SUMMARY PROJECT REPORT FOR PROPOSED CONSTRUCTION OF KAKIMERA MICRO IRRIGATION SCHEME IN TURKANA COUNTY

PROGRAM TO BUILD RESILIENCE FOR FOOD AND NUTRITION SECURITY IN THE HORN OF AFRICA - KENYA

Summary Project Report
April 2022

Proponent

The Project Coordinator
Ministry Of Agriculture, Livestock And Fisheries & Co-Operatives
State Department of Crop Development and Agricultural Research
Program to Build Resilience for Food and Nutrition Security in the Horn of Africa - Kenya
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SUBMISSION FORM

A team of Environmental experts prepared this SPR report in accordance with the Environmental Management and Coordination Cap 387 and the Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019 and the Legal Notice NO. 31 of 2019. We the undersigned, do hereby certify that this report was prepared based on the information provided by the proponent as well as that collected from other primary and secondary sources and on the best understanding and interpretation of the facts by the environment experts.

We are pleased to herewith submit the SPR Report for the proposed construction of Kakimera Micro Irrigation Scheme in Turkana County

Environmental Experts

NAME: Mwangi Simon Thuku... NEMA Reg. No.: 7772.

Sign: .......................................................... Date: ..................................

PROPONENT

For and on behalf of:

The Project Coordinator,
Ministry of Agriculture, Livestock, Fisheries & Co-Operatives
State Department of Crop Development and Agricultural Research
Program to Build Resilience for Food and Nutrition Security in the Horn of Africa - Kenya
P.O. BOX 30028 00100

NAIROBI KENYA

Name: ........................................... Title: ...........................................

................................................................. ...........................................

Signature Date

Disclaimer
This Environmental Impact Assessment Report is being submitted in accordance with the terms and conditions of contract in respect of provision of consultancy services. It has been carried out in full observance of the EIA regulations and in compliance with the Environmental...
## FACT SHEET

<table>
<thead>
<tr>
<th><strong>Project Name</strong></th>
<th>Kakimera Micro Irrigation Scheme in Turkana County</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assignment Name</strong></td>
<td>Summary Project Report (ESIA)</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td>Kakemera drip irrigation is located at Kakemera village, Kanamkemer sub location, Kanamkemer ward in Turkana Central Sub County</td>
</tr>
<tr>
<td><strong>Coverage</strong></td>
<td>The total project area is 10Ha. Out of this, 5 acres will be under shade net and the balance will be under open drip irrigation system.</td>
</tr>
<tr>
<td><strong>Main water source</strong></td>
<td>Boreholes equipped with solar powered pumps, source of water already done.</td>
</tr>
<tr>
<td><strong>Proponent</strong></td>
<td>The Ministry of Agriculture, Livestock, Fisheries and Cooperatives, State Department for Crop Development</td>
</tr>
<tr>
<td><strong>GPS Coordinates</strong></td>
<td>Northing 341473.078, Easting 785698.245 and Elevation 489.126</td>
</tr>
</tbody>
</table>
| **Project Description** | The irrigation infrastructure comprises of the following:  
  - Solar powered booster pump  
  - Main filtration unit  
  - Supply main pipeline, HDPE  
  - Inline drip lines, with emitters at 30cm spacing. Each lateral to be about 100m long  
  - Feeder branches, to serve the manifold pipes  
  - Manifold pipelines, each 200m;  
  - End caps at the end of each drip line  
  - Access roads  
  - Fence around the farm;  
  - Shade nets to cover 5 acres  
  - Raised water tanks |
| **Land Ownership** | The community project is located on community land and therefore land ownership documents NOT required (see attached community resolution forms) |
| **Project Cost** | Approximately 68 Million Kenya Shillings |
| **Proponent** | Project Coordinator,  
  State Department of Crop Development and Agricultural Research  
  Drought Resilience and Sustainable Livelihoods Program (DRSLP) |
| **ESIA Expert** | **Lead Expert**  
  Mwangi Simon Thuku  
  P.O. BOX 14057 -00400,  
  Nairobi.  
  Email: thuku.simon@gmail.com |
EXECUTIVE SUMMARY

Background

Agriculture remains the backbone of the Kenyan economy. It is the single most important sector in the economy, contributing approximately 25% of the GDP, and employing 75% of the national labor force (Republic of Kenya 2005). Over 80% of the Kenyan population lives in rural areas and derive their livelihoods, directly or indirectly from agriculture. Given its importance, the performance of the sector is therefore reflected in the performance of the whole economy. The development of agriculture is also important for poverty reduction since most of the vulnerable groups like pastoralists, landless, and subsistence farmers, also depend on agriculture as their main source of livelihoods. Growth in the sector is therefore expected to have a greater impact on a larger section of the population than any other sector. The development of the sector is therefore important for the development of the economy as a whole.

The importance of the sector in the economy is reflected in the relationship between its performance and that of the key indicators like GDP and employment. Trends in the growth rates for agriculture, GDP and employment, show that the declining trend experienced in the sector’s growth especially in the 1990s is reflected in the declines in employment and GDP as a whole.

Vision 2030 has identified agriculture as one of the key sectors to deliver the 10 percent annual economic growth rate envisaged under the economic pillar. To achieve this growth, transforming smallholder agriculture from subsistence to an innovative, commercially oriented and modern agricultural sector is critical.

However, for a long time, Kenya has experienced periodic rise and fall in the prices of agricultural produce occasioned with poor infrastructure, over exploitation by middlemen, and sometimes overproduction. Since Kenya’s economy is highly dependent on the performance of the agricultural sector, these challenges have has increasingly impoverished the people of Kenya since they cannot fetch good returns from their agricultural product.

The Government of Kenya (GoK) through the Ministry of Agriculture, Livestock, Fisheries and cooperatives; State Department of Crop Development and Agricultural Research, Drought Resilience and Sustainable Livelihoods Program (DRSLP) is set to implement project in six (6) arid and semi-arid (ASAL) counties namely Marsabit, Isiolo, Samburu, Marsabit, West Pokot, and Turkana.

The program aims to contribute to poverty reduction, food security and accelerated sustainable economic growth in the Horn of Africa through improved rural incomes. Specifically, it aims to improve the drought resilience of arid and semi-arid land communities. Project interventions cover water supply for people, livestock, irrigation and sanitation as well as the effective management of head-waters and basic water sources; improvement of plant and animal production, marketing and disease management.

The program is anchored under three main project components, which are;
(i) Component 1: Strengthening the resilience of drought prone areas and Pastoral and Agro-Sylvo-
Pastoral Production systems to Climate Change

(ii) Component 2: Supporting Agribusiness Development:

(iii) Component 3: Strengthening Adaptive capacity to Climate Change

Project components

The proposed irrigation system is composed of the following main infrastructure components:

- Boreholes equipped with solar powered pumps, source of water.
- Solar powered booster pump
- Main filtration unit
- Supply main pipeline, HDPE
- Inline drip lines, with emitters at 30cm spacing. Each lateral to be about 100m long
- Feeder branches, to serve the manifold pipes
- Manifold pipelines, each 200m;
- End caps at the end of each drip line
- Access roads
- Fence around the farm;
- Shade nets to cover 5 acres
- Raised water tanks

Environmental Social Impact Assessment (ESIA)

In response to the legal requirements that demand that an Environmental and Social Impact Assessment (ESIA) be carried out on projects that are likely to have negative impacts on the environment, the consultant carried out ESIA study. The assessment was carried out to determine the likely environmental impacts anticipated from implementation of the proposed project and the mitigation measures that can be implemented to address the anticipated negative impacts. The assessment was done in accordance with the Environmental Management and Coordination Act (EMCA) 1999 and Environmental (Impact Assessment and Audit) Regulations 2003, among other national legislations, standards and international protocols. This was done in order to comply with environmental and quality standards, and meet requirements as per the applicable laws and regulations in Kenya.

Objectives

The objective of the study was to carry out an Environmental and Social Impact Assessment (ESIA) of the project areas in accordance with the Environmental Impact and Audit Regulations 2003 and the international guidelines for ESIA and submit report to NEMA for approval. On the social impact assessment, it includes; carrying out a socio-economic and environmental status analysis through a baseline survey and preparation of an Environmental and Social Management Plan (ESMP).

Scope of work

The Environmental and Social Impact Assessment study included:

(a) Analysis of the socio-economic and socio-environmental status of the areas during pre and post construction- and thus justify development of the affected irrigation project.
(a) Assessment of the Community's capacity to implement the proposed mitigation measures, and make appropriate recommendations, including potential capacity building and training needs and their costs.

(b) Preparation of an Environmental and Social Management Plan (ESMP) based on the Environmental baseline survey. The ESMP outlines:

(c) Evaluation of the Social Impact and how the Communities in the area will benefit or lose upon implementation of the project.

(d) Based on the information collected from the Social Economic Baseline Survey, in the report the consultant has shown how the identified adverse effects will be mitigated.

(e) The consultant also consulted key stakeholders through interviews, focus group discussions, and public barazas. Records of public consultations are provided in the appendices.

**Approach and Methodology**

To meet the objectives of the study, we adopted systematic, integrated, participatory and collaborative approaches. We gathered information through document reviews, field investigations, focus group discussions and key informant interviews. We consulted Key Informants, administrators, scheme leaders, community leaders among others.

The EIA experts examined all legal and regulatory frameworks, socio-economic profiles in the project area, identified environmental impacts and proposed relevant mitigation measures. The report also provides environmental management framework, monitoring and evaluation mechanisms.

Some of the key components in the ESIA include:

i) **Public Consultations:** Consultations was conducted with the affected persons/communities where issues that may arise during the project life cycle were discussed.

ii) **Project Impacts:** The project traversed a long stretch of land with considerable levels of immitigable impacts to the flora and fauna. Some impacts were socio-economic in nature especially during the construction phase. This would be addressed by interventions suggested in the ESMP section.

iii) **Monitoring and Evaluation:** There will be need for continued monitoring and evaluation. This will ensure that issues that may arise before and after project implementation are properly addressed.

iv) **Community expectations:** All the community expectations and concerns as obtained during the public participation were documented and addressed.

**Policy, Legal and Regulatory Framework**

The Environmental Management and Co-ordination Act Cap 387, and Environmental Impact Assessment and Audit (Amendment) regulations, 2019 are the legislation that governs ESIA studies in Kenya. This project falls under the Second Schedule of EMCA Cap 387, which lists the type of projects that are required to undergo ESIA studies and under subtitle 1 *Medium Risk Projects* under Environmental Impact Assessment and Audit (Amendment) regulations, 2019. Other key national laws
that govern the management of environmental resources in the country have been discussed in this report.

The Kenya Government policy on all new projects, programmes or activities requires that an environmental impact assessment be carried out at the planning stages of the proposed undertaking to ensure that significant environmental and social impacts are taken into consideration during the planning/design, construction, operation and decommissioning of the facility. The project underwent screening process which identified the proposed project as a Medium-Risk Project as per the 2nd schedule of Environmental Management and Coordination Act (EMCA Cap 387) – amendment via legal notice no. 31 – April 2019. The project does not lead to displacement of Project Affected Persons (PAPs) and only site-specific environmental impacts are envisaged. Therefore, the undertook Environmental and Social Impact Assessment and developed a Summary Project Report (SPR) pursuant to Regulation 7 (1) of the Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019.

**Environmental and social impacts**

The environmental and social impacts are discussed in three phases namely: construction, operational and decommissioning phases. The summary of the positive impacts of the proposed rehabilitation and expansion of irrigation project are as follows:

a) Creation of direct and indirect employment opportunities during the construction and operation phases;

b) Increased agricultural productivity, through the provision of capacity for intensive land use by irrigation;

c) Increase in on-farm revenue;

d) Improved food security;

e) Increased women involvement in irrigation will provide impetus for sustainable development.
### Summary of the negative impacts and mitigation measures

**Table I:** Summary of the negative impacts and mitigation measures

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Mitigation/ Enhancement Measures</th>
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</thead>
<tbody>
<tr>
<td><strong>Construction Phase</strong></td>
<td></td>
</tr>
<tr>
<td>Interference with the physical setting</td>
<td>• Adequate survey should be done on the water pipeline route</td>
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<td></td>
<td>• Anyone, whose property is affected to be compensated for disturbance</td>
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<td></td>
<td>• Engagement shall be done to assess whether there is grievances.</td>
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<tr>
<td>Noise pollution and vibration</td>
<td>• Noise maintained in accordance to the manufacturer’s specification</td>
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<td></td>
<td>• Operators to put on ear masks to prevent direct noise from the machinery</td>
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<td>• Machines that are less vibrating to be used</td>
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<td></td>
<td>• When high vibration needed, to be done during the day</td>
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<tr>
<td>Slope Instability</td>
<td>• Use of manual labour for trenching and backfilling</td>
</tr>
<tr>
<td></td>
<td>• Avoid utilisation of heavy machinery near steep landscapes</td>
</tr>
<tr>
<td></td>
<td>• Construction activities to be conducted during dry season</td>
</tr>
<tr>
<td>Air Quality Degradation/ Dust Emissions</td>
<td>• Supply and construction vehicles will only use the designated transport routes. The drivers will also be advised to stick to prescribed speed limits</td>
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<td></td>
<td>• The contractor will ensure proper repair and maintenance of vehicles and equipment to minimize exhaust gases</td>
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<td></td>
<td>• The contractor shall ensure the appropriate speed limits are observed at along all road sections that will be used by construction vehicles on a needs basis to eliminate the creation of dusts</td>
</tr>
<tr>
<td></td>
<td>• Construction workers will be provided with dust masks to mitigate</td>
</tr>
<tr>
<td>Workers Accidents and Hazards during Construction</td>
<td>• Contractors to adhere to Occupational Health and Safety rules and regulations as stipulated in the Occupational Safety Act of Kenya of 2007 and revised in 2010</td>
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<td></td>
<td>• 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</td>
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<td></td>
<td>• In case of accidents, injured persons should be given first aid and immediately taken to the hospital</td>
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<td></td>
<td>• Investigation on the cause of accidents done and adequate conclusion to be arrived at</td>
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<tr>
<td>Potential Impact</td>
<td>Mitigation/ Enhancement Measures</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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</tbody>
</table>
| Extraction and use of Construction Materials         | • 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 humans and livestock                                                                                                                                  |
| Generation of Liquid and Solid Waste                 | • Provision of solid waste collection facilities (waste bins)  
  • Contracting licensed solid waste handlers  
  • Sensitization of construction workers on proper disposal of solid wastes  
  • The contractor will maintain all site vehicles and equipment is 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 utilised within the project site and will not be discharged into watercourses.                                                                                                      |
| Loss of Flora and Fauna                             | • The proponent shall ensure that clearing of vegetation clearing is limited to the pipeline trench area (i.e. 0.5 meters width) within the road reserve  
  • Transportation of construction materials to be done through the existing local roads  
  • Avoidance of vegetation clearing along riparian land  
  • Sensitization of construction work-force on environmental conservation and ecological protection  
  • Re-vegetation of completed pipeline route with fibrous rooted indigenous vegetation species                                                                                                                           |
| Increased Vehicular and Human Traffic                | • Transportation of construction material to specific sites will be done through the existing local roads  
  • The contractor will rehabilitate the local roads that will be damaged during construction activities  
  • Consultation with the local communities on planned 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                                                                                                                                  |
<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Mitigation/ Enhancement Measures</th>
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</thead>
<tbody>
<tr>
<td>Occupation Health and Safety</td>
<td>- Continuous supervision of occupational, health and safety management to ensure compliance</td>
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<td></td>
<td>- Occupational Safety and Health Training for contractor’s staff</td>
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<td></td>
<td>- Conduct orientation talks and visits</td>
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<td></td>
<td>- Conduct toolbox talks</td>
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<tr>
<td>Operation Phase</td>
<td>--------------------------------------------------------------------------------------------------</td>
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<tr>
<td>Increase in Waterborne Diseases</td>
<td>- Choice of irrigation system that is efficient in water use</td>
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<td></td>
<td>- Removal of any stagnant water</td>
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<td></td>
<td>- Use of nets at homes</td>
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<td></td>
<td>- Use of gumboots in the irrigation field</td>
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<tr>
<td>Slope-instability</td>
<td>- Repair and maintenance staff shall drain the pipeline sections to be worked on to avoid spillage of water</td>
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<td></td>
<td>- Pipeline leakages or bursts shall be swiftly attended to</td>
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<tr>
<td>Water use conflicts</td>
<td>- Water abstraction laws followed</td>
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<td></td>
<td>- Farmers training on water use</td>
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<td></td>
<td>- Installation of water meters</td>
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<td>- Enforcement of water Act, 2016</td>
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<td></td>
<td>- Establishment of an Irrigation Water User Committee</td>
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<tr>
<td>Pollution of Water</td>
<td>- Machines used during operation maintained in good condition</td>
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<tr>
<td></td>
<td>- Oils and greases emanating from repair and maintenance activities will be collected in containers to avoid entry into local drainage channels</td>
</tr>
<tr>
<td></td>
<td>- All polluted water treated before discharging to water bodies</td>
</tr>
<tr>
<td>Soil erosion and Siltation of Surface water resources</td>
<td>- Use excavated earth materials for backfilling</td>
</tr>
<tr>
<td></td>
<td>- Sprinkling of backfilled trenches with water</td>
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<td></td>
<td>- Compaction of backfilled trenches</td>
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<tr>
<td></td>
<td>- Re-vegetation of excavated areas</td>
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<tr>
<td></td>
<td>- Channelling of surface water runoff away from irrigation channels and pipelines</td>
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<tr>
<td>Health and Safety Hazards</td>
<td>- Train all workers on Health, Safety and Environment (HSE) with an aim of improving awareness</td>
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<tr>
<td></td>
<td>- The proponent will erect appropriate safety signage during repair and maintenance activities</td>
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<td></td>
<td>- The proponent shall provide first-aid facilities for R&amp;M staff</td>
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<tr>
<td>Potential Impact</td>
<td>Mitigation/ Enhancement Measures</td>
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<td>------------------------------------------------------</td>
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<tr>
<td>Decommissioning Phase</td>
<td></td>
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<tr>
<td>Reduced availability of irrigation water to users</td>
<td>• The proponent shall provide an alternative source of irrigation water to the users of the project</td>
</tr>
<tr>
<td>Slope Instability</td>
<td>• Use of manual labour for excavation and backfilling</td>
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<td></td>
<td>• Avoid utilisation of heavy machinery near steep landscapes</td>
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<tr>
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<td>• Evacuation vehicles will only use the designated transport routes. The drivers will also be</td>
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<td>advised to stick to prescribed speed limits</td>
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<td></td>
<td>• The contractor will ensure proper repair and maintenance of vehicles and equipment to minimize</td>
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<td></td>
<td>exhaust gases</td>
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<td></td>
<td>• The contractor shall ensure recommended speeds on road sections that will be used by construction</td>
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<td></td>
<td>vehicles are adhered to on a needs basis to reduce the creation of dusts</td>
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<td></td>
<td>• Construction workers will be provided with dust masks to mitigate</td>
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<tr>
<td>Interruption of Existing Infrastructure and Socio-</td>
<td>• The proponent will liaise with KURA and KeRRA for authorisation to cut through main roads and</td>
</tr>
<tr>
<td>Economic Activities</td>
<td>feeder roads that fall under their jurisdiction.</td>
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<td></td>
<td>• The contractor will immediately restore the damaged sections of roads and water supply networks</td>
</tr>
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<td></td>
<td>to pre-construction conditions</td>
</tr>
<tr>
<td>Impact on Socio-Economic Activities</td>
<td>• Notification to local community members whose farms have encroached on the reserve will be</td>
</tr>
<tr>
<td></td>
<td>notified of pending decommissioning activities</td>
</tr>
<tr>
<td>Loss of Flora and Fauna</td>
<td>• The proponent shall ensure minimal clearing of vegetation</td>
</tr>
<tr>
<td></td>
<td>• Transportation of decommissioning wastes to be done through the existing local roads</td>
</tr>
<tr>
<td></td>
<td>• Sensitization of decommissioning work-force on environmental</td>
</tr>
<tr>
<td>Potential Impact</td>
<td>Mitigation/ Enhancement Measures</td>
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<td>----------------------------------------</td>
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<tr>
<td>conservation and ecological protection</td>
<td>- Re-vegetation of cleared areas with indigenous vegetation species</td>
</tr>
</tbody>
</table>
| Increased Vehicular and Human Traffic  | - Transportation of decommissioning wastes to specific sites will be done through the 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 drivers to comply with prescribed speed limits                                                                                                                                                                                                                                                                                                      |
| Generation of solid and liquid waste   | - Provision of solid waste collection facilities (waste bins)  
- Contracting licensed 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 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 utilised within the project site and will not be discharged into water courses.                                                                                                                                                                                                                                    |
| Health and Safety                      | Continuous supervision of occupational, health and safety management to ensure compliance                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                                        | - Occupational Safety and Health Training for contractor’s staff  
- Orientation talks and visits  
- Toolbox talks                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

**Conclusion**

Based on the findings, it is evident that rehabilitation, construction and operation 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 it is indicated in this report, 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 this report.
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<td>AfDB</td>
<td>African Development Bank</td>
</tr>
<tr>
<td>EMCA</td>
<td>Environmental Management and Coordination Act</td>
</tr>
<tr>
<td>ESIA</td>
<td>Environmental and Social Impact Assessment</td>
</tr>
<tr>
<td>ESMP</td>
<td>Environmental and Social Management Plan</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organization</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GHG</td>
<td>Green House Gases</td>
</tr>
<tr>
<td>GIR</td>
<td>Gross Irrigation Requirement</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>Ha</td>
<td>Hectare</td>
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<tr>
<td>HIV</td>
<td>Human Immuno-Deficiency Virus</td>
</tr>
<tr>
<td>KEBS</td>
<td>Kenya Bureau of Standards</td>
</tr>
<tr>
<td>Kg</td>
<td>Kilogramme</td>
</tr>
<tr>
<td>Km</td>
<td>Kilometer</td>
</tr>
<tr>
<td>KMS</td>
<td>Kenya Meteorological Service</td>
</tr>
<tr>
<td>M asl</td>
<td>Meters Above Sea Level</td>
</tr>
<tr>
<td>m</td>
<td>Metre</td>
</tr>
<tr>
<td>Mm</td>
<td>millimeter</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Environment Management Authority</td>
</tr>
<tr>
<td>NIR</td>
<td>Net Irrigation Requirement</td>
</tr>
<tr>
<td>NPV</td>
<td>Net Present Value</td>
</tr>
<tr>
<td>OC</td>
<td>Organic Carbon</td>
</tr>
<tr>
<td>PCPB</td>
<td>Pest Control Products Board</td>
</tr>
<tr>
<td>PET</td>
<td>Potential Evapotranspiration</td>
</tr>
<tr>
<td>pF</td>
<td>Soil Moisture Retention Potential</td>
</tr>
<tr>
<td>pH</td>
<td>Degree of Acidity or Alkalinity</td>
</tr>
<tr>
<td>ppm</td>
<td>Parts per Million</td>
</tr>
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<td>RAM</td>
<td>Readily Available Soil Moisture</td>
</tr>
<tr>
<td>RGS</td>
<td>River Gauging Station</td>
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<tr>
<td>TOR</td>
<td>Terms of Reference</td>
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<td>TRAM</td>
<td>Total Readily Available Moisture</td>
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<td>UTM</td>
<td>Universal Transverse Mercator</td>
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<td>WHO</td>
<td>World Health Organization</td>
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<tr>
<td>WRA</td>
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INTRODUCTION

1.1 Preface

The Government of Kenya (GoK) through the Ministry of Agriculture, Livestock, Fisheries and Cooperatives; State Department of Crop Development and Agricultural Research, Drought Resilience and Sustainable Livelihoods Program (DRSLP) is set to implement project in six (6) arid and semi-arid (ASAL) counties namely Marsabit, Isiolo, Samburu, Marsabit, West Pokot, and Turkana.

The program aims to contribute to poverty reduction, food security and accelerated sustainable economic growth in the Horn of Africa through improved rural incomes. Specifically, it aims to improve the drought resilience of arid and semi-arid land communities. Project interventions cover water supply for people, livestock, irrigation and sanitation as well as the effective management of head-waters and basic water sources; improvement of plant and animal production, marketing and disease management.

The program is anchored under three main project components, which are;

(i) Component 1: Strengthening the resilience of drought prone areas and Pastoral and Agro-Sylvo-
Pastoral Production systems to Climate Change

(ii) Component 2: Supporting Agribusiness Development:

(iii) Component 3: Strengthening Adaptive capacity to Climate Change

1.2 Project Description

Proposed Kakemera drip irrigation is located at Kakemera village, Kanamkemer sub location, Kanamkemer ward in Turkana Central Sub County. The surveyed project site borders Kakemera primary school on western side (about 300 – 500 m away from the site) and Kakemera villages on Southern and Eastern side. The project site is about 600 m away from Kanamkemer – Naotin – Napeikar murram road.

The site lies within the coordinates, N 341473.078, E 785698.245 and Elevation 489.126. E 064092.9836 N 03275703543. The development drip irrigation is one of the activities listed under schedule II of the Environmental Management and Co-ordination Act (EMCA, 1999). This SPR study was conducted through consultation with the farmers, pastoralists, local administration, local leaders, government officers in Turkana and the EIA team headed by the consultant.

1.3 Objectives of the SPR

The principal objective of the SPR is to address the possible positive and negative environmental and social impacts expected during the establishment and operation of the proposed project, with the aim of proposing mitigation measures to the negative impacts and enhancement measures for the positive impacts. This is in line with ensuring that such a development does not negatively impact the environment in terms of social, health, economic and physical (soil, water, plant and animals) state of the area. The SPR identified the possible environmental impacts during the construction, implementation and operational phases of the project. The exercise was carried out in accordance with the National Environmental Management Authority (NEMA) Environmental Impact Assessment and Audit Regulations and guidelines in addition to African Development Bank Group Operational Safeguards.
This report addresses the following key specific objectives:

- To review existing legal and institutional framework related to the proposed developments complex project development.
- To collect and collate baseline information relevant to the proposed marketing shed development.
- To collect primary data through the community participatory process.
- To identify and assess positive and negative impacts of the proposed project.
- To identify and analyze alternative options for the proposed project.
- To develop mitigation measures and cost estimates for the negative impacts of project.
- To design an Environmental Management Plan (including cost estimates) and a monitoring framework for the environmental impact of the project.

1.4 Scope of work

The Environmental and Social Impact Assessment study included:

(a) Analysis of the socio-economic and socio-environmental status of the areas during pre and post construction- and thus justify development of the affected irrigation project.

(b) Assessment of the Community's capacity to implement the proposed mitigation measures, and make appropriate recommendations, including potential capacity building and training needs and their costs.

(c) Preparation of an Environmental and Social Management Plan (ESMP) based on the Environmental baseline survey. The ESMP outlines:
   (i) Institutional arrangements, training requirement and responsibilities for monitoring implementation of the mitigation measures and monitoring indicators;
   (ii) Proposed work program, budget estimates, schedules, staffing and other necessary support services to implement the mitigation measures;
   (iii) Preparation of emergency response measures to accidents as appropriate e.g., flood damages etc.
   (iv) The proposed concerned parties should agree on the time horizons and mitigation measures for implementing the recommendations in the ESMP.
   (v) Potential environmental and social impacts resulting from the activity;
   (vi) Proposed mitigation measures.

(d) Evaluation of the Social Impact and how the Communities in the area will benefit or lose upon implementation of the project.

(e) Based on the information collected from the Social Economic Baseline Survey, in the report the consultant has shown how the identified adverse effects will be mitigated.

(f) The consultant also consulted key stakeholders through interviews, focus group discussions, and public barazas. Records of public consultations are provided in the appendices.

The expert also evaluated the social impact and showed how the communities in the area will benefit or
lose upon implementation of the project. Based on the information collected from the socio-economic baseline survey, the consultant proposed mitigation measures.

The expert consulted with stakeholders and the public on the environmental and social aspects of the proposed project. The consultant recorded all public consultations and the issues raised e.g. views of affected stakeholders; date and location of consultation meetings; a list of attendees, their affiliation, contact addresses and a summary.

1.5 SPR Approach and Methodology

The report applied an inter alia approach incorporating environmental, social, cultural, economic, legal, safety and health impacts of the project. The integrated nature of the impacts review ensured all possible negative impacts were identified and adequately mitigated. Given that nature and magnitude of the proposed project, a summary environmental and social impact assessment project report, was opted for, to ensure comprehensiveness and completeness of the assessment as per the guidelines. The methodology followed during the assessment was as follows:

1.5.1 Environmental screening

The environmental screening exercise was conducted to determine whether an environmental impact assessment would be required and what level of assessment was necessary. This was done in line with the requirements of the EMCA (Cap 387), specifically the second schedule which categorizes projects into; Low Risk Projects; Medium Risk Projects and High-Risk Projects.

The Environmental Management and Co-ordination Act Cap 387, and Environmental Impact Assessment and Audit (Amendment) regulations, 2019 are the legislation that governs ESIA studies in Kenya. This project falls under the Second Schedule of EMCA Cap 387, which lists the type of projects that are required to undergo ESIA studies and under subtitle 1 Medium Risk Projects under Environmental Impact Assessment and Audit (Amendment) regulations, 2019. Other key national laws that govern the management of environmental resources in the country have been discussed in this report.

The Kenya Government policy on all new projects, programmes or activities requires that an environmental impact assessment be carried out at the planning stages of the proposed undertaking to ensure that significant environmental and social impacts are taken into consideration during the planning/design, construction, operation and decommissioning of the facility. The project underwent screening process which identified the proposed project as a Medium-Risk Project as per the 2nd schedule of Environmental Management and Coordination Act (EMCA Cap 387) – amendment via legal notice no. 31 – April 2019. The project does not lead to displacement of Project Affected Persons (PAPs) and only site-specific environmental impacts are envisaged. Therefore, the undertook Environmental and Social Impact Assessment and developed a Summary Project Report (SPR) pursuant to Regulation 7 (1) of the Environmental (Impact Assessment and Audit) (Amendment) Regulations,
Further, the African Development Bank Group Operational Safeguards were also considered since development of the drip irrigation project will be financed by African Development Bank (AfDB). The Bank has adopted a series of five Operational Safeguards (OS):

- OS1 sets out the Bank’s overarching requirements for borrowers or clients to identify, assess, and manage the potential environmental and social risks and impacts of a project, including climate change issues.
- OS2-5s support the implementation of OS1 and set out specific requirements relating to different environmental and social issues, including gender and vulnerability issues, that are triggered if the assessment process reveals that the project may present certain

1.5.2 Desktop study

Desktop study included documents review on the nature of the proposed activities, project documents including designs, policy and legislative framework as well as the environmental setting of the area among others. Key documents reviewed included the following: Kenya policies, strategies and guidelines; National and County Laws and regulations; applicable Multilateral Environmental Agreements (MEAs) and AfDB policies operations safeguards.

1.5.3 Physical inspection of the site and surrounding

Physical inspection of the proposed site, which included field investigation at site and surrounding areas, was done on 17th March 2022. The field investigations were meant for physical inspections of the site characteristics and the environmental status of the surrounding areas to determine the anticipated impacts from the project.

1.5.4 Public participation

Public participation via the use of public meetings & questionnaires, key stakeholder and informant interviews were carried out during the exercise. To ensure adequate public participation in the ESIA process, questionnaires were administered to the project stakeholders, project site neighbours and beneficiaries to the proposed development project. The information gathered was subsequently synthesized and incorporated into the EIA summary project Report.

1.5.5 Reporting.

The Environmental Impacts Assessment report was compiled from the findings in accordance with the EIA guidelines issued by NEMA for Summary Project Report. The Consultant ensured constant briefing of the proponent during the exercise.

The exercise culminated with the production and documentation of this summary project report designed
to ensure that the proposed development complies with the Environmental Management and Coordination Act (EMCA, Cap 387).

1.6 Data Analysis, Documentation and Report Structure

The Environmental Impacts Assessment report was compiled from the findings in accordance with the EIA guidelines issued by NEMA for Summary Project Report. The Consultant ensured constant briefing of the proponent during the exercise.

The exercise culminated with the production and documentation of this summary project report. The report structure is organized according to the 2nd schedule of Environmental Management and Coordination Act (EMCA Cap 387) – amendment via legal notice no. 31 – April 2019 as outlined below: and the provisions of the developed Environmental and Social Management Framework.

The project report submitted under sub regulation (1) shall specify —

(a) the nature of the project;
(b) the location of the project including —
   (i) proof of land ownership, where applicable;
   (ii) any environmentally sensitive area to be affected;
   (iii) availability of supportive environmental management infrastructure; and
   (iv) conformity to land use plan or zonation plan; and
(c) Potential environmental impacts of the project and the mitigation measures to be taken during and after implementation of the project.

1.7 Responsibilities and Undertaking

Turkana County Department of Agriculture provided a technical team to provide information required by the environmental expert. The proponent also facilitated stakeholder engagement through public participation and provided the relevant project documents and information to enable the expert compile the report.
PROJECT DESCRIPTION

2.1 Nature of the Project

2.1.1 Design Concept and Material

The siting, design concept, criteria and operationalization for the sub project were developed in accordance with the general guidelines and standards used in the design and development of proposed project as developed by the Ministry of Agriculture, Livestock, Fisheries & Co-Operatives

The supporting structures namely; the fence, toilet and gate were also developed in line with the Kenyan Building and Construction Standards *(Annex 4)*

2.1.2 Project Design

The proposed irrigation system is composed of the following main infrastructure components:

- Boreholes equipped with solar powered pumps, source of water.
- Solar powered booster pump
- Main filtration unit
- Supply main pipeline, HDPE
- Inline drip lines, with emitters at 30cm spacing. Each lateral to be about 100m long
- Feeder branches, to serve the manifold pipes
- Manifold pipelines, each 200m
- End caps at the end of each drip line
- Access roads
- Fence around the farm;
- Shade nets to cover 5acres
- Raised water tanks

2.1.3 Proposed crops

The table 2.1 is a summary of the proposed crops and the expected percentage of land to be put under the respective crop for the two seasons in a year.

<table>
<thead>
<tr>
<th>No</th>
<th>Crop</th>
<th>Season</th>
<th>Planting date</th>
<th>% land</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tomatoes</td>
<td>1</td>
<td>3rd January</td>
<td>50%</td>
</tr>
<tr>
<td>2</td>
<td>Local vegetables</td>
<td>1</td>
<td>2nd January</td>
<td>20%</td>
</tr>
<tr>
<td>3</td>
<td>Water melons</td>
<td>1</td>
<td>2nd January</td>
<td>20%</td>
</tr>
<tr>
<td>4</td>
<td>Green beans</td>
<td>1</td>
<td>2nd July</td>
<td>10%</td>
</tr>
</tbody>
</table>
The total project area is 10Ha. Out of this, 5 acres will be under shade net and the balance will be under open drip irrigation system.

2.2 Proposed Project Activities

The activities associated with the proposed project have been categorized under four phases of project implementation namely; planning, construction and closure/decommissioning as discussed in the following subsection.

2.2.1 Planning Phase Activities

The main activities considered during this phase are: community mobilization, public consultation, tendering, and design works process as required by procurement regulations and site hand over.

2.2.2 Construction

Construction phase entails the following activities:

- Earthworks;
- Concrete and stone or masonry works;
- Metal works/ steelwork
- Pipe works – HDPE Pipes;

2.2.3 Operation Phase Activities

The project operational activities will include: land preparation, planting, pest and weed management, harvesting, utilization of the produce and storage. Utilization, management, repair and maintenance of the project will be done by the community through their elected executive committee.

2.2.4 Decommissioning Phase Activities

Decommissioning of the drip irrigation project and associated amenities will become necessary if or when the project goals change, when the need arises, climatic conditions or change of government policy as regards the land use. Once this occurs, the affected structures will be demolished. Non-reusable materials will be sold to licensed scrap metal dealers.

The closure of the project will involve stopping all activities and demolishing the built structures. The affected land shall be landscaped and replanted with suitable indigenous grass and trees.

2.3 Administration

Kakimera is in Turkana sub-county of Turkana county. It is in Kanamkemer ward, Kanamkemer Location, Naotin sub-location Kakemera village.
Proposed Kakemera drip irrigation is located at Kakemera village, Kanamkemer sub location, Kanamkemer ward in Turkana Central Sub County. The surveyed project site borders Kakemera primary school on western side (about 300 – 500 m away from the site) and Kakemera villages on Southern and Eastern side. The project site is about 600 m away from Kanamkemer – Naotin – Napeikar murram road.

Figure 2.1: Location of the proposed site on google map

2.4 Irrigation Requirement

2.4.1 Crop water requirement

The crop water requirement has been determined using the following relationship:

\[ \text{ETe} = \text{Kc} \times \text{ETo} \]

Where,

\[ \text{Kc} = \text{crop factor and} \]
\[ \text{ETo} = \text{reference crop evapo-transpiration (mm/day).} \]

The Kc-values were obtained from FAO, Training Manual No. 3 and from other standard documents and project reports.

The ETo-values are for Lodwar Meteological station, which is the closest and most representative of the project area as it lies within the same agro-climatic zone.

**The maximum crop water requirement obtained was 7.71mm/day.**
2.4.2 Gross Irrigation Requirement

For the purposes of estimating project water requirement, the tomatoes water requirement has been used. This crop has the highest water demand.

For drip irrigation system, the idea is to provide water throughout as the crop requires. For this case, solar powered pumps from a borehole will pump water to the system. This means that effective irrigation time is 8 hours in a day.

Tomatoes has a spacing of 0.6m x 0.3m. The volume of water required by the crop is thus 0.6m * 0.3m * 7.71/1000m ie 1.4lits/day/0.18m². Thus for the 10Ha targeted for irrigation, total scheme requirement will be 9lits/sec based on a 24 hrs of irrigation 7 days a week. Since solar powered pumps will be used to pump water, the maximum number of hours for irrigation will be 8 hrs in a day and farmers will be expected to irrigate for 6 days in a week. Therefore, the gross scheme water requirement becomes,

\[
SWR = 9\text{lits/sec} \times \frac{24}{8} \times \frac{7}{6} \times \frac{1}{0.95} \text{ where 0.95 is the overall scheme efficiency.}
\]

\[
SWR = 33\text{lits/sec}.
\]

2.5 Land Ownership

The proposed project is located on community land and therefore no land ownership documents are required. (See attached resolution forms)

2.6 Environmentally Sensitive Area

There are no environmentally sensitive areas within the project location. However, areas near water structures tend to be overgrazed during dry seasons. Due to the vastness of the grazing area, there is regeneration of grassland within a short period of rains. The proposed sub project is an agricultural activity and the land is agricultural which is in line with the physical planning zonation.

**BASELINE INFORMATION**

3.1 Soils and Land Suitability

The predominant soils in Kakimera are undifferentiated tertiaiy volcanic soils and derived from colluvial and alluvial deposits. They are shallow to moderately deep well drained and dark reddish brown/dark greyish brown in colour. The soil along the Kerio River that is classified as riverine flood plain is riverine alluvium that is pale brown to dark brown in colour. They are deep, non-saline and locally calcareous. The soils are stratified fine sand to clayey with a high infiltration rate. The soil can be describe moderate to high fertility.

3.2 Topography and Drainage

For Kakimera project the land slopes gently towards Turkwel river at about 10% slope. The drainage is good and the area is suitable for irrigation especially drip irrigation.
3.3 Climate
3.3.1 Rainfall
In most cases, the monthly rainfall for Turkana County falls within one or two days and therefore, most of it is lost as runoff. There are two rainfall seasons, i.e. March – May (long rains) and October – November (short rains).

The wettest months are April and May with 39.1mm and 32.7mm respectively. The rainfall ranges between 120mm and 600 mm per year. The western parts and areas of higher elevation in the county receive more rainfall. The rainfall is erratic in spatial and temporal distribution. Kakimera project area falls within the 200-400mm.

The rainfall pattern and its distribution are unreliable and erratic over the years as is evidenced by the annual figures derived from Lodwar meteorological station. Rain is usually accompanied by thunderstorms in the late afternoons and at night.

3.3.2 Temperature
Turkana County has an arid climate with temperatures ranging from a low of 24°C to a high of 38°C with a mean of 30°C.

3.3.3 Relative humidity
The relative humidity ranges between 28 % in January to 61 % in May and The mean relative humidity is 43.7 %.

3.3.4 Solar Radiation
The project area experiences an average solar radiation of 499.6 cal/c m².

3.3.5 Sunshine hours
The sunshine hours ranges between 9.0 hours in July to 10.7 hours in September and an average of 9.8 hours per day.

3.3.6 Wind speeds
The project area experiences an average wind speed of 5.01.0 m/hour

3.3.7 Evaporation
Turkana County is characterized by moisture deficit throughout the year since the rainfall is less than the evaporation. Irrigation is therefore necessary for crop production to supplement the rainfall.

Open pan evaporation values for Lodwar meteorological station are adopted due to its nearness to the project area. Generally, the mean monthly evaporation is higher than the monthly rainfalls. The Total annual evaporation is 2,714 mm is far much lower than the total rainfall 243.1mm hence giving an indication of high deficit in moisture availability for crop production and Figure 8). Monthly maximum evaporation is 255mm observed in the month of September while the minimum is 204mm observed in the month of April. The highest evaporation is seen to occur in the windiest month (September). Mean monthly maximum and minimum wind speeds of 6 mph and 4.3 mph experienced in October and May respectively. The mean value is 5.01 mph
3.4 Number of farmers
The design is done for 10Ha each as per the TOR. The number of farmers to benefit in Kakimera project is 100 households. The project will be run by an 11 elected member committee who will work closely with the local administration.

3.5 Water source
For Kakimera project, water is readily available in the nearby Turkwel River, however ground water is also available if the nearby boreholes is a theory to go by. There is plenty of sunshine making solar powered pump ideal to pump water. The design is based on the borehole as water source.
PUBLICATION AND PARTICIPATION

4.1 Preamble
The Kenyan government through the constitution 2010 has enshrined the need for human societies’ involvement in project development in accordance to the principles of public participation as provided for in Articles 1(2), 10(2), 35, 69(1)(d), 118, 174(c) and (d), 184(1)(c), 196,201(a) and 232(1)(d).

In addition, EMCA, requires active public participation in project development. The proposed project has incorporated public consultations in order to understand the local impacts, needs and wishes of the community and eventually incorporate them into the final designs and operations of the project.

4.2 Objectives of Community and Stakeholders Consultation
The key objectives of the consultation and public participation for proposed project was to:
(i) Disseminate information to the public and stakeholders about the project with Special reference to its key components and description
(ii) Create awareness to the public on the need for the EIA before project implementation.
(iii) Gather comments, suggestions and concerns of the interested and affected parties
(iv) Incorporate the information collected in the SPR
(v) Build community consensus and acceptance of the proposed project.

4.3 Methodology of Public Participation and Consultation
During public participation, public consultative meetings and admission of questionnaires to allow for systematic understanding and interaction of the project beneficiaries, neighbors, local community members/surrounding enterprises and any other would be affected/interested parties were used.

4.3.1 Public consultation questionnaires
ESIA questionnaires were administered, to gather information from key stakeholder and the members of the public. This was done using structured questionnaires to assess the environmental and socio-economic views of the respondents. Approximately 10 questionnaires were administered in the project area. Filled questionnaires administered in the project area are appended to this report (Annex 6)

4.3.2 Public consultation meetings
In seeking the views of the key stakeholders, and any other would be affected/interested parties the consultant organized a consultative meeting targeting Kakimera community, the administration, the proponent, key staff at County and sub-county level. The meeting was used to gather information on the negative and positive impacts of the proposed project, mitigation measures that could be incorporated into the design and the level of acceptance of the proposed project.

The minutes and list of attendees is appended herein this report (Annex 2 & 3).
Plate 4.1: Environment expert and the scheme members during a baraza
4.4 Key Issues Arising from Public Participation Meetings

The consultant held a public consultative meeting (barazai) with the community in conjunction with the proponent and the administration.

The lists of attendees are presented in Appendix I. The agenda for the meeting was to inform the community about the project and receive comments and suggestions from the participants.

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

4.4.1 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.

(b) Irrigated agriculture will contribute to enhanced food security and improved nutrition at the household level. This will alleviate the negative impact of erratic and unreliable rainfall pattern on the community’s productive resources.

(c) Income diversification strategy; Investment in irrigation development is a strategy in reducing risks associated with rainfall variability and achieving food security.

(d) Employment opportunities will be offered to the construction workers and any other person who will be hired to provide her/his services during the 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.

(e) The irrigation scheme will also play a role in reduction of idleness particularly amongst the youth due to an increase in income generating activities both directly or indirectly.

(f) The standard of living of the community especially vulnerable beneficiaries (elderly, female headed households and children) since there will be a reduction in distances traveled and time spent in search of water and time on agriculture. Therefore playing a significant role in income generation and increasing food and nutritional security amongst the vulnerable households.

(g) By providing direct and indirect local employment, the project will ease the direct resource dependency pressures on forest and forest resources.

(h) Reduced poverty levels through increased incomes and improved livelihoods resulting from construction of the proposed project and maintenance employment and consumption from the local markets, emergence of other associated economic opportunities and activities.

4.4.2 Issues and Concerns

(a) Inadequate water for farmers far away from the water source, the community expressed concern over water distribution and rationalization. The project management will put in place mechanisms to enable all to access water in compliance with regulations.
b) Health risks associated with increased incidences of mosquito and malaria borne diseases due to increased breeding sites. This would be mitigated through capacity building of the community on mosquito preventive and control measures.

c) Lack of marketing strategy and infrastructure for products; currently farmers do not have a crop storage and marketing plan. There is an 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 in irrigation; the community in the project area have limited knowledge on irrigation crop development. This could be attributed to limited knowledge and lack of irrigation crop production skills, tillage services, fertilizer, seed, chemicals and operation of irrigation equipment and management.

e) Damage of road infrastructure that is currently being developed during transportation and haulage of construction materials to project sites.

f) Clearing of vegetation during construction phase, this would be addressed through reforestation programs and sparing of indigenous trees during the clearing process.

g) The potential for pesticide and agro-chemical residues getting into the aquatic resources as the agricultural activities intensifies

h) Lack of credit especially for irrigation purposes to enable farmers to 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.

All the respondents had a strong conviction on the key benefits they would have from the proposed project. This is mainly associated with 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 and feasibility of demand. Equally, most respondents were willing to pay for the services associated with the project. Projects have operation costs and initial capital needs to be recouped after a certain duration. These are fundamental aspects that 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 success.
PROJECT ALTERNATIVES

5.1 Introduction
This chapter looks at the alternatives to the proposed project in terms of site, technology, design, scale and extent. The comparisons of these with the proposed project give rise to the best project option for adoption.

5.2 The proposed alternative.
This report has been prepared based on sound desktop and field studies made by the ESIA expert. The findings and recommendations are based on the proposed site, materials and the proposed technologies to be used in implementation of the proposed project. Drip irrigation, water is conveyed under pressure through a pipe system to the fields, where it drips slowly onto the soil through emitters or drippers which are located close to the plants. Only the immediate root zone of each plant is wetted. Therefore this can be a very efficient method of irrigation. Drip irrigation is sometimes called trickle irrigation. This technology is too labour intensive and is expensive to operate. That notwithstanding, the design engineer proposes for consideration and adoption of the technology.

5.3 Project Alternatives
5.3.1 Alternatives to Site
The proposed site has been selected by the State Department for Crop Development, based on selection criteria for irrigation development in the country. The Engineers were therefore supposed to come up with the best irrigation system that suits this location. A feasibility study and ESIA was conducted in the area and the best irrigation technology for the area was identified.

5.3.2 Alternative to Technology
There are various alternative irrigation technologies that may be applied to the scheme and they include the following:

- **Surface Irrigation**
  Surface irrigation is the application of water by gravity flow to the surface of the field. Either the entire field is flooded (basin irrigation) or the water is fed into small channels (furrows) or strips of land (borders). There is scarcity of water in the area and therefore this irrigation method isn’t appropriate.

- **Basin Irrigation**
  Basins are flat areas of land, surrounded by low bunds. The bunds prevent the water from flowing to the adjacent fields. Basin irrigation is commonly used for rice grown on flat lands or in terraces on hillsides. In general, the basin method is suitable for crops that are unaffected by standing in water for long periods (e.g. 12-24 hours). The crops proposed for irrigation in this system do not fall in this category. Environmental and public health impacts associated with this system are also numerous and it is on this account that it is not considered in this scheme.

- **Furrow Irrigation**
Furrows are small channels, which carry water down the land slope between the crop rows. Water infiltrates into the soil as it moves along the slope. The crop is usually grown on the ridges between the furrows. This method is suitable for all row crops and for crops that cannot stand in water for long periods (e.g. 12-24 hours). Environmental impacts associated with this technology are also enormous and this informed the consultant's decision not to consider it for implementation.

- **Border Irrigation**

Borders are long, sloping strips of land separated by bunds. They are sometimes called border strips. Irrigation water can be fed to the border in several ways including opening up the channel bank, using small outlets or gates or by means of siphons or spiles. A sheet of water flows down the slope of the border, guided by the bunds on either side.

- **Sub-Surface**

Sub-irrigation systems provide water to crops by controlling the water-table level so that crop roots can reach the capillary fringe above the water table and extract all their water needs from it. Although sub-irrigation often provides some benefits, the extra investments required in durable inputs are not always offset by the benefits. Managers need to evaluate the changes in the input-output relationships and prices associated with the new technology to determine profitability. From a financial perspective, the key factors to consider when making capital investment decisions are a project’s profitability and potential risk.

### 5.3.3 No project Alternatives

Kenya’s GDP was US$29.5 billion in 2007, of which the Agricultural sector contributed 24% and a further 27% through value adding by the sector. The agricultural sector accounts for large percentage of rural employment. Kenya relies on rain fed agriculture for production of foodstuffs and other marketed crops. Rainfall is intermittent and unreliable in some years. The estimated potential area for irrigation in Kenya is about 540,000 hectares (3,240Km²).

The country is faced with the problems of an increase in the number of people living below the poverty line of less than US $ 1 per day. Currently there has been a dramatic increase in food prices in the country necessitating the need for increase in food production. The proposed project will go a long way in improving the current situation on food prices in the country and the standards of living of the people near the project area.

Not implementing the proposed micro-irrigation scheme and continuing with the current farming practices and information systems would mean that benefits, including increased agricultural production expected from the project and the associated National economic benefits, would not be achieved. At the same time, the negative impacts associated with the project would not materialize Therefore the ‘No Action’ alternative is not feasible for Kakimera community in Turkana County.
POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

6.1 Preamble
This chapter presents the assessment of the issues likely to arise as a result of implementation of the proposed micro-irrigation project. The anticipated impacts are discussed in three phases namely: construction, operational and decommissioning phases and as well in-regard to their likelihood of occurrence on the physical, biological, occupational and socio-economic environments.

6.2 Impacts during Construction Phase

6.2.1 Positive Impacts

6.2.1.1 Creation of Employment opportunities for residents of the project area
The proposed project will provide short term and long term employment opportunities to the local community. During the construction of the proposed Project, there will be employment opportunities for both professionals and unskilled workers. Several workers including casual labourers, plumbers and engineers are expected to work on during the construction period. Semi-skilled, unskilled labourers and formal employees are expected to obtain gainful employment during the period of construction. With labour intensive construction technologies, the project will provide employment for youths and provide support to the Government of Kenya initiatives on creation of jobs.

The creation of employment opportunities is beneficial both from the economic and social point of view. Economically, it means abundant unskilled labour will be used in digging of trenches, laying of pipes, and transport of construction materials. Socially these people will be engaged in productive employment and minimize social ills like alcohol abuse which is rampant in the project area. This positive social change in the social behaviour will be one of the anticipated transformational indicators in the project area.

6.2.1.2 Injection of money into the local economy
The project will contribute to the National kitty. The contractor will pay Value Added Tax (V.A.T) on purchasing materials for the project. Construction workers will also pay income tax from their earnings while working on the project. A large sum of the project money shall be released into the local economy due to the construction activities. This money will be in form of payments for skilled and unskilled labour; Purchases of construction materials; and payments for local provisions including fuel, foods and accommodation.

6.2.1.3 Creation of market for construction materials
The project will require materials, some of which will be sourced locally within the project area. Some of this include sand, hard-core and soft stones. Local suppliers will be given first priority in supply of construction materials.

6.2.2 Negative impacts

6.2.2.1 Soil Erosion

Impact
The project will involve excavations. These earthworks will result in soil erosion and especially along the steep sections. Improper drainage of runoff from the project area to lower catchments can also cause erosion. Clearing of vegetation during the construction and excavation works for the pipeline could also result in an increase in runoff along the line and thus encourage erosion.

6.2.2.2 Interference with the physical setting

Impact
The proposed project could result into the interruption of existing infrastructure such as access roads to farm, water supply lines, fences and farm structures. These services are critical and have implications with the general social and economic performance.

6.2.2.3 Noise Pollution and Vibrations

Impact
Construction of the proposed project will most likely result in noise emissions as a result of the machines used such as tractors, bulldozers, excavators, vehicles delivering materials to the site etc. Noise could impact negatively on the workers during the construction phase. Noise can also be a nuisance to the local community if construction works begin too early in the day and continues into the night. Noise levels from construction activities exceeding 60 dB (A) at the construction campsite have a negative impacts to the environment.

6.2.2.4 Slope stability

Trenching activities during construction phase might interfere with dormant shear zones there thus leading to land damages where volumes of soil being transported downhill where proper care is not taken.

6.2.2.5 Air Quality Degradation/ Dust Emissions

Impact
Dust will be emitted during excavation, movement of vehicles and related earthworks. Particulate matter pollution is likely to occur during the route clearance, excavation and during the transport of construction materials. This is likely to affect site workers and the residents, in extreme situations leading to respiratory problems and eye site problems.

6.2.2.6 Workers Accidents and Hazards during Construction

Impact
Construction workers are likely to have injuries and hazards at the construction works, unavoidably exposing them to occupational health and safety risks. The workers are also likely to be exposed to risk of accidents and injuries resulting from accidental falls, injuries from hand tools and construction equipment.

6.2.2.7 Extraction and use of Construction Materials

Impact
Construction materials such as hard-core, soft stones and sand will be obtained from quarries. These materials will be harvested from natural resource and banks such as rivers and land. The proposed development is being carried out at a level that can create considerable damage to the resource due to materials extraction.

6.2.2.8 Generation of Liquid and Solid Waste

Impact
Solid wastes generated during construction include papers used for packing, plastics, cuttings and trimmings off materials among others. Dumping around the site will interfere with the aesthetic status and has a direct effect on the surrounding community. Disposal of the same solid wastes off-site could also be a social inconvenience if done in the wrong places. The off-site effects could be pest breeding, pollution of physical environment including water resource, invasion of scavengers and informal recycling by communities. Liquids generated include used oil, petrol/diesel, greases etc. When this waste gets into surface and subsurface water, resources it causes pollution and this might affect humans and animals.

6.2.2.9 Loss of flora and fauna

Impact
There are no trees established where the water pipes would be laid; there are also no habitats for rare/extinct faunal species. The reserve harbours scattered shrubs and grasses. Lower class animals and variety of insecta family are common and will inevitably be affected during the construction stage. Construction activities will therefore have minimal impact on flora and fauna characteristic of the area.

The removal of natural vegetation will also lead to loss of biodiversity. However, some natural trees within the agricultural landscape can be retained to ensure maintenance of biodiversity. Agro-forestry can also be adopted. The conversion of semi-natural grasslands to improved irrigated pastures will significantly reduce indigenous plant and invertebrate biodiversity. This can be mitigated by proper planning and management of the Project’s activities.

The nature of irrigation scheme will radically change both the agricultural and natural ecology in the project area. The creation of reservoirs and channels provides the possibility of enhanced aquatic habitats. In particular, reservoirs and channels may also offer favourable habitats for disease transmitting insects and snails. The consumption of water for irrigated agriculture and the reduced quality of return flows is likely to adversely impact on downstream ecosystems. Reduced flows, increased salt concentrations, lower oxygen levels, higher water temperatures and increased pollution and silt loads all tend to favour vigorous, tolerant species (aquatic weeds). Marked changes to the water environment, both in quantity and quality, are liable to have negative impacts on downstream aquatic biota which may be adversely affected by changes to the hydrology or morphology of a river system.

The introduction of exotic species of plant or animal may oust indigenous species or introduce disease agents which may affect plants, animals and/or man, causing ecological imbalances.

6.2.2.10 Public Health
Impact

Construction and rehabilitation works and traffic during operation will create dust, air and noise pollution, which can have an impact on public health. Oil wastes from vehicles can also impact on public health if they find their way into water sources. The leaded compounds will accumulate on any vegetation planted for consumption purposes. Sanitation and hygiene in the workmen’s camp are also issues of concern, and if not properly addressed can lead to outbreaks of illness such as hepatitis, typhoid, intestinal worms, etc. Construction works are associated with an increase in sexually transmitted diseases such as STDs and HIV/AIDS due to the influx of workmen interacting with the local people. Construction teams can also cause social upheaval among communities near the project area.

6.2.2.11 Workers accidents and hazards during construction

Impact

During construction of the proposed project, it is expected that construction workers are likely to encounter occupational health hazards as a result accidents at the construction site. Because of the construction activities including metal grinding and cutting, concrete work, steel erection and welding among others, construction workers will be exposed to risks of accidents and injuries. Such injuries can result from injuries from hand tools and construction equipment cuts from sharp edges of metal sheets and collapse of building sections among others.

6.3 Impacts during Operational Phase

6.3.1 Positive Impacts

6.3.1.1 Contribution to the flora, fauna and micro-climate

The supply of irrigation water to the farms in the project area will motivate the farmers to grow crops, fodder crops for the animals and trees. Through this, it is envisaged that the number of flora and fauna species will increase. This means that micro climate within the project area will be enhanced. This will immensely contributed to the property value, land value and aesthetic value of the area while ensuring that the environment remains healthy and productive.

6.3.1.2 Creation of Employment

During operational phase, there will be employment opportunities especially for those who will be employed to manage, maintain irrigation water supply system. A number of youths within the project area will be employed in the farms to undertake such activities as cultivation, weeding, harvesting collecting centers and storage & cooling facilities among others. This will improve their living standards and by engaging, they will also change their social behaviour.

6.3.1.3 Creation of Wealth

The proposed irrigation project will ultimately provide revenues to the beneficiaries and expand the wealth base for the Nation. It will pump both liquified and tied up wealth hence making the nation gain. It will also go a long way in uplifting Turkana County and its neighbourhood as a whole. Once the people will be empowered in the project area, some will invest and develop the nearby towns.
6.3.1.4 **Improved Food Security**
Crop production through rain-fed agriculture and minimal irrigation has not been reliable due to the unreliable rainfall in the area. This has led to the rampant cases of food shortage in the households. The improvement and use of irrigation water through the proposed project will increase crop production and thus alleviate the food shortage problem in the households. Surplus produce could be sold and earn households much needed income.

6.3.1.5 **Improved Well-being of Women and Children**
At the household level, women and children bear the burden of fetching water. Other than the time spent in getting water from long distances, these practices has far reaching consequences on their health and wellbeing.

Improved Irrigation water accessibility at homesteads would translate to time saving by the women. Time saved thus would be invested in other engagements that could bring financial benefits to the family. Children also bear the brunt of water borne diseases while women are tied down to provide nursing care to the sick family members. With proximity of water all these negative impacts will be reversed in the project area.

6.3.2 **Negative Impacts**
6.3.2.1 **Water logging and Soil salinity**

**Impacts**
Water-logging and salinization of soils are common problems associated with irrigation. Water-logging results primarily from inadequate drainage and over-irrigation and, to a lesser extent, from seepage from canals and ditches. It concentrates salts, drawn up from lower in the soil profile, in the plants' rooting zone. Alkalization, the build-up of sodium in soils, is a particularly detrimental form of salinization which is difficult to rectify. On irrigated land, salinization is the major cause of land being lost to production and is one of the most prolific adverse environmental impacts associated with irrigation. However, very limited research has been conducted to quantify the economic impact of irrigation induced salinization. The use of irrigation water might also alter the structure of the soil. This can be mitigated by performing salinity test which will help ensure the soils are not destroyed in the long run and proper choice of the irrigation method.

During the operation of the irrigation scheme it is expected that soil erosion will occur from the tilled land (agriculturally induced erosion), the canals, dykes, drains etc. The method of irrigation profoundly affects the vulnerability of the land to erosion. Because irrigated land is wetter, it is less able to absorb rainfall and runoff will therefore be higher.

Reasons for an increase in soil salinity on the irrigation scheme could be as a result of the following:

- Salts carried in the irrigation water are liable to build up in the soil profile, as water is removed by plants and the atmosphere at a much faster rate than salts.
- Solute applied to the soil in the form of artificial and natural fertilizers as well as some pesticides may not all be utilized by the crop.
- Salts which occur naturally in soil may move into solution or may already be in solution in the form of saline groundwater. This problem is often severe in arid areas where natural flushing of salts (leaching) does not occur.

6.3.2.2 Increase in Waterborne Diseases

Impact
Once the irrigation water is supplied to the farms, most households will use the same as drinking water and for domestic use without any treatment. This would increase the chances of contracting waterborne diseases such as typhoid and cholera. There will be increased chances of stagnating water in the farmers and thus attracting the breeding of mosquitoes, which will be responsible for the spread of malaria. This will lead to ill health problems among the residents and even increase the chances of child mortality rates in severe cases. Aim is to have separate system for domestic and irrigation water.

6.3.2.3 Reduced socio-economic conditions

Impact
Uneven distribution of irrigation water between the beneficiaries will result into water use conflicts. This scenario will arise when some farmers in the upper section of the project will over abstract the water and minimize the water availability to the downstream users. This will result in conflicts and could even interfere with the sustainability of the project. Secondly, too much abstraction of water from the River would result into conflicts between the upstream and downstream users. This will be a one of the worst case scenarios that could result to the withdrawal of the water abstraction permit for the Micro-irrigation Scheme.

6.3.2.4 Increased inequality
The impact of irrigation on poverty reduction depends upon the structure of a rural economy and on how the additional farm income generated by improved access to irrigation is actually spent within a rural economy, and its feedback impacts on rural employment and rural wage structures. In some cases new technologies and interventions can unintentionally create new burdens for women.

6.3.2.5 Pollution of Water

Impact
The key environmental issue during operation will be the increased use of agricultural biocides (insecticides, herbicides, fungicides etc.) and fertilizers due to expected intensification of agricultural activities in the project area. Production of horticultural crops will demand increased use of biocides many of which are toxic and can have a long term effect in soils. This might also find their way into the River and thus impact negatively the downstream ecosystems.
The pollution of surface & underground water by agricultural chemicals leads to the deterioration of water quality while increased nutrient levels in the irrigation and drainage water results in algal blooms, proliferation of aquatic weeds and eutrophication in irrigation canals and downstream waterways. This can be mitigated by the enforcement of relevant legislations in the upstream areas.

6.3.2.6 Soil Erosion and Slope stability

Impact
The operation phase of the project will be characterised by periodic excavation to repair the pipeline to connect new distribution networks. Excavation along existing shear zones within the water pipeline may trigger landslides. Furthermore, pipe bursts and water leakages from the pipeline system may also cause soil liquefaction and slope instability leading to lands damages.

Soil erosion from cultivation of steep slopes and stream banks in the project area will lead to silt deposition in the rivers. This will increase the turbidity levels in the rivers and could also affect the hydrology of the rivers and the downstream ecosystems.

6.3.2.7 Negative impacts on Hydrology

Rise of water table
In the long-term frequent problems of irrigation schemes is the rise in the local water-table (water logging). Low irrigation efficiencies are one of the main causes of rise in water table. Poor water distribution systems, poor main system management and old in-field irrigation practices are the main reason. High water table also makes the soil difficult to work. Good irrigation management, closely matching irrigation demands and supply should be put in place.

6.3.2.8 Ecological change
The nature of irrigation scheme will radically change both the agricultural and natural ecology in the project area. The creation of reservoirs and channels provides the possibility of enhanced aquatic habitats. In particular, reservoirs and channels may also offer favourable habitats for disease transmitting insects and snails. The consumption of water for irrigated agriculture and the reduced quality of return flows is likely to adversely impact on downstream ecosystems. Reduced flows, increased salt concentrations, lower oxygen levels, higher water temperatures and increased pollution and silt loads all tend to favour vigorous, tolerant species (aquatic weeds). Marked changes to the water environment, both in quantity and quality, are liable to have negative impacts on downstream aquatic biota which may be adversely affected by changes to the hydrology or morphology of a river system.

Changes to the morphology of river estuaries can result from increased erosion or sedimentation. Areas of mangrove may be threatened by changes to the estuary morphology. Mangroves need both significant fresh water recharges and sediment rich flows in order to thrive. A reduction in flow leads to an increase in the soil salinity which favours more salt-tolerant species. Mangroves trap silt, transported by flood flows, and obtain their inorganic nutrients from it. These flushing flows also serve to keep the deltaic
channels open. Irrigation can have a direct impact on wetlands by either changing the hydrological conditions or by reducing water quality in downstream areas.

The introduction of exotic species of plant or animal may oust indigenous species or introduce disease agents which may affect plants, animals and/or man.

6.3.2.9 Occupation Health and Safety

There will be numerous activities in the many enterprises in the Irrigation Project. There will be many people working in the farms. The activities in the sectors pose numerous occupational and health risks. The players in these sectors need to take precautionary measures for the workers such as use of safety kits, trainings and awareness creation on health and safety issues and insurance schemes for workers. A full pledged health and safety plan need to be

6.4 Impacts during Decommissioning

6.4.1 Negative Impacts

6.4.1.1 Reduced availability of Irrigation water to users

The termination of the project at the end-of-project life will reduce the amount of water for irrigation available to the established beneficiaries. This will cause increased competition for the water resources e.g. for household use diverted for irrigation. Consequently, water-related conflicts and utilisation of contaminated sources will occur. Aim is to have separate system for domestic and irrigation water.

6.4.1.2 Slope stability

The decommissioning phase will involve excavation of the pipeline to remove pipe sections and fittings. Excavation activities might interfere with dormant shear zones thereby triggering water land inflicted damages.

6.4.1.3 Soil erosion and Siltation of Surface Water Resources

Excavation activities during decommissioning will loosen soil thereby making it vulnerable to erosion due to wind and surface water run-off. Excavated soils could be swept into surface water bodies by storm water floods during rains. This will increase the turbidity and sediment loads of the water bodies nearby thereby increasing the cost of surface water de-siltation.

6.4.1.4 Air Quality Degradation/ Dust Emission

Potential air quality degradation will occur as a result of vehicular and equipment emissions/ exhaust gases. Generation of dusts from trucks and vehicles accessing the project site and camp sites as well as piling of excavated material is expected to degrade the local air quality.

6.4.1.5 Interruption of Existing Infrastructure and Services

The water pipeline route traverses an existing road reserve but some sections will cross tarmacked and feeder roads. Construction work will interfere with existing supply and distribution pipeline networks thereby interrupting irrigation water supply services. These services are critical and have implications with spill over from the weirs effects on the social and economic performance.
6.4.1.6 Effect on Socio-Economic Activities
During the decommissioning phase, any crops planted along the irrigation water pipeline will be cleared to make way for decommissioning activities. Visits to the project area will have minimal encroachment by way of farmlands. This impact will therefore have minimal adverse effect to the local communities.

6.4.1.7 Loss of Flora and Fauna
There will be no trees established within the pipeline route reserve during the operational phase of the project other than shrubs and grasses. Decommissioning activities will therefore have minimal impact on flora and fauna.

6.4.1.8 Increased Vehicular and Human Traffic
An influx of workers to the project sites will be experienced during the decommissioning phase of the project. This might contribute to the disruption of social order within the local communities. Increased vehicular traffic during the transportation of decommissioning wastes and salvaged materials might result in the destruction of light traffic roads and increase the risk of transportation accidents.

6.4.1.9 Generation of Liquids and solid wastes
Decommissioning activities will generate various solid wastes ranging from earth material, pipe and fitting debris, wrappings, equipment oils and greases, waste asphalt concrete, human wastes to food wastes. Poor handling and disposal of such waste will lead to environmental pollution. Such wastes have the potential to enter and clog the local drainage channels thereby causing flooding.

6.4.1.10 Health and Safety Hazards
Workers and the local community will be susceptible to health and safety hazards during the decommissioning phase of the project. Inherent occupational risks include muscular-skeletal injuries, falls into un-marked/ uncovered trenches and accidents from construction vehicles. The influx of construction workers may put pressure on existing local resources, cause social conflicts, promiscuity and related sexually transmitted diseases.
IMPACT ENHANCEMENT AND MITIGATION MEASURES

7.1 Preamble
In the context of sustainable development, projects should be implemented in a manner to enhance the living standards of the targeted beneficiaries and the resident communities. The consultant was guided by the principles of sustainability in the formulation of practical mitigation measures for potential impacts identified through stakeholder engagement, public consultation and expert knowledge. The main objective was to maximize social, environmental and economic benefits of the project and to minimize any associated adverse impacts. This chapter presents the proposed enhancement and mitigation measures of potential impacts for the project.

7.2 Enhancement Measures for Positive Impacts
Enhancement refers to the deliberate attempts taken in the design and subsequent phases of the project to ensure the success of a wider range of direct and indirect positive outcomes to communities and/or the biophysical environment. This can be in the form of opportunities for social and community development, improved health and wellbeing, improved biodiversity, restored ecosystems and landscape character, and protected and respected cultural heritage.

The project will strive to enhance the positive impacts envisaged. The proponent will support the implementation of the Environmental and Social Management Plan (ESMP) at construction and operation phases of the project. Any impacts not envisaged under the ESMP will be identified through structured monitoring and evaluation under the project. The proponent will improve the experience its customers through better irrigation services and expansion of coverage area. The contractor will maximise the utilisation of local labour for construction activities to enhance the socio-economic status of the local communities.

7.3 Mitigation Measures for Negative Impacts

7.3.1 Construction Phase

7.3.1.1 Soil Erosion
Incorporating soil conservation measures during construction would help to mitigate damage caused by erosion.

7.3.1.2 Interference with the physical setting
During construction, adequate survey should be done on the water pipeline route and anyone whose property is affected should be compensated for disturbance. This can be sought by engaging formally with land owners within the project area.

The contractor should be in a position to pass relevant information to each of the affected persons and at the end, an equal engagement should be done to assess whether there is grievances.

7.3.1.3 Noise Pollution and Vibrations
The contractor should maintain the levels of noise pollution from the machinery in accordance to the manufacturer’s specification. The required decibels should be adhered to and to those operating the machines they should put on ear masks to prevent direct noise from the machinery.
The contractor should use machines that are less vibrating and those that are well serviced to prevent excessive vibration. Where vibration due to compacting is very high, we propose the compaction to be done during the day.

7.3.1.4 Slope stability
The contractor should avoid the usage of heavy excavation machinery along the pipeline route. Manual labour shall be used for trenching and backfilling during construction.

7.3.1.5 Air Quality Degradation/ Dust Emissions
The following measures will be observed during the construction phases of the project to mitigate against the degradation of local air quality/dust emissions;

i) Supply and construction vehicles will only use the designated transport routes. The drivers will also be advised to stick to prescribed speed limits

ii) The contractor will ensure proper repair and maintenance of vehicles and equipment to minimize exhaust gases

iii) The contractor shall ensure appropriate vehicle speeds road sections that will be used by construction vehicles on a needs basis to eliminate the creation of dusts

iv) Construction workers will be provided with dust masks to mitigate against occupational health risks of inhaling exhaust gases and dust

v) The contractor should sprinkle water to maintain dust to the low minimum at all times

7.3.1.6 Workers Accidents and Hazards during Construction
Proponent will develop and commit the contractors to Site Occupational Health and Safety rules and regulations as stipulated in the Occupational Safety Act of Kenya of 2007 and revised in 2010. It provides for the safety, health and welfare of workers and all persons lawfully present at workplace. It shows that it is the responsibility of every employer to ensure the safety, health and welfare of all employees at work working in his/her workplace.

Section 101 of the occupation safety and health Act, requires that in workplaces where employees are exposed to any injurious or offensive substances, the 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. Again, section 102 provides that employer supply suitable goggles or effective screens to protect the eyes of person

Should an accident occur on the site;

i) The injured person should be given first aid and immediately taken to the hospital

ii) An investigation should be initiated immediately to ascertain the cause of the accident and preliminary findings released within 12 hours.

7.3.1.7 Extraction and use of Construction Materials
The contractor should ensure that after the construction materials such as marram, ballast, soft stones etc. have been extracted, the site should be backfilled to help retain the value of the land resource, before the site is to be backfilled it should be fenced to prevent the following: Deaths of persons and livestock due to falling in it or drowning when filled with rainwater, and creation breeding ground for mosquitoes, which cause malaria.

7.3.1.8 Generation of Liquid and Solid Waste

The project contractors should take adequate measures on the spilled substance on land and water bodies during construction. They should ensure that there is minimal spillage and if it is more, then scooping and adequate, dumping required. With liaison with the relevant authorities they should as well make sure that the required measures is followed on the spillage.

The project contractor will provide solid waste collection facilities (waste bins) for the temporary storage of wastes prior to disposal at an appropriate and designated location. The contractor will also liaise with the County government and the local NEMA office for direction on licensed waste collectors and suitable dumping sites for generated wastes. The contractor will also sensitize construction workers on proper disposal of wastes.

7.3.1.9 Loss of flora and fauna

The proponent shall ensure that clearing of any vegetation is limited to the water pipeline trench area (i.e. 0.5 meters width) within the road reserve and that transportation of construction materials is done through the existing local roads. The areas to be cleared for the water pipeline trench, camp-site and materials holding yard shall be identified and marked out prior to the start of construction activities. In addition, clearance of vegetation on riparian land will be avoided.

The construction work-force will be sensitized on the importance of environmental conservation and ecological protection to prevent the exploitation of natural resources around the project area and destruction of ecosystems. On completion of the construction work, the trenched pipeline areas will be allowed to re-vegetate with fibrous rooted vegetation species.

7.3.1.10 Occupational Safety and Health

The following measures will be observed/ implemented to reduce/ eliminate potential health and safety risks;

The contractor shall erect an appropriate project signboard as directed by the proponent. The signboard shall include information on the project proponent, funding organization, project contractor, project manager, civil and structural engineer among other relevant information that will be required by the proponent.

The contractor will erect the appropriate safety signage along the construction route cautioning against various health and safety risks and prescribing particular mandatory actions. Road signs will also be erected to warn pedestrians and motorists of construction activities and diversions at road sections where the pipeline will cross.
The contractor and the proponent will provide adequate first-aid facilities in the project sites to handle medical emergencies during construction. A standby vehicle will also be provided to swiftly transport ill/injured staff and members of community to the nearest medical facility.

The contractor will comply with National and international labour laws in recruiting construction staff. All workers will be required to produce their National identification cards, NHIF and NSSF registration numbers. Child labour will not be used in construction work.

All construction workers will be required to wear Personal Protective Equipment (PPE) i.e. helmets, gloves and safety boots during the construction phase. The workers will also be sensitized on health and safety standards that they should observe.

A comprehensive HIV/AIDS sensitization programme will be formulated to create awareness among construction workers and local community. The programme will be supported by a qualified community health practitioner who will also offer testing and counselling services. Information fliers and protection devices will also be made freely available during the construction phase.

7.3.2 Operation Phase

7.3.2.1 Water logging and Soil salinity

Careful management should be practiced to reduce the rate of salinity build up and minimize the effects on crops. Management strategies include: leaching; altering irrigation methods and schedules; installing sub-surface drainage; changing tillage techniques; adjusting crop patterns; and, incorporating soil ameliorates.

7.3.2.2 Increase in Waterborne Diseases

Waterborne diseases such as bilharzia, malaria, foot rot will be realised during the operation phase of the project. Prevention is by choosing an irrigation system that is very efficient and does not cause water logging in the field. As well, the design irrigation scheduling should be followed to prevent an increase in the irrigation hours in one section.

During the operation phase of the project, repair and maintenance staff shall drain the pipeline sections to be worked on to avoid spillage of water. Any pipeline leakages or bursts shall be swiftly repaired to avoid triggering land-damages on steep slope

7.3.2.3 Reduced socio-economic conditions

Water use Conflicts

Water abstraction from any water body in Kenya, is guided by Water Resources Authority (WRA). The authority outlines the quantity of water abstracted by any user. Within the catchment, WRUAs solves any conflict of water use in any river in that catchment. In an irrigation field, there is Irrigation Water Users Association (IWUA) who will be formed to guide the use of the water in the irrigation fields. The IWUA will assist in the following:

Assist in the formation of the committee who will be required to form strict by-laws that will guide on water usage and conflict resolution in the irrigation scheme. Conduct farmers training on best irrigation
practices that aims at efficient water use. Install a water meter at the intake and at household levels in order to control water usage and form a basis of rationing. Strictly enforce the Water Act 2016, in order to guide on water usage for the benefit of all stakeholders.

Increased inequality

- Targeting and empowering women starts at the household level to manage water resources and related irrigation technologies.
- Increasing women’s access to market and production information, joint financial services and mobile money services
- Mobilize groups of women to adopt technology to ensure more accountability for its management, use, and transparency of benefits.
- Establish clear, precise rules for incorporating women in water management
- Strengthen the role of women, improving their ability to enhance their self-esteem, degree of integration, and position, and increasing their democratic participation in water management
- Train women in production issues
- Highlight and value women’s contribution to their household’s economy.

7.3.2.4 Pollution of Water
The loss and deterioration of water quality has both regional and national costs through impacts on recreation and other amenity values, human health and vulnerable ecosystems. This risk may be partly offset by the method of irrigation used and other improved land management techniques.

7.3.2.5 Soil Erosion
The project contractor shall ensure that excavated earth materials and grass planted on them to prevent it from being washed away. The same soil can be used for backfilling the water pipeline trenches where needed. The backfilled soil will also be sprinkled with water and compacted to a similar density to the existing ground. The cleared sites will be re-vegetated to improve ground cover and minimize soil erosion and also improve on aesthetics of the project area. Some of the following activities will further improve soil management.

- Promote good farm management practices that aim at soil conservation
- Training should be conducted during project implementation to ensure that members, IWUAs and scheme management understand and take up their role in catchment management;
- Train farmers in soil and water management to avoid land degradation
- Proper tillage methods e.g. minimum tillage

7.3.2.6 Negative impacts on Hydrology
Rise of water table

- Use of good irrigation management, closely matching irrigation demands and supply
- Installation and maintenance of adequate drainage system. This will help reduce seepage and increase irrigation efficiency, thereby reducing groundwater recharge.

7.3.2.7 Ecological change and imbalances
The use of herbicides should be limited as far as possible. Herbicides should only be used under strict control and only when other options are not available. Herbicides may not be used near sensitive environments especially wetland areas

Use “best practices” in handling/ using agricultural chemicals

The proponent and other relevant government should ensure that invasive alien plant species are not introduced to the area and should they be identified then this should be immediately removed

7.3.2.8 Occupation Health and Safety
All workers will be required to wear Personal Protective Equipment (PPE) i.e. helmets, gloves and safety boots during the operation phase. The workers will also be sensitized on health and safety standards that they should observe

During the operation phase of the project, repair and maintenance staff shall drain the weir and should be cleaned of debris and logs to avoid clogging and hence spillage of water to the neighbouring farms, homesteads and possible landslides. Protective clothing’s should be used as well.

7.3.3 Decommissioning Phase

7.3.3.1 Reduced availability of Irrigation water to users
The proponent shall provide an alternative source of irrigation water to the beneficiaries of the project. Assessment on the water resources in the area will be done.

7.3.3.2 Slope stability
The use of manual labour for excavation and backfilling is recommended. Avoidance of utilisation of heavy machinery near steep landscapes and as well this activities to be conducted during dry season.

7.3.3.3 Soil erosion and Siltation of Surface Water Resources
The project contractor shall ensure that excavated earth materials during decommissioning should be well extracted and prevented from flowing to the nearby water bodies to cause siltation. The same soil should be returned to the same spot and gentle compaction done manually to prevent it from being washed away. The cleared sites will be re-vegetated to improve ground cover and minimize soil erosion and also improve on aesthetics of the decommissioned area.

If the soil causes siltation, then proper desiltation should be done along the sites that decommissioning would be done.

7.3.3.4 Air Quality Degradation/ Dust Emission
The following measures will be observed during the decommissioning phases of the project to mitigate against the degradation of local air quality/ dust emissions;

- 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 appropriate vehicle speeds on road 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 against occupational health risks of inhaling exhaust gases and dust.
- The contractor should sprinkle water to maintain dust to the low minimum at all times.

7.3.3.5 Interruption of Existing Infrastructure and Services

The project proponent will apply for authorisation from relevant National authorities to interfere with existing infrastructure. The proponent will liaise with KURA and KeRRA for authorisation to cut through main roads and feeder roads that fall under their jurisdiction. The contractor will immediately restore the damaged sections of roads and water supply networks to pre-construction conditions.

7.3.3.6 Effect on Socio-Economic Activities

The local community members whose farms have encroached on the reserve will be notified of pending construction activities in advance and asked to harvest any crops and salvage any useful fence materials there-in.

7.3.3.7 Loss of Flora and Fauna

The proponent shall ensure that clearing of any vegetation is limited to the water pipeline trench area when the pipes are removed in decommissioning phase. The areas to be cleared should be of minimal plants and birds for campsite and decommissioned materials holding yard shall be identified and marked out prior to the start of decommissioning activities. In addition, unnecessary clearance and especially in riparian land discouraged.

Sensitisation to the work force on environment and ecological protection to prevent the exploitation of natural resources around the project area and destruction of ecosystems encouraged. On completion of the decommissioning, the trenched pipeline areas, soil will be put back and re-vegetate with the surrounding vegetation.

7.3.3.8 Increased Vehicular and Human Traffic

Transportation of decommissioned material to specific sites will be done through the existing local roads where possible. The contractor will rehabilitate the local roads that will be damaged during decommission phase. Vehicular and human traffic shall be restricted to the road reserve as much as possible. Drivers/
operators of vehicles will be advised to comply with prescribed speed limits to reduce the risk of road accidents.

7.3.3.9 Generation of Liquids and Solid wastes
The project contractors should take adequate measures on the spilled substance on land and water bodies during decommissioning. They should ensure that there is minimal spillage and if it is more, then scooping and adequate, dumping required. With liaison with the relevant authorities they should as well make sure that the required measures are followed on the spillage.

The project contractor will provide solid waste collection facilities (waste bins) for the temporary storage of wastes prior to disposal at an appropriate and designated location. The contractor will also liaise with the County Government and the local NEMA office for direction on licensed waste collectors and suitable dumping sites for generated wastes. The contractor will also sensitize construction workers on proper disposal of wastes.

7.3.3.10 Health and Safety Hazards
The following measures will be observed/implemented to reduce/eliminate potential health and safety risks;

- The contractor shall erect an appropriate project signboard as directed by the proponent. The signboard shall include information on the project proponent, funding organization, project contractor, project manager, civil and structural engineer among other relevant information that will be required by the proponent.

- The contractor will erect the appropriate safety signage along the construction route cautioning against various health and safety risks and prescribing particular mandatory actions. Road signs will also be erected to warn pedestrians and motorists of construction activities and diversions at road sections where the pipeline will cross.

- The contractor and proponent will provide adequate first-aid facilities in the project sites to handle medical emergencies during construction. A standby vehicle will also be provided to swiftly transport ill/injured staff and members of community to the nearest medical facility.

- The contractor will comply with National and international labour laws in recruiting construction staff. All workers will be required to produce their National identification cards, NHIF and NSSF registration numbers. Child labour will not be used in construction work.

- All construction workers will be required to wear Personal Protective Equipment (PPE) i.e. helmets, gloves and safety boots during the construction phase. The workers will also be sensitized on health and safety standards that they should observe. During the operation phase of the project, repair and maintenance staff will also be required to use PPEs.

- A comprehensive HIV/AIDS sensitization programme will be formulated to create awareness among construction workers and the local community. The programme will be supported by a
qualified community health practitioner who will also offer testing and counselling services. Information fliers and protection will also be made freely available during the construction phase.

- During the operation phase of the project, repair and maintenance staff shall drain the weir should be cleaned of debris and logs to avoid clogging and hence spillage of water to the neighboring farms and homesteads and also landslides.
ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

8.1 Preamble

The purpose of the ESMP is to ensure that environmental and social impacts and risks identified during the ESIA are effectively managed during the construction, operation and decommissioning of the proposed project. The ESMP specifies the mitigation and management measures for each impact/risk, party allocated responsibility, means of monitoring and frequency, objective verifiable indicators and an indicative budget. The ESMP also establishes a monitoring plan, capacity building plan and institutional arrangements to support its implementation.

The project proponent shall avail this ESMP to the successful contractor awarded the tender for construction work for this project. The contractor will be required to formulate a more specific ESMP and work methods that will ensure construction of the project in compliance with established standards and legislation. The contractor will factor the costs of implementing the ESMP into their budget. The project proponent will take the necessary steps to ensure that the ESMP is fully implemented.
### Environmental and Social Management Plan

#### Table 8.1: Environmental and Social Management Plan

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Mitigation/ Enhancement Measures</th>
<th>Responsibility</th>
<th>Monitoring means / Frequency</th>
<th>Verifiable Indicators</th>
<th>Estimated Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Phase</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
| Soil Erosion                     | • Incorporating soil conservation measures during construction would help to mitigate damage caused by erosion.  
• Carry out inspection of each of the sites’ soil stability before excavation;  
• All borrow pits sites shall be clearly indicated on a plan and approved by the Engineer;  
• Borrow pits and quarries to be located more than 100 metres from watercourses to minimize storm water runoff into watercourse | Contractor     | During construction           | • Soil erosion rates,  
• stability of bank                                                                      | Contract Cost   |
| Interference with the physical setting | • Adequate survey should be done on the water pipeline route  
• Anyone, whose property is affected to be compensated for disturbance  
• Engagement shall be do to assess whether there is grievances. | MOALF&I        | Prior to project implementation | • No. of person affected  
• No. of properties destroyed                                                            | 20,000          |
<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Mitigation/ Enhancement Measures</th>
<th>Responsibility</th>
<th>Monitoring means / Frequency</th>
<th>Verifiable Indicators</th>
<th>Estimated Costs (Kshs.)</th>
</tr>
</thead>
</table>
| Noise pollution and vibration    | • Noise maintained in accordance to the manufacturer’s specification  
• Operators 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 | Contractor      | During construction        | • State of machines used  
• Type of machines used for compaction                                                  | 20,000         |
| Slope Instability                | • Use of manual labour for trenching and backfilling  
• Avoid utilisation of heavy machinery near steep landscapes  
• Construction activities to be conducted during dry season | Contractor      | Throughout the construction phase | • Type of technique utilised for trenching and backfilling                            | 30,000         |
| Air Quality Degradation/ Dust Emissions | • 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   | Contractor      | Daily Monitoring           | • Records of speed limits signs erected  
• Records of machine and vehicle service  
• Evidence of use of dust masks by workers on site                                         | 30,000         |
<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Mitigation/ Enhancement Measures</th>
<th>Responsibility</th>
<th>Monitoring means / Frequency</th>
<th>Verifiable Indicators</th>
<th>Estimated Costs</th>
</tr>
</thead>
</table>
| Workers Accidents and Hazards during Construction     | • Contractors to adhere to Occupational Health and Safety rules and regulations as stipulated in the Occupational Safety Act of Kenya of 2007 and revised in 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 the cause of accidents done and adequate conclusion to be arrived at | Contractor       | Daily Monitoring              | • No of persons injured  
• Type of injury experienced                              | Contractor Cost  |
<p>| Extraction and use of                                  | • The construction extraction site should be                                                                                                                                                                                    | Contractor      | After extraction of          | • No. of open sites                                       | Contractors costs |</p>
<table>
<thead>
<tr>
<th>Potential Impact</th>
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<th>Monitoring means / Frequency</th>
<th>Verifiable Indicators</th>
<th>Estimated Costs (Kshs.)</th>
</tr>
</thead>
</table>
| Construction Materials            | backfilled to help retain the value of the land resource  
- Fencing to be done before backfilling to prevent accidents of humans and livestock                                                                                                                                                  | Contractor     | Monitoring construction materials |  
- Type of fencing required                                                                                                                 | 20,000                   |
| Generation of Liquid and Solid Waste |  
- Provision of solid waste collection facilities (waste bins)  
- Contracting licensed solid waste handlers  
- Sensitization of construction workers on proper disposal of solid wastes  
- The contractor will maintain all site vehicles and equipment is 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 utilised within the project site and will not be discharged into watercourses.                                                                 | Daily Inspection |  
- Presence/ absence of scattered solid wastes at sites  
- Availability of waste receptors  
- No. of sensitization meetings held with workers                                                                                           |                        |
<table>
<thead>
<tr>
<th>Potential Impact</th>
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<th>Estimated Costs (Kshs.)</th>
</tr>
</thead>
</table>
| Loss of Flora and Fauna      | • The proponent shall ensure that clearing of vegetation clearing is limited to the pipeline trench area (i.e. 0.5 meters width) within the road reserve  
• Transportation of construction materials to be done through the existing local roads  
• Avoidance of vegetation clearing along riparian land  
• Sensitization of construction work-force on environmental conservation and ecological protection  
• Re-vegetation of completed pipeline route with fibrous rooted indigenous vegetation species  
• Define ecological requirements.  
• Operate reservoirs to suit downstream requirements and encourage wildlife around reservoirs.  
• Designate land (in law and supported by protection institutions) for flood plains; wetlands; watersheds; drainage water | Proponent / Contractor | Routine inspections | • No. and type of vegetation cleared  
• No. and type of indigenous species re-planted  
• Size of area cleared  
• Size of area re-vegetated | 30,000                |
<table>
<thead>
<tr>
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<th>Estimated Costs (Kshs.)</th>
</tr>
</thead>
</table>
| Increased Vehicular and Human Traffic    | - Transportation of construction material to specific sites will be done through the existing local roads  
- The contractor will rehabilitate the local roads that will be damaged during construction activities  
- Consultation with the local communities on planned 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 | Contractor     | Routine inspections           | - No. of accidents involving project vehicles  
- Transportation control logs  
- No. of road spots rehabilitated  
- Community complaints                                                       | Routine project activity |
| Occupation Health and Safety             | - 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  
- Conduct toolbox talks                                                                 | Proponent / contractor | Routine Inspection  
- Throughout construction phase  
- At employment of new staff  
- On a daily basis                                                              | HSE inspection reports  
- Training reports  
- Training attendance sheets  
- Orientation report  
- No. of toolbox talks conducted                                                   | 35,000.00               |
<p>| Sub-Total of Cost Estimates for the Construction Phase |                                                                                              |                |                               |                                                                                      | 185,000                 |
| Operation Phase                          |                                                                                              |                |                               |                                                                                      |                         |</p>
<table>
<thead>
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<th>Estimated Costs (Kshs.)</th>
</tr>
</thead>
</table>
| Increased soil salinity| • Improve Irrigation and Drainage operation to match demand both how much and when  
• Provide drainage including disposal of water to evaporation ponds if quality of river flow adversely affected by drainage water  
• Maintain channels to prevent seepage, and reduce inefficiencies resulting from siltation and weeds  
• Allow for access to channels for maintenance in design.  
• Provide water for leaching as a specific operation.  
• Set-up or adjust irrigation management infrastructure to ensure sufficient income to maintain both the irrigation and drainage systems.  
• Analyse soils and monitor changes so that potential problems can be managed.  
• Careful management should be practiced to reduce the rate of salinity build up and                                           | • Proponent/beneficiaries | -                           | -                      | 50,000                 |
<table>
<thead>
<tr>
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<th>Estimated Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in Waterborne Diseases</td>
<td>• Choice of irrigation system that is efficient in water use&lt;br&gt;• Removal of any stagnant water&lt;br&gt;• Use of nets at homes&lt;br&gt;• Use of gumboots in the irrigation field&lt;br&gt;• Manage Irrigation and Drainage to prevent disease spread.&lt;br&gt;• Educate about causes of disease&lt;br&gt;• Improve health facilities.</td>
<td>Proponent/Beneficiaries</td>
<td>On need basis</td>
<td>• Type of irrigation system used&lt;br&gt;• Amount of stagnant water</td>
<td>Proponent's cost</td>
</tr>
<tr>
<td>Slope-instability</td>
<td>• Operations and maintenance staff shall drain the pipeline sections to be worked on to avoid spillage of water&lt;br&gt;• Pipeline leakages or bursts shall be swiftly attended to</td>
<td>Proponent</td>
<td>On a needs-basis</td>
<td>• No. of water inflicted lad damages attributable to the project</td>
<td>Proponent's cost</td>
</tr>
<tr>
<td>Water use conflicts</td>
<td>• Water abstraction laws followed&lt;br&gt;• Farmers training on water use&lt;br&gt;• Installation of water meters&lt;br&gt;• Enforcement of water Act, 2016&lt;br&gt;• Establishment of an Irrigation Water User Committee</td>
<td>WRA/IWUA/Beneficiaries</td>
<td>During water abstraction and use</td>
<td>• Amount of water flowing in a river&lt;br&gt;• Amount of water abstracted&lt;br&gt;• Number of farmers plots&lt;br&gt;• Irrigation frequency per plots&lt;br&gt;• Committee Established</td>
<td>Proponent's cost</td>
</tr>
<tr>
<td>Potential Impact</td>
<td>Mitigation/ Enhancement Measures</td>
<td>Responsibility</td>
<td>Monitoring means / Frequency</td>
<td>Verifiable Indicators</td>
<td>Estimated Costs</td>
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</tbody>
</table>
| Pollution of Water                                   | • Machines used during operation maintained in good condition  
• Oils and greases emanating from operations and maintenance activities will be collected in containers to avoid entry into local drainage channels  
• All polluted water treated before discharging to water bodies                                                                                                 | Proponent/ Beneficiaries | All farming operations        | • Number of machines e.g. tractors used                                               | Beneficiaries   |
| Soil erosion and Siltation of Surface water resources | • Use erosion control techniques which disperse erosive energy and avoid concentrating it e.g providing good vegetative cover will disperse the energy of rain drops and contour drainage will slow down surface runoff  
• Proper maintenance of irrigation                                                                                                                                   | Proponent/ Beneficiaries | On a needs-basis              | • Soil conservation techniques put in place                                           | Proponent’s cost|
<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Mitigation/ Enhancement Measures</th>
<th>Responsibility</th>
<th>Monitoring means / Frequency</th>
<th>Verifiable Indicators</th>
<th>Estimated Costs (Kshs.)</th>
</tr>
</thead>
</table>
| Ecological change and imbalances         | - The use of herbicides should be limited as far as possible. Herbicides should only be used under strict control and only when other options are not available. Herbicides may not be used near sensitive environments especially wetland areas  
  - Use “best practices” in handling/ using agricultural chemicals  
  - The proponent and other relevant government should ensure that invasive alien plant species are not introduced to the area and should they be identified then this should be immediately removed | Proponent NEMA PCPB (Pest Control and Products Board)                          | Periodic activities            |                       | No. Water Quality Tests Undertaken | 50,000                |
| Health and Safety Hazards                | - Train all workers on Health, Safety and Environment (HSE) with an aim of improving awareness  
  - The proponent will erect appropriate safety signage during operations and maintenance activities                                                                                                                 |                                                                                  | On a needs-basis               |                       | Training on HSE conducted | Benefits of first-aid kit |
<p>|                                          |                                                                                                                                                                                                                                   |                                                                                  |                               | Availability of first-aid kit during R&amp;M work | Benefits’ cost           |</p>
<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Mitigation/ Enhancement Measures</th>
<th>Responsibility</th>
<th>Monitoring means / Frequency</th>
<th>Verifiable Indicators</th>
<th>Estimated Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced availability of irrigation water to users</td>
<td>• The proponent shall provide an alternative source of irrigation water to the users of the project</td>
<td>proponent</td>
<td>During and after the decommissioning phase</td>
<td>• Customer complaints</td>
<td>Proponent’s cost</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Alternative sources of water provided</td>
<td></td>
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<td></td>
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<tr>
<td>Slope Instability</td>
<td>• Use of manual labour for excavation and backfilling</td>
<td>Contractor</td>
<td>Throughout the decommissioning phase</td>
<td>• Type of technique utilised for trenching and backfilling</td>
<td>No direct costs</td>
</tr>
<tr>
<td></td>
<td>• Avoid utilisation of heavy machinery near steep landscapes</td>
<td></td>
<td></td>
<td>• No. of water inflicted land damages that occur during the decommissioning phase</td>
<td>(integrated in the works costs)</td>
</tr>
<tr>
<td></td>
<td>• Decommissioning activities to be conducted during dry season</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Soil erosion and Siltation of Surface water resources</td>
<td>• Use excavated earth materials for backfilling</td>
<td>Contractor</td>
<td>Daily Inspection</td>
<td>• Presence/ absence of stockpiled excavated earth material</td>
<td>No direct costs</td>
</tr>
<tr>
<td></td>
<td>• Sprinkling of backfilled trenches with water</td>
<td></td>
<td></td>
<td>• No. of silt traps installed</td>
<td>(integrated in the works costs)</td>
</tr>
<tr>
<td></td>
<td>• Compaction of backfilled trenches</td>
<td></td>
<td></td>
<td>• No. of surface drains constructed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Re-vegetation of excavated areas</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Channelling of surface water runoff away</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potential Impact</td>
<td>Mitigation/ Enhancement Measures</td>
<td>Responsibility</td>
<td>Monitoring means / Frequency</td>
<td>Verifiable Indicators</td>
<td>Estimated Costs</td>
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</tbody>
</table>
| Air Quality Degradation/ Dust Emissions  | • Evacuation 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 dusts  
• Construction workers will be provided with dust masks to mitigate | Contractor       | Daily Monitoring                          | • Records of water sprinkling  
• Number of speed limit signs erected  
• Evidence of use of dust masks by workers on site                                                      | Contractors cost |
| Interruption of Existing Infrastructure and Socio-Economic Activities | • The proponent will liaise with KURA and KeRRA for authorisation to cut through main roads and feeder roads that fall under their jurisdiction.  
• The contractor will immediately restore the damaged sections of roads and water supply networks to pre-construction | Proponent/ Contractor | Before and during the decommissioning phase | • Permit from KURA/ KeRRA  
• Engineer’s inspection of repaired road sections  
• Complaints from the local community                                                                | Proponent’s cost |
<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Mitigation/ Enhancement Measures</th>
<th>Responsibility</th>
<th>Monitoring means / Frequency</th>
<th>Verifiable Indicators</th>
<th>Estimated Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact on Socio-Economic Activities</td>
<td>• Notification to local community members whose farms have encroached on the reserve will be notified of pending decommissioning activities</td>
<td>proponent</td>
<td>Before the decommissioning phase</td>
<td>• Complaints from the local community during decommissioning activities</td>
<td>No direct costs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>anticipated</td>
</tr>
</tbody>
</table>
| Loss of Flora and Fauna                              | • The proponent shall ensure minimal clearing of vegetation  
• Transportation of decommissioning wastes to be done through the existing local roads  
• Sensitization of decommissioning workforce on environmental conservation and ecological protection  
• Re-vegetation of cleared areas with indigenous vegetation species                                                                                                                                                   | Proponent/ Contractor  | Routine inspections          | • No. and type of vegetation cleared  
• No. and type of indigenous species re-plant  
• Size of area cleared  
• Size of area re-vegetated                                                                                                                                                                                      | Routine project activity |
| Increased Vehicular and Human Traffic                | • Transportation of decommissioning wastes to specific sites will be done through the existing local roads  
• The contractor will rehabilitate the local roads that will be damaged during decommissioning activities                                                                                                           | Contractor             | Routine inspections          | • No. of accidents involving project vehicles  
• Transportation control logs  
• No. of road spots rehabilitated  
• Community complaints                                                                                                                                                                                               | Routine project activity |
<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Mitigation/ Enhancement Measures</th>
<th>Responsibility</th>
<th>Monitoring means / Frequency</th>
<th>Verifiable Indicators</th>
<th>Estimated Costs (Kshs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation of solid and liquid waste</td>
<td>• Consultation with the local communities on planned road diversions</td>
<td>Contractor</td>
<td>Throughout decommissioning phase</td>
<td>• Presence/ absence of scattered solid wastes at sites</td>
<td>50,000.00</td>
</tr>
<tr>
<td></td>
<td>• Restriction of Vehicular and Human Traffic to the road reserve where possible</td>
<td></td>
<td></td>
<td>• Availability of waste receptors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Sensitization of drivers to comply with prescribed speed limits</td>
<td></td>
<td></td>
<td>• No. of sensitization meetings held with workers</td>
<td></td>
</tr>
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<td></td>
<td>• Provision of solid waste collection facilities (waste bins)</td>
<td></td>
<td></td>
<td>• Evidence of oil leaks and greases on site</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Contracting licensed solid waste handlers</td>
<td></td>
<td></td>
<td>• Evidence of waste water flowing through local drainage channels</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Sensitization of construction workers on proper disposal of solid wastes</td>
<td></td>
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<tr>
<td></td>
<td>• The contractor will maintain all site vehicles and equipment to a serviceable state.</td>
<td></td>
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<td></td>
<td>• Oils and greases emanating from repair and maintenance activities will be collected in containers to avoid entry into local drainage channels</td>
<td></td>
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<td></td>
<td>• Water from cleaning of equipment will be utilised within the project site and will not be discharged into water courses.</td>
<td></td>
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</tr>
<tr>
<td>Potential Impact</td>
<td>Mitigation/ Enhancement Measures</td>
<td>Responsibility</td>
<td>Monitoring means / Frequency</td>
<td>Verifiable Indicators</td>
<td>Estimated Costs (Kshs.)</td>
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</tr>
<tr>
<td>Health and Safety</td>
<td>• Continuous supervision of occupational, health and safety management to ensure compliance</td>
<td>Proponent/contractor</td>
<td>• Routine Inspection</td>
<td>• HSE inspection reports</td>
<td>70,000.00</td>
</tr>
<tr>
<td></td>
<td>• Occupational Safety and Health Training for contractor’s staff</td>
<td></td>
<td>• Throughout decommissioning phase</td>
<td>• Training reports</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Orientation talks and visits</td>
<td></td>
<td>• At employment of new staff</td>
<td>• Training attendance sheets</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Toolbox talks</td>
<td></td>
<td>• On a daily basis</td>
<td>• Orientation report</td>
<td></td>
</tr>
</tbody>
</table>

Grand-Total of Cost Estimates 12,000,000.00
CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusion
Based on the findings, it is evident that rehabilitation, construction and operation of the proposed irrigation project will result in overall economic growth and development of a result as improvement in the availability of water for agricultural use within the project area. As it is indicated in chapter nine, 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.

The water diversion and intake works will be constructed across a river valley with minimal destruction to the environment. Any destroyed vegetation and trees will be planted elsewhere through massive afforestation activities to protect the intake works catchment. Many people are also likely to benefit from the project and the agricultural improvement anticipated will lead to improved food security not only within the area but across the region and Nationally. No conflict between domestic and irrigation water since we envisage to harvest flood water.

9.2 Recommendations
The following should be observed:

- Ensure minimum destruction of vegetation especially at the water diversion and intake works for the scheme. If possible, all project–related activities should be done within the designated project alignment areas.
- Rehabilitate quarries, borrow and gravel pits to avoid potential health hazards.
- Replant bare areas within the vicinity of the intake works with vegetation cover to prevent soil erosion. This should also be done along the river valleys to help in ensuring that siltation of water courses from the anticipated increased agricultural activities are mitigated.
- Ensure that both construction and agricultural worker’s occupational health and safety standards are maintained through capacity building, proper training on protection, clothing and managing their residential camps up to the required health standards. The proponent, project beneficiaries and the contractor therefore need to ensure all the workers wear safety gears/clothing like gas masks while in dusty working areas. Use of earmuffs must also be ensured by the contractor especially for the people working in areas where the noise level is high.
- Annual environmental audits should be carried out on the project in order to ensure compliance of the project with the mitigation measures outlined in the ESMP. To ensure that the impact on the environment can be completely minimized, a monitoring and training activity should be carried out as outlined in the report.
- The design and the quality of construction of the abstraction works need to be strictly controlled to ensure maximum life of the works in order to get value for money from the investment. All activities concerning construction and maintenance such as, work execution, site inspection and material testing, shall be strictly monitored by an engineer or a designated official. This is important to ensure
the quality of maintenance works. Engineers and/or designates official shall be trained and experienced enough to judge the appropriateness of the work executed in order to carry out the monitoring properly.

- There is need for strengthening and promotion of the role of community groups, women and youth to fully participate in health, sanitation, water resources and environmental management and conservation.

- Strengthen various water testing laboratories within the project area through the provision of adequately trained personnel and necessary laboratory equipment. These would in turn strengthen field operations especially water quality monitoring. The laboratories should also research into suitable technologies to support standards on drinking water, effluent discharge and solid waste disposal and waste water management.
REFERENCES

Agriculture Act (Chapter 318 of the Laws of Kenya)


Controlled Substances Regulations, 2007 (Legal Notice No.73 of 2007)

Design manual for small dams and pans in Kenya 1992


Environmental Management and Co-ordination Act, 1999 (EMCA)


Land (Group Representatives) Act (Chapter 287 of the Laws of Kenya)

Land Adjudication Act cap 95

Legal Notice No. 101: The Environmental (Impact Assessment and Audit) Regulations, 2003


National Biodiversity Strategy Action Plan

National Poverty Eradication plan. Government printers, Nairobi 1999:


Physical Planning Act (Cap. 286)


Sessional Paper No. 6 of 1999 on Environment and Development

Sessional Paper No. 6 of 1999 on Environment and Development.


The Antiquities and Monuments Act 1983 cap 215

The Employment Act, 2007

The Environment (Impact Assessment and Audit) Regulations 2003

The Environmental (Impact Assessment and Audit) Regulations. Kenya Gazette Supplement No. 75 of 14th Sep, 2003

The Environmental Management and Co-ordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006

The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009

ANNEXES

11.1 Annex 1: Minutes of Public Consultation meetings (including list of stakeholders)

MINISTRY OF AGRICULTURE, LIVESTOCK, FISHERIES & CO-OPERATIVES

STATE DEPARTMENT OF CROP DEVELOPMENT AND AGRICULTURAL RESEARCH

Program to Build Resilience for Food and Nutrition Security in the Horn of Africa - Kenya

Minutes for Public Baraza meeting held for the proposed Kakimera Micro-irrigation Project in Turkana County on the 17th March 2022.

Present.

A team of members as indicated below conducted public participation

(i) PCU - Project coordination unit. (Desk Officer)
(ii) EIA – Environmental Impact Assessment Expert.
   - CCU – County Coordination Unit – Department of Agriculture
(iii) Community Members (as per the attached list)

1. Introduction.
   - The public baraza was called to order by the village admin at 14:00HRS with a word of prayer from Village admin Jared Chegem.
2. Purpose of the meeting.
   - The EIA experts explained to the community the purpose of the meeting, which was to inform them about the project ESIA so that they can identify key issues that would arise from the project implementation and provide them with an opportunity to raise their concerns.
3. Presentation by the EIA consultants.

The EIA team emphasized on the importance of public participation. The team also emphasized on the need to conduct a study to establish the negative and positive impacts of the project to the affected community. The following highlights were particularly reaffirmed:

- The local community would be completely involved via the committee members elected by the community.
- Study will explore all possible impacts by the project
- The report shall present all mitigation measures for the impacts.

The expert pointed out some of the positive impacts from the project as Employment opportunities for the local community members during the construction phase, increased revenues and increased safety of the area because the market will be well lit.
Key Issues Arising from Public Participation Meetings

The consultant held a public consultative meeting (barazais) with the community in conjunction with the proponent and the administration

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

Perceived Benefits

(i) 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.

(j) Irrigated agriculture will contribute to enhanced food security and improved nutrition at the household level. This will alleviate the negative impact of erratic and unreliable rainfall pattern on the community’s productive resources.

(k) Income diversification strategy; Investment in irrigation development is a strategy in reducing risks associated with rainfall variability and achieving food security.

(l) Employment opportunities will be offered to the construction workers and any other person who will be hired to provide her/his services during the 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.

(m) The irrigation scheme will also play a role in reduction of idleness particularly amongst the youth due to an increase in income generating activities both directly or indirectly.

(n) The standard of living of the community especially vulnerable beneficiaries (elderly, female headed households and children) since there will be a reduction in distances traveled and time spent in search of water and time on agriculture. Therefore playing a significant role in income generation and increasing food and nutritional security amongst the vulnerable households.

(o) By providing direct and indirect local employment, the project will ease the direct resource dependency pressures on forest and forest resources.

(p) Reduced poverty levels through increased incomes and improved livelihoods resulting from construction of the proposed project and maintenance employment and consumption from the local markets, emergence of other associated economic opportunities and activities.

Issues and Concerns

i) Inadequate water for farmers far away from the water source, the community expressed concern over water distribution and rationalization. The project management will put in place mechanisms to enable all to access water in compliance with regulations.
j) Health risks associated with increased incidences of mosquito and malaria borne diseases due to increased breeding sites. This would be mitigated through capacity building of the community on mosquito preventive and control measures.

k) Lack of marketing strategy and infrastructure for products; currently farmers do not have a crop storage and marketing plan. There is an urgent need for scheme beneficiary farmers to develop collaborative and effective marketing strategies to access larger and more sustainable markets.

l) Lack of adequate knowledge in irrigation; the community in the project area have limited knowledge on irrigation crop development. This could be attributed to limited knowledge and lack of irrigation crop production skills, tillage services, fertilizer, seed, chemicals and operation of irrigation equipment and management.

m) Damage of road infrastructure that is currently being developed during transportation and haulage of construction materials to project sites.

n) Clearing of vegetation during construction phase, this would be addressed through reforestation programs and sparing of indigenous trees during the clearing process.

o) The potential for pesticide and agro-chemical residues getting into the aquatic resources as the agricultural activities intensifies

p) Lack of credit especially for irrigation purposes to enable farmers to 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.

All the respondents had a strong conviction on the key benefits they would have from the proposed project. This is mainly associated with 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 and feasibility of demand. Equally, most respondents were willing to pay for the services associated with the project. Projects have operation costs and initial capital needs to be recouped after a certain duration. These are fundamental aspects that 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 success.

Adjournment

There being no other business, over, one member of the community gave a vote of thanks to the team and also further thanking the entire organizers of the proposed project. The meeting ended with a word of prayer.
11.2 Annex 2: Public Participation Attendance List
## ATTENDANCE LIST

**Activity:** Kakimera Micro Irrigation Scheme in Turkana County  
**Date:** 17/03/2022

<table>
<thead>
<tr>
<th>S/NO.</th>
<th>NAME</th>
<th>GENDER</th>
<th>ORGANIZATION</th>
<th>EMAIL/PHONE NUMBER</th>
<th>SIGNATURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Francis Ekidor</td>
<td>M</td>
<td>Kakimera Community</td>
<td>0724861510</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Musa Louren Ekiru</td>
<td>M</td>
<td>MEMBER</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Everline Nakoi</td>
<td>F</td>
<td>MEMBER</td>
<td>0792723988</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Chrisine Napoetok</td>
<td>F</td>
<td>MEMBER</td>
<td>0705828531</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>William Ekidor</td>
<td>M</td>
<td>MEMBER</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Samson Ekiti</td>
<td>M</td>
<td>MEMBER</td>
<td>0741696257</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Dinyo Topus</td>
<td>M</td>
<td>MEMBER</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Anna Nkur</td>
<td>F</td>
<td>MEMBER</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>George Esken</td>
<td>M</td>
<td>MEMBER</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Rebecca Kariu</td>
<td>F</td>
<td>MEMBER</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Nasirion Louren</td>
<td>F</td>
<td>MEMBER</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Paulina Amekui</td>
<td>F</td>
<td>MEMBER</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Njoror Jackson</td>
<td>M</td>
<td>MEMBER</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Emerson Ngauken</td>
<td>F</td>
<td>MEMBER</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Nirol Amekui</td>
<td>F</td>
<td>MEMBER</td>
<td>N/A</td>
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<tr>
<td>S/NO.</td>
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<td>GENDER</td>
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<tr>
<td>16</td>
<td>AKAM NG'UKON</td>
<td>F</td>
<td>MEMBER</td>
<td>N/A</td>
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</tr>
<tr>
<td>17</td>
<td>ALICE LOKURA</td>
<td>F</td>
<td>MEMBER</td>
<td>N/A</td>
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<td>18</td>
<td>DORCAS ASINYEN</td>
<td>F</td>
<td>MEMBER</td>
<td>N/A</td>
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<tr>
<td>19</td>
<td>FREDICK MUYA</td>
<td>M</td>
<td>SECRETARY</td>
<td>0719322729 <a href="mailto:munya@kakimera.co.ke">munya@kakimera.co.ke</a></td>
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<td>20</td>
<td>THOKO MUGI</td>
<td>M</td>
<td>EIA-Exper.</td>
<td>0725631031</td>
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<td>21</td>
<td>HILLARY SUSA</td>
<td>M</td>
<td>CFT-Irr.</td>
<td>0724772548</td>
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<tr>
<td>22</td>
<td>DAVID SIKI</td>
<td>M</td>
<td>N/A</td>
<td>davidewang'<a href="mailto:wajuma@kakimera.co.ke">wajuma@kakimera.co.ke</a></td>
<td></td>
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</tbody>
</table>
11.3 Annex 3: ESIA/EA license.

M/S Mwangi Simon Thuku
(individual or firm) of address
P.O. Box 14057 - 00400, Nairobi

is licensed to practice in the
capacity of a (Lead Expert/Associate Expert/Firm of Experts) Lead Expert
registration number 7772
in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: 1/18/2022
Expiry Date: 12/31/2022

Signature

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001:2015 Certified
11.4 Annex 4: Site Layout Plan/Drawings
11.5  Annex 5: E&E Field Assessment Questionnaires
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT QUESTIONNAIRE

PROPOSED: Kakimera Micro Irrigation Scheme in Turkana County

Pursuant to the provisions of the Environmental Management and Coordination Act Cap 387 Environmental Impact Assessment (EIA) and Audit (EA) Regulation 2003, Public Health Act and Legal Supplement 2003, a social site assessment for EIA is being conducted on the proposed project.

**RESPONDENT**

Name: [Name]

County: [County]

Sub County: [Sub County]

Ward: Kakimera

Mobile No: [Mobile No]

(Please note that these details are required for the purposes of authenticity in relation to the proposed project)

1. Do you support the proposed project in the area? Yes [ ] No [ ]

2. Do you think the proposed project is suitable and compatible with the surrounding developments? Yes [ ] No [ ]

3. Within this area, are there similar projects? Yes [ ] No [ ]

4. What are some of the positive environmental and socio-economic impacts you can attach to this project? (suggest enhancement measures for the identified impacts)
   
   (i) During Construction Phase
   
   (1) [Comments]

   (ii) During Operation Phase
   
   (1) [Comments]

5. What are some of the negative environmental and socio-economic impacts you can attach to this project? (suggest mitigation measures for the identified impacts)

   (i) During Construction Phase
   
   (1) [Comments]

   (ii) During Operation Phase
   
   [Comments]
(1) Attack by domestic animals on farm crops and livestock keeps...

6. In your general opinion should the proposed project be implemented/allowed to proceed? Tick one
   
   Yes( ) No( )

7. Any other comments/suggestions you would like to make in relation to this proposed project.
   
   All stakeholders to be involved to ensure success especially community members.

Signature ___________________________ Date: 17/03/2022

THANK YOU FOR YOUR RESPONSE.
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT QUESTIONNAIRE

PROPOSED:  ...Kakimera Micro Irrigation Scheme in Turkana County...

Pursuant to the provisions of the Environmental Management and Coordination Act Cap 387 Environmental Impact Assessment (EIA) and Audit (EA) Regulation 2003, Public Health Act and Legal Supplement 2003, a social site assessment for EIA is being conducted on the proposed project.

RESPONDENT

Name: Frederick Muya
County: Turkana
Sub County: Turkana Central
Ward: Kanamkena
Mobile No.: 0719322279

(Please note that these details are required for the purposes of authenticity in relation to the proposed project)

1. Do you support the proposed project in the area? Yes (✓) No (  )
2. Do you think the proposed project is suitable and compatible with the surrounding developments? Yes (✓) No (  )
3. Within this area, are there similar projects? Yes (✓) No (  )
4. What are some of the positive environmental and socio-economic impacts you can attach to this project? (suggest enhancement measures for the identified impacts)
   (i) During Construction Phase
      - Project will create job in the community members during construction.
      - Locally available materials will get market

   (ii) During Operation Phase
      - Community members will be involved in agricultural activities hence food availability
        for consumption and sell
      - Availability of enough water for farming and domestic consumption.

5. What are some of the negative environmental and socio-economic impacts you can attach to this project? (suggest mitigation measures for the identified impacts)
   (i) During Construction Phase
      - Displacement of grazing areas for livestock. Need to have proper fencing to avoid conflicts

   (ii) During Operation Phase
      - It will attract security concerns. Properties like solar and other materials will require security to avoid them being stolen by thieves.
      - Training required on skills for farming and future sustainability.
6. In your general opinion should the proposed project be implemented / allowed to proceed? Tick one
   Yes (✓)               No (  )

7. Any other comments/suggestions you would like to make in relation to this proposed project.
   TSCA Community members on importance of the project. They need to own the project for their future.

Signature ___________________ Date 17.03.2022

THANK YOU FOR YOUR RESPONSE
ENVIROMENTAL AND SOCIAL IMPACT ASSESSMENT QUESTIONNAIRE

PROPOSED Kakimera Micro Irrigation Scheme in Turkana County

Pursuant to the provisions of the Environmental Management and Coordination Act Cap 387 Environmental Impact Assessment (EIA) and Audit (EA) Regulation 2003, Public Health Act and Legal Supplement 2003, a social site assessment for EIA is being conducted on the proposed project.

RESPONDENT
Name: [redacted]
County: Turkana
Sub County: Turkana Central
Ward: Kamum Kemer
Mobile No: 07269 527264

(Please note that these details are required for the purposes of authenticity in relation to the proposed project)

1. Do you support the proposed project in the area? Yes [ ] No [ ]

2. Do you think the proposed project is suitable and compatible with the surrounding developments? Yes [ ] No [ ]

3. Within this area, are there similar projects? Yes [ ] No [ ]

4. What are some of the positive environmental and socio-economic impacts you can attach to this project? (suggest enhancement measures for the identified impacts)

   (i) During Construction Phase
      1. Improved economy due to circulation of money in the area.

   (ii) During Operation Phase
      1. Improved nutrition among the beneficiaries due to variety of food from farm.
      2. Improved economy resulting from food sold.

5. What are some of the negative environmental and socio-economic impacts you can attach to this project? (suggest mitigation measures for the identified impacts)

   (i) During Construction Phase
      1. Loss of indigenous trees

   Mitigation: Selective tree clearing.

   (ii) During Operation Phase


6. In your general opinion should the proposed project be implemented / allowed to proceed? Tick one

- Yes (✓)
- No ( )

7. Any other comments/suggestions you would like to make in relation to this proposed project.

- Intensive training on farmers to cascade sustainability...

Signature: ___________________________ Date: 17/03/2022

THANK YOU FOR YOUR RESPONSE
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT QUESTIONNAIRE

PROPOSED: Kakimera Micro Irrigation Scheme in Turkana County

Pursuant to the provisions of the Environmental Management and Coordination Act Cap 387 Environmental Impact Assessment (EIA) and Audit (EA) Regulation 2003, Public Health Act and Legal Supplement 2003, a social site assessment for EIA is being conducted on the proposed project.

RESPONDENT
Name: Jackson E. Kider
County: Turkana
Sub County: Kianjakono
Ward: Kianjakono
Mobile No: 0721432823

(Please note that these details are required for the purposes of authenticity in relation to the proposed project)

1. Do you support the proposed project in the area? Yes( ) No( )

2. Do you think the proposed project is suitable and compatible with the surrounding developments?
   Yes( ) No( )

3. Within this area, are there similar projects? Yes( ) No( )

4. What are some of the positive environmental and socio-economic impacts you can attach to this project? *(suggest enhancement measures for the identified impacts)*
   (i) During Construction Phase
   The following we need are: Tools, fencing the garden. Some small animals like damage the seeds. So far we needed some fines for killing them.

   (ii) During Operation Phase
   We need in-plant security, fencing, seed for work and self-employment for youth working in the area.

5. What are some of the negative environmental and socio-economic impacts you can attach to this project? *(suggest mitigation measures for the identified impacts)*
   (i) During Construction Phase
   The problems that we faced during farming insecurity, theft, animal damages.

   (ii) During Operation Phase


We create the self-employment units for farmers to dig the trenches in good ways with good arrangement.

6. In your general opinion should the proposed project be implemented/allowed to proceed? Tick one
   Yes (✓)  No ( )

7. Any other comments/suggestions you would like to make in relation to this proposed project.
   "Thank God for giving us energy for ploughing our farmland."

Signature........................................... Date. 17/03/2022

THANK YOU FOR YOUR RESPONSE
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT QUESTIONNAIRE

PROPOSED: Kakimera Micro Irrigation Scheme at Nakoin Unit

Pursuant to the provisions of the Environmental Management and Coordination Act Cap 387 Environmental Impact Assessment (EIA) and Audit (EA) Regulation 2003, Public Health Act and Legal Supplement 2003, a social site assessment for EIA is being conducted on the proposed project.

RESPONDENT
Name: David Ruyai Lokwol
County: Turkana
Sub County: Kapoita
Ward: Kanam Kember
Mobile No.: 0702295284

(Please note that these details are required for the purposes of authenticity in relation to the proposed project)
1. Do you support the proposed project in the area? Yes ✓ No ( )
2. Do you think the proposed project is suitable and compatible with the surrounding developments? Yes ✓ No ( )
3. Within this area, are there similar projects? Yes ( ) No ( )
4. What are some of the positive environmental and socio-economic impacts you can attach to this project? (suggest enhancement measures for the identified impacts)
   (i) During Construction Phase
      Dust cloud pollution
      Destruction of trees (loss of trees)

   (ii) During Operation Phase
      Conflict at farm ownership

5. What are some of the negative environmental and socio-economic impacts you can attach to this project? (suggest mitigation measures for the identified impacts)
   (i) During Construction Phase
      Sprinkling of water to prevent dust working during the day

   (ii) During Operation Phase
      Registration of land
      Conflict resolution enhancement
6. In your general opinion should the proposed project be implemented / allowed to proceed? Tick one
   Yes (√)       No ( )

7. Any other comments/suggestions you would like to make in relation to this proposed project.
   The project will improve livelihood in the community through farming and enhance household income

Signature: ___________________________ Date: 17th March 2022

THANK YOU FOR YOUR RESPONSE
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT QUESTIONNAIRE

PROPOSED: Kakimera Micro Irrigation Scheme in Turkana County
April 2022

Pursuant to the provisions of the Environmental Management and Coordination Act Cap 387 Environmental Impact Assessment (EIA) and Audit (EA) Regulation 2003, Public Health Act and Legal Supplement 2003, a social site assessment for EIA is being conducted on the proposed project.

RESPONDENT
Name: Christine Napayek
County: Turkana
Sub County: Turkana Central
Ward: Karaukembei
Mobile No: 0777873765

(Please note that these details are required for the purposes of authenticity in relation to the proposed project)

1. Do you support the proposed project in the area? Yes No

2. Do you think the proposed project is suitable and compatible with the surrounding developments? Yes No

3. Within this area, are there similar projects? Yes No

4. What are some of the positive environmental and socio-economic impacts you can attach to this project? (suggest enhancement measures for the identified impacts)

   (i) During Construction Phase

      Income from...Casual labour.

   (ii) During Operation Phase

      Solution to hunger as families would have food
      Benefits...would be easy.
      Service...income...due to...sale & crops.

5. What are some of the negative environmental and socio-economic impacts you can attach to this project? (suggest mitigation measures for the identified impacts)

   (i) During Construction Phase

      Cutting...would attract...conflict
      between...livestock...keepers...and...spear...farms.

   (ii) During Operation Phase
6. In your general opinion should the proposed project be implemented/allowed to proceed? Tick one.

- Yes
- No

7. Any other comments/suggestions you would like to make in relation to this proposed project.

The government should supervise every step to enable success through LES.

Signature: ____________________________  Date: 17.03.12022

THANK YOU FOR YOUR RESPONSE
11.6 Annex 6: Filled Environmental and Social checklist for the subproject
11.7 Annex 7: Community Land Resolution Form