

**ENVIRONMENTAL IMPACT ASSESSMENT PROJECT REPORT FOR THE
PROPOSED MIRUKA WATER PAN IN SIAYA COUNTY.**



FEBRUARY 2019

Declarations

I,-----on behalf of Kenya Climate Smart Agriculture Project, submit this Environmental Impact Assessment (EIA) Project Report, for the Proposed rehabilitation of Miruka water pan Project The EIA Project has been carried out in accordance with the Environmental Management and Coordination Act, 1999 CAP 387 and the Environmental (Impact Assessment and Audit) Regulations, 2003.

Signature: : -----

Designation: EIA/AUDIT LEAD EXPERT REG. NO.-----

I.....on behalf of Kenya Climate Smart Agriculture Project, submit this Environmental Impact Assessment (EIA) Project Report for the Proposed Construction of Miruka water pan Project.

Signed at _____ this _____ Day of _____ 2019

Signature

Designation:

Acronyms

EIA	Environmental Impact assessment
EMCA	Environmental Management Coordination Act
EMP	Environmental Management Plan
GOK	Government of Kenya
LVSWSB	Lake Victoria South Water Services Board
Mm	Millimeters
NEMA	National Environment Management Authority
WHO	World Health Organization
WRMA	Water Resources Management Authority
WSB	Water Service Board
KCSAP	Kenya Climate Smart Agriculture Project
CPC	County Project Coordinator
PMA	Pan Management Committee
KFS	Kenya Forest Service

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EXECUTIVE SUMMARY

In the commitment to protect the environment and also recognizing the requirements of the government of Kenya on the fulfillment of Environmental Impact Assessment and regulations, Kenya Climate Smart Agriculture Project (KCSAP) Siaya County, engaged experts in carrying out an environmental impact assessment report for proposed Miruka water pan in Bondo sub county.

The report presents the assessment findings in accordance with the Environmental Management and Coordination Act (EMCA) Cap 387, Environmental (impact assessment and audit) regulations and the EIA and audit guidelines. The EIA Assessed the baseline environment condition and predicated the possible negative impacts and mitigation measures and an environmental management plan for the proposed project.

The objective of the Environmental Impact Assessment study is to ensure that sustainable development happens within the project implementation.

To adequately address the environmental issues emanating from the implementation of the proposed project, the team of experts carried out environmental and social screening for the project which was followed by the Environmental and Social Impact study. The latter comprised mobilization, liaison and stakeholders consultations, a scoping exercise, desk and field studies, data analysis, impact assessment, and analysis of health and safety issues associated with the proposed project.

Further it has highlighted the relevant legislation for the project and documented evidence based baseline data on the project. The measures proposed herein in the report need to be implemented to enhance sustainable utilization of our environment. It is hereafter reinforced that Project specifications, guidelines, licenses and permits must be in possession of the contractor and the proponent prior to commencement of construction. Through regular safety meetings, all water pan construction employees and contractors working in the project will have to be made aware of these documents and their contents.

The study findings show that the negative environmental impacts are minimal both in magnitude and scope. These impacts include: risk of spread of malaria and other water

borne diseases and loss of vegetative cover. The potential negative impacts of the project are low and easy to mitigate, therefore they should not prevent the project from proceeding.

Moreover the water pan project will lead to community access to water and improved food security at household level, the few negative impacts identified have been adequately mitigated through diverse measures proposed in the EMP and thus we recommend that the project be considered for an EIA clearance and subsequent implementation.

1 INTRODUCTION

This Environmental Impact Assessment is carried on the behalf of Kenya Climate Smart Agriculture Project (KCSAP), Siaya County .The KCSAP who is the proponent wish to rehabilitate a water pan in Ogago C Village, Bar Kowino Sub Location, North Sakwa Ward in Bondo Sub County.

The proposed project seeks to ensure Security, create employment and generate income to the community of Ogago C.

1.1 Project Objectives

The project aims at ensuring food security, employment creation and generation of income to Ogago C community members.

The project also anticipates the following:

- i. Reduced surface water run off through harvesting of excess rain water
- ii. Protection and conservation of soil from degradation
- iii. Sustainable crop and livestock production throughout all seasons of the year and to provide a harmless (environmental) mode of aquatic protein production.
- iv. Increase the resilience through sustainable agricultural production
- v. Enhanced carbon sequestration through incorporation of agro forestry around the Dam.

1.2 EIA Objectives

(KCSAP) conducted this EIA in order to comply and fulfill health, safety and environmental standards ,the applicable laws and regulations in Kenya

1.3 Scope

The Environmental Impact Assessment covered the proposed project site and to larger extent the catchment area for the Miruka water pan.

It focused on the following

1. Describing nature of the project ,location and rationale
2. Describing the pertinent policies, legislation regulation
3. Identification positive or negative environmental impacts of the project
4. Propose environmental mitigation plan to minimize those negative impacts

5. Conduct a public participation exercise during the process
6. Develop Environmental management plan (EMP)

1.4 Terms of Reference for EIA

This EIA was carried out in accordance with the stipulations of Legal Notice No. 101, the Environmental Impact Assessment and Audit Regulations; 2003. This is the Legislative supplement to the Environmental Management Coordination Act, CAP 387 and was produced on June 13, 2003.

The analysis includes the following;

1. To collect baseline socio economic data of the project area and potential impact expected from the project construction, implementation and operation phases of the project.
2. To review existing policy, legal and institutional framework and environmental management as relates to the water pan project
3. To identify and contact stakeholders ,plan and undertake stakeholders and public consultation at appropriate time and places
4. To conduct interviews through the community participatory process
5. To identify and analyze project alternatives in terms of siting technology and materials among variables that maybe necessary
6. To develop mitigation measures and cost estimates from all the identified negative impacts of the project
7. To design and environmental and social management plan(including cost estimates) and a monitoring programme for the identified negative environmental and social impacts and describe how this plan shall be implemented (how, when, who ,where)
8. Review the water pan design and its compliance to national and international environmental requirements and standards.
9. To gather and provide any other data and information that will be useful or may be required for EIA by NEMA

10. To prepare 5 copies of EIA project and one soft copy (in CD Rom) for onward transmission to NEMA as provided for under EIA and EA regulations (2003)

1.5 Methodology and approach

1.5.1 over view

In executing the EIA the proposed project area and the surrounding catchment were assessed Literature review of the project site has been done and review of Environmental management and coordination act guidelines and related policies, various reports and reference material on physical and biological data have been consulted.

During the field investigations, pre-visit survey was conducted on the proposed site and the catchment area in order to have general overview of the project location, the community and other stakeholders. The foregoing groups gave valuable information through interviews and questionnaires administered during the public participation process.

1.5.2 Field work approach

The field work carried out was separated into three phases. This was to allow for systematic approach to predict the potential impacts and mitigation measures the phases included:

- Pre survey visit and desktop study
- Focused group discussions
- Questionnaire administration

1.5.3 Phase 1 pre-visit survey and desktop study

The survey was conducted within the proposed site and immediate catchment area and observations were made .The destop study involved literature review and study of past reports and baseline information

1.5.3.1 Phase two: Group discussions

The relevant stakeholders, beneficiaries , local administrators and opinion leaders held focused group discussion where they informed about the project by the proponent and their views on the possible impacts were collected with possible mitigation measures.

1.5.3.2 Phase three

A socio impact questionnaire was administered to the proponent , local administration and the surrounding community to collect socio economic impact. A total of 20 questionnaires were issued

2 ENVIRONMENTAL BASELINE CONDITION

2.1 Background Information on the Project Area

The Sub county was carved out of the original Siaya District in 1998. In 2007 the Sub county was further sub divided into Bondo and Rarieda Sub counties. The Sub county has a total area of 1,328. Km² of which 577 km² is land surface, while 751 km² is under Lake Victoria. It borders Siaya and Busia sub countys to the North – West, Rarieda Sub countys to the East and Suba Sub countys across the Lake on the South – East, to the West lies the Republic of Uganda. Bondo sub county lies between Long: -0.099622S Lat: 34.283932E Alt: 1241M ASL

2.2 Administrative and Political units

The sub county has a total of three divisions, namely; Nyang’oma, Maranda and Usigu. The divisions are further divided into eleven locations and twenty six sub-locations. The sub county has only one constituency i.e. Bondo constituency with thirteen Council Wards. Six of the wards are found within Bondo town council while the remaining seven are in Bondo county council.

Table 1: Administrative Unit by Area

Division	Area (Km ²)	Location	Sub- Location
Maranda	205	4	9
Nyang’oma	185	2	7
Usigu	187	5	10
Total	577	11	26

Source: Sub county Commissioner, Bondo, 2008

BONDO DISTRICT ADMINISTRATIVE UNITS

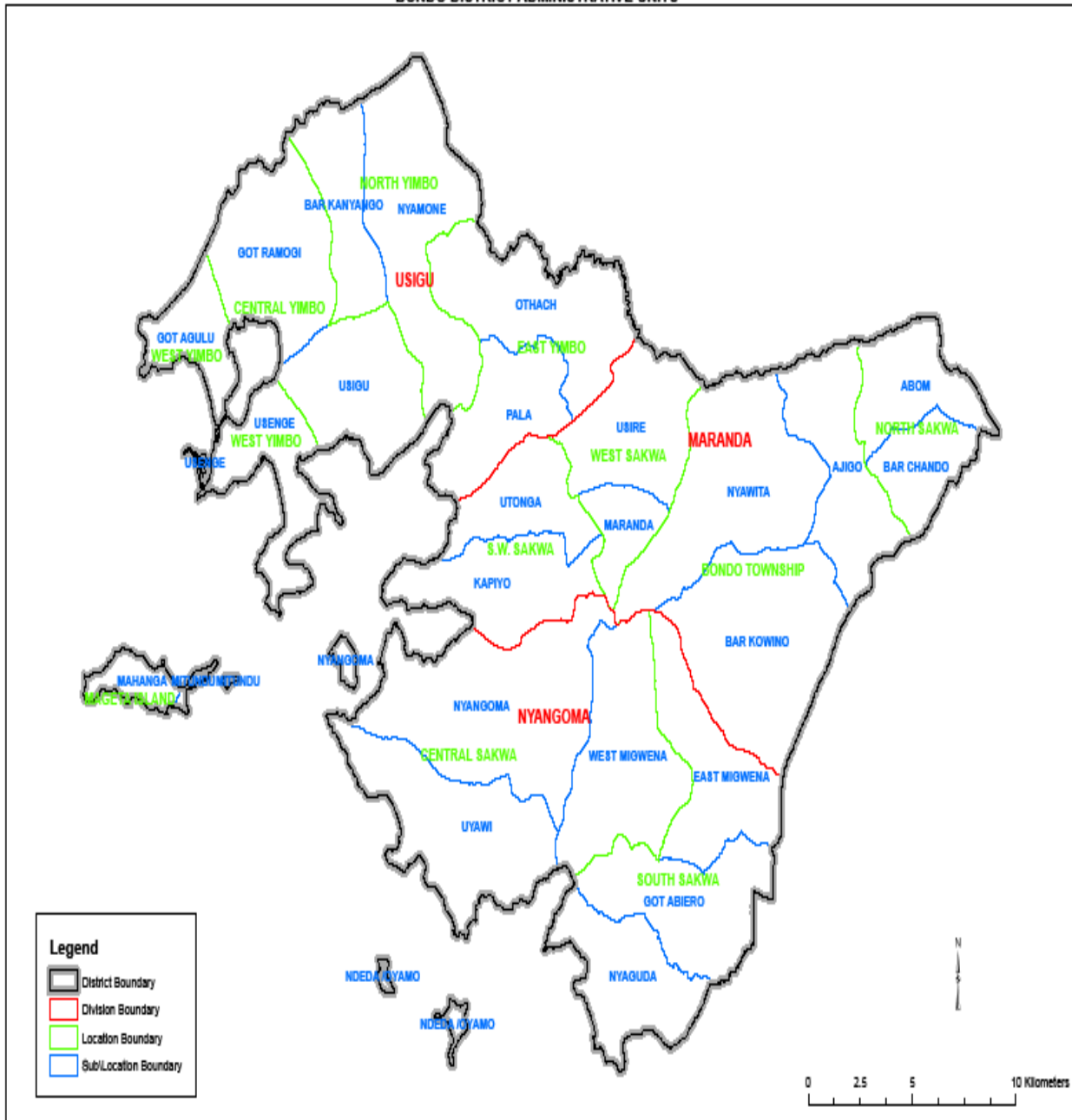


Figure 1 : Map of Bondo Sub County showing administrative boundaries

2.2 Topography

Topographically, the sub county is divided into scattered highlands such as Got Ramogi and Usenge in Usigu division, Got Abiero and Sirafuongo in Nyang'oma division, lowlands of Yala Swamp and Uyoma Plains. These result into differences in relief, soils and land use. These features give rise to altitudes ranging between 1140m and 1400m above the sea level. The oldest exposed volcanic rocks such as basalt, elite and rhyolite cover the sub county geologically. Others include intrusive of post Nyanzanian/preKavirondian age. In Uyoma Peninsula are found tertiary volcanoes consisting of the nepheline lava agglomerates.

2.3 Climatic Conditions

The sub county has a modified equatorial climate with strong influence from local relief and the expansive lake, which influence rainfall amounts and distribution. Predominantly, the sub county has warm, dry and humid climate with mean annual rainfall ranging between 800-1600 mm on bi-modal rainfall pattern of long rains occurring between March and May and short rains occurring between October and November. Temperatures too vary with mean of 22.5°C and evaporation varies between 2000 mm and 2200 mm annually.

2.4 Hydrological Systems

Despite bordering the largest fresh water lake in the region, the sub county often experiences water scarcity. The major water supplies in the sub county includes: Bondo Water Supplies and South Sakwa, Olango- Akoko- beka- Nyangoma; Usigu- Wambasa and Penwa Water projects in rural areas. In addition, these water supplies are supplemented by shallow wells which include Magak, Midago and Rambogo shallow wells. Some of the existing water pans includes Kolango; Mabiju; Nyaera; Kothach; Kogola; Konyieng; Kodido; Ogenya; Kobom; Kobuoga; Heka; Tinga; Kochola; Apuodo; and Kotenga Water pans. There is still need for expansion of water supply systems in addition to desilting the existing dams like Ouya dam, Anyuongi, Gologolo, Aredo, Nyaguda, Kusura, Got abiero, Maranyona, East migwena, among others

In the southern part of Bondo Sub county a rural water supply was constructed by the Catholic Church more than 20 years ago: the South Sakwa Water Supply Scheme. It has an intake at Olago Beach including treatment works, a rising main to the storage reservoir on top of Serafwongo Hill, from where an extensive distribution network supplies many rural centres in South Sakwa Division. Initially it was intended the scheme would also reach Bondo Town, but this was never implemented.

In the northern part of the Sub county, the North Sakwa Water Supply was constructed and completed about 15 years ago, but never actually commissioned due to irregularities. The scheme is now completely abandoned, has been vandalised and nothing much but a few ruins of the intake works are left at the Yala River.

2.5 Geology and Soils

From the geological coverage, the soil types found range between black-cotton, sandy loams and laterites including red volcanic soils in the north.

The sub county has various soil types as highlighted below;

- West Sakwa, South Nyang'oma and Usigu division have ferralsols
- North Sakwa, East and Central Yimbo have luvisols with low-moderate fertility
- Yala Swamp in Usigu division has gleysols, which are water logging, fertile and variable
- Madiany division has fertile and moderately deep Phaeozeous soils
- Nyandiwa valley in South Asembo has valley soils of low fertility.

2.6 Biological Diversity

2.6.1 Flora

Generally, the main vegetation types in Bondo and the surrounding area includes dry woodland and savanna. The woody vegetation is dominated by *Acacia* sp., *Albizzia* sp. and *Butyrospermum* sp., while *Cymbopogon*, *Hyparrhenia*, *Londetia*, *Cyperus* and *Papyrus* constitute herbaceous vegetation. The areas where the pipeline passes are characterised by scattered trees and shrubs, and herbaceous vegetation including several forbs, and grasses. The common tree types are *Acacia* spp, *Catus* and *Euphorbia* among others.



Vegetation at Miruka water pan

2.7 Infrastructure

The sector is comprised of the ministries of roads, transport, energy and housing. Others include, Nairobi metropolitan development, public works and the Kenya wildlife services (roads, airstrips other infrastructure).

On roads, the sub county's main roads include the Akala- Usieko road which is tarmacked and transverses the entire sub county. Others include feeder roads such as: Bondo- Kipasi- Amoyo; Migwena- Wagusu; Wagjusu- Nyaguda; Wagusu- Yimbo; Migwena- Ouya- Wichlum; Koilo- Ludhi roads in Nyagoma division. In Usigu, some of the roads include: Usigu- Jusa; Komugu- Ochuodho; Mago- Got matar and Oele beach- Ugambe beach roads. In Marada, there is also Yala River- Owimbi; Gagra- Ndigwa; maranda- Nango; Kambajo- Utonga beach; Ajingo- Nyawita- Bondo; Ajigo- Yala River; Junction D- Nyamonye and Gobei- Masala. Most of the feeder roads are impassable during rain seasons and requires regular maintenance. Over the years, roads network has improved with the number of kilometres under tarmark.

Rural electrification programmes in the sub county include: Akoko- Liuda- Olago; Nyango- Wagusu; Usege- Jusa; Got matar- Abidha; Nyamoye- Masamba; Odogo- Uhanya beach; in addition to Bondo town and its environs. The rural electrification is being accelerated and currently more than 12 shopping centres and 18 secondary schools are connected to electricity.

2.8 Population

According to the 2008 projected population, the sub county has an estimated population of 144,631 people, where 68,800 are male and 75,831 are female.

The Sub county has witnessed a steady increase in population over the years. Densities are high in urban centres, shopping centres and beaches where there are considerable economic activities and better infrastructural development. The sub county has a population density of 259 persons/ Km². At divisional level, Usigu division has the highest density of 262 persons/ Km² while Nyagoma has the least at 218 persons/ Km². This scenario is attributed to urbanisation, where Usigu having Usenge Urban area has high Population density compared to Nyangoma Division. Again Usigu Division has more economic activities through fishing hence high fertility.

Mageta Island and West Yimbo Locations leads with 695 and 592 persons/Km² respectively. This is due to high economic activities in fishing leading to high fertility. On the other hand South West Sakwa and West Sakwa locations have the lowest density of 104 and 124 persons/ Km² respectively. Again both locations have harsh environmental conditions with erratic rainfall and poor soil types leading to poor Agriculture conditions hence low density. Bondo Town and Usenge are the major urban areas with many activities.

2.9 Economic Activities

2.9.1 Agriculture and Livestock Production

Agriculture contributes 79% to the household incomes. The Agriculture sector in Bondo is predominantly small scale in nature and it accounts for about 80% of the total Agriculture output. Production is carried out on farms averaging 2-3 hectares mainly for subsistence purposes.

The main food crops are maize, sorghum, beans, cassava and sweet potatoes. Where, maize and sorghum are the main staple foods with an annual production of 201,080 bags which is far much below the sub county's consumption requirement of 350,000 bags. The main cash crop is cotton, which the ministry of agriculture has been trying to revive in the last 3 -4 years. Other cash crops like Amaranth and sunflower are also being grown in small scale.

Irrigation based farming is still very limited. The area under irrigation is about 106 Ha while irrigation potential is estimated at 1186 Ha mainly managed by registered groups doing horticultural farming along the lake shore and river Yala. The number of farmers doing irrigation both groups and individuals are 2657.

Farming in the sub county is hindered by a number of constrain such as low utilization of water and efficient water use technology. Others include high input cost, poor and long marketing chains, low level of mechanization and high transport costs.

Most livestock in the sub county are local breed with the population of 105,320 Zebu cattle, 115,470 indigenous poultry, 102,400 local goats and 32,000 sheep. However, the population of exotic breed is steadily picking up as a result of increased extension services. The number of exotic breeds is as follows: 140 dairy cattle, 16200 hybrid poultry and 300 dairy goats. The ability of the Sub County to fully exploit its potential in livestock production is seriously hampered by diseases brought about by ticks and tsetse flies or spread through livestock movement. Diseases such as East coast fever, trypanosomiasis and foot and mouth seriously limits livestock production, movement, trade and overall returns to investment in the livestock industry Unchecked keeping of livestock has resulted to overgrazing which has increased the loss of soil cover, through soil erosion.

2.9.2 Fishing

The Sub county is endowed with an estimate of 1000 km² of water mass making fishing to be one of the major economic activities in the Sub county. Fishing is an important source of food, employment and foreign exchange earner particularly in the lake region, aggregate annual fish landing in Bondo sub county is about 3,370 tonnes. This low level of fish exploitation is due to the use of inappropriate fish gears, exploitation by middlemen and lack of cooling facilities.

However it's imperative to note that Over-fishing in breeding grounds in bays along the lakeshore and trawler fishing has negatively impacted on sustainable exploitation in the industry.

2.9.3 Trade and tourism

The Tourism sector is yet to be exploited to a large scale commercial sector. However, there has been considerable improvement in setting up hotel facilities due to increase demand for seminars and workshops in the area. Domestic tourism is also picking up well under management by Bondo County Council and Kenya Wildlife Services. KWS has also been instrumental in promoting ecotourism.

Areas tourism potential include the vast lake Victoria shoreline, numerous island inhabited by hippos, crocodiles, water bucks, monkeys, monitor lizard, snakes and birds of various species like the crown bird and other crane species. Various tourism activities can be undertaken in Lake Victoria if fully exploited. These include; sport fishing, boating and cruising safaris. The numerous islands like Mageta, Ndenda, and Oyamo can be used for camping safaris. The sub county lies within the south west tourist circuit, along with Ruma National Park in Homa-Bay and Ndere Island in Kisumu Sub county. The cruising safaris could be formed to cater for tourists visiting Mageta, Oyamo, Ndenda and Sirigombi Island. Tourism activities can also be promoted in legendary sites such as Ramogi Hills, which is regarded as a pre-historic site explaining the origin of the Luo community.

2.10 Environmental management

Environmental management and conservation is still a challenge in the sub county as majority of the people directly rely on natural resources (land, water, forest reserves, sand and fishery) for their livelihoods. Overexploitation of these resources leads to their depletion and degradation of the environment. Most people employ bad farming and fishing practices that led to the degradation of the environment and the supporting natural resources. Excessive use of pesticides pollutes the environment, farming in wet lands, poor sand harvesting practices, continuous logging, and use of illegal fishing gears are some of the threats facing the environment in the sub county.

3 INSTITUTIONAL, POLICY AND LEGAL FRAMEWORK

This chapter describes the existing institutional and legal frameworks in Kenya that are directly related and influence the implementation of projects in regard to the environment in ASALs. Policies and legal statutes in Kenya play a significant role in ensuring the ultimate protection and sustainable development in Kenya and the focus of this chapter is to highlight the relevant policies and Acts and point out how it relates to the project.

3.1 *Environment Management and Coordination Act CAP 387*

The Environmental Management and Coordination Act (EMCA) Cap 387 is an Act of parliament that was enacted to ensure sound environmental management of our environment. This Act makes regulations that have led to the establishment of the National Environmental Management Authority (NEMA) Kenya.

Every Kenyan according to the environmental management and coordination act EMCA CAP 387 is entitled to a clean and healthy environment and has the duty to safe guard and enhance the environment. The project falls in the 4th category of second schedule (s.58(1), (4)) of projects which require environmental impact assessment to be done .further section 58 of EMCA gives general guidelines in relation to the process which are

- .(1) Notwithstanding any approval, permit or licence granted under this Act or any other law in force in Kenya, any person, being a proponent of a project, shall, before financing, commencing, proceeding with, carried out, executing or conducting or causing to be financed, commenced, proceeded with, carried out, executed or conducted by another person any undertaking specified in the Second Schedule to this Act, submit a project report to the Authority, in the prescribed form, giving the prescribed information and which shall be accompanied by the prescribed fee.
- 2) The proponent of a project shall undertake or cause to be undertaken at his own expense and environmental impact assessment study and prepare a report thereof where the Authority, being satisfied, after studying the project report submitted under subsection (1), that the intended project may or is likely to have or will have a significant impact on the environment, so directs.

- (3) The environmental impact assessment study report prepared under this subsection shall be submitted to the Authority in the prescribed form, giving the prescribed information and shall be accompanied by the prescribed fee.
- (4) The Minister may, on the advice of the Authority given after consultation with the relevant lead agencies, amend the Second Schedule to this Act by notice in the Gazette.
- (5) Environmental Impact Assessment studies and reports required under this Act shall be conducted or prepared respectively by individual experts or a firm of experts authorized in that behalf by the Authority. The Authority shall maintain a register of all individual experts or firms of all experts duly authorized by it to conduct or prepare environmental impact assessment studies and reports respectively. The register shall be a public document and may be inspected at reasonable hours by any person on the payment of a prescribed fee.
- (6) The Director-General may, in consultation with the Standards Enforcement and Review Committee, approve any application by an expert wishing to be authorized to undertake Environmental Impact Assessment. Such application shall be made in the prescribed manner and accompanied by any fees that may be required.
- (7) Environmental impact assessment shall be conducted in accordance with the environmental impact assessment regulations, guidelines and procedures issued under this Act.
- (8) The Director-General shall respond to the applications for environmental impact assessment license within six months.
- (9) Any person who upon submitting his application does not receive any communication from the Director-General within the stipulated time may within nine months of such submission start his undertaking

The act further makes it an offence for anyone Any person who –

- (a) Fails to submit a project report contrary to the requirements of section 58 of this Act;

- (b) Fails to prepare an environmental impact assessment report in accordance with the requirements of this Act or regulations made thereunder;
- (c) Fraudulently makes false statements in an environmental impact assessment report submitted under this Act or regulations made thereunder;

Commits an offence and is liable on conviction to imprisonment for a term not exceeding twenty four months or to a fine of not more than two million shillings or to both such imprisonment and fine.

3.2 The Water Act 2012

The new Water Act (2012)Cap 372 of the laws of Kenya seeks to make better provision for the conservation, control of pollution, apportionment and use of the water resources in Kenya, and for purposes they are incidental thereto and connected therewith. The Act vests ownership and control of water in the government subject to any rights of user. Under this provision the responsibility to regulate access, use and control of water resources is vested in the Water Resources Management Authority (WRMA).

The Water Act protects water bodies and sources from pollution and controls their use by the Company. This Act therefore will govern the activities of the company on terms of water use and disposal to guard against the potential pollution of water from the companies' activities.

The Act also gives provisions for protecting catchments from deforestation. The Minister may designate protected catchment areas, within which activities may be regulated as nearly. However, the water act does not provide for control of other land uses that may degrade the catchment through soil erosion. The Agriculture Act, on the other hand, does provide a framework for dealing with these problems, although these provisions seem rarely to be implemented.

Control of water pollution is covered in a general sense by the Water Act. The legislation is deficient, since it does not lay down water quality and discharge standards or provide

powers for these to be defined. It also does not provide for water quality monitoring. The Public Health and Pest Control Products Acts also touch directly or indirectly on water pollution, but there is little institutional capacity to implement their provisions.

3.3 The Agriculture 2012

The Agriculture Act Cap 318 of the Laws of Kenya seeks to promote and maintain a stable and

sustainable agriculture, to provide for the conservation of the soil and its fertility and to stimulate the development of Agriculture land in accordance with the accepted practices of good land management and good husbandry. This Act primarily guides and regulates farming practices especially in relation to the proximity of farming within the riparian section. The Act specifies that no Agriculture activity is allowed and or permitted within the riparian area of a wetland, river or Lake. The Agriculture Act is the principal landuse statute covering, *inter- alia*, soil conservation, and Agriculture land use in general.

It is, indeed, a crucial piece of legislation insofar as it relates to both small scale and medium-scale farms within the project area and catchment.

3.4 The Forest Act 2012

The Forests Act, Cap 385 of the Laws of Kenya addresses reservation, protection, management, enforcement and utilisation of forests and forest resources on government land and provides for the establishment, control and regulation of Central Forests, forests and forest areas and on un-alienated Government land in Kenya. The Act, therefore, applies not only to state plantations and land controlled and managed by the Forestry Department for research purposes or for establishment of commercial timber plantations, but also areas which have been set aside for the conservation of fauna and flora, for the management of water catchment area, for the prevention of soil erosion or for the protection and management of indigenous forests on alienated Government land.

3.5 Public Health Act 2017

The Public Health Act (Cap 242)protects human health. Prevent and guard against introduction of infectious diseases into Kenya from outside, to promote public health and the prevention, limitation or suppression of infectious, communicable or preventable diseases within Kenya, to advice and direct local authorities in regard to matters affecting the public health to promote or carry out researches and investigations in connection with the prevention or treatment of human diseases. This Act provides the impetus for a healthy environment and gives regulations to waste management, pollution and human health.

This Act controls the activities of the project with regard to human health and ensures that the health of the surrounding community is not jeopardized by the activities of the project such as water development.

The project can be a public health hazard as well as beneficial to the greater public health. A case example is of a water pan which can be breeding ground for mosquitoes and other water borne diseases and provision and protection of domestic water

3.6 The Land Planning Act 1968

The Land Planning Act (Cap 303) of 1968 of the Laws of Kenya makes provision for planning the use and development of land. Sec 6 (1) of the subsidiary legislation provides that *"a local authority may, after consultation with, and with the agreement of the Minister, prepare and submit to the Minister for his approval an area plan, as the case may be, for that part of the area under its jurisdiction to which these regulations apply."*

3.7 Physical Planning Act 2012

This Act (Cap 286) provides for the preparation and implementation of physical development plans for connected purposes. It establishes the responsibility for the physical planning at various levels of Government in order to remove uncertainty regarding the responsibility for regional planning. A key provision of the Act is the requirement for Environmental Impact Assessment (EIA).

It provides for a hierarchy of plans in which guidelines are laid down for the future physical development of areas referred to in a specific plan. The intention is that the three-tier order plans, the national development plan, regional development plan, and the local physical development plan should concentrate on broad policy issues.

The Act also promotes public participation in the preparation of plans and requires that in preparation of plans proper consideration be given to the potential for socio-economic development needs of the population, the existing planning and future transport needs, the physical factors which may influence orderly development in general and urbanization in particular, and the possible influence of future development upon natural environment.

Any change of use of the actual development without authority constitutes an offence. Similarly, anyone who deposits refuse, scrap or waste materials in a designated area without the consent of the planning authority or the relevant local authority shall be guilty of an offence under the regulations. The general sentence under the regulations is a fine of not exceeding five thousand shillings or Imprisonment not exceeding six months, or to both, such fine and imprisonment.

3.8 Occupational safety and health act (OSHA) 2007

The act also sets minimum standards that are to be maintained in such workplaces to safeguard safe ,safety and welfare of workers.these are aimed at elimiantion of hazerds from workplaces.the act further requires all workplaces to display the abstract of the for all workers to read and remind themselves on how to protect them selves from hazards.the act makes it mandatory for occupiers or employers personal protective equipment and all practible means to prevent injury to health of workers who are exposed to any potentially harmful substances or condtions.the act further requires all workplaces to have first aid boxes under the charge of trained first aid attendants of health and safety.such rules include the following.

A)Building operations and works of engineering implimentaion rules

The rules guide health and safety matters in all implementation activities. The provisions of OSHA 2007 relevant to building operations and engineering implementations works are contained in building operations and works engineering construction rules. The rules have general safety measures to be observed in any building operations and works of engineering implementation. These state "every contractor shall comply with the requirements of these rules designed to ensure health, safety and welfare of all persons engaged in building operations or works of engineering implementation undertaken by him or in any activity incidental to and at the site of the building operations or works of engineering implementation where dust or fumes likely to be injurious to the health of persons employed are given off, all reasonably practical measures shall be taken to prevent the inhalation of the dust or fumes by the persons employed by ensuring adequate ventilation or providing suitable respirators at the workplace.

B) first aid rules

These have details on first aid requirements in terms of facilities and capacity building among non medical workers

C) noise rules

The rules have established levels beyond which workers may not be exposed without protection. The noise prevention and control rules are described in legal notice no 25 of Kenya gazette supplement no 22 of April 2005 and apply to every workplace, premises, place, process and operations to which the provisions of the factories and other places of work act cap (514 applies).

4 PROPOSED PROJECT

4.1 Overview

The objective of proposed Miruka water pan is ensure food Security, create employment and generate income for the surrounding communities. The approximate capacity of the pan will be 20,000 cubic meters.

This chapter describes major activities that will be involved during project implementation, the materials that will be used and the possible alternatives (which are detailed in the next section).

4.2 The proposed project

The Miruka proposed project will be managed and operated by Miruka community. The water pan is on a public land. The pan is registered as a community group (Mirika Dam Community Development Group Registration Number - BON/S.H/8452) by the ministry of social services. The land around the pan where farming will be done is privately owned but the owners are willing to offer for production.

Miruka water pan with approximately 20,000 cubic meters storage capacity consists of the following components;

1. site survey and design
2. Environmental Impact Assessment (EIA) survey
3. Water pan excavation and pipe layout (draw off system)
4. Fencing of the water pan
5. Construction of cattle trough
6. Construction of sanitary facilities

4.3 Project budget

The total cost of the project will be approximately 12,384,744 million Kenya shillings.

ITEM NO	DESCRIPTION OF ACTIVITY	TOTAL COST (kshs)
1	Dam Construction & auxiliary structures	9,034,744
2	Horticulture Production Activities	1,962,000
3	Catchment Protection Activities	879,900
4	Agro forestry activities	508,100
	Total	12,384,744

5 PROJECT ALTERNATIVES

5.1 Project Site

Miruka Dam is located in Ogago C Village, Bar Kowino Sub Location, North Sakwa Ward in Bondo Sub County. The project is to provide water to the community of Ogago C through rain water harvesting of surface runoff. During the inception period a meeting was held with Ogago C village community members, to sensitize them about the proposed project to be implemented in the area. The site was surveyed with support from the Ministry of Agriculture in Bondo.

5.2 Technology: Water Pan Selection

Three types of gully - embankment water pans commonly used in Kenya are: homogeneous, zoned, and diaphragm. These design types were evaluated to select the most appropriate design compatible with the water pan site survey details. These designs are described below:

5.2.1 Homogeneous water pans:

As the name implies, homogeneous water pans are built from a single material. This should contain between 20 and 30 per cent clay with the balance made up of silt, sand and some gravel. Normally, homogeneous water pans are confined to relatively small heights.

5.2.2 Zoned earth embankment

The most stable gully - embankment water pan that can be built is the zoned water pan. This type of design is soil type and profile specific. It has steeper slopes, thus reducing earthwork volumes and costs. The pervious shell on the upstream side prevents the buildup of water pressures if a rapid drawdown of water level occurs in the storage. It is built from different material types.

5.2.3 Diaphragm water pans

The diaphragm method is adopted when the amount of clay available at the site is limited; the bulk of the water pan is made up of pervious material such as sand, gravel or rock. A thin layer, or diaphragm, of clay is placed on the upstream slope to provide the impervious section. The preferred material for the diaphragm is a stable low-plastic clay or sand—clay, that is, material with a 12 to 40 per cent clay content. These clays are less likely to experience structural changes with alternate wetting and drying than are high-clay materials.

5.3 Selection of water pan Criteria

The appropriate design is selected after careful consideration of the physical conditions, soils available on site and possible usage and based on our engineering opinion.

5.3.1 Scale

The size of the water pan was limited to the available budget. However, no Engineering design specification was compromised.

5.3.2 Potential Environmental Impacts

The three designs pose same environmental impacts, hence the potential environmental impacts was not used as a criteria for selection of the project water pan design

5.3.3 Capital & Operation Costs

Operating costs were overridden by the technical design, hence not used as a selection criteria for the water pan. However an options of drilling, casing, equipping boreholes was suggested by the community but the cost of the same is prohibitive.

5.3.4 Sustainability

The proposed water pan is suitable and cheaper to rehabilitate. Thus, it was decided that the recommended design be used and enhance maintenance measures to sustain the pan for longer period.

5.4 No project Alternative

The no construction alternative would imply that the pan site be left in its present state. This decision is unacceptable because it would greatly affect development in this part of Kenya, as well impart negatively on water, sanitation and food security status in the project area. While the “no project construction’ alternative may ensure non-interference in the biodiversity, social conditions without the project will continue to be negatively impacted as a result of inaccessibility to water.

6 PUBLIC CONSULTATIONS AND DISCLOSURE

6.1 Background

The welfare of societies and the quality of life is directly linked to sustainable use of our natural resources. This has been duly recognized in Agenda 21, where it is stated that: "Special attention should be paid to the demand for natural resources generated by unsustainable consumption and to the efficient use of those resources consistent with the goal of minimizing depletion and reducing pollution."

The Kenya government has enshrined the need for human societies’ involvement in project development in the Constitution. This has been set out in the EMCA, 2005 and Environmental (Impact and Audit) Regulations, 2003. Community consultation and participation ensures that communities and stakeholders are part and parcel of the proposed developments and in so doing assures the sustainable use of resources. It has also demonstrated successfully that projects that go through this process will acquire high level of acceptance and accrue benefits to a wider section of the society.

Public consultations form a useful component for gathering, understanding and establishing likely impacts of projects determining community and individual preferences and selecting alternatives. Furthermore, through public participation, it is possible to enhance project

designs and ensure sustainability of the projects. The proposed project has incorporated public consultations in order to understand the local impacts, needs and thoughts and eventually incorporate them into the final designs and operations of the project.

6.2 Objectives

The main objectives of the public consultation process were to:

- Inform the public of the details of the proposed Project rehabilitation;
- Collect views on the positive and negative impacts anticipated by the local residents and how these can be overcome; and
- Build community consensus and acceptance of the proposed project.

6.3 Methodology

Public participation for the proposed Miruka water pan construction Project was conducted through questionnaires to allow for systematic understanding and interaction of the Potentially Affected Persons (PAP's) and the Proponents.

More than (10) questionnaires were issued to relevant line ministries, local administration and individuals whom the Consultant deemed were to be affected by the proposed development. These questionnaires are attached in the appendices for ease of reference.

A second stage whose findings are incorporated into this study involved holding of a Stakeholders public baraza on site. During the baraza, Stakeholders had a chance to interact with the proponent represented by the (KCSAP) Officer, relevant Ministries such as water. Presentation on project scope was made, after which an open interaction forum followed during which all pertinent issues were raised and agreed upon with all stakeholders.

6.4 Consultation and Disclosure outputs

The Appendice presents the information on the public consultations undertaken under the environmental impact assessment for the proposed Miruka water pan. This information includes selected responses.

6.5 Consultations Beyond design stage

In order to ensure that the development runs smoothly, the consultations discussed here were structured to aid the completion of the Design and narrow down on key issues. These consultations should therefore be preceded by continuous engagement of various stakeholders under the following stages:

- Construction phase and reported through the Initial Environmental Audit; and
- Operation phases and reported through the Statutory Environmental Audit of the Project.

The consultation should ensure that community, and especially the donor of the land on which the water pan is to be located, commit to respect that the site where the water pan will stand shall be open to the public at all times.

6.6 Salient issues

6.6.1 Opinion on Project implementation

It is clear from the questionnaires received back that water is a key component of the Got Abiero residents. A sizeable number of residents admitted that they are interested in this project and in so doing pointed to the benefit that will accrue to them.

6.6.2 Health implications

Health issues were highlighted either as negative or positive. Negative in the sense that there could be increased incidents of water related diseases, introduction of mosquito larvae eating fish to the reservoir after construction was seen as the best method to mitigate the same. The project is viewed positively in the sense that with adequate water for domestic use and their livestock as the community is agro- pastoralist.

6.6.3 Anticipated impacts

As earlier mentioned, the current impacts identified are mainly related to water borne diseases. Positive impacts identified by stakeholders can be listed as follows:

- Adequate supply of water for household and livestock
- Improved household income levels

- Improved household food security and better nutritional status
- Employment creation for the youth and women

Some of the negative impacts identified include the following:

- Catchment erosion and siltation
- Encroachment into pan catchments
- Dust and air pollution
- Increased water borne diseases

6.6.4 Overall outcome of consultations

In the overall, the stakeholders considers this project positive and will like to see the implementation take off.

7 IMPACT IDENTIFICATION MATRIX

Project Phase	Activities	Potential environmental attributes to be affected																		
		<i>Physical</i>				<i>Biological</i>		<i>Socio-economic</i>					<i>Infrastructure</i>							
		<i>Land</i>	<i>Climate</i>	<i>Water</i>	<i>Air</i>	<i>Fauna</i>	<i>Flora</i>	<i>Demography</i>	<i>Economic/Em ployment</i>	<i>Welfare</i>	<i>Health</i>	<i>Culture</i>	<i>Energy</i>	<i>Water</i>	<i>Waste Management</i>	<i>Transport</i>	<i>Educaation</i>	<i>Housing</i>	<i>Telecom</i>	<i>Financial Implications</i>
Project Preparation	Location of project	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Surveying	Y	N	Y	Y	Y	Y	N	Y	Y	N	N	N	N	N	Y	N	N	N	Y
	Construction of project camp Site	Y	N	Y	Y	N	Y	N	Y	Y	N	N	N	N	N	N	N	N	N	N
	Water pan site clearance	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	N	N	N	N	N	N	N	Y
Construction	Excavate water pan site	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	N	N	N	N	N	N	N	Y
	Construct intake trench, water pan embankment and spill way	Y	N	Y	Y	N	N	N	Y	Y	Y	Y	N	N	N	N	N	N	N	Y

Operation	water drawing for livestock	Y	N	Y	N	N	Y	N	Y	N	N	N	N	Y	Y	N	N	N	N	Y
	Water fetching	Y	N	Y	N	N	Y	N	Y	N	N	N	N	Y	Y	N	N	N	N	Y

Table 2: showing impact identification matrix

7.1 IMPACTS PREDICTION: PROJECT LOCATION

7.1.1 Resettlement and compensation

It is generally recognized that people affected by the construction of water pans and reservoirs meant for public benefits are liable for compensation for three basic categories of loss namely:-

- Permanent loss of possessions for example land required for water pan site and for crops or buildings and trees lost
- Temporary loss of possessions for example land required and leased for construction
- Partial loss of legal rights

The pan is on a public land. The land around the pan where farming will be done is privately owned but the owners are willing to offer for production.

7.1.2 Impairment of historic and cultural sites

According to information gathered from the community leaders there are no documented cultural sites that could be affected by constructing water pan. Consequently no mitigation measures have been considered.

7.1.3 Catchment erosion and siltation

The Miruka water pan catchment area is noted to have gentle slopes with sparsely distributed population. This has the potential to accelerate soil erosion and impose severe economic costs to the project if appropriate soil conservation measures are not included in the planning of the project. This is considered to be a major and negative impact.

7.1.4 Impacts on surface and groundwater hydrology

Impacts on surface and groundwater resources can be severe if the annual evaporation and seepage from the impounded reservoir is higher than total annual discharge. This is proposed for investigation during the design stage where appropriate measures will be instituted. Overall it is anticipated that gradual ground water recharge, flood control will be improved while encouraging economical utilization of surface water. This is a positive impact which need to be enhanced.

7.1.5 Inundation of mineral resources

The area to inundate does not have any identified mineral deposits. Thus no mitigation measures are proposed.

7.1.6 Debridement of Agriculture land and forests

The area to be used for the water pan was set aside by the local community for the construction. The area was demarcated indicating the area where settlement by the local community would not be permitted to safeguard the land for the intended purpose. There are already trees on the land and they will be cut to pave way way for project construction. Being a significant impact, appropriate mitigations are proposed.

7.1.7 Health & Safety

Health and safety of the local community and construction workers may be affected in the following ways:-

- Introducing animal wastes directly through defecating and urinating
- Accumulation of water in excavated pose health risks such as providing conducive habitat for disease vectors like malaria and other direct water borne infections,
- High risk to HIV/AIDS among the community as a result of social interactions with the contractors' workforce and other outsiders,
- Improved social and economic status of the served areas,
- Pollution of water sources from point sources as (cattle sprays, pit latrines, lack of sanitation)
- Death of both humans and animals due to drowning

7.2 Impacts Prediction: Construction Phase

7.2.1 Dust and noise pollution

During excavation there is bound to be emission of dust from the excavation sites. Similarly the equipment for excavation can generate considerable noise which could negatively affect the construction workers or people living near the excavation sites. These impacts are considered to be negative, major and temporary. Mitigation measures have been considered.

7.2.2 Workers' safety

Workers safety could be affected by a variety of ways ranging from injury from falling objects, inhalation of dust from construction sites to impairment of hearing due to noise from construction equipment. These impacts are considered to be negative and major and mitigation measures have been considered.

7.2.3 Sanitation of construction camp

The wastes generated by the construction crew can have disastrous effects on the local environment if not disposed appropriately. For example wastewater including excreta, solid waste and used oils can pollute the ground water. These impacts are considered to be major and negative and mitigation measures have been considered.

7.3 Impacts Prediction: Project Operations

7.3.1 Downstream erosion

When water is stored in a reservoir it leads to settling of suspended solids. When the same water is released from the reservoir it can cause considerable erosion of valley bank due to increased velocity of the surface flow. Adequate measures are therefore needed during the design stage to avert this situation.

7.3.2 Changes in water quality of the impounded reservoir

Storage of water in a reservoir alters its quality in proportion to the storage period. Due to photosynthesis water at the surface of such reservoirs will naturally exhibit algal growth whereas water at the bottom of the reservoir will be silt laden and anaerobic. Thus water for domestic use should be drawn from the reservoir at such a level as to avoid such conditions. Water quality will be ensured by treatment at the water kiosk.

7.3.3 Introduction of disease vector problems

Standing water bodies such as reservoirs attract people to settle near by and provide the habitat and circumstances for water related problems. For the case of Miruka water pan the commonly expected problems will be that of diseases related to mosquitoes and snails. These are considered to be major and negative impacts especially when it is noted that malaria and water related diseases are already the main ailments affecting the local

community as pointed out in the socioeconomic survey. Mitigation measures have been considered.

7.3.4 IMPACTS EVALUATION

Source of impact	Impact description	Nature of Impact			
		<i>Negative</i>		<i>Positive</i>	
		Major	Minor	Major	Minor
	Catchment erosion and siltation	Yes			
	Encroachment into river catchments	Yes			
	Impacts on surface and groundwater		Yes		
	Water use conflicts		Yes		
	Hydrology		Yes		
Construction	Enhanced erosion / changes in topography due to excavation		Yes		
	Increased water supply			Yes	
	Dust and noise pollution		Yes		
	Workers' safety		Yes		
	Sanitation of construction camp		Yes		
	Social pressure on local community		Yes		
Operation	Reduction in disease incidences such as those associated with use of water from contaminated shallow			Yes	

	wells.				
	Regulation of flow of flooding downstream of pan				Yes
	Offer opportunity for fishing				Yes
	Provision of water for re-forestation activities			Yes	
	Introduction of disease vector problems	Yes			

Table 1- impact evaluation matrix

8 ENVIRONMENTAL MITIGATION MEASURES

8.1 Specific Mitigation Measures

The table below gives specific impact classification and mitigation measures

Impact	Impact Description	Nature of Impact	Proposed Mitigation Measures
Siting	Catchment siltation and erosion	Major	<ul style="list-style-type: none"> • Install silt traps in suitable locations • Disilting of silt traps when full. This should be done before the rains • Integrated land use management involving all stakeholders to ensure catchment protection
	Encroachment into pan catchment	Major	<ul style="list-style-type: none"> • Encourage terracing to check soil erosion
	Impacts on surface and groundwater hydrology	Major	<ul style="list-style-type: none"> • Involve local community in formation of water pan management committee with clear mandate of ensuring no encroachment takes place beyond pan area
Construction	Dust and noise pollution		Minor <ul style="list-style-type: none"> • Ensure that emission levels of machinery are within permissible limits. • Ensure that there is no work done at night.
	Negative environmental effects from construction activities in the site (pollution from oil spills	Major	<ul style="list-style-type: none"> • Good site management including provision of on site sanitation facilities, disposal sites. Contract specifications to include these requirements

	and solid waste and excreta)			
	Alterations in the flow of water and changes in water quality during the construction of the water pan embankment	Major		<ul style="list-style-type: none"> • Adequately divert the runoff away from construction areas • Ensure good engineering practices
	Enhanced erosion / changes in topography due to excavation.			<ul style="list-style-type: none"> • Obtain earth fill from flooding zone. • Re-vegetate with native species
	Social pressure on local community		Minor	<ul style="list-style-type: none"> • Enlighten personnel about STDs (HIV/AIDS) and use of condoms. • Help strengthen healthcare system • Strengthen basic facilities
	Downstream erosion		Minor	<ul style="list-style-type: none"> • Provide silting basin to check velocity of released water
	Changes in water quality of the impounded reservoir		Major	<ul style="list-style-type: none"> • Check upstream sanitation practices • Partner in enlightenment for increased environmental awareness in surrounding communities. • clear vegetation and remove it from area to be impounded
	Introduction of disease vector problems	Major		<ul style="list-style-type: none"> • Monitor the presence of disease vectors • Contribute to strengthening of local health facilities through public enlightenment

				<ul style="list-style-type: none"> • Contribute to public health programmes to eradicate / protect against malaria, schistosomiasis • Direct contributions in terms of drugs provision of infrastructure, etc. • Spillway ensures continuous flows, hence the likelihood of creation of habitats for bilharzias is remote
	Loss of scenery due to dumping of excavated material		Yes	Liaise with local community so that excavated often fertile material can be put to good use.

Table 5- impact classification and mitigation measures

9 ENVIRONMENTAL MONITORING & MANAGEMENT PLANS

Environmental monitoring is a key aspect of environmental management as it ensures a continuous or periodic follow-up on the identifiable environmental parameters both in quantity and or quality. To achieve the foregoing, a clear tabulation of all impacts, mitigations measures, those responsible and respective time frames are considered as follows:.

Environmental Management and Monitoring Plan for Proposed Miruka water pan: Design & Preliminary Construction Phase						
Activities	Potential Negative Impacts	Mitigation Measures	Responsible	Frequency/Timing	Cost	Verifiable Indicators
1. Project Design Phase						
Planning, Surveying, EIA study	<ul style="list-style-type: none"> ▪ Trampling on vegetation ▪ lack of consensus towards the project between Stakeholders 	<ul style="list-style-type: none"> ▪ Avoid unnecessary vegetation destruction ▪ Intensify consultations 	<ul style="list-style-type: none"> ▪ CPC ▪ Department of water ▪ Surveyors ▪ NEMA 	Throughout project design stage	As provided in the contract	
2. Site Preparation Phase						
Excavation	<ul style="list-style-type: none"> ▪ Soil erosion 	<ul style="list-style-type: none"> ▪ Compact the embarkment using the excavated top soil ▪ Proper design of the inlets ▪ Have soil conservation structures along the the run off channel ▪ Proper design of spillway ▪ Planting of grasses on embarkment 	<ul style="list-style-type: none"> ▪ CPC ▪ Contractor ▪ Pan Management Committee 	2 weeks from start of works	Provided in the project's cost	

	<ul style="list-style-type: none"> Loss of biodiversity 	<ul style="list-style-type: none"> Afforestation Introduction new wetland species 	<ul style="list-style-type: none"> KFS Fisheries 	Continous	Provided in the project's cost	
	<ul style="list-style-type: none"> Contamination of soil due to oil spillage 	<ul style="list-style-type: none"> Ensure proper service for machinery introduce oil collection bins whenever spillage is detected 	<ul style="list-style-type: none"> Contractor 	Contract period	Provided in the project's cost	
	<ul style="list-style-type: none"> Excessive noise and vibration from machinery 	<ul style="list-style-type: none"> Carry out works during day time Use protective gears such as ear muffs 	<ul style="list-style-type: none"> Contractor 	Contract period	Provided in the project's cost	
	<ul style="list-style-type: none"> Accidents and Injuries 	<ul style="list-style-type: none"> Use of Personal Protective Equipments(PPEs) Fence off the water pan area and introduce a gate and ensure control access, Project signboard 	<ul style="list-style-type: none"> Contractor Pan Management committee 	Contract Period	Provided in the project's cost	
Construction of auxillary works	<ul style="list-style-type: none"> Solid waste generated 	<ul style="list-style-type: none"> Dispose waste at designated dump sites or engage NEMA licensed waste collectors Re-use some of the solid wastes Have mobile toilets in 	<ul style="list-style-type: none"> Contractor Pan Management committee CPC Public Health 	Contract Period	30,000	

		place				
	<ul style="list-style-type: none"> Excessive noise and vibration from machinery 	<ul style="list-style-type: none"> Carry out works during day time Use protective gears such as ear muffs 	<ul style="list-style-type: none"> Contractor Pan Management Committee 	Contract period	Provided in the project's cost	
	<ul style="list-style-type: none"> Accidents and injuries 	<ul style="list-style-type: none"> Use of Personal Protective Equipments(PPEs) Fence off the work area and introduce a gate Ensure control access Project signboard 	<ul style="list-style-type: none"> Contractor Pan Management Committee 	Contract period	Provided in the project's cost	
Project operation Phase						
Project Operation Phase	<ul style="list-style-type: none"> Water contamination from use of agrochemicals 	<ul style="list-style-type: none"> Promote integrated pest management Promote organic farming Promote safe use of agrochemicals 	<ul style="list-style-type: none"> CPC Pan Management Committee 	Continuous	Provided in the project's cost	
	<ul style="list-style-type: none"> Water pollution from toilet effluent 	<ul style="list-style-type: none"> Use of biodigester for organic wastes use of septic tank for inorganic –e.g waste waters from bathroom 	<ul style="list-style-type: none"> CPC Pan Management Committee 	Continuous	Provided in the project's cost	
	<ul style="list-style-type: none"> Contamination of water by the users 	<ul style="list-style-type: none"> Use of cattle troughs Use of water kiosk Water testing and 	<ul style="list-style-type: none"> CPC Pan Management Committee 	Continuous	Provided in the project's cost, Water	

		treatment			treatment to be done through partners	
	<ul style="list-style-type: none"> ▪ Siltation of the water pan 	<ul style="list-style-type: none"> ▪ Train on pan maintenance, ▪ Use score dams and silt traps ▪ Revolving funds for pan maintenance 	<ul style="list-style-type: none"> ▪ CPC ▪ Pan Management Committee 	Continuous	Revolving funds to come from water use charges/fees	
	<ul style="list-style-type: none"> ▪ Introduction of alien plant and animal species 	<ul style="list-style-type: none"> ▪ Use of locally adapted environmental friendly plant and animal species ▪ Promote relevant use of alien plant species 	<ul style="list-style-type: none"> ▪ CPC ▪ KFS ▪ Pan Management Committee 	Continuous	Provided in the project's cost	
	<ul style="list-style-type: none"> ▪ Vector borne diseases 	<ul style="list-style-type: none"> ▪ Provision of long lasting treated mosquito nets and repellants. ▪ Introduction and stocking of the pan with fish to prey on mosquito larvae. ▪ Rift Valley Fever vaccinations and routine spraying of livestock ▪ Treatment of the affected 	<ul style="list-style-type: none"> ▪ CPC ▪ Public Health ▪ Livestock ▪ Veterinary ▪ Fisheries, ▪ Pan Management Committee ▪ Medical Health 	Continuous	To be met through relevant stakeholders	
	Water use conflict	<ul style="list-style-type: none"> ▪ Have grievance redress 	<ul style="list-style-type: none"> ▪ CPC 	Continuous		

		committee <ul style="list-style-type: none"> ▪ Have Social Accountability Integrity Committee ▪ Have different draw off point for the users ▪ Have a fence and gate ▪ Formalize the Pan Management committee 	<ul style="list-style-type: none"> ▪ Local administrators ▪ Pan Management Committee 			
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10 CONCLUSIONS AND RECOMMENDATIONS

This report has highlighted the relevant legislation for the project and documented evidence based baseline data on the project. The measures proposed herein in the report need to be implemented to enhance sustainable utilization of our environment. It is hereafter reinforced that Project specifications, guidelines, licenses and permits must be in possession of the contractor and the contracting department prior to commencement of construction. Through regular safety meetings, all water pan construction employees and contractors working in the project will have to be made aware of these documents and their contents.

To enhance the proposals in this report, all employees and contractors should comply with all Kenyan Regulatory requirements relating to the construction and operation of the water pan project and facilities.

Environmental management and monitoring programs will have to be conducted in full cooperation with local authorities. The rights and interests of local land owners, resource users, trappers etc. must be respected.

Before excavation starts, runoff control measures shall be designed to redirect surface runoff away from access routes to the site. Organic material, topsoil, and subsoil shall be stripped and piled separately for compactment of the embankment. Site clearing shall be minimized but will permit the safe and efficient movement of personnel, material and equipment, while allowing for excavation of materials. The contractor will have to institute erosion and dust control measures on site. Washing and maintenance of vehicles and equipment in the excavated area shall not be permitted. Signs will have to be erected to warn unauthorized personnel of safety hazards. Before commencement of the work, the Contractor shall provide (KCSAP) with their protocol for containment, transport and disposal of wastes. Hazardous materials will have to be stored within dedicated areas at work camps and marshalling yards in full compliance with regulatory requirements.

The water pan project will lead to improved food security at household level, the few negative impacts identified have been adequately mitigated through diverse measures proposed in the EMP and thus we recommend that the project be considered for an EIA clearance and subsequent implementation.

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