenya, Ministry of Water and Irrigation, Nairobi, 2005**” have been applied all through for the purposes of estimating the water demand of the area.

4.1.4 Design data

Data acquisition and hydrological modelling

A reconnaissance survey was carried out to get an appreciation of the available water and land resources, the current land uses and water abstraction and irrigation water demand. Rainfall, potential evapotranspiration and river flow data was then used to fit a continuous, lumped rainfall runoff model within the rainfall runoff library

Table 3: Data acquisition and hydrological modelling

Acreage	= 30 acres
Number of farmers	= 60 farmers
Farm plot / farmer	= 30/60 = 0.5 acres
Reference Evapotranspiration	= 5.2mm/day
Crop Evapotranspiration	= 5.2 x 1.2 = 6.24mm/day
Available Soil Moisture	= 160mm/m
Rooting soil depth	= 0.45
Allowable soil depletion factor	= 0.5
Field Application Efficiency (Ea)	= 85%
Conveyance Efficiency (Ec)	= 90%
Distribution System Efficiency (Ed)	= 90%
Overall Irrigation Efficiency (Ef)	= Ea* Ec*Ed = 0.85 x 0.9 x 0.9 = 0.688 = 69%

4.1.5 Crop and Irrigation Water Design

Table 4: Crop and Irrigation Water Design

1.	Net depth of water application (dnet) dnet= (FC-PWP) x RZD x P
	Where;
	dnet = Net depth of water application per irrigation for the selected crop (mm)
	FC = Soil moisture at field capacity mm/m)
	PWP = Soil moisture at the permanent wilting point (mm/m)
	RZD = The depth of soil that the roots exploit effectively (m)
	P = The allowable portion of available moisture permitted for depletion by the crop before the next irrigation
	dnet = 160 x 0.45 x 0.5 = 36
2.	Gross depth of water application (dgross) dgross = dnet / Ef
	36/ 0.69 = 52
3.	Irrigation frequency (IF) IF = dnet / ETcrop
	where;
	IF = Irrigation frequency (days)
	dnet = Net depth of water application (mm)
	ETcrop = Crop evapotranspiration (mm/day)
	IF = 36/ 6.24 = 5.76 = 6 days
4.	Irrigation cycle (IC) = 6 days
5.	System capacity (Q) Q= V/ T
	Where:
	Q = Discharge (m ³ /hr or l/sec)
	V = Volume of water to be abstracted per day (m ³ or l)
	T = Irrigation duration per day (hr or sec)
	V = 10 x A x dgross
	Where:
	V = Volume of water abstracted per day (m ³)
	A = Area irrigated daily (ha)
	dgross = Gross depth of application at overall scheme level (mm)
	10 = Conversion factor to convert mm to m ³ /ha
	A = At/ IC
	Where
	A = Area irrigated per day (ha)
	At = Total area (ha):
	IC = Irrigation cycle (days)
	A= 12 ha / 6 = 2 ha (Area to be Irrigated per day)
	V= 10 x 2 x 52 = 1040 m ³ /day
	The system capacity, assuming 8 hours of irrigation per day, will be equal to:
	Q = 1040/ 8 = 130 m³/ hr

4.1.6 Design of the Pipe System

Table 5: Pipe sizing

1.	Pipe Sizing
	Size is given by diameter in metres (D)
	$Q = A \times V = \pi D^2 V / 4$
	Where:-
	Q = Water flow rate in m ³ /s
	V = Velocity in m/s
	The recommended range of velocity in commercial pipes is 1.0 – 1.5m/s.
	For this design, use 1.4m/s
	$D = \sqrt{4 Q / \pi V}$
	Then;
	$D = \sqrt{4 \times 0.036 / 3.14 \times 1.4}$
	= 0.0327
	= 0.18 m
	= 18 cm = 7 inches
	Use 6 inches for this design.

Table 6: Head losses

2.	Head Losses
	The Hazen-Williams equation will be used for this purpose to find the Frictional Losses
	$H_f100 = K(Q/C)1.852 \times D^{-4.87}$
	Where;
	H _f 100 = Friction losses over a 100 m distance (m)
	K = Constant 1.22 x 10 ¹² , for metric units
	Q = Flow (l/s)
	C = Coefficient of retardation based on type of pipe material (C = 140 for plastic)
	D = Inside diameter (mm)
	$H_f100 = 1.22 \times 10^{12} \times (38.2/140)^{1.852} \times 180^{-4.87}$
	H _f 100 = 1.14 m
	The frictional losses are 1.14m for every 100m
	Frictional Losses for 800m main pipeline distance;
	$H_f800 = 1.14 \times (800/100) = 9.15\text{m}$
	Total Head Requirements
	Suction Lift = 2.00m
	Frictional Losses = 9.15m
	Riser = 0.04m
	Miscellaneous 10% = 3.11m
	<u>Elevation Difference = 20.00m</u>
	Total = 34.3 m

Table 7: Power Requirements

3.	Power Requirements
	The following equation is used;
	$kW = [Q \times TDH / 360 \times Ep] \times 1.2$
	Where:
	kW = Power requirements (kW)
	Q = Discharge (m ³ /hr)
	H = Head (m)
	Ep = Pump efficiency (obtained from the pump performance chart)
	360 = Conversion factor for metric units
	1.2 = 20% derating (allowance for losses in transferring the power to the pump)
	$kW = [130 \times 50 / 360 \times 0.6] \times 1.2 = 36.1kW$

4.1.7 Determination of Sizes for Infield Water Distribution Chambers

As one-way infield water distribution off takes. The chambers will receive water from the riser pipes and discharge to the earthen secondary canals.

Table 8: Sizes of infield water chambers

(a)	Crest length (or discharge weir)
	Given by $Q = C \times B \times If \ 1.5$
	Where Q - Discharge flow rate - m ³ /s
	C - Discharge co=efficient taken as 1.6
	If - Depth of sub mergence
	Given flow rate = 0.0382m ³ /s
	Assume depth of submergence = 0.2m
	Hence $B = Q / C \times If \ 1.5 = 0.0382$
	$1.6 \times (0.2)1.5 = 0.0382$
	$1.6 \times 0.09 = 0.265m = 26.5cm$
(b)	Depth of discharge - D
	$D = Q / B \times V$
	Where Q = discharge flow rate - m ³ /s
	D = Depth of discharge in the box (m)
	V = Velocity of floe (assumed 1.0m/s)
	Hence $D = 0.0382$
	$B \times V$
	$= 0.0382 / (0.265 \times 1)$
	$= 0.144m$
	$= 14.4cm$
	Free board = 0.1
	Then D = 14.5

	Width of Box. (W)
	By rule thumb, should be three times more than B above.
	Hence Width = $26.5 \times 3 \geq 75$ cm
	Let W = 100cm= 1m

4.1.8 Summary Report

Table 9: Summary Report

Area (Acres)	30acres
System Capacity (Q)	130m ³ /hr
Total Dynamic Head (m)	40m
Power Requirements (kW)	36.1kW
Main Pipe Size (Inches)	6 inches

4.1.9 Design and layout of the Irrigation infrastructure and scheme as per specifications

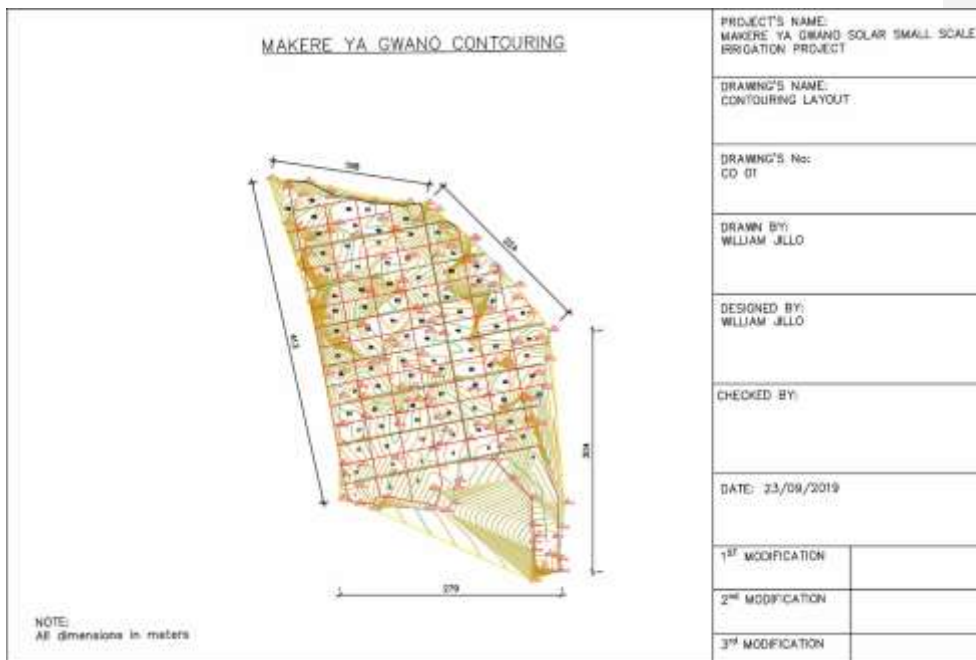


Figure 3: Makere Ya Gwano Contouring

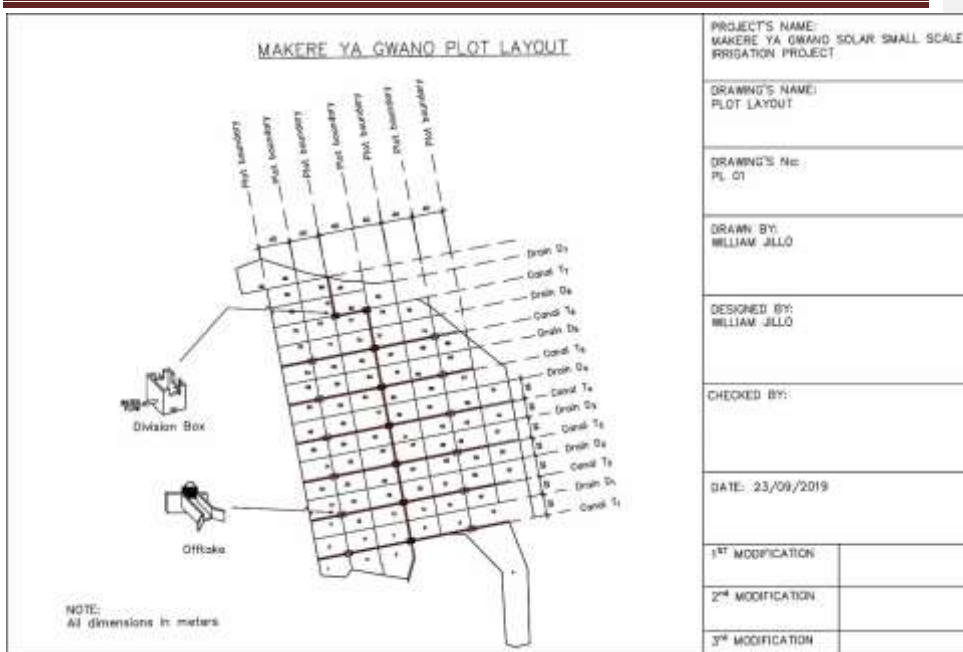
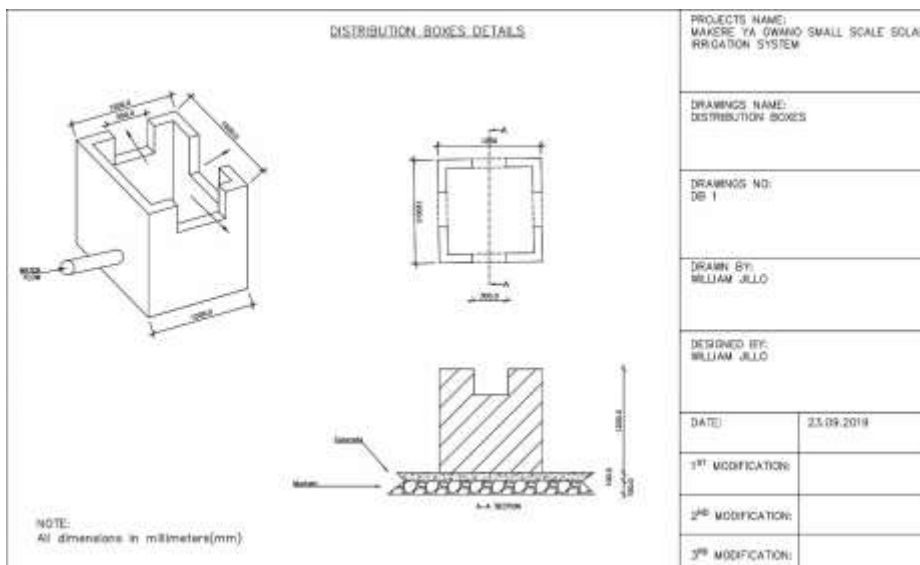


Figure 4: Makere Ya Gwano Plot Layout



4.2 Construction phase

4.2.1 Support infrastructure

Support infrastructure will comprise of check dams upstream to control soil erosion canal works will include but not limited to the following:

- i. Excavation works
- ii. Lining with clay soil
- iii. Construction of pipe draw off system
- iv. Construction of communal water pipes
- v. Fencing of the reservoir as described in the bill of quantities and technical drawings

The project will be fully funded by KCSAP with minimal contribution from the community

4.3 Materials and Equipment Needed

Table 7 below indicate the materials, tools and equipment that will be used during construction

Table 10: Materials and Equipment Needed

Materials	Construction/D Tools &Equipment
Preliminary Works	Grader for constructing canals
Provision and installation of Pontoon structure	Lorry -10 Tonne
Solar water pump & solar panels	
Main Pipeline and installation of main pipeline	Pick-up one tonne
Infield Distribution farm layout	Water Boozer (1,000litres) to spay along the channels to remove dust
Post handling facility indicate type grain storage	
Excavation works	Vibrator
Personal protective equipment	
Fencing	Foot sheep Roller
Fuel	
Farm inputs	Concrete Mixer
Water permits	
Land preparation	

4.4 Proposed Project Activities

The activities associated with the proposed project have been categorized under three phases of project implementation viz planning, excavation & Embankment construction , auxiliary works construction, operation, closure/decommissioning as discussed in the following submission

4.4.1 Planning Phase Activities

The main activities considered during this phase are: Irrigation scheme siting, production of site layout drawing, irrigation scheme sitting entails reviewing and survey of the project area, identification of suitable site and determination of the required layout configuration so as to achieve the desired results. This was done by Engineers from the Ministry of water and Irrigation

4.4.2 Construction Phase Activities

Construction phase entails the following activities

- I. Equipment mobilization
- II. Transportation and delivery of materials to the site
- III. Excavation
- IV. Embankment construction works
- V. Construction of Auxiliary works-(fence, piping system, canal construction)

4.4.2 Operation Phase Activities

After successful expansion construction of Makere Ya Gwano Irrigation scheme, the community will be allowed to access water through a piping system from the river Tana and drawing to the canals where water will be flowing by gravity to the farms as per the design layout. The activities will be managed by a management committee which will be in place

4.4.2 Decommissioning Phase Activities

Decommissioning of the irrigation scheme will become necessary if or when the scheme attains its end life i.e when it no longer become productive or when the need arises. One this occurs, the affected irrigation scheme will be deactivated according to the well closure procedure. Non-reusable pipes will be sold to licensed scrap metal dealers. The closure of the water source will involve removing the piping system and backfilling of the depression left behind as necessary. The affected canals will be backfilled, landscaped and replanted with suitable indigenous grass and trees

4.5 Types of waste to be generated

Table 8 below indicates the types of waste to be generated during project implementation and proposed options for their management

Table 11: Types of waste generated

Types of Waste	Proposed Waste Management Option
Used oil filters	<ul style="list-style-type: none">• Accumulate safely and dispose-off through licensed hazardous waste handler
Used fuel filters	<ul style="list-style-type: none">• Accumulate safely and dispose-off through licensed hazardous waste handler
Used Oil	<ul style="list-style-type: none">• Accumulate safely and sell to licensed scrap metal dealers
Empty plastic & Metal containers	<ul style="list-style-type: none">• Issue out to staff for reuse• Issue out to the local community as part of corporate Social Responsibility (CSR) contribution• Reuse within household e.g for fabricating solid waste containers• Return to the supplier for reuse
Empty gunny bags	<ul style="list-style-type: none">• Issue out to the local community• Reuse within household• Return to the supplier
Noise	<ul style="list-style-type: none">• Undertake operations during the day

CHAPTER FIVE: PROJECT ALTERNATIVES

5.0 Introduction

This chapter discusses the alternatives in the proposed Makere Ya Gwano Irrigation scheme in terms of zero option, alternative construction materials, alternative irrigation areas and the water source options

5.1 No Project Alternative

The “Zero option” represents a situation which would result if the project was not implemented. In that case, both the positive and negative impacts of construction and operation of the project will not occur. This option will however, involve several losses to the proponent and the country

as a whole. The major impact of not proceeding would be the forfeiture of expected benefits.

These include:

- Adequate water for irrigation purposes
- Increased crop and livestock productivity
- Creation of employment
- Enterprise development
- Local economic development

The economic status of the community and Kenya will remain unchanged; and the local skills would remain underutilized. From the analysis above, it is apparent that the No project alternative is no alternative to the community and the government of Kenya.

5.2 Alternative Project site

The proposed project location was selected based multiple factors which include:

- Project target area: The area was selected for implementation of irrigation scheme through Ghapala Community based organization who applied for the KCSAP World Bank funded project. The site is situated in arid area and receive low rainfall of slightly above 200mm per year
- Previous studies had indicated the suitability of the area for irrigation
- Existence of water resources from river Tana can support irrigation
- High agricultural production potential particularly high value crops

Alternative site would therefore have to bear similar characteristics. This would present a major challenge since most sites would not have all these characteristics.

5.3 Relocation Option

Relocation to a different site is an option available for the project implementation. At present the proponent does not have an alternative site. It means that the proponent in consultation with community has to look for the land. Looking for land to accommodate the scale and size of the project and carrying out required public participation may take about 6 months, although there is no guarantee that the land would be available. The proponent will take another 6 months to design and approvals since design and planning has to be according to site conditions.

Project design and planning before the stage of implementation will cost the developer millions of Kenya Shillings. Whatever has been done and paid to date will be accounted as a loss to the proponent. Assuming the project will be given a positive response by the relevant authorities including NEMA and Tana River County, this project would have been delayed by over (1) year before implementation. This is a delay that the county economy cannot afford. This would also lead to a situation like NO project alternative option. The other consequence of this is that it would be a discouragement for the crop sector development stakeholders in their bid to address effects of climate change. In consideration of the above concerns and assessment of the current proposed site, relocation of the project is not a viable option.

5.4 Analysis of Alternative construction Materials and Technology

The infrastructure for the proposed irrigation project will be constructed using modern locally and internationally accepted materials to achieve public health, safety security and environmental aesthetic requirements.

Equipment that conserves energy and water will be given first priority without compromising on cost or availability factors. They will be made using locally sourced stones, cement, metal bars fittings that meet the Kenya Bureau of Standards requirements. Heavy use of timber during construction is discouraged because of destruction of forests.

The exotic species would be preferred to indigenous species in the construction where need will arise

5.4.1 Irrigation Technology Options

Irrigation methods are the systems how to get water for irrigation purposes from its sources. The choice of irrigation methods depend on several factors such as topography, water resources, the plants cultivated, the land tenure systems, the growing seasons and train and water regimes. The main irrigation technologies considered in this project include: surface irrigation, sprinkler and drip systems of which their benefits and limitations are considered in the choice of the best alternative

Surface canal irrigation

Surface irrigation is an irrigation system in which gravity flow is applied to move water across the land in order to infiltrate and wet it. Surface irrigation is further classified as border strip, basin or furrow irrigation. Surface irrigation is the most commonly used method of irrigation and represents as much as 95 percent of common irrigation activity today

The most obvious advantage of surface irrigation is that it is the most widely understood method of irrigation due to its popularity. Surface irrigation is comparatively cheap to develop, and requires minimal investment on the part of the farmer. Surface irrigation is not affected by climate and water quality characteristics. The major disadvantage of surface irrigation is that it tends to water logging and soil salinity if there are no provisions for adequate drainage. Another disadvantage is that it tends to be labor intensive

Canal is an artificial channel for water through lands that was perhaps naturally devoid of sustained water flow. Hence, water seeping canals down to soil below my, at times raise the ground water very close to the ground level. This may result in blocking all the voids in the soil and obstructing the plant roots to breathe. It has been observed that water logging conditions adversely affects crop production as it is reduced drastically. Apart from seeping water of canals, excessive and unplanned irrigation also caused water logging conditions. This happens because the farmers at the head reaches of canals draw undue share of canal water in the false hope of producing larger agricultural outputs.

Sprinkler Irrigation

Sprinkler or overhead irrigation is an irrigation system in which water is distributed throughout the field by the aid of high-pressure sprinklers. The idea is to simulate rainfall during dry weather. The advantage of sprinkler irrigation systems include their more even distribution of water when different soil types are found within one irrigation scheme. Sprinkler irrigation systems are better than surface irrigation in leaching out salts from the soil and they are not affected by uneven land distribution. The disadvantage of sprinkler system is that they are affected by wind conditions which disturb the even distribution of water from sprinklers

Benefits of Sprinkler Irrigation systems	Limitations of sprinkler irrigation
<ul style="list-style-type: none"> ✓ Systems losses (runoff, seepage) substantially reduced ✓ Over irrigation is completely eliminated and uniformity of application is high ✓ Irrigation water requirement reduced as compared to other methods ✓ No land levelling required in the field and land use for productive purposes can be maximized ✓ Fertilizer can be injected in the irrigation water to reach the root zone directly ✓ The system allows better weed control 	<ul style="list-style-type: none"> ✓ Poor uniformity and application efficiency in high wind regimes and/or dry and hot conditions ✓ Capital cost is high with greater operational costs due to higher energy requirements ✓ Not suitable for paddy crops ✓ Crops prone to disease due to moist environment ✓ Water with impurities and sediments may damage the system

Drip Irrigation

Drip irrigation is an irrigation system in which water is delivered at the root of the plant, drop by drop. It is also known as trickle irrigation. The main advantage of drip irrigation is that it is the most water-efficient method of irrigation. The disadvantages are that it is the most expensive and least aesthetically pleasing method because of all the plastic lines which have to be installed close to each other on the ground.

Benefits of Sprinkler Irrigation systems	Limitations of sprinkler irrigation
<ul style="list-style-type: none"> ✓ Minimized fertilizer/nutrient loss due to localized applications and reduced leaching ✓ High water application efficiency ✓ Levelling of the field not necessary ✓ Ability to irrigate shaped fields ✓ Allows safe use of recycled water ✓ Moisture within the root zone can be maintained at field capacity ✓ Soil type plays less important role in frequency of irrigation ✓ Minimized soil erosion 	<ul style="list-style-type: none"> ✓ Minimized weed growth ✓ Highly uniform distribution of water i.e controlled by output of each nozzle ✓ Lower labour cost ✓ Variation in supply can be regulated by regulating the valves and drippers ✓ Fertigation can easily be included with minimal waste of fertilizers ✓ Foliage remains dry thus reducing risk of diseases ✓ Usually operated at lower pressure than other types of pressurized irrigation, reducing energy costs

Limitations of drip irrigation

- i. Expense; Initial cost can be more than overhead systems
- ii. Waste; the sun can affect the tubes used for drip irrigation, shortening their useable life.
- iii. Longevity is variable

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- iv. Clogging; if water is not properly filtered and the equipment nor properly maintained, it can result in clogging
 - v. Drip irrigation might be unsatisfactory if herbicides or top dressed fertilizers need sprinkler irrigation for activation
 - vi. Drip tape causes extra cleanup cost after harvest. You will need to plan for drip tape winding disposal, recycling or reuse.
 - vii. Waste of water, time & harvest, if not installed properly. These systems require careful study of all the relevant factors like land topography, soil, water, crop and agro-climatic conditions and suitability of drip irrigation system and its components.
 - viii. Germination Problems; In lighter soils subsurface drip may be unable to wet soil surface for germination
 - ix. Requires careful consideration of the installation depth
 - x. Salinity; most drip systems are designed for high efficiency, meaning little or no leaching fraction. Without sufficient leaching, salts applied within the irrigation water may build up in the root zone, usually at the edge of the wetting pattern. On the other hand, drip irrigation avoids the high capillary potential or traditional surface-applied irrigation, which can draw salt deposits up from deposits below.

Most suitable option for proposed project

Based on the natural conditions (climate, soil infiltration, slope, water quantity, water availability), social conditions (expensive, labour, type of crop, level of technology) and environmental factors (water use efficiency, salinity control, pollution control) Surface canal irrigation presents the most suitable irrigation method for this project.

The river Tana flows downstream all the way to the Indian Ocean. Due to gravitational flow and water is being tapped, it is easy to pump water by use of solar and distribute to the crop fields through the canals by gravitational force. This will be clean and economical source of energy with minimal costs of only maintain the canals, piping systems and solar

Rain water harvesting

This is feasible source of water for the proposed irrigation scheme since it has been adopted by other programs in the country. However due to the unreliability of the rainfall, it will not address the water needs of the farmers who require reliable water over a given period of time.

CHAPTER SIX: PUBLIC CONSULTATIVE PROCESS AND DISCLOSURE

6.1 Introduction

The following section describes the consultations and public participation held to assess the opinions and attitude of the various stakeholders to the irrigation project. The goal and objective of public participation is to ensure adequate information is provided to all stakeholders in a clear and timely manner and to present sufficient opportunity to these groups to voice their concerns and opinion so that their views can be incorporated into the project design and development as well as augment overall benefits and avoiding potential conflicts.

The client is committed to proactive and on-going communication with all parties interested in the development of the project. During our field inspection, we established that the project, stakeholders including individuals and groups had been actively engaged in the consultation process. Public consultations in relation to the ESIA occur at all stages, starting with inception and planning when the potential lands and alternative sites are being considered. A participatory approach was adopted as an ongoing strategy throughout the entire project cycle. Public participation and consultations were done through individuals, groups and community meetings. Selection of ways to consult, and expand participation by community and other stakeholders, took into consideration literacy levels prevalent in affected communities; ethnicity and cultural aspects and practical conditions (like distance). The role of political and cultural leaders, including the community elders, in the participation strategy is important

6.2 Objectives of the Public Consultations/meetings

The overall goal of the consultation process is to disseminate project information and to incorporate the views of the Project Affected Persons (**PAPs**) in the design of the mitigation measures and the management plan.

The specific aims of the consultation process were to:-

Improve project design and, thereby, minimize conflicts and delays in implementation;

- Facilitate the development of appropriate and acceptable entitlement options; Increase long term project sustainability and ownership.
- Reduce problems of institutional coordination.
- An important element in the process of impact assessment is consulting with stakeholders/community to gather the information needed to complete the assessment.

The main objectives of community consultations were to:-

- Provide clear and accurate information about the project to the beneficiary community;
- Obtain the main concerns and perceptions of the population and their representatives regarding the project;
- Obtain opinions and suggestions either individually or directly from the affected communities on their preferred mitigation measures
- Identify local leaders with whom further dialogue can be continued in subsequent stages of the project.
- Enable the indigenous knowledge of the local community to identify benefits, flow of storm water, possible effects and mitigation measures.
- Identify plant species that have to be cleared and promote the indigenous palatable plants species within the project site.

The process of consultation and public participation was aimed at obtaining local knowledge, increasing public confidence and reducing conflicts

Stakeholder Identification

To enhance maximum participation and achieve a better output, the right stakeholders were taken on board. This was done through stakeholder identification and involvement based on their needs, interests, and potential impact on project outcome that is the irrigation scheme project construction.

6.3 Participation Consultation/Interviews

The participant consultations were done on two levels, that is apart from the desk top studies from the various offices in the county and Sub County levels, community participatory meeting at the project site done at two levels that is Focused Group discussions (**FGDs**) and individual interviews on persons sampled among men, women and youth among the participants. Information collected to enrich the EIA study report. Individual interviews done on prepared questionnaires to capture individual perception on the project (*Sample example of questionnaire attached as appendix*)

Several visits were organized to the proposed irrigation site by the project team. During some of the visits a field tour of the general area was undertaken and a detailed examination of the ecological setting of the area was carried out. Types of existing plant species and wild animals were recorded. The environmental condition existing in the proposed project area were

documented to provide baseline data. The possible impacts of the proposed project activities were thereafter assessed against the documented baseline data. Section 35-2 of the environmental Impact Assessment and Audit Regulations 2003, requires that an EA should “*examine and seek views on environment, health and safety issues from the local community and other potentially affected communities*”

6.3.1 Sources of Information

During the environmental impact assessment, public participation was a key component in getting information to be incorporated in writing this report. Positive and negative views of the perceived affected neighbors were sought. The exercise was conducted by a team of registered environmental experts through administration of pre-designed questionnaires, and interviews in various areas surrounding the proposed project site



lead expert consulting with community members at Makere Ya Gwano

Community members filling the questionnaire

Figure 5: Public participation, participants filling questionnaire

The neighboring communities were asked to comment and give views concerning the proposed project on various issues concerning the following:

- ❖ The positive impacts that may emanate from the development of the proposed project
- ❖ Measures that the developer should put in place during and after the project to mitigate impacts
- ❖ Whether the proposed project construction and occupation will cause the negative impacts on the following:
 - a) Local residents
 - b) Natural ecology of the area

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- c) The human environment
 - d) Public health and safety
 - e) Effects on the soil
 - f) Effect on areas of scenic beauty
 - g) Effect on plant species composition

Many respondents were consulted during public appraisal exercise although, some declined to give their contacts or real identification card numbers. However their views have been incorporated in this project.

The sub item below summarizes issues were raised and captured in the questionnaires from the community (respondents) towards the proposed irrigation schemem project and issues captured during the desktop studies analysis. The issues have been categorized as positive and negative issues (Selected Sampled filled questionnaires attached as appendix)

6.3.2 Key issues arising from public participation meetings

Consultative meetings (baraza) with community in conjunction with the proponent and the administration.

The list of attendants are presented in Appendix 1. The agenda of the meeting was to inform the community about the project and receive comments and suggestion from participants

The following is a summary of issues raised by members who attended the meetings

6.3.3 Perceived Benefits

- a) The proposed project will create significant economic and social benefits to the communities and contribute to the attainment of the National priority goals and ongoing National efforts to accelerate economic growth and alleviate poverty under the Food and Nutrition Security under Agenda 4
- b) Irrigated agriculture will contribute to enhanced food security and improved nutrition at the household level. This will alleviate impact of erratic and unreliable rainfall pattern on the community's productive resources
- c) Employment opportunities will be offered to the construction workers and any other person who will be hired to provide her/his services during construction phase. In addition to direct employment, supplies of basic necessities to the workers will also lead to more employment opportunities and acquisition of entrepreneurial skills. This will engrain a sense of project ownership within the community
- d) The irrigation scheme will also play a role in reduction of idleness particularity amongst the youth due to an increase in income generating activities either directly or indirectly

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- e) By providing direct and indirect local employment, the project will ease the direct resource dependency pressure on forest and wildlife resources
 - f) The project would ensure that greenhouse gas emission is reduced by using solar power to pump water
 - g) Trees would also be planted in the project areas to act as carbon sink hence mitigating greenhouse gas effects to the environment
 - h) The project will address issues of increased productivity, food insecurity and poverty reduction both at household and community level through continuous irrigated agriculture, good agricultural practices hence enabling continuous supply and availability of food throughout the year.
 - i) The target crop during the first season would be dry maize and the expected yields per acre would be 15 bags (90Kg) per acre hence the scheme is expected to produce 450 bags which is 13,500 Kg of maize.
 - j) The target market would be local NGO's, local and away traders, and millers among others
 - k) The project would also address the issues of nutritional balance due to the integration of traditional high value crops such as amaranths vegetables and the yellow fleshed sweet potatoes that are highly rich in vitamin A hence reduced levels of malnutrition levels in the project area.
 - l) Post-harvest losses would also be reduced by capacity building the farmers on post-harvest handling and provision of hermetic bags to prevent the products from attack by storage pests.
 - m) The beneficiaries would also become resilient to climate change by continuous production through the small-scale irrigation scheme hence continuous supply of food to the households.
 - n) The climate smart technologies that they would use for planting the traditional high value crops would also enable continuous crop production. Using solar powered submersible pumps would cut greenhouse gas emission.
 - o) Cross cutting issues that would arise in the project would also be taken into consideration along the value chain like gender mainstreaming, youth, people living with ability among others by ensuring activities and technologies are user friendly to them.
 - p) The maize stalks that would be left after harvesting would be used as livestock feeds hence improve on livestock production

6.3.4 Issues of concern

- a. The water being conveyed to the irrigation plots about 750m away is through a 3' diameter Upvc pipeline which is inadequate. The community expressed concern on water distribution and rationalization which does not reach the targeted community. The project management will put in place mechanism to enable all GHAPHALA CBO community members to access water in compliance with regulations
- b. Health risks associated with increased incidences of mosquitoes and malaria borne diseases due to increased breeding sites. This would be mitigated through capacity building to community on mosquito preventive control measures
- c. Lack of marketing strategy infrastructure for product; currently farmers do not have a crop storage and marketing plan. There is urgent need for scheme beneficiary farmers to develop collaborative and effective marketing strategies to access larger and more sustainable markets
- d. Lack of adequate knowledge and skills in irrigation. This could be attributed to limited knowledge and lack of irrigation crop production skills, tillage services, fertilizer, seed, integrated pest management and operations of irrigation equipment and management
- e. Poor road infrastructure that would hinder supply of farm produce to markets at Hola
- f. Clearing of vegetation during construction phase, this would be addressed through reforestation programs and sparing of indigenous trees during the expansion and clearing process
- g. Lack of credit especially for irrigation purposes to enable grow high value crops and source inputs on time, and at competitive rates may hamper scheme productivity and adoption of climate smart agriculture techniques. The project beneficiaries through collective action can enhance access to financial service providers
- h. Human Wildlife conflict: Some of the respondents felt that the proposed project would bring a problem of wildlife (herbivores particularly warthogs, antelopes, buffaloes or even elephants that are within the area) and livestock conflict due to passage to water animals at the river Tana . They however advocated that the community should identify sites outside the locality for wildlife to water and create a livestock corridor (Malkas) to the river Tana for watering of animals
- i. Accidents during Construction: There is likelihood that during the construction phase of the proposed project, construction workers may get involved in accidents as a result of falling building stones/bricks, sharp metals and machines used in the construction. The

proponent will strictly adhere to safe working practices to protect the workers, neighbors and passers-by

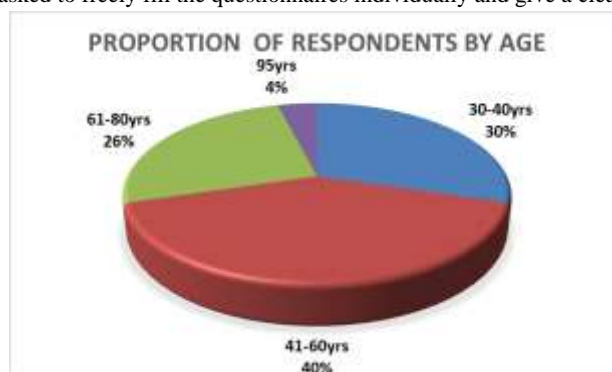
- j. Noise pollution: There was concern over the possibility of high noise and vibration levels in the project site as a result of excavation and construction works. The sources of noise pollution will include transport vehicles, construction machinery and metal grilling and cutting equipment. However the proponent will take appropriate steps to minimize noise impacts including provision of appropriate protective equipment to construction workers, planning and minimizing the frequency of materials transport, ensuring that all equipment are well maintained

Almost all the respondents (99%) had a strong conviction on the key benefits they would have from the proposed project. This is mainly associated with expansion of the scheme and supply of more water for irrigation purposes. The perception of such benefits is an indication that there is a serious need for such a project. Equally, most of the respondents (97.5 %) were willing to pay for any extra services associated with the project grant. Projects do have operation costs and initial capital needs to be recouped after a certain duration. These are fundamental aspects that will contribute to the aspect of breaking even by key stakeholders. Therefore, the ability to handle all these issues would be a key indicator of potential project sources

6.4.1 Questionnaires Summary

Prior to administering the questionnaires, the residents and stakeholders were taken through the EIA questions concerning the proposed irrigation scheme as contained in the questionnaires and how they fill them. They were asked to freely fill the questionnaires individually and give a clear picture of potential impacts of the proposed development.

The respondents reside around the proposed irrigation scheme. The summaries of questionnaire are presented in pie charts and graphics.



Out of the total number of *Figure 6: Summary of Respondent's years (age) as residents*

respondents who are residents in

the proposed project site 30 % are below 40 years old while 40% are between 41and 60 years

and while 26 % are 61 years and above (Figure 7)

All the respondents were of the in agreement that the irrigation scheme project be constructed (Figure 8)

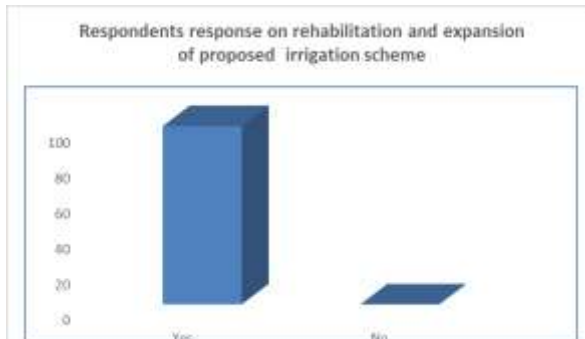


Figure 7: Respondents awareness about the proposed water pan

Majority of respondents reported that the main benefits of the proposed irrigation scheme is employment creation and enhanced food security at 95 percent and 90 percent respectively (Figure 9)

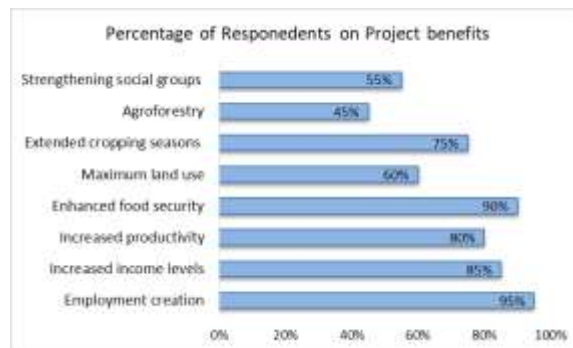


Figure 8: Respondents comments on benefits of the project

The negative impact noted by respondents is increase in water borne diseases, solid waste generation, devegetation, water pollution and conflicts with a rating of 90, 85, 75 and 70 percent respectively. (Figure 10). Proliferation of invasive species, salinization and moral decadence were also mentioned albeit with a low proportion

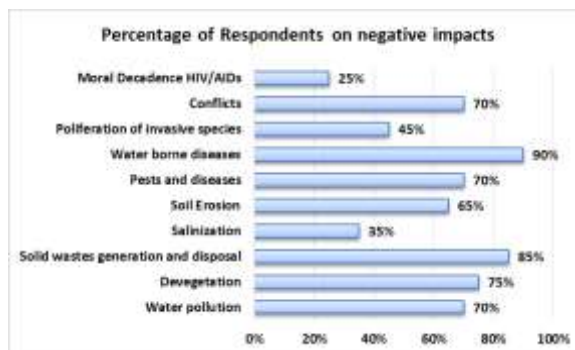


Figure 9: Respondents comments on negative impacts of the project

The main mitigation factors reported in the FGDs and community questionnaire was Establishment of management committee and Capacity building 95 percent and 85 percent respectively (Figure 11).

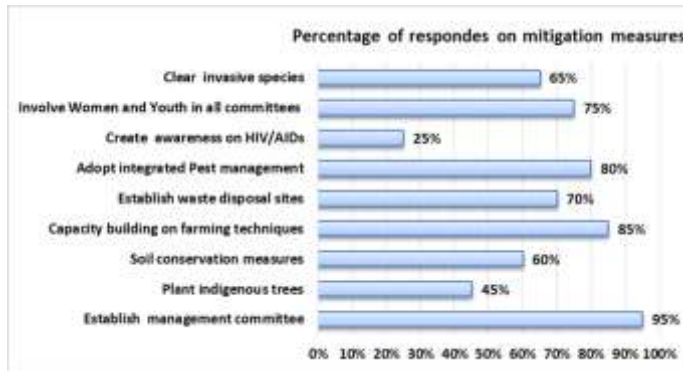


Figure 10: Proportion of respondents on mitigation measures

Figure 12 shows that the highest proportion of respondents were females 59 percent followed by males 41 percent. The proportion of youth in the focused group discussion was very low and there is need for the management committee to involve the youth

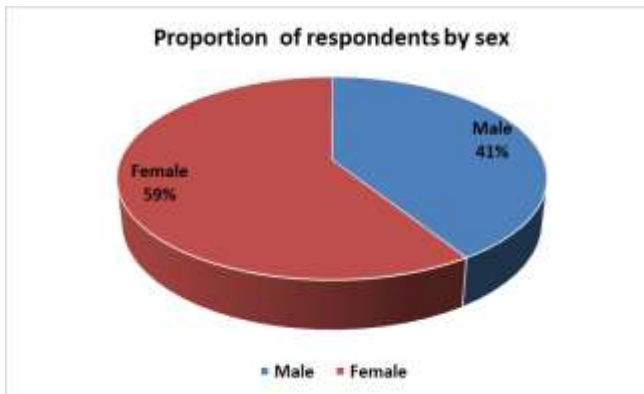


Figure 11: Proportion of respondents by gender either Male or Female

On whether they anticipate any problem, complaint or conflict against the project with respect to water, land, public health, loss of livelihood and others, majority of the respondents identified none. This might be as a result of the high expectation they placed on the proposed project. However, the EIA team have identified probable negative impacts and suggested best practices on their mitigation/reduction in chapter seven and Environmental Management Plan (EMP) section

Sample questionnaires are attached /appended annexed

CHAPTER SEVEN: IMPACT IDENTIFICATION AND MITIGATION MEASURES

This chapter identifies both negative and positive impacts associated with irrigation construction.

7.1 Impact Classification and Mitigation Measures

Table 12: Impact Classification and Mitigation Measures

Phase	Impact Description	Nature of Impact		Proposed Mitigation
	Encroachment into riparian area	Major		<ul style="list-style-type: none"> • Community policing • Sensitize community on protection • Fence off the site
	Impacts on surface and groundwater hydrology		Minor	<ul style="list-style-type: none"> • Involve local community in formation of an irrigation management committee with clear mandate of ensuring soil conservation • Increased recharge rates
Construction	Devegetation leading to loss of flora and fauna	Major		<ul style="list-style-type: none"> • Proper demarcation of construction areas to minimize trees to be felled • Have strict control of construction vehicles to ensure that they operate only within the area to be disturbed by access routes and other works • Promote agroforestry during the operation phase to replace and enhance vegetation cover in the project area • Contractor to ensure vegetation is cleared only where necessary and if in the process mature trees are cut, new trees should be planted in areas adjacent to the cleared ones

	Risk of accidental drowning, Injuries during irrigation canal construction and/or due to vehicular traffic		Minor	<ul style="list-style-type: none"> • Keep unauthorized persons away from dangerous zones • Put warning signs(written in Kiswahili, local “Pokomo/orma ”language) at strategic sites • Ensure regular monitoring of embankment and canals to avoid accidents
	(Pollution from oil spills and other solid waste		Minor	<ul style="list-style-type: none"> • Vehicle maintenance should be done on purpose-built impervious concrete platforms with oil and grease traps • Standard operating practices for re-fueling mobile equipment such as a minimum 15m from any water channel should be practiced • Ensure all equipment is in good condition, clean and free from leaks • Oil spill contaminant and clean up equipment should be safely kept by the contractor

Pollution from other solid waste(there will be some solid containers of materials such as cement, and gravel packs and other packets of materials and equipment to be used during implementation of the project	Major		<ul style="list-style-type: none"> • The excavated material shall be recycled • The proponent will ensure the contractor disposes any remaining wastes be it paper or polythene containers, cement, bentonite and gravel bags, excavated material, remnant gravel pack, among others in a sensible way before the project is commissioned • Minimize waste generated by adopting cleaner production methods such as conserving raw materials, enabling the recovery and re-use of waste product where possible. • Containers or package for storing hazardous waste including used oil to be securely bundled and labelled as provided for by Regulation 18 the environmental management and coordination(Waste Management) Regulations, 2006 and Public Health Act
Alterations in flow of water and changes in water quality during the construction of irrigation facilities	Major		<p>Adequately divert the runoff away from construction areas</p> <p>Ensure good engineering practices</p>
Enhanced Erosion/changes in topography due to excavation	Major		<ul style="list-style-type: none"> • Minimize exposed areas by properly demarcating the project area to be affected by the construction works through minimal devegetation • The contractor must implement erosion measures to avoid erosion in areas that are prone to erosion e.g drainage lines • Topsoil must be reinstated and rehabilitated on top of subsoil • All excavation works must be properly backfilled and compacted

	Social pressure on local community		Minor	<ul style="list-style-type: none"> • Enlighten personnel about STDs (HIV/AIDS) and use of condoms • Partner with NGOs in campaign to stop the spread of HIV/AIDS • Strengthen basic facilities • Avoid actions that could cause or escalate tension
	Air Quality		Minor	<ul style="list-style-type: none"> • Any stockpiles of earth (excavated), though little should be enclosed or covered and watered during dry or windy conditions to reduce dust emission • Masks should be provided to all personnel in dust generation areas throughout the period of construction • Emissions of gases from fuel combustion machines can be reduced by use of for example exhaust systems that are in good working condition. These will significantly help in reducing the noise levels and the amount of destructive gases to atmosphere

	Safety health and Environmental (SHE) Concerns	Major		<ul style="list-style-type: none"> • Construction sites shall be adequately protected or fenced off from unauthorized intrusions and warning signs, barricades should be properly displayed and strictly adhered to. • Provision of safe working area with adequate well-equipped First Aid kits should always be maintained on site at all times during the whole period of construction • Client shall ensure that contractor adheres to the rules set by authorities for the protection of his workmen such provision of insurance and protective gear • As regards compliance by the contractor, Client should ensure that all mitigation measures are strictly enforced through his site representative and this assurance should be firmly embodied in a signed Contract document • Education on operation and management of the facility, including all environmental aspects should be offered to all the concerned for purposes of Project responsibility, sustainability in terms of water quality and yields as well as safety
	Destruction of cultural Heritage sites		Minor	<ul style="list-style-type: none"> • Proper identification and demarcation of sites of cultural heritage • Establishing mechanisms for negotiations where disturbance of such site is inevitable

	Introduction of disease vector problems	Major		<ul style="list-style-type: none"> • Monitor the presence of disease vectors • Contribute to strengthening of local health facilities through public enlightenment • Contribute to public health programmes to eradicate/protect against malaria, schistosomiasis • Enhance community animal spraying and immunization programmes
	Loss of scenery due to dumping of excavated material		Minor	<ul style="list-style-type: none"> • Liaise with local community so that excavated and often fertile material can be put to good use
	Social evils (Increased moral decadence due to influx of people from different cultures and increased income	Major		<ul style="list-style-type: none"> • Sensitize workers by the contractor in collaboration with other stakeholders such as Ministry of Public health • Provision of social facilities such as HIV testing kits, condoms etc
	Conflicts over employment opportunities	Major		<ul style="list-style-type: none"> • Give preference to local youth employment opportunities and be gender sensitive

7.1 Construction phase

Construction phase shall begin with excavation in an area of about 30ha. Construction impacts have the potential to create nuisance to adjacent neighbors but these could be managed to acceptable limits. In addition the construction impacts are also temporary in nature

7.1.1 Anticipated Positive impacts during Construction phase

a) Employment opportunity

The construction phase of the irrigation project will be characterized by recruitment of minimum numbers of people to work with contractors. The rise in population will create corresponding increase in demand for goods and services such as food for construction, workers, housing, health care and need for transport. These needs will be satisfied by people living within the project area where local women will provide food vending services, homes will rent out spaces for new population and shops will also benefit from increase of sales.

Construction works will provide employment opportunities for both skilled and unskilled labour. Several workers including casual laborers, masons, carpenters, joiners, electricians and plumbers are to work during the project construction life.

In order to improve employment opportunities and make the project attractive to the people living in the area, the following are vital:

- Capacity building and training of men, women and youth on specialised labour that will be required during construction
- Gender mainstreaming during the recruitment process of workers to work in the construction process; and
- Open recruitment without bias to any gender, clan will enhance the project acceptability

b) Provision of Market for Supply of Building Materials

The construction work will require supply of large quantities of building materials such as cement, timber, steel, among others most of which will be sourced locally.

c) Local economic development

The proposed irrigation project will create employment and business opportunities that will contribute to improved local economic development. This will be characterized by expansion and emergence of new enterprise

7.1.2 Anticipated Negative Impacts during Construction phase

a) Vegetation Loss

Clearing of vegetation including grass, shrubs and trees is likely to occur during the laying of canals for water conveyance and other development that involve excavation. This will be done along the riparian area and within the farms. Devegetation in these areas will degrade the riparian area which plays a crucial role in protecting river Tana in addition felling of trees in this area will directly or indirectly affect the community who derive their livelihoods from these valuable trees

b) Increased soil erosion

Excavation of soil for canal construction and laying of pipeline as well as are major activities during the construction phase of the project. They are bound to result in significant amounts of loose of residual soil, prone to erosion through surface water runoff, especially during rainy season

c) Air quality and dust emission

Principal dust sources during construction will be generated during excavation works and possibly from project burrow pits, also during haulage of construction materials over distances. Gases from construction equipment and vehicles will also be emitted. The dust may cause respiratory complications to workers and nearby residents. Fumes and carbon compounds from the equipment and machines inhibit visibility and form deadly compounds in the air. If inhaled, severe respiratory complications are imminent

d) Disposal of Excavated Soil

Excess materials will result from excavations for the construction of canals and other facilities. The materials will include topsoil and gravel/rocks (some can be used in roadwork and backfilling). The excavated soils will have to be disposed of in an environmentally sound manner

e) Noise and vibration

The construction works delivery of building materials by heavy trucks, blasting and use of machinery/equipments including bulldozers, generators, metal grinders and concrete mixers will contribute to high levels of noise and vibration within the construction site and the surrounding area. Such noise within the site can cause nuisance and disturbance to the project workers and the residents, passers-by and other persons in within the vicinity of project site

f) Extraction of construction Materials

The construction will require bulk materials for construction of irrigation infrastructure. These materials include silt, sand, gravel and aggregates (rock). Construction activities may lead to environmental degradation if the construction materials are sourced from ecologically sensitive areas such as river banks. It is important that materials are sourced from licensed suppliers

whose sources are environmentally sustainable. Transportation of materials to the site should be done in a manner that does not cause destruction of vegetation on site

g) Increased Solid waste generation

Large quantities of solid waste will be generated at the site during construction works. Such waste will consist of metal cuttings, rejected materials, surplus materials, surplus spoil, and excavated materials, paper bags, empty cartons, empty paint and solvent containers, broken glass among others. Such solid waste materials can be injurious to the environment through chocking of water bodies, blockage of drainage system and negative impacts on human and animal health. This may be accentuated by the fact that some of the waste materials including metal cuttings and plastic containers are not biodegradable and can have long term and cumulative effects on the environment

h) Oil spills

The machines on site and vehicles contain moving parts which require continuous oiling to minimize the usual corrosion or wear and tear. Possibilities of such oils spilling and contaminating the soil and water on the site are possible. The potential for water contamination is likely and the effects are injurious to the aquatic life patterns and making drinking water unsafe for human consumption and domestic livestock

i) Risks of accidents and injuries to workers

Due to the intensive construction activities including erection and fastening of structures, metal grinding and cutting, concrete work, steel erection and welding among others, construction workers will be exposed to risks of accidents injuries. Such injuries can result from accidental falls from high elevations, injuries from hand tools and construction equipments cuts from sharp edges of metal.

j) Social Evils

This is the social impact expected from the proposed development during the construction stage. This will include for example an increase on the spread of STDs & AIDS, liquors drinking, drugs taking, prostitution etc. These are common anti-social vices at any construction site, which cannot be completely eradicated

k) Destruction of cultural heritage sites

During construction, sites of cultural significance could be destroyed to pave way for infrastructure development. Such areas in the project include forest sites where religious and cultural practices are conducted. Destruction of such areas may erode the cultural heritage of the community and destroy community cohesion

l) Conflicts

Conflicts are likely to occur over employment opportunities during the construction phase. This

may be due to the absence of other livelihood or employment opportunities for the residents especially the youth

7.2 Operation Impacts during the Operation phase

7.2.1 Positive Impacts

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- **Employment Creation**

Employment opportunities are one of the long term impacts of the proposed project that will be realized during the operation phase. This will be directly through farming and sale of farm produce and indirectly through the provision of auxiliary services such as marketing, Banking, transport, communication among others. Employment will lead to a general improvement in the livelihood of the community.

- **Increased income level**

The main source of income is small scale. People rely on rain fed agriculture and poorly managed irrigated crop production, charcoal burning. The expansion and construction of irrigation scheme will lead to increased crop production and consequently increased household incomes. This will in turn lead to poverty reduction through employment and livelihoods in the region

- **Increased productivity**

The project will lead to an increased in crop and livestock production which will enhance food security among households in the area. In addition, the increased production will sustain and support expansion of agro-based factories in the country

- **Improved food security**

The project will increase food production by irrigation in the area and in the country at large. It will also improve the health status of the people and eliminate malnutrition problems that are prevalent in the area. The net result is the reduction in the cost of preventing and treating ill family members. Improving food security will have positive impact on the individual income and poverty status of the beneficiary household.

- **Maximum land use**

Most of the land in the project area has not been under any productive use due to unreliable rainfall. The proposed irrigation will ensure this land is put into productive use for maximum benefit.

- **Extended cropping seasons**

91

The community will have advantage of farming throughout the year compared to other farmers who rely on rain. This will increase their output and consequently their income.

- **Improved extension services**

The irrigation project will attract extension services and provide the farmers with training opportunities

- **Agro forestry**

The project will also increase tree cover in the area through agroforestry. This will help to conserve soil and indigenous trees.

- **Strengthening of social groups**

The project will strengthen community based group organizations such as women groups, youth groups, cooperative societies during mobilization so as to increase their capacity to manage irrigation scheme

7.2.2 Negative Impacts during operation phase

a) Vegetation loss

Clearance of vegetation in the farms may be done to allow for cultivation and this may lead to or aggravate soil erosion which eventually causes sedimentation in the rivers. The clearance of vegetation near river banks may also be done to allow for farming. Cultivation of riverbanks without adequate conservation measures triggers intensive soil erosion and siltation in the river. Since the community also relies on fuel-wood as a source of energy the rate of devegetation might be aggravated as irrigation activities increase access to the buffer zone.

b) Changes in flow regime

Siltation due to intensive and unsustainable farming practices in the scheme may lead to significant changes in the river Tana flow regime. Significant changes in the flow regime (low flow regime in this case) (-20%) is likely to alter micro-habitats leading to the loss of aquatic species and consequently the loss of livelihood for communities that rely on these species

c) Water pollution

The proposed project may cause pollution of River Tana through deposition of organic and inorganic matter from the farms. Such pollution include: sediment and particulate organic solids; Particulate bound nutrients, chemicals, and metals, such as phosphorous, organic nitrogen, apportion of metals applied with some organic wastes

Though insignificant in the area, the continued use of agrochemicals may cause non-point pollution to the existing water resources. This might have health implications on those who use the contaminated water. Water containing nutrients from fertilizers may cause eutrophication which causes death of fish and other aquatic biota. Farmers therefore need to be trained on safe use of agricultural chemicals and emphasis on integrated pest management

Pollution in the river tana will have significant impact on the biodiversity it supports including aquatic and riparian species. This will greatly affect the livelihoods of those who depend on these ecosystem goods. In addition pollution will affect the livelihoods of downstream communities who depend on the water for domestic and agriculture/livestock purposes

d) Salinization

The introduction of large volumes of water into the soil in a continuous basis through irrigation is likely to change both the soil physical and chemical attributes. Inappropriate management of water e.g through excessive irrigation and inadequate drainage will lead to water logging and leaching of water soluble nutrients to levels where they are no longer available for use of plants.

e) Water logging

Waterlogged conditions will adversely affect growth and development of many plants including crops; it may also encourage change in natural composition of vegetation by suppressing and encouraging development of various plants respectively. If proper land drainage is not practiced, irrigation has the potential of increasing soil salinity through raised water table and accumulation of soluble salts.

Water logging may occur because of poor levelling of canals that leave water o stand in some sections of the field. The concentrated water from the irrigation outlets and malfunctioning of canals may also cause soil erosion and water logging especially water holding soils the eventually affect stability of the irrigation canals. Drainage development and lining of canals will render the impact insignificant

f) Solid waste disposal

The solid waste will comprise mainly of agrochemical packaging materials, soil excavated and rock debris, metal cut offs plastics, cardboards, paper, wood and waste concrete among several others, which can cause water pollution and animal health risks. Poor disposal of such waste poses a health hazard to both children and animals. This agrochemical containers and other crop waste may find their way into the river causing pollution and eutrophication.

f) Soil Erosion

Different types of soil erosion are expected in the area including water erosion and gully. Continuous cultivation on cleared land without conservation measures, and animal tracks and uncontrolled grazing may cause loose soils that become susceptible to erosion. Intensified agricultural practices due to irrigation may accelerate soil erosion in the project area.

Out-of-date in fill water management practices involving poor cut and fill operations through

watercourse embankments can result in soil erosion at the head end of the irrigated field and in sedimentation at the mid or tail-end locations of the field.

g) Sedimentation

Irrigation schemes can fail if sediment load of the water supply is higher than the capacity of the irrigation canals to transport sediment. Sedimentation from within the scheme itself can be a problem, for example, wind-blown soil filling canals

Reservoir siltation shortens the active life of the reservoir and must be given careful consideration at the design stage. The increase in erosion due to the economic activity prompted by the reservoir and its access roads needs to be taken into account

h) Pests diseases and weed

Irrigated agriculture often provides improved conditions for crop diseases to develop particularly fungal and bacterial foliage diseases. This leads to an increase in use of hazardous chemicals to aquatic systems and become rapidly concentrated in the food chain. Use of fertilizers results in eutrophication of the river Tana and may also affect health of the locals. Phosphates tend to be fixed to soil particles and therefore may reach the river when soil is eroded. Diseases and weeds spread rapidly through waste water and drainage water. Local variety of weeds may thrive in the irrigated environment and reduce agricultural productivity

k) Flood occurrence

Flooding is a common occurrence in the area but may be aggravated by project activities such as natural vegetation clearance and sedimentation in water channels due to poor maintenance. Flooding leads to economic and social losses through destruction of crops. Irrigation infrastructure and increased waterborne diseases. Radically altered flood regimes may have a negative impact on the downstream ecosystem

l) Ecological imbalance and degradation

Without appropriate management measures, irrigated agriculture has the potential to create ecological imbalance both at the project site and in adjacent areas. Excessive clearance of natural vegetation cover in the project area, for example, can expose the soil to erosion, leading to a loss of top soil and nutrient leaching. The removal of roots and vegetation disrupts the water cycle, increasing the rate at which water enters rivers and streams thereby changing flow regimes and increasing siltation in the downstream zone (delta region)

The introduction of exotic species like *Prosopis Juliflora* may get rid of indigenous species or introduce disease agents which may affect plants, animals and/or man. Fertilizers and

pesticides are widely applied to correct imbalances. These can percolate through the soil and/or be carried away in the drainage water polluting both groundwater and surface water especially in the downstream zone. The nutrients in fertilizers may give rise to eutrophication of surface water bodies and promote the growth of aquatic weeds. Pesticides residues are hazardous to health of both man and animals. The use of IPM will be promoted and enhanced

i) Conflicts

Conflicts between farmers and livestock keepers due to destruction of crops

Conflicts may occur when livestock graze on cultivated land

Conflict between farmers and wildlife

Conflicts between beneficiary and non-beneficiary communities leading to asset vandalism and crop theft

Tension and insecurity between the beneficiaries and non-beneficiaries may arise over benefits accruing from the irrigation scheme. Non-beneficiaries question the justice of being excluded from the benefits of the irrigation scheme. Project beneficiaries considered enjoying special privileges denied other households without any justification. These may result in loss of human life and destruction of property. This may hinder farming activities which contributes to poverty and food insecurity and may constrain social development of the project area.

Conflicts among beneficiaries over water access and distribution within the scheme

Due to limitation in the amount of water to be abstracted for proposed project, conflicts are likely to emerge over water allocation among the members of the scheme. Conflicts may lead to tension within the community and degrade the social cohesion. Conflicts may also arise among water beneficiaries over water access as some members feel that water distribution is unfairly done.

Conflicts among beneficiaries over allocation of the operations and maintenance costs

Operation and maintenance of an irrigation system require co-ordination and collective action problems arise easily when each farmer wants to use more water and invest less in the system.

j) Increased waterborne diseases

Polluted water is a major cause of human disease. The most common disease associated with contaminated irrigation water are cholera, ascariasis, amoebiasis, giardiasis and E.coli. The construction of irrigation might also lead to an increase in malaria incidences. Schistosomiasis is also a key disease caused by parasitic trematode worms which in their adult form live in the blood stream of human hosts. Aquatic weeds provide an important substrate for the snails. Poor sanitation and poorly constructed sanitary facilities in the fields may also lead to contamination

of water bodies leading to the spread of diseases.

k) Occupational health and Safety

The use of pesticides, fertilizers and other agro chemicals may affect the farmers who handle them through inhalation or indirect skin contact. This may cause complicated health conditions. In addition, once they are washed into water bodies they may cause contamination and affect downstream users who draw water from the river.

l) Moral decadence

Since project will lead to an increase in income and raise living standards in the area, there is a likelihood of increased social vices such as prostitution theft, alcoholism among others.

7.2.3 Summary of potential Impacts

Table 13: Summary of Key potential positive and negative impacts

Environmental Impact	Positive/negative	Direct/Indirect	Temporary/Permanent	Major/Minor	Occurrence	
					Design/Construction	Operation
Employment creation	Positive	Direct	Permanent /Temporary	Major	Yes	Yes
Increased income levels	Positive	Direct	Permanent	Major		Yes
Increased productivity	Positive	Direct	Permanent	Major		Yes
Improved food security	Positive	Direct	Permanent	Major		Yes
Maximum land Use	Positive	Direct	Permanent	Major	Yes	Yes
Extended cropping season	Positive	Direct	Permanent	Major		Yes
Improved Extension Services	Positive	Direct	Permanent	Major		Yes
Agroforestry	Positive	Direct	Permanent			Yes
Devegetation	Negative	Direct	Temporary	Minor	Yes	
Soil erosion	Negative	Direct	Temporary	Minor	Yes	
Oil spills	Negative	Direct	Temporary	Minor	Yes	No
Dust Emission	Negative	Direct	Temporary	Minor	Yes	No

Environmental Impact	Positive/negative	Direct/Indirect	Temporary/Permanent	Major/Minor	Occurrence	
					Design/Construction	Operation
Excavation works	Negative	Direct	Temporary	Major	Yes	No
Generate of exhaust emission	Negative	Direct	Temporary	Major	Yes	No
Increased water demand	Negative	Direct	Permanent	Major	No	Yes
Increased potential for accidents	Negative	Direct	Temporary	Minor	Yes	Yes
Solid waste generation	Negative	Direct	Temporary	Major	Yes	Yes
Risk of injuries	Negative	Direct	Temporary	Minor	Yes	Yes
Social Evils	Negative	Indirect/Direct	Temporary	Major	Yes	Yes
Conflicts	Negative	Direct	Temporary	Minor	Yes	Yes
Salinization	Negative	Indirect/Direct	Temporary	Minor	No	Yes
Water logging	Negative	Direct	Temporary	Major		Yes
Pests diseases and weeds	Negative	Indirect/Direct	Temporary	Major		Yes

7.3 Anticipated Impacts during the decommissioning phase

Decommissioning refers to the formal process of removing something from the operational status. It requires time in order to properly deal with potential hazards and risks that may be encountered.

7.3.1 Decommissioning activities

A typical decommissioning involves water evacuation from the canal and pipeline securing irrigation infrastructure, demobilization of irrigation systems, pumps and plant and disconnection from the solar powered mains, removal of unstable fills and configuration for long term drainage, which includes measures such as out-sloping, water-barring, ditch removal and a variety to other site specific solutions

At the expected end of the economical life of the proposed project, the structure will be demolished and replaced with other development, which will be applicable and suitable at that particular period. The decommissioning exercise will have both positive and negative impacts.

7.3.2 Positive Decommissioning Impacts

Employment Creation

For demolition to take place properly in good time, there will be need to employ people who will be involved in the demolition exercise for the proposed project on its decommissioning.

Rehabilitation

During the decommissioning stage rehabilitation works will be undertaken at the proposed scheme area to restore it to its original state. This will include replacement of topsoil and re-vegetation, which will enhance the aesthetic value of the area

7.3.3 Negative Decommissioning Impacts

Dust

Large quantities of dust will be generated during demolition works. The dust will affect the demolition workers and neighboring land users and people

Solid waste generation

Demolition of the project of this magnitude will result in large quantities of solid waste. The waste will contain the materials that were used in the construction. Although demolition waste may be considered as less harmful to the environment because they are composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment.

Noise vibration

The demolition works will lead to significant deterioration of the acoustic environment within the project site and the surrounding areas. This will be as a result of the noise and vibration that will be experienced as a result of demolition

CHAPTER EIGHT: MITIGATION MEASURES AND MONITORING PROGRAMS

The Chapter highlights the necessary mitigation measures for the expected negative impacts of the proposed project

8.1 Construction related impacts

a) Devegetation

Devegetation during the construction of the irrigation canals and other infrastructure may be mitigated through:

- Proper demarcation of construction areas to minimize trees to be felled

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- Have strict control of construction vehicles to ensure that they operate within the area to be disturbed by access routes and other works
 - Promote agroforestry during the operation phase to replace and enhance vegetation cover in the project area
 - The contractor should ensure that vegetation is cleared only where necessary and if in the process mature trees are cut, new trees should be planted in areas adjacent to the cleared ones.

b) Soil Erosion

This may be mitigated by the following measures:

- Minimize exposed areas by properly demarcating the project area to be affected by the construction works through minimal devegetation
- Control construction vehicles to ensure that they operate only within the area to be disturbed by access routes and other works to avoid accelerated devegetation that causes soil erosion
- The contractor must implement erosion control measures to avoid erosion in areas that are prone to erosion e.g drainage lines
- Topsoil must be reinstated and rehabilitated on top of subsoil
- All excavation works must be properly backfilled and compacted

c) Air quality

This may be mitigated by the following measures:

- Any stockpiles of earth (excavated), though little, should be enclosed or covered and watered during dry or windy conditions to reduce dust emissions
- Masks should be provided to all personnel in dust generation areas throughout the period of construction
- All equipment on site should be properly maintained in good operating condition so as to emit minimal air pollution
- Emission of gases from fuel combustions by machines can be reduced by use of e.g exhaust systems that are in good working condition. This will significantly help in reducing the noise levels and the amount of destructive gases to atmosphere.
- Control of speed and operation of and operation of construction vehicles will help in preventing generation of much dust in the atmosphere. Access routes regularly sprinkled with water in order to reduce effect of dust.
- Workers shall wear dust masks
- Vehicles delivering soil materials should be covered to prevent dust emission
- Activities generating dust (excavation, handling and transport of soils) to be carried out in calm weather.

d) Noise*Recommended Mitigation measures*

- People participating in the construction should be provided with Personal Protective Equipment (PPE) such as ear muffs for ear protection
- Sound-attenuated equipment should be used as much as possible
- No unnecessary hooting by project and resident vehicles
- Noise levels should be kept within acceptable limits preferably as stipulated within the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) Control Regulations 2009 :
- Limit pickup trucks and other small equipments to an idling time, observe a common sense approach to vehicle use and encourage workers to shut off vehicle engines whenever possible;

e) Oil spills*Recommended Mitigation Measures*

- Vehicle maintenance should be done on purpose-built impervious concrete platforms with oil and grease traps
- Standard operating practices for re-fuelling mobile equipment such as a minimum 15m from any water channel should be practiced
- All above surface tanks should be bounded and mounted on paved surfaces
- Ensure that all equipment is in good condition, clean and free from leaks
- Oil spill containment and clean up equipment should be safely kept by contractor

f) Solid waste

There will be some solid containers of materials such as cement, and gravel packs and other packets of materials and equipment to be used during implementation of the project

Recommended Mitigation Measures

- The excavated material shall be recycled
- The proponent shall ensure the contractor disposes any remaining wastes be it paper or polythene containers, cement, bentonite and gravel bags, excavated material, remnant gravel pack, among others in a sensible way before the project is commissioned
- Minimize waste generated by adopting cleaner production methods e.g conserving raw materials, enabling the recovery and reuse of waste product where possible
- Use durable long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time
- Provide facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements of nature i.e sunshine

among others

- Containers or package for storing hazardous waste including used oil to be safely bundled and labelled as provided for by Regulation 18 under the Environmental Management Coordination (Waste Management) Regulations 2006 and the Public Health Act

g) Safety Health and Environmental (SHE) Concerns

Every construction tool equipment and machines shall be well set adequately maintained. As well the construction area shall be kept free from objects such as sharps and tripping, which cause emergencies and occurrences of accidents ranging from minor cuts to fatalities during construction

Recommended mitigation Measures

- The construction site shall be adequately protected or fenced off from unauthorized intrusions and warning signs, barricades should be properly displayed and strictly adhered to.
- Provision of safe working area with adequate and well-equipped First Aid should always be maintained on site at all times during the whole period of construction
- In addition to the proponent should ensure that the contractor adheres to rules set by authorities for protection of his workmen such provisions of insurance and protective gear
- Adequately washing facilities should be provided for workers' hygiene and protection
- Engage contractors who are fully conversant with occupational health and safety matters at workplace. As regards compliance by the contractor, the proponent on his part should ensure that all mitigation measures are strictly enforced through his site representative and his assurance should be firmly embodied in a signed contract document.
- Information and education on operation and management of the facility, including all the environmental aspects should be offered to all the concerned for purposes of project responsibility, sustainability in terms of water quality and yields as well as safety.

h) Destruction of cultural heritage sites

This can be mitigated through

- Proper identification and demarcation of sites of cultural heritage
- Establishing mechanisms for negotiation where disturbance of such sites is inevitable

i) Social Evils

- Increase moral decadence due to an influx of people from different cultures and increased incomes could be mitigated through:

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- Sensitization of workers by the contractor in collaboration with stakeholders such as Ministry of Public Health
 - Provision of social facilities such as HIV/AIDs counselling and testing centre

j) Conflict over employment opportunity

Mitigation measure

- Give preference to local Youth and women for employment opportunities

8.2 Operation phase impacts

a) Devegetation

Recommended Mitigation Measures

- Strengthen the existing community based groups that promote conservation of trees through registration as Community Forest Associations
- Promotion of Agroforestry
- Selective felling of trees according to the provisions of the county environment agency
- Creating synergies with farmers, government and non-governmental groups to enhance tree planting

b) Changes in flow regime

Recommended Mitigation Measures

- Ensure compliance with water resource regulations so as to maintain at least steady base flow of the river to sustain ecological and social requirements downstream
- Maintain the mandatory buffer are of 50 meters for conservation of the river ecosystem
- Regular monitoring of water quantities to ensure compliance with WRA license
- Build capacity of the WRUAs to establish regulations on water management including fines against unauthorized access to irrigation water

c) Water pollution

Recommended Mitigation Measures

- Sensitize farmers on sustainable agriculture practices such as proper use of agrochemicals, river bank conservation, agroforestry and soil conservation
- Educate farmers on Integrated Pest Management practices, dangers of pesticide contamination and conservation of water bodies
- Strengthen existing customary laws on conservation of rivers

d) Sedimentation

Recommended Mitigation Measures

- Provision of a sedimentation basin that will allow settlement of asmuch as possible sediment before getting into the larger part of the canal system

e) Salinization

Recommended Mitigation Measures

- Provide adequate drainage within the farms
- Regular maintenance of the channels
- Regular monitoring and soil analysis to manage potential problems
- Sensitization of farmers on farm water management

f) Solid waste disposal

Recommended Mitigation Measures

- Establish a waste disposal site for hazardous waste in a location approved by NEMA in accordance with the waste management regulations
- Sensitization of farmers on waste management
- Designate waste disposal sites/areas for agrochemical packaging
- Regular monitoring of waste management status in the farms

g) Water logging

Recommended Mitigation Measures

- Capacity building of farmers on irrigation water management
- Construction and maintenance of adequate drainage system
- Apply water using appropriate irrigation methods
- Apply soil and water conservation methods on farms

h) Increase in Invasive species *Prosopis juliflora* (Mathenge)

Recommended Mitigation Measures

- Cutting and uprooting the plant either manually or mechanically
- Clear the irrigation canals from plant growth
- The large trees of *Prosopis juliflora* can be used for fuel wood to generate income

i) Soil Erosion

Recommended Mitigation Measures

- The design of farm irrigation systems will provide for conveying and distributing irrigation water without triggering soil erosion
- Provide free board in the design of the conveyance structures to protect them from floods and siltation
- Application of conservation treatments such as land levelling, irrigation water management, conservation tillage, and crop rotations to control irrigation-induced erosion
- Use cover crops to reduce soil displacement by water or wind

j) Sedimentation

Recommended Mitigation Measures

- Sediment extraction of headworks to be carried out regularly by the community members
- Provision of a sedimentation basin that will allow settlement of as much as possible sediment before getting into larger part of the canal system

k) Pests diseases and weed

Recommended Mitigation Measures

- Adopt integrated pest management control mechanism
- Training and awareness programmes on sustainable pest control
- Intensified extension services
- Use of linings , shade and intermittent drying out to complement traditional techniques of mechanical removal

l) Flood occurrence

Recommended Mitigation Measures

- Construction of flood dykes and establishment of flood control bunds/drains to trap and control flood water protect the irrigation infrastructure
- Conservation of the riparian zones
- Planting trees along the riparian zones to strengthen its ability to buffer floods

m) Conflicts

Conflicts between farmers and livestock keepers due to destruction of crops

Mitigation Measures

- Rules for grazing during the cultivation season should be formulated so as to minimize the destruction of crops by animals and to ensure amicable settlements of complaints over crop destruction
- Livestock should not be allowed to cause damage in the irrigated system
- Animal corridors to watering points should be provided within the scheme

Conflicts between beneficiary and non-beneficiary communities leading to asset vandalism and crop theft

Mitigation Measures

- Ensure equity allocation to the community members
- Build the capacity of local conflict resolution mechanisms
- Increase community sensitization on the negative impacts of conflict on livelihoods and local development through barazas and other forums

Conflicts among beneficiaries over water access and distribution within the scheme

Mitigation Measures

- Water should be distributed in turns following spatial sequence of the plots
- Conflicts should be managed by water committee, if they are beyond the capability of the committee, they should be referred to the community court
- Each beneficiary should have access to water on equal basis

- Ensure beneficiary participation and community management during project planning

Conflicts among beneficiaries over allocation of the operations and maintenance costs

Mitigation Measures

Every user should participate in structure maintenance

- A water committee should be established and should be responsible for resource mobilization for maintenance
- Conflicts should be managed by water committee, if they are beyond the capability of the committee, they should be referred to the local authority or line ministry (WRA, MoALF)

n) Increased waterborne diseases

Recommended Mitigation Measures

- Provision of convenient and culturally acceptable sanitary facilities in the farm
- Proper construction of toilets to prevent infiltration
- Equip health centers with facilities and drugs
- Provision of treated nets to the targeted communities
- Sensitization of the community on prevention of waterborne diseases

o) Occupational health and Safety

Recommended Mitigation Measures

- Capacity building on sustainable use of agrochemicals
- Adoption of integrated pest and disease control
- Intensified extension services

p) Moral decadence

Mitigation Measures

- Creation awareness on HIV/AIDs, social responsibility
- Strengthen existing structures that address social responsibility issues

8.3 Decommissioning Phase Impacts

a) Noise and Dust

During decommissioning phase, the potential environmental impacts will be noise and dust arising from the debris generated during demolitions. As such, appropriate technologies and methods will be used to minimize such noise and dust by for example providing for dust shields around the premise and ensuring that the workers are appropriately dressed in the right PPEs

The following noise containment techniques will be employed to minimize the impact of temporary destruction noise at the site

- Use equipment designed with noise control elements

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- Limit pick-up trucks and other small equipment to a minimum idling time and observe a common-sense approach to vehicle use, and encourage workers to switch off engine whenever possible

b) Solid Wastes

Some of the materials from the demolition shall be used in other construction sites as well as for landscaping activities on site while the remaining portions shall be disposed in accordance with the relevant National Environmental Laws and Regulations.

The solid waste resulting from demolition works will also be managed as follows;

- Provision of facilities for proper handling and storage of demolition materials to reduce the amount of waste caused by damage or exposure to the elements
- Use materials that have minimal packaging to avoid the generation of excessive packaging waste
- Adequate collection and storage of waste on the site and safe transportation to the disposal sites and disposal methods at designed areas be provided

CHAPTER NINE: ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN (EMMP)

The overall objective of the Environmental Management and Monitoring Plan (EMMP) is to ensure that mitigation measures of identified adverse effects throughout the design, construction, operation and decommissioning phases are implemented and that they are effective so as to promote the positive effects. It will also enable response to new and developing issues of concern. The EMP is vital output of an Environmental Impact Assessment as it provides a checklist for project monitoring and evaluation.

9.1 Responsibilities

The EMMP has various components with the respective stakeholders involved towards the implementation of the corrective actions, various persons and organizations are to be involved in the project. The following should be involved in the implementation of the EMMP: Project Proponent, Project Management Committee, the contractors and relevant government agencies

9.2 EMMP monitoring

There should be continuous monitoring and follow up on the project activities to ensure that the EMMP is implemented and that its objectives are achieved. The implementing staff, the community, and the contractor should ensure that the mitigation measures are put in place as outlined in the EMMP.

9.3 Design and Construction Phase

The necessary objectives, activities, mitigation measures and allocation of costs and responsibilities pertaining to prevention, minimization and monitoring of significant negative impacts and maximization of positive impacts associated with construction phase of the proposed irrigation are outlined below:

Table 14: Environmental management and monitoring plan during construction and operation phase

Expected Negative Impacts	Recommended Mitigation Measures	Performance Monitoring Indicator	Means of Verification	Responsibility Monitoring Implementation	Time Frame	Cost
De-vegetation	-Proper demarcation of construction sites to minimize disturbance -Strict control of construction vehicles to ensure that they operate only within the area to be disturbed by access routes and other works -As much as possible, avoid cutting down indigenous tree species of socio-economic importance	-Demarcation of sites -Entire labour force	-Irrigation reports/photographs -Site plan showing demarcation	Contractor Environmental Management Committees WRUAs	Throughout construction period	100,000
Soil erosion	-The contractor should implement erosion control measures to avoid erosion in areas that are prone to erosion e.g drainage lines -All excavation works must be properly backfilled and compacted	Construction sites demarcated All excavation backfilled	-Site plan showing demarcations	Contractor WRUAs	Construction period	N/A
Air Pollution (dust exhaust)	-Workers shall be trained on management of air pollution from vehicles and machinery -Vehicles delivering soil material should be covered to reduce dust emissions -Use of dust suppressants -Sensitization of workers on occupational health safety -Workers provided with protective gear like helmets, dust masks, ear muffs when working. Engines of vehicles and machinery not be left running.	-Workers/vehicle operators sensitized on reduced emissions -workers provided PPE	-site visit /reports Photographs -Sensitization report	Contractor	Construction	200,000

Expected Negative Impacts	Recommended Mitigation Measures	Performance Monitoring Indicator	Means of Verification	Responsibility Monitoring Implementation	Time Frame	Cost
	-Equipments on the site should be properly maintained so as to emit minimal air pollution					
Noise Pollution	-Workers should be provided with Personal Protective Equipment (PPE) -Use of PPE should be enforced -Sound –attenuated equipment should be used in as much as possible -Ensure use of equipment with exhaust systems in good working condition -Regular servicing of equipment -Noise levels should be kept within acceptable limits -Limit pickup trucks and other small equipments to idling time	-PPE provided to workers Regular servicing of equipments No of cases reported relating to noise pollution	Complaints register	Contractor	Construction Phase	N/A
Solid Waste management	-Minimize waste generated -Recycling of the excavated material -Storage of construction waste in designed collection points Appropriate waste disposal- directly/through licensed waste collectors -The disposal site need to be more that 100 meters from water course and in apposition that will facilitate prevention of storm water run-off from the site from entering the water courses	-Designed waste collection points established -Waste collection company engaged	-Waste storage points -Waste disposal facilities/contract collector	Contractor Community Environmental Management commitees	Construction	500,000
Oil spills	-Vehicle maintenance should be done on purpose built	Oil and grease traps established	Soil tests	Contractor	Construction phase	100,00

Expected Negative Impacts	Recommended Mitigation Measures	Performance Monitoring Indicator	Means of Verification	Responsibility Monitoring Implementation	Time Frame	Cost
	Impervious concrete platforms with oil and grease traps. -Standard operating practices for re-fuelling mobile equipment such as a minimum 15m from any water channel should be practiced					
Occupational health and safety	-Availability of adequate and appropriate sanitary facilities -Ensure workers health and safety throughout the campaign -Train at least one employee on first aid skills -Have fire extinguishers and train workers on how to use them -Have dust suppressants to reduce dust	Latrines provided Recorded accidents occurrences and near misses OSH sensitization conducted	Safety records	Contractor	Construction	500,000

9.4 Environmental Management and monitoring plan during operation phase

The environmental management and monitoring plan for the operational phase provides specific guidance related to the operational activities associated with the irrigation project. It is centered on sound environmental management practices that will be undertaken to minimize adverse impacts on the environment through normal operations of irrigated agriculture. The plan further identifies measures to be taken in an event of emergencies or incidences during the operation of the scheme. The table below shows operation phase of the irrigation project

OPERATION PHASE

Table 15: Environmental Management and Monitoring plan for operation phase

Expected Negative Impacts	Recommended Mitigation Measures	Performance Monitoring Indicator	Means of Verification	Responsibility Monitoring Implementation	Time Frame	Cost
Water pollution	-Sensitize farmers on sustainable agricultural practices, river bank conservation, agroforestry, soil conservation -Educate on integrated pest management dangers of contaminating the river with synthetic fertilizers -Regular water monitoring -Strengthen customary laws on conservation of the rivers	-Soil conservation measures -Trees plant along with crop -Farmers practicing IPM - Regular water quality data from WRMA -	-Training reports/photographs -Field observations on number of trees planting along with crop production -Minutes of community meetings	KCSAP, WRMA, GHAPALA Community CBO County Government Agriculture Office in Tana Rivere	Throughout operation period	100,000
Sedimentation	-Sediment extraction at head works be carried out regularly	-amount sediment basin	-Low sediment levels in the larger part of the canal	County Government Agriculture Office in Tana Rivere GHAPALA Community CBO	Throughout operation period	
Salinization	-Provide adequate drainage within the farms Regular maintenance of canals	-Regular monitoring of soil analysis to manage potential problems	-Reports on the salinity levels of the soil samples	County Government Agriculture Office in Tana River WARMA	Throughout operation period	200,000
Water logging	Construction and maintenance of adequate drainage system Apply soil and water conservation methods on farms Apply suitable irrigation methods	Drainage systems properly maintained Conservation methods applied Irrigation methods monitored	Report on status of drainage systems Report on conservation methods being applied in the farms	County Government Agriculture Office in Tana River Community members(GHAPALA Community CBO)	Throughout operation period	N/A

Expected Negative Impacts	Recommended Mitigation Measures	Performance Monitoring Indicator	Means of Verification	Responsibility Monitoring Implementation	Time Frame	Cost
Solid Waste management	-Establish waste disposal site for hazardous waste in allocation approved by NEMA in accordance with waste management regulations --Designed waste collection points established -The disposal site need to be more that 100 meters from water course and in apposition that will facilitate prevention of storm water run-off from the site from entering the water courses	Regular monitoring of waste management status in the farms - Storage of construction waste in designed collection points	-Number of Waste storage points -Number Waste disposal facilities/contract collector	County government of Tana river Community members WARMA	Throughout operation period	500,000
Soil Erosion	-Provide free board in the design of the conveyance structures to protect them from floods and siltation -Use of cover crops to reduce soil displacement by water -Design irrigation system will provide for conveying and distributing irrigation water without triggering soil erosion	Design of farm irrigation systems conducted Cover crops used to reduced water displacement	Report on the conveyance structures established	KCSAP project Community members Community forest Association Water Resource User Association	Operation period	500,000
Pest, disease and weeds	-Training and awareness programmes on sustainable pest control -Adopt integrated pest management control mechanisms -Intensified extension services	No of persons trained IPM mechanism adopted Extension services provided/intensified	Reports Photographs	KCSAP project team Tana River County Government Department of Agriculture WRUA members	Operation period	600,000
Conflicts	Animal corridors to watering points be provided within the scheme	Animal corridors provided	Number of corridors provided (<i>Malkas</i>)provided	Community members WRUA members	Operation period	400,000

Expected Negative Impacts	Recommended Mitigation Measures	Performance Monitoring Indicator	Means of Verification	Responsibility Monitoring Implementation	Time Frame	Cost
	-Build capacity of local conflict resolution mechanisms	Capacities on conflict resolution built	Number of farming communities trained on conflict resolution	Tana River County Agricultural office	Operation period	
	-Conflict among beneficiaries over water access and distribution within the scheme	Ensure beneficiary participation and community management	Number of beneficiaries targeted	Community members KCSAP project implementation team County Agricultural Office	Operation period	
	-Conflict among beneficiaries over allocation of the operations and maintenance costs	Water committee be established responsible for resource mobilization	Water Committee established and functional	WRMA, WRUA, Tana River county Agricultural office	Operation period	
Water borne diseases	-Provision of treated nets to the targeted communities -Equip health centres with drugs -Provision of water treatment tablets	Mosquito nets provided Health centers equipped Water treatment tablets provided Communities sensitized	Number of targeted households provided with Mosquito nets, Water treatment tablets and sensitized	County Government in charge of Health services KCSAP County project implementation team County Director NEMA	Operation period	
Occupational Health Safety	All health risks equipments must be cleared from the project site Adopt integrated pest and disease control	Health risk equipments cleared Integrated pest and disease control adopted	Number of health risk equipments cleared Report on activities adopted on integrated pest and	County Government in charge of Health services Tana River county Agricultural office	Operation period	

Expected Negative Impacts	Recommended Mitigation Measures	Performance Monitoring Indicator	Means of Verification	Responsibility Monitoring Implementation	Time Frame	Cost
			diseases control			
Moral Decadence	-Create awareness on HIV/AIDs , social responsibility -Strengthen existing structures that address social responsibility	Awareness on HIV/AIDs social responsibility created	Reports Social platforms established No of Barazas/ Meetings	County Government in charge of Health services Tana River county Agricultural office	Throughout the project period	

9.5 Environmental monitoring

Environmental Monitoring is carried out to ensure that all construction activities comply and adhere to environmental provisions and standard specifications, so that all mitigation measures are implemented

9.5.1 Monitoring water quality

The water body to be monitored during the implementation phase of this project is River Tana. This is because the project will draw water from the river for irrigation purposes. The river ecosystem will be affected and thus need for monitoring. The table below shows the monitoring plan for water quality in the project catchment.

Table 16: Monitoring water quality

Monitoring objective	To monitor water quality and prevent water pollution
Policy/legal line	Ensure compliance with water quality regulations
Parameter	Water quality
Indicators	Nutrients (Nitrates, phosphates, potassium, organic compounds, Turbidity, E-Coli)
Monitoring method	Samples should be taken from the upstream inlet point and downstream points of the river for testing at an accredited laboratory
Reporting	Photographs, laboratory analysis reports and documentation
Period	Quarterly
Responsibility	NEMA, WRA, Ministry of Agriculture, Livestock and Fisheries

9.5.2 Monitoring river flow and quantity

There will be need to monitor the flow of river Tana since the water abstracted and the remaining environmental flow will affect the sustainability of riverine ecosystem. The following table shows the monitoring plan for river flow and quantity

Table 17: Monitoring river flow quantity

Monitoring objective	To monitor water quality and prevent water pollution
Policy/legal line	Ensure compliance with water Act
Parameter	Water quantity and flow rate
Indicators	The amount and percentage of water abstracted from the river The amount and percentage of water that remains for environmental sustainability
Monitoring method	River gauging at the intake point and downstream using appropriate devices and expertise
Reporting	Appropriate internal system documentation
Period	Annually
Responsibility	NEMA, WRA, Ministry of Agriculture, Livestock and Fisheries

9.5.2 Monitoring Soil quality

During the construction and operation phase there will be use of machinery which requires oils and greases for maintenance, and would interfere with soil quality when disposed or when leaked. During irrigation, the use of fertilizers may also leach in to the soil and interfere with its quality too. There is therefore need to ensure that these potential pollutants are controlled and do not degrade the soils. The table below shows monitoring plan for soil quality in the project areas

Table 18: Monitoring Soil quality

Monitoring objective	To monitor soil quality and prevent soil pollution in the project area
Policy/legal line	Ensure compliance with the EMCA Act Cap 387 and irrigation policy
Parameter	Contamination with chemicals oils and grease
Indicators	Physical and chemical characteristics of soils: PH levels, Organic compounds and salts in the soils at designated points
Monitoring method	Sampling and testing of soils

Reporting	Appropriate internal system documentation
Period	Annually
Responsibility	Ministry of Agriculture, Livestock and Fisheries

9.5.3 Monitoring Soil Erosion

During the construction and operation phase of the irrigation project, there will be interference with soil structure and stability especially when excavating, dredging and cultivating. There is need to ensure that these works do not adversely alter the soil structure. The table below shows the monitoring plan for soil erosion in the project area

Table 19: Monitoring Soil Erosion

Monitoring objective	To preserve soil in the project area
Policy/legal line	Ensure compliance with the EMCA Act Cap 387 and related Acts
Parameter	Physical facilities, soil fertility
Indicators	Formation of gullies, siltation and erosion
Monitoring method	Physical tests, Measurements, Observation
Reporting	Photos and reports
Period	Quarterly
Responsibility	WARMA, Ministry of Agriculture, Livestock and Fisheries

9.5.4 Monitoring invasive species

During operation phase of the irrigation project, there will be interference with irrigation canals water flow ways and cultivation in the farms , due to increase of growth of invasive planta mainly *Prosopis juliflora* (Mathenge) which is dominant in the area. There is need to ensure that all the invasive plants are cleared and the farms are free from the plants

Table 20: Monitoring invasive species

Monitoring objective	To remove invasive species(<i>Prosopis juliflora</i>)
Policy/legal line	Ensure compliance with the EMCA Act Cap 387 and eliminate all <i>Prosopis juliflora</i>
Parameter	Canals and water ways cleared of invasive species
Indicators	Acreage of invasive species cleared
Monitoring method	Observation
Reporting	Photos and reports

Period	Annually
Responsibility	NEMA , Ministry of Agriculture, Livestock and Fisheries

9.6 EMMP for the Decommissioning phase

Decommissioning refers to the formal process of removing something from the operational status. This being the final phase in the project cycle, decommissioning may present possible opportunities associated with the return of the land for alternative use. However, depending on the nature of the operational activity, the need to manage risks and potential residual impacts may remain well after operation ceased

The EMMP will direct the initial stages of decommissioning phase. The table below shows the EMMP of the decommissioning phase for the irrigation project.

Table 21: EMP for decommissioning phase of proposed project

Expected Negative Impacts	Recommended Mitigation Measures	Performance Monitoring Indicator	Means of Verification	Responsibility Monitoring Implementation	Time Frame	Cost
Demolition Waste	<ul style="list-style-type: none"> -Use an integrated solid waste management system i.e Through a hierarchy of options: Source reduction; Recycling Resuse; Sanitary land filling -Provide facilities for proper handling and storage of demolition materials to reduce the amount of waste caused by damage -Use materials that have minimal packaging to avoid the generation of excessive packaging waste. 	Registered waste collector engaged	Inspection and observation	Contractor	One-off	1,000,000

Expected Negative Impacts	Recommended Mitigation Measures	Performance Monitoring Indicator	Means of Verification	Responsibility Monitoring Implementation	Time Frame	Cost
	Ensure adequate collection and storage of waste on the site and safe transportation to the disposal sites and disposal methods at licensed disposal sites					
Noise	-Use equipments designed with noise control elements -Limit vehicles to a minimum idling time encourage workers to switch off engines whenever possible -Install sound barriers for pile driving activity -The noisy demolition works will be planned to be during the day	PPEs provided to workers Number of cases reporting relating to noise pollution	Observation	Contractor	Throughout decommissioning period	100,000
Occupational health and safety risks	-Adherence to the Occupational Health and Safety Rules and Regulations stipulated in the occupational Safety and Health Act, 2007 -Provision of appropriate personal protective equipment as well as ensuring a safe and healthy environment for demolition workers	Number of reported incidences	Inspection and observation	Proponent	Throughout decommissioning period	500,000

9.6 INTERNAL AUDIT/ENVIRONMENTAL SOCIAL MONITORING

During the implementation phase of the project, the Project management and Community will undertake regular monitoring which is intended for proper safety and protection of the environment and irrigation construction project. The community land owners and the proponent KCSAP will follow the monitoring system that will assist in observation, evaluation assessment and reporting on the performance of different/various variables captured in **Environmental Management Plan (EMP)**.

The overall objective of environmental and social monitoring is to ensure that mitigation measures are implemented and that they are effective and efficient. Environmental and social monitoring will also enable response to new and developing issues of concern.

Environmental Monitoring plan is an action plan that guides the implementation and monitoring of the proposed **mitigation** measures.

Suggested FEW Audit check (Aspect, Performance and Frequency indications) table for the noted environmental issues relevant to the proposed irrigation project.

Table 22: Internal Audit/Environmental Social Monitoring

Aspect	Performance Criteria	Frequency	Responsibility
Aesthetic value of the natural biodiversity and environment status of the Irrigation scheme project and the surrounding area	Ensure proper and continued planting trees, healing of scooped soils, landscaping and conservation of the project site at all times	Review quarterly	+ Project proponent + Irrigation management committee + Community +County Government
Neighborhood issues	Keep record of complains or compliments coming from the	Review annually	+ Project proponent +Ghapala Irrigation management committee

	communities and action taken to keep the project sustainable and the community benefitting from the project success in terms of water access, availability of other offshoot benefits		+ Community +County Government
Water use and utilization	Water to be tested for compliance with NEMA standards in terms of quality and quantity supply	Review Monthly	+ Community +County Government + County department of Public health and Crop/livestock services + National Government
Waste management disposal	Ensure all soft and solid waste built up is disposed accordingly as per the NEMA regulations	Review quarterly	+ Community Irrigation management committee +County Government + NEMA

CHAPTER TEN: CONCLUSIONS AND RECOMMENDATIONS

The proposed project presents multiple environment and social benefits including: Increased agricultural production, increased household incomes, local economic growth and enhanced climate resilience in a semi-arid region. It will also allow for optimal use of natural resources in the County. On the other hand the project could spur negative environmental impacts. These include: vegetation clearance during expansion and rehabilitation of the irrigation infrastructure; intensified water use conflicts or access to the water points, siltation and encroachment into sensitive ecosystems such as forest and riparian land. The negative impacts however can be mitigated through technical design consideration, community sensitization, strategic partnerships, staff capacity building-implementing agencies and continuous monitoring of environmental conditions against the baseline

10.1 Conclusion & Recommendations

From the findings of the study that are detailed in this report, the Makere Ya Gwano irrigation project will play an important role in improving the livelihoods of the local community through increased and improved agricultural production. The improved agricultural production will enhance household food security; generate local employment and increased household incomes of targeted Makere Ya Gwano Village members and the larger Wenje community

In addition to following the laid down guidelines and according to the information collected, collated and analyzed during the study, it is the lead experts considered opinion that:

- The project DOES NOT pose any irreversible environmental impacts identified that are generally related to development projects and the mitigation measures for those that have been clearly articulated;
- The project will bring positive environmental impacts that surpass the few and minor negative impacts identified. The negative environmental impacts are addressed by the detailed environmental management plan, which will be executed during the project implementation and operation phases to safeguard the environmental interests
- The project is in line with the existing county plans within the various sectors of water, environment, land and general development.

-
- The proponent will collaborate with key stakeholders in environment, water, health and agriculture among others to ensure successful implementation and monitoring of mitigation.
 - The proponent has agreed to adhere to the laid down laws and procedure of NEMA in setting up the project. Its successful implantation will contribute to the economic growth of the country in regards to poverty eradication as well as reducing the water use conflicts
 - The proposed project is a socially environmentally and economically viable venture the befits support in order to contribute to the Vision 2030 development goals; its implementation will be beneficial to the country through its contribution to food security, poverty eradication and improved water resource management and reduced water related conflicts
 - A copy of the environmental and social management plan must be given to the contractor prior to construction. The contractor needs to demonstrate how the ESMP will be implemented in the construction process.
 - The proponent and government agencies particular NEMA-environmental lead agency should strengthen their grievances redress mechanisms

11.0 KEY REFERENCES

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11.0 ANNEX 1: MINUTES OF THE COMMUNITY CONSULTATION MEETINGS

MINUTES OF THE COMMUNITY BARAZA/MEETING ON FOR PROPOSED REHABILITATION AND EXPANSION OF MAKERE YA GWANO SOLAR SMALL-SCALE IRRIGATION SCHEME IN MAKERE VILLAGE, KINAKOMBA WARD, TANA RIVER-SUB COUNTY IN TANA RIVER COUNTY HELD ON 10th DECEMBER, 2019 AT MAKERE YA GWANO VILLAGE AT 10.00 AM

Members Present:

List attached

Agenda

Project Brief

Community Sensitization on EIA

Public participation

AOB

Min 1./10/12/2019: Introduction

The meeting commenced at 11a.m with a word of prayers from the Mr Martin Kofa Kilimo Chairman of the proposed rehabilitation and expansion of Makere Ya Gwano Irrigation Scheme. He welcomed the participants and informed the meeting that rain fed agriculture is a challenge and currently there is food scarcity. The community have lost most of their livelihoods through floods and water scarcity during dry season.. He stated that through irrigation food security can be addressed. He welcomed the visitors from Tana River Kenya Climate Smart Agriculture Project (KCSAP) County office and Nairobi and expressed their happiness for receiving the visitors again. He then introduced the County Project Coordinator from Tana River County office Mr Peter Munyoki and the Village Elder Mr .

Min 2./10/12/2019: County Project Coordinator-Kenya Climate Smart Project (KCSAP's) Remarks

The CPC welcomed the participants and he made reference to the screening exercise which undertaken at the community level. He gave a brief highlight on the objective of the visit and the need to conduct an Environmental Impact Assessment on the proposed rehabilitation and expansion of Makere Ya Gwano solar small-scale irrigation scheme in Makere village, Kinakomba ward, Tana River Sub County. He at the same time briefed them on their proposal of how to undertake selective bush clearing during opening up of land for the expansion and rehabilitation construction. He further narrated the importance of the

Environmental and Social Impact Assessment (ESIA) Project for proposed rehabilitation and expansion of Makere Ya Gwano Solar Small-Scale Irrigation Scheme in Makere Village, Kinakomba Ward, Tana River-Sub County In Tana River County

Environmental Impact Assessment Exercise and called on proper attention to the lead experts' quest for further clarifications. The team leader invited the EIA lead experts to explain in detail the purpose of the visit

Min 3/10/12/2019 Project Brief

A farmer Mr Malibe Ahibi from the community gave brief overview of how the project started. He noted that they had no nay machinery and they were trained and facilitated by Wenje catholic mission. They started by clearing bushes and they used to rely on rain-fed agriculture. Catholic mission assisted the community with solar panels which they would use to pump water from the river Tana through a shallow well. However the pipes were small in size and could not pump adequate water to the irrigation site. Challenge of crop destruction by wildlife was rampant. Irrigation facilities were inadequate and crop husbandry skills was poor.

Min 4./10/12/2019: Community Consultation/Sensitization on EIA

The EIA expert mentioned the need for public participation in Environmental Impact Assessment as a priority and legal requirement by the Government of Kenya, He enlightened the participants about EIA; its purpose objectives; legal framework including legislation and policies governing environment; the rights and role of community towards environmental protection and management. He further took the community through selected legislation governing the environment including the new constitution

The community was informed that it is mandatory to hold at least one baraza to give the community/neighbors/stakeholders an opportunity to give their views with respect to the benefits; impacts both negative and positive in order to establish whether the project is economically viable, socially accepted and environmentally friendly/sound

Min 3./23/4/2017: Community participation

The EIA lead expert guided the community members on procedures of giving their opinion and that each speaker was to follow but not limited to the following criteria:

- Personal identification by: location names, age, gender, mobile telephone number
- Indicate whether he or she is aware of the proposed expansion, rehabilitation, construction and its related activities incidental thereto and connected therewith the under the Kenya Climate Smart Agriculture Project? Yes/No
- Give opinion on the expected benefits from the irrigation project
- Give opinion on the anticipated negative/adverse impacts that may result from this project and related activities

-
- Propose mitigation measures to avoid, alleviate or reduce the adverse effects
 - Identify any conflict, complaints expected to arise due to expansion, rehabilitation and construction
 - Suggest ways to resolve conflict, complain amicably
 - Indicate other issues relevant to the implementation of the irrigation project

The community beneficiary opinions were documented below:

Informed the proponent that there is a challenge on the diameter of the water pipes, they are of a relatively smaller size.. If the project was in place the food would be available and the problems of food insecurity malnutrition levels would be minimized. Food availability at household will be enhanced and incidences of food poor will be reduced.

Community youth member informed the proponent that there will be employment creation. The project will open avenues for the youth to produce food crops especially maize and sell as food and stovers as feed for livestock. It will also cushion conflict between livestock keepers and the farmers who plant crops. However the team was informed that wildlife is a big problem mainly the herbivores i.e Elephants, Buffaloes, warthogs, bush pigs

When asked about benefits of proposed water project they identified the following;

1. Employment creation
2. Crops for household consumption and selling
3. The irrigated crops will increase household income promote fodder for livestock upkeep and enhance the food security status of the community
4. The project will sensitize the community on planting of appropriate crop types, pasture and conservation of animal feeds

Min 3./23/4/2017: Possible adverse effects of the project and suggested mitigations

- The community were unanimous that there will be no serious negative environmental impacts resulting from the irrigation scheme construction activity.
- However, some minimal environmental degradation as a result of selective bush cutting and thinning might occur while opening the area for excavating the pan
- There will be removal of selected vegetation creating open spaces that would be used for pasture development,
- However the removed vegetation would be mitigated by planting palatable forage for livestock which would still cover the soil around the embankments and catchment areas.
- Establishment irrigation management committee to coordinate access and utilization of water facilities

Min 4./10/12/2019: A.O.B

Environmental and Social Impact Assessment (ESIA) Project for proposed rehabilitation and expansion of Makere Ya Gwano Solar Small-Scale Irrigation Scheme in Makere Village, Kinakomba Ward, Tana River-Sub County In Tana River County

OWNERSHIP OF THE LAND TO BE OCCUPIED BY THIS PROJECT INVESTMENT?

The Community participants reaffirmed that the land belongs to the community and no individual person in the community could claim ownership of the land. The EIA Expert then informed the community that they would be expected to put their names down to show that they were consulted and they agreed that they would have this project implemented in their area.

Commented [KT10]: The land is private owned by a family

CONSENT

The Community members present agreed unanimously that project implementation should continue. They acknowledged that the entire community was not present at the meeting but they would inform them all that had been discussed and agreed during the meeting.

RESOLUTION

The NEMA Expert thanked the Community for giving consent for project implementation. He stated that the Community response to the EIA exercise will go to the experts to facilitate issuance of other certification as the case may be.

CLOSING REMARKS

The County Project Coordinator thanked the participants for attending the meeting and informed that he will be available frequently during project implementation to monitor progress. He noted that success of the project depends on all stakeholders. The Management Committee from the community must remain as a family and know that there will be maintenance cost.

There being no other business to discuss, the meeting was closed with a word of prayer at 2.30 pm.

11.1 ANNEX II LIST OF PARTICIPANTS



Activity title: Environmental and Social Impact Assessment (ESIA) Project for proposed rehabilitation and expansion of Makere Ya Gwano Solar Small-Scale Irrigation Scheme in Makere Village, Kinakomba Ward, Tana River-Sub County In Tana River County

Activity Venue: HOLA (WENT)

Date: 10th Dec 2019

LIST OF PARTICIPANTS

No	Name	Gender	Age	Id number	Organization	Tel Number	E mail	Signature
1	MURIEL K. KOTA	M	73	0101302	SHARIFU	---	---	<i>[Signature]</i>
2	AMOS B. GABO	M	53	1031057	"	---	---	<i>[Signature]</i>
3	YAKUB H. MURDIT	M	49	30610515	"	0748949915	---	<i>[Signature]</i>
4	ESTHER D. BODGERS	F	61	0172010	"	0748281802	---	<i>[Signature]</i>
5	EUNICE G. DITHOTO	F	37	23429204	"	0705554997	---	<i>[Signature]</i>
6	AMAT MUMBLE	M	51	1188252	"	0728906350	---	<i>[Signature]</i>
7	MARIE H. GIPPO	F	77	3927723	"	0716677259	---	<i>[Signature]</i>
8	PIZAE CARACHA	M	46	1095027	"	0712437328	---	<i>[Signature]</i>
9	ESTHER H. BANYA	F	41	2105941	"	0711219587	---	<i>[Signature]</i>
10	REBECCA KOFI	F	65	11892887	"	---	---	<i>[Signature]</i>
11	PURITY DITHOTO	F	30	319822019	"	0714375140	---	<i>[Signature]</i>



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KCSAP
Kenya Climate Smart Agriculture Program

MINISTRY OF AGRICULTURE, LIVESTOCK, FISHERIES
AND IRRIGATION
(STATE DEPARTMENT FOR CROPS AND RESEARCH)

Activity title: ESIA FOR PROPOSED REHABILITATION AND EXPANSION OF
MAKERE YA GWANO SOLAR SMALL-SCALE IRRIGATION SCHEME

Activity Venue: H.A. (M.A. NJE)

Date: 10th November 2015

LIST OF PARTICIPANTS

No	Name	Gender	Age	Id number	Organization	Tel Number	E mail	Signature
12	MUSIES DIMITIO	M	43	2175770	SINAGARA SBO	0702854140		<i>Musies</i>
13	ROSE JORGSON	F		12725010	"	0702856714		<i>Rose</i>
14	JANE M. GALANA	F	46	23424467	"	0702856737		<i>Jane</i>
15	FUMBA OMBI	F	30	31728154	"			<i>Fumba</i>
16	MUSS GALANA	M	55	82727025	"			<i>Muss</i>
17	MURUNGU MARINI	F	49	7252704	"	077851510		<i>Murungu</i>
18	HARON GALANA	M	62	0264084	"	0725239806		<i>Haron</i>
19	MAGITHA ELIZ	F	67	392723	"	0798758784		<i>Magitha</i>
20	GESION GALANA	M	45	2264278	"			<i>Gesion</i>
21	LINA GARD	F	30	0664629	"			<i>Lina</i>
22	HANIA N. HIRIO	F	77	2921539	"	0798758784		<i>Hania</i>

11.2 ANNEX III: PUBLIC CONSULTATION QUESTIONNAIRE.

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR PROPOSED REHABILITATION AND EXPANSION OF MAKERE YA GWANO SOLAR SMALL-SCALE IRRIGATION SCHEME IN MAKERE VILLAGE, KINAKOMBA WARD, TANA RIVER-SUB COUNTY IN TANA RIVER COUNTY

County Project Coordinator (CPC), Kenya Climate Smart Agricultural Project (**KCSAP**), Ministry of Agriculture, Livestock and Fisheries. P.O. Box 10 - 70101 Tana River intends to establish an irrigation project under their Investment structures in Makere Ya Gwano village in Tana River County.

To ensure that the project is implemented in an environmentally and social sound manner, the proponent the **County Project Coordinator (CPC)**, Kenya Climate Smart Agriculture Project (**CPC**) in consultation with EIA Lead expert is conducting an Environmental Impact Assessment (**EIA**) for the proposed site.

The main objective of the **EIA** study is to identify key environmental, health, social and economic issues associated with the proposed project and establish appropriate mitigation measures for the negative impacts while enhancing the positive impacts.

Public Participation of interested and affected parties in the **EIA** is a requirement of the Environmental Management and Coordination Act, 1999.

In public and partnership participation, you have been identified as one of key informant. You are requested to document your views, opinions and concerns regarding the proposed irrigation project

This questionnaire acts as a guide for the respondent to provide relevant information on the proposed project. All the information obtained shall be used entirely for the proposed study on the project and shall be treated confidential.

We appreciate your cooperation and thank you for your willingness to participate in this exercise.

Please return the completed questionnaire to the EIA/EA lead Expert.

Fredrick Aloo

Phone numbers: -

+254-726-589 117

E-mail address: -

fredrick.aloo@gmail.com

Address: -

P.O. BOX 34188-00100

NAIROBI – Kenya

Environmental and Social Impact Assessment (ESIA) Project for proposed rehabilitation and expansion of Makere Ya Gwano Solar Small-Scale Irrigation Scheme in Makere Village, Kinakomba Ward, Tana River-Sub County In Tana River County

11.3 ANNEX IV: SAMPLE QUESTIONNAIRE FILLED BY RESPONDENT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT QUESTIONNAIRE

Ministry of Agriculture, Livestock and Fisheries (NAL&F), the state department for Crops and Research through Kenya Climate Smart Project (KCSAP) intends to Rehabilitate and expand Makere Ya Gwano solar small-scale irrigation scheme in Makere village, Kinakomba ward, Tana River-sub County. Mr Fredrick Aloo and associates NEMA Lead Expert No 9048 has been retained to undertake ESIA study. We are pleased to seek your views (as beneficiary/neighbor/stakeholder) concerning the intended development. For this purpose it would be appreciated if you would kindly fill in this brief questionnaire. The information is STRICTLY for the purpose of this study and shall remain confidential

Respondent details

Name	Institution/organization	Telephone
DYOBIA GAFD MOSEP	GHABHALA	0702584140

Gender

Male Female

Human and Natural Environmental Concerns

- Are you aware of the proposed rehabilitation and expansion of the Makere Ya Gwano Irrigation Scheme
 Yes No
- Do you think the proposed rehabilitation and expansion of irrigation scheme and its activities pose any dangers to the environment
 Yes No

If yes briefly explain:

N/A

- Do you have any objections/reservations to the proposed expansion and rehabilitation of the irrigation scheme
 Yes No

If yes give reasons

N/A

4. What do you think are the positive and negative socio-economic and environmental impacts of the proposed project

Positive	Negative
a) Food security	a) Oil spills
b) Social impact	b) Social evils (HIV/AIDS)
c) promote markets	c) conflicts
d) increased income	d) waterborne diseases
e) employment	e) Pests, Weeds (challenges)
f)	f) Salinity

5. Suggest mitigation measures for any negative impact(s) that may result from implementing the proposed project:

- a) Storage facilities for produce
- b) Trainings on good farm practices
- c) Soil conservation

Signature: [Signature] Date: 9/12/2019

11.4 ANNEX V: PHOTOS ON PUBLIC CONSULTATION AND FILLING OF QUESTIONNAIRE



Community members showing the ESIA lead expert the proposed irrigation site



The ESIA team visiting the extraction point source of irrigation water River Tana



Community members filling questionnaire



Lead Expert undertaking discussions with community members on environmental issues related to the project

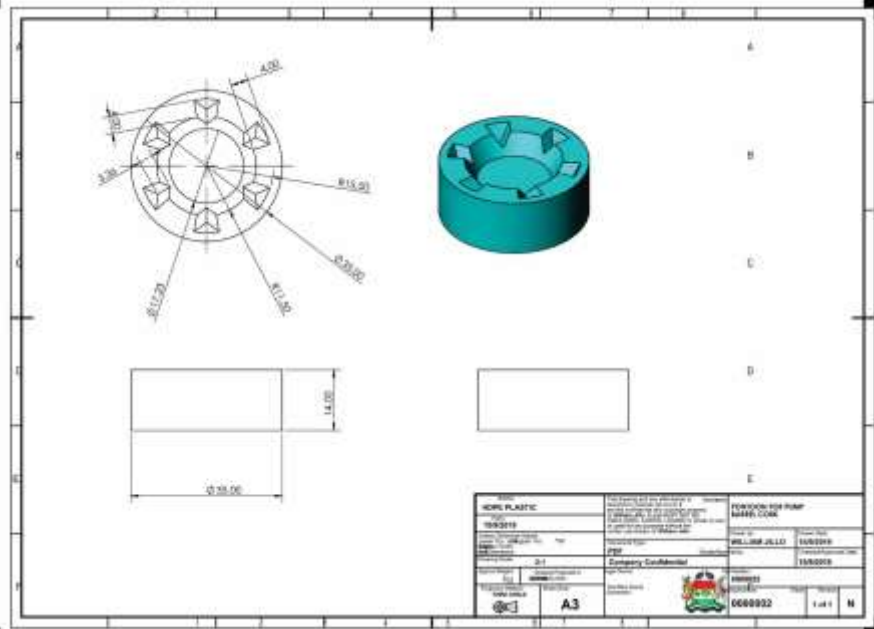
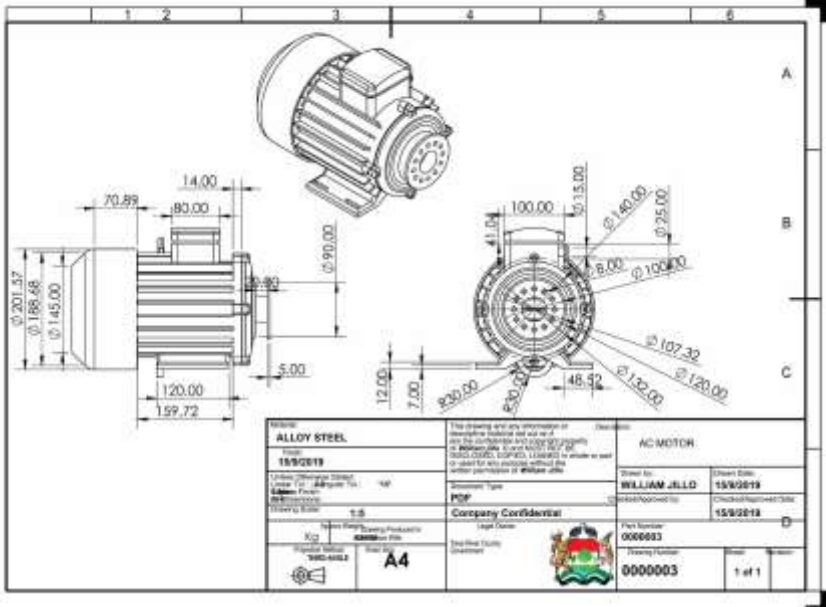


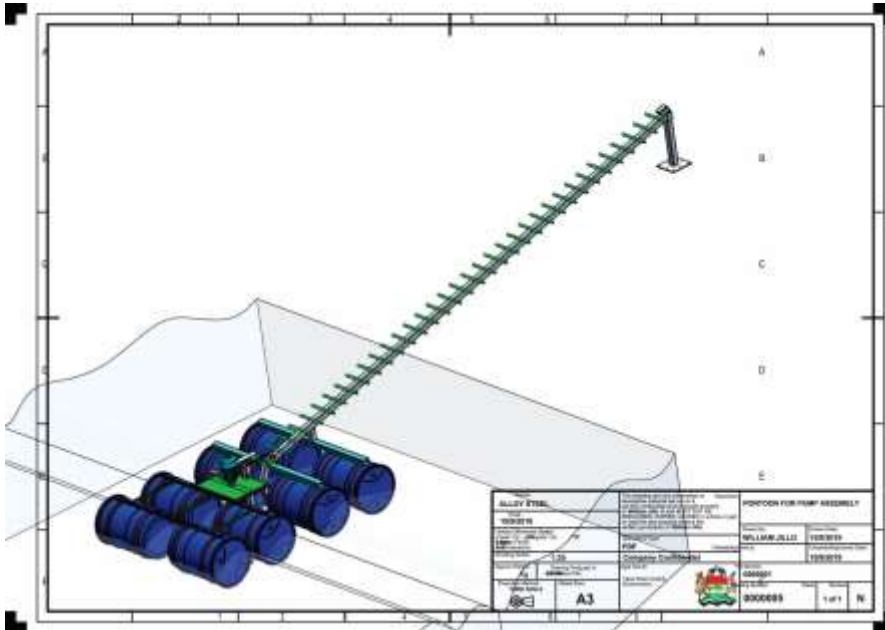
Community members showing the lead expert existing solar panels used to pump water to the existing farms under irrigation



Community members raising their hands in acceptance that the project should be implemented

11.5 ANNEX VI: IRRIGATION INFRASTRUCTURE DESIGN





11.6 ANNEX VII: COMMUNITY RESOLUTION AGREEMENT

A Resolution from the community for rehabilitation and expansion of the irrigation scheme on the Communal land

Commented [KT11]: Private land

11.7 ANNEX VIII EIA CERTIFICATE AND PRACTISING LICENCE

FORM 5

(r.14(4))



**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/BC/2344

Application Reference No: NEMA/EIA/ER/5235

This is to certify M/s **Fredrick Onyango Aloo** of
P.O. Box 45963-00100 Nairobi, (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: **9049**

Issued Date : **3/23/2017**

Signature

(Seal)

Director-General
The National Environmental Management Authority





11.8 ANNEX XI EIK MEMBERSHIP CERTIFICATE