REPUBLIC OF KENYA

NATIONAL WATER CONSERVATION AND PIPELINE CORPORATION

THE PROPOSED ISIOLO DAM WATER PROJECT

ENVIRONMENTAL IMPACT ASSESSMENT
STUDY REPORT

FOR

PROPOSED ISIOLO DAM PROJECT

AUGUST 2016

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SUBMISSION FORM

We, **CAS Consultants Limited** do hereby certify that this report was prepared based on the data collected from primary and secondary sources and on the best understanding and interpretation of the facts by the environmental assessment team.

We are pleased to herewith submit the Environmental Impact Assessment (EIA) Project Report for the proposed Isiolo dam project.

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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 Management and Coordination Act, 1999 and subject to terms and conditions of the National Environment Management Authority (NEMA).

EIA FOR ISIOLO DAM PROJECT

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ACRONYMS

AfDB	African Development Bank
AIDS	Acquired Immuno-Deficiency Syndrome
ASAL	Arid and Semi Arid Lands
BD	Biological Diversity
CFCs	Chlorofluorocarbons
CITES	Convention on International Trade in Endangered Species
CRC	Convention on the Rights of the Child
DOHS	Directorate of Occupational Health and Safety
EMCA	Environmental Management and Coordination Act
ERSWEC	Economic Recovery Strategy for Wealth and Employment Creation
ESAP	Environmental and Social Assessment Procedures
EIA	Environmental Impact Assessment
FAO	Food and Agricultural Organisation
PI	Public Involvement
EMP	Environmental Management Plan
RE	Resident Engineer
ESO	Environmental & Social Officer
ESMP	Environmental/Social Management Plan
HH	Household Head
HIV	Human Immuno-deficiency Virus
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
KeRRA	Kenya Rural Roads Authority
KETRACO	Kenya Electricity Transmission Company
KFS	Kenya Forest Services
KNBS	Kenya National Bureau of Statistic
KIHBS	Kenya Integrated Household Budget Survey
KWS	Kenya Wildlife Service
LHS	Left Hand Side
Masl	meters above sea level
MDGs	Millennium Development Goals
MEMR	Ministry of Environment and Mineral Resources
MDNKOAL	Ministry of State for Development of Northern Kenya and other Arid Lands
NWCPC	National Water Conservation and Pipeline Corporation
NEMA	National Environmental Management Authority

NMK	National Museums of Kenya
NGOs	Non-governmental Organisations
ODA	Official Development Assistance
OP	Operation Policy
OSHA	Occupational Health and Safety Act
PAP	Project Affected persons
RAP	Resettlement Action Plan
LAP	Land Acquisition Plans
PA	project Affected
RHS	Right Hand Side
STI	Sexually Transmitted Diseases
ToR	Terms of Reference
URTI	Upper Respiratory Tract Infection
UNEP	United nations Environment Programme
UNESCO	United Nations Education and Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
WRMA	Water Resources Management Authority
WRUAS	Water Resource Users Associations

EXECUTIVE SUMMARY

Overview

National Water Conservation and Pipeline Corporation commissioned CAS Consultants Limited to undertake the EIA study for the proposed Isiolo Dam Project near Oldonyiro at crocodile jaws (Nkutuk Elkinyang) along Ewaso Nyiro River. As part of the EIA study process in Kenya, CAS Consultants has prepared EIA Report (this report) for submission to NEMA as a fulfillment of EIA Regulations 2003 and EMCA 1999.

The Environmental Impact Assessment findings presented in this EIA Report provides a critical examination of issues considered important in fulfilling the requirements of a clean, sustainable and healthy environment especially in a project that would touch on varius phases of the environment; biophysical and socio-economic setting. This report is primarily aimed at establishing the impacts of the proposed Isiolo Dam project on the environment and biodiversity; sustainability of resource utilization; resource use conflicts and socio-economic; socio-cultural and socio-political well being of the nearby residents and the region. During the study, the EIA team undertook consultations, interviews and field visits to the project area and offices of relevant stakeholders. The views and concerns of all relevant stakeholders were noted and considered when writing this study report.

Every dam causes partly temporary and partly permanent submergence of land in the upstream and displacement of economic interests on land and their property generally, along-with submergence of plant life and disruption to animal life. Also downstream of dams, such effects are caused by ancillary facilities on a similar but much smaller scale. The consequent social and economic loss is generally assessed and compared with benefits due to the dam. The downstream uses are met with mostly from flow by gravity or regulated releases into the river, whereas in the upstream, lifting of water is involved. All these disadvantages have to be assessed in advance to plan ameliorative measures. During implementation of the project and during operation, each disadvantage calls for careful management and monitoring.

The Proposed Project

The proposed Isiolo dam has a maximum height of 83m with the crest on 1580masl while the bed level is on 1497mas. The storage capacity of the reservoir is approximately 215 MCM of water and the water will flow by gravity to the Isiolo Resort City and Isiolo Town alongside

other rural areas targeted for supply. In addition to storing flood flow from the Ewaso Nyiro river for regulating downstream flows during dry periods, The zone to be inundated by water upon completion of the dam is expected to extend about 1500 Ha in area and a further acquisition of 500 Ha for exclusive conservation use and dam buffer totalling 2083Ha.

At the time of this study, the river was generally flowing and the damsite had weir serving local community and oldonyiro centre. There were hippos, elephants and impalas grazing on the riparian among other wild life.

The proposed dam area is characterized with sparse vegetation comprising of indigenous trees mainly *Acacia mellifera*, *Acacia seyal*, *Acacia nilotica*, *Acacia senegal* and *Acacia tortillis* with undergrowths of shrubs and grasses including *Cyperus esculentus, Cynadon. Nlemfuensis, Eragrostis tenuifolia,Eleusine indica, Digitalia Spp and Dactylectium Spp* on the dry land while reeds (phragmites) and cyperus species and aquatic grasses are found on the river banks. Below is a summary of the project design components.

Overall Objective of the Project

Residents in the three counties and the region in general, are forced to walk long distances in search of water for domestic use and livestock. The little water found is mostly not fit for livestock or even human consumption, effectively risking the people's health and hygiene. This is clearly depicted in the reported cases of water borne ailments (diarrhea, intestinal worms, bilharzias and skin problems) in the project area and as found by the the Social Economic Studies of the dam design. Intervention initiatives, therefore, are necessary from every possible quarter to improve water supply services. The proposed dam is projected to supply gravitated water to about 304,000 individuals upon commisioning in year 2020 and further 1,000,000 individuals by year 2035. However, much more individuals can be reached with pumping of the water. The proposed dam will open up the area for development by further being an enormous viable source of water for domestic, livestock use, industrial and irrigation down stream. Apart from other incidental benefits like fisheries and tourism the dam axis may provide a causeway that will open up the area by improving access between Laikipia, Isiolo and Samburu Counties.

The National Policy on Water Resources Management and Development focuses on streamlining provision of water for domestic use, agriculture, livestock development and industrial utilization with a view to realizing the goals of the Millennium Development Goals (MDGs) as well as Vision 2030. Isiolo Dam has been identified by the National Water Conservation and Pipeline Corporation as a necessary facility to supply water to the semi-arid

greater Laikipia, Samburu and Isiolo Counties besides enhancing the flows of Ewaso Nyiro River.

Land Ownership

Land in the proposed project area in Laikipia county is owned by private ranches and community conservancies on a free hold basis with title deeds while Isiolo county has community conservancy with the land tenure being trustland. The respective county councils own the land in trust for the communities and therefore NWCPC would therefore have to acquire the land from the owners (2083 Ha) for the purposes of constructing the proposed Isiolo Dam and compensate them appropriately. Land acquisition will be addressed by the Resettlement Action Plan to proceed after final designs.

Public Consultation

Public participation was mainly achieved through direct interviews, observations, questionnaire administration, holding stakeholder and public meetings. Those consulted included county leaders, sector stakeholders, opinion leaders, sectoral heads; local leaders; members of the Provincial Administration consisting of the County Commissioners; area chiefs, local NGOs and CBOs and the county governments of Isiolo, Samburu and Laikipia, WRUAS, downstream communities and all stakeholders. Other people consulted included representatives from relevant government ministries and departments including Ministries of Lands Housing and Urban Development, Environment Water and Mineral Resources, Public Health and Sanitation;Agriculture; Gender, Culture Sports and Social Services; Water Resources Management Authority (WRMA). The consultation schedule is as shown in the table below.

Type of meeting	Target Stakeholders	Venue	Dates	Form and Evidence of Participation
Public Baraza	General Public (Upstream)	Kirimon location (Samburu/Laikipia County)	30/05/2013	Baraza attendance list and Photos Appendix III & IV
		Oldonyiro location (Isiolo/Laikipia County	03/06/2013	Baraza attendance list and Photos Appendix III & IV
		Kipsing location Isiolo County	02/06/2013	Baraza attendance list and Photos Appendix III & IV
	General Public (Down stream)	Merti area	28/04/2014	Baraza attendance list and Photos Appendix III, IV and Annex VI: Downstream Consultations report.
		Habaswain Area	29/04/2014	Baraza attendance list and Photos Appendix III, IV and Annex VI: Downstream Consultations report.
		Sericho Area	30/04/2014	Baraza attendance list and Photos Appendix III, IV and Annex VI: Downstream Consultations report.
Stakeholders Workshop	Sector Wide Stakeholders*	Rangelands Hotel Isiolo	16/07/2013	Workshop report annex I
	Sector Wide Stakeholders*	Grande Hotel Isiolo	2/04/2014	Workshop report annex II
	Leaders Workshop	Rangelands Hotel Isiolo	23/05/2014	Leaders workshop report Annex V
Focused group discussions (FGD)	Group Ranches and Mid WRUAS	Longaboli bandas	31/08/2013	Isiolo Dam Social Impact Assessment Report Annex IV
	WRUAS Lower Ewaso	WRUA office Maili Saba-Isiolo	3/09/2013	Isiolo Dam Social Impact Assessment Report Annex IV
	Conservancies and WRUAS	Sabuk Lodge	1/09/2013	Isiolo Dam Social Impact Assessment Report Annex IV
	Land owners	Sabuk Lodge	10/10/2013	Annex III Land Compensation Report.
	FGD with area CBOs and NGOs	Sportsman Arms Hotel Nanyuki	2/05/2014	Downstream Consultation Report Annex VI.

Potential Positive Impacts

The positive impacts associated with the proposed project include:

i. The dam will be effectively used to regulateEwaso Nyiro River and enhance flows of the dam by storing the flood volume and releasing it later ensuring a sustainable supply of water to various users downstream and subsequent flooding of Lorian swamp all year round.
ii. Improved land use systems occasioned by availability of water in the area. The project will attract more investment to the region hence leading to accelerated business growth.
iii. The project will ease the current water deficit in Laikipia, Samburu and Isiolo counties and the environs consequently promoting the country's economic growth.
iv. The proposed project presents an opportunity for tourism, training and skills acquisition.
v. The goods will be sourced from local suppliers thus creating a ready market leading to general economic growth.
vi. Provision of employment opportunities during both construction and operation phases of the project. Impoundment itself may however be favourable to some fish species.
vii. Improved infrastructural services within the project area opening it up for development opportunities.
viii. Improved livelihoods in the three counties due to improved access to clean water and socio-economic benefits both directly and indirectly.
ix. Reduction of human wildlife conflicts occasioned by scarce water resources.

Potential Negative Impacts Associated with the Proposed Project.

The negative impacts identified which need to be mitigated appropriately include:

i. Loss of vegetation;
ii. Loss of wildlife habitat 2083 Ha;
iii. Effects on farming and traditional land uses;
iv. Soil erosion;
v. Air, dust and noise Polution;
vi. Sanitary and health problems from construction camps;
vii. Land degradation due to material harvesting;
viii. Land scape changes;
ix. Changes in the downstream water quality;

x. Reduction of biodiversity due to blocking of movement of organisms;
xi. Spread of waterborne diseases; spread of malaria, bilharzia and river blindness may proliferate from stagnation of the watercourse;
xii. Exclusion of future land uses;
xiii. Turbidity and siltation during filling;
xiv. Danger of people drowning either intentionally or accidentally looms with the construction of this dam;
xv. Break up of community bonds;
xvi. Loss of livelihoods;
xvii. Proliferation of squatters and vagrants within towns neighbouring the project area;
xviii. Increase in incidences of anti-social behaviours;

Potential Mitigation Measures

i. Controlled cutting and burning of vegetative materials. Trees and other usefull materials be subcontracted to one subcontractor to harvest the tree materials to be utlised as timber and firewood;
ii. Site planning for avoidance of negative impacts and compensation including influx planning by the contractor before works. There is need for prior planning of activities so that the construction process does not negatively affect people.
iii. Shoreline protection. This will reduce the possibility of erosion of the riverbed. Shoreline can be protected through plantation of trees and grass along the riverbed. This will be achieved through acquisition of 500 Ha for exclusive conservation besides riparian areas;
iv. Relocation of people to suitable areas, especially for those who may be directly affected as a result of the dam construction. There should also be provision of compensation for loss of access to resources and employment opportunities for those affected;
v. There is need to establish compensatory parks or reserved areas for animals that may be dislocated. 500 Ha will be acquired for conservation;
vi. The dam should be planned and managed within the context of regional development plans so that it fits within the framework of the developments;
vii. Reforestation elsewhere to replace trees cut (catchment restoration initiatives);
viii. Noise controls and traffic restrictions;
ix. Use of dust suppressants to reduce air polution;
x. Well planned camps and employment of locals;
xi. Compliance to the provisions of the EHS management plan to safeguard workers and training the construction team on site safety, environment and social issues
xii. assign a vehicle specifically for emergencies;

xiii. Promote collection, separation and disposal of wastes during construction and operation in accordance with the management plan;
xiv. Erosion control through conservation agriculture;
xv. Shoreline protection e.g. through riprap and gabions;
xvi. People should be educated on the likely dangers of accessing the area especially if there is proof that certain animals like crocodiles may have inhabited the water;
xvii. Reservoir clearing, shoreline stabilization and removal and covering of organics so as to avoid greenhouse gas release;
xviii. Safety provision (e.g. fencing of the dam of work sites;
xix. Vector control, disease prophylaxis and treatment by sponsoring a local health centre to be used by the construction team;
xx. Control of land use in watershed (especially prevention of conversion of forests to agriculture);
xxi. Basin-wide integrated planning to avoid overuse, misuse, and conflicting uses of water and land resources;
xxii. Land use planning efforts, which include watershed areas above dam.

Output

The output of the study is the production of this EIA Report with recommendations for Environmental Management Plans for the project planning, construction, operation and decommissioning. In addition, the process also recomended development of a Resettlement Action Plan (RAP) that would guide decisions on compensation and resettlement of the project-affected population.

Conclusion

Based on the findings, it is evident that construction of the proposed dam will result in overall economic growth and development as a result as improvement in the availability of water for livestock, domestic use, industrial and minor irrigation for Isiolo Resort City and isolo town inclusind adjoing areas. The potential positive impacts can be easily mitigated. However, some important resources may be affected negatively though temporarily during construction such as flora, fauna, the neighboring community and air. Loss of livelihood comes out as a significant impact and should be handled appropriately. RAP studies will be done separately from this report.

Recommendations

i. There be continued stakeholder consultation throughout the dam life cycle;

ii. Need to consult with NGOs, CBOs to in implementing proposed environmental management plans;

iii. There is need for RAP studies to come up with a livelihood restoration programmes for the communities/workers anticipated to lose livelihood in their conservancy lodges. These workers whose work will be temporarily lost will need to be restored during that period of relocation and construction of the conservancy lodges/ hotels which acts as tourist destinations;

iv. A continued consultation with Kenya Wild life Services on management of the wildlife in the project area;

v. First priority for employment opportunities for both skilled and unskilled labour be given to the locals as a way of uplifting their livelihoods during the study and at construction stages.

1 INTRODUCTION

1.1 Background

The development and management of water resources in Kenya is based on the view that water is a social good and is a catalyst for economic development. The current access to safe water in the country is estimated at about 87% in urban areas and approximately 48% in the rural areas while the national average stands at about 57% as per the KIHBS report 2005/6. On the other hand, Eastern and North Eastern Provinces had the lowest proportions of households using safe drinking water sources.The Government of Kenya (GOK) has recognized the need for comprehensive institutional reform and increased investment in the water and sanitation sector in order to remove bottlenecks in its programme to alleviate poverty, employment and wealth creation.

Isiolo Dam was identified by the National Water Conservation and Pipeline Corporation as a necessary facility to supply water to the proposed Isiolo Resort City, Isiolo Town, and to regulate flows of River Ewaso Nyiro. Isiolo Town is currently served by Isiolo water supply constructed in 1980-1983 to serve a population of 15,000 persons. The population has been on the increase and has since grown to 46,496 as per the KNBS 2009 census. The resulting water demand has far exceeded the production capacity of the existing water supply. This has necessitated substantive water supply augmentation works. In addition the Government of Kenya plans to develop Isiolo Town into a Resort City under the Vision 2030 Development Plan. As a result of this the water demand will increase beyond what short term water supply measures can manage. This in effect calls for a more long term solution to water supply to Isiolo Town and thus this Project.

National Water Conservation and Pipeline Corporation commissioned CAS Consultants Limited to undertake the EIA study for the proposed Isiolo Dam Project near Oldonyiro at crocodile jaws along Ewaso Nyiro River. As part of the EIA study process in Kenya, CAS Consultants has prepared an EIA report (this report) for submission to NEMA in compliance to EMCA 1999 and EIA Regulations 2003.

The overall ecosystem will also get transformed to the benefit of the communities if the proposed mitigatation measures are implemented. The proposed project will be at the boundaries of Laikipia, and Isiolo counties and major beneficiries will be Laikipia, Samburu and Isiolo counties. Following feasibility studies covering the entire counties, it was established that water is a priority to all in terms of livelihoods and social requirements. The dam embankment is proposed to be located immediately downstream (~1km) from the crocodile jaws bridge at the boundary of Isiolo and Laikipia counties.

Harnessing of the fluctuating river flows in River Ewaso Nyiro and other small rivers joining Ewaso Nyiro River would provide water supply for domestic, livestock, minor irrigation, and even industrial activities in the counties of Isiolo, Laikipia and Samburu. Most importantly the dam will regulate the flows of the river and ensure continued flow of the River Ewaso Nyiro into Lorian swamp and down stream communities because of storage of water during the wet seasons in the catchment areas, synergies created through WARMA; regulating water abstration upstream and catchment restoration programmes initiated by government of Kenya. The proposed dam will cover an area of 2083 Ha. It will inundate the Oldonyiro in Isiolo County and Kirimon, Impala and Ewaso locations in Laikipa County.

National Water Conservation and Pipeline Corporation therefore has undertaken an Environmental and Social Impact Assessment (EIA) study in compliance with legislations and to ensure sustainable development.

1.2 Project Justification

After decades of neglect, the government of Kenya is committed to close the development gap between the ASALs and the rest of Kenya. To do so, it charged the former Ministry of State for Development of Northern Kenya and other Arid Lands (MDNKOAL) to develop policies and interventions addressing the challenges specific to ASAL, mostly regarding their climate, pastoral and agro-pastoral livelihood strategies and low infrastructure, financial, and human capitals. The proposed dam will improve on livelihood strategies and infrastructure development.

Provision for safe drinking stands at a national average of 59% (83% urban and 52% rural) (UNEP 2008). Kenya's Water resources are also highly vulnerable to climate variability often resulting into floods and drought with inadequate storage capacity which limits the ability to buffer against the water shortage shocks. Rainfall is unevenly distributed throughout the country, with less than 200 mm/yr falling in northern Kenya (UNEP 2009) . The project will increase the regional and national access to safe drinking water alongside mitigating the floods whilst storing the waters.

Residents in the three counties and the region in general, are forced to walk long distances in search of water for domestic use and livestock. The little water found is mostly not fit for domestic or even human consumption, effectively risking the people's health and hygiene. This is clearly depicted in the reported cases of water borne ailments (diarrhea, intestinal worms, bilharzias and skin problems). Intervention initiatives, therefore, are necessary from every possible quarter. The proposed dam will open up the area for development by further being an enormous viable source of water for domestic and livestock use, industrial and minor irrigation. Apart from other incidental benefits like fisheries and tourism the dam axis may

provide a causeway that will open up the area by providing social and economic access between Laikipia, Isiolo and Samburu Counties.

The National Policy on Water Resources Management and Development focuses on streamlining provision of water for domestic use, agriculture, livestock development and industrial utilization with a view to realizing the goals of the Millennium Development Goals (MDGs) as well as Vision 2030. Isiolo Dam has been identified by the National Water Conservation and Pipeline Corporation as a necessary facility to supply water to the semi-arid greater Samburu and Isiolo Counties.

Sustainable development of natural resources in a developing country such as Kenya is hampered by material and technological limitations, and the gaps in the basic infrastructure needed to get started. This problem becomes especially manifest in the arid and semi-arid lands (ASAL) of Kenya, where the physical, environmental and socio-economic structures for the development of a reliable database are either lacking, or in very poor state. Yet the ASALs take up about 80% of the total land area in Kenya. They are mainly hot and dry, with highly variable rainfall (in space and time), and evaporation rates which are twice the annual rainfall. The soils have low organic matter content due to low vegetation density and microbial activities. Soil-water storage is rather limited and the soils are very susceptible to degradation. Ewaso Nyiro River would be able provide water supply for domestic, livestock, irrigation, hydropower and even industrial activities in the beneficiary counties. The overall ecosystem of the project area stands to get transformed to the benefit of the communities. This fact justifies this project environmental and social benefits.

1.3 The Proponent

The National Water Conservation and Pipeline Corporation, established by Legal Notice No. 270 of 24th June 1988 in accordance with the provisions of the State Corporations Act Cap. 446 of the Laws of Kenya, is an autonomous agency to developing water state schemes and spearheading construction of dams for water supplies, flood control and other uses, construction of dykes for flood control and development of bulk water supplies for Water Service Boards and other Water Service providers among other responsibilities. NWCPC is developing the proposed Isiolo Dam being one of such initiatives designed to provide water for domestic requirements, limited irrigation activities.

1.4 Project Activities

The dam project begins with the concept development that involved desk and field assessment with a view to establishing the need for the project. A wide range of

considerations including the capacity of the existing water sources, water demand and uses as well as social and economic linkages of water in the target area have been undertaken. This was achieved by NWCPC and referenced under the feasibility study and has not been discussed further under this report.

The concept is followed by a detailed feasibility study. Like this environmental scoping process, this study involved determination of the viability of the proposed dam sites with respect to sustainability of water, food, environmental suitability, social acceptability and economical justifications. Development objectives and the need to protect and maintain the natural environment must go hand in hand. This is because environmental sustainability, including the conservation of biodiversity, underpins human well-being (UN 2005).

To regulate the flows of the Ewaso Nyiro River, provide water to the communities downstream, provide small irrigations and ultimately supply the proposed Isiolo Resort City and Isiolo town with water, various alternatives have been investigated in the past. The investigations have covered both run-off water and storage schemes. Dam sites at the Ngare Ndare and Ngare Sirgon dam sites were eliminated because the discharge from the river is inadequate to meet the project objectives. Dam sites along the Ewaso Nyiro river were explored at Murun dam site which had a difficult terrain and relatively low elevation in comparison to the areas of supply, crocodile jaws dam site was chosen by the consultant because of it meeting the project objectives. The no project option meant that the status quo remains i.e. the current water shortage in the three counties and the associated problems will persist.

Physical, LiDAR, geodetic surveys, measurements and social evaluations were carried out in conjunction with all stakeholders and in reference to all other social and economic initiatives in the project area. According to the feasibility so produced, the project is a fulfillment of the communities long time dream of water flow stabililty while the positive implications over-rides the negative impacts that would otherwise be mitigated through integrated measures throughout the dam construction and operation. Actual activities will include bush clearing, decommissioning of point sources of pollution, earth moving and excavations, embankment construction, inundation period and commissioning of the dam.

1.5 Purpose of the Report

The main purpose of this EIA Report is to highlight the significance of the project's potential environmental impacts in order to predict, mitigate, compensate for negative impacts, enhance positive impacts and develop an Environmental and Social Management Plan for the dam project.

1.6 Objectives of the EIA Study

The objectives of this EIA report are:

- To comply with the Environmental (Impact Assessment and Audit) Regulations, 2003, Regulation 6, which requires that an application for an Environmental Impact Assessment (EIA) licence.
- Study the baseline environmental conditions in the project area, such as the physical, biological and socio-economic environment;
- Study the project conditions and requirements in terms of location, construction and operational requirements;
- Study the positive and negative impacts of the improvement of the dam on the traditional society living within the influence of the study area including, but not limited to, job creation and improvement in livelihood;
- Study the gender issues in the project area in-so-far as the dam sections influence the lives of the women, children, the elderly and the disabled, and quantify the benefits, which would accrue to them during and after the construction of the dam
- Assess environmental and social impacts of the project and suggest suitable mitigation measures for adverse impacts;
- Prepare an environmental management plan (EMP) for implementation and monitoring of mitigation measures along with budgetary estimates, institutional and reporting requirements.

1.7 EIA Terms of Reference

CAS Consultants Limited was appointed by the National Water Conservation and Pipeline Corporation (NWCPC) to undertake feasibility and design studies such as to include the following;

i. Identifying appropriate alternative dam sites,
ii. Conduct environmental and social impact assessment (EIA) of the selected project site and the entire project coverage area,
iii. Undertake literature review on previous studies in the Ewaso Nyiro basin and reappraise recommendations on the dam sites alternatives,
iv. Undertake design works of the most appropriate dam site and include the intake, water draw-off facilities, treatment works, transmission mains and strategic storage tanks,
v. Prepare tender documents

The scope of the EIA is to develop suitable recommendations to be integrated in the project design and implementation for mitigation of anticipated adverse impacts to the environment and social setting the project and service areas. An evaluation of public opinions and stakeholders attitude towards the project was captured through interviews and consultative forums conducted throughout the project area. The study has been conducted in compliance with the Environmental Impact Assessment Regulation as outlined under the Gazette Notice No. 56 of 13th June 2003 established under EMCA, 1999.

Defined Specific Objectives of the EIA include (see detailed ToR in Appendix II);

a. A description of the dam site, treatment works area, Transmission lines, storage tanks area and baseline environment and social conditions,
b. Identification of the impacts associated with entire project,
c. Establishment of appropriate mitigation measures,
d. Development of an environment management plan with monitoring indicators for post construction period.
e. Provide appropriate factor for land acquisition and resettlement plans.

The consultant developed terms of reference for the study and submitted to NEMA for approval. Approved Terms of Reference is attached as appendix II of this report.

1.8 EIA Methodology

In accordance to the EIA regulations the objectives of the study should include the following key issues;

i. A clear description of the proposed project including its objectives, design concepts, proposed water uses and anticipated environmental and social impacts,
ii. Description of the baseline conditions in the project areas such as to cover the physical location, environmental setting, social and economic issues,
iii. A description of the legal, policy and institutional framework within which the proposed dam project will be implemented,
iv. Description of the project alternatives and selection criteria,
v. Details of the anticipated impacts to the environment, social and economic aspects of the area covered by the project.
vi. Appropriate mitigation and/or corrective measures,
vii. Develop an environmental management plan (EMP) presenting the project activities, potential impacts, mitigation actions, targets and responsibilities, associated costs and
viii. monitoring indicators,

1.8.1 The Approach

The ultimate goal of this approach was to identify impacts resulting from the proposed project to be determined on the basis of the baseline conditions established during the field work and information obtained from the documents reviewed. For subjective predictions of the impacts, the site area was subjected to environmental scoping process.

Detailed evaluation of the project area has been undertaken to focus on any significant environmental issues. The communities living within the proposed dam coverage area were interviewed during consultation and participation process during the detailed study process. Among the tools that were used included questionnaires, self writing forms, photographs, etc. Overall, the study was undertaken through the stages below;

A. Scoping Process

This process was designed to provide a preliminary view of the environmental and social status. It involved establishment of the diversity on physical environment, climatic conditions, demographic trends as well as the hydro-geological status in the area. Relevant policy and legal requirements were listed. The study team strived to share experiences on water resources and social issues in that part of the country, and in particular with regard to water demand and utilization. This enabled determination of project elements that would be emphasized on. Among the aspects identified and that have been discussed in detail under this report included;

Environmental Aspects

i. Submergence of Ewaso Nyiro River including the related ecosystems (unique indigenous vegetation species and habitats for indigenous micro and macro organisms,
ii. Siltation- Sand transportation and storage in the dam and immediately upstream,
iii. Removal of biomass (live and dead) accumulated over hundred of years,
iv. Water quality effects from point sources dotted all over the project area, livestock pens, manyattas, pit latrines etc
v. Emergence of new species in the area such as to include vectors, wild animals and plant species
vi. Effects on micro climatic conditions in the neighbouring areas

Social and Economic

i. Land issues with respect to land ownership, land acquisitions, compensations

ii. Social linkages of the dam such as to include public health (HIV/AIDS, Malaria, typhoid,bilharzias, etc,
iii. income generation (employment, economic opportunities, irrigation, etc.) and access to water,
iv. Cultural linkages, disruption of cultural setting of the host community due to new interactions
v. Economic values of existing natural resources (wildlife, biomass, sand, soils, stones, etc.),

B. Documentary (Literature) Review

Various relevant documents were reviewed for a clear understanding of the terms of reference, environmental status of the project area and the target river systems, data on demographic trends (for the project area, the beneficiary areas and the adjoining Counties), land use practices in the affected areas (either as catchments, dam location or the beneficiary areas), development strategies and plans (local and national) as well as the policy, legal and institutional documents.

C. Field Assessment

Field assessment was designed to address the physical and biological environment as well as the people in the project area. Determination of the affected environmental and social features would not only be felt within the dam area but also in the neighboring counties (upstream, around the dammed area and downstream). The field work session was, therefore, focused on establishing the anticipated positive and negative impacts in terms of physical and biological environment (hydrology, climatic patterns and water resources related aspects), social and economic trends, (population trends, settlement trends, economic patterns, cultural setting and linkages, land ownership issues, etc.). A field checklist is attached as Appendix I. Specific objectives of the field assessment included;

i. Obtain any available information and data from the local public offices including environment, water, lands and agriculture. Initial Public consultations were also organized with the stakeholders and beneficiaries.
ii. Evaluate the environmental setting around the proposed site. General observations were focused on the topography, land use trends, surface water sources, public amenities, wetlands, settlements, forests, soils, etc. Also to identify climatic and land cover variations along the affected areas,
iii. Evaluate social, economic and cultural settings in the entire project areas,
iv. Undertake comprehensive consultative public participation exercise such as to reach a large section of the project affected persons as well as other stakeholders.

D. Public Consultations

The process of public consultations involved identification of the project stakeholders, communities, engaging County Governments, local NGOs, CBOs, sectoral heads, County Commissioners to the assistant chiefs through letters and follow-up calls, awareness creation and mobilization of communities through chiefs and their assistants and drawing up a timeframe. The consultative meetings were conducted as shown below. The attendance list of the varius foras are attached as Appendix III

Table 1.1 Consultations Schedule.

Type of meeting	Target Stakeholders	Venue	Dates
Public Baraza	General Public (Upstream)	Kirimon location (Samburu/Laikipia County)	30/05/2013
		Oldonyiro location (Isiolo/Laikipia County	03/06/2013
		Kipsing location Isiolo County	02/06/2013
	General Public (Down stream)	Merti area	28/04/2014
		Habaswain Area	29/04/2014
		Sericho Area	30/04/2014
Stakeholders Workshop	Sector Wide Stakeholders	Rangelands Hotel Isiolo	16/07/2013
	Sector Wide Stakeholders	Grande Hotel Isiolo	2/04/2014
	Leaders Workshop	Rangelands Hotel	23/05/2014
Focused group discussions (FGD)	Group Ranches and Mid WRUAS	Longaboli bandas	31/08/2013
	WRUAS Lower Ewaso	WRUA office Maili Saba-Isiolo	3/09/2013
	Conservancies and WRUAS	Sabuk Lodge	1/09/2013
	Land owners	Sabuk Lodge	10/10/2013
	FGD with area CBOs and NGOs	Sportsman Arms Hotel Nanyuki	2/05/2014

1.9 The project team

CAS Consultants Limited has assembled a project team based on appropriate skills and experience from CAS staff. This comprises of the following:

- Dr Eng S.M Mwarania – Project Director;
- Eng Peter Njurumba – Dam Expert;
- Eng Gilbert Maiyo—Water Supply Engineer
- Kibet Koech – Environmental Scientist;
- Joseph Mutwika - Ecologist
- Pauline Ikumi – Socio-economist;
- Joel Odhiambo- Social Development expert.

1.10 Project Cost

The estimated construction of the dam is KES. **10**,170,839,864.00. PURSUANT to regulation 48 of the Environmental (Impact Assessment and Audit) Regulations, 2003, as read with paragraph 4 of the fifth schedule thereof. It is notified to the public that the Cabinet Secretary for Environment, Water and Natural Resources has reviewed the Environmental Impact Assessment fees payable as follows:0.1% of the total cost of the project to a minimum of KSh.10,000 with no upper capping, As per GAZETTE NOTICE NO. 13211.

1.11 Study Limitations

This study was limited to the proposed dam area, proposed pipeline for water distribution and downstream ecosystem and communities. However, the consultant took cognizant of impacts, direct, indirect and cumulative impacts on the proposed project area and project area of influence. Its assumed that the downstream area after Archers Post will benefit more due to regulated river flows.

2 LEGAL AND REGULATORY FRAMEWORK

2.1 Background

In the Constitution of Kenya, 2010, the State clearly undertakes to carry out the following:

- Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits.
- Work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya.
- Protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities.
- Encourage public participation in the management, protection and conservation of the environment.
- Protect genetic resources and biological diversity.
- Establish systems of environmental impact assessment, environmental audit and monitoring of the environment.
- Eliminate processes and activities that are likely to endanger the environment.
- Utilise the environment and natural resources for the benefit of the people of Kenya.

“Every person has the right to a clean and healthy environment, which includes;

- The right to have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69; and
- The right to have obligations relating to the environment fulfilled under Article 70”.

Thus, every activity or project undertaken within the republic must be in tandem with the State’s vision for the national environment as well as adherence to the right of every individual to a clean and healthy environment. NWCPC has complied to the constitutional requirement by undertaking EIA for the proposed Isiolo Dam plus the added benefit of downstream river flows regulations and sustained ecosystem.

2.2 Legal Framework

Kenya has over 77 statutes which relate to environmental concerns. Most of these statutes are sector specific, covering issues such as public health; soil erosion; protected areas;

endangered species; water rights and water quality; air quality, noise and vibration; cultural, historical, scientific and archaeological sites; land use; resettlement; etc.

Previously, environmental management activities were implemented through a variety of instruments such as policy statements and sectoral laws and also through permits and licences.

With the enactment of the Environmental Management and Co-ordination Bill in December 1999, the institutional framework for environmental management was strengthened. The Environmental Management and Co-ordination Act (EMCA) of 1999 provided for the establishment of a National Environment Management Authority (NEMA), which became operational in July 2002, with the statutory mandate to co-ordinate all environmental activities.

2.2.1 Environmental Management and Coordination Act (No. 8 of 1999)

''An Act of Parliament to provide for the establishment of an appropriate legal and institutional framework for the management of the environment and for matters connected therewith and incidental thereto''.

Under section 58 (1) *of Kenya Government's Environment Management Coordination Act (EMCA)*, *Number 8 of 1999 and National Environmental Management Authority (NEMA) Regulations for Environmental Impact Assessment and Audit of June, 2003,* the proposed Construction of Isiolo dam project falls under the prescribed list of projects for which environmental impact assessment is mandatory, prior to implementation.

The basis is that the proposed project constitutes several components of activities, which would generate considerable changes and significant effects to the environment including on land, water, atmospheric resources and biological diversity.

Part II of the Act confers the right of every person to a clean environment and to its judicial enforcement. The Act therefore makes it mandatory for the project proponent to work in a clean environment and protect people living close to the project.

All the chapters 1 to 13 apply to the new project at one stage or the other and therefore the project proponent is required to understand and use the Act in total. The Act provides for the setting up of the various EIA Regulations and Guidelines which are discussed below:

2.2.1.1 Environmental Impact Assessment and Audit Regulations 2003

The Environmental Impact Assessment and Audit Regulations state in Regulation 3 that *"the*

Regulations should apply to all policies, plans, programmes, projects and activities specified in Part III and V of the Regulations'' basically lists the guidelines of undertaking, submission and approval of the EIA Report (this report).

2.2.1.2 Environmental Management and Co-ordination (Waste Management) Regulations 2006

These are described in Legal Notice No. 121 of the Kenya Gazette Supplement No. 69 of September 2006. These Regulations apply to all categories of waste as provided in the Regulations. These include:

- Industrial wastes;
- Hazardous and toxic wastes;
- Pesticides and toxic substances;
- Biomedical wastes;
- Radio-active substances.

These Regulations outline requirements for handling, storing, transporting, and treatment / disposal of all waste categories as provided therein. Wastes contaminated with petroleum product are considered to be hazardous. The project will have to abide by these regulations in dealing with waste management especially the provisions of Industrial, Hazardous and toxic wastes which may be generated during construction and operation.

2.2.1.3 Environmental Management and Coordination, (Water Quality) Regulations 2006

These are described in Legal Notice No. 120 of the Kenya Gazette Supplement No. 68 of September 2006. These Regulations apply to drinking water, water used for agricultural purposes, water used for recreational purposes, water used for fisheries and wildlife and water used for any other purposes.

In fulfilling the requirements of the regulations the project proponent will have to undertake monitoring of both domestic water and wastewater and ensure compliance with the acceptable discharge standards.

2.2.1.4 Environmental Management and Coordination, Conservation of Biological Diversity (BD) Regulations 2006

These regulations are described in Legal Notice No. 160 of the Kenya Gazette Supplement No. 84 of December 2006. These Regulations apply to conservation of biodiversity which

includes Conservation of threatened species, Inventory and monitoring of BD and protection of environmentally significant areas, access to genetic resources, benefit sharing and offences and penalties. There are no localised endangered species in the project area. However, land take during construction and operation will affect the migratory routes of wildlife; this will be mitigated by anti poaching initiatives and enforcement of the Wildlife (Conservation and Management) Act. CAP 376. *The proponent also will sensitize and empower conservancies to occupy the land neighbouring the dam site so as to foster flora and fauna. This will be achieved by fencing off the conservancies, provision of services (watering points for domestic and livestock) on the periphery of the conservancies.*

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

These regulations are described Legal Notice No. 131 of the Kenya Gazette Supplement no. 74, October 2006 and will apply to all internal combustion engine emission standards, emission inspections, the power of emission inspectors, fuel catalysts, licensing to treat fuel, cost of clearing pollution and partnerships to control fossil fuel emissions used by the Contractor. The fossil fuels considered are petrol, diesel, fuel oils and kerosene.

2.2.1.6 Environmental Management and Coordination (Controlled Substances) Regulations 2007

These regulations are described in Legal Notice No. 73 of 2007. The Government of Kenya banned the importation of Chlorofluorocarbons (CFCs) with effect from 1 January 2009, to ensure that Kenya is compliant with the provisions of the Montreal Protocol on Substances that Deplete the Ozone Layer.

This regulation makes it mandatory for industries, and other stake holders in ODS trade, to obtain a license to import these substances. The ozone-friendly refrigerants, oil lubricants, and other ozone-friendly alternative chemicals to CFCs shall be the only ones that shall be licensed for importation for use in equipment. No license shall be issued to any person to import CFCs.

The customs officers, at the points of entry, shall use CFC identifiers to detect and intercept CFCs that may be imported illegally. Intercepted CFC shall be shipped back to the country of origin at the cost to be met by the importer. The proponent shall not utilize CFCs or if necessary they get express permissions from NEMA.

2.2.1.7 Environmental Management and Coordination (Wetlands, Riverbanks, Lake Shores and Sea Shore Management) Regulations 2009

These regulations are described in Legal Notice No. 19 of the Kenya Gazette Supplement no. 9, February 2009. These regulations include management of wetlands, wetland resources, river banks, lake shores and sea shores. Specific sections have requirements that apply to Ewaso Nyiro River as a major source of dam water. The regulations will empower the County Environment Committee in Laikipia and Isiolo to co-ordinate, monitor and advise on all aspects of wetland and water resource management within the counties.

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

These Regulations prohibit making or causing any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. It also prohibits the Contractor from excessive vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment or excessive vibrations which exceed 0.5 centimetres per second beyond any source property boundary or 30 metres from any moving source. Under the regulation the Contractor will be required to undertake daily monitoring of the noise levels within the project area during construction period to maintain compliance.

2.2.2 Occupational Health and Safety Act

This is an Act of Parliament which provides for the safety, health and welfare of all workers and all persons lawfully present at workplaces and it also provides for the establishment of the National Council for Occupational Safety and Health and for connected purposes. It applies to all workplaces where any person is at work, whether temporarily or permanently and therefore will apply to the project both during construction and operation phases.

The purpose of this Act is to:

- Secure the safety, health and welfare of persons at work; and
- Protect persons other than persons at work against safety and health arising out of, or in connection with the activities of persons at work.

2.2.3 Water Act 2002

Water in Kenya is owned by the Government, subject to any right of the user, legally acquired. The control and right to use water is exercised by the Minister administering the Act, and such use can only be acquired under the provisions of the Act. The Minister is also vested with the duty to promote investigations, conserve and properly use water through out Kenya. Water

permits may be acquired for a range of purposes, including the provision and employment of water for the development of power and other uses. The following are the regulations developed under Water Act 2002 relevant to the project.

2.2.3.1 The Water Resources Management Rules (2007)

These Rules are described in Legal Notice Number 171 of the *Kenya Gazette Supplementary Number 52 of 2007*. They apply to all water resources and water bodies in Kenya, including all lakes, water courses, streams and rivers, whether perennial or seasonal, aquifers, and shall include coastal channels leading to territorial waters.

The Water Resources Management Rules empower Water Resources Management Authority (WRMA) to impose management controls on land use falling under riparian land.

The EIA team has established that this Act will be at the centre of all the dam development activities. The proponent NWCPC will adhere to the rules and regulations stipulated in the Water Act.

2.2.4 The Wildlife (Conservation and Management) Act (Cap 376)

This principal Act regulates wildlife conservation and management in Kenya. The Act establishes Kenya Wildlife Service (KWS) as the implementing agency. Under section 9 and subsection 3A, the functions of KWS are stated among others as: to provide advice to the government and local authorities and landowners on the best methods of wildlife conservation and management and authority to ensure viability of conservation areas. Furthermore, the Minister responsible for wildlife has discretionary powers to promulgate such regulations to enhance the management of such conservation areas, so long as the regulations so promulgated are reasonable and not ultra vires to the parent Act.

The proposed Isiolo dam will sit astride three wildlife conservancies (Nalare, Koija and Ilmotiok) and four privately owned land (Olmalo, Loisaba, Suyian and Impala). These parcels of land have conservation initiatives currently ongoing. Due to the vastness of the land in comparison to the 2073Ha that will be acquired for the dam. The proponent has proposed in the EMP several mitigatory and compensatory measures which includes acquisition of 1000 Ha to be put under exclusive conservation uses.

2.2.5 The Forests Act 2005

The Forests Act 2005 repealed Cap 385 of the Laws of Kenya and provides for the establishment, control and regulation of Forests. The Act confers powers on the Minister

responsible of Forests to set aside specific areas for the conservation of fauna and flora, for the management of water catchments, prevention of soil erosion or for the protection and management of indigenous forests on alienated Government land. Such forest land includes those formerly gazetted under Cap 385, thus essentially putting the control of all Kenyan forests under a single statute. The Forests Act makes illegal, any alienation of gazetted forest land for any purposes considered contradictory to the dictum of conservation, requiring that, such proposals to be debated and approved by Parliament, after completion of a comprehensive EIA Study. The project doesnt touch on any land allienated for the protection and management of indigenous forests or Government land.

This EIA Study has ruled out any significant interaction between the proposed project and gazetted forestland. The only impact therefore will manifest in form of the trees to be cleared to pave way for the dam construction which will be compensated by afforestation of the buffer area. This act will be fulfilled during aforestation initiatives for the purposes of catchment restoration and protection of the dam by planting trees on the buffer areas of the dam to compensate for the loss of flora during construction.

2.2.6 The Agriculture Act, Cap 318 of the Laws of Kenya

This statute seeks to promote and maintain a stable agriculture, to provide for the conservation of the soil and its fertility and to stimulate the development of agricultural land in accordance with the accepted practices of good land management and good husbandry. This Act primarily guides and regulates farming practices. The Agriculture Act is the principal land use statute covering, inter-alia, soil conservation and agricultural land use in general.

The Agricultural Land-Use Rules under Cap 318 are clear on activities proscribed in riparian areas and it's essential that the proposed construction of the dam doesnt contradict requirements of this Act, but provides opportunities to expand irrigable land in the country and utilisation of sustainable agriculture. Catchment restoration activities up and down stream will ensure reduce soil erosion and afforestation.

2.2.7 The Kenya Roads Act 2007

This Act created three public bodies to cater for the national roads development and maintenance programme as follows:-

i. The Kenya National Highways Authority charged with the responsibility of managing and maintaining all road works on class A, B, C as well as other rural paved roads non of their roads is affected by the project.
ii. The Kenya Rural Roads Authority responsible for all rural and small urban roads of class D and below. The roads that will be use d by the project implementation team

include E462/465/470. These roads are under KeRRA jurisdiction.

iii. The Kenya Urban Roads Authority to manage and maintain all road works on urban roads in cities and major towns.

The bridge at crocodile jaws areas along E462 will be removed and an improved road and bridge will be provided at the crest of the dam which will give an aerial view of the entire dam area. And a bridge further to the dam area near Ilmotiok to provide alternative crossing to Maralal, Rimuruti area, this has been proposed to be developed by the county government.

2.2.8 The Physical Planning Act (Cap 286)

This Act 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 mainly the county Level. The Act provides for a hierarchy of plans in which guidelines are laid down for the future physical development of areas referred to in the 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 advocates for public participation in the preparation of plans and requires that proper consideration be given to the potential for economic and social development.

This EIA study has confirmed that the Feasibility Study took account of regional development plans in identifying the the most suitable dam site. Public consultations have been undertaken as part of the EIA and the same will be continued when this report is advertised an *displayed for the statutory public review.*

2.2.9 The Antiquities and Monuments Act, 1983 Cap 215:

The Act aim to preserve Kenya's national heritage. Kenya is rich in its antiquities, monuments and cultural and natural sites which are spread all over the country. The National Museums of Kenya is the custodian of the country's cultural heritage, its principal mission being to collect, document, preserve and enhance knowledge, appreciation, management and the use of these resources for the benefit of Kenya and the world. Through the National Museums of Kenya many of these sites are protected by law by having them gazetted under the Act.

This study has ascertained that assets protected under this act are not encountered anywhere within the project area of influence. But a chance procedure has been provided for in the EMP.

2.2.10 Occupiers Liability Act (Cap. 34)

Rules of Common Law regulates the duty which an occupier of premises owes to his visitors in respect of danger and risk due to the state of the premises or to things omitted or attributes an affliction on his/her health to a toxic materials in the premises.

In additional to acquisition a of dam area, the NWCPC will mount a public sensitisation programme to ensure that people are aware of the hazards posed by presence of the dam in the project area.

2.2.11 Way Leaves Act (Cap. 292)

The Act provides for certain undertakings to be constructed e.g. transmission lines, pipelines, canals, pathways etc., through, over or under any lands. This project is under the provision of the Act. Section 3 of the Act states that the Government may carry any works through, over or under any land whatsoever provided it shall not interfere with any existing building or structures of an ongoing activity.

As a precursor to construction of the pipeline, NWCPC will acquire rights to a 6.0 m-wide corridor along the entire route (90KM) of traverse as allowed for under this Act.

2.2.12 Penal Code (Cap.63)

The Act makes it criminal for anybody to pollute common resources such as air, public water supply,acoustic quality, etc and stipulates fines for diverse offences.

The ESMP prepared as part of this EIA has identified nuisances as potential adverse impacts of the project and has recommended activities towards mitigation/ minimisation/ avoidance of nuisances arising from the project activities.

2.2.13 The Standards Act Cap 496

The Act is meant to promote the standardization of the specification of commodities, and to provide for the standardization of commodities and codes of practice; to establish a Kenya Bureau of Standards, to define its functions and provide for its management and control. Code of practice is interpreted in the Act as a set of rules relating to the methods to be applied or the procedure to be adopted in connexion with the construction, installation, testing, sampling, operation or use of any article, apparatus, instrument, device or process.

The Act contains various specifications touching on water supply products and the Proponent shall ensure that commodities and codes of practice utilised in the project adhere to the provisions of this Act.

2.2.14 Public Roads and Roads of Access Act (Cap. 399)

Sections 8 and 9 of the Act provides for the dedication, conversion or alignment of public travel lines including construction of access roads adjacent lands from the nearest part of a public road. Section 10 and 11 allows for notices to be served on the adjacent land owners seeking permission to construct the respective roads.

The EIA study has confirmed that only E462 will be costrained during construction and no new access roads will be opened up and the project will rely on existing roads.

2.2.15 The Lakes and Rivers Act Chapter 409 Laws of Kenya

This Act provides for protection of river, lakes and associated flora and fauna. The Act should however be read in conjunction with the Water Act 2002 which has clearly outlined modalities for the management of Riparian areas.

In line with requirements of the Water Act 2002 and its Water Management Rules, the development of the dam will be on a riparian areas but where construction in such sites is inevitable, an authorization will be obtained from the Water Resources Management Authority (WRMA).

2.2.16 The Limitations of Actions Act (Cap. 22)

This Act provides for recognition of squatters and the conditions under which they would have rights for compensation for loss of land. If squatters have been in occupation of private land for over twelve (12) years, then they would have acquired rights as adverse possessors of that land as provided under the limitation of Actions Act, section 7.

The issue of restoration of livelihoods are quite central to the construction and operation of the proposed dam and indeed the financing agencies. In line with requirements of World bank OP 4.12, the NWCPC is advised to commision a Resettlement Action Plan (RAP) to guide resolution of all displacement concerns occasioned by the proposed development. There are settlement on government land especially in the Livestock Holding Grounds in Isiolo county.

2.2.17 Acts Related to Land

Kenya recently undertook reforms in the land sector creating a policy and new legal and institutional frameworks. Some Acts were repealed in the. The new legal frameworks include:

a) The Land Registration Land Act, 2012.

This is an Act of Parliament to revise, consolidate and rationalize the registration of titles to land, to give effect to the principles and objects of devolved government in land registration, and for connected purposes. The Land Registration Act of 2012 repeals the following previous legislations:

- The Indian Transfer of Property Act, 1882;
- The Government Lands Act, (Cap 280);
- The Registration of Titles Act, (Cap 281);
- The Land Titles Act, (Cap 282);
- The Registered Land Act, (Cap. 300)

b) The Land Act, 2012

This is an Act of Parliament to give effect to Article 68 of the Constitution, to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land based resources, and for connected purposes. Previous laws repealed by this Act are:

- The Wayleaves Act (Cap. 292);
- The Land Acquisition Act (Cap. 295)

This Act will apply to the land to be acquired for dam construction, auxiliary sites and water supply pipeline. All matters relating to land acquisition shall be dealt with in the Resettlement Action Plan recommended by this study.

2.2.18 HIV & Aids Act 2006

Act promotes public awareness about causes, modes of transmission, consequences, means of prevention and control of HIV and AIDS through educational and information campaign This act is relevant to the proposed project at construction and operational phase in ensuring that community and non-community members are aware about HIV/AIDS. HIV and Aids awareness campaigns proposed in the EMP will go along way in behavioural change of the communties in the project area.

2.2.19 Food, Drugs and Chemical Substances Act , CAP 254 Revised Edition 2012 of (1992)

The Act prohibits any person to sell any poisonous, adulterated or unfit food for consumption, to advertise any food in a manner that is false, misleading or deceptive as regards the safety

of the food and to sell or store food under unsanitary conditions. This act is relevant to the project at the construction phase where food vendors, restaurants will sell food to construction teams on site. It also prohibits sell of drugs that is adulterated deceptive or prepared under unsanitary conditions. This act is relevant to projects construction and operational phase for those who will be selling medicinal drugs for either animals or humans or any other drugs in the area. The contractor shall ensure that food production in the camp are prepared under acceptable conditions as provided in the Act.

2.2.20 Alcoholic Drinks Control Act No. 4 of 2010

The Act ensures control of alcoholic drinks, licensing for sell of drinks prohibits sale of alcoholic drinks to person under the age of 18 years. It also prohibits drunk and disorderly behaviour in licensed premises, shops, hotels and other public places. There local administration will be required to enforce the act and also the constractor not to allow drinking by personnel during work hours

2.2.21 National Environment Policy 2012

The policy promotes Environmental Health Impact Analysis (EHIA) as a component of the Environmental Impact Assessment (EIA) for all development projects. Enhance the provision of occupational health and safety services. This policy is relevant to this proposed project in carrying out health and environmental impact assessments to screen for risks and also ensure that occupational health and safety rules and guidelines are adhered to during construction, operational and decommissioning phase.

2.3 International guidelines

The following World Bank safeguard policies relates to the dam development.

a. **Environmental Assessment (Operational Policy, OP 4.01):** OP 4.01 covers impacts on the natural environment (air, water and land); human health and safety; physical cultural resources; and trans-boundary and global environment concerns. By this report the proponent has developed an Environmental and Social Management Plan.

b. **Water Resources Management (Operational Policy, OP 4.07):** This OP relates to water resources management for providing portable water, sanitation facilities, flood control and water for productive activity. It calls for economical viability, environmental sustainability and social equitability. The policy is relevant to the project because of sound management of water resources. The objective of the dam development is sustainable utilisation of water resource in the project area.

c. **Involuntary resettlement (Operational Policy, OP 4.12):** Relates to land acquisition and resettlement in the event that private land will be required for development of the dam and pipeline. Resettlement Action Plan has been recommended to be undertaken as a separate study for this project.

d. **Operational Directive 11.03 (Safeguarding Cultural Property)**: This directive defines the cultural property as having archaeological, palaeontological, historical, religious and unique natural values. During the social impact assessment, the consultant didn't identify critical cultural properties in the project area which could be affected. However, a chance find procedure has been provided.

2.4 International conventions

The following international conventions will be evaluated in detail during the full EIA Study:

a. Convention on Biological Diversity;

The Convention on biological diversity is a commitment by the world's nations to conserve biological diversity, to use biological resources sustainably and to share equitably the benefits arising from the use of genetic resources. It is the first global legal instrument to comprehensively address all aspects of biological diversity. —genetic resources, species and ecosystems. The proposed dam site and pipeline for the Isiolo Dam is not founded in sensitive ecosystems and main objective of the project is to regulate flows of Ewaso Nyiro River and equitable access of the resource both by all the communities in the project area, and ensuring the downstream users including Lorian Swamp have continued flow and access of the water

resource. However, loss of flora in the area to be inundated will be compensated by replanting of indigenous trees at the buffer and along the pipeline.

b. The Ramsar Convention;

The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The proposed project site doesn't fall within the 9 criterions set out by the convention on identification of Ramsar sites. Development of the Dam will have positive payoffs to Lorian swamp which is an important ecological site by regulating flows and ensuring the flow of the river Ewaso Nyiro.

c. Convention on the Conservation of Migratory Species of Wildlife Animals;

The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or the Bonn Convention) aims to conserve terrestrial, marine and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale. The impacts of the project on migratory species will be localized to the proposed pipeline. The consultant has proposed to lay underground pipeline and replant indigenous trees along the proposed pipeline and in the buffer areas of the dam. By this migratory species will regain the routes upon completion of construction. Appropriate mitigation shall be developed on site during construction by consulting KWS and other wildlife agencies in the area on best onsite mitigation for the migration routes during construction.

d. African Convention on the Conservation of Nature and Natural Resources;

The contracting States shall undertake to adopt the measures necessary to ensure conservation, utilization and development of soil, water, flora and faunal resources in accordance with scientific principles and with due regard to the best interests of the people. Development of the dam will reduce pressure on flora exerted by the human activity and wildlife but storing water for sustainable use.

e. Kyoto Protocol to the United Nations Framework Convention on Climate Change.

The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The project has identified streams of carbon dioxide and green house gases and provided reduction and mitigating measures in the environmental management plan in chapter 8.

3 DESCRIPTION OF THE PROJECT ENVIRONMENT

3.1 Biophysical Environment Introduction

The Arid and Semi-Arid Lands (ASALs) cover 80% of Kenya's land area. A vast majority (74%) of ASAL constituents were poor in 2005/06; poverty rates in the ASALs have increased from 65% in 1994 (KIHBS 2005/6 cited in the former Ministry of State for the Development of Northern Kenya, which contrasts with the rest of Kenya -- national poverty rates fell from 52% to 46% in the decade 1996- 2006. Similar stark inequalities between the ASALs and other areas of Kenya are found in health and education as well as infrastructure development and services provisioning (Ministry of State for the Development of Northern Kenya 2010a).

The Ewaso Ng'iro catchment is a landscape comprised of communal and trust lands, cattle ranches and private wildlife conservancies managed by both pastoralist communities and commercial enterprises, as well as agricultural plots managed by agribusinesses and smallholder farmers. Although parks and protected areas cover less than 10% of the catchment it is home to the greatest diversity and density of wild ungulates in East Africa outside of the Serengeti-Mara park system The Ewaso Nyiro North makes up the largest drainage basin in Kenya, covering a total of 210,226 km^2 which is predominantly ASAL. It lies north to north east of Mt. Kenya and the Nyandarua (Aberdare) range. Although the main river originates from the Nyandarua range, the tributaries originating from Mt. Kenya supply most of the flow. Whereas the surface flow from the Ewaso Nyiro river disappears into the Lorian Swamp in Kenya, subsurface flows continue eastwards to recharge rivers inside Somalia, which eventually drain into the Indian Ocean.

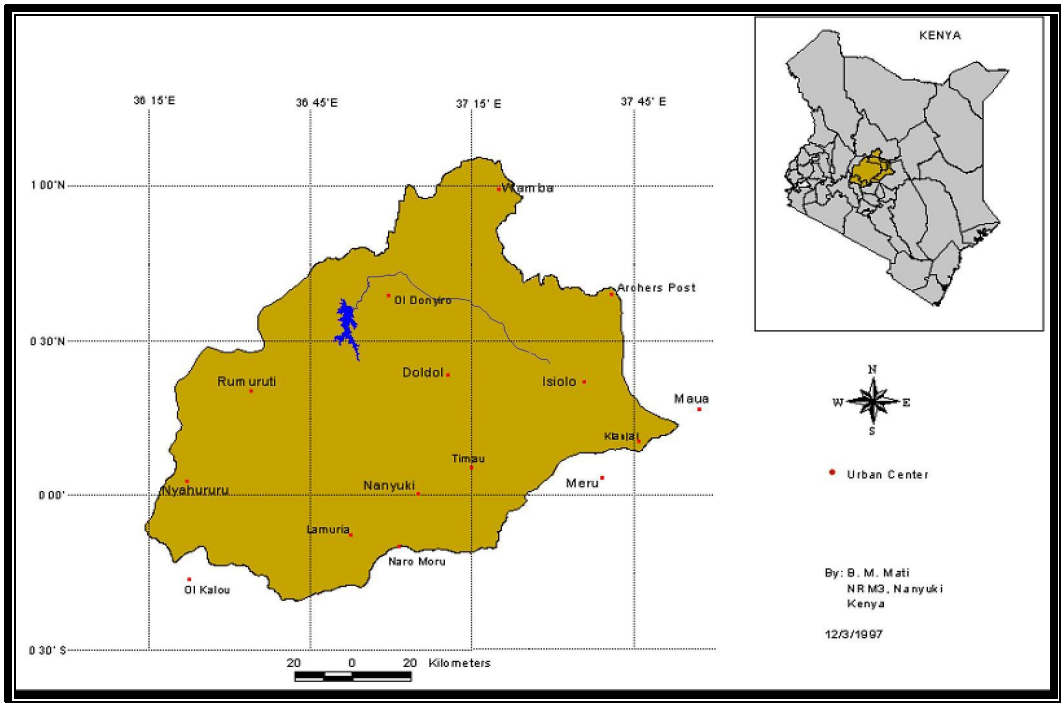
3.1.1 Upper Ewaso Nyiro North Basin

The Upper Ewaso Nyiro North basin (or simply Upper Ewaso Nyiro basin), is the upstream section of the greater Ewaso Nyiro River basin, bounded by the natural topographic divide, and controlled downstream at Archers' Post. The basin covers an area of 15,634 sq.km between latitudes 0^o 20' south and 1^o 00' north and longitudes 36^o 15' east and 38^o 00' east (Figure 3.1). The proposed dam site is at Oldonyiro. The biggest town in the region is Nanyuki, situated 200 km north of Nairobi. Although the basin traverses a diverse topography and climatic zones I -VI, about 70% of the basin comprises what is known as the "Laikipia Plateau".

The Laikipia Plateau is a zone of transition from the wetter to drier part of the eastern Kenya highlands. A large proportion of the central region is under large scale ranches, while wheat and barley are grown on the higher (wetter) altitudes. Small scale subsistence settlements are

also spreading. Pastoralists inhabit the northern region, an area having a harsh and fragile environment, where widespread overgrazing, soil erosion and general land degradation are quite rampant (Ericksen etal 2011)

Figure 3.1 Geographical Location of upper Ewaso Nyiro basin and proposed damsite and pipeline in blue.



Dam site exploration for the proposed Isiolo Dam water project has been carried out in the Northern slopes of Aberdare's and Mt Kenya Water Towers. Administratively the project area where the proposed dam site is sits astride two counties of Isiolo and Laikipia. The proposed dam area covers boundaries of two counties and has similar socio-economic, biophysical and geographical settings.

3.1.2 Rainfall

Rainfall in the Upper Ewaso Nyiro Basin varies with altitude, and since the Basin lies in the lee slopes of Mt. Kenya and the Nyandarua range, the area is generally dry. Rainfall ranges from 365 mm per annum at Archer's Post to over 2000 mm on the Nyandarua range. However, the average annual precipitation for most of the Basin is about 700 mm. A varied rainfall distribution is found in the Basin. In the western and north western parts, rains occur in a single season, between April and August. The eastern side has a clear bimodal distribution with rainfall maxima in April and October. The central region is a transition zone, where the two patterns overlap. The figure below shows the rainfall distribution around the dam area. The dam area receives very little precipitation during the wet periods.

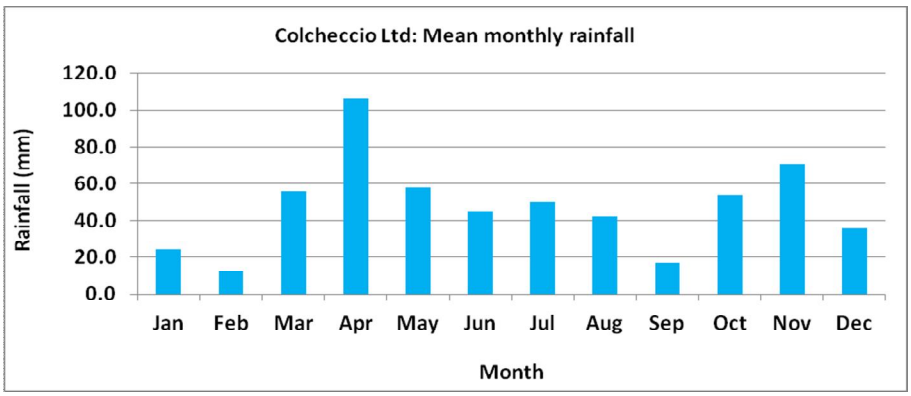


Figure 3.2: Colcheccio Ltd: Mean monthly rainfall

Temperatures are relatively low, with mean annual temperatures ranging about 18-200C Figure 3.2 shows the rainfall distribution patterns in the upper Ewaso Nyiro basin. The proposed project site is in the northern parts of the catchment area with less than 500mm annual rainfall as indicated in the figure 3.2 below; inset in blue is the specific inundation area and pipeline. For the Crocodiles Jaws Reservoir, the mean daily temperature has been estimated by averaging the mean daily temperatures at Rumuruti Dam (altitude 1770m.a.s.l.) and Isiolo (1100masl) stations. The temperature results are summarised in Table 3-1 below.

Table 2.0: Estimated mean daily temperature : Ewaso Nyiro North basin

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rumuruti	16.1	17.1	17	17.4	17.3	16	16.4	16.7	16.5	17.5	17.2	16.8
Isiolo	23.3	24.3	24.7	23.9	23.9	23.2	22.6	22.9	23.9	24.3	22.6	22.3
Croc. Jaws	19.7	20.7	20.85	20.65	20.6	19.6	19.5	19.8	20.2	20.9	19.9	19.55

While the estimated mean daily temperatures at Crocodiles Jaws are graphically shown in figure 3.3 below.

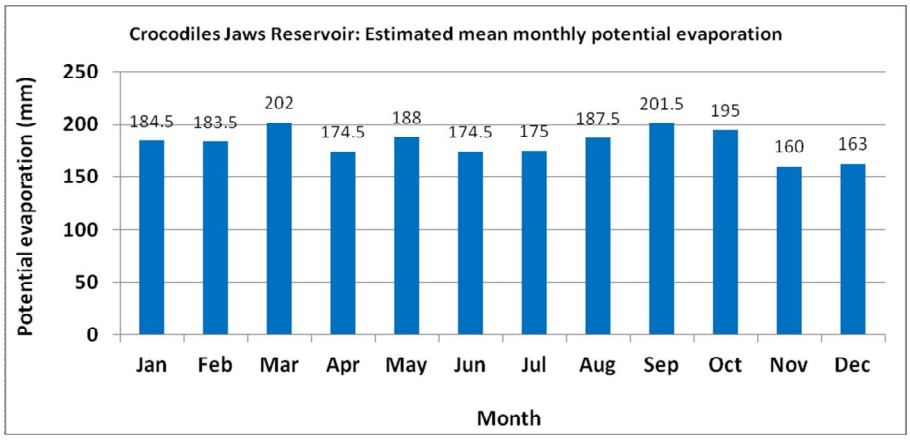
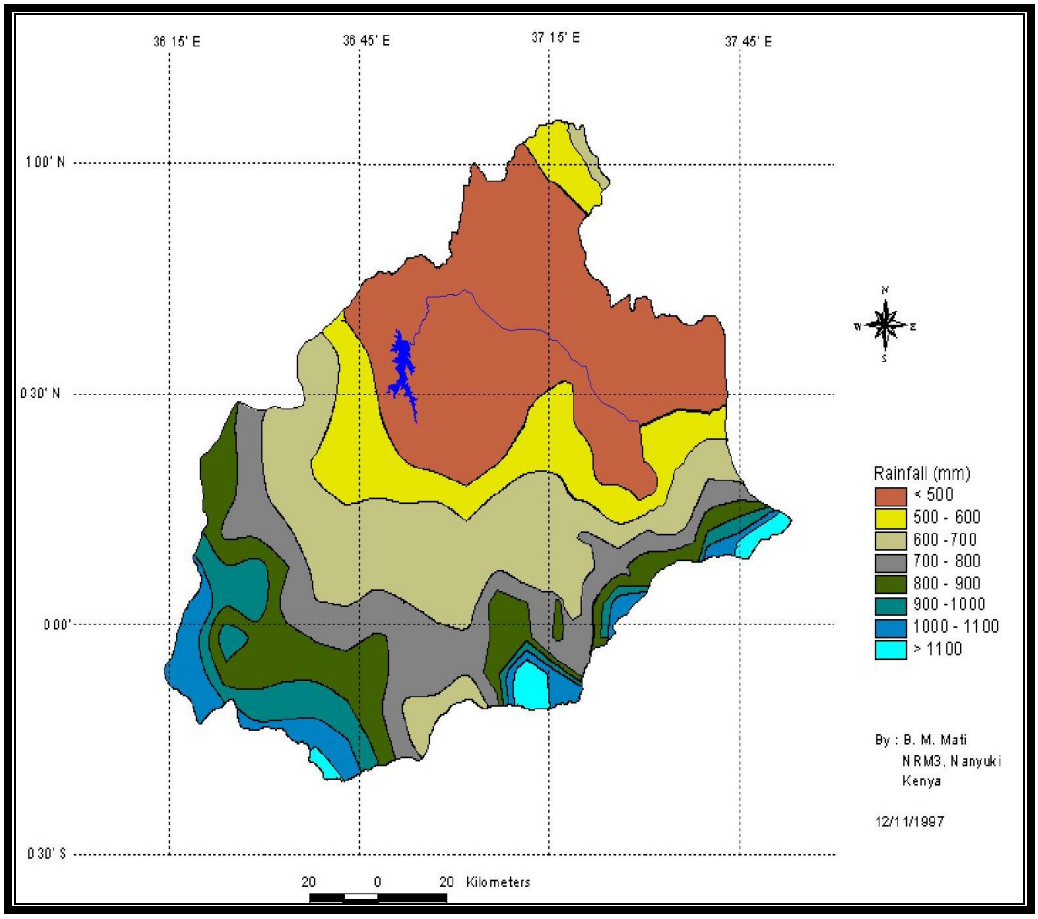


Figure 3-3: Estimated mean monthly evaporation at Crocodiles Jaws

Figure 3.2 Rainfall Distribution Patterns in the Upper Ewaso Nyiro Basin. Inset is the Dam Site (Inundation Area) and Pipeline in Blue.



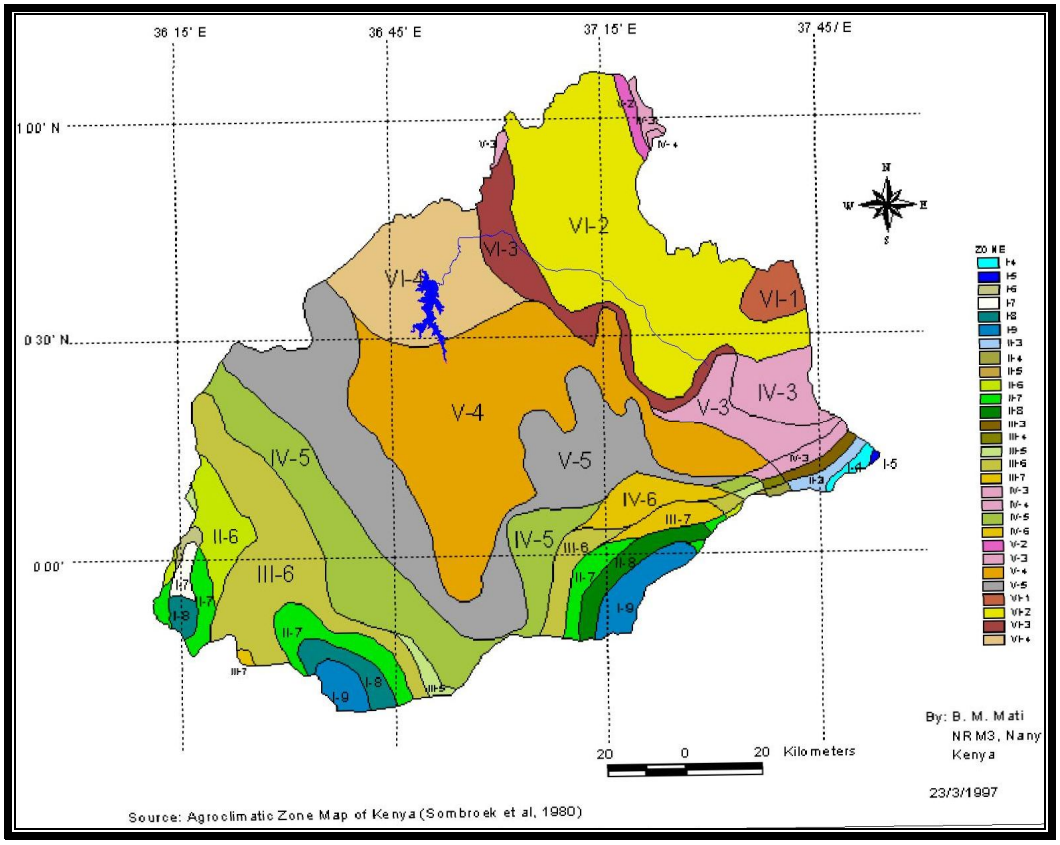
3.1.3 Agro-climatic zone map

In the Upper Ewaso Nyiro basin, land use, crop performance, range management and other social and economic activities are more closely associated with the agro-climatic zones than with rainfall amount. This is because these zones also show the effects of temperature and evaporation, which are important for agricultural production.

The agro climatic zone map in figure 3.3 shows that high moisture and low temperature gradients are associated with increasing relief. Moisture gradient increases from zone I to VI, while temperature decreases with zone 1 being hottest (about 33^{o}C) and zone 9 coldest. Therefore, zone VI-1 is very hot and very dry, while zone I-9 is very cool and very wet. The other zones lie between these two extremes. The central part of the basin, which forms the Laikipia Plateau lies in moisture zones IV-VI, and temperature zone 4-5. This indicates a relatively cool dry region, which is normally unsuitable for rainfed crop production. The hot, dry

areas are found in the north of the basin. However, the soils can sustain irrigable agriculture and livestock production hence improving the livelihoods in the project area.

Figure 3.3 Agroclimatic Zone of the Upper Ewaso Nyiro Basin, Project Dam Site and Pipeline Inset in Blue Colour.



3.1.4 Soils Map

Soils maps are important in land and water management. Activities such as conducting feasibility studies for land use planning, assessment of erosion, agriculture and environmental conservation rely on a good knowledge of the soils resource. The soils of the Upper Ewaso Nyiro basin are diverse and they vary with the topography and the geology. Figure 3.4 shows that about 36 major soil types were identified based on the FAO soil classification (FAO, 1987). The dominant soils include the following :-

i. Soils on mountains and major scarps. These are developed on older volcanoes and they include, haplic phaeozems lithosols, eutric regosols;
ii. Soils on plateaus are developed on tertiary basic igneous rocks. They include; ortho-vertic phaeozems, vertisol and planosols;

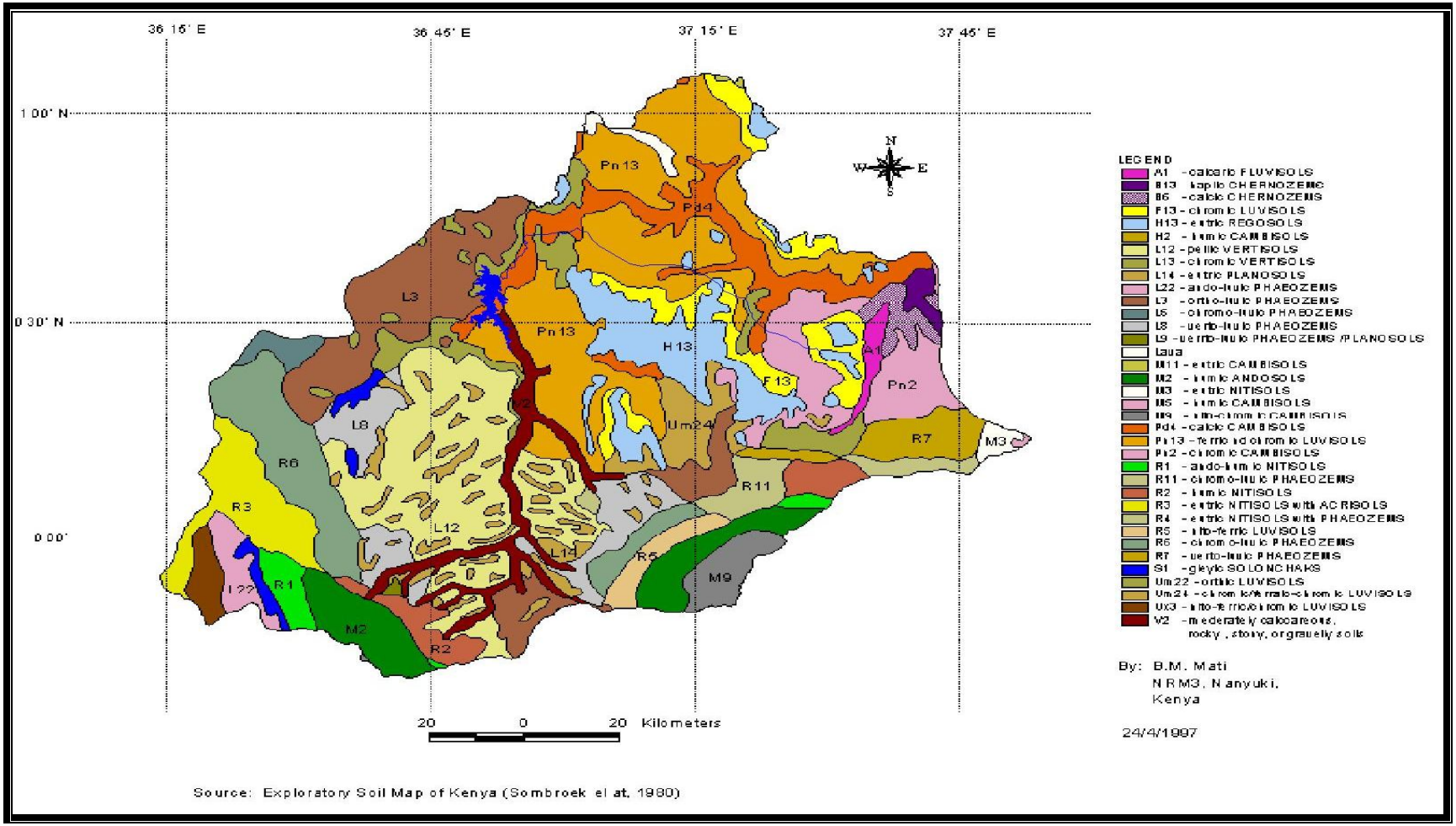
iii. Soils on dissected and non-dissected plains. These are developed from basalts. They include chromic luvisols, ortho-luvic phaeozems and chromic cambisols.

In the proposed dam site is calcic cambisols and in the pipeline is ferric. Chromic luvisols, there are rock outcrops and soils derived from basalts. They include eutric regosols, arenosols, calcic cambisol and haphic xerosols. Construction material sourcing shall be obtained within the project area. This will demand proper management of the material sources as stipulated in the ESMP. Figure 3.4 Soils of the Upper Ewaso Nyiro basin inset in blue color is the dam site and pipeline.

3.1.5 Geology

The catchment has four major lithology classes: igneous rocks, sedimentary rocks, metamorphic rocks and unconsolidated rocks. Igneous rocks are formed from molten lava, sometime referred as volcanic rocks. The texture of igneous rocks is determined by how fast the molten material cool and how large the mineral crystals grow within the rock. Basalt is fine-textured and granite is coarse textured. Weathering of fine-grained rocks produces soils containing fine material such as clay and silt, while coarse textured rocks develop into sandy soils. Sedimentary rocks are formed either by accumulation of fragments of rocks, minerals and/or organisms which are cemented together, either chemically or by compression. Metamorphic rocks are formed within igneous or sedimentary rocks are buried deep within the earth and are subjected to high amounts of heat, pressure and /or chemical activity. Geological investigation confirms that limited water loss will be experienced on the dam base and also the demand for construction material will be reduced hence minimized environmental degradation.

Figure 3.4 Soils of the Upper Ewaso Nyiro Basin.



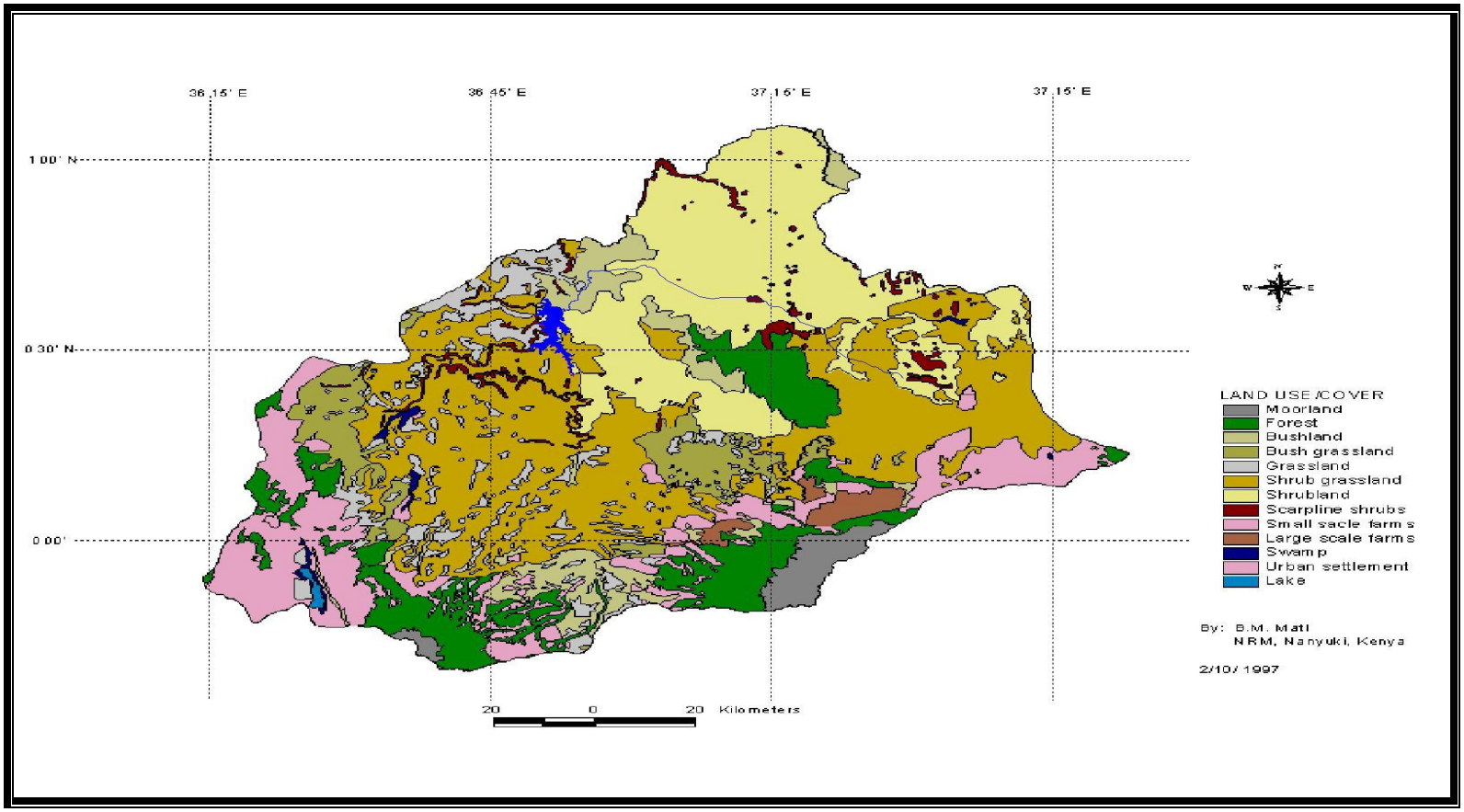
3.1.6 Land Use/Cover Map

The land use and natural vegetation types in the Upper Ewaso Nyiro basin depend on the altitude, climate and soils. On mountain slopes, moist montane forests dominate. There are also riverline forests especially in higher altitude, and dry forests in the drier highlands such as Mathews Range. Shrub grasslands and bush grasslands occupy much of the Laikipia Plateau area, while in the plains of Isiolo and Samburu, shrubland is dominant. The dominant vegetation is Shrubland consists of woody plants about 6 m tall and without a significant presence of trees. Canopy cover is more than 20%. The herbaceous understorey is usually sparse, then bush grassland consists of grassland with scattered trees and shrubs having a combined canopy cover less than 20% and abit of Grassland where Grasses or sedges dominate these communities. Woody plants are either lacking or are dwarfed and inconspicuous. Woody plants compose less than 2% of the canopy cover.

The proposed dam area is characterized with sparse vegetation comprising of indigenous trees mainly *Acacia mellifera*, *Acacia seyal*, *Acacia nilotica*, *Acacia senegal* and *Acacia tortillis* with undergrowths of shrubs and grasses including *Cyperus esculentus, Cynadon. Nlemfuensis, Eragrostis tenuifolia,Eleusine indica, Digitalia Spp and Dactylectium Spp* on the dry land while reeds (phragmites) and cyperus species and aquatic grasses are found on the river banks. Below is a summary of the project design components.

The predominant economic activity is animal husbandry, much of it on large commercial ranches, and on communal grazing lands or group ranches. Livestock is also found on small scale farms as part of mixed farming. Wildlife is found in most parts of the basin and there are privately-owned as well as on government-run game reserves. Range management therefore plays a very important role in the sustainable management of the natural resources in the Basin. The project area is scrubland which is very susceptible to soil erosion hence adequate erosion control measures for construction and operation are necessary. Figure 3.5 below shows Land Use Cover of the Upper Ewaso Nyiro basin. inset in Blue is the dam site and the pipeline.

Figure 3.5 Land Use Cover of the Upper Ewaso Nyiro Basin. Inset in Blue is the Dam Site and the Pipeline.



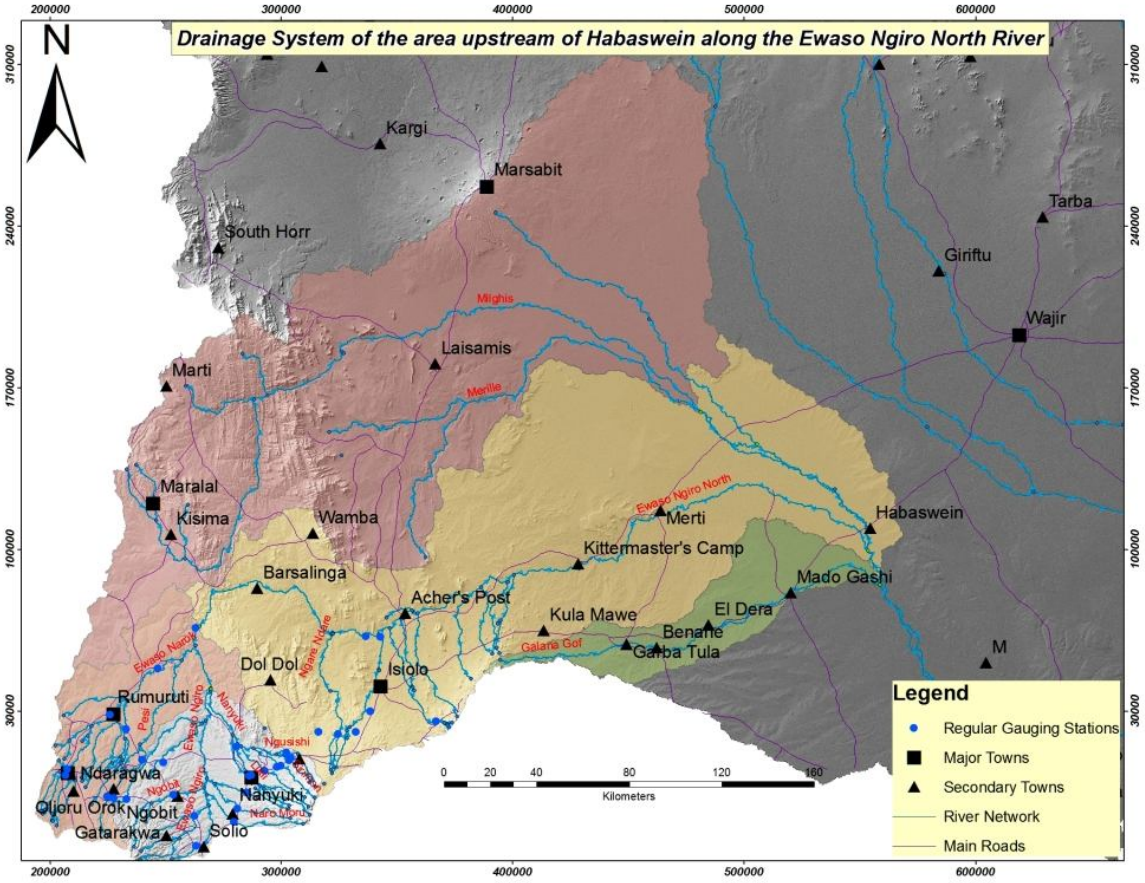
Land-use changes in the Ewaso landscape have occurred primarily as a result of once-nomadic pastoralists shifting to sedentary lifestyles (due to multiple factors that are both favourable and unfavourable) which have resulted in increases in stocking densities, fencing, habitat fragmentation, and depletion of grass, browse and water - all of which have negative implications for livestock and wildlife management

Also in the uplands of Laikipia the abstraction of river water for irrigation has an impact on the livestock in the lowland areas. Analysis of the rainfall and stream flow data within the Ewaso Ng'iro Basin have shown that in the lower reaches within Isiolo, dry season flows are declining (Mati et al. 2005). This has been attributed to the high levels of irrigation abstraction upstream, which can reach 60 percent of the river flow during the dry seasons (Gichuki et al. 1998). The proponent is working closely with Water Resource Management Authority (WARMA) to regulate water abstraction upstream.Government of Kenya is restoring the forests in the catchment area which are whose integrity affects their capacity to mitigate floods and drought, prevent soil erosion, maintain water quality, increase groundwater infiltration and influence the micro-climate in and surrounding the forest (GoK 2010).

3.1.7 Drainage of the Catchment Area

Although the basin is traversed by many stream channels, many of them are ephemeral, and others are large gully beds. The drainage map is shown in the figure 3.6 below showing all the rivers and lagas joining Ewaso Nyiro River. This is important particularly when assessing the potential of floods downstream after construction of the dam. There are nine rivers both perennial and seasonal joining Ewaso with good discharge of water which will sustain the flooding of the Lorian plains. Its also worth noting that the Lorian plains is also recharged by the huge Merille and Milghis river which join Lorian plains from the North. Therefore the consultant through the hydrological expert is confident that flooding of Lorian plains is sustained where as the Ewaso Nyiro River channel will flood and sustain the river flows which is very critical for the downstream ecosystem and sustenance of peacefully co-existence of the pastoralist communities who occasionally move upwards in search of water when the River doesn't flow downstream. This upward movement sparks conflicts with the upstream pastoralists.

Figure 3.6 Drainage System of the Area Upstream of Habaswein (River Ewaso and its Tributaries)



3.2 Socio-Economic Environment.

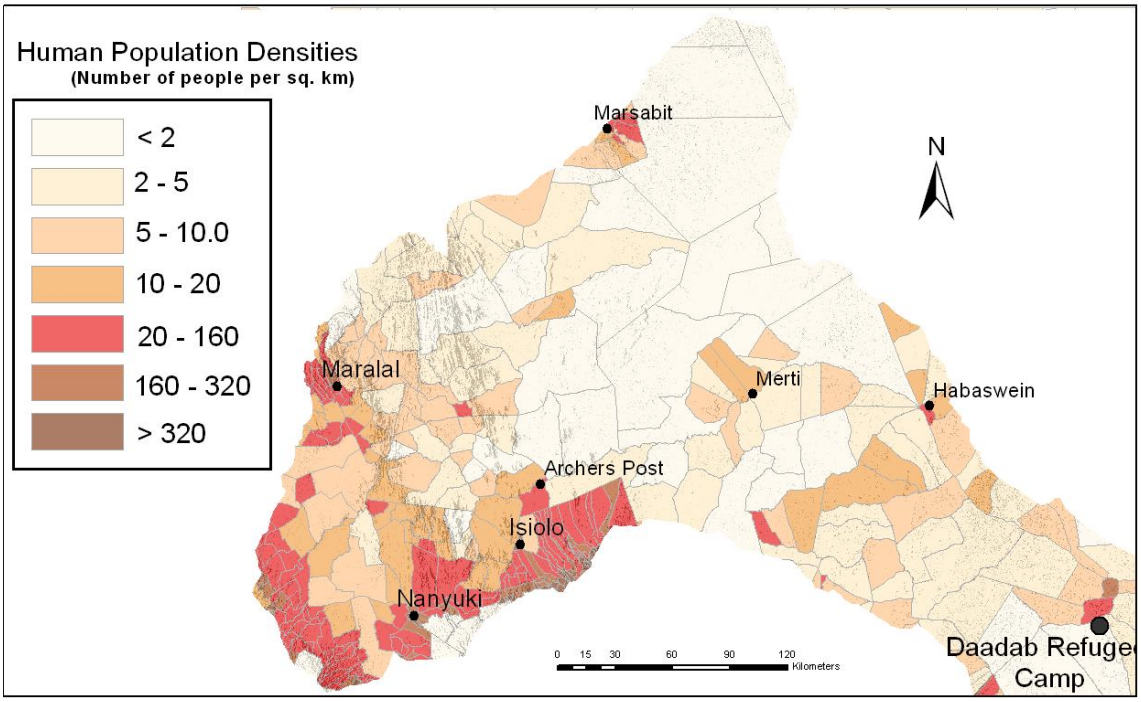
This Section provides an overview of the Project's socio-economic environment, with an emphasis on the population living in and surrounding the site of the proposed Isiolo Reservoir also referred to as Crocodile's Jaws Dam. As indicated elsewhere in this report, the proposed reservoir area is sparsely populated and primary information has been obtained from (a) a socio-economic survey of a sample of at least 50 households in the administrative units/locations covered by the proposed reservoir area, (b) community meetings and group discussions with residents and local opinion leaders. Large Swathes of the reservoir cover Conservancies and ranches and whose views were captured in a workshop held in the reservoir area. Where necessary, reference is also made to the wider socio-economic context as contained in other reports and publication. The proposed reservoir straddles two administrative Counties namely Laikipia and Isiolo.

3.2.1 Population Density

Ewaso Ng'iro has ethnically diverse communities. The counties in the upper parts of the catchment (Laikipia, Meru and Nyeri) are home to the Mukogodo Maasai, Kikuyu, and Meru, who live side by side with Europeans, Turkana, Samburu and Pokot. The northern part of the catchment is mainly inhabited by traditional pastoralists consisting of the Samburu, Gabra, Rendille and Boran, while the lowlands to the east are mostly inhabited by Boran, Somali, Samburu and Rendille (all pastoralists) and the Meru (agro-business). Approximately 1.85 million people reside in the catchment according to the 2009 census, versus the low population of about 282,300 people in 1969.

There is significant variation in human population density with densities greater than 100 people per km^2 in the highlands, and densities of 10 people per km^2 and below in many parts of the dry lowlands. This geographic variation in human population density relates to the differences in climate, agroclimatic potential and rural urban markets. The project is expected to serve a huge population in the project area of influence in total is Laikipia North 32,762, Wamba 59,094 and Isiolo 100,094 as per the 2009 KNBS Census.

Figure 3.7 Shows Human Population Densities in the Ewaso Nyiro Basin



3.2.2 Isiolo County

Isiolo County is located in the upper eastern region of Kenya. The county covers an area of 15,517 km^2 with temperatures ranging from 12^{0}C to 28^0 C. Rainfall range between 150 mm to 650 mm per annum typical of Arid and Semi Arid Locations (ASALS) in Kenya. It borders Wajir to the east, Garissa County to the south east, Marsabit County to the north, Samburu and Laikipia Counties to the West and Meru and Tana River Counties to the South.

The county has its headquarters in Isiolo town and the total population is 100,176 of which 50,380are male while 49,796 are females. The average population density is 6 people per km² with a total of 22,463 households (KNBS 2009). The county is made up of two constituencies (Isiolo North and South) in turn comprised of 10 county wards.

The county resources include Forests, wildlife, minerals, building sand, water, pasture and land. There are conservation areas situated within county and which act as tourist Attractions including Buffalo Springs, Shaba and Bisanadi Game Reserves and the Lewa Downs Conservancy. There are 6 Commercial bank branches and 1 Micro-Finance Institution.

The County's main economic activities/industries are Pastoralism, subsistence agriculture, small-scale trade, and limited harvesting of gum Arabica resin with the main agricultural products comprising of beef, milk and limited cultivation of crops.

There are 91 Primary Schools, Secondary (11), and Tertiary (1) institution. On the health front the county has 24 Dispensaries, 1Health Centres and 1 District Hospitals and numerous private clinics. The Infant Mortality Rates is 43/1000 while the Under Five Mortality Rates is 56/1000.

3.2.2.1 Settlement Patterns

The County's population distribution and density is mainly influenced by water availability and security. Apart from Central and East division that are densely populated due to their well-developed infrastructure and reigning commercial centres, people in other divisions tend to settle around watering points. Besides, they are also settled around the market centres considered relatively more secure. The settlement patterns are heavily influenced by the nomadic way of life of the local people who are majorly pastoralists. Administrative headquarters tend to guarantee social and economic security in addition to rare watering points and thus has attracted farming communities and pastoralists due to guaranteed water supply. Loss of livestock has also influenced settlement in urban centres as the affected populace relocate in search of relief supply and informal jobs. As a consequence, majority of them live in informal and poorly planned settlements (Manyatta) with poor housing and sanitation conditions.

The community in the county comprise of boranas who are the majority, Meru, Somali, Samburu and Turkanas. Meru and Somali are majority in Isiolo town and are largely limited to central division giving it a highly cosmopolitan outlook. The main languages spoken are Kimeru, Boran, English and Swahili. Internally, the Borans identify themselves along clans. The clan is a key factor in development and in distribution of the resources in the district.

3.2.2.2 Agriculture and Rural Development

Crop agriculture contributes about 10% of the County household income. Due to frequent drought and lack of water for irrigation, the sector has not been fully exploited. Drought affects productivity of major crops and livestock and remains a serious threat to food security in the County. Livestock production is the mainstay of the rural population of Isiolo. Livestock kept are mainly the traditional cattle for production of milk, eggs, and meat. Livestock accounts for 90% of the Isiolo County income. The proposed project will provide more watering points in the project area where by many are no longer functional due to inconsistent water supply.

	
Dry communal watering point. The project will ensure continued supply of water to this critical livestock and wildlife watering points	Livestock keeping is the backborn of the pastoralist economy.
	
Wild life co-exist with pastoralism. The project impacts on wildlife and pastoralism is temporary and limited only to construction period.	The landscape is flat rolling terrain with bushland vegetation cover.

Photo Plate 3.1 Showing major socio-economic setting of the project area.

3.2.2.3 Physical Infrastructure

The road network is very poor in the County due to its remoteness and vastness except for the areas peripheral to Isiolo town. Most of the rural population has virtually no road network rendering accessibility difficult. People walk over long distances to reach the nearest motor-able roads and it gets worse during the rainy season. The major hindrance to opening up new roads is the seemingly uneconomical sense of the investments and scarce resources. Most of the population lives across seasonal rivers which require a lot of funds to connect by construction of bridges and drifts. Supply of water for domestic and livestock will transform the

Isiolo county to be an economic hub hence gaining more infrastructural investment by the government.

3.2.2.4 Environment, Water and Sanitation

The main source of water for most households is spring water which is not fit for domestic uses, a sample of the water along the Ewaso Nyiro channel was sampled and the results indicate low quality water which will require treatment before distribution. The water tests results is attached as appendix XI. Potable tap water is available around Isiolo town. Roof catchments are a rare phenomenon and a lot of water runs to waste during rainy season that normally take the form of floods. Water is the most limiting resource in the County. Most of the rivers in the area are seasonal and ground water is limited in most water basins. With water in high demand for human and livestock, its availability influences the nature and extent of human settlement and grazing patterns. Increased population pressure, however, has forced people to settle in areas where water is very scarce leading to conflict over limited pasture sites for livestock use. The scenario has posed environmental challenges. The destruction of water catchment areas, inadequate sewage system and conflict in resource use e.g. sand harvesting verses water needs is prevalent. Un-coordinated and uncontrolled harvesting of sand along the rivers coupled with over grazing and poor farming methods greatly have led to massive soil erosion. Besides, cutting down of trees for charcoal burning etc have exacerbated environmental problems. Availability of water for varied uses by the locals will reduce pressure on other natural resources especially trees which were being harvested for charcoal and sand harvesting which were gaining ground as alternative income sources.

3.2.2.5 Poverty Levels

About 71% of the County population lives below poverty line and females and children are more vulnerable to poverty with a dependency ration 100:107. The most affected group by poverty is the landless. All land is under the trusteeship of the Isiolo County Council. The land tenure and use is under communal system, therefore there is no commitment on the part of an individual to develop land. The issue of land ownership contributes highly to the high level of poverty.

3.2.2.6 Gender Inequality

Women are more vulnerable to poverty than men. Women spend most of their time searching for water and firewood. They virtually do not own or control assets like livestock and rarely take part in decision making or development matters. As young girls they remain at home to help in household chores and herding so they are not able to develop skills that will enable them find gainful employment or engage in business. Upon operation of the proposed project

gander inequality will be reversed since water which occupies 50% of women time will be readily available liberating more hours for socio-economic engagement by women.

3.2.3 Laikipia County Profile:

Laikipia County borders Samburu County to the North, Isiolo County to the Northeast, Meru County to the South, Nyeri to the South, Nyandarua County to the Southwest, and Baringo County to the West. The headquarter is at Nanyuki town. With a land area of 9,462.0 Km^2 the County has an annual relief rainfall pattern. Due to its location along the equator and proximity to Mount Kenya, the county experiences a cool temparate climate, with mean annual temperatures of between 16°C and 26°C. The county receives an average of 400mm and 750mm rainfall annually with areas considered to be farming zones receiving considerably higher amounts than average. Most of the residents in Laikipia North are pastoralists who move from one area to another in search of water and pasture when the area gets too dry

The Population is 399,227 (Male – 49.8 %, Female – 50.2 %) with an average distribution of 42 people per km^2. Typical age distribution is 0-14 years (42.1 %), 15-64 years (53.8 %) and 65+ years (4.0 %). The road network comprise of 139.3 Km Bitumen, 353.7 Km Gravel Surface and 573.4km of Earth Surface roads.

Agriculture is the dominant economic activity. Majority of residents keep livestock and grow different food crops such as maize, carrots, peas, potatoes, wheat and cash crops as well as horticultural crops. Laikipia County is known for its big open ranches like Solio, Borana and Oljogi which provide a significant source of beef for local consumption and export. The county also benefits from tourism due to the many wildlife conservancies and ranches. Because of its diverse wildlife and exclusive resorts, it's one of the top destinations for local and foreign tourists. Some of the tourist attraction sites include; Ol Pejeta Conservancy, Thomson Falls, Laikipia Plateau reserve, Solio Ranch, Oljogi Ranch and Borana ranch among others.

The county is served by two district hospitals - one located in Nanyuki town and the other in Nyahururu town. Among other healthcare facilities are 56 dispensaries, 8 health centers, 9 medical clinics and 2 nursing homes, found in main towns and suburbs. The Infant Mortality Rates is 50/1000 while under Five Mortality Rates: 60/1000; the most prevalent Diseases include Malaria, Diarrhoeal diseases, Bronchopneumonia

As of 2013, there are 350 primary schools and 91 secondary schools in Laikipia County. Some of the top schools include Nanyuki Secondary, Njonjo Girls and Nyahururu Elite School. Tertiary institutions include Laikipia University and Karatina University College - Nanyuki Campus.

Resources include Indigenous Forests, Wildlife and Rivers. The main economic Activities/industries are Horticulture, Mixed farming, Livestock Farming and tourism. There are 6 Commercial Banks, 9 Micro-Finance Institutions, and 2 Village Banks.

3.2.3.1 Topographic Features:

The river Ewaso Nyiro runs along the boundary with Samburu County and is the main drainage system with seasonal rivers within the district that drain into it during the rainy season. The district is endowed with several natural resources necessary for development including arable land, forest, sand and wildlife.

3.2.3.2 Agriculture and Rural Development:

Over 80% of the County population depend on livestock whereby beef cattle, sheep and goats are reared in 13 group ranches and 4 individual ranches found in the area. The major challenges have been livestock diseases and poor marketing system and the major threat is the frequent droughts causing major movements in search of pasture and water. Most livestock keeping is done by pastoralists. There is one gazeted forest, Mukogodo Forest and is mainly conserved as it is a major water catchment area.

3.2.3.3 Environment, Water and Sanitation

The main water sources across the livelihood zones are rivers/streams, boreholes, piped water systems, dams/pans shallow wells, springs and sub surface dams/sand dams which account for 80 percent of water requirement. Other alternative sources are roof catchment in the mixed farming and marginal mixed farming livelihood zones. The county has a total of 270 boreholes out of which 210 are operational while the rest non operational due to inadequate funds for maintenance. The average latrine coverage in the County is at 73.5% but lower in the rural pastoral areas (Laikipia North) currently at 40.4 percent, this is an improvement from 21 percent in 2012. In the marginal mixed farming (Central and Rumuruti Division) the toilet coverage stands at 89.1 percent on average. In the mixed farming (Nyahururu) the coverage is at 75.2 percent. The low latrine coverage in pastoral areas is due to nomadic lifestyle of most households, cultural factors and, construction cost. Ventilated Improved Pit (VIP) latrines are mostly in the marginal and purely mixed farming zones while the pastoral zone use pit latrines without VIP. Up scaling of latrine coverage is ongoing through formation of community units with community health workers and community health committees led by community health extension workers. Solid waste disposal is mainly done through refuse pits and crude dumping. Disposal of liquid waste is done which is managed by Nanyuki and Nyahururu municipalities is normally through soak pits and septic tanks but are limited to about five to

eight percent of the urban population due to the prohibitive construction costs. Waste incineration is practiced in major Hospitals like Nanyuki, Nyahururu, Rumuruti and Doldol.

3.2.3.4 Development Challenges:

Insecurity remains a major challenge to development in Laikipia North region which is prone to inter community conflicts over pastures and watering points especially during the dry spells. During the period of prolonged drought in the region herder's move from Samburu and Isiolo Counties into the northern fringes in search of pasture and water and conflicts arise as they do not respect the community rights of land ownership as they graze even on conserved areas where eco-tourism has been introduced as an alternative source of livelihood. This has been a major cause of insecurity as it normally ends up in tribal clashes in the district.

3.2.3.5 Land Ownership:

In Laikipia North District, land in the district is communally owned except for the four private ranches. Due to communal ownership syndrome, management of natural resources is not important hence there is heavy degradation. There are 13 group ranches in the district and their registers have not been updated for a long time. This has been a major source of conflict between the young and the older generations.

3.2.3.6 Human/Livestock/Wildlife Conflict

Laikipia is home to many wildlife species with the major ones being elephants, Zebras, Buffaloes and the endangered species of wild dogs. The wildlife is a major threat to the lives of both human and livestock as they roam freely in the district which is inhabited by pastoralists. Further the elephant is a threat to the water infrastructure as they destroy watering points, pans/dams, and pipes in search of water. The project proposes to have conservancies move closer to the river and the dam areas whereas the community moves out so as to be supplied with water for the livestock and domestic uses. This will ensure limited interaction and competition for scarce resources between livestock and wildlife.

3.2.3.7 Gender Inequality

Gender roles are either productive or reproductive where women are mostly involved in both yet reaping very little economic benefits from the same. Men on the other hand are mainly involved in productive activities e.g. formal and non- formal employment, livestock etc. They have both access to and control over economic resources and infrastructure at the household and communal level thus having an upper arm in decision making. The project through

sensitization, awareness campaigns and provision of safe water will be a means to gender equity.

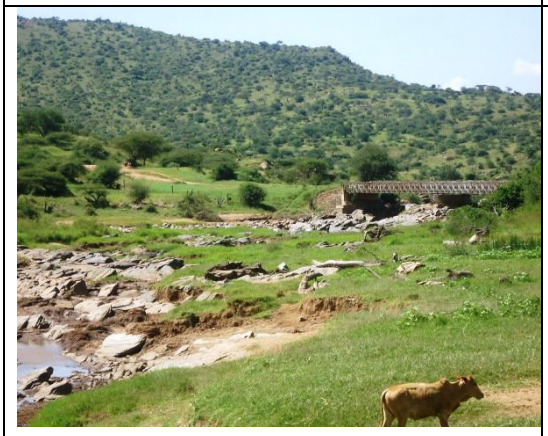
	
One of the roads leading to the proposed dam site near ndugu Zanguni mission. Roads in the project area are in very poor state. Construction of the dam will open up the area through improvement of road infrastructure.	Gender marginalisation has seen women and girls spend alot of their time in search of water. Provision of water to communities will ensure gender equity.
	
Bridge linking Laikipia North and Samburu counties. The bridge is in the area going to be inundated, the proponent proposes to elevate the bridge to the dam crest so as to ensure connection between the two counties and aesthetics.	Massive sand deposition in the project area shows the threat of dam siltation. The consultant has proposed silt dams upstream and catchment restoration to reduce the erosion threats on the dam.

Photo Plate 3.2 Showing varied components of the project environment.

3.2.3.8 Drought

Laikipia County especially the Northern parts experiences low erratic and unreliable rainfall and experiences drought after every 4 years, leading to famine and loss of livestock due to lack of pasture and water. Due to the ravaging effects of drought in the entire district the communities continue to rely on relief food hence cannot effectively participate in economic activities.

	
Some of the livestock from watering at Lolnginyang point. The project proposes to provide separate watering points for livestock and domestic uses so as to reduce water conflicts with wild life	Some of the ungulates in the project area. Wild life sometimes compete with livestock and humans for common scarce resources (water). The project will ensure availability of these very important resource hence reducing conflicts.

Photo Plate 3.3. Photos showing wildlife and livestock resources in the project area.

3.2.3.9 Poverty

It is estimated that the county poverty level is 46 % (Rural & Urban). The poverty levels are higher in the Northern parts of the county where the main economic activity is nomadic pastoralism include. The lower part of the county i.e. Iligwesi location (which has Mukogondo natural resources) is better endowed with wildlife where eco-lodges are found. Poverty levels are higher in Mukurian and Mukogondo locations which are highly degraded and livestock cannot survive. The table below shows the administrative areas that were covered in the socio-economic survey.

Table 3-1; Administrative units sampled in the socioeconomic survey

County	Location	Sub-location
Isiolo	Oldonyiro	Oldonyiro
		Lonkopito
Laikipia	Ilmotiok	Ilmotiok
		Impala
	Oloibosoit	Ewaso
		Kirimon

Figure 3-5; the inundation area map showing the administrative locations covered

3.2.4 Sample Statistics for the Project Area of Influence.

The proposed Isiolo Dam socio-economic survey recorded more males (70.6%) than females (29.4%) respondents. Amongst households at the proposed site, 84.3% were male headed

with the rest being female headed. The percentage of female headed households coming out of this survey (15.7%) is a slightly lower than the 39.2% recorded at Kenya Integrated Household Budget Survey and also lower than the National figure of 30% from the same survey (KIHBS, 2006). The mean age of the household head was 40.06 years while the median was 35 years. Over 90% of the household heads are over the age of 25 years; with the youngest head being 22 years. There are only 8% of the households being headed by individuals over 65years and who are considered to be outside the working age population (15-64 years). Social Impact Assessment report is attached as addendum III of this report.

There is a uniform distribution of household heads highest proportion of household heads is found in the 22-62 years age group at 90 per cent as presented in the chart below.

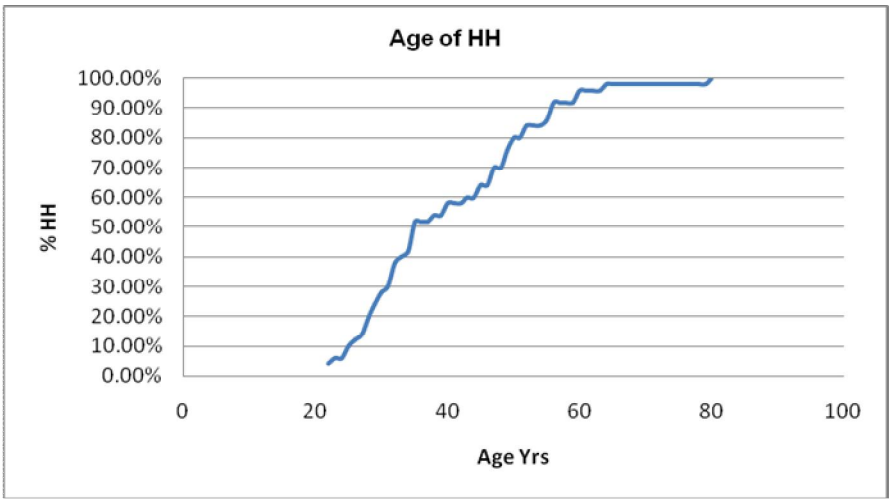


Figure 3-6; Age of household heads

3.2.4.1 Educational Attainment

The level of education attained by the household head affects the household income, household size, access to education by the children and the way other critical household decisions are made. The socio-economic survey collected data on formal schooling and vocational training for all household heads. Formal education is categorised into classes consisting of; primary (Standards 1 to 8), secondary (Forms 1 - 4), tertiary schooling (vocational training) and university education. From the sample the attainment is in sharp contrast with the KIHBS findings of 21% of the eligible population who can both read and write nationally as 68% of household heads were illiterate having had no form of schooling at all. The table below shows the education levels of household heads.

Table 3-2; education levels of household heads

Household Head Education Level	
Primary	19.61%
Secondary	9.80%
University	1.96%
None	68.63%
Total	100.00%

Significantly all female and 63% of the male household heads were illiterate. More male household heads had also completed their primary education; most of the few household heads that had progressed to tertiary school were also males. On the overall the issues of gender and education inequalities are quite evident in the polled households. Opening up the area and provision of basic services will reverse the gender inequality in the project area. However, the consultant also proposes more focus on the women when opportunities of employment arise.

3.2.4.2 Household Size

The nomadic communities in the upper Eastern Kenya of where the project is located have one of the highest average household sizes of 6.1 people per household. From the surveyed population, the mean size of households is 5.73 members; this compares well to the average size of 5.5 members recorded in the 2005/2006 Integrated Household Budget Survey in the rural areas.

3.2.4.3 Vulnerable Groups

When large-scale displacement threatens to disrupt communities, special measures to mitigate adverse impacts on vulnerable groups, such as children, the elderly, and those with physical or mental disabilities are required. In the context of impact assessment and resettlement planning, in particular, vulnerability has come to refer to two socio - economic dynamics. At a general level it refers to the insecurity experienced by all project-affected persons **(PAP)** because of the loss of private and communal property, severed/constrained access to social services, etc. At a more specific level, it refers to those persons who, because of their socio- economic position, are especially vulnerable to project-induced impacts. Project support measures commonly designed for this latter group aim to improve their livelihoods so that they are better equipped to deal with project-induced changes. With respect to the proposed Isiolo Dam Project at crocodile jaws, the following households/social categories could be considered as potentially vulnerable to the changes induced by the Project:

Households where a member of the household has a disability; 11.8% of the affected households that have been interviewed have at least one member with a physical or mental disability

Household with an aged household head; 13.7% of the affected households that have been interviewed have at least a member who is over 55 years, worse still 14% of the household heads are older than 65 years

Female-headed households; 15.7% of the affected households that have been interviewed are headed by females.

School going children; 84.3% of the affected households that were interviewed had school going children who were under the age of 15 years, the average number of under 15s per household is 2.15 while more than half of the households had at least 2 school going children.

3.2.4.4 Primary Occupation of Household Head and HH Income

Another important demographic feature to consider is the employment status of household head. The survey makes reference to the labour force participation rates of household heads in the context of primary occupation of household heads and main source of livelihood for the household. The dominant primary occupation in the project area is pastrolism which is nomadic in nature as reported by 72.5% while another 8% of the household heads parctice juggle crop production with pastralism. Another 17.6% and 2% of respondents indicated that they were in formal employment or carrying out business as main economic activities respectively. Substantially all male household heads that were formally employed are males. The main source of livelihood recorded was livestock rearing at 92.2% whereas 2% relied on crop cultivation. Only 5.9% indicated their livelihoods not being dependent on agriculture. Other livelihoods mentioned in the survey included business and employment. The level of participation in commercial activities other than pastrolism and Crop production is dismally low as only 7.8% indicated to be earning some form of income from Small business full time or part-time. The table below shows the degree of reliance on other businesses to subsist in the proposed project area.

Table 3-3; businesses by household heads

Small business full time or part-time	Percentage
Bike Repair	3.92%
Carpentry	1.96%
Hotel Or Cafe	1.96%
None	92.16%
Total	**100.00%**

Of the 7.8% that were involved in other businesses the average monthly income was a misery Kshs1500 with half of these making Kshs3000 and below from the business per month. Just 3% of the household heads were recorded as formally employed mostly as medical workers, public administration, and school teachers. On the duration of months employed per year, the formally employed are permanent full time formally engaged for 12 months in a year. Of the employed household heads 60% were based at or near home while the rest were working away from the home area. Of those in informal employment 50% were fully engaged for 12 months in a year with 16% being engaged for less than 3 months in a year. The average daily income for the informally employed is Kshs 388.83; in the informal category 43% were based at or near home while the rest were working away from the home area.

None of the households indicated having a regular source of income generated locally. However 15.7% households that declared remittances regular source of income. For this portion of households, these income sources were bringing in an average of Kshs2,100 per month. Due to the arid nature and vulnerability of the nomadic livelihoods, responses indicated that about 33% of the households were receiving food aid ranging from beans, cooking oil, cereals/flour and children supplements.

The importance of subsistence agriculture in the livelihoods of households in the proposed reservoir area is underscored by the low reported incomes; many households had no incomes to report of. Without subsistence contributions from nomadic pastrolism and the marginal crop cultivation, these incomes alone cannot sustain the livelihoods of the sizes of households cited. Agricultural activities therefore make a positive contribution to household nutrition, which suggests that designing effective programmes for guaranteeing or even improving the current agricultural productivity for affected families could have a potentially positive impact on household and child nutritional status.

3.2.4.5 Ethnicity

The proposed project area is a multi-ethnic zone consisting of mainly Turkana, Borana, Samburu and Somali. Resource based ethnic clashes are not uncommon in the area. As a result the area is characterized by pronounced ethnicity and identification of the locals with their ethnic backgrounds; mainly the pastoralists comprise of Cushites (Samburu/Boran), Nilotes – Northern Maasai while the conservancies and ranches are mainly run by descendants of Kenyan settler families of European decent. However due to migration and land sales, Bantu communities from neighbouring counties have infiltrated in the area including the Merus and the Kikuyu as can be seen from the table below.

Table 3-4; Ethic Composition

Ethnic Group	Percent Composition
Samburu	51%
Maasai	43%
Kikuyu	6%

3.2.4.6 Housing

Other than agricultural land that potentially falls in the inundated area there will be housing and other private property that was noticed in the area. The Social-economic Survey team made observations of the kind of materials used roofing, walls and floor and based on these the housing was categorized three classes. According to these criteria there were;

- Type 1 (Permanent-Stone/brick walls and sheet roof/tiles)
- Type 2 Semi-Permanent- timber walls and sheet roof
- Type 3 (temporary-mud/wooden frame /thatched roof)

The table below shows the types of materials used for various components of housing.

Table 3-5; Housing Types in the project area

Housing Material	Walls	Flooring Material		House Roofing Material	
Dressed stones/ Bricks/ Blocks	9.8 %	Cement	13.7 %	Iron sheets	19.6 %
Dung/Mud	84.3%	Dung/Mud	86.3 %	Thatch	76.50%
Others	5.9 %			others	3.9 %
Total	**100.00 %**		**100.00%**		**100.00%**

According to the surveyors' observations/appreciations houses in the reservoir area are mainly traditional type 3 houses; some 84.3% of homesteads had dung/mud walled houses and thatched roof, only 6% could be classified as Type 2 or semi permanent while 9.8% had permanent housing. With the proposed reservoir being in a rural nomadic set up, the vast

majority of the households enumerated in the socio-economic study owned their homesteads, in fact none indicated to be renting the occupied house.

3.2.4.7 Land Type and Use

Agriculture remains the most important economic activity in Kenya, the contribution of the agricultural sector to Kenya's GDP stands 19% while employing 75% of the labour force. The proposed dam project will inundate close to 2,000 ha of semi-arid grassland and bush savannah. Most of the land is commercial cattle ranch, on which wildlife conservation is a primary land use. The rest is communal land owned by Laikipia-Maasai pastoralists who herd goats, sheep and cattle. Both the commercial ranchers and pastoralists use ancient traditional herding systems, developed to protect livestock from predators and cattle rustlers whereby during the day the cattle are closely tended by herders and at night they are brought into thorn bush enclosures known as 'bomas'

In particular Laikipia has the highest number of wildlife in Kenya outside protected areas. Most of the ranches have been turned overtime into wildlife sanctuaries. Other investments include horticulture farming being practiced in large scale farms, wheat farming cattle ranching and the dairy industry. Some of the big ranches and large scale farms have also developed research foundations or conservation trust where they receive funding from individuals or institutions with an interest in conserving wildlife species particularly endangered species like the African black rhino, wild-dogs, gravy zebra and other species.

Group ranches have also been converted into community wildlife conservation trusts. Laikipia has the highest number of tourist facilities compared to any other county in the interior of the country. This is no different in the proposed reservoir areas falling under Laikipia County falling under prime conservancy land. In the proposed Nkutuk dam area the Conservancies whose parcels might be partially submerged include; Francombe, Loisaba, Suyian, and Impala. Group ranches likely to be affected include Ilmotio and Koija.

In Isiolo County since all the is classified as "low potential," most of it is administered by the Isiolo County as "Trust land" for the Government while grazing lands are communally owned. Large areas of the county are occupied by bush lands, grasslands and shrub lands, comprising various combinations of dry land vegetation such as Acacia and grasses. Due to the unreliable and inadequate rainfall, crop cultivation is limited to small areas around Central Division and Kinna and irrigated farming around permanent water sources such as rivers. With the exception of game reserves like Shaba, Buffalo and private game ranches, where ecotourism is an important economic activity, the rest of the county is taken up by communally-owned pastoral grazing lands. The affected area mainly comprising of less than 1% of Ol Donyiro Sub location is therefore essentially communally owned grazing lands. Since

land resource is owned accessed communally, it is not possible to isolate how much land each household relies on for grazing and other uses.

Private ownership of land in the reservoir area is nonexistent, with all the households polled in the socio-economic survey reporting that they had communal ownership tenure of the fields. None of the households were renting the land under use currently. Even for the communal ownership, no documentation ascertaining entitlement was mentioned and all the households quoted the authority of unwritten family/clan agreements as giving the right to possess or own land.

Land fragmentation, particularly in the arable land areas of Kenya, is closely tied to the cultural values and practices associated with land ownership and inheritance as well as territorialism practised by almost every ethnic group in rural Kenya. Parents are supposed to pass down part of the ancestral land to their children when they (children) mature. Amongst many Kenyan communities in general, land is valued as wealth and source of livelihood, status, and honour and therefore control of it is very important. Rural land is also valued for retirement and burial as most Kenyan communities do not inter their dead in cemeteries but rather return bodies' to their rural homes for burial. All these factors lead to fragmentation of rural land either through inheritance or purchases. However for the land in the proposed reservoir area being in a rural communal ownership set up, no such fragmentation was foreseen as all the respondents indicated that subdivisions were not anticipated in the next five years.

3.2.4.8 Production Dynamics and Settlement Patterns

From the household statistics the main source of livelihood recorded was nomadic pastoralist and subsistence crop production at 94%; only 6% indicated their livelihoods not being dependent on livestock rearing. As such the proposed reservoir area lies on a traditional rural set up where livestock production is the mainstay. Perhaps due to the nomadic nature of lifestyles for the polled households, only 51.3% had started livestock/production farming in the locality under study more than 10 years ago; 7.7% had farmed in the area for one year or less.

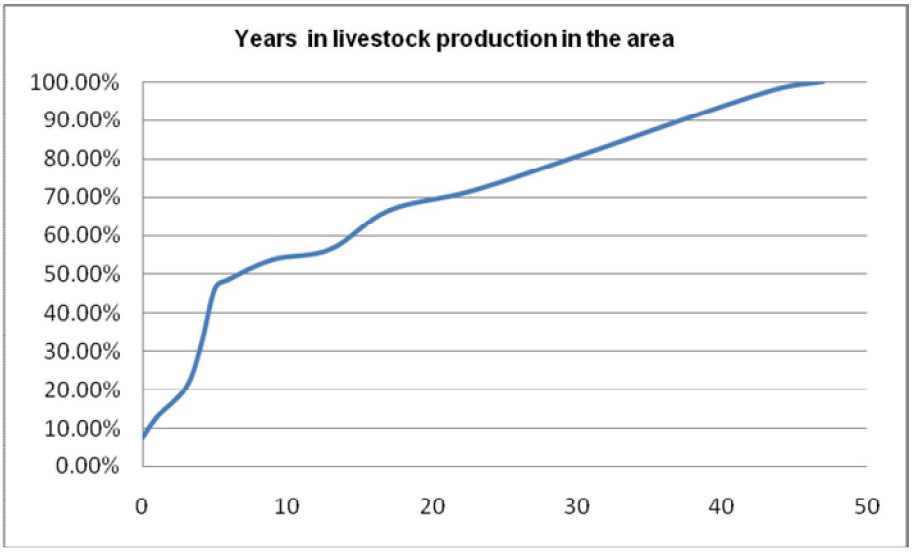


Figure 3-7; Length of stay in the current plot

Local migration of persons in search of resources is common as the situation is closely mirrored on the time spent farming on the current plot; only 28.6% had lived on the current plot for more than 10 years while 11.7% had exploited the current land resource for one year or less. Predominantly, inheritance is key to ownership of land and other assets; 90.7% of land owners had acquired it through inheritance. Slightly over 51% of the residents have been settled in the area for more than 10 years.

The proposed reservoir area mainly consists of ASALs characterised by frequent droughts. Extensive livestock production, through nomadic pastoralism, is therefore the most suitable form of utilising these ASALs. It is estimated that over 60% of all livestock in Kenya is found in the ASALs, where it employs about 90% of the local population. Livestock husbandry is therefore an important component of local economic activities, particularly in the communal lands / group ranches of Ol Donyiro, Ilmotio and Koija. Livestock kept by households includes Camel, cattle, goats, sheep and fowls. Livestock provides meat, milk and a cash income. However due to non participation in crop production and frequent droughts and vulnerability of livelihood to weather changes, only 14% of respondents indicated to be self sufficient in food production. To offset the food shortages where possible, 97.7% of households normally buy the extra from the local food market.

Table 3-6; Livestock production and uses

Livestock	Percentage	Type Kept		Reason for Keeping		
		Indigenous	Exotic	Sale	Food	Drought Power
Cattle	88.20%	97.80%	2.20%	88.90%	11.10%	-
Sheep / Goats	94.10%	97.90%	2.10%	91.70%	8.30%	-
Poultry	56.90%	89.70%	10.30%	14.80%	85.20%	-
Donkey	3.90%	100.00%	0.00%	88.90%	-	100.00%
Camel	13.70%	100.00%	0.00%	88.90%	11.10%	100.00%

3.2.4.9 Water and Sanitation

The average distance to the water source for domestic use is 4.3km while 50% indicated that they travel over 5km to fetch water. The survey results on water sources used by communities in the proposed reservoir area are shown by village in the table below. Only 4% have access to piped water supply; a large majority (70.8%) obtained their water from unprotected surface sources namely river, spring/stream and water pans. These villages, in particular, would benefit from Project initiatives to improve access to safe water.

Table 3-7; Water sources in the project area

Water Source	Percent
Piped Supply	3.9%
River	52.9%
Spring/Stream	2.0%
Borehole	35.3%
Water pan	5.9%
Total	100.0%

According to WHO (UNESCO 2010) basic access can be defined as the availability of at least 20 litres of drinking water per person per day within a distance of not more than 500 m of the dwelling, corresponding to a maximum water hauling round trip of 30 minutes. Based on access distance measure alone, only 7.8% of the residents have basic access to water within a reasonable distance. However the situation is even worse considering the fact that all these water is obtained from surface sources in its raw form and which are open to contamination. Many a times these sources are shared between humans and animals only that the livestock area taken to the source for watering as opposed to carrying the water home which would be tedious. The scenario is replicated as far as livestock watering is concerned with 98% of respondents taking their livestock to rivers and pans at least 3km away.

The proposed project will reach out to over 92,953 individuals with safe water upon commissioning of the project and further 188,564 by the year 2036. This area coverage of water supply in the areas where gravity flow can be commanded is shown in the table 3.8 below. It's worth taking note that pumping of water can double the population reached by water supply in the project area. The livestock in the area will also be provided with watering points. However, the mandate of the consultant is to design for above infrastructure and let water service providers do the reticulation from the main off takes provided at strategic points of the main pipeline.

Table 3.8 Table showing areas targeted for water supply thats is commanded by gravity.

Urban areas	Population 2009	Projected Population Initial Year 2013	Projected Population Initial Year 2016	Projected Population Future Year 2026	Projected Population Ultimate Year 2036
Isiolo County					
RESORT CITY			19,868	43,292	94,334
ISIOLO (TOWN)	46,128	80,000	61,111	91,333	136,501
OLDONYIRO	652.65	9,828	12,589	17,930	25,538
KIPSING	527.21	5,560	7,122	10,144	14,447
Laikipia County					
SIEKU	342.79	2,102	2,692	3,835	5,462
BURAT	344.18	8,590	11,003	15,671	22,321
ISIOLO WEST	383.97	4,262	5,459	7,776	11,075
Mumonyot	150.53	3,349	4,290	6,110	8,702
Arjijo	137.61	1620	2,075	2,955	4,209
Samburu County					
Ltrimun	162.07	1,672	2,142	3,050	4,345
Lpus	119.06	1,075	1,377	1,961	2,793
Lkisin	165.95	1,564	2,003	2,853	4,064
Nkaroni	341.4	4,272	5,472	7,794	11,101
Ngogoltin	489.02	2,239	2,868	4,085	5,818

SEIA	418.02	3,035	3,888	5,537	7,886
Wamba Town	40.06	6,247	8,002	11,397	16,232
Matakwani	326.14	3,396	4,350	6,196	8,824
Lenkusaka	92.96	980	1,255	1,788	2,546
Remote	89.1	1,237	1,584	2,257	3,214
Lerata	309.2	907	1,162	1,655	2,357
Archres post	324.89	6,275	8,038	11,448	16,305
LosEIA	1880	1,044	1,337	1,905	2,713
Koiting	415	2,617	3,352	4,774	6,800
Ngutuk Engiron	242	697	893	1,272	1,811
		72,568	**92,953**	**132,392**	**188,564**

3.2.4.10 Health Status

The communities living in the vicinity of the proposed Isiolo dam site are mostly rural in character. From the Kenya Integrated Household Survey, only 11.3% of Kenyans travel one kilometer or less to reach a health facility, while about a half (47.7%) travel for 5 kilometres or more. More than a half of rural dwellers travel 5 or more kilometres to reach a health facility, while only11.9 per cent of urban dwellers travel similar distances. The project area being a rural area in an ASAL County a situation where average distances of 5 kilometres or more might be more probable.

However, it would definitely be of great benefit if improvements in the quality of the services provided could be made in the form of increased personnel - nurses, doctors and clinical officers; a wider range of the medical services provided the upgrading of laboratory services and transportation means, increased availability of drugs and equipment as well as the availability of periodical consultations by qualified physicians. The largely rural population like many traditional communities in Kenya also has access to traditional healers that are familiar with the use of medicinal plants as well as a body of oral knowledge transmitted from generation to generation.

To assess the most pressing health afflictions currently, the respondents were also asked the most common diseases in the households in the past 10 years; the results show that malaria is the most common health problem in the locality.

Table 3-9; common diseases in the households

The most common diseases in the area in the last 10 years	Percent
Malaria	86.%
Diarrhea	8%
Typhoid	2%
Pneumonia	2%
Others	2%

The study area can be generally regarded as pristine in the sense that very little pollution of the air, water and soil is observed in this rural environment of sparse population density – Isiolo County has one of the lowest population densities in Kenya. Contaminants to water include chemical fertilizers and pesticides used for agriculture in the upper catchment areas- Northern slopes of Abadares and Mt Kenya. However since the agriculture practiced in these areas is mostly family size subsistence farming and few localised large commercial agricultural establishments, the level of contamination of the soil and water by these products is likely to be moderately small. One local contaminant that can be regarded as threatening to the local populations is human excreta. Since the survey team did not observe a functional toilet in 90.2% of the households, the only option is open defecation in bushes and this practice poses a significant risk to the health of the residents especially in the villages with a higher population density. In fact after Malaria, water borne diseases transmitted through the faecal-oral route rank highly in prevalence.

3.2.4.11 Infrastructure and Communication and Movement

Development of dams improves welfare through increased agricultural productivity, access to markets and other basic services. Transport and telecommunication systems are also important determinants of the physical costs of accessing markets. Poor infrastructure network restricts the development of input and product markets. The road infrastructure in the area is poor with no bitumen standard road in the project area; the only roads criss-crossing the proposed reservoir area are either classified or unclassified earth/ murram surface roads that are very dusty in the dry season and muddy and impassable during the rainy season. Respondents in the socio-economic survey were asked to the standards of the roads in the area where at best only 25.5% felt that the roads were of average condition; the rest rated the roads as poor or very poor. The main means of transport used in the area is as shown in the table below; due to the poor condition of the roads coupled with sparse population, public transport is almost non-existent.

Table 3-10; Transport in the area

Main means of transport in the area	
Matatu	3.9%
Bicycles	5.9%
Buses	1.87%
On foot	33.3%
Motorcycle	47.1%
Others	9.8%

In 86.3% and 13.7% of the cases the transport is used to transport goods to the market and to go to the market respectively. In other cases it is used to carry the sick to the hospital or as an income generating activity.

The public consultations/focus discussions also sought broad perspective on access to key services/facilities. Although most services and facilities are accessed on the same side of the Ewaso Nyiro River, the River is crossed by some households to access services. Services/facilities that are located outside of the proposed reservoir area include hospitals/clinics, secondary schools and major markets.

3.2.4.12 Sources of Energy

Kerosene, charcoal and wood remain the most popular sources of energy in the use of mainly in rural Kenya. The survey sought to establish the sources of energy for cooking and lighting in the project area. The table below shows the prevalence of use for various sources indicating that the use of clean renewable energy sources is still very low in the area.

Table 3-11; Sources of energy

	Main energy source for lighting	Main source of energy for cooking
Wood	47.1%	90.2%
Kerosene	47.1%	2%
Charcoal	-	5.9%
Solar	5.9%	0.74%
Others	-	2%

As can be seen a resounding majority of 90.2% uses wood for cooking while for close to half of the households, the same fuel is used for lighting.

3.2.4.13 Attitudes Towards the Project

The results from the stakeholder consultation programme showed that communities are generally positive about the Project and support its implementation. In the feasibility study stage the consultant has undertaken consultations with various stakeholders aimed at informing them about the proposed project and also registering their views on the same; this has increased their awareness of the benefits and impacts that projects of this nature can bring. From the household survey 74.5 % of respondents fear the greatest shortcoming occasioned by the project to be less land for livestock grazing while 19.6% singled displacement of persons out as the major negative effect. The low percentage of respondents viewing displacement as a threat could be due to the nomadic nature of living which means people do not have attachment to place of living for long. Once implemented 52.9% cited anticipated negative effects to include increased diseases, 41.2% displacement of persons, 3.9% loss of infrastructure such as roads and bridges as an effect stemming from the project implementation while 2% stated other effects including broken social ties drowning risks. Resettlement and loss of land issues will be dealt in Resettlement Action Planning which is not a part of this report.

Table 3-12; Information sharing methods

Consultation methods	
Chiefs baraza	74.50%
Seminars	3.90%
Individual consultation	2.00%
Market places	5.90%
Public gathering	2.00%
Community representatives	11.80%

While considering the most effective information sharing modes the residents considered many factors that included how informative the method is, the time taken for information flow, the trustworthiness of the method is as well as inclusivity of the method.

3.2.4.14 Sacred and Special Places

Sacred sites are areas or places significant meaning within the context of the localised indigenous or religious belief system. Some are somehow related to African mythology. These beliefs endeavour to explain the questions of ultimate human reality, including the origins of humans and animals. The table below enumerates the revered places cited by the respondents in or near the proposed reservoir area;

Table 3-83; kinds of revered sites

Revered sites	
Sacred Places	94.1%
Graveyards	-
Cultural places	88.2%
Archeological Places	-

From the household survey, 94% of the respondents indicated the presence of sites held as sacred to the local communities within the area. However, no sacred places were encountered during the survey while there were no graves or archaeological sites documented in the household survey. This could result from the fact that the pastoralist communities who are predominant in the project area do not revere the dead much. If present in the proposed development area, graves in both African Cultures and Western n religions are regarded as sacred places and any disturbance should be accompanied by special rituals/sacrifices to consecrate them. The project activities will include civil works, which may affect cultural property (e.g. graves). Chance find procedures have been included in Appendix VI.

4 DESCRIPTION OF THE PROJECT

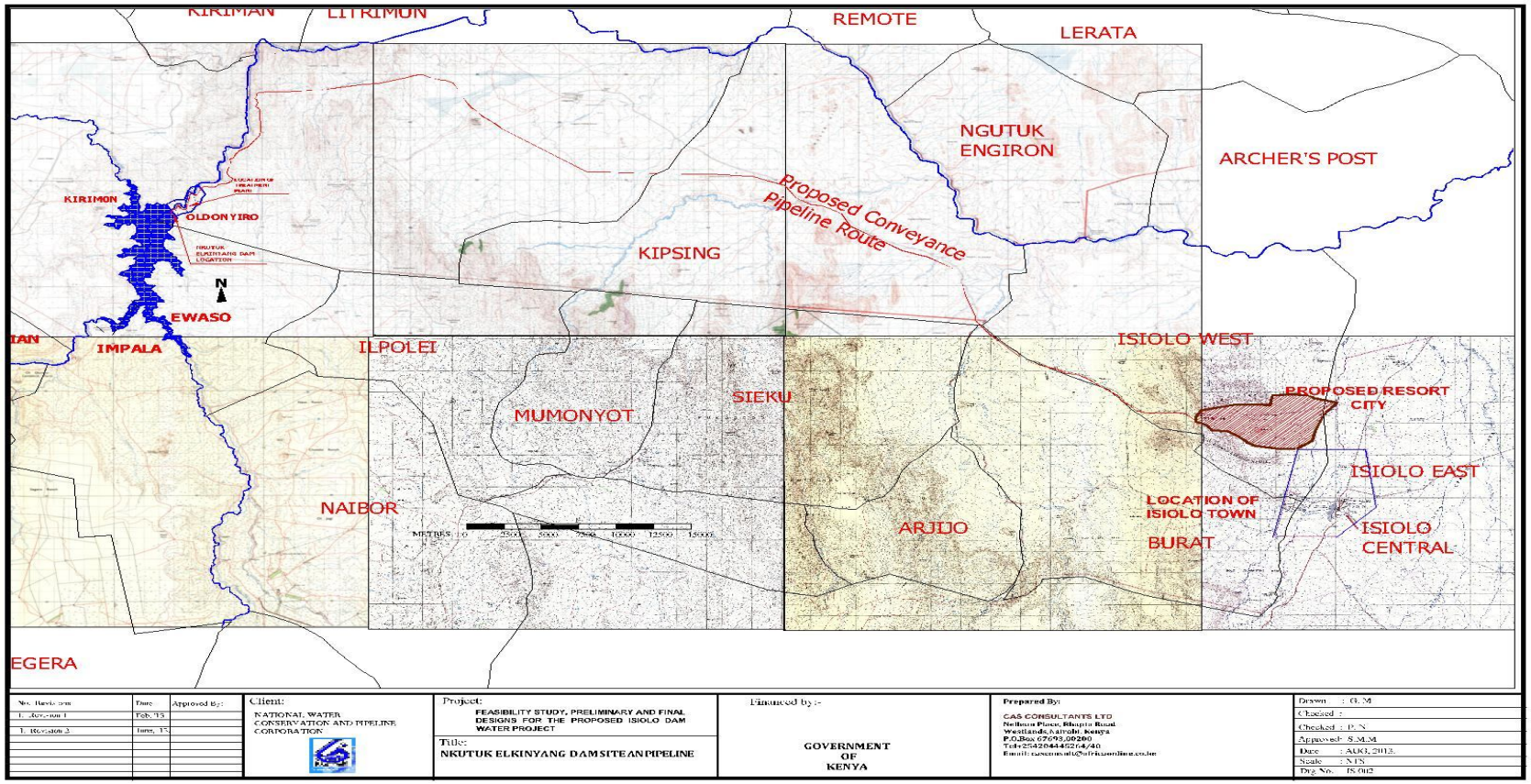
4.1 Introduction

Kenya has Five (5) major water towers namely Mt. Kenya, the Aberdares, Mau Forest, Cherangany Hills and Mt. Elgon and River Ewaso Nyiro emanates from the Aberdares. The project area lies in the Drainage area 5DA (Ewaso Nyiro North River Basin). The river systems draining the area rise from the Northern and North Eastern slopes of Mt Kenya which is one of the key water towers in the country. The towers have been in relatively good conditions until the past few decades when there was a lot encroachment by people due to population increase and pressure on land. This has destroyed the catchment areas to levels that have adversely affected normal precipitation and consequently the river flows. This has the potential of adversely affecting the proposed reservoir(s) thereby causing rapid siltation of the same and subsequent reduction of the storage capacities of the reservoir much below the design capacities. The consequence is that the economic lifespans of the dams might be reduced significantly and the end result is dredging which is a very expensive undertaking. In order to curb this undesirable phenomenon, environmental conservation activities will have to be undertaken concurrently with dam development with WRMA taking the lead as mandated under the Water Act 2000 and Rules and Regulations 2007 and Kenya Forest Service (KFS) in catchment restoration. Government of Kenya has several initiatives geared towards catchment restoration which will mitigate on this potential hazard.

4.2 Description of the System Components

The proposed project will consists of the following components: figure 4-1 indicating layouts of Dam site area, Water treatment Plant, proposed Pipeline, Proposed isiolo Resort city and Isiolo Town.

Figure 4-1 Shows the proposed dam and its component.



The salient features for the 83m high dam are presented below:

Project Name	Nkutuk Elkinyang Dam
Counties	Isiolo and Laikipia North
River Basin	Ewaso Nyiro River Basin
River	Ewaso Nyiro
Design Stage	Preliminary Design Report
Type of Dam	Rockfill dam with an impervious clay core
Catchment area	8,580km2
Dam Crest Elevation (masl)	1,580
River Bed Elevation (masl)	1,497
Dam Height (m)	83
Gross Freeboard	5.5m
Normal Water Level	1574.5
Crest Length (m)	1,075
Embankment Volume (m^3)	3,470,000CM
Submerged Area (ha)	2,083 ha
Embankment Fill	2,228,876
Storage Capacity (CM) up to NWL	214,261,547
Dead Storage (CM)	107,287,500
Useful Storage (CM)	106,974,047
ESC	96.1
Submerged Area (m2)	20,825,737
Reservoir Fetch (km)	14.53
Mean river flow (m^3/sec)	9.0
PMF	2,500m3/sec
Minimum flow	9m3/sec
Mean flow	16.44m3/sec
Compensation flow	2.5m3/sec
Service Spillway	
Type	Open channel
Inflow Design Flood (PMF)	2,500CM
Front width	280m
Energy dissipater at the toe	Flip bucket
Width of outflow section (m)	50
Length of the outflow section (m)	1147
Depth of water	2.1
Slopes Second section Third Section Fourth Section	0.0665
Energy dissipater	Flip bucket
Angle of inclination	20 degrees
Plunge pool distance	60m

Table 4.1 Project Summary Sheet

4.2.1 Dam Area and Buffer Zone

The zone to be inundated by water upon completion of the dam is expected to extend 2– 3km at the dam axis and narrow down to 100 – 500m towards the far upstream (~9km upstream of

the dam axis). This implies that all the low lying areas will be inundated leaving “islands” of the few raised grounds. Such “islands” will provide opportunities for biodiversity conservation.

At the time of this study, the river was generally flowing but the dam site had a small weir serving local community and oldonyiro centre. There were hippos, elephants and impalas grazing on the riparian among other wild life.

The dam area is characterized with sparse vegetation comprising of indigenous trees maily Acacia Mellifera and Acacia Tortillis with undergrowths of shrubs and grasses on the dry land while reeds (phragmites) and cyperus species and aquatic grasses are found on the river banks.

Ewaso Nyiro river waters provide water sources for the immediate communities (who use it for small scale irrigation of food crops), watering their livestock and drinking water. Communities from as far as 30km also access the rivers for livestock watering and fetching water for domestic use. The river is the main tributary of Lorian swamp which is downstream the dam area. The River also supply water to several wildlife and game reserves dotting the three counties which also form a key revenue source for the three counties.

There are at least four group ranches in the area to be inundated and several about 9 lodges around the dam area and the buffer zone. The lodges owners lease land from the group ranches and conservancies. All the lodges identified were operational as at May 2013.

Typical land use in the dam area includes limited agricultural activities and majorly livestock keeping, tourist utility developments. There are two small trading centres of Ewaso and Oldonyiro.

There are clear access roads to the dam site and it surroundings. The access road is an established class E road which is in a poor state with irregular maintenance by the lodge owners.

4.2.2 Catchment Area and the Rivers

The catchment areas of the dam are the Mt. Kenya and the Aberdare Ranges which are two of the five (5) major water towers in the country, the other towers being Mt. Elgon, the Mau and Cherangany Hills. The agricultural parts of the catchment areas at the feet of the mountains are Kieni East and Kieni West areas where agricultural activities are intensive and the soils are left bare and fragile and hence prone to erosion during the rains. Mt. Kenya is the origin of Naro Moru and Nanyuki rivers although they finally drain into the Ewaso Nyiro river which finally drains into the Lorian Swamp. The catchment area is 8,580km2.

The Aberdares are known for their botanical riches and torrential waterfalls plunging from cloud-shrouded heights to spray filled ravines. The ranges occupy 767km2. There are two peaks namely Letasima at 4,000 m and Kinangop at 3,907 m. The other major rivers that emanate from the Aberdare Ranges are Karemenu, Ewaso Ngobit, Amboni (Honi), Karura, Gura, Chania, and Thaara. The first two rivers namely Karemenu and Ewaso Ngobit finally drain into the Ewaso Nyiro River while the other rivers drain into the Tana river and which finally drains into the Indian Ocean.

4.2.3 Sediment Loads

A bigger part of the catchment area of the dam is within the Aberdare Forest which still has good vegetation cover. The other parts in Kieni East and Kieni West are under intensive agricultural activities and therefore susceptible to produce huge sediment loads. However, for purposes of estimating the volume of sediment loads, the Consultant has adopted sediment yield rates as recommended in the Design Manual of 1992.

The sediment yield from the entire drainage area is dependent on the sediment erosion and transporting characteristics of the area and the transporting characteristics of the river channels flowing into the reservoir. The table below shows different computations by the dam experts in projecting the potentials of siltation. This shows that the dam in 75 years will still operate at 50% efficiency.

Method of Computation	Volume of the sediment load
200m3/km2/year	128,745,500
Thwort, Hoather and Law	122,721,480
Sediment Equation	100,580,130

Table 4.2; catchment sediment Yields using various methods

However, this volume is expected to decrease significantly with the implementation of the catchment management strategies by the Water Resources management Authority under the Catchment Area advisory Committees and the Water Resource Users Association Groups.

4.2.4 Climate and Rainfall

The climate in this area is characterized by bimodal rainy seasons i.e. long rainy seasons from March to May and the short rains occurring between October and December. The general distribution is that during the long rainy season from March to May, the highest rainfall is experienced in April while during the short rainy season; the minimum rainfall is experienced

in October and November. The major dry period is from December to February with January being the driest month of the year. The minor dry period extends from June to September with July being the driest month during this period.

4.2.5 Hydrology

The proposed dam is located on Ewaso Nyiro North River at approximate coordinates 37 N 635, UTM 670 and at an approximate altitude of 1500 m.a.s.l. The river flow at the proposed dam location is contributed by Ewaso Nyiro North River and the Ewaso Narok River. During the rainy season, some flow is contributed by Lpalaglagi Seasonal River. Rivers Ewaso Nyiro North and Ewaso Narok are gauged at RGS 5DC01 and 5AC08 respectively. The gauging stations are approximately eleven (11) kilometres upstream of the proposed dam location. Preliminary analysis indicates that by neglecting losses in the river, the combined flow through RGS 5DC01 and RGS 5AC08 passes through the proposed dam location. In particular, this situation pertains during the rainy season.

The analysis further shows that maximum flows occur in April to May and November to December months. These two periods will contribute the flow for storage at the proposed reservoir. The following table shows the estimated mean monthly flow at the proposed dam based on the flows through RGS 5DC01 and 5AC08.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Discharge	9.356	8.855	8.386	27.246	28.206	13.376	12.018	15.784	13.134	14.770	25.406	20.767

Table 4.3; Estimated mean monthly discharge for Ewaso Nyiro North River at proposed dam

The flow volumes through the dam site during the rainy seasons of April to May and November to December amount to 146.17 million and 121.47 million cubic metres respectively without considering any contribution from Lpalaglagi Seasonal River. However, dams are supposed to harness flood flows during the rainy seasons and the storage capacity of the reservoir cannot therefore be based on mean flows but rather on the peak flood flows although they last for a relatively short period of time.

4.2.6 Dam Design Criteria

The following considerations shall be made during the design of the dam:

i. The slopes of the embankment should be stable under all conditions of construction and operation, including rapid drawdown of the reservoir.
ii. The foundation under the reservoir area must be water tight. Since the ERT has revealed a fissured foundation, then pressure grouting will be done as a way of foundation treatment.

iii. Seepage losses through the embankment will be controlled through proper compaction of the construction materials , foundation and abutments must be controlled so that piping, sloughing or removal of material by solution does not occur.

iv. The dam height and freeboard must be sufficient to prevent overtopping by the waves and include an allowance for settlement of the foundation and embankment.

v. The spillway front together with the outflow sections must be adequate to evacuate the flood flows and thus avoid overtopping the embankment wall which is one of the main causes of failure of earth dams.

vi. The hydrology of the river systems should be such that the runoff will impound the reservoir within a given period of time. Secondly the flows during the dry period should be adequate to maintain the reservoir.

vii. The spillway will be designed against a flood flow of Q(1000) or PMF as opposed to the Q(500) which is recommended by WRMA in the Water Resources Management Authority (WRMA) Rules 2007.

viii. Due to the size of the dam and the amount of capital investment, an emergency spillway will be included as a safety measure to evacuate floods with magnitudes exceeding the capacity of the service spillway.

ix. The service spillway will be a side channel O gee which will then reduce to a reasonable width within the outflow section. This will facilitate construction of a bridge above it for provision of connectivity between Isiolo and Laikipia Counties.

x. The toe of the O gee spillway will have a USBR Type III energy dissipater to dissipate the kinetic energies of the flows lest these energies erode the spillway and thus cause its instability.

xi. At the terminal point of the outflow section of the spillway, the energy dissipater will be a flip bucket.

4.2.7 Reservoir Characteristics and LiDAR Survey

Reservoir characteristics are plotted using the data obtained through the LiDAR survey. The curves show the relationship of reservoir storage volumes and the areas versus the height of the dam and thus help to interpreted the volume of storage in the reservoir and the inundated area for any given height. The data for plotting the curves is as follows:

Elevation (m)	Depth (m)	Flooded Area (m^2)	Storage Volume (m^3)	Cumulative Storage Volume (m^3)
1513.00	0.00		0.00	0.00
1514.00	1.00	735.8051	735.81	735.81
1516.00	3.00	15838.4466	16,574.25	17,310.06
1518.00	5.00	24657.685	40,496.13	57,806.19
1520.00	7.00	34145.124	58,802.81	116,609.00
1522.00	9.00	158417.4839	192,562.61	309,171.61
1524.00	11.00	215778.3425	374,195.83	683,367.43

1526.00	13.00	297742.724	513,521.07	1,196,888.50
1528.00	15.00	373574.7801	671,317.50	1,868,206.00
1530.00	17.00	533695.6857	907,270.47	2,775,476.47
1532.00	19.00	691045.9574	1,224,741.64	4,000,218.11
1534.00	21.00	812372.9544	1,503,418.91	5,503,637.02
1536.00	23.00	944955.1602	1,757,328.11	7,260,965.14
1538.00	25.00	1089147.141	2,034,102.30	9,295,067.44
1540.00	27.00	1267325.454	2,356,472.60	11,651,540.03
1542.00	29.00	1477300.426	2,744,625.88	14,396,165.91
1544.00	31.00	1691327.003	3,168,627.43	17,564,793.34
1546.00	33.00	1966960.615	3,658,287.62	21,223,080.96
1548.00	35.00	2265425.524	4,232,386.14	25,455,467.10
1550.00	37.00	2631275.539	4,896,701.06	30,352,168.16
1552.00	39.00	3005813.891	5,637,089.43	35,989,257.59
1554.00	41.00	3673735.213	6,679,549.10	42,668,806.70
1556.00	43.00	4267685.492	7,941,420.70	50,610,227.40
1558.00	45.00	4931643.289	9,199,328.78	59,809,556.18
1560.00	47.00	5854251.931	10,785,895.22	70,595,451.40
1562.00	49.00	6741788.013	12,596,039.94	83,191,491.34
1564.00	51.00	7704546.437	14,446,334.45	97,637,825.79
1566.00	53.00	8844428.858	16,548,975.30	114,186,801.09
1568.00	55.00	10083086.92	18,927,515.78	133,114,316.87
1570.00	57.00	11445772.21	21,528,859.13	154,643,176.00
1572.00	59.00	12960781.84	24,406,554.05	179,049,730.04
1574.00	61.00	14504899.41	27,465,681.25	206,515,411.30
1576.00	63.00	16479645.09	30,984,544.51	237,499,955.80
1578.00	65.00	18568070.31	35,047,715.40	272,547,671.20
1580.00	67.00	20825737.49	39,393,807.80	311,941,479.01

Table 4.4 Relationship of Reservoir Storage Volumes, Dam Area versus the Height of the Dam

4.2.8 Dam Spillway

The spillway is supposed to pass normal (operational) or flood flows in a manner that protects the structural integrity of the dam or the reservoir impoundment structures. Spillways are hydraulically sized to safely pass the Inflow Design Flood (IDF). The IDF will be equal to, or less than, the Probable Maximum Flood (PMF). Due to the size of the dam, it is recommended to have two spillways namely a service and an emergency spillway and they are described below:

4.2.8.1 Types of Spillways

There are various types of spillways but they are all geared towards providing the safety of the dam by avoiding overtopping during releases of the flood flows. The ones considered for EIsiolo dam are as follows:

A. Service Spillway

The service spillway will provide unregulated (uncontrolled) releases from a reservoir without damage to the dam or the appurtenant structures due to releases up to and including the design discharge.

B. Emergency Spillway

The emergency spillway will be designed to provide additional protection against overtopping of the dam and it is intended for use under extreme conditions such as misoperation or malfunction of the service spillway or other emergency conditions like during very large, remote floods such as the PMF. Some degree of structural damage or erosion would be expected due to releases up to and including the design discharge. After the spillway sill, the outflow channel will only be aligned and the flood flow will thereafter create its own course as it discharges into the river course. However, the sill will be constructed using reinforced concrete to prevent it from erosion

4.2.9 Design of the Service Spillway

The service spillway is designed to evacuate the 1,000 year return flood flow which according to hydrological analysis and enhancement is 1,500m^3/sec. The adopted 1,000 year return period compares well with the return periods of flood flows used in the designs of spillways in other countries. The return periods of the flood flows used for designs of spillways differ from country to country and they are mainly guided by downstream conditions so as to ensure minimum damages in the event of dam failure.

4.2.10 Bridge above the Service Spillway

Ewaso Nyiro river forms the natural boundary between Isiolo and Laikipia Counties at the reservoir area and Isiolo and Samburu Counties further downstream of the dam. Isiolo and Laikipia Counties are connected by a single lane steel bridge which is located about 1.6km upstream of the proposed dam axis. However, this bridge will be submerged after the impoundment of the reservoir. In order to maintain connectivity between the two counties, the crest of the dam will be used as the new road between the two counties. The road on the crest will be extended to cross the spillways on both sides of the river i.e. the main service spillway in Laikipia County and the emergency spillway in Isiolo County. However, the bridge on the service spillway is very essential because it will be spilling water during the rainy season. The emergency spillway will have its crest on the flood water level and it will, therefore, be spilling water when the flood flows exceed 1,500m^3/sec. In this regard and due to the nature of operation of this spillway, a drift may be constructed on its crest which will be on level 1577.5masl.

The bridge will be supported by piers which will cause a contraction effect and hence reduce the effective width of the spillway front. In this regard, it is necessary to establish the variation in the depth of flow as a result of the pier contraction effect.

4.2.11 Weir Supplying Water to Oldonyiro

The weir which supplies water to Oldonyiro town will equally be submerged after the impoundment of the reservoir. The alternative will be to connect Oldonyiro town to the water supply after the water is treated to ensure supply of potable water to the residents of Oldonyiro Town and the environs. The existing rising main as well as the storage tank on elevation 1668masl and coordinates 0274028 and 0068300 will be connected to the new project and maintain the water supply pipes and the reticulation system within the town. Also, during construction water will be pumped to the main reservoir serving Oldonyiro.

4.2.12 Lobarishereki Irrigation Scheme

The National Irrigation Board is constructing a weir within the limits of the reservoir and this weir will supply irrigation water to Lobarishereki area which is about 8km from the dam site and it is on altitude 1626masl. The water will initially flow through a reinforced concrete culvert then pumped to an open canal which will finally deliver it to the irrigation area. The pumping head as of now is about 160m. However, after the completion of the dam, the irrigation water will be drawn from the reservoir and the pumping head will be reduced to about 70m which will realize substantial savings during the operation and maintenance phase of the irrigation activities.

4.2.13 Energy Dissipation

The proposed energy dissipater will be a flip bucket to be constructed at the terminal point of the spillway. The flows at this point have very high values of kinetic energy and they would erode the river course and even the river banks unless dissipated. In order to dissipate these energies, a flip bucket will be constructed at an inclination of 200 to the horizontal. Upon hitting the inclined section of the spillway, the flow is deflected to the atmosphere where it losses substantial amount of energy before hitting the ground.

4.2.14 Depth of Water Above the Spillway Sill (Net Freeboard)

The depth of water above the spillway sill is computed on the basis of the critical depth of water at the point of the sill, whereby the depth of water above the sill is 1.5 times the critical depth. The critical depth is calculated on the basis of the design flood flow and the width of the spillway all compounded to give the specific discharge.

4.2.15 Slope Protection

4.2.15.1 Upstream Slope Protection

The upstream slope is prone to erosion through wave action. In order to avert this possible erosion of this slope, a one (1.0) m thick riprap will be placed on the slope. The riprap material will be placed on either granular material.

4.2.15.2 Downstream Slope Protection

The downstream slope will be protected from erosion by planting suitable grass on a 25cm thick red soil. Equally, two No. 5m wide berms will be constructed and they will drain precipitation runoff water to the side drains which finally evacuate the water

4.2.16 River Diversion

River diversion works will be provided for diverting the river flows during construction. This will entail construction of a 15m high coffer dam on the upstream part of the reservoir. The coffer dam will direct water to a river diversion tunnel or culvert which will evacuate it to the downstream part of the dam and thus create a good working environment.

When impounding the reservoir, a compensation flow equivalent to 85% of the base flow will be released for sustenance of the ecosystem downstream of the dam. For this purpose, a pipe will be installed to run through the diversion culvert to the end of the embankment where it will discharge the water back into the river at the terminal point of the service spillway.

The river diversion system for this dam is designed against a flood flow of a return period 20 years which is estimated at 700m^3/sec.

4.2.17 Compensation Flow

During impoundment of the reservoir, it will be necessary to release compensation flow equal to 85% of the base flow, and this flow is to sustain the ecosystem downstream of the dam. This flow is 1.91m3/sec which 85% of the base flow and it will be released through a pipe to be fixed in the diversion culvert.

4.2.18 Impoundment of the Reservoir

After plugging the diversion culverts, the impoundment of the reservoir will start and during which time compensation flows of 1.92m^3/sec will continue to be released for sustenance of the ecosystem downstream of the dam. The impoundment process will be done considering two hydrographs namely the minimum flows and the mean flows which constitute 8.1m^3/sec and16.44m^3/sec respectively.

4.2.18.1 Case I – Minimum Flows

This scenario assumes an empty reservoir with a storage capacity of 214,261,547 CM and 6.5m^3/sec being the difference between the minimum flow (inflow) and the compensation flow of 2.5m3/sec. The time taken to fill up the reservoir is calculated as follows:

Inflow	= 6.5m3/sec
Volume per month	= 16,848,000 CM
Total storage capacity of the reservoir	= 214,261,547 CM
Time taken to fill up the reservoir	= 214,261,547/16,848,000 months
	= 12.7 months

The impoundment period is rounded to 13 months.

4.2.18.2 Case I – Mean Flows

The release of the compensation flow of 1.92m^3/sec out of the minimum flow of 16.44m^3/sec will leave a discharge of 14.52m^3/sec. Considering this discharge, the monthly volume is 37,635,840 CM. The period of impoundment of the reservoir up to the normal water level so as to harness the storage volume of 214,261,547 CM is, 5.7 months.

However, there are periods of flood flows during which the replenishment of the reservoir will take a much short time, but the above cases have been considered as the worst case scenarios but still they are acceptable as good periods of reservoir replenishment.

4.2.19 De-silting Chamber

Based on the detailed silt analysis of the water the requirement of de-silting chamber will be decided. However the chamber if required will be designed with hoppers and baffle walls to achieve the required settling velocity. Also silt traps/dams will be designed upstream so as to safeguard the integrity of the dam and its sustainability.

4.2.20 Sustainability of the Flows to the Downstream Areas

The reliability of the flows to the downstream areas of the dam which is the main area of concern is ensured through the concept of a dry dam condition whereby the useful storage of the reservoir less the water demand for Isiolo and the other areas will be released during the months of low flows namely January, February March and then June, July, August, September and October. The dry dam condition ensures creation of a space within the reservoir in which the flood flows will be stored during the rains and then released during the dry spells and thus

attenuate flooding of the downstream areas though by a negligible percentage. The stored waters will mitigate droughts through release of the stored waters during the dry periods. .

4.2.21 Rate of Water Releases

The rate of draw down which is the degree of the reliability of the flows is shown in the following table, and it takes into consideration the balance of the volume water between the useful storage and the water demand for Isiolo and this flow should be released before the onset of the next rains so as to create the dry dam condition:

Calendar period	**Months (No)**	**Useful Storage (m^3)**	**Water Demand (m^3)**	**Volume to be released (m^3)**	**Rate of Water Releases (m^3/sec)**
Ju, July, Aug, Sept & Oct	5	87,000,000	41,000.000	46,000,000	3.55
Jan, Feb & Mar	3	87,000,000	41,000,000	46,000,000	5.92

Table 4.5; Dry season Releases from the dam

The conclusion from the above table is that the flows will be maintained throughout the year although at different rates for the two main dry periods. This assures reliability of the flows and the fact that the river will never dry up again. This water will be used for the improvement of livestock husbandry, minor irrigation and general social economic development aimed at alleviating poverty within the project area.

4.2.22 Flooding of Areas Surrounding Lorian Swamp

Ewaso Nyiro river flows from Mt. Kenya and the Aberdares catchment areas through Nyandarua, Kieni East and Kieni West areas, Laikipia and Isiolo counties and further downstream through to the Archers Post, Gortu, Merti and finally to the Lorian swamp slightly downstream of Merti Town and finally to Habwaswein in Wajir South Sub-county in the main Wajir County. During the rainy season, the floods are rains to the communities downstream in the sense that the floods are spread in the Lorian Swamp whereby they cause regeneration of pasture and at the same time provide water for the animals. Some fears have been expressed by downstream communities that the floods will no longer be experienced in their areas upon the construction of the dam and thus interfere with their livelihoods. However, these fears are allayed by the following reasons:

i. The Merille and Milghis rivers from Samburu County and other rivers from Marsabit County all join upstream of Habaswein Town and further downstream of the same town they join with the Ewaso Nyiro river. It is worth noting that the river systems mentioned above carry even more flood flows than the Ewaso Nyiro River. In this regard, flooding of the Lorian Swam will be sustained and, therefore, there is no interference with people livelihoods downstream.

ii. Rivers Engare Sirgon, Engare Ndare, Isiolo and other main lagas all join the main Ewaso Nyiro river downstream of the dam and increase the River capacity and volumes to cause floods downstream.

iii. The amount of the flood flow trapped in the dam reservoir is very small compared with the actual flood flow of the Ewaso Nyiro river. If the estimated Q1000 amounting to 1,500m^3/sec or the PMF amounting to 2,500m^3/sec are realized from the contributing catchment areas, then the time taken to fill up the reservoir is 1.653 and 0.992 days respectively. Hence the dam doesn't threaten flooding downstream.

Considering the period of peak flood flows to be from 5 to 7 days, then the floods flows released through the spillway or the overflows are huge enough to cause the required flooding especially more so if they are supplemented by the flood flows carried by the rivers mentioned under item (iii) above.

4.2.23 Water Supply

The water demand for the project area has been taken to be the demand for Isiolo Town & its environs, the Isiolo resort city and areas along the pipeline route. While the demand for Isiolo is determinate the demand components from the pipeline route is rather indeterminate and shall depend on the target area means of conveyance, gravity or pumping. The demand has been analysed and based on design horizons for year 2016 as initial year, year 2026 as future year and year 2036 as ultimate year. The objective of this study is to increase the water supply for Isiolo town and the environs to address the acute water shortage. The total water demand at the ultimate design life of year 2036 will be 113,681M^3/day as shown in the table 4-6 below. Appendix IX shows the proposed distribution network and pipeline.

LOCATION	POPULATION 2009	Projected Population Initial Year 2016	Projected Population Future Year 2026	Projected Population Ultimate Year 2036	Rural Domestic Demand For initial Year 2016 M^3/Day
OLDONYIRO	9828	12,588.77	17,930.03	25,537.51	168.37
KIPSING	5560	7,121.85	10,143.57	14,447.35	95.25
SIEKU	2102	2,692.47			36.01

			3,834.85	5,461.93	
BURAT	8590	11,003.01	15,671.44	22,320.64	147.17
ISIOLO WEST	4262	5,459.23	7,775.52	11,074.57	73.02
Mumonyot	3349	4,289.76	6,109.86	8,702.19	57.38
Arjijo	1620	2,075.07	2,955.50	4,209.48	27.75
Ltrimun	1672	2,141.68	3,050.37	4,344.60	28.64
Lpus	1075	1,376.98	1,961.21	2,793.33	18.42
Lkisin	1564	2,003.34	2,853.33	4,063.97	26.79
Nkaroni	4272	5,472.04	7,793.76	11,100.55	73.19
Ngogoltin	2239	2,867.96	4,084.79	5,817.92	38.36
SEIA	3035	3,887.56	5,537.00	7,886.28	52.00
Wamba Town	6247	8,001.84	11,396.92	16,232.48	107.02
Matakwani	3396	4,349.97	6,195.60	8,824.32	58.18
Lenkusaka	980	1,255.29	1,787.89	2,546.48	16.79
Remote	1237	1,584.48	2,256.76	3,214.28	21.19
Lerata	907	1,161.78	1,654.71	2,356.79	15.54
Archres post	6275	8,037.70	11,448.00	16,305.24	107.50
LosEIA	1044	1,337.27	1,904.66	2,712.78	17.89
Koiting	2617	3,352.14	4,774.41	6,800.13	44.83
Ngutuk Engiron	697	892.79	1,271.59	1,811.12	11.94
TOTAL		**92,953.01**	**132,391.77**	**188,563.90**	**1,243.25**
RESORT CITY	0	19,868.00	51,532.48	133,661.97	2461.15
ISIOLO (TOWN)	46128	62,756.63	135,486.87	292,505.99	7773.98
	46128	**82,624.63**	**187,019.34**	**426,167.95**	**10235**

Table 4-1 Showing the Project Water Demands.

4.2.24 Water Treatment Plant

A conventional water treatment works is being proposed for the project. The plant is expected to comprise of the following units upon completion (designed in accordance to Ministry of Water and irrigation manuals)

i. Pre-treatment units with inlet works installed with chemical doses mainly alum or other flocculants and soda ash) for removal of the sediments and suspended matter,
ii. Sedimentation chambers that facilitate settlement of sludge and other particulate matter from the flocculation process. 3No. simple, tolerant and easy to handle chambers are designed such as to accommodate required water per day and a detention period of 2.5 hours each.
iii. Filtration will follow the sedimentation stage to remove the finer particles that could not settle. Six filters (rapid gravity principle) are proposed for Isiolo Dam each with adequate bed area, flow rate and a backwash.
iv. Adequate volume backwash storage tank will also be installed next to the filters to wash at recommended rate
v. Pumping station will comprise of pumps (one active one standby) to take water to tanks. There will also be two pumps installed to lift water to the backwash tank. Other units in the pump station will include a plant control equipment, chlorine stores and feeder equipment and air compressors

4.2.25 Other Components

The treatment plant will also comprise the following features;

i. Chemicals for water treatment (chlorine aluminum or other flocculants and soda Ash) will be stoned in a masonry storehouse
ii. Operators houses (pump attendants, chemical attendants, water operators and general labourers,
iii. Utility water reticulation for the treatment plant premises,
iv. Access roads and in-house walkways, parking lots and vehicles service bays,
v. Security arrangement and facilities,
vi. Sanitation (septic tanks and soak pits or small wetlands for in-house sewage,
vii. Appropriately designed drainage system,
viii. Safety aspects (in-house and external)
ix. Tanks

4.2.26 Irrigation

Part of the purposes of Isiolo Dam will be to regulate and streamline the flows in Ewaso nyiro River for agricultural activities downstream. It is expected that minor irrigations after Kipsing will ensue from the dam and other feeder canals downstream. Details of the irrigation scheme

are, however, beyond the scope of this study. But the dam has incorporated the multipurpose use of the dam in its design.

4.3 Project Activities

4.3.1 Planning and Feasibility Studies

The dam project begins with the concept development that involved desk and field assessment with a view to establishing the need for the project. A wide range of considerations including the capacity of the existing water sources, water demand and uses as well as social and economic linkages of water in the target area have been undertaken. This was achieved by the NWCPC as a reference for the feasibility study and has not been discussed further under this report.

The concept is followed by a detailed feasibility study. Like this environmental scoping process, this study involved determination of the viability of the proposed dam project with respect to sustainability of water feed, environmental suitability, social acceptability and economical justifications. Preliminary physical surveys, measurements and social evaluations were carried out in conjunction with all stakeholders and in reference to all other social and economic initiatives in the project area. According to the feasibility so produced, the project is a fulfilment of the communities long time dream of water availability while the positive implications over-rides the negative impacts that would otherwise be mitigated through integrated measures through the dam construction and use of the water there from. Fieldwork of planning and feasibility studies is not visible on the ground since it is basically observations and social interactions without physical measurements.

4.3.2 Design Work

While design work is mainly a desk activity, there are significant ground activities. Topographical surveys, cadastral surveys, hydrological evaluations and measurements, geological and soils tests and other environmental considerations are among the physical activities. The activities involve partial clearing of vegetation in some sections, intrusion onto private lands and excavations in some parts to determine geological profiles among others. Interactions with the local communities for first hand information particularly with respect to special physical features, land ownership and desired design considerations is also undertaken during this stage.

The rest of the work is carried out at the desk levels such as to include design calculations and drawings, consultations between various stakeholders and the client, design reporting and

development of project costs estimates. Implementation schedules and responsibilities are also prepared under this stage. Environment and social impact assessment study utilized the design outputs, particularly at the preliminary stage, in determining quantified impacts and appropriate preventive action plans. The environmental management plan is guided by the details in the design principles.

4.3.3 Construction Phase

Dam construction is the most notable phase due to the involved activities. This activity will cover the entire area 2120 Ha the area to be inundated is 1495 Ha, 500ha for buffer, 1000Ha for exclusive conservation and about 50 Ha distribution lines and tank sites.

Among the significant features of the phase would include;

i. Submergence of grazing fields and ecotourism areas in the affected area that will include among others demolition of the lodges, removal of the building debris and relocation to alternative areas,
ii. Decommissioning of pollution point sources throughout the area proposed for inundation. Pollution point sources include pit latrines, septic tanks (where they exist), cattle pens, and any waste dumping sites,
iii. Vegetation clearing of the area covered including extraction of root zone and the removal of all dead plant matter away from the project area to suitable disposal areas,
iv. Excavations and earth moving as per the design including removal of spoils to the designated duping locations. This will also overlap with vegetation removal and decommissioning of the point sources of pollution,
v. Construction of access roads, workmen camps, construction sites (workshops, offices, machinery yards, material sites, etc.), communication facilities, water storage facilities, etc.
vi. Masonry works and erection of structural components at the various locations as per the designs.
vii. Rehabilitation works of the affected areas including deep excavations and material sites, re-vegetation of appropriate zones, polluted sites, etc.

4.3.4 Commissioning

This will be the formal hand-over and operationalisation of the dam upon completion. Among other activities, the contractor and the client will ensure there are no unresolved social concerns, the facility has been completed to the design details, affected sites have been well rehabilitated and that all components are operational. In addition to the paper work, there will be a physical evaluation of the facility that will involve the contractor, NWCPC, relevant Government departments and the design consultant.

4.3.5 Dam Operations

The very initial stage of the dam operation will be to ensure it is relieving water from the catchment through the rivers and runoff during the rains. This could take upto one year during which there will be strict management of flows in the river to ensure dependants and ecosystems downstream are sustained. Upon the dam filling, the water will be utilized in accordance to established guidelines and regulations agreeable to the Water Act and other regulatory authorities.

4.3.6 Project Outputs

The dam was found to have a potential of water supply for both domestic and industrial use, as well as irrigation purposes. The preliminary design report gives a summary of the design parameters that was considered for the three components of the Isiolo Dam Project. It is anticipated that the key output of this project is a dam to provide water for domestic use (113,681) m^3 per day that is also the main target of the project). In addition to offsite water use, it is expected that onsite benefits will be realized by the residents such as to include fishing, direct irrigation for small scale food production, possible tourism potential and improved sanitation and hygiene.

4.3.7 Dam Decommissioning

Upon completion of construction the dam site offices shall be decommissioned and at the end of the useful phase of the dam is over or the dam becomes obsolete, decommissioning will take place and the following are decommissioning activities:

i. Removal of construction camp sites (housing, toilets and washrooms, waste dumps, etc.);
ii. Removal of construction residual material holding sites,
iii. Effects of material borrow pits left open
iv. Disposal effects of wastes and debris;
v. Removal of part or all of the water treatment plants
vi. Demolition of the water distribution tanks;
vii. Demolition of the dam structure,
viii. Removal of the transmission pipeline

On contractors camp and auxiliary construction sites, the contractor to prepare a decommissioning plan of all construction installations and associated sited at least 3 months prior to end of construction. On the dam, NWCPC to notify NEMA at least one year before the intention to decommission. Undertake a decommissioning audit at least six months before the activity and provide a decommissioning plan. Undertake the decommissioning following the

decommissioning plan, under supervision of NEMA. Rehabilitate the affected locations to the satisfaction of NEMA and other stakeholders.

5 PUBLIC CONSULTATION

5.1 General

Public consultation is useful for gathering environmental data, understanding likely impacts, determining community and individual preferences, selecting project alternatives and designing viable and sustainable mitigation and compensation plans.

Public consultation in the EIA process is undertaken during the project design, implementation and initial operation. The aim is to disseminate information to interested and affected parties (stakeholders), solicit their views and consult on sensitive issues.

5.2 Objectives of the public consultation

The specific aims of the consultation process are to:

1. Improve project design and, thereby, minimize conflicts and delays in implementation;
2. Facilitate the development of appropriate and acceptable entitlement options;
3. Increase long term project sustainability and ownership;
4. Reduce problems of institutional coordination;
5. Make the resettlement process transparent; and
6. Increase the effectiveness and sustainability of income restoration strategies, and improve coping mechanisms.

An important element in the process of impact assessment is consulting with stakeholders to gather the information needed to complete the assessment.

The main objectives of community consultations are to:

- Provide clear and accurate information about the project to the communities;
- Obtain the main concerns and perceptions of the population and their representatives regarding the project;
- Obtain opinions and suggestions directly from the affected communities on their preferred mitigation measures; and
- Identify local leaders with whom further dialogue can be continued in subsequent stages of the project.

5.3 Public Consultation Plan

A public consultation and disclosure plan is outlined in Table 5-1 below:

Table 5-1 Public Consultation and Disclosure Plan

Activity	Disclosure information	Tool	Responsibility	Audience	Expected output
Introductory meetings:	Screening (Project Report)	Formal meetings (Stakeholders consultative meeting)	• Project proponent • Lead EIA Expert	• Project Regulators • Project implementers • Project beneficiaries. • Affected and interested parties	• Identification of stakeholders. • Classification of stakeholders. • Development of stakeholder database. • Pre-emption of potential impacts.
Information dissemination:	Proposed expansion project and the environmental requirements.	Formal meetings Barazas Informal meetings One-on-one interviews Emails	• Lead EIA Expert • Project Team	• Project Regulators • Project implementers • Project beneficiaries'	• Stakeholder reaction to proposed project i.e. community concerns and inputs. • Number of potentially affected stakeholders.
Public disclosure:	Findings of the EIA study.	Formal meetings Barazas	• Lead EIA Expert	• Project Regulators • Project implementers • Project beneficiaries'	• Stakeholder acceptance of proposed project.

It is the policy of the regulation that a participatory approach is taken in the investigations of impacts at all stages of the EIA (EIA Regulations 2003). It is also a requirement of the government that adequate consultations with all relevant stakeholders are done before the inception of any development project.

The consultation exercise planned as follows:

- Initial awareness / introductory meetings with several identified stakeholders'. The purpose of this is to introduce the stakeholders to the proposed expansion. Secondly, the initial consultations inform the detailed EIA study.
- A detailed stakeholder engagement where all groups identified from the initial meetings would be invited for 'barazas' and all aspects of the proposed expansion presented to them for their comments and observation. Stakeholders will have adequate time after any meetings to submit their comments. Questionnaires will be issued to individuals identified as key stakeholders.
- A public disclosure meeting once the EIA study is complete to inform all stakeholders involved of their final input and recommendations of the EIA project team.

5.4 Stakeholder Identification

Stakeholders to be consulted during the EIA stage have been identified based on their needs, interests, relative power and potential impact on project outcome. In this regard, the following stakeholders were identified:

a. Ministry of Energy;
b. Kenya Forest Service;
c. Kenya Wildlife Service;
d. Ministry of Agriculture;
e. Meteorological department;
f. Samburu, Laikipia and Isiolo County governments;
g. County Commissioners (Samburu, Laikipia and Isiolo;
h. Local Leaders (Samburu, Laikiapia and Isiolo;
i. Chiefs and assistant chiefs of project area locations;
j. Water Resource Management Authority;
k. County executives and ministers (Samburu, Laikipia and Isiolo);
l. County Gender and Social Services Offices;
m. Public Health Offices;
n. County Environment, Water and Natural Resources Office;

o. Communities residing within the project area of influence;
p. Relevant NGOs within the project area; and
q. Any other interested and affected party.
r. Water supply service providers

5.5 Initial Consultations

The County Commissioners and the respective departments of Samburu, Isiolo and Laikipia were contacted in May 2013 during the preliminary site visit. The purpose of this initial meeting was to inform the officers of the Isiolo Dam project and to help in the identification of the key stakeholders. They were all supportive of the project. Also three public meetings, focused group discussions and working meetings with land owners/group ranches management teams and community representatives were conducted. The attendance list is herein attached as appendix III. A further stakeholder's consultative meeting was held on July 16, 2013; the meeting focused on introducing the project, stakeholder's identification and prediction of potential impacts. The outcome of the meeting was that further and detailed consultations was needed to inform the varied stakeholders the potential impacts of the project and detailed proceedings (attendance list) as appendix III of this report and photos plates as Appendix IV. The following section outlines the stakeholders consultations during the EIA study. Consultation schedule is as shown in table below

Table 5-2 Consultations Schedule.

Type of meeting	Target Stakeholders	Venue	Dates	Form and Evidence of Participation
Public Baraza	General Public (Upstream)	Kirimon location (Samburu/Laikipia County)	30/05/2013	Baraza attendance list and Photos Appendix III & IV
		Oldonyiro location (Isiolo/Laikipia County	03/06/2013	Baraza attendance list and Photos Appendix III & IV
		Kipsing location Isiolo County	02/06/2013	Baraza attendance list and Photos Appendix III & IV
	General Public (Down stream)	Merti area	28/04/2014	Baraza attendance list and Photos Appendix III, IV and Annex VI: Downstream Consultations report.
		Habaswain Area	29/04/2014	Baraza attendance list and Photos Appendix III, IV and Annex VI: Downstream Consultations report.
		Sericho Area	30/04/2014	Baraza attendance list and Photos Appendix III, IV and Annex VI: Downstream Consultations report.
Stakeholders Workshop	Sector Wide Stakeholders*	Rangelands Hotel Isiolo	16/07/2013	Workshop report annex I
	Sector Wide Stakeholders*	Grande Hotel Isiolo	2/04/2014	Workshop report annex II
	Leaders Workshop	Rangelands Hotel Isiolo	23/05/2014	Leaders workshop report Annex V
Focused group discussions (FGD)	Group Ranches and Mid WRUAS	Longaboli bandas	31/08/2013	Isiolo Dam Social Impact Assessment Report Annex IV
	WRUAS Lower Ewaso	WRUA office Maili Saba-Isiolo	3/09/2013	Isiolo Dam Social Impact Assessment Report Annex IV
	Conservancies and WRUAS	Sabuk Lodge	1/09/2013	Isiolo Dam Social Impact Assessment Report Annex IV
	Land owners	Sabuk Lodge	10/10/2013	Annex III Land Compensation Report.
	FGD with area CBOs and NGOs	Sportsman Arms Hotel Nanyuki	2/05/2014	Downstream Consultation Report Annex VI.

- * The items starred indicate consultations and meetings held and independent reports made and submitted to client the National Water Conservation and Pipeline Corporation. They form part of this EIA study and reference has been made to in the report development.

5.6 Key Issues Raised in Public Consultations

The Key issues that have been raised through the public consultation process mostly in barazas, workshops and focus group discussions are summarised below.

5.6.1 Project a Solution to Existing Water Problem

Existing water projects were mentioned but cannot meet current water demand. The communities urged that during the construction period these should be looked into or connected and improved with the bigger project proposed. Speedy implementation of the project was therefore called for. In fact one of the questions in most of the consultation meetings was the exact timelines of implementation for the project as they saw this as a very important project for them. They urged that distribution of water for drinking should not be charged as villagers cannot afford its costs. The current existing water schemes do not supply irrigation water and hence urged that the proposed reservoir and its design for water supply should put that into considerations supplying a surplus for irrigation.

5.6.2 Loss of Conservancy/Agricultural Land

Notwithstanding support for the Project, there was a concern about the loss of grazing land/conservancy wildlife and livestock holding land in the Reservoir area and, in particular, over compensation for the loss of fields. The affected conservancies and communities requested that the dam be scaled down to result in a smaller dam that meets the objective but displaces/affects a smaller number of people/wildlife. Some were of the opinion that desertification will result since availability of water at the flanks of the proposed dam will act as a magnet resulting in crowding and overgrazing within a certain radius from the shoreline. It was also felt that since the tenure in the area is trust land, there might not be compensation after all as the government will appropriate the required land from one department to the other without involving those in whose trust the land is held. The consultant proposes to create a buffer on the dam site followed by conservancies and the community on the periphery who will be supplied with water for domestic and livestock uses.

The need for coming up with a livelihood restoration programmes for the communities/workers anticipated to lose livelihood in their conservancy lodges pointed out. The workers whose work will be temporarily lost to be restored during that period of relocation and construction of the conservancy lodges/ hotels which acts as tourist destinations

5.6.3 Employment Opportunities

Employment on construction works was seen as a major Project benefit. However, people were concerned that contractors would bring people from outside the area to take up employment, especially unskilled employment. It was suggested that the communities should form village committees that will register all employable labour and their skills so that the lists could be given to the employer to ensure that local people get priority access to construction jobs. The contractor shall adopt the most appropriate and transparent strategies for recruitment and may include adoption of concentric model where opportunity are prioritised primarily from community level and widening to county, regional, national and international.

5.6.4 Resettlement

Concerns were raised over the possibility of households having to resettle for the development of the Reservoir. Some respondents also felt that households who will be close to the Reservoir water level should be given the choice to relocate if they feel they want to. In all instances, people want to be involved in the determination of compensation packages. They also stated that compensation should be paid before the implementation of the dam, having learned from the (perceived/reported) experiences of people who were resettled for the construction of other government projects including dams elsewhere.

5.6.5 Straining Community Relations

A concern was expressed that water has a potential to create conflicts between conservancies and different communities around the dam when they come to water animals at the dam flanks. There were already some disagreements over the use of water by livestock from different conservancies/communities. Impoundment of the Isiolo could increase disagreements over water use. To counteract this, small watering ponds for animals to avoid concentration of livestock in one place were suggested. The volume of water to be stored in the reservoir will be in sufficient volumes to meet all the communities' demands all year round. Another area of potential conflict related to whether communities through whose land the transmission pipelines will pass would have access to the water. These communities are in equal need of the water (as affected communities they should be given access to the water) the consultant proposes that the pipeline provides for communal watering points whereby communities downstream are to be provided with safe drinking water for both domestic and livestock use. Further details of specific areas and the target population is in chapter 4, section 4.2.23.

Equally water and land resource users in the lower Ewasio Ngi'ro felt that the proposed dam did not spell out good news for them since it was targeting to harvest the very same floods

that they rely on for pasture growth in the flood plain towards Lorian Swamps. This they felt would lead to conflicts and sufferings if implemented. But in essence the project will attempt to regulate the flows of River Ewaso Nyiro to ensure that conflicts are minimized by having an enhanced discharge downstream.

5.6.6 Threat to Pastoralist Livelihoods

The proposed dam being multipurpose in nature and allocating some water to irrigation, the local communities saw this as an avenue through which farming communities from outside the area will be brought in and allocated land. This would mean less land for grazing for the locals who are traditionally pastoralist and not ready to change livelihoods to irrigated farming. The communities also do not eat fish traditionally and therefore saw little sense of the fishery multipurpose use of reservoir. Awareness campaigns, sensitization and capacity building on change of lifestyle and cultural beliefs is required to empower the community harness fully the resources of the project area without being exploited by emigrants.

5.6.7 Vulnerable Groups Assistance

During the consultations, the women welcomed the project and suggested that they should be considered when it comes to employment opportunities at implementation stage. In the same vein the youth were concerned that if large land belonging to conservancies was taken, the conservancies e.g. Lemartis and will move and leave them jobless. Alternative opportunities were foreseen both at construction and operation stage.

5.6.8 Pressure on Local Resources

When the dam is finally implemented, it might serve as one giant watering pool for animals and the local community was concerned of what will happen when people come and settle along the dam shores in search of water for their livestock after implementation of the project; this would lead to overgrazing, conflicts and desertification. This concentration in one area by people and many animals might lead to emergence of a small town within the reservoir area in search of the rare commodity (water).This might lead to deforestation as people would engage in other activities like charcoal burning as a sources of income. These nomadic pastoralists would also construct manyattas around the dam. A proposal of fencing the dam area with an electric fence and creating smaller watering points along the pipeline to avoid communities and their livestock and wildlife grazing in a concentrated area to avoid creating a big desert by the dam area and reduce human wildlife conflicts was proposed by owners of the conservancies who were interviewed and sensitized.

5.6.9 Wildlife

The resulting dam will create a habitat extending to near people settlements for beasts like crocodiles that; these are known to attack humans and livestock and calls were made to fence off the area to keep crocodiles at bay. But the project will ensure that there are minimal conflicts between the project and wildlife and wildlife and humans. The acquisition of land in excess of 750Ha for conservation and dam buffers will reduced these risks, also the community will be provided with watering points outside the dam area in the settlement where they will no longer be in contact with the water body.

5.6.10 Loss of Infrastructure (Kibaleng bridge)

During the public consultation held at Koija Group Ranch the importance of the single lane bridge linking the South and North banks of Ewaso Ng'iro was stressed. This road and proposed bridge will provide an alternative link to Maralal and Rumuruti via Mpala area and alternative crossing for wild animals too. The county government has earmarked the bridge for construction. The concerned communities asked for an alternative to be provided if that one was to be submerged. Communities noted that in many areas there are no schools, proper roads hospitals etc. Proposals were made for the project proponent to consider constructing them under the corporate social responsibility.

5.6.11 Sharing of Benefits –

The communities in the affected locations indicated that they have shared the river water resources with the downstream users' since time immemorial and requested that in case the project is implemented; ways should be devised for water to continue flowing in the river and also if possible for them to get benefits of the project as well.

5.6.12 Vices such as Theft, Diseases and HIV/Aids and other Sexually Transmitted Infections

There was a concern over the influx of migrants / workers in the area; the possibility of vices such as crimes and an increase in sexual activity and with it sexually transmitted diseases such as HIV/AIDs because of the presence of large numbers of construction workers brought in from other areas.

5.7 Interviews with WRUAS

In the interviews with lower Ewaso Nyiro River Water Users Association, it was anticipated that less water conflicts within the different WRUAs, Most communities neighbouring the

project will also benefit from the project; the proposed project will supply water for the wildlife and the livestock; Food production will increase in the area if water is provided for irrigation. However, it was pointed out that there will be need for those involved in the proposed project to go an extra mile to convince the people in the area that the river will not dry with the proposed project.

Discussions were also held with the mid Ewaso WRUA at the Ilmotiok Group Ranch in Olangoboli bandas. According to the participants the project's negative effects include displacement natural environment and people, conflicts between residents and wild animals, Influx of immigrants leading to diseases such as HIV, upsurge of water borne diseases eg malaria etc. The positive effects anticipated included Development of conservation in the area, Availability of jobs, adequate water, new livelihood opportunities such as fishing, tourism attraction and Corporate Social Responsibility driven projects such as schools, hospitals. To counter these problems the following recommendations were made

1. Adequately disseminate information to the locals on what the project is about
2. Improve health facilities as diseases are expected to emerge
3. Educate the residents on the various uses of benefits, uses and opportunities brought about by water such as tourism and irrigation
4. Relocate water pipeline from Oldonyiro to Tura and then simultaneously supply to Oldonyiro and Koija areas through gravity since Tura is at higher ground. This will discourage also residents and animals from the reservoir
5. Put up a bridge at Tabarua to link Laikipia North and West across Ewaso River. This will help in movement of people and animals in the two areas as they are nomadic
6. Encourage conservation within reservoir so that residents can be discouraged from dam area
7. As part of CSR help the community put up modern lodges to tap the tourist potential
8. Involve the community during the studies
9. Arrange exchange visits with other success stories with other dams
10. There is also a proposed power line from Ethiopia traversing the area and there is need to consult with KETRACO to confirm their proposed power pylons' beacons.

At the consultative workshop held with land owners within the reservoir in Oldonyiro the following were some of the major concerns raised;

1. Downstream people will suffer if water is abstracted
2. Community need to accept the idea of the project so need of creation of awareness on the proposed project
3. The local people whose land will be taken wanted to know What will be the benefit for them
4. Time line for this proposed project need to be given e.g. when will construction begin
5. How big will the dam be and how much land will be taken and how wide will the dam be and how long will it take to fill the dam

6. The community felt that the Top down approach has been applied as they had not asked for the proposed project to be brought to them

7. There is a lot of illegal abstraction from upstream and those from the lower or downstream end up with no water

8. Concerns from those living upstream are different from those from downstream

9. What will happen to the corridors for the wild animals

10. It is important to note that there is less water during the dry season downstream because of over abstraction upstream. There is need to stop the illegal abstraction of water upstream thus need for regulations

11. There are still more stakeholders and communities in the project area who need to fully understand the project

12. The communities in the area depend a lot on tourism and this must be understood

13. What about compensation this must be very clear to the affected people; the question of compensation criteria was raised with participants asking what will happen to the people with no titles for their land yet their land will be taken by the proposed project

14. For the big hotel owners there is need to take into consideration that they will lose in terms of business during the construction period and they wanted to know how they will be compensated during that period

15. The dam project should also benefit the community of the area too; the need to have a management plan for the area around the proposed dam is important to consider. So the area around the dam should be managed properly (beyond the 10 m buffer zone)

16. There is need to strengthen in terms of capacity the WRUAS so that they can monitor the abstractors especially upstream; WARMA should ensure there is no illegal abstraction of water

17. Need for more meetings with the communities to really understand the project and understand which areas will be affected were stressed

18. A proposal was made to form committees (Task Force) which will be in touch with the project staff/ designers and project proponent -NWCPC. Names were proposed at the meeting. The role of the task force will be to work with the project staff and give concerns for the communities

All the concerns raised in different forums has been addressed directly in this report.

6 ALTERNATIVES TO THE PROJECT

To close the development gap between the ASALs and the rest of Kenya, regulate the flows of the Ewaso Nyiro River, provide water to the communities downstream, provide small irrigations and ultimately supply the proposed Isiolo Resort City and Isiolo town with water, various alternatives have been investigated in the past. The investigations have covered both run-off water and storage schemes. Below is a brief discussion of the various alternatives that have been considered.

6.1 Analysis of Alternatives

The county of Isiolo and the communities in Laikipia and Samburu counties and its environs are facing chronic water shortage due to the ever changing environmental conditions, unregulated abstraction of Ewaso Nyiro River, rising population and the competing demands from the existing water sources. Various studies have been conducted in the past to improve the water supply to the communities in the counties. A feasibility study was undertaken by CAS consultants in regard to identifying the most feasible source of water for these counties. The consultant evaluated capacity, technological, material and location alternatives. The analyses are as follows.

6.1.1 Ngare Ndare River.

The total impoundments in the Ngare ndare dam sites are mainly expected to come from runoff flow volumes through the Dam sites during the rainy season of March to May and November to December. At the Ngare Ndare site these flows amount to 16.89 million and 6.62 million cubic metres respectively which implies that the Ngare Ndare Dam can only hope to impound 23.51 million cubic meters of water within the two seasons/annually and not viable to meet the objectives of the dam.

6.1.2 Ngare Sirgon Dam site,

the runoff flow volumes during the two rainy season amounts to 12.49 million and 4.89 million cubic metres respectively, this gives a total of 17.38 million cubic meters of water available for impoundment. The capacity isn't viable to meet the objectives of the dam. The Ngare Ndare and Ngare Sirgon sites with potential annual runoff of 23.51 and 17.38 million cubic meters of water respectively would require 1.8 and 2.4 reservoir fillings to service the annual demand which is not practical from a hydrological point of view.

6.1.3 Ewaso Nyiro River Channel

Similarly the runoff flow volumes through the Ewaso Nyiro Dam site during the rainy season of April to May and November to December amounts to 146.17 million and 121.47 million cubic metres respectively which would give least 267.64 million cubic meters of water annually. Has capacity to have the desired volumes of water and further can even sustain multipurpose use of the dam. Further, the consultant analysed the best locations suitable for the dam along the Ewaso Nyiro River either at Crocodile Jaws and Murun Dam site.

A comparison of the results of annual runoff through the proposed sites from the hydrological study and the Isiolo water Demand reveals that only the dam sites located at the Ewaso River main channel namely Murun and Crocodiles Jaws have the potential to harness sufficient to meet the Ultimate Isiolo Resort City water Demand in an average year.

Between the two Ewaso River channel dams, the ground elevation at the Murun dam site is about 1140masl while Isiolo Town is on elevation 1135masl. Developing a dam at this site may not be very viable because of the small difference in elevation which may hinder free flow of water to the supply areas through gravity. Alternatively, disproportionately huge diameter pipes may have to be installed since this will reduce the frictional losses through the pipe system. This leaves the Crocodiles Jaws Dam site at an elevation of 1580 m.a..s.l; storage capacity of 239.81 against an annual runoff of 267.64 million being the most feasible site for development to service the Water Supply Demand for Isiolo Resort City. A water supply dam dam will have an impact on sustainable livelihoods and economic opportunities in the area. Focus on Isiolo Town, proposed Resort City, and floodplain – Lorian Swamps, the rural market centres and its environs the dam will serve an area with both urban and rural characteristics which are likely to be uplifted to its anticipated Vision 2030 status. The rural environs served by the dam is also includes other rural areas characterized by having very little infrastructure and a high degree of poverty. The construction of a dam in such an area presents an opportunity to extend the benefits of the investments to include other aspects such as water storage for irrigation, fishing and the generation of hydro-power through an optimized sharing of water amongst these uses.

Multi-purpose objectives are however often difficult to reconcile in terms of operating rules for reservoirs with different objectives requiring divergent storage-for example water supply and irrigation all aim to use stored water in a competing manner. Reservoir sediment management also presents considerable challenges related to different multi-purpose objectives.

To counter this inter- and cross-sectoral coordination of water demands and strong institutional capacities will require to be put in place to ensure water rights and allocation quotas are distributed fairly among the uses, with potentially competing demands and impacts.

A Multi-purpose dam, if well planned and managed; provides an important option to meeting some of the area's development challenges. By storing huge volumes of water to improve drinking water supply or agricultural food production through irrigation, and enhanced flood

control providing clean and reliable energy, it will contribute and to human security in general. In vulnerable region such as the proposed dam area that oscillates between extremes of flooding during rains and drought during the dry spell, a multipurpose dam can also be an appropriate response to the impacts of climate change.

6.1.4 Do Nothing Option

This option would mean that the local and regional/national benefits would not be realised. Isiolo Town would not have a reliable water supply and other adjacent rural areas and centres such as Ol Kipsing, Donyiro, Wamba and Burat would continue to experience water supply shortages which would become worse over time. Further development of proposed Resort City and water-dependent industries would be constrained with subsequent loss of national income and employment flow-on effects to the economy of Kenya. Lorian and other areas in the flood plain will continue to experience the usual drying of the river during the dry spells and flooding in wet seasons which would become worse over time.

If the Project does not proceed there would not be the need to compensate the 147 or so project affected households and numerous conservancies; however the area would also potentially miss out on development opportunities that the Project could bring including water supply for existing Isiolo Town, proposed resort City and outlying rural areas, provision of irrigation water, control of flooding and economic opportunities through Project construction and operation including employment and small business opportunities.

A “do nothing” option would also mean that archaeological sites if any would not be permanently inundated. However this option would not stop the current deterioration of the sites from exposure to climate and human use. Either way, development or no development, cultural heritage sites will deteriorate. The only difference is the rate and opportunity for salvage. In a “do nothing” option, the salvage opportunity is very low, only prompted by individual research interests, which come very sporadically. With the construction of the proposed Dam, salvage / detailed recording of sites is assured since it would be a mitigation component of the Project. It would ensure that the cultural heritage information would not be lost and that it would be collected in the shortest possible time.

Given the health risks posed inadequate supply of potable water to Isiolo town and the outlying rural areas, disruption occasioned by the recurrent flooding to the flood midstream and plain population, together with the benefits that the power and irrigation components stand to bring to the inhabitants of area, Northern Kenya Region and nationally, the no project scenario is likely to result in more adverse impacts overall than those that have been related to the construction of the dam at Nkutuk Elkinyang.

7 POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

7.1 General

Following the site visit and studies, potential environmental and social impacts of the proposed project have been identified to determine whether or not the proposed project will have adverse impact on the environment.

The Environmental Management and Co-ordination Act (EMCA) No.8 of 1999 provide the legal and statutory guideline for the environment and social impact assessment process in Kenya.

7.2 Positive Impacts

7.2.1 Regional and National Benefits

Isiolo Town is currently served by Isiolo water supply constructed in 1980-1983 to serve a population of 15,000 persons. The population has been on the increase and had since grown to the order of 60,000 persons by 2012, and as a result the water demand has far exceeded the production capacity of the existing water supply. There are Short Term Isiolo Intervention Measures to improve for Water Supply to Isiolo Town through drilling of twelve boreholes around Isiolo Town and to shift the existing water intake to the upstream of the river where the water quality will be good and away from areas of intensive agricultural activities which are competing for water use from the river. However, these interventions are expected to increase Water Supply to Isiolo Town by about an additional 4,000m^3/day against a demand of 60,000m^3/day. This highlights the need for substantive water supply augmentation works.

Besides the increased water demand in the supply area, a lot of water-consuming agricultural activities are taking place in Isiolo River catchment. This has resulted in over-abstraction of water from Isiolo River during the dry season that has sometimes resulted in no water reaching the Isiolo Water Intake. The environs of Isiolo town, the upstream and downstream catchments are therefore water stressed areas. There is at present stiff competition and occasional open conflict over the access and utilization of the water resources. Hence the need to mitigate and relieve the massive water stress through the development of the proposed Isiolo Dam.

Considering that the town is one of the Vision 2030 flagship projects earmarked as a resort city there is need to construct a new water supply to serve the town and its environs. The new water supply from the proposed dam should be able to meet the present water demand for the town and the projected water demand by ultimate year (year 2036). The Government of Kenya

plans to develop Isiolo Town into a Resort City under the Vision 2030 Development Plan and with it increased water demand. Resort City Hospitality Industry developments and other sectors will also require increasing amounts of water. Water demand has outstripped the available supply, leading to water shortages, an increase in the proportion of the town's population without water supply services and the curtailing of planned new connections (Isiolo Water Company; 2013). The situation will deteriorate unless immediate effective steps are taken to procure additional supplies. The proposed Dam will provide the long term solution to water supply to Isiolo Town and its environs.

Project benefits to existing Isiolo town and proposed Resort City will be long-term and of very high value in terms of improved water security. National benefits will also accrue in the form of improved national economic variables such as production capacity and economic growth associated with sustaining of an increased urban, peri-urban and Resort City population through more secure water supply.

7.2.2 Local Benefits

The KIHBS indicates that on Overall, 57% of households use safe drinking water with Eastern and North Eastern regions (part of which Isiolo falls) having the lowest rates of using safe drinking water. The proposed project will also supply rural areas of Ol Donyiro, Kipsing, Burat and Isiolo West in Isiolo County while in Nothern Laikipia County some parts of Sieku and Mumonyot will be supplied. These benefits of access to safe water are moderate, long-term and of high significance.

Given local economic conditions in the proposed Reservoir area, which is characterised by constrained access to cash incomes and relatively high levels of poverty, the Project has the potential to contribute to local economic development. If conceptualised as an infrastructure project with fairly substantial local development potential, the Project can assist with the diversification of local livelihood strategies (e.g. through the implementation of preferential employment strategies) and contribute to an increase in household incomes.

Respondents in the socio-economic survey were aware of these potentials, and it is highly likely that their support of the Project is partly influenced by a belief that Project benefits would accrue to local communities. For instance, over 90% of the respondents in the socio-economic survey were willing to move and settle elsewhere if the proposed dam inundated their land and employment of local people came up in the discussions and barazas as one of the benefits.

One recurring problem typical of the ASALs and in the project area is droughts and flush floods. Although some participants in discussions alluded to the fact that flooding in the area

can sometimes be helpful to both ecosystems and people current interventions are more reactive than preventive; the dam if implemented can be one of the long-term flood mitigation measures. The Middle and Lower Ewaso basins are criss-crossed by many ephemeral valleys and gullies (locally called lagha). These are un-gauged and handle large volume of flush floods during the rains, but remain dry for most of the year. The Ewaso Nyiro River itself rises on the west side of Mount Kenya and Northern Abadares and flows north into the Merti area before disappearing eastwards and into the Lorian Swamp, approximately 30kilometres from Merti. The river has always been seasonal with water flowing between April to December sometimes with a dry period in August. Yet these patterns are becoming more and more difficult to predict, as the overall flow is lower and now the rain seems to come much later every year.

At present there is no systematic arrangement for assessment of flood damages and maintenance of damage data. Damage assessment is usually made by various line departments after every major flood but due to lack of coordination, the data is rarely compiled to have a comprehensive appreciation of the actual socio-economic and environmental impact of floods. However according to Ministry of Water and Irrigation Flood Mitigation Strategy (MoWI) of 2009, flooding in this basin reduces access to clean water by destroying or polluting drinking water supplies, increasing the chances of contracting waterborne diseases. The terrain encourages stagnant water that remains after flooding and can increase exposure to mosquito-borne diseases such as malaria by providing a medium for mosquitoes to breed. Washed-away bridges and impassable roads can isolate communities for extended periods, leading to food and other shortages.

Likewise, in the past, a major drought was expected once every 10 years, but over the past three decades major droughts have recurred after every 5-7 years (CETRAD 2003). This means that ASAL livelihood systems do not adequately recover to withstand the next drought. A dam located in the proposed location will serve as a regulating reservoir harvesting and storing the flood flows during storms and releasing the same into the stream channel to augment low flows during times of drought. The immediate project benefit to the residents adjacent to the last stretch of the River will be long-term and of very high value in terms of assured non interruption of livelihoods and or loss of lives. The compensation flow of about 1.916M^3/s is 85% in exceedance of probability flows. This project will also reach out to over 188,564 individuals by the year 2036 and their livestock who would otherwise be scavenging for water in the ASAL areas. A detail of the targeted population is in chapter 3 section 3.2.3 subsection 3.2.3.9 of this report.

7.2.3 River Flow Stabilization

The dam is expected to moderate water flows downstream of Ewaso Nyiro river throughout the year with potential ecological stability and constant availability of water to the downstream dependants. Currently Ewaso Nyiro River sometimes doesn't flow past Archers post due to over abstraction and other human activities upstream, damming the river will ensure that peak flows during the wet season in the catchment areas is stored in the reservoir so as to be discharged continuously all year round. The all year round flows of the river will ensure the river dependants downstream are restored and Lorian swamp ecosystem thrives. The compensation flows at 1.916M3/s is adequate to ensure flows into Lorian Swamp. This flows is over and above environmental flows.

7.2.4 Catchment Restoration and Erosion control measures

With the proposed sand check dams upstream, the check dams will also help control siltation of of the dam and Ewaso Nyiro river downstream, that is a significant benefit to the ecological status, also catchment conservation will reverse the environmental degradation and soil erosion upstream. The government has rolled out several initiatives through its agencies geared towards catchment restoration, regulation of abstraction and enforcement of Water, Environment and Agricultural sector legislations.

7.2.5 Reduction of Water Resource Conflicts

The dam water has the potential to sustain ecological habitats (particularly indigenous) including vegetation and aquatic and terrestrial wildlife (fish, crocodiles, hippos, snake species, etc. Many a times pastoralists and wildlife move upstream due to the river drying up, regulations of river flows ensure that there is no upstream movement in search of water resources.

7.2.6 Improved Access to Services

The proposed Isiolo Dam will ensure that infrastructure is improved in the area as the roads, electricity, water supply and housing for the project teams will be provided. In general hygiene and sanitation of the project area, Isiolo Resort City and the service area will significantly improve as a result of readily available water, and particularly from the treated water supply,

7.2.7 Food Security

The project will provide water for minor cultivation of crops (kitchen gardens), domestic purpose, livestock use, industrial purpose, irrigated fodder development downstream of Archers post due to presence of wildlife migratory routes and game reserves upstream of Archers post, etc. The irrigation schemes component in the multipurpose use of the dam is

only feasible downstream of Archers Post due to above reasons. More importantly during the consultation held in the project area, the pastoralist communities are keen on the stabilization of the Ewaso Nyiro River flows upto Lorian swamp as opposed to development of irrigation schemes whereby their economic mainstay is livestock and not crop agriculture. However, water for irrigation downstream has been considered for possible irrigation schemes developed by National Irrigation Board under Ministry of Agriculture.

7.2.8 Several Economic Benefits will Accrue as Follows:

i. Employment generations: during the construction phase there will be improved employment opportunities for local people and new comers and also during operation periods of the project it is expected employment opportunities for people will be created. This will be in the form of skilled and unskilled laborers and it is a good opportunity for local community.
ii. Fishery Development: - Fishery development will enable the local communities to diversify their economy. The introduction of fishery development through creation big water body could help to improve the nutritional status of the local people and the region. Moreover it could be an additional source of cash income due to the commercial fishing.
iii. Development of infrastructure: The proposed dam project is expected to develop thousands of hectares of irrigated agriculture, thereby generating support services, the local people will have access to health care, water supply sanitation facilities, markets, communication facilities, electric supply, Schools, heath facilities and services etc.
iv. Crop diversification: The introduction of irrigation enable farmers to diversify their crops based on local markets demand and export.
v. Increased social interactions thereby avoid backwardness and establishment of new way of life.
vi. Micro climate improved because of existence of water on the reservoir
vii. Improved forage varieties provided and increase animal productivity and production
viii. Mitigation of flood and drought syndrome: Implementation of the project will be a means of for flood protection, which seems to be a threat downstream. The execution of this irrigation project will be helpful in mitigating the drought syndrome that results into poverty and instability in the society and controlling floods caused by surface inflows, direct rainfall, overtopping the riverbanks, poorly drained soils and lake Tana backwater effect that hampered the development of rainfed crops during the rainy season.

7.3 Negative Impacts

Construction activities are likely to generate a range of impacts that may be adverse to the living and health conditions of affected communities. These could include:

- damage to private property due to construction activities; for example, blasting operations and impact rollers; and
- Impacts on wildlife and livestock farming practices during the construction period (e.g. acquisition of grazing areas; injuries to livestock).
- Experience from other large-scale infrastructure projects also shows that the presence of a relatively large construction workforce drawn from outside the area may have a number of effects on the local social environment. These could include;
  - ✓ greater demand for, and pressure on, social services and facilities (e.g. health, educational and water supply facilities and systems);
  - ✓ increases in the incidence of diseases (e.g. alcoholism, sexually transmitted diseases and other diseases such as tuberculosis);
  - ✓ clashes between the workforce and local communities over construction jobs; civil disturbances; and
  - ✓ Disturbances to the social practices and fabric of local communities (e.g. influx of job seekers; development of informal settlements; changes to the position of women and vulnerable groups).

The occurrence and significance of these impacts are a function of workforce size and composition: the larger and more foreign the workforce, the higher the anticipated social disturbances. The “development status” of local communities, similarly, determines the extent to which social disturbances may occur: the more isolated and underdeveloped the area, the higher the anticipated disturbances. The workforce that will be required at the Dam site is likely to be relative large and could, therefore, have significant effects on local communities which quiet and rural in nature. A strategy will be implemented to enhance the employment of local community members on the construction works. Nonetheless, the impacts referred to above will still occur and for individuals and households affected by them, the disturbances could be highly significant.

7.3.1 Land Acquisition Requirements

The Project will require permanent acquisition of land as well as temporary occupation of land. Permanent land acquisition will occur for the construction of the Dam Wall, the creation of the Reservoir, as well as for other permanent infrastructure such as the access road to the Dam Wall, the Power Plant, water treatment plant, switchyard, transmission line and a permanent

operations office. Temporary land occupation will be required for the construction of temporary access roads, the operation of a quarry and for construction camps and resident engineer's offices.

A parallel technical study is ongoing, which will determine the most appropriate location/alignment of infrastructure such as the Power Plant, construction camps, offices and the access road to the Dam Wall. With the exception of the inundated area and the Reservoir footprint, it is therefore not possible to give the final location of the associated infrastructure at the Reservoir site other than provisional locations. The Project's anticipated land requirements are summarised below;

I. **Dam Embankment and Reservoir**; The Project will require the permanent acquisition of land, and inundation of communal resources and activities, improvements on this land (pasture land and conservancies, privately-owned trees and probably a number of graves). Land acquisition is estimated at 2,587Ha.
II. **Power Plant and Switch Yard;** The Power Plant and Switch yard will require the permanent acquisition of land in the vicinity of the Reservoir, anticipated to consist mainly of grazing fields and rangeland. Land acquisition estimated to be determined at design stage.
III. **Water Treatment Plant and conveyance pipeline;** the water will be treated at a location immediately downstream of dam site prior to conveyance; pipelines will be placed on reserves of existing roads and on private land. Land occupation outside public road reserves by the treatment plant is estimated at 6.1ha while the 93km pipeline on a 3m way leave requires at least 27Ha. This land consists of range lands currently being used for grazing.
IV. **Access Road to Dam Wall;** The new access road to the Dam Wall, which will require the permanent acquisition of land, anticipated to consist mainly of agricultural fields and rangeland. Land acquisition estimated to be determined at design stage. The project design proposes to relocate the existing bridge linking Ewaso and Kirimon locations to the dam crest so as to ensure accessibility of both locations.
V. **Associated Infrastructure;** This Project component includes the quarry (material borrow sites), works areas, temporary roads, construction camps, offices that will be required during the construction period. Most of the land will be occupied on a temporary basis, although some permanent land acquisition will be necessary for an operational office complex in the vicinity of the Dam Wall/power plant. Land required for the associated infrastructure is anticipated to consist of rangelands and pasture land. Land acquisition estimated to be determined at design stage.

The land take for the development of the dam will be 2083Ha. This land is currently owned by private ranches and community conservancies in Laikipia county while land in Isiolo is owned by Nalare

community conservancy and held in trust by the county government of Isiolo. The table 7.1 shows the land ownership county and size of land to be inundated. Appendix 8 shows land to be inundated by the proposed Isiolo dam. In the table below the 6 land owners command in excess of 61,000Ha of land which is mainly on conservation and controlled grazing alongside ecolodges. The project will take 2587Ha of land which is about 3.5% of the entire land holding of the 6 parcels. Hence, there is need for strengthened conservation activities to be partly sponsored by the project especially in establishing community eco lodges as income generating assets for the community conservancies.

LAND OWNERSHIP AND LAND INUNDATED.			
County	**Land Owner**	**Av Total Land size (Ha)**	**Proposed Land to be acquired (%)**
Laikipia	Impala	22,042.22	0.617 (136.198)
	Loisaba	25, 868.9	4.22 (1093.58)
	Francombe	2,561.58	1.36 (35.02)
	Ilmotio	3,797.04	0.039 (1.5)
	Koija	7500	5.488 (411.60)
Isiolo	Nalare	-	(399.54)
Total		**61,769.74**	**3.36 (2077.438)**

7.1 Table Showing land ownership and sizes proposed to be acquired.

Mitigation Measures.

The primary mitigation measure would be to avoid or minimize land acquisition where feasible, exploring all viable alternatives; and where acquisition of land or other assets is unavoidable, compensation should be provided to the full value of the land or assets acquired and any loss of livelihood as a result.

The Project, in particular the Reservoir, will acquire a range of private fixed assets (fields, houses and trees) and communal natural resources for which appropriate compensation and/or mitigation measures are required. Project-affected persons will be entitled to a combination of compensation and rehabilitation support measures based on factors such as ownership rights and type of loss. The following guiding principles will apply to the Project. The principles are consistent with international involuntary resettlement safeguards, while also incorporating local legislation and practices.

- Principle 1: Relocation and land acquisition will be avoided or minimised.

- Principle 2: Ongoing and meaningful consultation will occur with project-affected persons and communities.
- Principle 3: Affected persons will be assisted to improve their livelihoods.
- Principle 4: Vulnerable groups and severely project-affected persons will be specifically catered for.
- Principle 5: Land acquisition/relocation planning, budgeting and implementation will be an integral part of the project.
- Principle 6: A proper database of affected persons will be established for management and monitoring purposes.
- Principle 7: Grievance and monitoring procedures will be in place.
- Principle 8: Legal obligations will be complied with.

I. Affected Households

Land use within the proposed Reservoir area is dominated by wildlife conservancies and nomadic pastoralism while other major land uses in order of importance comprise of farming, woodlots and forestry. At a full supply level of the 1580 contour above mean sea level, the reservoir will directly affect an estimated 167 households, through the permanent acquisition of wildlife conservancies, pasture land and trees. Table 6.1 gives the demographics of the affected Enumeration/administrative areas. Assuming a uniform distribution of population and taking the enumeration area population densities as given in the 2009 Population and Housing Census (KNHBS, 2010), this would imply that as many as 147 households may be affected by loss of livelihood or assets.

Table 7-2; Households Potentially Affected by the Reservoir at Isiolo Site

County	Location	Sub-location	Population	Households	% Inundation	Households Affected
Isiolo	Oldonyiro	Oldonyiro	6972	1348	0.15%	2
		Longopito	2856	587	0.15%	1
Laikipia	Ilmotiok	Ilmotiok	3166	473	3.34%	16
		Impala	1494	486	3.34%	16
	Oloibosoit	Ewaso	2687	549	12.54%	69
		Kirimon	5105	1299	3.32%	43
Total						**147**

Source; KNBS, 2010

A total of 147 households are therefore anticipated to be affected through the permanent loss of assets or loss of livelihoods such as grazing fields, trees and livelihoods when the

construction commences and impoundment. The number is expected to increase marginally after the inclusion of other ancillaries to the dam such as the access road to the Dam Site, material borrow sites if outside the reservoir area, the Power Plant and the switchyard.

II. Loss of Graves

During the socioeconomic survey, the respondents did not indicate the presence of graves; however it will be improbable not to expect interment places in such a vast area during construction. The exhumation and re-internment of graves is a sensitive matter that will be managed according to the wishes of the relatives of the deceased and with their full participation/cooperation.

III. Livelihood Impacts

Income Sources of Affected Households

From the socio-economic survey statistics the main source of livelihood recorded was nomadic pastoralist and subsistence crop production at 94%; only 6% indicated their livelihoods not being dependent on livestock rearing/agriculture. More female household heads were involved in pastoralist activities that their male counterparts at 100% and 77% respectively. The other reported income sources of the estimated 167 households affected by the Reservoir, and appurtenant structures included business and full time employment. Although a wide range of income sources are used, only a few are accessed by a significant number of affected households. On the overall only 2% were classified as business persons. Substantially the formally employed 6% consists of males only while 1.6% indicated their livelihoods not being dependent on agriculture. Income sources that could be affected by the Project are the livestock production and sale of products and farming and sale of farm products from the inundated land. The Project could have significant livelihood impacts on household that solely survive on the use/exploitation of a range of local natural resources found in the inundation area.

7.3.2 Construction Material Sourcing

a. Borrow Pits and Quarries

Possible sources of materials will be identified and the sites investigated for material extraction Materials sites (quarry and borrow areas) if not reinstated and rehabilitated after project completion, can cause landscape scarring, dangers of overhanging cliffs and falling rocks which creates environmental, health and safety hazards, stagnant water pits where

children and animals drown. Land will be acquired for obtaining construction materials i.e. borrow pits and quarries.

Mitigation Measures

The Contractor is required to do the following:

1. The Contractor will be responsible for ensuring that appropriate authorisation and licences to use the proposed borrows pits and quarries has been obtained before commencing activities;
2. Carry out inspection of each of the site's soil stability before excavation;
3. All borrow pits sites shall be clearly indicated on a plan and approved by the RE;
4. Borrow pits and quarries shall be located more than 20 meters from watercourses to minimise storm water runoff into watercourse;
5. The Contractor shall give 14 days notice to nearby communities of his intention to begin excavation in the borrow pits or quarries;
6. Prepare health and safety plan before any work on the quarries is commenced;
7. Cordon off the quarry and borrow areas to keep livestock and children off;
8. The Contractor shall rehabilitate and decommission all borrow pits and quarries
9. Stockpile top soil on site and use during rehabilitation of the borrow site and quarries;
10. Use borrow pits or quarries for material spoil dumping if approved by the RE and "landowner". The spoils should be profiled to fit into the surrounding landscape and covered with topsoil;
11. Plant suitable saplings;
12. In case of blasting:
    i. The Contractor will obtain a current and valid authorisation from the Department of Mines and Geology prior to any blasting activity. A copy of this authorisation shall be given to the RE;
    ii. A qualified and registered blaster shall supervise all blasting and rock-splitting operations;
    iii. The Contractor shall maintain pre blast monitoring records;
    iv. The Contractor shall notify emergency services appropriately;
    v. The Contractor shall ensure environmental protection
    vi. The Contractor shall notify the community on site activities. All signals shall also be clearly given; and
13. The Contractor shall use appropriate cover material e.g blast mats. Topsoil shall not be used as blast cover.
14. The Contractor shall prepare and implement borrow pit plans and borrow pit rehabilitation plans, which would minimise the risk of erosion.

15. The Contractor and Developer will be responsible for maintaining the restoration activities at the susceptible sites including borrow pits and quarry sites until recovery is satisfactory over a 2 year time frame.
16. NWCPC will be expected to lease/acquire 1000 Ha of land on the dam site and plant indigenous trees to serve as an offset to the vegetation loss as a result of the project activities.

b. Sand Harvesting

Sand for construction is available in the rivers channel. It can also be available from areas near Kipsing. It is anticipated that sand harvesting in this areas will cause the following environmental problems, albeit to small extent:

Siltation of the river;
Uncontrolled harvesting lead to dry river beds hence affecting the water table / storage capacity of the river.

Mitigation Measures

1. The contractor is expected to follow the Sand Harvesting Regulations published by NEMA.

c. Construction and Operation of New Borrow Pits and Quarries

1. Topsoil shall be stripped prior to removal of borrow and stockpiled on site. This soil shall be replaced on the disturbed once the operation of the borrow site or quarry is complete;
2. Storm-water and groundwater controls shall be implemented to prevent runoff entering streams and the slumping of soil from hillside above;
3. The use of borrow pits or quarries for material spoil sites may be approved by the RE (and/or with the appropriate consent of the “landowner”). Where this occurs, the materials spoiled in the borrow pit shall be profiled to fit into the surrounding landscape and covered with topsoil.
4. The Contractor shall prepare and implement borrow pit plans and borrow pit rehabilitation plans, which would minimise the risk of erosion.

d. Blasting

1. If blasting is required, the Contractor will be responsible for obtaining a current and valid authorisation from the Department of Mines and Geology prior to any blasting activity. A copy of this authorisation shall be given to the RE;

2. A qualified and registered blaster by the Department of Mines and Geology shall supervise all blasting and rock-splitting operations at all times;
3. The Contractor shall ensure that appropriate pre blast monitoring records are in place (i.e. photographic and inspection records of structures in close proximity to the blast area);
4. The Contractor shall ensure that emergency services are notified, in writing, a minimum of 24 hours prior to any blasting activities commencing on Site;
5. The Contractor shall take necessary precautions to prevent damage to special features and the general environment, which includes the removal of fly-rock. Environmental damage caused by blasting/drilling shall be repaired at the Contractor's expense to the satisfaction of the RE and the relevant authorities;
6. The Contractor shall ensure that adequate warning is provided to the local communities immediately prior to all blasting. All signals shall also be clearly given;
7. The Contractor shall use blast mats for cover material during blasting. Topsoil shall not be used as blast cover.
8. The Contractor shall prepare and implement borrow pit plans and borrow pit rehabilitation plans, which would minimise the risk of erosion.

e. Asphalt, Bitumen and Paving

The site of the asphalt plant shall be selected and maintained according to the following basic criteria:

1. The plant shall be situated on flat ground;
2. Topsoil shall be removed prior to site establishment and stockpiled for later rehabilitation of the site;
3. Bitumen drums / products shall be stored in an area approved by the RE. This area shall be indicated on the construction camp layout plan. The storage area shall have a smooth impermeable (concrete or thick plastic covered in gravel) floor. The floor shall be bunded and sloped towards a sump to contain any spillages of substances;
4. The area shall be covered to prevent rainwater from contacting the areas containing fuels, oils, bitumen etc and potentially generating contaminated runoff;
5. The plant shall be secured from trespassers and animals through the provision of fencing and a lockable gate to the satisfaction of the RE;
6. Well-trained staff shall be responsible for plant workings.
7. Within the bitumen plant site, areas shall be demarcated/marked for plant materials, wastewater and contaminated water;
8. An area should be clearly marked for vehicle access;
9. Drums/tanks shall be safely and securely stored;
10. Materials requiring disposal shall be disposed of at an appropriate waste facility.

f. Cement/Concrete Batching

1. Where required, a Concrete batching plant shall be located more than 20m from the nearest stream/river channel;
2. Topsoil shall be removed from the batching plant site and stockpiled;
3. Concrete shall not be mixed directly on the ground;
4. The concrete batching works shall be kept neat and clean at all times;
5. Contaminated storm-water and wastewater runoff from the batching area and aggregate stockpiles shall not be permitted to enter streams but shall be led to a pit where the water can soak away;
6. Unused cement bags are to be stored so as not to be effected by rain or runoff events;
7. Used bags shall be stored and disposed of in a manner which prevents pollution of the surrounding environment (e.g. via windblown dust);
8. Concrete transportation shall not result in spillage;
9. Cleaning of equipment and flushing of mixers shall not result in pollution of the surrounding environment;
10. Suitable screening and containment shall be in place to prevent windblown contamination associated with any bulk cement silos, loading and batching;
11. Waste concrete and cement sludge shall be scraped off the site of the batching plant and removed to an approved disposal site;
12. All visible remains of excess concrete shall be physically removed on completion of the plaster or concrete and disposed at an approved disposal site. Washing the remains into the ground is not acceptable;
13. All excess aggregate and sand shall also be removed;
14. After closure of the batching plant or any area where concrete was mixed all waste concrete/cement sludge shall be removed together with contaminated soil. The surface shall then be ripped to a depth of 150mm and the topsoil replaced evenly over the site and re-grassed.

7.3.3 Impacts on Livestock Farming

As indicated in the socio-economic description, livestock husbandry is an important component of local economic and social activities; many of the enumerated households actually do own livestock. In fact 90% of land use in ASAL areas revolves around livestock keeping. The community meetings revealed that livestock-owning households, especially those with cattle, goats, sheep, donkeys etc were particularly concerned about the loss of grazing land, especially in the upper reaches of the Reservoir, and of access to water from the river for livestock watering. The River is, furthermore, an important source of livestock watering. Impact is expected to be long term and of medium significance. This will be mitigated by provision of community watering points at strategic places as shown in table 5.1.

7.3.4 Impacts on Wildlife Conservation

Laikipia and Isiolo County is one of East Africa's most important areas for wildlife conservation for several reasons. Laikipia contains higher populations of large mammals than any protected or unprotected landscape in Kenya, outside of the Maasai Mara National Reserve. Laikipia is also rich in biodiversity with over ninety-five species of mammals, 540 species of birds, over 700 species of plants and almost 1000 species of invertebrates already identified. However it is perhaps the two counties assemblage of large, globally threatened mammals that makes it particularly unique from a biodiversity perspective. Laikipia county contains half of Kenya's black rhinos, the country's second largest population of elephants, Kenya's third largest and only stable population of lions, the world's sixth largest population of African wild dogs, a large proportion of the world's remaining Grevy'z zebras, perhaps as many as two thirds of the world's remaining Reticulated Giraffe, a globally significant population of cheetah, Kenya's largest population of patas monkeys and a unique race of hartebeest. Laikipia is arguably, therefore, one of the last viable refuges for large terrestrial mammals in East Africa. As a result of these, the two county conservancies are among the top high end market tourist destinations that generated an estimated $US 20,500,000 in tourism revenue, directly supporting 6,500 people. The wildlife sector raised a further $3,500,000 for social development projects such as education, healthcare, infrastructure development, security and livelihood support and $5,000,000 for wildlife conservation. Besides, the County is at the cutting edge of community conservation. From the mapping done about 4% of the proposed reservoir area is in Isiolo while the rest is in Laikipia. This suggests that as much as 1,993ha of conservancy land will be inundated; however this area represents only about 0.25% of the 800,000ha dedicated to conservation in the region and therefore the effect is not expected to be significant in terms of disruption of conservation based economic activities such as tourism.

Mitigation Measures

The consultant proposes to enhance the buffer zone of the dam by planting trees and fencing off the conservancies neighboring the dam area to protect wildlife and promote controlled grazing in the conservancies; limiting grazing in the conservancies to periods of low or no pastures in other grazing areas. The Supervising Engineer and Environmental and Social Officer will liaise with the Kenya Wildlife Service to identify the exact known wildlife crossing areas, natural habitats, breeding zones and ensure that these areas are avoided or minimal construction disturbance is experienced in these critical areas. Appropriate safety signage is placed on these areas indicating their ecological roles and significance. Warning signage's at important animal crossing points, animal tunnels or bridges may be used to reduce collision rates, especially for protected or endangered species. During RAP process the consultant also proposes that the community should be facilitated to set up, operate lodges so as to make them have interests in conservation and generate income to the members. This measure is

expensive and will be used only at a few locations where it is both justified (by the importance of the animal population and the crossing route as recommended by KWS) and affordable (relative to the cost of the project and the funds available). It will also be important that the Supervising Engineer in liaison with the local administration take care of areas with high population of livestock so that appropriate signage is placed along the road warning motorists. Any irrigation scheme may be set up past Archers post since the upper part of the river forms an important wild life migratory corridor and several game reserves and conservancies. This is aimed at minimizing impacts on wildlife in the long term.

7.3.5 Loss of Land and Natural Resources

Initial mapping shows that the storage at 1580 contour will affect an estimated 2,073 ha of land, while an option at 1,570m above sea level could affect 1,129 ha of conservancies and grazing land comprising of mostly permanent land losses. Estimates of land requirements associated with the other Project components including the Power Plant and Switch Yard; Access Road to Dam Wall, Power Transmission lines associated Infrastructure which includes the quarry (material borrow sites), works areas, temporary roads, construction camps and office complex have not been determined and will be available at the design stage.

The land to be submerged is in private ranches consisting parts of Sabuk, Loisaba, and Impala; conservancies likely to be affected include Ilmotiok and Koija as well as communal grazing land held under trust in Oldonyiro (Nalare Wildlife Conservancy) on the Isiolo side. Although the total landholdings of affected households and the percentage land loss will be determined only during cadastral survey and valuation exercise, it is clear that the affected the parcels/households/owners are not likely to be significantly affected by the loss because of their large landholdings. Refer to section 7.3.1 above and appendix 8.

Although most of the interviewed households who stand to lose land reported had lived on the current plot for more than 10 years, 98% of the respondents were willing to move and settle elsewhere if the proposed dam inundated their land perhaps due to their already nomadic nature livelihoods and the sparse population in the area as lack of land for resettlement is not viewed as one of the threats that might hinder implementation.

Due to the arid nature and vulnerability of the nomadic livelihoods, responses indicated that about 33% of the households were receiving food aid ranging from beans, cooking oil, cereals/flour and children supplements. The vulnerability of the local livelihoods of households in the proposed reservoir area is underscored by the low reported incomes; many households had no incomes to report of. It is clear that without subsistence contributions from nomadic pastoralism and the marginal these incomes alone cannot sustain the livelihoods of the sizes

of households cited. Diversified agricultural activities such as inclusion of irrigated agriculture can therefore make a positive contribution to household nutrition, which suggests that designing effective programmes for guaranteeing or even improving the current agricultural productivity for affected families could have a potentially positive impact on household and child nutritional status.

Land losses will also have impacts on forms of livelihood and income-generating activities that rely on access to common property and natural resources. A range of natural resources that are useful to local communities will be inundated by the creation of the Reservoir at Nkutuk Elkinyang. These include medicinal plants, riparian trees, grazing land and water from the Ewaso River and its numerous tributaries (for domestic use and livestock watering). These resources play an important role in the livelihoods of households and other resource user groups such as herbalists/traditional healers.

The loss of useful natural resources will also affect households in the vicinity of the Reservoir who rely on these resources, since their primary resource harvesting areas will be inundated. Harvesting of similar resources in other areas will create an added economic burden. Furthermore, the inundation of natural resources will lead to increased pressure on similar resources in the surrounding. Construction of the Reservoir is also expected to lead to a reduction in the volume of river silt downstream of the Dam Wall, where pastoralists graze animals during times of drought.

7.3.6 Health

The communities living in the neighbourhood of the proposed dam site are mostly rural in character except for a few small rural market centres. Majority of the residents travel for over 50 minutes to access the nearest health facility. It would therefore definitely be of great benefit if improvements in the quality of the services provided could be made in the form of supplementary training for the nurses, a wider range of the medical services provided the upgrading of laboratory services, as well as equipping the centres with adequate drugs in addition to the availability of periodical consultations by qualified physicians. The population has also access to traditional healers that are familiar with the use of medicinal plants as well as a body of oral knowledge transmitted from generation to generation.

The study area can be generally regarded as almost pristine in the sense that very little pollution of the air, water and soil is observed in this rural environment of low population density. Contaminants may water include chemical fertilizers and pesticides used for agriculture in the highlands. Since the agriculture practiced in the area is mostly family size subsistence farming and no large commercial agricultural establishments are exploited, the

level of contamination of the soil and water by these products is likely to be small. One contaminant that can be regarded as threatening to the local populations is human excreta. Since the survey team did not observe a functional toilet in 90.2% of the households, the only option is open defecation in fields and this practice poses a significant risk to the health of the residents especially around the manyattas where with a higher population density are concentrated considering the high population density and heavy reliance on unimproved surface water sources.

The pressure of morbidity, i.e. the overall risk to become sick, has been measured on the basis of households' own reported most common diseases in the past 10 years; the results show that malaria is the most common health problem in the locality. The chart below shows the prevalence of various diseases with malaria being the most common.

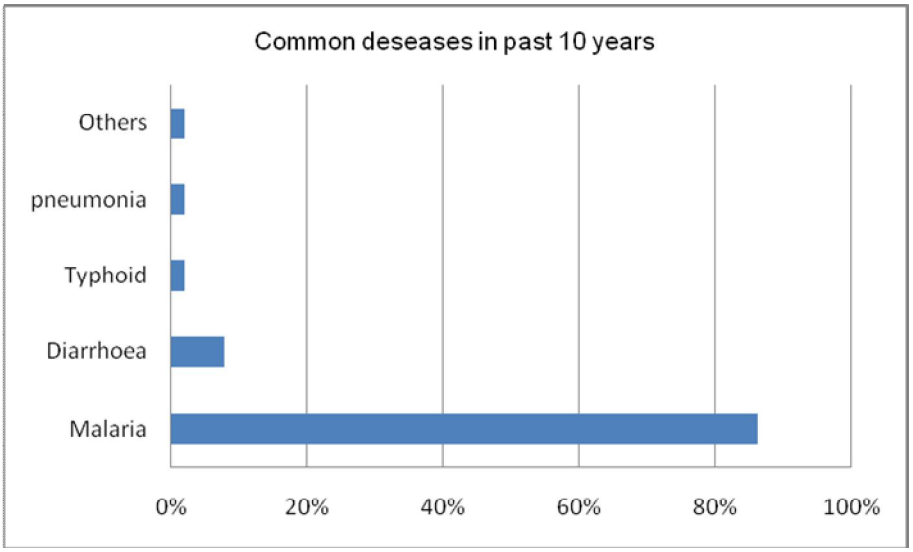


Figure 7-3; common diseases in the area

Diarrheal diseases also affect a substantial proportion of the population as slightly more than a quarter had reported incidences in the past 10 years. The incidence of diarrheal is related to existing water and sanitation facilities. The great majority of the study population (70.8%) accesses its water primarily from untreated surface sources. In terms of sanitation facilities, 90.3% of the study population was not using a latrine. Consequently, a programme for the promotion of the construction of ventilated improved pit latrines (VIP) or other acceptable sanitation hardware would be a very adequate intervention in the study area.

7.3.7 Cultural Heritage

A. Cultural Heritage Sites

There are no recorded/gazetted cultural heritage sites in the proposed reservoir and none were observed during the current survey, around the foundation area of the proposed dam wall. However from literature searches, the archaeology potential of the Ewaso Basin seems to be rich and relates in most cases to an East African Holocene hunter-gatherer culture. Archeological remains of occupation of the area are found in Lewa which is near the Isiolo site and are some of Kenya's best archaeological sites outside the Rift Valley. The hill on which Lewa House is built is home to warrior graves many thousands of years old. They were a tall race who communicated with rock gongs. Later people developed these gongs into a game that's now played all over Africa. It should also be noted that major excavations from dam and appurtenant structures construction could potentially expose such and more fossil heritage.

B. Severed/Constrained Access

As a natural feature of the physical landscape, the Ewaso Ng'iro has always constrained the movement of people to some degree, and the location of social services such as schools, hospital and market centres partly reflects this reality. Nevertheless, the Reservoir will be a permanent barrier, as opposed to the River, which is crossed on a regular basis. Impeded access resulting from Reservoir inundation relate principally to the inundation of a single lane bridge (GPS Coordinates 263, 379; 66,179 Alt.1524m) which will be submerged taking out vital links. This is an important market access route and livestock migration route according to the consultation findings with the locals. Sections of earth roads crisscrossing the area but with no bridges linking the two banks will also be submerged. The resulting lake will also have 'tongues' stretching back in local streams/rivers, these tongues too will impede access. This is considered to be one of the most important Project impacts. Impacts are long term and of high significance.

At about 1.56 upstream of the proposed dam axis is also a weir that serves aas an intake for Ol Donyiro town Water Supply (GPS Coordinates 263, 105; 66,940 Alt.1526m); this too will be submerged and rendered unusable.

7.3.8 Population Relocation

A demarcation line based on the 1580 contour with a buffer corridor around the reservoir is recommended for the proposed Reservoir. Any households/structures below this line will have to be relocated. Since there are currently no such markings on the ground, a provisional assessment of relocation requirements was made using the available Survey of Kenya 1:50,000 Topo Map superimposed with the reservoir boundary as well as the 2009 Kenya Population and Housing Census GIS Shape files. From the resulting map the percentages of Enumeration areas submerged by the reservoir and the population densities were used to

estimate the relocation requirements. This shows that the proposed Reservoir may result in up to 167 households in 6 enumeration areas – Oldonyiro, Lonkopito, Ilmotiok, Impala, Ewaso, Kirimon - being required to relocate. Material borrow sites if located outside the reservoir area would also require relocation of additional households.

The final alignment/configuration of the project components will be determined during the final design stage. Provision and measures will have to be made in the Project's Entitlement Matrix for the proper compensation and rehabilitation of any households or businesses that may require relocation. Impact is expected to be long term but of medium significance because of the relatively low number of involuntary resettlement required.

A. Vulnerable Households/Social Categories

In the context of resettlement planning, in particular, vulnerability refers to two socio - economic dynamics. At a general level it refers to the insecurity experienced by all project-affected persons because of the loss of private and communal property, severed/constrained access to social services, etc. At a more specific level, it refers to those persons who, because of their socio- economic position, are especially vulnerable to project-induced impacts. Project support measures commonly designed for this latter group aim to improve their livelihoods so that they are better equipped to deal with project-induced changes. With respect to the proposed Project, the following households/social categories have been considered as potentially vulnerable to the changes induced by the Project;

Households where a member of the household has a disability; 11.8% of the affected households had at least one member with a physical or mental disability implying the 17 of the 79 households resettlement have this kind of vulnerability.
Generally, the availability of special services for the disabled in the project area is nonexistent; support is in majority of the cases given by family members and the larger community as a coping strategy. This section of population with physical or mental disabilities, depending on their situation, will require special assistance to understand the need to relinquish property or current homes, orient themselves to new areas, construct housing, find out an reach alternative service providers, and meet a whole set of other specific needs.

Household with an aged household head; 13.7% of the household heads are older than 65 years who are outside the labour participation bracket, this would imply about 20 households have this kind of vulnerability . Resettlement experience worldwide shows that the elderly often fail to adapt following displacement. This group of residents tend to have a lifelong "place attachment," lack the economic opportunity or the capacity to obtain new sources of income, and lose traditional leadership roles or social standing as a result of community dispersion or social change. Like young children, the elderly are disproportionately vulnerable

to disease and even death in resettlement operations, and therefore this project will have to take into consideration their special needs

Female-headed households; 15.7% or about 23 of the affected households that have been interviewed are headed by females. In human societies being a male or female often translates into the opportunities enjoyed by either of the two sexes as prescribed by the societal values and norms. In the African society in particular is predominantly patriarchal, restrictions have been put on these opportunities thus causing disparities between males and females; females lack access and control of resources such as Land and are often left out in decision making in land matters. In the proposed reservoir area the survey found out that in majority of the households, it is the males (husband and sons) who make decisions concerning the family land matters. This puts women at a disadvantage implying that they might miss out on the decision making process and eventual compensation.

School going children; 84.32% (122) of the affected households had school going; with the average number of under 15s per household at 2.15, as many as 571 of the 677 persons to be relocated could be school going age.

Children usually lack the legal, political, and economic clout to protect their own standards of living. In case of resettlement, school-aged children will lose physical or economic access to education despite the prominent role that education plays in their development. Special arrangements need to be made to help children continue schooling in the transition phase of resettlement, some of them may find it difficult to resume education once permanent schools are constructed and staffed at resettlement sites. Disruption of household access to resources could also expose children to nutritional deficiencies. The resettlement operations, therefore, will have to ensure children's needs are met especially so their access to education.

In addition vulnerability is not a given or static condition; a household may become vulnerable when a household head becomes aged, falls ill or becomes disabled, destitute or poverty stricken; and hopefully less vulnerable as their health and economic circumstances improve. Because vulnerability is a dynamic concept, the identification, assessment (and monitoring) of vulnerable households should be an ongoing process throughout the compensation/livelihood restoration programme.

The recommended procedure for the identification, assessment and monitoring of vulnerable households is summarised below;

Assess vulnerability classification

- demographic information
- agricultural farming activities
- livestock farming activities
- employment and other off-farm activities
- support networks

- current nutritional intake and requirements
- medical examination, where required

Establish and approve support and development measures

- short-term support measures
- long-term re-establishment measures

Implement short-term support and long-term development measures

i. vulnerable household allowance
ii. cultivation support
iii. other in-kind measures
iv. preferential employment on construction works
v. skills training/enhancement

Monitor effectiveness of support and development measures

i. establish register of vulnerable homesteads
ii. develop re-establishment indicators
iii. undertake monitoring of household re-establishment
iv. implement further remedial measures where necessary
v. confirm re-establishment

The community participation structure (Proposed Dam Committee) will play a key role in the process of identifying and assessing the needs of vulnerable households, and in monitoring the effectiveness of livelihood enhancement measures.

7.3.9 Hydrology and River Flows

During the development of the dam project, an embankment and spillway will be constructed. This will change the flow regime of the river. Changes to the low flow regime may have significant negative impacts on downstream users.

The proposed project design shall be of a low water demand and flows shall be allowed in order not to significantly alter the river natural flows during construction and the discharge flows during filling up the dam will be 1.916M^3/s and on operation the discharge flows will be 5M^3/s to ensure river flows to Lorian Swamp. This shall allow the population downstream to have continued access to the river water.

Mitigation Measure

i. Ensure compliance with the water resources regulations at all times. At least 30% of the base flow should always flow in the stream to sustain ecological and social requirements downstream,
ii. With effects on the level of flood heights downstream, it may be necessary to review the riparian land and extent of sub-aquatic ecosystem downstream,

iii. River gauging stations around the dam and downstream may require to be reactivated to monitor effects of the dam to the river basin over time,

7.3.10 Discrimination on Employment Opportunities

Most of the skilled labourers will have to be brought in from outside the project area, and this may cause some resentment among the local people. Generation of employment opportunities by the project could result to conflict between local residents and new comers or outsiders, if not appropriately managed. A concern expressed during consultations was that unskilled labour may be available to men more than women leading to gender discrimination.

Mitigation Measures

i. To avoid conflicts with the local people on employment it is proposed that the Contractor employs the locals in liaison with local administration in unskilled and semi-skilled duties;the contractor is advised to be transparent and adopt a concentric model of recruitment to ensure equity.
ii. To promote the livelihood of vulnerable groups such as the women-headed households, there will be a need to undertake sensitisation and awareness campaigns to the local community to promote gender equity in employment during the dam construction works.

7.3.11 Surface Runoff

During construction phase, project activities like vegetation clearing, dredging, quarrying and compaction of soil due to movement of heavy machinery will increase the rate of surface runoff and may be more pronounced during the rainy seasons. This may lead to gullying, siltation and increased sediment loads in watercourses.

Contractor should therefore ensure that there is minimal site disturbance, protection of drainage in soft spots and slope control.

Mitigation Measures

Erosion Control

The Contractor shall take reasonable measures to control storm water and the erosive effects. During construction the Contractor shall protect areas susceptible to erosion by installing necessary temporary and permanent drainage works as soon as possible and by taking measures to prevent the surface water from being concentrated in drainage channels or

streams and from scouring slopes, banks or other areas. To minimize risks of erosion, the execution of major earthworks will be restricted as far as possible to the dry season.

Areas affected by construction related activities and/or susceptible to erosion must be monitored regularly for evidence of erosion, these include:

i. Areas stripped of topsoil;
ii. Soil stockpiles;
iii. Spoil sites;
iv. Borrow pits;
v. Sites for bridges and drainage structures.

On any areas where the risk of erosion is evident, special measures may be necessary to stabilise the areas and prevent erosion. These may include, but not be limited to:

i. Confining construction activities;
ii. Using cut off drains;
iii. Using mechanical cover or packing structures such as geofabric to stabilise steep slopes or hessian, gabions and mattress and retaining walls;
iv. Mulch or chip cover;
v. Constructing anti-erosion berms;
vi. The erosion prevention measures must be implemented to the satisfaction of the RE;
vii. Where erosion does occur on any completed work/working areas, the Contractor shall reinstate such areas and areas damaged by the erosion at his own cost and to the satisfaction of the RE and ESO;
viii. The Contractor shall be liable for any damage to downstream property caused by the diversion of overland storm water flows.

Sedimentation Control

i. Provide sand check dams upstream of the dam, and more specifically along Ewaso Nyiro and Ewaso Narok rivers. The dams could be located at east every 5 – 10km from each other depending on topography and accessibility,
ii. The check dams should be provided downstream of every major tributary could provide additional sand dams for water storage to serve the immediate communities upstream of the dam.
iii. The sand dams could also serve as approved sand harvesting points to be managed through organized community groups that will also enhance conservation of the river flood plains and acceptability by the local communities,
iv. The communities at the dam site could also be assisted to get organized into groups for an economic disposal of the accumulated sand ahead of the dam construction. Access to the site, is however a limiting factor in this regard,
v. While holding sand back for the safety of the dam, modalities should be established

vi. to ensure that economic interests of downstream dependants of the sand are also addressed.

7.3.12 Noise Emission

Noise is expected during the construction activities, use of vehicles and heavy machinery. During operations noise levels are bound to increase due to the use of generators. This may lead to noise disturbance to the nearby communities and wildlife. The contractor will give prior notice of activities and time durations to neighbouring households, ensure that engines are switched off when not in use and provide adequate personal protective equipment. During operation the proponent should adequately maintain its equipment and undertake noise monitoring. Generators will be well insulated or placed in enclosures to minimize noise levels.

Mitigation Measures

i. The Contractor shall keep noise level within acceptable limits and construction activities shall, where possible, be confined to normal working hours in the residential areas;
ii. Schools, hospitals and other noise sensitive areas shall be notified by the Contractor at least 5 days before construction is due to commence in their vicinity. Any excessively noisy activity shall be conducted outside of school hours, where approved by the RE;
iii. Any complaints received by the Contractor regarding noise will be recorded and communicated to the RE;
iv. The Contractor must adhere to Noise Prevention and Control Rules of April 2005.

7.3.13 Air Quality and Dust Emissions.

Air quality will be affected mainly from the dust generated from quarrying, site clearance, and general construction activities. During the operation phase, air quality may be affected if the hydro-electric equipments are not properly maintained. Prolonged exposure to the pollutants may affect the health of workers and general public in the vicinity of the sites, especially the respiratory systems. The contractor should therefore water all dusty ground before excavation begins and sprinkle water on graded routes to reduce fugitive dust emissions. During operation the proponent should adequately maintain its equipment so as to reduce fugitive emissions.

Mitigation Measures

Air emissions from construction machinery, including dust, is regarded as a nuisance when it reduces visibility, soils private property, is aesthetically displeasing or affects palatability of grazing. Dust generated by construction related activities must be minimised.

The Contractor shall be responsible for the control of air emissions and dust arising from his operations and activities.

(i) Workers shall be trained on management of air pollution from vehicles and machinery. All construction machinery shall be maintained and serviced in accordance with the contractor's specifications;

(ii) Asphalt plants and concrete batching plants shall be well sealed and equipped with a dust removal device;

(iii) Workers shall be trained on dust minimisation techniques;

(iv) The removal of vegetation shall be avoided until such time as clearance is required and exposed surfaces shall be re-vegetated or stabilised as soon as practically possible;

(v) Water sprays shall be used on all earthworks areas. Water shall be applied whenever dust emissions (from vehicle movements or wind) are visible at the site in the opinion of the RE;

(vi) Vehicles delivering soil materials shall be covered to reduce spills and windblown dust;

(vii) Vehicle speeds shall be limited to minimise the generation of dust on site and on diversion and access roads;

(viii) Any complaints received by the Contractor regarding dust will be recorded and communicated to the RE and ESO.

7.3.14 Impacts on of Flora and Fauna

The proposed site is a communal land being used for utilised by both domestic and wild animals. Various riverine flora and fauna on the proposed dam site and along the transmission line area will also be affected. Vegetation clearance may lead to soil erosion and hence soil degradation especially along the riverbanks and habitat destruction for faunal species leading to general disturbance causing the displacement of some species. The proponent should therefore revegetate the area with indigenous tree species at the end of project construction phase.

Mitigation Measures

With regard to clearing of work sites and adjacent area vegetation, the following are recommended:

i. Clearing of vegetation shall be kept to a minimum;
ii. Areas to be cleared should be agreed and demarcated before the start of the clearing operations;
iii. Clearing and removal of vegetation, especially at borrow sites must be carried out in such a way that damage to adjacent areas is prevented or minimised;
iv. Upon completion of works revegetation of the area surrounding the dam should be revegetated to form the buffer
v. Make use of inventory developed in this study of the unique biodiversity within the affected areas for purposes of preventing species loss. In this regard, regularly update database of animal and plant species found in the project area as a basis for conservation and monitoring of newly introduced species in the future. The inventory and monitoring register should be maintained by NWCPC in collaboration with the environmental office and other interested parties,
vi. An ecologist would be required to oversee monitoring and management of ecological changes around the dam ecosystem,
vii. The role of the Kenya Wildlife Services would be crucial in monitoring the new habitats and characteristics of the wildlife migrating into the dam area,
viii. Establish community interests and values in the evolving ecological setting and enhance economic benefits from the same,
ix. Areas with dense indigenous vegetation are not to be disturbed unless required for construction purposes, nor shall new access routes be cut through such areas.
x. Removal of vegetation in the inundated areas should be done upon completion of construction and before filling the dam.
xi. Trees should be trimmed rather than removed wherever possible;
xii. The use of indigenous plants as firewood is prohibited unless they are obtained from approved sources;
xiii. There is a possibility of encountering wildlife during the construction works, these animals should be avoided and not perturbed;
xiv. Wildlife poaching or game hunting is forbidden.

The use of fuel wood by construction workers should be discouraged. Workers should be encouraged to use alternative energy sources such as kerosene, electricity or gas. It is also recommended that the contractor establish contracts with wood fuel suppliers, where wood is used. The suppliers should show permits from the relevant Government agencies to prevent illegal felling of trees and to ensure plantation timber is used.

For the overall enhancement of the environment in the project area it is recommended that the Contractor plants indigenous trees along the pipeline and in the dam buffer area, this should be included in the Bill of Quantities. Planting of trees in dam adjacent areas will help to

support local flora and fauna. In some cases, planting may also provide additional habitats and migration routes for local animals, while also guarding against erosion. Planting should be done wherever possible with native species, which are likely to require little maintenance and may prove beneficial in maintaining ecosystem integrity. In cases where non-native species are deemed essential, careful monitoring should be planned, to ensure that they do not compete too successfully with native species and spread uncontrollably.

Deliberate effort will be made by the proponent in close association with KWS/KFS and other stakeholders. to uproot any invasive flora and stop their spread in the project area and farmlands. Invasive including *Lantana camara* and P*rosopis julliflora* can be very destructive in any natural ecosystems and their spread should be checked as much as possible through uprooting, burning and prevention of growth to reproductive stage

7.3.15 Material and Wastes Management

Both liquid and solid wastes will be produced during the construction and operational phases. Solid wastes expected at the hydropower project site would include but not be limited to the following: papers, polyethylene bags, plastic containers, broken glasses, foodstuff remains, and leaf debris from clearing of site, among others. Liquid wastes may include run-off water and used oils from servicing activities. A waste management plan will be put in place to address this.

Mitigation Measures

A. Site Housekeeping

i. Cooking facilities at camp and work sites

- The contractor should locate construction camp at Ewaso market or near Ewaso market so as to reduce further disturbance of land, area aesthetics and provide an opportunity of relinquishing the camp for community use upon completion
- The Contractor shall designate cooking and eating areas, subject to the approval of the RE. Sufficient bins for waste disposal shall be present in these areas;
- Any cooking on site shall be done on either well maintained gas cookers or by containing fires (e.g. in a drum) and locating them away from flammable vegetation or construction materials;
- The Contractor shall provide kerosene stoves, electricity and / or gas cookers (or other alternative non-wood stoves) for workers. It is preferable for the Contractor to set up a central canteen for resident labour force to control fuel consumption;

The following will not be permitted:

- Cooking outside the designated areas and in particular beyond the site.
- Open cooking fires or fires for heating.
- The use of surrounding and/or indigenous vegetation for cooking or heating fires.

a) Sanitation

- The Contractor shall comply with all laws and any by-laws relating to public health and sanitation;
- All temporary/ portable toilets or pit latrines shall be secured to the ground to the satisfaction of the RE to prevent them from toppling over;
- The type and exact location of the toilets shall be approved by the RE prior to establishment. The use of septic tanks may only be used after appropriate investigations have been made and the option has been approved by the RE;
- All toilets shall be maintained by the Contractor in a clean sanitary condition to the satisfaction of the RE;
- A wash basin with adequate clean water and soap shall be provided alongside each toilet. Staff shall be encouraged to wash their hands after use of the toilet, in order to minimise the spread of possible disease;
- The Contractor shall ensure that no spillage occurs when the toilets are cleaned or emptied and that the contents are removed from the site to an appropriate location/facility for disposal;
- The Contractor shall instruct their staff and sub-contractors that they must use toilets provided and not the bush or watercourses.

b) Solid Waste Management

The site is to be kept clean, neat and tidy at all times. No burying or dumping of any waste materials, vegetation, litter or refuse shall be permitted.

The Contractor shall implement measures to minimise waste and develop a waste management plan to include the following:

- All personnel shall be instructed to dispose of all waste in a proper manner;
- At all places of work the contractor shall provide litter collection facilities;
- The final disposal of the site waste shall be done at the location that shall be approved by the RE, after consultation with local administration and local leaders;

- The provision of sufficient bins (preferably vermin and weatherproof) at the camp and work sites to store the solid waste produced on a daily basis;
- Wherever possible, materials used or generated by construction shall be recycled;
- Provision for responsible management of any hazardous waste generated during the construction works.

c) Wastewater and Contaminated Water Management

- No grey water runoff or uncontrolled discharges from the site/working areas (including washdown areas) to adjacent watercourses and/or water bodies shall be permitted;
- Water containing such pollutants as cements, concrete, lime, chemicals and fuels shall be discharged into a conservancy tank for removal from site. This particularly applies to water emanating from concrete batching plants and concrete swills;
- The Contractor shall also prevent runoff loaded with sediment and other suspended materials from the site/working areas from discharging to adjacent watercourses and/or water bodies;
- Potential pollutants of any kind and in any form shall be kept, stored and used in such a manner that any escape can be contained and the water table not endangered;
- Wash areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas (including groundwater) are not polluted;
- The Contractor shall notify the RE of any pollution incidents on site.

d) Workshops

Where practical, all maintenance of equipment and vehicles on Site shall be performed in the workshop.

- If it is necessary to do maintenance on site, but outside of the workshop area, the Contractor shall obtain the approval of the RE prior to commencing activities;
- The Contractor shall ensure that there is no contamination of the soil, vegetation or surface water in his workshop and other plant or emergency maintenance facilities.

The workshop shall be kept tidy at all times and shall have the following as a minimum:

- A smooth impermeable floor either constructed of concrete or suitable plastic covered with sufficient gravel to protect the plastic from damage;
- the floor shall be bunded and sloped towards an oil trap or sump to contain any spillages of substances (e.g. oil);

- Drip trays shall be used to collect the waste oil and lubricants during servicing and shall also be provided in construction areas for stationary plant (such as compressors);
- The drip trays shall be inspected and emptied daily;
- Drip trays shall be closely monitored during wet weather to ensure that they do not overflow.

e) General Materials Handling, Use and Storage

- All materials shall be stored within the Contractor's camp unless otherwise approved by the RE;
- Stockpile areas shall be approved by the RE;
- All imported fill, soil and/or sand materials shall be free of weeds, litter and contaminants. Sources of imported materials shall be listed and approved by the RE;
- The Contractor shall ensure that delivery drivers are informed of all procedures and restrictions (including 'No go' areas) required;
- Any electrical or petrol driven pumps shall be equipped and positioned so as not to cause any danger of ignition of the stored product;
- Collection containers (e.g. drip trays) shall be placed under all dispensing mechanisms for hydrocarbons or hazardous liquid substances to ensure contamination from any leaks is reduced;
- Regular checks shall be conducted by the Contractor on the dispensing mechanisms for all above ground storage tanks to ensure faulty equipment is identified and replaced in timely manner;
- Only empty and externally clean tanks may be stored on bare ground. All empty and externally dirty tanks shall be sealed and stored on an area where the ground has been protected.

f) Fuels, Oils, Hazardous Substances and other Liquid Pollutants

- Hazardous materials shall not be stored within 2 kilometres of the top water level of public water supply reservoirs;
- Hazardous materials shall be stored above flood level and at least 20 metres from any watercourse;
- Areas for the storage of fuel and other flammable materials shall comply with standard fire safety regulations;
- Chemicals and fuel shall be stored in storage tanks within a secure compound. All chemicals and fuels shall be stored in accordance with manufacturer's instructions;

- Storage areas or secondary containment shall be constructed of waterproof reinforced concrete or approved equivalent, which is not adversely affected by contact with chemicals captured within them;
- The minimum volume for secondary containment shall be 110% of the capacity of the largest tank system, plus 10% of the total capacity of all other separate tanks and containers within the bund wall with closed valves for controlled draining during rains;
- Pipe-work carrying product from the tank to facilities outside the containment shall be provided with secondary containment;
- Tank equipment such as dispensing hoses, valves, meters, pumps, and gauges shall be located within the containment or provided with own containment;

Security shall be provided to guard against vandalism when the site is unattended. This includes:

- Fencing of the tank compound with locks or other adequate security controls at the site;
- Locks on unattended dispensing hoses;
- Appropriate training for the handling and use of fuels and hazardous material is to be provided by the Contractor as necessary. This includes providing spill response and contingency plans;
- Extreme care will be taken when transferring chemicals and fuels from storage vessels to equipment and machinery on an impervious sealed area which is kerbed and graded to prevent run-off. Chemical and fuel transfer areas shall drain away from the perimeter bund to a containment pit. The design shall provide for the safe and efficient movement of vehicles;
- All chemicals stored within the bunded areas shall be clearly labelled detailing the nature and quantity of chemicals within individual containers;
- Any chemical or fuel spills shall be cleaned up immediately. The spilt liquid and clean-up material shall be removed, treated and transported to an appropriate site licensed for its disposal;
- Stormwater shall be diverted away from the fuel handling and storage areas. An oil water interceptor shall be provided to treat any rainwater from fuel storage and handling areas.

7.3.16 Water Use

Most people live and use water upstream or downstream of the project site. The dam development should not present a hindrance to using water for the people living there, but their water use may be somewhat restricted during the construction phase. Further, the Water

Act, 2002, states that use of water for domestic purposes shall take precedence over the use of water for any other purpose. The Act recommends that a developer should reserve such part of the quantity of water in a water resource as in the opinion of Water Resources Management Authority, is required for domestic purposes.

The contractor and proponent should observe the Water Act 2002 and shall arrange for the necessary approvals / permits from the Water Resources Management Authority.

A majority of the households in and around the project area lack access to clean potable water; the project will result in a man-made lake that can be a reliable source of drinking water. Some mitigation measures include;

Installation, maintenance or upgrading of water system in the surrounding villages for the residents to feel beneficiaries of the water harnessing dam in their midst; in fact most of the support for the project in the area is derived from the fact that improved domestic water is a priority development issue in the project area with the dam being seen as a potential source. Implementation of a programme for the promotion of VIP latrines targeting the local population majority of which was found to be without adequate sanitation facilities.

Reservoir will result in impeded/severed access to livestock watering points located on the portion of the Ewaso Ng'iro River that will be inundated. The Project will, in cooperation with affected communities and relevant ministry/departments, ensure that suitable alternative watering points are identified and established.

7.3.17 Water Loss

The general rate of surface water loss from the dam area could increase through exposure to weak geological points and also increased surface area. Fractures and fissures provide a potential for infiltration of water into the sub-surface and possibly creating springs on the lower areas. Other mode of water loss would be the high temperatures in the project area and inadequate vegetation coverage leading to high evaporation rates. The implications of the evaporation would be more pronounced on increased surface area of water exposure. While this has not been quantified at this point, it is expected to be relatively significant.

These water loss pathways effectively imply;

i. Unaccounted for water losses from the dam structures such as fissures in the base rock and hence unachieved desired objectives,
ii. The scenario could also affect weaknesses to housing foundations downstream of the phenomena,

iii. Micro-climate moderation (lower temperatures and higher humidity) through increased atmospheric moisture arising from evaporation,
iv. Potential losses at consumer points through wastage and leakages.

Mitigation Measures

i. Geological profiles throughout the area proposed for inundation should be established to identified areas of weaknesses and appropriate strengthening measures incorporated,
ii. Sub-surface water infiltration trends on affected areas should be established and monitored over a period of time with respect to effects on houses and other structures,
iii. Indigenous trees and shrubs that have low water dissipation capacity should be encourages around the dam buffer zone to minimize loss of water through evapo-transpiration processes,
iv. Ensure enhanced maintenance of the distribution pipelines,
v. Introduce economic and financial initiatives towards water saving and responsible utilization at consumer points.

7.3.18 Water Quality

The construction of the dam will have some long-term impacts on water quality as the inundation reduces the velocity of the water and will cause sedimentation in the river and increased turbidity and pollution. The contractor and proponent should therefore keep natural water channels free from obstruction and proponent should consult with the project stakeholders and their engineers for sustainable implementation of the project.

Mitigation Measure

- No grey water runoff or uncontrolled discharges from the site/working areas (including washdown areas) to adjacent watercourses and/or water bodies shall be permitted;
- Water containing such pollutants as cements, concrete, lime, chemicals and fuels shall be discharged into a conservancy tank for removal from site. This particularly applies to water emanating from concrete batching plants and concrete swills;
- The Contractor shall also prevent runoff loaded with sediment and other suspended materials from the site/working areas from discharging to adjacent watercourses and/or water bodies;
- Potential pollutants of any kind and in any form shall be kept, stored and used in such a manner that any escape can be contained and the water table not endangered;

- Wash areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas (including groundwater) are not polluted;
- The Contractor shall notify the RE of any pollution incidents on site.
- Institute a broad water quality monitoring system such as to focus on the catchment sources, incoming flows, entire dam water, treated water and water downstream of the dam location,
- All vegetation materials (live and dead) at the dam site shall be cleared and removed before the area is excavated and inundated,
- Maintain appropriate records on water quality as required by the law,
- Pit latrines will not be inundated due to their long term potential contamination of water, but will be decommissioned and the earth scooped for safe disposal to pre-agreed sites. The exact locations for all pit latrines, therefore, will be established to enable smooth relocation,
- All graves falling within areas to be inundated will require decommissioning and relocating to prevent contamination of water. The exercise should be undertaken in full observance of traditional rites as well as the wishes of the affected families,
- Proliferation of aquatic macro-fauna could be encouraged along the periphery of the dam to ensure natural aeration of the water,
- Identify specific point sources of water pollution (cattle pens, market centers, agro-chemical use points, etc.) for isolation and management.

7.3.19 Change of Land Use

During construction work part of the land will be used for construction of the inundated area and auxiliaries. Part of the work may include quarries, deviations, workmen's camps, storage of plant equipment leading to change in land use. During the process there is possible destruction of the remaining vegetation lining the riverbank and changes in the scenic view.

The contractor should restore some of the destroyed sites and should not allow the use of wood fuel but encourage use of other energy/fuel sources such as electricity and gas. The proponent should also establish long-term procedures for reducing soil erosion around the river e.g. through initiation of water catchment management programmes.

Nomadic pastoralism and wildlife conservation will be affected by inundation. The animal production and tourism sectors are key to the development of Isiolo and Laikipia County Economies, the proposed reservoir will inundate over 2,000ha affect over 147 of families negatively impacting on food security and poverty reduction efforts in the Counties. The proposed project should have a component targeting intensification of animal production in the area surrounding the dam so as allow for producing more food on the same amount of land in

the process guaranteeing food security. Activities aimed at intensification of livestock production need to be incorporated considering that most households that had livestock in the baseline survey mostly kept the traditional stocks of low productivity. These would mainly entail upgrading of the traditional breeds into improved breeds and better management methods. Proposed multipurpose use of the store water should target irrigation of fodder crops to make up for the loss of pasture occasioned by inundation.

Consultation with stakeholders is an ongoing process, and will continue to occur throughout the Project cycle. It will form a key part of the further development and implementation. In brief, the implementing agency will provide sufficient personnel and resources to ensure that activities related to the social component of the Project (e.g. consultation and compensation) are properly implemented and managed. With regard to public consultation and disclosure, the following are important activities to be managed and coordinated by the implementing agency;

i. The establishment of an information office in the Isiolo reservoir area;
ii. Institutional and process development;
iii. Liaison and consultation with Project-affected stakeholders, and engagement protocols;
iv. Involvement of local NGOs in awareness-raising, capacity-building and other aspects of the consultation and participation process;
v. Dissemination of Project-related information;
vi. Participatory planning; and
vii. Management of a grievance resolution procedure.

A plan for future public consultation is a valuable tool to continue the process initiated in earlier project phases. The following future activities will be undertaken as part of the public consultation and disclosure process

7.3.20 Aquatic Ecosystem

Impacts on aquatic ecology will arise from changes in the natural flow regime of the river. Spillages of fuel from trucks and the transfer from trucks to storage facilities pose a hazard. Other petroleum products associated with equipment maintenance (e.g. hydraulic fluids, oil, solvents) and chemicals will be used in relatively small quantities. These fuels and chemicals are damaging to aquatic organisms. They can also pollute surface and groundwater sources.

The most important changes in water quality in terms of aquatic life are increased sediment load and pollution during the project construction phase. This will affect the fauna in the river.

The contractor should ensure that refuelling, oil changes and lubricating mobile equipment will be done on designated area off-site and no exotic species should be introduced into the river.

7.3.21 Health, Safety and Security

a) General Health and Safety

i. The Contractor shall comply with all standard and legally required health and safety regulations as promulgated by Factories and Other Places of Work Act;
ii. The Contractor shall provide a standard first aid kit at the site office;
iii. The Contractor shall ensure that staff are made aware of the risks of contracting or spreading sexually transmitted diseases, particularly HIV/AIDS and how to prevent or minimise such risks;
iv. The Contractor shall be responsible for the protection of the public and public property from any dangers associated with construction activities, and for the safe and easy passage of pedestrians and traffic in areas affected by the construction activities;
v. All works which may pose a hazard to humans and domestic animals are to be protected, fenced, demarcated or cordoned off as instructed by the RE. If appropriate, symbolic warning signs must be erected;
vi. Speed limits appropriate to the vehicles driven are to be observed at all times on access and haul roads. Operators and drivers are to ensure that they limit their potential to endanger humans and animals at all times by observing strict safety precautions;
vii. No unauthorised firearms are permitted on site;
viii. The Contractor shall provide the appropriate Personal Protective Equipment for staff.

b) HIV/Aids

The implementing agency for HIV/AIDS campaign shall monitor activities regularly to assess effectiveness and impact. This should include an initial, interim and final assessment of basic knowledge, attitude and practices taking account of existing data sources and recognising the limitations due to the short timeframe to show behaviour change. The assessment will be supported by qualitative information from focus group discussions.

i. A comprehensive health awareness campaign, carried out in conjunction with the dam project team will be done to prevent outbreak of disease. This will include Successful preventive measures such as immunizing the vulnerable population, and educating people about diseases and how they are contracted, and how to avoid them by using treated water and keeping living areas cleaner;

ii. Treating affected local and migrant populations will also be used in controlling the movement of disease vectors (through contaminated water and between people).

iii. The Contractor shall be responsible for the protection of the public and public property from any dangers associated with construction activities, and for the safe and easy passage of pedestrians and traffic in areas affected by the construction activities;

iv. All works which may pose a hazard to humans and domestic animals are to be protected, fenced, demarcated or cordoned off as instructed by the RE. If appropriate, symbolic warning signs must be erected;

v. The HIV/AIDS awareness campaigns should be conducted at the camps as well as in the trading / market centres. The contractor shall take an active role in civic and public health education to his employees and the community.. The campaign shall include the training of facilitators within the workers, information posters in more frequented areas in the campsite and public areas, availability of promotional material (T-shirts and caps), availability of condoms (free), and theatre groups. The contractor will co-ordinate with the Provincial and District HIV/AIDS control councils, health officers and the NGOs undertaking education and sensitization programmes;

vi. The contractor will provide condoms at appropriate places in the work camps. The campaigns will be continuously done by the relevant Government organisation even during operation phase of the dam;

vii. The implementing agency for HIV/AIDS campaign shall monitor activities regularly to assess effectiveness and impact. This should include an initial, interim and final assessment of basic knowledge, attitude and practices taking account of existing data sources and recognising the limitations due to the short timeframe to show behaviour change. The assessment will be supported by qualitative information from focus group discussions.

c) Fire Prevention and Control

i. The Contractor shall take all reasonable and precautionary steps to ensure that fires are not started as a consequence of his activities on site;

ii. The Contractor shall ensure that there is basic fire-fighting equipment available on site;

iii. Flammable materials should be stored under conditions that will limit the potential for ignition and the spread of fires;

iv. 'Hot' work activities shall be restricted to a site approved by the RE;

Smoking shall not be permitted in those areas where there is a fire hazard. These areas shall include:

a. Workshop;

b. Fuel storage areas;

c. Any areas where vegetation or other material is such as to make liable the rapid spread of an initial flame;

The Contractor shall ensure that all site personnel are aware of the fire risks and how to deal with any fires that occur. This shall include, but not be limited to:

a. Regular fire prevention talks and drills;
b. Posting of regular reminders to staff;
c. Any fires that occur shall be reported to the RE immediately and then to the relevant authorities;
d. In the event of a fire, the Contractor shall immediately employ such plant and personnel as is at his disposal and take all necessary action to prevent the spread of the fire and bring the fire under control;
e. Costs incurred through fire damage will be the responsibility of the Contractor, should the Contractor's staff be proven responsible for such a fire.

d) Emergency Procedures

The Contractor shall submit Method Statements covering the procedures for the main activities which could generate emergency situations through accidents or neglect of responsibilities. These situations include, but are not limited to:

- Accidents at the work place;
- Accidental fires;
- Accidental leaks and spillages;
- Vehicle and plant accidents;

Specific to accidental leaks and spillages:

- The Contractor shall ensure that his employees are aware of the procedure for dealing with spills and leaks;
- The Contractor shall also ensure that the necessary materials and equipment for dealing with the spills and leaks is available on site at all times.

Specific to hydrocarbon spills:

- The source of the spill shall be isolated and the spillage contained using sand berms, sandbags, sawdust, absorbent material and/or other materials approved by the RE;

- The area shall be cordoned off and secured;
- The Contractor shall ensure that there is always a supply of absorbent material readily available to absorb/breakdown the spill;
- The quantity of such materials shall be able to handle a minimum of 200l hydrocarbon liquid spill;
- The Contractor shall notify the relevant authorities of any spills that occur;
- The Contractor shall assemble and clearly list the relevant emergency telephone contact numbers for staff and brief staff on the required procedures. These contact details shall be listed in English and Kiswahili;
- The treatment and remediation of areas affected by emergencies shall be undertaken to the reasonable satisfaction of the RE at the cost of the Contractor where his staff have been proven to be responsible for the emergency.

e) Site Security

The Contractor will need to take the following measures:

i. Provide for armed security at the entire working time and period;
ii. Appropriate fencing, security gates, shelter and armed security guards are to be provided at the Construction Site to ensure the security of all plant, equipment and materials, as well as to secure the safety of site staff;
iii. The Contractor must ensure that good relations are maintained with local communities and their leaders to help reduce the risk of vandalism, theft and bandits;
iv. Site staff that are found to be involved in incidences of theft or pose other security risks to the local community are to be dismissed and reported to the authorities.

7.3.22 Occupational Health and Safety

Health and safety of both workers and the public is a key concern during the construction and operation phases. Accidents may occur due to unsafe working practices and conditions. The contactor should provide adequate personal protective equipment (PPE) to workers and conduct relevant training to workers e.g. training on proper use of PPE and safety issues. During operation, the proponent should guard all moving parts of machines; provide personal protective clothing and ensure they are correctly used, display for all to read the health, safety and environmental management policies, ensure that there is a trained first aider on site and comply the provisions of the Environmental Health Safety (EHS) management plan to safeguard workers.

Mitigation Measures

- The Contractor shall comply with all standard and legally required health and safety regulations as promulgated by Factories and Other Places of Work Act;
- The Contractor shall provide a standard first aid kit at the site office;
- The Contractor shall ensure that staff are made aware of the risks of contracting or spreading sexually transmitted diseases, particularly HIV/AIDS and how to prevent or minimise such risks;
- The Contractor shall be responsible for the protection of the public and public property from any dangers associated with construction activities, and for the safe and easy passage of pedestrians and traffic in areas affected by the construction activities;
- All works which may pose a hazard to humans and domestic animals are to be protected, fenced, demarcated or cordoned off as instructed by the RE. If appropriate, symbolic warning signs must be erected;
- Speed limits appropriate to the vehicles driven are to be observed at all times on access and haul roads. Operators and drivers are to ensure that they limit their potential to endanger humans and animals at all times by observing strict safety precautions;
- No unauthorised firearms are permitted on site;
- The Contractor shall provide the appropriate Personal Protective Equipment for staff.

7.3.23 Historical, Cultural and Archeological Resources

This study did not reveal areas of archeological materials within the project area. Therefore, there is no apparent danger of destroying past cultural heritage if the proposed project proceeds.

Mitigation Measures

Care should be taken while doing excavation works. If any suspect cultural or material sites are identified, then the finding should be reported to the client and to the National Museums of Kenya.

At a minimum, if materials of paleontological (fossil bones and human bones of human heritage) or archaeological nature (stone, iron or other prehistoric artifacts or features) are encountered (discovered) while, for instance drilling or excavating by machine, the following steps have to be undertaken.

an archaeologist should be consulted to assess the cultural heritage value of the finding

In case the finding is determined to be a monument or object of archaeological or paleontological interest, this should be reported to the National Museums of Kenya (the institution charged with the responsibility of safeguarding Kenya's cultural heritage).

The above steps would be in line with the Laws of Kenya. According to the National Museums and Heritage Act of 2006 (the law responsible for the protection and preservation of cultural heritage in Kenya), under Part IV (Searches and Discoveries), Section 30 on Notification of Discoveries states as follows:
"Where a person discovers a monument or object of archaeological or palaeontological interest, the person shall, within seven days, give notice thereof, indicating the precise site and circumstances of the discovery, to the National Museums, and in the case of an object, shall deliver the object to the National Museums or to the District Commissioner" This is done partly to enable or to allow rescue excavation (salvage)to avoid destroying the archaeological, paleontological or other object or site of past cultural heritage.

The following “chance find” procedures to be included in all civil works contracts:
If the Contractor discovers archeological sites, historical sites, remains and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall:

a) Stop the construction activities in the area of the chance find
b) Delineate the discovered site or area;
c) Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local Heritage Warden or the national Museums of Kenya take over;
d) Notify the supervisory Project Environmental Officer and Project Engineer who in turn will notify the local Heritage Warden and the National Museums of Kenya (NMK) immediately (within 24 hours or less);

Responsible local authorities and the Culture Department within the County would then be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archaeologists of the National Museums of Kenya. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage, namely the aesthetic, historic, scientific or research, social and economic values.
Decisions on how to handle the finding shall be taken by the NMK. This could include changes in the layout (such as when finding irremovable remains of cultural or archeological importance) conservation, preservation, restoration and salvage.
Implementation for the authority decision concerning the management of the finding shall be communicated in writing by relevant local authorities.

-Construction work may resume only after permission is given from the NMK concerning safeguard of the heritage.

Gender Equity and Vulnerable Groups

Resettlement operations will need to ensure children's nutritional needs are met, along with their access to education. In addition, if children contribute economically to family welfare, resettlement operations will include measures to eliminate child labour to the fullest extent possible.

The resettlement operation shall enumerate the number and types of disabilities in the displaced population and make arrangements to provide the assistance needed by these individuals or their families.

The resettlement programming should ensure that meaningful consultations with women are included; so as to ensure women inclusion the resettlement program should issue information on resettlement entitlements and choices to every adult member of the household, not just to the head of the household. Informal contributions to household subsistence by women include subsistence agriculture and collection of fuel and water, not to mention cooking, cleaning, and childcare. All of these activities are to be included in calculating household incomes.

7.4 Operational Impacts

The presence of a large body of water in the post-construction period will pose a danger to community members, particularly of drowning. Although the creation of the proposed Reservoir will require involuntary relocation of most affected households, some households will be left close to the water level which could lead to safety concerns.

Water fluctuations of the Reservoir will also be problematic; for example, areas close to water line will not be able to be used for cultivation, and any crossings will have to take water level changes into account. These potential safety impacts are rated as high, long-term and of high significance.

7.4.1 Biting Flies and Mosquitoes

In addition to being vectors for some disease like malaria biting flies and mosquitoes can be irritant when in season. It is important that the project does not exacerbate the already high prevalence of biting flies and mosquitoes in the area. Strategies for the management of dams will be described that may reduce the breeding sites of these insects.

Use dam management strategies that can reduce the breeding sites of biting flies and mosquitoes, such as:

✓ allowing the rapid draw-down of the reservoir, allowing both a rapid drop in shoreline water levels and an artificial flood downstream that will flush out any vector breeding places in rock pools;

✓ minimising low flow zones in artificial channel (Irrigation canals if included) networks to minimise habitats for the propagation of vectors;

7.4.2 Access to Health Services

The current availability of health services in the project area has already been analysed in previous sections of this report. It was demonstrated that majority of the local population is still far from health services in terms of distance to the nearest primary care unit. Consequently, the building of new health clinics in the area will help and also the upgrading of the services in terms of provision of sufficient personnel and equipment as well as drugs. This can be considered a form of mitigation for the various health risks that the project will generate, especially during the construction phase. This obviously does not preclude the establishment of a first aid unit at the main construction site itself, a service which is necessary given the large size of the workforce. For health services that go beyond first aid, the managers of the project can make special arrangements with one of the already existing clinics and provide the needed upgrades. This will then benefit both the workforce and the local population.

Health facilities are a source of concern by the residents; mitigation measures/projects under this include an upgrade the existing primary health care units through;

- Supplementary training for the local nurses,
- Assisting in the provision of a wider range of medical services and drugs,
- Assisting in the enhancement of laboratory services,
- Assisting in making available periodical consultations by qualified physicians.

Establish a first aid unit at the main construction site and make special arrangements with one of the already existing clinics to provide health services beyond first aid.

7.4.3 Personal Health Practices

One of the major health concerns related to the project is its potential to significantly increase the spread of HIV/AIDS and other sexually transmitted infections (STIs) in the local population and among the workers. There is no doubt that the mobilization of a large workforce over the construction period which may be in excess of 36 months will bring about an intensification of sexual activity in the area and will see an increase in the number of active sex workers. This will happen in a region where 5.7% of the population aged 15-49 years has been shown to be HIV positive.

- Implement an extensive HIV/AIDS and STI education campaign among the local population, targeting not only youth but adults as well. Such a campaign should be initiated immediately, well before the start of the construction phase. It should be complemented by increased access to condoms in the area as well as to voluntary counselling and testing.
- Implement a comprehensive and on-going HIV/AIDS and STI education campaign targeting all workers hired for the project, both local and international. It should be complemented by easy access to condoms at the workplace as well as to voluntary counselling and testing.
- Implement a well thought and effective HIV/AIDS and STI education campaign among sex workers. Such a campaign should be initiated immediately and pursued throughout the construction phase of the project as a constant flux of individuals involved in this activity is expected. It should be complemented by increased access to condoms specifically targeted for this group as well as voluntary counselling and testing, together with improved access to medical services.
- Upgrade all local health clinics serving the local population in terms of training for the local nurses specifically focused on the diagnosis and treatment of STI and HIV/AIDS, the uninterrupted availability of Rapid HIV testing and of AIDS counsellors, the increased accessibility to complementary laboratory tests provided by central laboratories, as well as the availability of periodical consultations by qualified physicians. These measures should encompass both the public and private health sector.
- Establish a strong, well publicized, effectively applied and closely monitored zero - tolerance policy in accordance with which workers and service providers seeking sexual favours in exchange for project related benefits will be banned for the remaining duration of the construction phase.

7.4.4 Child Development

By reason of their increased susceptibilities, and because of the long term and profound effects that both noxious and beneficial exposures to the embryo and small child potentially have over the entire life of the individual, children deserve special attention during any health impact assessment. Consequently, the intent of this section is to summarize the positive and negative impacts that the project is expected to have on child development.

For the population living in the proposed area of the dam, possible impacts for children will be mostly experienced during the construction period. While the loss of grazing land may result in a more limited diet for some households which could translate into higher levels of child malnutrition, it seems likely that the financial benefits of the project in terms of job creations and compensations will counterweight this negative impact and generally result in diet improvement for the majority of the population and its children. One condition for this to happen is for the local population to be given priority during the recruitment of workers, especially as regards the unskilled and semi-skilled jobs. As it is generally recognized that financial benefits to women often translate into more tangible benefits to the family and children in particular than when men are employed, the recruitment of women should be given due emphasis by the managers of the project.

Children have also been shown to be highly vulnerable to respiratory diseases. Consequently, the risks associated with deterioration in air quality parameters during the construction phase will have a greater negative impact on small children than on the adults of the local population. The implementation of the recommended control measures with respect to dust and combustion gases are consequently of special importance to the small children which form a portion of this population. If such measures as well as those related to noise level are duly implemented, the potential negative impact of the project on the development of children will have been largely avoided.

As it is generally recognized that financial benefits to women often translate into more tangible benefits to the children than when men are employed, the recruitment of women should be given due emphasis by the managers of the project.

7.4.5 Quality of Life

This is another broad category to assess the general impacts of the project on the quality of life of the potentially affected populations, bringing together findings already considered under the previous categories and wider issues related to socioeconomic development. Needless to say, reduced flooding downstream, supply of electricity generated; increased access to safe drinking-water and irrigation is a major contributor to the enhancement of the quality of life of

the hundreds of thousands of individuals in the recipient populations. For those living in the vicinity of the dam however, the situation is more complex, with a mixed bag of both positive and negative factors. Elements that will result in a deterioration of the quality of life during the construction phase include such stressors as dust, combustion gases, noise, the increased risk of road traffic accidents, a likely increase in the incidence of HIV/AIDS and STI, a probable deterioration of the general safety conditions in the area, as well as the loss of some resources such as agricultural land, trees, medicinal plants, etc.

Negative factors will also exist during the operation phase of the project, such as a more restricted access to the river and an increased difficulty to cross the river and use the services available on the opposite side. Elements contributing positively to the quality of life of the local population are related to compensations that will be paid for the loss of resources, the temporary employment during the construction phase of the project, the expected boom in local businesses during the same period, as well as the long-term improvement of the local road infrastructure. It can be seen from this mixed set of positive and negative elements that the nature of the mitigations measures that will be implemented as well as their efficient application will be a major factor in the balance between an improved or worsened quality of life for the local population.

7.4.6 Cultural Heritage

There are no known archaeological sites along the Ewaso at the proposed Dam location. However the archaeology potential of the is rich and for such sites if they exist, the major impact will be total destruction in terms of inundation by development of a dam
It is recommended that:

1. The archaeology reconnaissance be undertaken to determine the extent to which the proposed dam development will impact on the historical and living heritage sites. It is recommended that detailed documentation be undertaken, to ensure that a proper database is established, which will record heritage sites using the state of the art technology.

2. That further site inspections be undertaken where dam excavation works penetrate below the Formations.

7.4.7 Dam Failure

The proposed dam is located in a sparsely populated area with no notable high population concentrations with 10km on either side of the river. The major structures within reach of water if the dam was to fail are:

Downstream of the dam there are the proposed water treatment works, staff houses and power house. The personnel working there would have to be evacuated at early signs of failure.

While full risk assessment study has not been undertaken this report provides general pointers for detailed evaluation and quantification of potential damages from various components of the project. It will, however, be necessary to undertake a comprehensive risk assessment of the project covering an all aspects of human life, social setting and economic trends linked with the dam.

Damages to environmental features, human life and properties could arise from the following scenarios;

i) The dam breaking,
ii) The spillways giving in,
iii) Collapsing of the raised storage tanks,
iv) Overflows onto upstream roads and bridges,
v) Accidental drowning of residents and their livestock.

Risk impacts associated with these scenarios varies depending on location, public awareness and preparedness, habitats and land use affected and duration of occurrence. It should be appreciated that at the time of the existing developments along the river basin had not taken these risks into consideration. The following sections briefly describe the risks and also propose preventive measures for consideration in the dam operations.

Immediately Upstream

Environmental features and social facilities upstream of the dam axis will be significantly affected by the dam through inundation or removal. The ecological status will also change to aquatic like setting. While this is short term, long term risks of the dam will include accidental drowning of human beings and their livestock. This is particularly so when rain water rivers are not easily noticeable.

Downstream Areas

Due to easy availability of water, land owners have tended to settle close to the river flood plains. There are homes and cultivated lands all the way downstream in additional to an assortment of environmental and social features such as to include;

(i) Bridges vehicular and foot bridges) that could be washed down in the event of a dam or spillway breakdown,
(ii) Vegetation and habitats of various species along both sides of the river basin,
(iii) Watering points for livestock and locations for local sources of water including abstraction facilities.

As the river approaches Archers Post, features to be affected are far apart but also sensitive. The affected areas include national reserves and tourist hotels downstream the dam area and upstream Archers Post. The topography is also mild with flatter and widely spread land where water could flood effectively reducing speed and force, hence reduced damages. Among the features at risk include:

From the above risks, we find that the failure of the dam shall not be catastrophic. But there will be other investments along the Ewaso Nyiro river in the future that should be implemented with due consideration of risk of failure of Isiolo dam.

8 Environmental and Social Management Plan (ESMP)

The Environmental and Social Management Plan (ESMP) is prepared to show how site specific concerns and mitigation measures are addressed through the detailed design, pre-construction, construction and post-construction / operation phase of the Project.

The ESMP has been developed with project knowledge and information available to date. Some of the Project's final details, such as proposed locations of construction camps, actual locations of borrow areas to be used by the Contractor, disposal areas for construction debris among other issues, are unknown at the present time. As project commencement and scheduling plans are developed and changed, components of the ESMP might require amending. This is therefore a working document, which can be updated whenever new information is received or site conditions change.

8.1 Objectives of the ESMP

The Environmental and Social Management Plan (ESMP) describes the range of environmental issues associated with the Project and outlines corresponding management strategies that will be employed to mitigate potential adverse environmental impacts. The ESMP conveys the Project's environmental and social constraints.

The Project will comply with all local laws and regulations, which seek to ensure that the construction work does not adversely affect the environment and social community resources.

The Supervising Consultant may periodically revise the ESMP in consultation with the Contractor, and subject to the approval from the Ministry Water, Environment and Natural Resources Kenya and the National Environment Management Authority. Revisions may be made to accommodate changes in work, weather and site conditions.

The ESMP should be made available to all Project Staff.

The objectives of the ESMP are:

- To bring the project into compliance with applicable national environmental and social legal requirements;
- To outline the mitigating/enhancing, monitoring, consultative and institutional measures required to prevent, minimise, mitigate or compensate for adverse environmental and social impacts, or to enhance the project beneficial impacts;

- To address capacity building requirements within the relevant Ministries if necessary.
-

8.2 Responsibilities

In order to ensure the sound development and effective implementation of the ESMP, it will be necessary to identify and define the responsibilities and authority of the various persons and organisations that will be involved in the project. The following entities will be involved on the implementation of this ESMP:

- NWCPC;
- National Environmental Management Authority;
- Resident Engineer,
- Environmental and Social Officer;
- Contractor;
- County Government.

8.2.1 NWCPC

The dam project is under the jurisdiction of NWCPC (the project proponent). Therefore, the responsibility for ensuring that mitigation measures specified in this ESMP and the contract documents are implemented will lie with them.

8.2.2 National Environmental Management Authority

The responsibility of the National Environmental Management Authority (NEMA) is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Government in the implementation of all policies relating to the environment and to ensure that all mitigation measures proposed are actually implemented.

8.2.3 The Resident Engineer and Environmental Officer

The Resident Engineer (RE) will be appointed by NWCPC or Supervising Consultant and will be required to oversee the construction programme and construction activities performed by the Contractor, in compliance with the present ESMP. The RE will have an Environmental and social officer (ESO) in its team to co-ordinate all aspects of the environment during project implementation. This will include following the construction to monitor, review and verify the implementation of the project's ESMP.

During construction, the ESO will be responsible for the following tasks:

- Updating environmental aspects (not covered in the EIA / ESMP) during project implementation;
- Auditing environmental and safety aspects at the work sites;
- S/He shall participate in the definition of the no working-areas and the location of campsite, borrow pits, quarries and other areas;
- Recommending solutions for specific environmental problems;
- S/He shall facilitate the creation of Community Liaison Groups and shall monitor the compliance of the social clauses of the Contract, in terms of local labour force and HIV/AIDS campaign;
- Overseeing strategies for sensitising the local population on health and safety problems;
- Attending consultations held at key stages of the project with the community and interested parties;
- S/He will be required to liaise with the respective Environmental Authorities on the level of compliance with the ESMP achieved by the Contractor on a regular basis for the duration of the contract;
- Controlling and supervising the implementation of the ESMP;
- Preparing quarterly environmental and social progress or “audits” reports on the status of implementation of measures and management of work sites.

8.2.4 The Contractor

The Contractor will be appointed by the NWCPC and will be required to comply with the requirements of the EIA/ ESMP and the Practice Manual for Water Supply Service in Kenya, which include specifications for Environmental Protection and Waste disposal, Borrow Pit and Quarry Acquisition and Exploitation, Landscaping and grassing and so on.

8.2.5 County Governments

The relevant ministerial and departmental officers in the local authorities should be called upon where necessary during project implementation to provide the necessary permits and advisory services to the project implementers. Some of the areas for which the officers will be required include:

- Approving locations for establishing work camps;
- Involvement in relocation of project affected persons in the dam site;
- Liaising with the NGOs in the project area to assist in the sensitisation campaigns for HIV/ AIDS and public health to the workforce and the local community;

- Issuing permits for tree felling, vegetation clearing, exploitation of quarries and borrow sites (whenever necessary);
- Identifying locations for disposal of construction debris;
- Issuing permits or relevant documentation for health and safety monitoring in accordance with local health and safety legislation and / or ILO standards.

Table 8-1 Isiolo Dam Environment and Social Management Plan

Anticipated Impacts	Proposed Mitigation Measure	Responsible Party	Time Frame	Estimated Cost (KShs.)
Planning and Design Phase				
Community mobilisation & Consultation	Prepare and implement a Consultation Plan as per the guidelines for RAP. Inform all communities affected by the Project of schedule of implementation of Project and their rights to compensation Introduce to reservoir foreshore communities a program to deal with latrine, wastewater, refuse pit, water supply and health and hygiene education matters. Undertake further consultation with affected communities on measures to mitigate impeded access caused by the proposed storage.	National Water Conservation and Pipeline Corporation (NWCPC) – Project Implementer	Continuous process between now and commencement of project implementation	3,000,000
Complete final Project design	Design dam and appurtenant structures and components Complete environmental and social impact assessment of dam, power plant, transmission line and associated structures, quarry and sand sources, permanent operator's camp and temporary construction camps. Integrate mitigation measures from this assessment with the EMP from the EIA. Development of operating rules and decision support system. Design improvements to existing water supply collection	National Water Conservation and Pipeline Corporation (NWCPC)	Before the commencement of construction	As per the assignment Contract.

	and reticulation systems for villages adjacent the reservoir foreshores. Undertake feasibility / cost estimates for foot bridges across the storage to mitigate against impeded access.			
Clearances, approvals and permits	Obtain written permission from private landholders to conduct activities on their land prior to commencing these activities, and provide copies to the Engineer.	Contractor / National Water Conservation and Pipeline Corporation (NWCPC)	As required prior to commencing the intended activities	RAP report
Involuntary Resettlement	Land acquisition will be avoided where feasible, or minimized, exploring all viable alternatives; and where acquisition of land or other assets is unavoidable, compensation should be provided to the full value of the land or assets acquired and any loss of livelihood as a result Prepare RAP including appropriate compensation and an alternative resettlement location in accordance with WB OP 4.14; Evictions and Resettlement Bill 2012 Involve the affected persons on all stages of the RAP and its implementation	National Water Conservation and Pipeline Corporation (NWCPC)	Once, at least 1 year before project commencement	RAP report
Local economy such as Employment & Livelihood of resettled people	All the affected people need to be provided with an economic safe landing, Compensation for lost economic activities to be addressed under RAP. Impress upon the contractor(s) to utilize local labour Arrange for local people to be employed and trained.	National Water Conservation and Pipeline Corporation (NWCPC)	Once, at least 1 year before project commencement Throughout construction phase	RAP Report

	Wherever possible construction materials will need to be sourced from the locality,			
Social Institutions such as Split of Communities	In RAP, to preserve existing social ties, a resettlement site for the communities should be considered and the preference of resettlers will be prioritised. Provide an alternative access to physical venues for social ties such as churches, meeting places for the women group, if they are disturbed by construction	Contractor / National Water Conservation and Pipeline Corporation (NWCPC)	Once, at least 1 year before project commencement Throughout construction phase	RAP Report
The Vulnerable Groups such as the Poor, /Ethnic People, the Women, the Elderly, the Children, and Physically Challenged People	People with special needs and/or the vulnerable groups should be given special priority during the RAP Provide easy and safe access to public utilities such as schools, health centres and watering points. Include women, poor & vulnerable groups in the implementation of the Project activities.	Contractor / National Water Conservation and Pipeline Corporation (NWCPC)	Once, at least 1 year before project commencement Throughout the construction phase	RAP Report
Misdistribution of Benefits and Damages	Ensure adequate compensations to residents whose land and structures are going to be affected, Compensation on damages to the local communities should be harmonized	Contractor / National Water Conservation and Pipeline Corporation (NWCPC)	Once when preparing the RAP	RAP Report

Severed / Constrained access	Access across the Reservoir will be restored through the provision of a vehicular bridge across the dam wall; Construction of a bridge downstream the dam axis to provide alternative crossing for livestock and wildlife; Possibility of establishing small boat/ferry services, to be run as income-earning activities by community members, will also be investigated in consultation with the affected communities.	National Water Conservation and Pipeline Corporation (NWCPC)	Done during Construction During the operation phase	Provided for in BoQs
Loss of Agricultural land Reduced food security for Project area	Project should have a component targeting intensification of agricultural production in the project area and away from the dam so as allow for producing more food on the same amount of land in the process guaranteeing food security. Similarly activities aimed at intensification of livestock production need to be incorporated considering that most households that had livestock in the baseline survey mostly kept the traditional stocks of low productivity. These would mainly entail upgrading of the traditional breeds into pedigree and better management methods	National Water Conservation and Pipeline Corporation (NWCPC)/Agriculture and Livestock production Departments	Once, at least 1 year before project commencement and continuing thereafter	No additional Costs
Loss of Livelihood for people exploiting natural resources on the Ewaso Nyiro River	Establish the affected persons from the census carried out and provide affected residents with alternative livelihoods under the RAP program	National Water Conservation and Pipeline Corporation (NWCPC)	Once when preparing the RAP	RAP Report
Cultural Heritage	Identify cultural heritage sites recorded during the cultural heritage assessment undertaken during the EIA and protect them (e.g. use of fencing) from disturbance while the recording / recovery program is in progress.	Contractor / National Water Conservation and Pipeline Corporation (NWCPC)/	Prior to commencement of and throughout construction phase	500,000

	The appropriate compensation and/or relocation shall be decided in consultation with the affected owners and relevant government officials, if any cultural/historical heritage is found during construction.	Archeology department at the National museums of Kenya		
Local Conflicts of Interests	Compensation issues be addressed under RAP	National Water Conservation and Pipeline Corporation (NWCPC)	Once when preparing the RAP	RAP Report
Water Usage or Water Rights & between upstream and downstream users	Adopting the established water resources management rules, Institute a liaison committee to provide an accessible communication channel between the community and National Water Conservation and Pipeline Corporation (NWCPC) / Government. Provide convenient alternative access to water during construction and operation.	Contractor / National Water Conservation and Pipeline Corporation (NWCPC)	Throughout operation phase Once construction phase	No additional Costs
Increase in insect bites, Water-borne, Insect-borne Communicable Diseases	Make sure that there is good drainage at all construction areas, to avoid creation of stagnant water bodies especially in urban/industrial areas, including water in old tires. Provide adequate sanitation and waste disposal at construction camps. Provide adequate health care for workers and locate camps away from vulnerable groups Construct/operate a health centre nearby the dam site as the project CSR to the community.	At all construction and camp sites Contractor	During construction	No additional Costs
Cultural Resources	If archaeological relics or remains are discovered, the appropriate authority should be notified immediately. The	Wherever such archaeological al	Throughout construction	No additional Costs

	construction should be stopped until the authorised organisation assesses the remains and approves continuation of work after appropriate measures are implemented. Archaeologists will supervise any necessary excavation to avoid any damage to the relics.	remains are discovered at site Contractor / Archaeologist		
Construction Phase				
Hydrology and River Flows	Ensure compliance with the water resources regulations at all times. At least 30% of the base flow should always flow in the stream to sustain ecological and social requirements downstream, With effects on the level of flood heights downstream, it may be necessary to review the riparian land and extent of sub-aquatic ecosystem downstream, River gauging stations around the dam and downstream may require to be reactivated to monitor effects of the dam to the river basin over time,	NWCPC and RE	Construction Period	No additional Costs
Surface Runoff (Soil Erosion and Sedimentation)	**Erosion control** The Contractor shall take reasonable measures to control storm water and the erosive effects. During construction the Contractor shall protect areas susceptible to erosion by installing necessary temporary and permanent drainage works as soon as possible and by taking measures to prevent the surface water from being concentrated in drainage channels or streams and from scouring slopes, banks or other areas. Areas affected by construction related activities and/or susceptible to erosion must be monitored regularly for	NWCPC and RE	Construction/operation Period	20,000,000.00

	evidence of erosion, these include: . On any areas where the risk of erosion is evident, special measures may be necessary to stabilise the areas and prevent erosion. These may include, but not be limited to: ✓ Confining construction activities; ✓ Using cut off drains; ✓ Using mechanical cover or packing structures such as geofabric to stabilise steep slopes or hessian, gabions and mattress and retaining walls; ✓ Mulch or chip cover; ✓ Constructing anti-erosion berms; ✓ The erosion prevention measures must be implemented to the satisfaction of the RE; ✓ Where erosion does occur on any completed work/working areas, the Contractor shall reinstate such areas and areas damaged by the erosion at his own cost and to the satisfaction of the RE and ESO; ✓ The Contractor shall be liable for any damage to downstream property caused by the diversion of overland storm water flows. **Sedimentation Controll** Provide sand check dams upstream of the dam, and more specifically along the river upstream. The check dams could be located at least every 5 – 10km from each other depending on topography and accessibility, The check dams should be provided downstream of every major tributary could provide additional sand dams for water storage to serve the immediate communities upstream of the dam.			

	The sand dams could also serve as approved sand harvesting points to be managed through organized community groups that will also enhance conservation of the river flood plains and acceptability by the local communities, The communities at the dam site could also be assisted to get organized into groups for an economic disposal of the accumulated sand ahead of the dam construction. Access to the site, is however a limiting factor in this regard, While holding sand back for the safety of the dam, modalities should be established to ensure that economic interests of downstream dependants of the sand are also addressed.			
Noise Emission and Air Quality Impacts	The Contractor shall keep noise level within acceptable limits and construction activities shall, where possible, be confined to normal working hours in the residential areas; Schools, hospitals and other noise sensitive areas shall be notified by the Contractor at least 5 days before construction is due to commence in their vicinity. Any excessively noisy activity shall be conducted outside of school hours, where approved by the RE; Any complaints received by the Contractor regarding noise will be recorded and communicated to the RE; The Contractor must adhere to Noise Prevention and Control Rules of April 2005. Workers shall be trained on management of air pollution from vehicles and machinery. All construction machinery shall be maintained and serviced in accordance with the contractor's specifications;	NWCPC and RE	Construction Period	No additional Costs

	Asphalt plants and concrete batching plants shall be well sealed and equipped with a dust removal device; Workers shall be trained on dust minimisation techniques; The removal of vegetation shall be avoided until such time as clearance is required and exposed surfaces shall be re-vegetated or stabilised as soon as practically possible; The contractor shall not carry out dust generating activities (excavation, handling and transport of soils) during times of strong winds. The RE shall suspend earthworks operations wherever visible dust is affecting properties adjoining the road; Water sprays shall be used on all earthworks areas. Water shall be applied whenever dust emissions (from vehicle movements or wind) are visible at the site in the opinion of the RE; Vehicles delivering soil materials shall be covered to reduce spills and windblown dust; Vehicle speeds shall be limited to minimise the generation of dust on site and on diversion and access roads; Any complaints received by the Contractor regarding dust will be recorded and communicated to the RE and ESO.			
Wildlife Impacts	Enhancing the buffer zone of the dam by planting trees and fencing off the conservancies neighboring the dam area to protect wildlife and promote controlled grazing in the conservancies; limiting grazing in the conservancies to periods of low or no pastures in other grazing areas. The Supervising Engineer and Environmental and Social Officer will liaise with the Kenya Wildlife Service to identify the exact known wildlife crossing areas, natural habitats, breeding zones and ensure that these areas are avoided or	NWCPC, local CBOs, NGOs, Conservancies and RE	Construction, Operation and decommissioning phases	30,000,000.00

	minimal construction disturbance is experienced in these critical areas. Appropriate safety signage is placed on these areas indicating their ecological roles and significance. Warning signage's at important animal crossing points, animal tunnels or bridges may be used to reduce collision rates, especially for protected or endangered species. This measure is expensive and will be used only at a few locations where it is both justified (by the importance of the animal population and the crossing route as recommended by KWS) and affordable (relative to the cost of the project and the funds available). It will also be important that the Supervising Engineer in liaison with the local administration take care of areas with high population of livestock so that appropriate signage is placed along the road warning motorists. Any irrigation scheme may be set up past Archers post since the upper part of the river forms an important wild life migratory corridor and several game reserves and conservancies. This is aimed at minimizing impacts on wildlife in the long term.			
Flora and fauna	With regard to clearing of work sites and adjacent area vegetation, the following are recommended: ✓ Clearing of vegetation shall be kept to a minimum; ✓ Areas to be cleared should be agreed and demarcated before the start of the clearing operations; ✓ Clearing and removal of vegetation, especially at borrow sites must be carried out in such a way that damage to adjacent areas is prevented or minimised; ✓ Upon completion of works revegetation of the area surrounding the dam should be revegetated to form the			10,000,000

	buffer ✓ Make use of inventory developed in this study of the unique biodiversity within the affected areas for purposes of preventing species loss. In this regard, regularly update database of animal and plant species found in the project area as a basis for conservation and monitoring of newly introduced species in the future. The inventory and monitoring register should be maintained by NWCPC Water Service Board in collaboration with the environmental office and other interested parties, ✓ An ecologist would be required to oversee monitoring and management of ecological changes around the dam ecosystem, ✓ The role of the Kenya Wildlife Services would be crucial in monitoring the new habitats and characteristics of the wildlife migrating into the dam area, ✓ Establish community interests and values in the evolving ecological setting and enhance economic benefits from the same, ✓ Areas with dense indigenous vegetation are not to be disturbed unless required for construction purposes, nor shall new access routes be cut through such areas. ✓ Trees should be trimmed rather than removed wherever possible; ✓ The use of indigenous plants as firewood is prohibited unless they are obtained from approved sources; ✓ There is a possibility of encountering wildlife during the construction works, these animals should be avoided and not perturbed; ✓ Wildlife poaching or game hunting is forbidden.			

Quarries, Borrow bits and Concrete Work Sites	**I. Planning Borrow Pits and Quarries** Where required, all borrow pits sites shall be clearly indicated on a plan and approved by the RE. ✓ The Contractor will be responsible for ensuring that appropriate authorisation to use the proposed borrows pits and quarries has been obtained before commencing activities; ✓ Borrow pits and quarries shall be located more than 20 meters from watercourses in a position that will facilitate the prevention of storm-water runoff from the site from entering the watercourse; ✓ The Contractor shall give 14 days' notice to nearby communities of his intention to begin excavation in the borrow pits or quarries; ✓ The Contractor shall prepare and implement borrow pit plans and borrow pit rehabilitation plans, which would minimise the risk of erosion. **II. Construction and Operation of New Borrow Pits and Quarries** ✓ Topsoil shall be stripped prior to removal of borrow and stockpiled on site. This soil shall be replaced on the disturbed once the operation of the borrow site or quarry is complete; ✓ Storm-water and groundwater controls shall be implemented to prevent runoff entering streams and the slumping of soil from hillside above; ✓ The use of borrow pits or quarries for material spoil sites may be approved by the RE (and/or with the appropriate consent of the "landowner"). Where this	NWCPC and RE	Construction Period	No additional Costs

	occurs, the materials spoiled in the borrow pit shall be profiled to fit into the surrounding landscape and covered with topsoil. **III. Blasting** ✓ If blasting is required, the Contractor will be responsible for obtaining a current and valid authorisation from the Department of Mines and Geology prior to any blasting activity. A copy of this authorisation shall be given to the RE; ✓ A qualified and registered blaster by the Department of Mines and Geology shall supervise all blasting and rock-splitting operations at all times; ✓ The Contractor shall ensure that appropriate pre blast monitoring records are in place (i.e. photographic and inspection records of structures in close proximity to the blast area); ✓ The Contractor shall ensure that emergency services are notified, in writing, a minimum of 24 hours prior to any blasting activities commencing on Site; ✓ The Contractor shall take necessary precautions to prevent damage to special features and the general environment, which includes the removal of fly-rock. Environmental damage caused by blasting/drilling shall be repaired at the Contractor's expense to the satisfaction of the RE and the relevant authorities; ✓ The Contractor shall ensure that adequate warning is provided to the local communities immediately prior to all blasting. All signals shall also be clearly given; ✓ The Contractor shall use blast mats for cover material during blasting. Topsoil shall not be used as blast			

	cover. **IV. Asphalt, Bitumen and Paving** The site of the asphalt plant shall be selected and maintained according to the following basic criteria: ✓ The plant shall be situated on flat ground; ✓ Topsoil shall be removed prior to site establishment and stockpiled for later rehabilitation of the site; ✓ Bitumen drums / products shall be stored in an area approved by the RE. This area shall be indicated on the construction camp layout plan. The storage area shall have a smooth impermeable (concrete or thick plastic covered in gravel) floor. The floor shall be bunded and sloped towards a sump to contain any spillages of substances; ✓ The area shall be covered to prevent rainwater from contacting the areas containing fuels, oils, bitumen etc and potentially generating contaminated runoff; ✓ The plant shall be secured from trespassers and animals through the provision of fencing and a lockable gate to the satisfaction of the RE; ✓ Well-trained staff shall be responsible for plant workings. ✓ Within the bitumen plant site, areas shall be demarcated/marked for plant materials, wastewater and contaminated water; ✓ An area should be clearly marked for vehicle access; ✓ Drums/tanks shall be safely and securely stored; ✓ Materials requiring disposal shall be disposed of at an appropriate waste facility.			

	Cement/Concrete Batching ✓ Where required, a Concrete batching plant shall be located more than 20m from the nearest stream/river channel; ✓ Topsoil shall be removed from the batching plant site and stockpiled; ✓ Concrete shall not be mixed directly on the ground; ✓ The concrete batching works shall be kept neat and clean at all times; ✓ Contaminated storm-water and wastewater runoff from the batching area and aggregate stockpiles shall not be permitted to enter streams but shall be led to a pit where the water can soak away; ✓ Unused cement bags are to be stored so as not to be effected by rain or runoff events; ✓ Used bags shall be stored and disposed of in a manner which prevents pollution of the surrounding environment (e.g. via windblown dust); ✓ Concrete transportation shall not result in spillage; ✓ Cleaning of equipment and flushing of mixers shall not result in pollution of the surrounding environment; ✓ Suitable screening and containment shall be in place to prevent windblown contamination associated with any bulk cement silos, loading and batching; ✓ Waste concrete and cement sludge shall be scraped off the site of the batching plant and removed to an approved disposal site; ✓ All visible remains of excess concrete shall be physically removed on completion of the plaster or concrete and disposed at an approved disposal site. Washing the remains into the ground is not acceptable;			

	✓ All excess aggregate and sand shall also be removed; ✓ After closure of the batching plant or any area where concrete was mixed all waste concrete/cement sludge shall be removed together with contaminated soil. The surface shall then be ripped to a depth of 150mm and the topsoil replaced evenly over the site and re-grassed.			
Material and Waste management	**i. Cooking facilities at camp and work sites** ✓ The Contractor shall designate cooking and eating areas, subject to the approval of the RE. Sufficient bins for waste disposal shall be present in these areas; ✓ Any cooking on site shall be done on either well maintained gas cookers or by containing fires (e.g. in a drum) and locating them away from flammable vegetation or construction materials; ✓ The Contractor shall provide kerosene stoves, electricity and / or gas cookers (or other alternative non-wood stoves) for workers. It is preferable for the Contractor to set up a central canteen for resident labour force to control fuel consumption; ✓ ✓ The following will not be permitted: ✓ ✓ Cooking outside the designated areas and in particular beyond the site. ✓ Open cooking fires or fires for heating. ✓ The use of surrounding and/or indigenous vegetation for cooking or heating fires.	NWCPC and RE	Construction Period	5,000,000.00

	ii. Sanitation ✓ The Contractor shall comply with all laws and any by-laws relating to public health and sanitation; ✓ All temporary/ portable toilets or pit latrines shall be secured to the ground to the satisfaction of the RE to prevent them from toppling over; ✓ The type and exact location of the toilets shall be approved by the RE prior to establishment. The use of septic tanks may only be used after appropriate investigations have been made and the option has been approved by the RE; ✓ All toilets shall be maintained by the Contractor in a clean sanitary condition to the satisfaction of the RE; ✓ A wash basin with adequate clean water and soap shall be provided alongside each toilet. Staff shall be encouraged to wash their hands after use of the toilet, in order to minimise the spread of possible disease; ✓ The Contractor shall ensure that no spillage occurs when the toilets are cleaned or emptied and that the contents are removed from the site to an appropriate location/facility for disposal; ✓ The Contractor shall instruct their staff and sub-contractors that they must use toilets provided and not the bush or watercourses. **iii. Solid Waste Management** The site is to be kept clean, neat and tidy at all times. No burying or dumping of any waste materials, vegetation, litter or refuse shall be permitted.			

	The Contractor shall implement measures to minimise waste and develop a waste management plan to include the following: ✓ All personnel shall be instructed to dispose of all waste in a proper manner; ✓ At all places of work the contractor shall provide litter collection facilities; ✓ The final disposal of the site waste shall be done at the location that shall be approved by the RE, after consultation with local administration and local leaders; ✓ The provision of sufficient bins (preferably vermin and weatherproof) at the camp and work sites to store the solid waste produced on a daily basis; ✓ Wherever possible, materials used or generated by construction shall be recycled; ✓ Provision for responsible management of any hazardous waste generated during the construction works. **iv. Wastewater and Contaminated Water Management** ✓ No grey water runoff or uncontrolled discharges from the site/working areas (including washdown areas) to adjacent watercourses and/or water bodies shall be permitted; ✓ Water containing such pollutants as cements, concrete, lime, chemicals and fuels shall be discharged into a conservancy tank for removal from site. This particularly applies to water emanating from concrete batching plants and concrete swills; ✓ The Contractor shall also prevent runoff loaded with			

	sediment and other suspended materials from the site/working areas from discharging to adjacent watercourses and/or water bodies; ✓ Potential pollutants of any kind and in any form shall be kept, stored and used in such a manner that any escape can be contained and the water table not endangered; ✓ Wash areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas (including groundwater) are not polluted; ✓ The Contractor shall notify the RE of any pollution incidents on site. **v. Workshops** Where practical, all maintenance of equipment and vehicles on Site shall be performed in the workshop. ✓ If it is necessary to do maintenance on site, but outside of the workshop area, the Contractor shall obtain the approval of the RE prior to commencing activities; ✓ The Contractor shall ensure that there is no contamination of the soil, vegetation or surface water in his workshop and other plant or emergency maintenance facilities. The workshop shall be kept tidy at all times and shall have the following as a minimum: ✓ A smooth impermeable floor either constructed of concrete or suitable plastic covered with sufficient gravel to protect the plastic from damage; ✓ the floor shall be bunded and sloped towards an oil			

	trap or sump to contain any spillages of substances (e.g. oil); ✓ Drip trays shall be used to collect the waste oil and lubricants during servicing and shall also be provided in construction areas for stationary plant (such as compressors); ✓ The drip trays shall be inspected and emptied daily; ✓ Drip trays shall be closely monitored during wet weather to ensure that they do not overflow. **vi. General Materials Handling, Use and Storage** ✓ All materials shall be stored within the Contractor's camp unless otherwise approved by the RE; ✓ Stockpile areas shall be approved by the RE; ✓ All imported fill, soil and/or sand materials shall be free of weeds, litter and contaminants. Sources of imported materials shall be listed and approved by the RE; ✓ The Contractor shall ensure that delivery drivers are informed of all procedures and restrictions (including 'No go' areas) required; ✓ Any electrical or petrol driven pumps shall be equipped and positioned so as not to cause any danger of ignition of the stored product; ✓ Collection containers (e.g. drip trays) shall be placed under all dispensing mechanisms for hydrocarbons or hazardous liquid substances to ensure contamination from any leaks is reduced; ✓ Regular checks shall be conducted by the Contractor on the dispensing mechanisms for all above ground storage tanks to ensure faulty equipment is identified and replaced in timely manner;			

	✓ Only empty and externally clean tanks may be stored on bare ground. All empty and externally dirty tanks shall be sealed and stored on an area where the ground has been protected. **vii. Fuels, Oils, Hazardous Substances and other Liquid Pollutants** ✓ Hazardous materials shall not be stored within 2 kilometres of the top water level of public water supply reservoirs; ✓ Hazardous materials shall be stored above flood level and at least 20 metres from any watercourse; ✓ Areas for the storage of fuel and other flammable materials shall comply with standard fire safety regulations; ✓ Chemicals and fuel shall be stored in storage tanks within a secure compound. All chemicals and fuels shall be stored in accordance with manufacturer's instructions; ✓ Storage areas or secondary containment shall be constructed of waterproof reinforced concrete or approved equivalent, which is not adversely affected by contact with chemicals captured within them; ✓ The minimum volume for secondary containment shall be 110% of the capacity of the largest tank system, plus 10% of the total capacity of all other separate tanks and containers within the bund wall with closed valves for controlled draining during rains; ✓ Pipe-work carrying product from the tank to facilities outside the containment shall be provided with secondary containment; ✓ Tank equipment such as dispensing hoses, valves, meters, pumps, and gauges shall be located within the			

	containment or provided with own containment; Security shall be provided to guard against vandalism when the site is unattended. This includes: ✓ Fencing of the tank compound with locks or other adequate security controls at the site; ✓ Locks on unattended dispensing hoses; ✓ Appropriate training for the handling and use of fuels and hazardous material is to be provided by the Contractor as necessary. This includes providing spill response and contingency plans; ✓ Extreme care will be taken when transferring chemicals and fuels from storage vessels to equipment and machinery on an impervious sealed area which is kerbed and graded to prevent run-off. Chemical and fuel transfer areas shall drain away from the perimeter bund to a containment pit. The design shall provide for the safe and efficient movement of vehicles; ✓ All chemicals stored within the bunded areas shall be clearly labelled detailing the nature and quantity of chemicals within individual containers; ✓ Any chemical or fuel spills shall be cleaned up immediately. The spilt liquid and clean-up material shall be removed, treated and transported to an appropriate site licensed for its disposal; ✓ Stormwater shall be diverted away from the fuel handling and storage areas. An oil water interceptor shall be provided to treat any rainwater from fuel storage and handling areas.			

Water Loss	✓ Geological profiles throughout the area proposed for inundation should be established to identified areas of weaknesses and appropriate strengthening measures incorporated, ✓ Sub-surface water infiltration trends on affected areas should be established and monitored over a period of time with respect to effects on houses and other structures, ✓ Indigenous trees and shrubs that have low water dissipation capacity should be encourages around the dam buffer zone to minimize loss of water through evapo-transpiration processes, ✓ Ensure enhanced maintenance of the distribution pipelines, ✓ Introduce economic and financial initiatives towards water saving and responsible utilization at consumer points.	NWCPC and RE	Construction/operation Period	No additional Costs
Discrimination on Employment Opportunities	✓ To avoid conflicts with the local people on employment it is proposed that the Contractor employs the locals in liaison with local administration in unskilled and semi-skilled duties; the contractor can adopt concentric model of recruitment. ✓ To promote the livelihood of vulnerable groups such as the women-headed households, there will be a need to undertake sensitisation and awareness campaigns to the local community to promote gender equity in employment during the dam construction works.	NWCPC and RE	Construction Period	No additional Costs
Water Quality	✓ No grey water runoff or uncontrolled discharges from the site/working areas (including washdown areas) to	NWCPC and RE	Construction/operation Period	No additional Costs

	adjacent watercourses and/or water bodies shall be permitted; ✓ Water containing such pollutants as cements, concrete, lime, chemicals and fuels shall be discharged into a conservancy tank for removal from site. This particularly applies to water emanating from concrete batching plants and concrete swills; ✓ The Contractor shall also prevent runoff loaded with sediment and other suspended materials from the site/working areas from discharging to adjacent watercourses and/or water bodies; ✓ Potential pollutants of any kind and in any form shall be kept, stored and used in such a manner that any escape can be contained and the water table not endangered; ✓ Wash areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas (including groundwater) are not polluted; ✓ The Contractor shall notify the RE of any pollution incidents on site. ✓ Institute a broad water quality monitoring system such as to focus on the catchment sources, incoming flows, entire dam water, treated water and water downstream of the dam location, ✓ All vegetation materials (live and dead) at the dam site shall be cleared and removed before the area is excavated and inundated, ✓ Maintain appropriate records on water quality as required by the law, ✓ Pit latrines will not be inundated due to their long term potential contamination of water, but will be decommissioned and the earth scooped for safe disposal to pre-agreed sites. The exact locations for all pit latrines,			

	therefore, will be established to enable smooth relocation, ✓ All graves falling within areas to be inundated will require decommissioning and relocating to prevent contamination of water. The exercise should be undertaken in full observance of traditional rites as well as the wishes of the affected families, ✓ Proliferation of aquatic macro-fauna could be encouraged along the periphery of the dam to ensure natural aeration of the water, ✓ Identify specific point sources of water pollution (cattle pens, market centers, agro- chemical use points, etc.) for isolation and management			
Health, Safety and Security	**i. General Health and Safety** ✓ The Contractor shall comply with all standard and legally required health and safety regulations as promulgated by Factories and Other Places of Work Act; ✓ The Contractor shall provide a standard first aid kit at the site office; ✓ The Contractor shall ensure that staff are made aware of the risks of contracting or spreading sexually transmitted diseases, particularly HIV/AIDS and how to prevent or minimise such risks; ✓ The Contractor shall be responsible for the protection of the public and public property from any dangers associated with construction activities, and for the safe and easy passage of pedestrians and traffic in areas affected by the construction activities; ✓ All works which may pose a hazard to humans and domestic animals are to be protected, fenced, demarcated	NWCPC and RE	Construction Period	12,400,000

	or cordoned off as instructed by the RE. If appropriate, symbolic warning signs must be erected; ✓ Speed limits appropriate to the vehicles driven are to be observed at all times on access and haul roads. Operators and drivers are to ensure that they limit their potential to endanger humans and animals at all times by observing strict safety precautions; ✓ No unauthorised firearms are permitted on site; ✓ The Contractor shall provide the appropriate Personal Protective Equipment for staff. **ii. HIV/AIDS** The implementing agency for HIV/AIDS campaign shall monitor activities regularly to assess effectiveness and impact. This should include an initial, interim and final assessment of basic knowledge, attitude and practices taking account of existing data sources and recognising the limitations due to the short timeframe to show behaviour change. The assessment will be supported by qualitative information from focus group discussions. ✓ A comprehensive health awareness campaign, carried out in conjunction with the dam project team will be done to prevent outbreak of disease. This will include Successful preventive measures such as immunizing the vulnerable population, and educating people about diseases and how they are contracted, and how to avoid them by using treated water and keeping living areas cleaner; ✓ Treating affected local and migrant populations will also be used in controlling the movement of disease vectors			

	(through contaminated water and between people). ✓ The Contractor shall be responsible for the protection of the public and public property from any dangers associated with construction activities, and for the safe and easy passage of pedestrians and traffic in areas affected by the construction activities; ✓ All works which may pose a hazard to humans and domestic animals are to be protected, fenced, demarcated or cordoned off as instructed by the RE. If appropriate, symbolic warning signs must be erected; ✓ The HIV/AIDS awareness campaigns should be conducted at the camps as well as in the trading / market centres. The contractor shall take an active role in civic and public health education to his employees and the community.. The campaign shall include the training of facilitators within the workers, information posters in more frequented areas in the campsite and public areas, availability of promotional material (T-shirts and caps), availability of condoms (free), and theatre groups. The contractor will co-ordinate with the Provincial and District HIV/AIDS control councils, health officers and the NGOs undertaking education and sensitisation programmes; ✓ The contractor will provide condoms at appropriate places in the work camps. The campaigns will be continuously done by the relevant Government organisation even during operation phase of the dam; ✓ The implementing agency for HIV/AIDS campaign shall monitor activities regularly to assess effectiveness and impact. This should include an initial, interim and final assessment of basic knowledge, attitude and practices taking account of existing data sources and recognising the limitations due to the short timeframe to show behaviour			

	change. The assessment will be supported by qualitative information from focus group discussions. **iii. Fire Prevention and Control** ✓ The Contractor shall take all reasonable and precautionary steps to ensure that fires are not started as a consequence of his activities on site; ✓ The Contractor shall ensure that there is basic fire-fighting equipment available on site; ✓ Flammable materials should be stored under conditions that will limit the potential for ignition and the spread of fires; ✓ 'Hot' work activities shall be restricted to a site approved by the RE; Smoking shall not be permitted in those areas where there is a fire hazard. These areas shall include: ✓ Fuel storage areas; ✓ Any areas where vegetation or other material is such as to make liable the rapid spread of an initial flame; The Contractor shall ensure that all site personnel are aware of the fire risks and how to deal with any fires that occur. This shall include, but not be limited to: ✓ Regular fire prevention talks and drills; ✓ Posting of regular reminders to staff; ✓ Any fires that occur shall be reported to the RE immediately and then to the relevant authorities; ✓ In the event of a fire, the Contractor shall immediately employ such plant and personnel as is at his			

	disposal and take all necessary action to prevent the spread of the fire and bring the fire under control; ✓ Costs incurred through fire damage will be the responsibility of the Contractor, should the Contractor's staff be proven responsible for such a fire. **iv. Emergency Procedures** The Contractor shall submit Method Statements covering the procedures for the main activities which could generate emergency situations through accidents or neglect of responsibilities. These situations include, but are not limited to: ✓ Accidents at the work place; ✓ Accidental fires; ✓ Accidental leaks and spillages; ✓ Vehicle and plant accidents; Specific to accidental leaks and spillages: ✓ The Contractor shall ensure that his employees are aware of the procedure for dealing with spills and leaks; ✓ The Contractor shall also ensure that the necessary materials and equipment for dealing with the spills and leaks is available on site at all times. Specific to hydrocarbon spills: ✓ ✓ The source of the spill shall be isolated and the spillage contained using sand berms, sandbags, sawdust, absorbent material and/or other materials approved by the			

	RE; ✓ The area shall be cordoned off and secured; ✓ The Contractor shall ensure that there is always a supply of absorbent material readily available to absorb/breakdown the spill; ✓ The quantity of such materials shall be able to handle a minimum of 200l hydrocarbon liquid spill; ✓ The Contractor shall notify the relevant authorities of any spills that occur; ✓ The Contractor shall assemble and clearly list the relevant emergency telephone contact numbers for staff and brief staff on the required procedures. These contact details shall be listed in English and Kiswahili; ✓ The treatment and remediation of areas affected by emergencies shall be undertaken to the reasonable satisfaction of the RE at the cost of the Contractor where his staff have been proven to be responsible for the emergency. **v. Site Security** The Contractor will need to take the following measures: ✓ Provide for armed security at the entire working time and period; ✓ Appropriate fencing, security gates, shelter and armed security guards are to be provided at the Construction Site to ensure the security of all plant, equipment and materials, as well as to secure the safety of site staff; ✓ The Contractor must ensure that good relations are maintained with local communities and their leaders to help			

	reduce the risk of vandalism, theft and bandits; ✓ Site staff that are found to be involved in incidences of theft or pose other security risks to the local community are to be dismissed and reported to the authorities.			
Occupational Safety and Health	✓ The Contractor shall comply with all standard and legally required health and safety regulations as promulgated by Factories and Other Places of Work Act; ✓ The Contractor shall provide a standard first aid kit at the site office; ✓ The Contractor shall ensure that staff are made aware of the risks of contracting or spreading sexually transmitted diseases, particularly HIV/AIDS and how to prevent or minimise such risks; ✓ The Contractor shall be responsible for the protection of the public and public property from any dangers associated with construction activities, and for the safe and easy passage of pedestrians and traffic in areas affected by the construction activities; ✓ All works which may pose a hazard to humans and domestic animals are to be protected, fenced, demarcated or cordoned off as instructed by the RE. If appropriate, symbolic warning signs must be erected; ✓ Speed limits appropriate to the vehicles driven are to be observed at all times on access and haul roads. Operators and drivers are to ensure that they limit their potential to endanger humans and animals at all times by observing strict safety precautions; ✓ No unauthorised firearms are permitted on site; ✓ The Contractor shall provide the appropriate Personal Protective Equipment for staff.	NWCPC and RE	Construction Period	6,000,000

	✓ Provide mobile toilet facilities on remote work sites.			
Historical, Cultural and Archeological Resources	Care should be taken while doing excavation works. If any suspect cultural or material sites are identified, then the finding should be reported to the client and to the National Museums of Kenya. At a minimum, if materials of paleontological (fossil bones and human bones of human heritage) or archaeological nature (stone, iron or other prehistoric artifacts or features) are encountered (discovered) while, for instance drilling or excavating by machine, the following steps have to be undertaken. an archaeologist should be consulted to assess the cultural heritage value of the finding In case the finding is determined to be a monument or object of archaeological or paleontological interest, this should be reported to the National Museums of Kenya (the institution charged with the responsibility of safeguarding Kenya's cultural heritage). The above steps would be in line with the Laws of Kenya. According to the National Museums and Heritage Act of 2006 (the law responsible for the protection and preservation of cultural heritage in Kenya), under Part IV (Searches and Discoveries),	NWCPC and RE	Construction Period	No additional Costs
Operational Phase				
Biting flies and Insects	allowing the rapid draw-down of the reservoir, allowing both a rapid drop in shoreline water levels and an artificial flood	NWCPC and RE	Operation Period	No additional Costs

	downstream that will flush out any vector breeding places in rock pools; minimising low flow zones in artificial channel (Irrigation canals if included) networks to minimise habitats for the propagation of vectors;			
Access to Health Service	Health facilities are a source of concern by the residents; mitigation measures/projects under this include an upgrade the existing primary health care units through; i. Supplementary training for the local nurses, ii. Assisting in the provision of a wider range of medical services and drugs, iii. Assisting in the enhancement of laboratory services, iv. Assisting in making available periodical consultations by qualified physicians.	NWCPC and RE	Operation Period	10,000,000.00
Personal health Practices	Implement an extensive HIV/AIDS and STI education campaign among the local population, targeting not only youth but adults as well. Such a campaign should be initiated immediately, well before the start of the construction phase. It should be complemented by increased access to condoms in the area as well as to voluntary counselling and testing. Implement a comprehensive and on-going HIV/AIDS and STI education campaign targeting all workers hired for the project, both local and international. It should be complemented by easy access to condoms at the workplace as well as to voluntary counselling and testing. Implement a well thought and effective HIV/AIDS and STI education campaign among sex workers. Such a campaign should be initiated immediately and pursued throughout the	NWCPC and RE	Operation Period	Multi agency input

	construction phase of the project as a constant flux of individuals involved in this activity is expected. It should be complemented by increased access to condoms specifically targeted for this group as well as voluntary counselling and testing, together with improved access to medical services. Upgrade all local health clinics serving the local population in terms of training for the local nurses specifically focused on the diagnosis and treatment of STI and HIV/AIDS, the uninterrupted availability of Rapid HIV testing and of AIDS counsellors, the increased accessibility to complementary laboratory tests provided by central laboratories, as well as the availability of periodical consultations by qualified physicians. These measures should encompass both the public and private health sector. Establish a strong, well publicized, effectively applied and closely monitored zero - tolerance policy in accordance with which workers and service providers seeking sexual favours in exchange for project related benefits will be banned for the remaining duration of the construction phase.			

The costs in the EMP are estimates by the consultant based on similar projects and aren't actual costs but estimates and only useful for planning purposes.

8.3 Uncertainty in ESMP

Uncertainty in ESMP may be occasioned by the following aspects:-

3. Non homogenous baseline due to ever changing external factors occurring during the entire project cycle;
4. Changes in legal and regulatory policy which influences the assessment of future baselines and post development issues;
5. Non uniform soil profiles which may be realized during project implementation;
6. Non compliance of the proponent and contractor with the implementation schedule.

The proponent (NWCPC) ought to beware of the above listed issues and together with the contractor adopt a proactive strategy to address the emerging issues and knowledge gaps.

8.4 ESMP Management Records

Environmental management records shall be kept on site during the duration of construction and shall include the following:

i) The updated version of the ESMP;
ii) All necessary permits and licences;
iii) All site specific plans prepared as part of the updated ESMP;
iv) All written instructions and reports issued by the RE / Supervising Consultant;
v) A register of audit non-conformance reports and corrective actions;
vi) All related environmental, social, health and safety management registers and correspondence, including any complaints;
vii) All records shall be kept at site premises and maintained in a legible state for the full period of construction.

8.5 Auditing of the ESMP

The ESO shall conduct quarterly audits to ensure that the system for implementation of the ESMP is operating effectively. The audit shall check that a procedure is in place to ensure that:

1. The ESMP being used is the up to date version;
2. Variations to the ESMP and non-compliance and corrective action are documented;
3. Appropriate environmental training of personnel is undertaken;

4. Emergency procedures are in place and effectively communicated to personnel;
5. A register of major incidents (spills, injuries, complaints, legal transgressions, spot fines and penalties etc) is in place and other documentation related to the ESMP;
6. Ensure that appropriate corrective and preventive action is taken by the Contractor once instructions have been issued through the RE.

8.6 Environmental and Social Monitoring

Environmental and social monitoring during construction and operation helps to predict unforeseen environmental and social impacts and allows measures to prevent or avert adverse impacts to be developed or introduced in a timely manner.

Maintenance of infrastructure during construction and operation is also important in contributing towards environmental conservation by for example, preventing soil erosion in the dam site and its upstream and downstream catchments and ensuring proper drainage of run-off.

During the construction and operation phase, monitoring will be undertaken to ensure that proposed mitigation measures for negative impacts and enhancement measures for positive impacts are implemented.

8.7 Costs for monitoring

The costs for mitigation of construction related impacts will be included in the contract documents. During construction and decommissioning phases of the project, the Environmental and Social Officer will co-ordinate the monitoring programme and prepare reports for submission to the environmental authorities.

8.7.1 Monitoring Schedule

Table 8-2: Monitoring Plan

Environmental/Social Aspect	Monitoring Indicators	Frequency	Remark
Construction			
Environmental pollution during construction (Air, Noise, Water, etc.)	Air quality	▪ Continuous visual observation, ▪ Measurements quarterly	Mainly dust from earth moving and emissions from the equipment
	Noise and vibrations	▪ Continuous surveillance ▪ Measurements on quarterly	Controlled from equipment
	Water quality	Once a month	Mainly downstream sediment levels
	Soil loss	Continuous surveillance	Extent of erosion in the immediate catchment
Ecological disruption	Vegetation types lost	Quarterly during driving	This will provide the nature of plants

Environmental/Social Aspect	Monitoring Indicators	Frequency	Remark
		construction period	species for compensation purposes
	Animal species and loss of habitats (fish, crocodiles, hippos, herbivires and carnivores etc.)	Initial and quarterly through the construction period	Specific habitats need to be marked before construction
Social disruption	Loss of pastures	Pre-construction activity	
	Compensation and relocation	Pre-construction activity ▪ Review at construction commencement ▪ Review at commissioning stage	▪ It would be expected all compensation and relocations are completed before construction is commenced
	Alternatives to institutions lost (schools, health centres, markets, etc.)	Before commencement of works	This aspect to be addressed alongside the resettlement process
	Acceptance at host areas for displaced persons and adaptability	Before construction period	▪ Constitutes part of the resettlement process ▪ Important to track potential social conflicts
Commissioning			
Waste disposal	Debris at points construction	Upon completion of works	It is a onetime assessment
	Successful decommissioning of construction camps	Upon completion of works	Site rehabilitation and evaluation will be necessary
Operations			
Environmental pollution (air, noise, water quality and flows)	Air quality	Half yearly sampling	Dust emissions, emissions from equipments.
	Noise and vibrations	Half yearly	Machine operations (mainly localized)
	Water quality	Half yearly measurements	Upstream and downstream the plant
Ecological trends	Invasive weeds	Annual survey (speciation)	This will identify new species and provide mitigation measures
	Wildlife habitats and breeding areas	Annual survey (speciation and counts)	Continuous opportunities to be established
	▪ Evolving habitats and species dynamics ▪ Influencing factors	Annually initially then every 3 years	New aquatic conditions expected to evolve gradually
Hydrology	Flows in the main river stream	Monthly (or during heavy rains)	This is am for challenge for the whole seven folks dam system
	Sediment transportation	Annual measurements at dam entry	This task is necessary for entire cascade system
	Dam capacity variations	Every 2 years	Also a major challenge to the cascade system
Safety from potential dam break	▪ Safety risks to immediate residents and their livestock ▪ Safety risks to downstream residents ▪ Potential features at risks	Safety risk audit every 3 years	Safety audits should also be an integral part of the entire cascade system
Social	Security and safety	Quarterly	▪ Involvement of the stakeholders and local communities would be necessary ▪ Safety of residents from wildlife and risks of drowning
	Access to water (domestic and irrigation)	Half yearly	Safety of residents from wildlife while accessing water
	▪ Land use changes ▪ Cultural trends	Annual surveys initially then every 3 years	An important determinant of social trends
Economic trends	Value of dam to residents (support to livelihoods, fishing, tourism, irrigation, etc.)	Half yearly.	This is an important factor on the CSR front.

8.8 Environmental Training and Awareness

The Contractor and sub-contractors shall be aware of the environmental requirements and constraints on construction activities contained in the provisions of the ESMP. The Contractor will therefore be required to provide for the appropriate Environmental Training and

Awareness as described in this ESMP in his costs and programming. An initial environmental awareness training session shall be held prior to any work commencing on site, with the target audience is all project personnel.

The training should include but not limited to the following:

i) Basic awareness and understanding of the key environmental features of the work site and environs;
ii) Understanding the importance of and reasons why the environment must be protected;
iii) Ways to minimise environmental impacts;
iv) Relevant requirements of the ESMP;
v) Prevention and handling of fire;
vi) Health risks pertinent to the site, including prevention of communicable diseases;
vii) Awareness, prevention and minimisation of risk with regard to the contraction and spread of HIV/AIDS and other sexually transmitted diseases;
viii) The Contractor shall erect and maintain Environmental and Health Information Posters for his employees regarding HIV/AIDS and natural resources; and
ix) The Environmental and Health Information Posters shall be erected at the eating areas and any other locations specified by the RE.

8.9 Environmental risk management

The failure of environmental mitigation can result in serious impacts such as erosion, increased incidents/accidents and disruption of the community lifestyles. Construction of a dam also involves occupational health and safety risks to construction workers, primarily in the areas of storage and handling of dangerous materials, and operation of heavy machinery close to traffic, slopes and watercourses. The anticipated risks in this project include:

1. Exposure to excessive dust particles or toxic fumes from concrete and other chemicals used in dam works;
2. Potential for collapse of trenches;
3. Risk of accidents involving wildlife and humans;
4. Risk of bush fires during dry seasons;
5. Risk of rock falls during blastings;
6. Risk of fuel spills and therefore contaminating soil and groundwater.

The risks can be mitigated to a large extent through:

1. Strengthening staff skills and training in environmental management;

2. Monitoring environmental actions and responsibilities and making provision for remedial actions;
3. Planning for remedial measures in case initial planned actions are not successful;
4. Limiting time of exposure to dust particles, chemicals and noise;
5. Establishing safety and inspection procedures in materials handling, operating heavy equipment and constructing trenches; and
6. Safe handling of toxic materials, explosives and other hazardous substances.

8.10 Emergency Procedures

The Contractor shall submit Method Statements covering the procedures for the main activities which could generate emergency situations through accidents or neglect of responsibilities. These situations include, but are not limited to:

1. Accidents at the work place;
2. Accidental fires;
3. Accidental leaks and spillages;
4. Vehicle and plant accidents;

Specific to accidental leaks and spillages:

i) The Contractor shall ensure that his employees are aware of the procedure for dealing with spills and leaks;
ii) The Contractor shall also ensure that the necessary materials and equipment for dealing with the spills and leaks is available on site at all times.

Specific to hydrocarbon spills:

i) The source of the spill shall be isolated and the spillage contained using sand berms, sandbags, sawdust, absorbent material and/or other materials approved by the RE;
ii) The area shall be cordoned off and secured;
iii) The Contractor shall ensure that there is always a supply of absorbent material readily available to absorb/breakdown the spill;
iv) The quantity of such materials shall be able to handle a minimum of 200l hydrocarbon liquid spill;
v) The Contractor shall notify the relevant authorities of any spills that occur;
vi) The Contractor shall assemble and clearly list the relevant emergency telephone contact numbers for staff and brief staff on the required procedures. These contact details shall be listed in English and Kiswahili;
vii) The treatment and remediation of areas affected by emergencies shall be undertaken to the reasonable satisfaction of the RE at the cost of the Contractor where his staff

have been proven to be responsible for the emergency.

viii)

9 Conclusion and Recommendations.

9.1 Conclusions

In view of the above findings, it can be concluded that there is a high level acceptance of the Dam project by all stakeholders including the communities living at the site as well as the beneficiaries in three counties of Laikipia, Isiolo and Samburu. This follows acute shortage of water for domestic and livestock keeping as well as irrigation for basic food production, a phenomenon experienced in the three counties and all the ASAL area in Kenya. Among the most notable aspects include;

i) The dam will also contribute immensely towards the long time interventions by various government agencies and organizations working with communities in water supply projects.
ii) The dam will not only uplift the living standards of the communities, but will also lead to improved land use, improve the livelihoods and enhance hygiene and sanitation at homestead levels.
iii) The dam development will go further into developing a water treatment plant to ensure availability of clean water for domestic use in the target areas,
iv) The dam will enable moderation of flows in Ewaso Nyiro River and downstream to ensure constant flow of river throughout the year, though with atteniated high flood levels along the basin,
v) Management of the dam will contribute towards environmental conservation initiatives such as to include sustainable sand harvesting, and access to biological resources in the area,

It is also concluded that the project magnitude will be significant such as to impose impacts to the physical and biological environment as well as the social, cultural and economic setting of the area. The negative impacts, however, are identifiable and can be mitigated through design and administrative measures. However, the overall positive impacts of the project far outweigh the negative projects.

9.2 Recommendation

It is recommended that the dam project proceed with the main objective remaining to regulating river flows along Ewaso nyiro channel, supply of safe water to communities, isiolo town and Isiolo Resort city with minimum implications to the environmental and social setting of the areas to be affected. In order to minimize environmental and social impacts from the dam construction and operation, the following broad recommendations are also proposed;

i) Vegetation clearing shall only be done on the dam construction area such to reduce loss of indigenous plants around the dam site,

ii) Over 160 people will be displaced by the project. In this regard, it will be necessary to undertake a comprehensive land acquisition and resettlement action plan (LAP & RAP) followed by appropriate compensations to the affected persons and families before the commencement of the project. Timely compensation will facilitate quick commencement of the project and smooth implementation of the same,

iii) Water quality will be of high importance. It will, therefore, be necessary to identify and decommission all pit latrines and waste holding locations for total removal for disposal into approved and pre-agreed dumping areas. This should also apply to cattle pens found in the area,

iv) Among the critical environmental aspects on the project area is sand harvesting. In order to protect the dam from accumulation of sand, provide sand trap/dams upstream of the dam site along Ewaso Nyiro and Narok rivers as well as other streams. The design of the facilities might also require additional acquisition of land,

v) Provide an opportunity for the local communities (land owners) dispose off natural resources on their land before acquisition. This could include controlled charcoal burning and briquette making as well as removal of sand accumulated at the dam site.

vi) Undertake a comprehensive risks assessment study of the dam components downstream the entire Ewaso Nyiro river basin with quantification and appropriate preventive propositions,

vii) Preparation and inclusion of the affected into existing social associations of their choice in the “new” settlement areas through education, awareness creation and facilitation. There may be need to pay for disturbance costs to those affected

viii) An all-inclusive participatory Resettlement Action Plan should be systematically conducted to establish who owns what (interested parties and shareholders) so as to determine the rightful owners who should benefit and the share each should receive

ix) In order to ensure safety, there is need to fence the dam and educate the communities on co-existence with wildlife. This also includes adopting economic activities that co- exist with wildlife such as eco-tourism

x) Organisation of the community into a strong unit to control local resources as well as social and economic benefits resulting from construction of the dam including sand harvesting and marketing of products such as fish, crops and livestock

xi) Put in place supportive and cushioning mechanisms and programmes for those affected such as training, enhancing access to alternative resources and livelihood means

xii) Fund/facilitate/built one hospital in the project area so as to be used during construction and operation phases without pushing its current capacity.

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Appendix I: Field Checklist.

Appendix II Terms of Reference (ToR)

Appendix III: Attendance List

Appendix IV: Photo Plates

Photo Plates

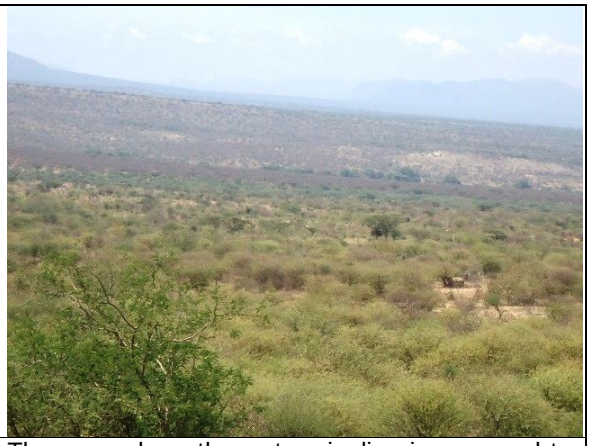
Public Consultations with communities within the proposed project area of Oldonyiro and Kirimun location.

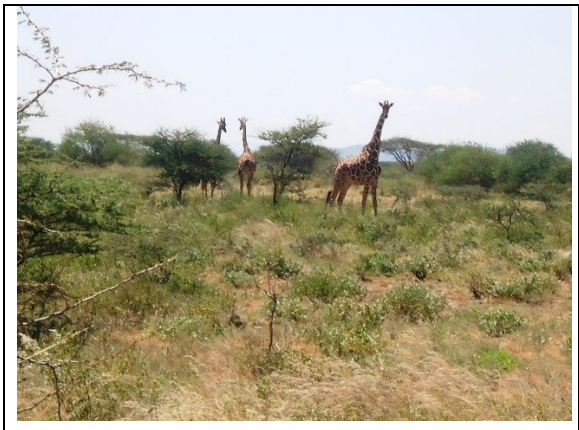
Leader workshop at Rangelands Isiolo May 2014

Consultations downstream at Merti

Proposed Dam area at Crocodile Jaws. Photo taken from the the proposed embankment area viewing the area going to be inundated.

Ewaso Nyiro river sustains a diverse ecosystem and mulit purpose use by the community including wildlife.

	
Existing weir at crocodile jaws point where the abstraction supplies oldonyiro market and nearby communities. The community weir will be removed and replance with an enhanced pipeline to Oldonyiro markets and its environs.	The area where the water pipeline is proposed to traverse. The ecosystem is water scarce and susceptible to erosion.

	
Some of the wild life found along the proposed pipeline area. The construction should be well planned so as not to affect wildlife habitats	A watering point along the pipeline area, the area needs to be provided with more watering points both for wild life and livestock.

	
Nandutu area, a point down stream of the dam site which is prone to flooding during the wet seasons. This is in Kipsing.	Ostriches found in the project area near Mulango

	
Stakeholders meeting at Rangeland Hotel Isiolo.	Stakeholders forum at Grande Hotel Isiolo

Appendix VI Chance Find Procedure.

Chance finds procedures should be incorporated into each sub-project ESMP and civil works contracts. The following wording is proposed:

If the Contractor discovers archeological sites, historical sites, remains and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall:

- Stop the construction activities in the area of the chance find;

- Delineate the discovered site or area;

- Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities or the Ministry of State for National Heritage and Culture take over;

- Notify the supervisory Project Environmental Officer and Project Engineer who in turn will notify the responsible local authorities and the Ministry of State for National Heritage and Culture immediately (within 24 hours or less);

Responsible local authorities and the Ministry of State for National Heritage and Culture would then be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archaeologists of the National Museums of Kenya. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage, namely the aesthetic, historic, scientific or research, social and economic values.

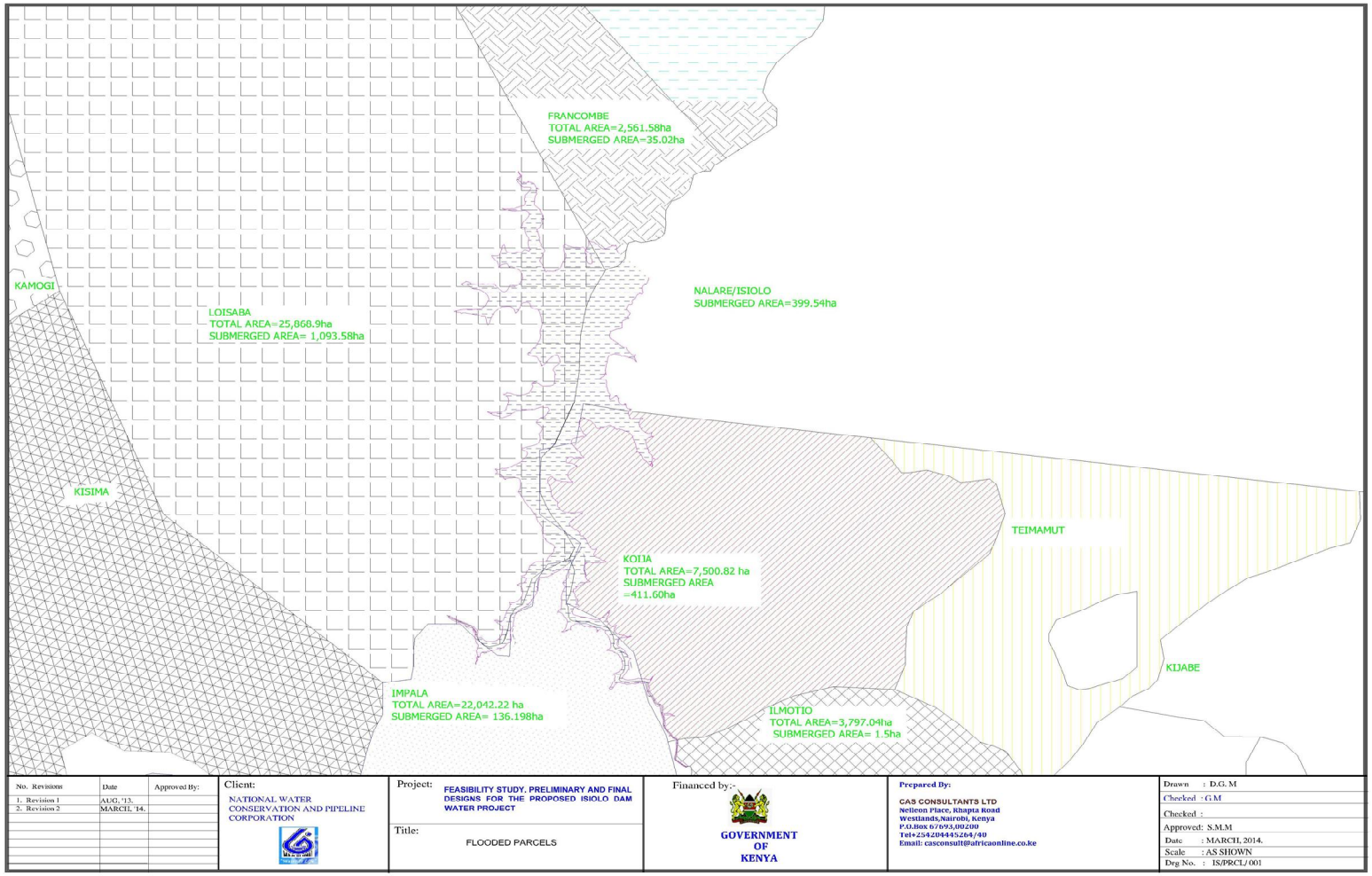
Decisions on how to handle the finding shall be taken by the responsible authorities and the Ministry of State for National Heritage and Culture. This could include changes in the layout (such as when finding irremovable remains of cultural or archeological importance) conservation, preservation, restoration and salvage.

Implementation for the authority decision concerning the management of the finding shall be communicated in writing by relevant local authorities.

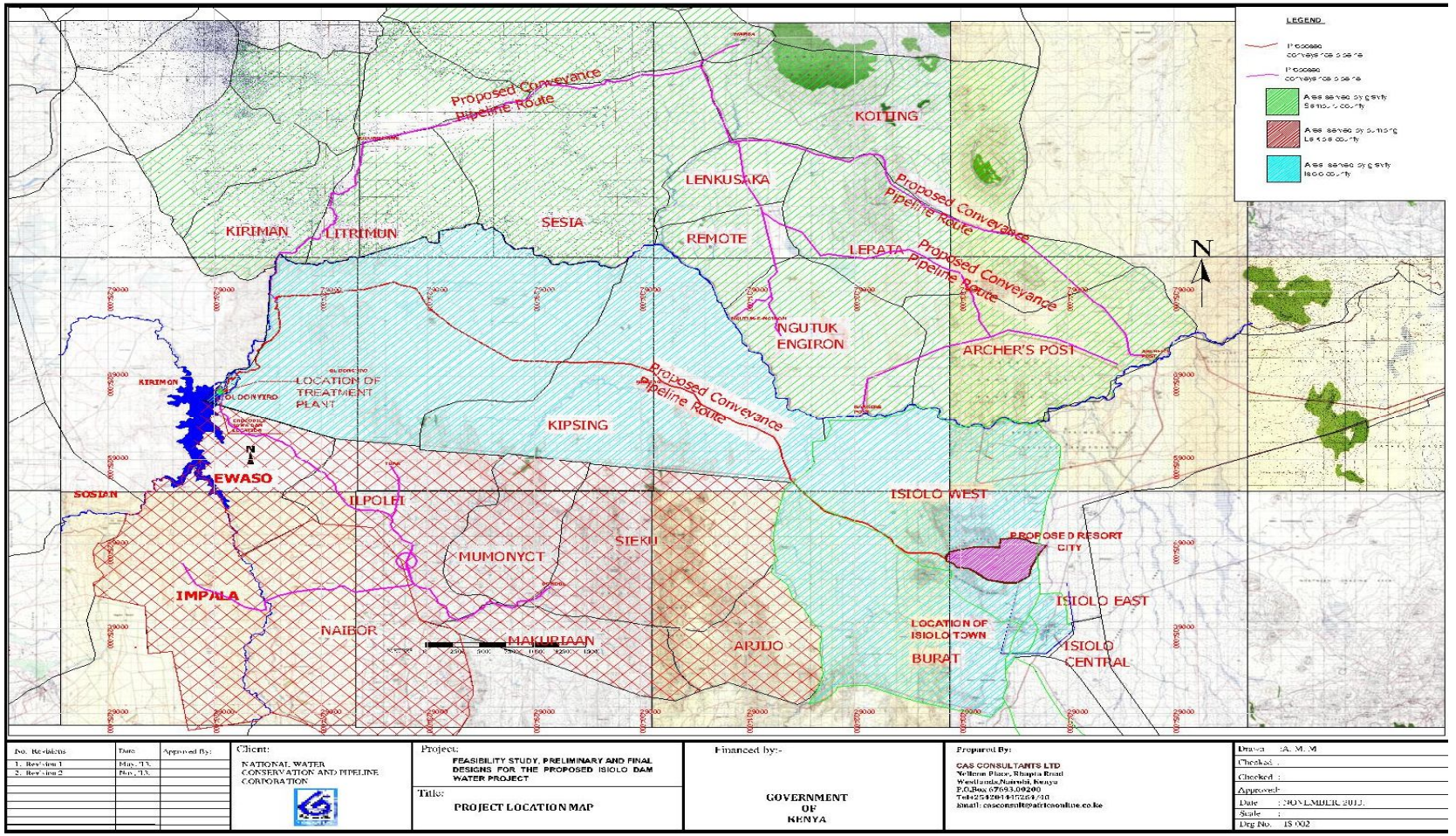
-Construction work may resume only after permission is given from the responsible local authorities or the Ministry of State for National Heritage and Culture concerning safeguard of the heritage

Appendix VII: Lead Firm 2014 License

Appendix VIII Land to be Acquired for the Dam Development.



Appendix IX Proposed Distribution Areas and Pipeline



Appendix X Summary of BoQ

Annex I; Workshop Report (Stakeholders Workshop)

Annex II: Workshop Report II

Annex III: Land Compensation Report.

Annex IV EIA Terms of References

Annex V: Leaders Workshop

Annex VI: Downstream Consultations Report